BIODIVERSITY SCOPING REPORT

271.6KM, 400Kv, WAJAALE-HARGEISA-BERBERA ELECTRICITY TRANSMISSION LINE SOMALILAND

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ACRONYMS

AAAC	Aluminium Alloy
AIS	Alien Invasive Species
AoI	Area of Influence
APLIC	Avian Powerline Interaction Committee
ASCII	American Standard Code for Information Interchange
ASP	Area Search Plots
AZE	Alliance for Zero Extinction
BMP	Biodiversity Management Plan
CABI	Centre for Agriculture and Bioscience International
CBD	Convention on Biological Diversity
CH	Critical Habitat
CHA	Critical Habitat Assessment
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DBH	Diameter Breast Height
DD	Data Deficient
DEM	Digital Elevation Model
EAPP	Eastern Africa Power Pool
EMF	Electro Magnetic Force
EN	Endangered
EN	Endangered (EN)
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standard
GIP	Good Industry Practice
GIS	Geographic Information System
GPS	Global Positioning System
HUTCL	Historically Underserved Traditional Local Communities
HV	High Voltage
HV	High Voltage
IBA	Important Bird Areas
IBAT	International Biodiversity Assessment Tool
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Areas
kV	Kilo volt
LC	Least Concern
LDV	Light Duty Vehicles
MoEM	Ministry of Energy and Mineral Resources
NDVI	Normalised Difference Vegetation Index
NG	Net Gain
NNL	No Net Loss
PA	Protected Area
PAPs	Project Affected Persons
RAP	Resettlement Action Plan
RET	Rare, Endangered and Threatened
RET	Rare, Endangered and Threatened

RoW	Right of Way
SCC	Species of Conservation Concern
SDM	Species Distribution Modelling
TL	Transmission Line
TPI	Topographic Position Index
UNFCC	United Nations Framework Convention on Climate Change
UV	Ultraviolet
VOPs	Vantage Observation Points
VU	Vulnerable

EXECUTIVE SUMMARY

This Biodiversity Scoping Report has been prepared as part of the Environmental and Social Impact Assessment (ESIA) Study Report that is assessing the potential environmental and social risks and impacts associated with the proposed construction of the 271.6km high voltage Wajaale-Hargeisa-Berbera 400kV double circuit transmission line and related facilities ('the Project') in Somaliland to ensure that environmental and social risk and impacts are considered and managed during the project lifecycle. The proposed Wajaale-Hargeisa-Berbera 400kV transmission line is located in Somaliland and traverses 2 regions i.e. Marodi-Jeh and Sahil starting at Wajaale (border between Ethiopia and Somaliland) passing through Hargeisa and terminating at the proposed Berbera. The line crosses 3 administrative districts (Gebiley, Hargeisa and Berbera) and a total of 22 villages. The project is a 271.6 km transmission line, starting from Wajaale (312271.34m E1067373.63m N) and terminating at (510257.67m E 1143971.30m N) a substation in Berbera in Somaliland.

The project is financed by the World Bank under Horn of Africa Regional Power System Transformation Project (P179036) and will be implemented by Eastern Africa Power Pool (EAPP) and Somaliland's Ministry of Energy and Mineral Resources (MoEM).

The proposed transmission line is passing 10km-50kms away from two critical habitats i.e. Boorama Plains and Gacan Libaax which have been identified as habitats to 5 species of avifauna classified as Critically Endangered (CR) and 10 species of avifauna classified as Endangered (EN). Boorama Plains is 10kms away from the transmission line while Gacan Libaax is more than 50kms away from the transmission line. The line is over 50kms from a protected area (Ga'an Libah National Park).

A total of 25 floral and fauna and avifauna species are known to occur within the buffer zone, reported from International Biodiversity Assessment Tool (IBAT) screening. On analyzing Rare, Endangered and Threatened (RET) status of these recorded species as per the IUCN categories, it was found that 4 floral species were in the Endangered (EN) category. The RET assessment of avifauna showed 5 species of birds in the Critically Endangered (CR) category and 10 species classified as EN. Amongst the fauna, 3 of the species in the category of CR and 3 in the category of EN.

The major objectives of the study were as follows:

- Undertake desktop description of the baseline receiving environment specific to the field of expertise (general surrounding area as well as site specific environment).
- To prepare a baseline of biodiversity values of the project affected area
- Identification and description of any sensitive receptors in terms of relevant specialist disciplines (biodiversity) that occur in the study area, and the manner in which these sensitive receptors may be affected by the activity.
- Identify 'significant' ecological, botanical and faunal features within the proposed transmission line route
- Identification of conservation significant habitats around the project area which might be impacted by the proposed development

- To study the impacts of power line construction on the biodiversity values in the affected 5km wide corridor (10km buffer).
- To plan/suggest suitable measures and strategies for mitigation/management of the anticipated impacts.
- Site visit to verify desktop information
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application.

The study involved literature review and field assessments which were conducted during the period February 15th-28th 2024. The study involved assessment of critical habitats and the floral and faunal diversity within the 10km corridor (5km buffer on each side of the transmission line), along the transmission line with the identification of Rare, Threatened or Endangered species reported from the area. Evaluation of likely adverse impacts on biodiversity of the buffer zone due to laying of proposed transmission line was also carried out to develop/list the possible mitigation measures for the same.

Potential Adverse Impacts

The possible adverse environmental issues associated with laying of transmission lines close to these areas may become a matter of concern if due care and mitigation measures are not planned and implemented. Therefore, to assess the likely impact and to develop an action plan, the Biodiversity Scoping Report has been prepared to inform the development of a biodiversity assessment study. The potential impacts of the transmission line on the biodiversity values of the areas within the 5km buffer were also assessed and evaluated for both construction as well as the operational phase of the project. Some of the major identified impacts during the construction phase include:

- Removal/pruning of vegetation from the tower base and in RoW corridor of the transmission line
- Construction related disturbances, including increased human presence, the resultant pollution, waste generation, increased noise level etc.
- Fire risk.

Similarly, some of the possible impacts during the operational phase include:

- Bird mortality due to collision and/or electrocution by the transmission lines.
- Potential influx of invasive weeds in the cleared area.

Mitigation Measures

The mitigation measures to reduce/manage such possible/identified direct and indirect impacts have been analysed and incorporated in the report. The present species matrix in the project-affected zone does not subject itself to a “net loss of biodiversity” on account of the erection and operation of the transmission line. Two factors that are potentially contributing to this include:

- The area to be affected/cleared is restricted to tower base and in RoW particularly in 4m width below each conductor along proposed transmission line and is not located in any protected area. The transmission line is outside of protected areas, reserves, forest etc.

- The present mix of species in the potentially affected area contains only limited number of Rare, Threatened or Endangered species, and most of the species are common to the region. Further, there is no major deviation in the species matrix along the length of the line, or in areas adjacent to the line. As such, although the vegetation clearing activity would entail removal of identified/selected trees, but it will not result in any loss at a species level or at diversity level due to the fact that the transmission line does not traverse forested areas. On the other hand, positive impacts associated with proposed transmission line outweigh the negligible and restricted/localized negative impact in RoW for which detailed mitigative measures have also been planned for implementation during laying of transmission line.

Assumptions

- **One Season Survey:** Due to time constraints, the survey was conducted within a single season, without accounting for seasonal variations between the dry and wet seasons. This assumption implies that the results primarily reflect resident bird populations active during the survey time frame, as migratory species may not be present outside their migration window.
- **Diverse Habitats Represented:** The VOPs (Viewpoint Observation Points) and grids were strategically selected to represent the variety of habitats found along the corridor, ensuring the study captured a broad spectrum of ecosystems. The rationale for this approach was to maximize habitat diversity within the constraints of accessibility and security, given the long and remote nature of the transmission corridor. The selection of VOPs aimed to ensure that the survey accurately reflected the bird populations from various ecological zones despite the logistical challenges.
- **12-Hour Daily Observations**: A 12-hour daily observation period was deemed sufficient to gather a representative sample of bird activity at each VOP. Considering the vast area covered by the survey, this duration balanced the need for thorough data collection while accounting for the limitations posed by accessibility, security concerns, and the physical constraints of conducting extended surveys across difficult terrain.
- **Grid Stratification:** The study transect was divided into 20km sections to account for geographic and habitat variation along the corridor. This grid stratification allowed for a practical yet effective way to sample the extensive and varied landscape. The 20km interval was chosen based on the long stretch of the transmission line corridor and its challenging accessibility, which required a manageable approach to cover diverse areas while ensuring sufficient data was collected.
- **Available biodiversity information is limited:** This assessment was conducted using the best available information on presence and distribution of the biodiversity of the region and informed by field surveys and observations of the status of habitats in the project AoI. However, it is acknowledged that potentially threatened or restricted range species could have been missed.

These assumptions, shaped by the time constraints, accessibility challenges, and security concerns of working in a vast, remote region, guided the design of the survey to maximize the effectiveness of the data collection while working within practical limitations.

Conclusion

In the transmission line corridor of Somaliland, the field data collection conducted on February 15th-28th February 2024 sought to evaluate the avian species diversity within certain habitat zones using stratified sampling. Although a rigorous methodology was employed that included 12 hours of daily observation and the designation of several VOPs representing coastal, wetland, savanna, grassland as well as urban zones, no records of endangered avifauna species were obtained at any time within the study period. This finding might be explained by multiple reasons, particularly the phase for conducting the survey.

The survey was conducted within the dry season and consequently did not overlap the migratory period of September until November, when certain migratory species, including many endangered species, pass through or rest within the study area. Considering that the survey was conducted within one season and did not consider seasonal variations like wet or rainy seasons, it is likely that the absence of species does reflect their migration or habitat use during the migration period.

In addition, the different habitats along the corridor were described, and the survey and remote sensing analysis incorporated potential human presence as well as other modifications and changes to the environment that may affect species distribution. Yet, not conducting the survey within the prescribed migration timeframe (September-November) presumably reduced the chances of observing some bird species limited to that time window, especially listed ones.

Thus, although the survey was useful in estimating the population of birds in the studied environments, additional surveys during the most active time for migrant and listed species within the region will yield a better understanding of the intricacies and dynamics of populations of these birds, and of the relevant conservation management attempts in this area.

1 INTRODUCTION

EMC Consultants was appointed to conduct a biodiversity (terrestrial ecology) scoping report, for the 271.6km high voltage Wajaale-Hargeisa-Berbera 400kV double circuit transmission line and related facilities project. The proposed Wajaale-Hargeisa-Berbera 400kV transmission line is located in Somaliland and traverses 2 regions i.e. Marodi-Jeh and Sahil starting at Wajaale (border between Ethiopia and Somaliland) passing through Hargeisa and terminating at the proposed Berbera. The line crosses 3 administrative districts (Gebiley, Hargeisa and Berbera) and a total of 22 villages. The project is a 271.6 km transmission line, starting from Wajaale (312271.34m E 1067373.63m N) and terminating at a substation in Berbera (510257.67m E 1143971.30m N) a substation in Berbera.

1.1 Scope of Work

- Desktop description of the baseline receiving environment specific to the field of expertise (general surrounding area as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist disciplines (biodiversity) that occur in the study area, and the manner in which these sensitive receptors may be affected by the activity;
- Identify 'significant' ecological, botanical and faunal features within the proposed development areas
- Identification of conservation significant habitats around the project area which might be impacted by the proposed development
- Site visit to verify desktop information
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application; and
- Generate map to identifying sensitive receptors in the study area, based on available maps, database information and site visit verification.

Area of Influence

For the purposes of this impact assessment, the definition of the Area of Influence/Zone of Impact (ZoI)[1] given in ESS 1 is used. For this Project, the direct AoI/ZoI is the spatial extent of the Project footprint and related facilities as well as on the associated effects on the receiving environment. The environmental AoI for the project includes the project transmission line and encompasses the ROW and the surrounding area where potential direct environmental impacts and risks are anticipated. Specifically, for the transmission line, the environmental AoI has been defined to include a buffer of 5km on both sides of the line (10km) and inclusive of the 40m ROW. This AoI encompasses the Project

[1] The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which affected communities' livelihoods are dependent. Associated facilities are facilities that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.
Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.'

components, ancillary facilities, and the expected spatial extent of potential environmental direct impacts from long-term operation.

1.2 Methodologies

1.2.1 Spatial Data Analysis

Spatial analysis was undertaken using a combination of existing datasets and remotely sensed imagery, all integrated within a Geographic Information System (GIS) platform. High-resolution remote sensing data were utilized to generate up-to-date land cover and habitat maps, which provided a detailed understanding of the ecological characteristics along the proposed transmission line corridor. These datasets were used to analyze potential spatial interactions between the proposed transmission line corridor construction and operational footprint and ecologically sensitive or important entities, including natural habitats, protected areas, and key biodiversity features. Emphasis was placed on identifying habitat types, assessing levels of modification, and understanding the landscape context using land cover classification derived from satellite imagery. The integration of these spatial layers within the GIS environment enabled accurate mapping, overlay analysis, and the identification of potential areas of concern requiring further field verification or mitigation planning.

1.2.2 Literature Study

A literature review was conducted as part of the desktop study to identify the potential habitats present within the project area.

- The IUCN Red List database was utilized to provide the most current account of the national status of flora.
- Field surveys were conducted to confirm (or refute) the presence of species identified in the desktop assessment. The specialist disciplines completed for this study included:
    - Botanical (flora)
    - Fauna (mammals and avifauna) and
    - Herpetology (reptiles and amphibians)

Brief descriptions of the standardized methodologies applied in each of the specialist disciplines are provided below.

1.2.3 Botanical Assessment

The botanical study encompassed an assessment of all the vegetation units and habitat types within the project area. The focus was on an ecological assessment of habitat types as well as identification of any Red List Data species within the known distribution of the project area. Due to the survey being conducted in the mid dry season this represented a severe limitation to the number of species identified. The methodology included the following survey techniques:

- Floral species identification
- Sensitivity analysis based on structural and species diversity and
- Identification of any potentially occurring floral red-data species or presence of suitable habitat for these species.

1.2.4 Faunal Assessment (Mammals & Avifauna)

The faunal desktop assessment included the following:

- Compilation of expected species lists
- Compilation of identified species lists
- Identification of any RedList Data or species of conservation concern (SCC) present or potentially occurring in the area; and
- Emphasis was placed on the probability of occurrence of species of national and international conservation importance.

The field survey component of the study utilized a variety of sampling techniques including, but not limited to, the following:

- Visual observations
- Identification of tracks and signs

1.2.5 Herpetology (Reptiles & Amphibians)

A herpetofauna assessment of the project area was also conducted. The herpetological field survey comprised the following techniques:

- Diurnal hand searches - are used for reptile species that shelter in or under particular microhabitats (typically rocks, exfoliating rock outcrops, fallen timber, leaf litter, bark etc.).
- Visual searches-typically undertaken for species whose behaviour involves surface activity or for species that are difficult to detect by hand-searches or pitfall trapping. Included walking transects or using binoculars to view the species from a distance without the animal being disturbed.
- Opportunistic sampling-reptiles, especially snakes, are incredibly elusive and difficult to observe. Consequently, all possible opportunities to observe reptiles are taken in order to augment the standard sampling procedures described above. This included talking to local people and reviewing photographs of reptiles and amphibians that the other biodiversity specialists may come across while on site.

1.2.6 Field Survey

The fieldwork and sample sites were placed within targeted areas (i.e. target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork. The focus of the fieldwork was therefore to maximise coverage and navigate within the target sampling sites in the field in order to perform a vegetation and ecological habitat assessment at each sample site. Emphasis was placed on sensitive habitats, especially those overlapping with proposed development areas. Due to the timing of the survey, morphological structures used to identify flora, such as inflorescences and flowers, are either limited or absent, thus affecting the floral species identified. At each sample site notes were made regarding current impacts (e.g. livestock grazing, erosion etc.), subjective recording of dominant vegetation species and any sensitive features present. In addition, opportunistic observations were made while navigating through the project area. Effort was made to cover all the different habitat types within the limits of time and access. The results of the fieldwork has been presented in

the ESIA report and used to guide the preparation of biodiversity assessment report. This report represents the results of the Scoping Phase only.

1.2.7 Key Legislative Requirements

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, may not be exhaustive and other legislation, policies and guidelines may apply in addition to those listed below.

- Convention on Biological Diversity (CBD, 1993)
- The United Nations Framework Convention on Climate Change (UNFCC,1994)
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973)
- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
- National Environment Policy, 2015
- National Forestry and Wildlife Conservation Law, Act No. 69/2015
- Environment Management Law No 79/2018
- Constitution of Somaliland, 2001
- National Climate Change Policy

1.3 Limitations

The following limitations should be noted for the study:
This report represents the results of the Scoping Phase only. The results of the fieldwork completed to date has been presented in the final ESIA report

- This study has not assessed any temporal trends for the respective seasons
- The assessment was based on the results of a scoping phase only, and information provided should be interpreted accordingly
- The SoW does not include biodiversity management plan
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the surveys, and as such there is a high level of confidence in the information provided.

1.4 Assumptions

- **One Season Survey:** Due to time constraints, the survey was conducted within a single season, without accounting for seasonal variations between the dry and wet seasons. This assumption implies that the results primarily reflect resident bird populations active during the survey time frame, as migratory species may not be present outside their migration window.
- **Diverse Habitats Represented:** The VOPs (Viewpoint Observation Points) and grids were strategically selected to represent the variety of habitats found along the corridor, ensuring the study captured a broad spectrum of ecosystems. The rationale for this approach was to maximize habitat diversity within the constraints of accessibility and security, given the long and remote nature of the transmission corridor. The selection of VOPs aimed to ensure that the survey accurately reflected the bird populations from various ecological zones despite the logistical challenges.

- **12-Hour Daily Observations**: A 12-hour daily observation period was deemed sufficient to gather a representative sample of bird activity at each VOP. Considering the vast area covered by the survey, this duration balanced the need for thorough data collection while accounting for the limitations posed by accessibility, security concerns, and the physical constraints of conducting extended surveys across difficult terrain.
- **Grid Stratification:** The study transect was divided into 20km sections to account for geographic and habitat variation along the corridor. This grid stratification allowed for a practical yet effective way to sample the extensive and varied landscape. The 20km interval was chosen based on the long stretch of the transmission line corridor and its challenging accessibility, which required a manageable approach to cover diverse areas while ensuring sufficient data was collected.
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2 PROJECT DESCRIPTION

2.1 Project Location

The proposed Wajaale-Hargeisa-Berbera 400kV transmission line is located in Somaliland and traverses 2 regions i.e. Marodi-Jeh and Sahil starting at Wajaale (border between Ethiopia and Somaliland) passing through Hargeisa and terminating at the proposed Berbera. The line crosses 3 administrative districts (Gebiley, Hargeisa and Berbera) and a total of 22 villages. The administrative locations of transmission line are shown in figure 2-1.

Figure 2-1. Transmission Line Route

Source: EMC Consultants 2024.

2.2 Project Activity Phases

The Project schedule includes the following four phases:

- **Pre-Construction phase (Phase 1):** includes detailed design, acquisition of land for the ROW and ancillary infrastructures (e.g. construction of workers' accommodation, identification of material sites) etc.
- **Construction, pre-commissioning, and commissioning phase (Phase 2):** includes civil works, construction of buildings and installation of site facilities, as well as mechanical and electrical works for transmission line and substations. The construction activities are planned to take approximately 18-24 months including pre-commissioning and commissioning phases. Currently it is foreseen that the main construction activities will start in the third quarter of 2026 and will be concluded in mid-2028.
- **Operations and maintenance phase (Phase 3):** the operation will commence and involve periodic maintenance activities at the Project site facilities and ancillary infrastructure. The design life of the line is of 50 years.
- **Decommissioning phase (Phase 4):** At the end of the planned operational lifetime, the operation of the Project facilities and ancillary infrastructure will be reviewed and either extended or decommissioned. Decommissioning will involve the removal and reuse/recycling/disposal of surface structures and the reinstatement and restoration of the affected sites.

2.3 Project Salient Features and Components

The main purpose of this project will be to evacuate 400kV high voltage power from Wajaale to Berbera passing through Hargeisa from where it will be energized into the national grid as part of the Ethiopia-Somalia interconnector.

2.3.1 High Voltage Transmission Line

The proposed transmission lines would be overhead transmission line consists of HV 400kV. Along the 271.6km stretch, it will require the erection of 679 towers, (271.6km*1000m/400m), each will be spaced at average distance of 400m (depending on the terrain and stability of the soil). The transmission line supporting structures will be steel lattice towers of two types-tension and suspension. Tension towers will be installed in angles and suspension towers will be installed along the line as load bearing support. The salient features of the 400kV Wajaale-Hargeisa-Berbera transmission line are given in Table 2.1.

Table 2-1: Project Salient Features

#	Features	Description
1	Voltage rating	400kV
2	Type of transmission line	Double Circuit
3	Width of Right of Way (RoW)	40m
4	Type of line support	Steel Towers
5	Conductor	AAAC Ash 180.7 mm^2
6	Conductor material	Aluminum Alloy
7	Line insulator	Disc type, Porcelain
8	Type of connection	Substation
	Tapping point	Jigjiga Substation

	Termination point	Hargeisa Substation
9	Number of angle towers	20
	Approximate number of towers to erect	679
10	Average/standard tower height (m)	40m
11	Approximate length of transmission line	271.6 km
	Average span between towers over normal topography	400m
12	Total land requires for installing a typical tower	256m^2 (16m x 16m)
13	Standard distance between phase-to-phase conductors (approx.)	4m

Source: Feasibility Study Report

Table 2-2: Tower Angle Point Locations

Angle points	Easting(X)	Northing(Y)	LONGITUDE	LATITUDE
SAP3_1	250879.460	1039895.220	42° 43' 53.4441" E	9° 24' 00.4519" N
SAP3_2	252613.415	1043799.788	42° 44' 49.4319" E	9° 26' 07.8556" N
SAP3_3	257273.665	1046314.363	42° 47' 21.6170" E	9° 27' 30.6414" N
SAP3_4	273449.341	1045939.217	42° 56' 11.8039" E	9° 27' 21.6618" N
SAP3_5	315234.237	1069013.566	43° 18' 57.7096" E	9° 39' 59.9737" N
SAP3_6	322583.777	1062866.417	43° 22' 59.7383" E	9° 36' 41.0530" N
SAP3_7	351110.085	1047398.884	43° 38' 37.3567" E	9° 28' 21.5757" N
SAP3_8	363606.863	1041236.904	43° 45' 27.8212" E	9° 25' 02.4983" N
SAP3_9	406855.959	1027630.832	44° 09' 06.8526" E	9° 17' 43.7146" N
SAP3_10	407555.345	1027839.115	44° 09' 29.7597" E	9° 17' 50.5502" N
SAP3_11	411673.235	1063039.787	44° 11' 42.0670" E	9° 36' 56.9343" N
SAP3_12	411690.145	1064760.130	44° 11' 42.4892" E	9° 37' 52.9464" N
SAP3_13	446512.758	1089868.242	44° 30' 43.8194" E	9° 51' 32.6003" N
SAP3_14	467651.214	1103424.282	44° 42' 17.4683" E	9° 58' 54.7927" N
SAP3_15	473793.939	1105051.830	44° 45' 39.1929" E	9° 59' 47.9476" N
SAP3_16	475233.061	1105176.724	44° 46' 26.4616" E	9° 59' 52.0472" N
SAP3_17	496275.549	1143162.880	44° 57' 57.5290" E	10° 20' 29.1511" N
SAP3_18	505158.271	1149336.061	45° 02' 49.6493" E	10° 23' 50.1423" N
SAP3_19	510114.067	1144933.246	45° 05' 32.5973" E	10° 21' 26.7526" N
SAP3_20	510258.269	1143971.073	45° 05' 37.3300" E	10° 20' 55.4231" N

Source: Feasibility Study Report

2.4 Route Selection

For selection of optimum line route, the following points were generally taken into consideration:

- The route of the proposed transmission line does not involve any human resettlement.
- Any monument of cultural or historical importance is not affected by the route of the transmission line

- The proposed route of transmission and distribution line does not create any threat to the survival of any community with special reference to Historically Underserved Traditional Local Communities (HUTCL).
- The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other establishments etc.
- The line route does not pass through any sanctuaries, national park etc.
- The line route does not infringe with area of natural resources.

3 SPATIAL CONTEXT OF PROJECT AREA

The Project is located within the northern parts of the country. The landscape of the regions traversed by the transmission line comprises a variety of habitats and land uses including shrubland, sparse vegetation and farmland. The transmission line does not cross any forests, reserves or protected areas. The only transmission line is over 50kms from a protected area (Ga'an Libah), and 50kms and 10kms away from 2 Key Biodiversity Areas (KBA)[2] which are also categorised as International Bird Areas[3] (Boorama Plains and Gacan Libaax). There is only one perennial river traversed by the transmission line route (Togga Baba). The smaller rivers and drainages have surface water only after periods of heavy rainfall. The two KBA/IBA sites, as well as the protected area, provide the most suitable habitats for such species and are highly likely to support wildlife, indicating potential impacts on biodiversity.

3.1 General Land Cover and Land Use

The land cover along the proposed transmission line corridor (Figure 3-1) spans a range of habitat types, reflecting varying degrees of ecological integrity. Analysis of satellite-derived land cover data integrated into GIS reveals that the corridor is predominantly composed of largely natural and natural habitats, with only a small proportion falling under the modified category. Based on the World Bank Environmental and Social Standard 6 (ESS6) classification, habitats can be categorized as:

3.1.1.1 Quantification of Habitat Extents in the Project AoI

The extent of the various mapped habitat types and their habitat status (i.e. modified/ natural) in the Project AoI (40m ROW and 1km buffer) are quantified in tables 3-1 and 3-2. The land cover along the proposed transmission line corridor spans a range of habitat types, reflecting varying degrees of ecological integrity. Analysis of satellite-derived land cover data integrated into GIS reveals that the corridor is predominantly composed of largely natural and natural habitats, with only a small proportion falling under the modified category.

3.1.2 Largely Natural Habitats (73.6%)

These areas exhibit minimal human disturbance and retain much of their original ecological character. They dominate the corridor and include:

- Sparse Shrubs and Sparse Herbaceous Vegetation- The most extensive land cover type, characterized by open arid or semi-arid landscapes supporting scattered shrubs and herbaceous species. These areas are ecologically important for supporting drought-adapted flora and fauna.

[2]Key Biodiversity Areas (KBAs): Key Biodiversity Areas (KBA) are 'sites contributing significantly to the global persistence of biodiversity', in terrestrial, freshwater and marine ecosystems. Sites qualify as global KBAs if they meet one or more of 11 criteria, clustered into five categories: threatened biodiversity; geographically restricted biodiversity; ecological integrity; biological processes; and, irreplaceability. KBAs comprise an "umbrella" set of internationally recognized priority sites for biodiversity that include Important Bird and Biodiversity Areas (IBAs); and Alliance for Zero Extinction (AZE) sites. For further information please see the Key Biodiversity Areas website.

[3] Important Bird and Biodiversity Areas (IBAs) are priority sites for bird conservation because they regularly hold significant populations of one or more globally or regionally threatened, endemic or congregatory bird species, or highly representative bird assemblages.

- Parklike Patches of Sparse Herbaceous Vegetation (20–10% cover) - Scattered grassland with occasional woody elements, representing transitional zones between shrublands and open grassland.
- Bare Soil and Unconsolidated Materials: Includes areas of exposed soils, sand, or gravel, often associated with seasonal watercourses or degraded patches.
- Loose and Shifting Sands: Sandy areas with minimal vegetation, likely to be mobile under wind action and potentially sensitive to disturbance.

3.1.3 Natural Habitats (17.3%)

These habitats are relatively intact ecosystems with native vegetation and minimal modification, supporting native biodiversity. Key types include:

- Shrubland with Herbaceous Layer: Dense shrub communities with a mix of grasses and forbs, indicative of stable dryland ecosystems.
- Shrubland with Herbaceous (20–10% cover): Slightly more open than the main shrublands, these areas still maintain high ecological value.
- Broadleaved Deciduous Woodland with Herbaceous Layer and Sparse Shrubs: Pockets of woodland provide critical habitat for woodland-adapted species.
- Closed to Very Open Herbaceous Vegetation with Trees and Shrubs: A mosaic of herbaceous cover interspersed with woody plants.
- Continuous Closed to Very Open Herbaceous Vegetation:
- Dense grasslands with varying canopy openness.
- Bare Rock(s): Extremely limited, representing exposed rocky outcrops.

3.1.4 Modified Habitats (4.7%)

These are areas subject to significant human influence, mostly through agricultural use:

- Permanently Cropped Area with Surface Irrigated Herbaceous Crops: Indicative of intensively cultivated fields, likely used for seasonal or commercial food production.
- Permanently Cropped Area with Small-Sized Fields of Irrigated Herbaceous Crops: Reflects fragmented subsistence farming with irrigation, common in peri-urban or settlement-adjacent zones.

Table 3-1. Habitat Description Along Area of Influence- 40m RoW

Habitat Description (40m RoW)	Area (ha)	ESS6 Category
Sparse shrubs and sparse herbaceous	87,015.2	Largely Natural
Shrubland with herbaceous	11,394.7	Natural
Permanently cropped area with surface irrigated herbaceous crop (s)	2460.4	Modified
Permanently cropped area with small sized F=field(s) of surface irrigated Herbaceous crop (s)	3,444.5	Modified
Parklike patches of sparse ((20-10)-4%) herbaceous vegetation	363.3	Largely Natural
Bare soil and/or other unconsolidated material(s)	2,459.5	Largely Natural
Broadleaved deciduous (40-(20-10) %) woodland with herbaceous layer and sparse shrubs	20.3	Natural

Closed to very open herbaceous vegetation with trees and shrubs	141.2	Natural
Continuous closed to very open herbaceous vegetation	15.0	Natural
Loose and shifting sands	93.4	Largely Natural
(40 - (20-10) %) shrubland with herbaceous	4874.1	Natural
Bare rocks	0.1	Natural

Table 3-2. Habitat Description Along Transmission Line Route 1km Buffer

Habitat Description (1 km buffer)	Area (ha)	ESS6 Category
Sparse shrubs and sparse herbaceous	4,350,761.574	Largely Natural
Shrubland with herbaceous	569,733.190	Natural
Permanently cropped area with surface irrigated herbaceous crop (s)	123,021.783	Modified
Permanently cropped area with small sized F=field(s) of surface irrigated Herbaceous crop (s)	172,224.596	Modified
Parklike patches of sparse ((20-10)-4%) herbaceous vegetation	18,165.664	Largely Natural
Bare soil and/or other unconsolidated material(s)	122,974.671	Largely Natural
Broadleaved deciduous (40-(20-10) %) woodland with herbaceous layer and sparse shrubs	1,015.760	Natural
Closed to very open herbaceous vegetation with trees and shrubs	7,060.040	Natural
Continuous closed to very open herbaceous vegetation	751.860	Natural
Loose and shifting sands	4,670.669	Largely Natural
(40 - (20-10) %) shrubland with herbaceous	243,707.153	Natural
Bare rock (s)	4.221	Natural

3.1.5 Land Use

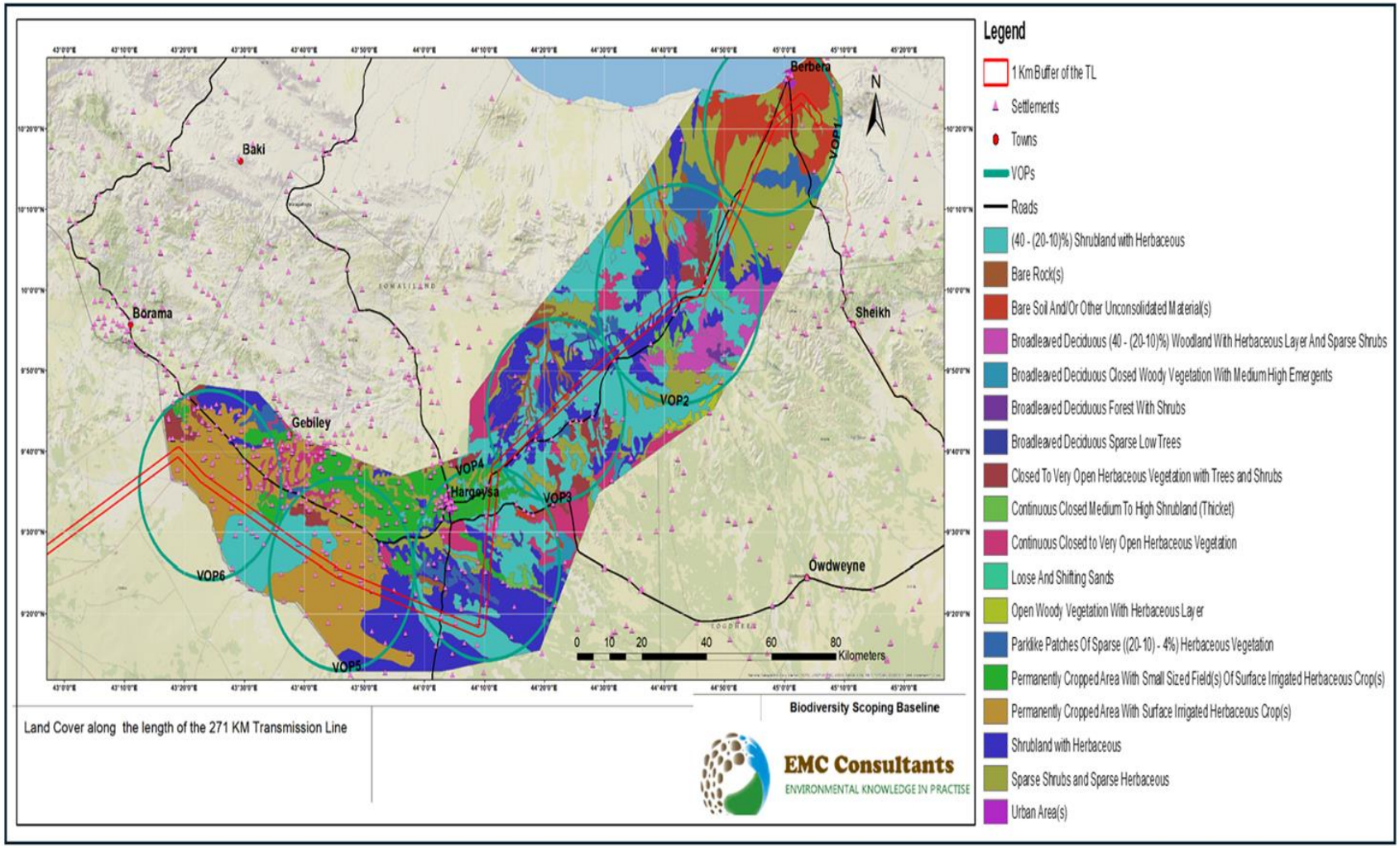
The land uses surrounding the project area consist of natural areas, modified habitats, agricultural land and rural areas with associated houses and livestock.

Table 3-3. Land Use Types Along Transmission Line Route

Km	Distances(km)	Land use/Land cover
25	0 to 25km	Agropastoral (high density of fields): sorghum, maize, shoats, cattle
58.24	25km to 83.4km	Agropastoral (medium density of fields)/wood collection: sorghum.
0.739	83.4km to 83.98km	Pastoralism (low density): shoats, camels, cattle
3.5	87.45km to 87.45km	Agropastoral (medium density of fields)/wood collection: sorghum
3.7	87.45km to 91.18km	Pastoralism (low density): shoats, camels, cattle.
1.05	91.18km to 92.23km	Agropastoral (medium density of fields)/wood collection: sorghum
14.5	92.23km to 106.73km	Pastoralism (low density): shoats, camels, cattle
1.58	106.73km to 108.31km	Pastoralism (high density)/wood collection and irrigated fields:fodder, sorghum
2.613	108.31km to 110.92km	Pastoralism (low density): shoats, camels, cattle.

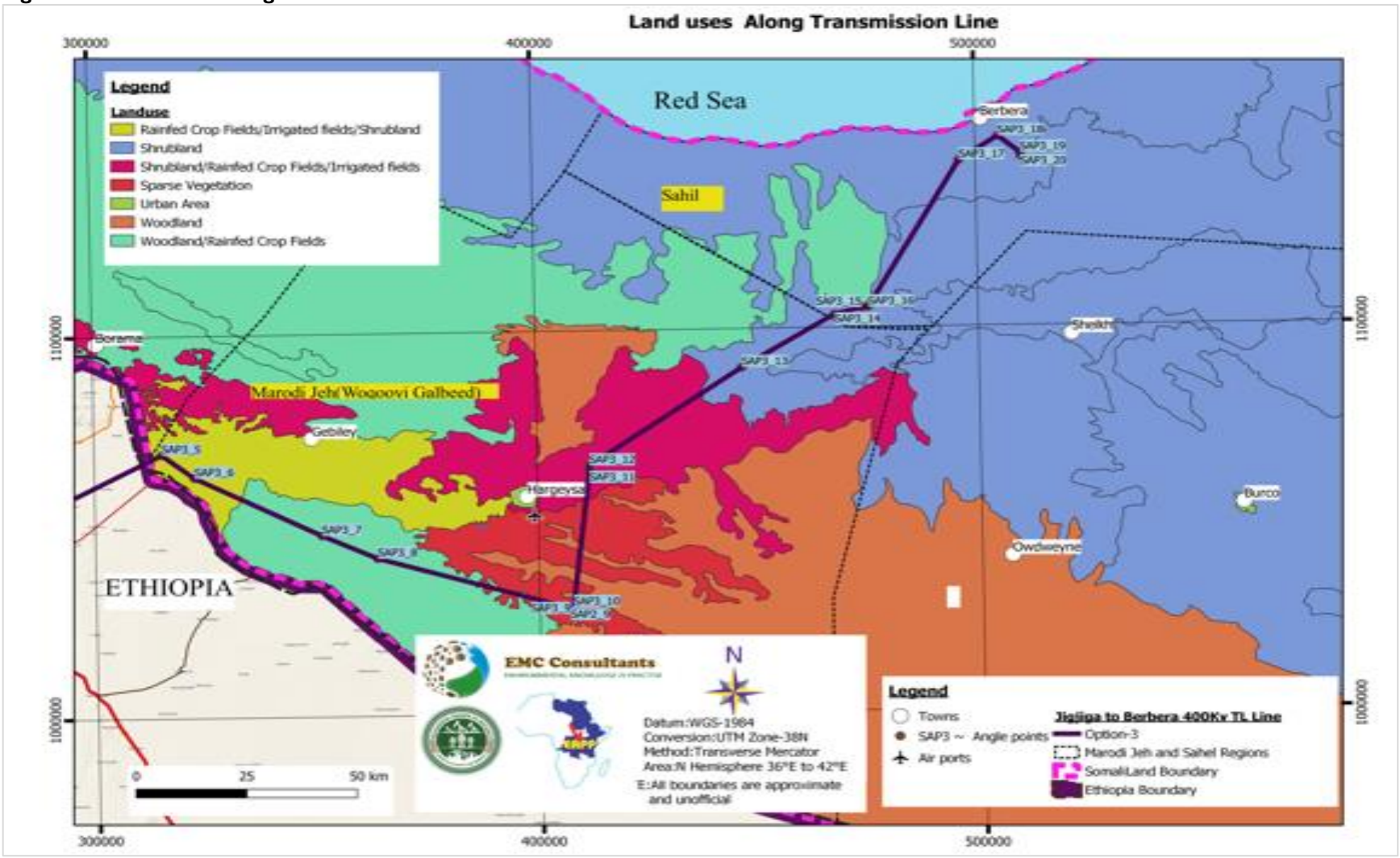
3.25	110.92km to 114.17km	Pastoralism (high density)/wood collection and irrigated fields:fodder, sorghum.
4.77	114.17km to 118.94km	Pastoralism (low density): shoats, camels, cattle
2.57	118.94km to 121.51km	Pastoralism (high density)/wood collection and irrigated fields:fodder, sorghum, camels, shoats
11.84	121.51km to 133.35km	Pastoralism (low density): shoats, camels, cattle
41	133.35km to 174.35km	Agropastoral (medium density of fields) with irrigated fields around togas: vegetable
74.68	174.35km to 249.03km	Pastoralism (low density) with scattered irirgated fields around togas: shoats, camels.
22.06	249.03km to 271.6km	Pastoralism (low density) in coastal plains: shoats, camels.

Figure 3-1. Land Cover Along Transmission Line Route



Source: EMC Consultants 2024.

Figure 3-2. Land Use Along Transmission Line Route



Source: EMC Consultants 2024.

3.2 Project Area in Relation to Protected Areas

A national conservation strategy used to exist but is now extremely low on the territories' agenda. Somaliland is part of Conservation International's Horn of Africa Hotspot which has over 60 endemic general and over 2,750 endemic species. Somaliland is a part of Somaliland-Masai steppe geographic region of plant endemism (savannas and shrub lands) and has 24 important bird areas. Generally, fauna has been depleted due to hunting and culling to protect livestock. The transmission line does not transverse any established protected area and is not within close proximity to any such ecosystem. The following protected area is found within 50km buffer zone. (Table 3-2). Based on the IBAT map, the transmission line route and AoI does not overlap with any protected area (Figure 3-3).

Table 3-4. Protected Areas

Area name	Distance	IUCN Category	Status	Designation
Ga'an Libah	>50 km	Not Reported	Designated	National Park

Source: IBAT

3.3 Key Biodiversity Area

There are 2 Key Biodiversity Areas[4] (KBA) which are 10kms and more than 50kms away from the transmission line as identified through the Integrated Biodiversity Assessment Tool (IBAT) and as shown in table 3-5, figure 3-3. These 2 KBAs are not in the direct AoI and only one KBA overlaps with the transmission line outside of the 10km buffer. Both sites/areas are designated as Important Bird and Biodiversity Areas (IBAs), reflecting their global significance for avian species conservation. Neither site is listed as an Alliance for Zero Extinction (AZE) site.

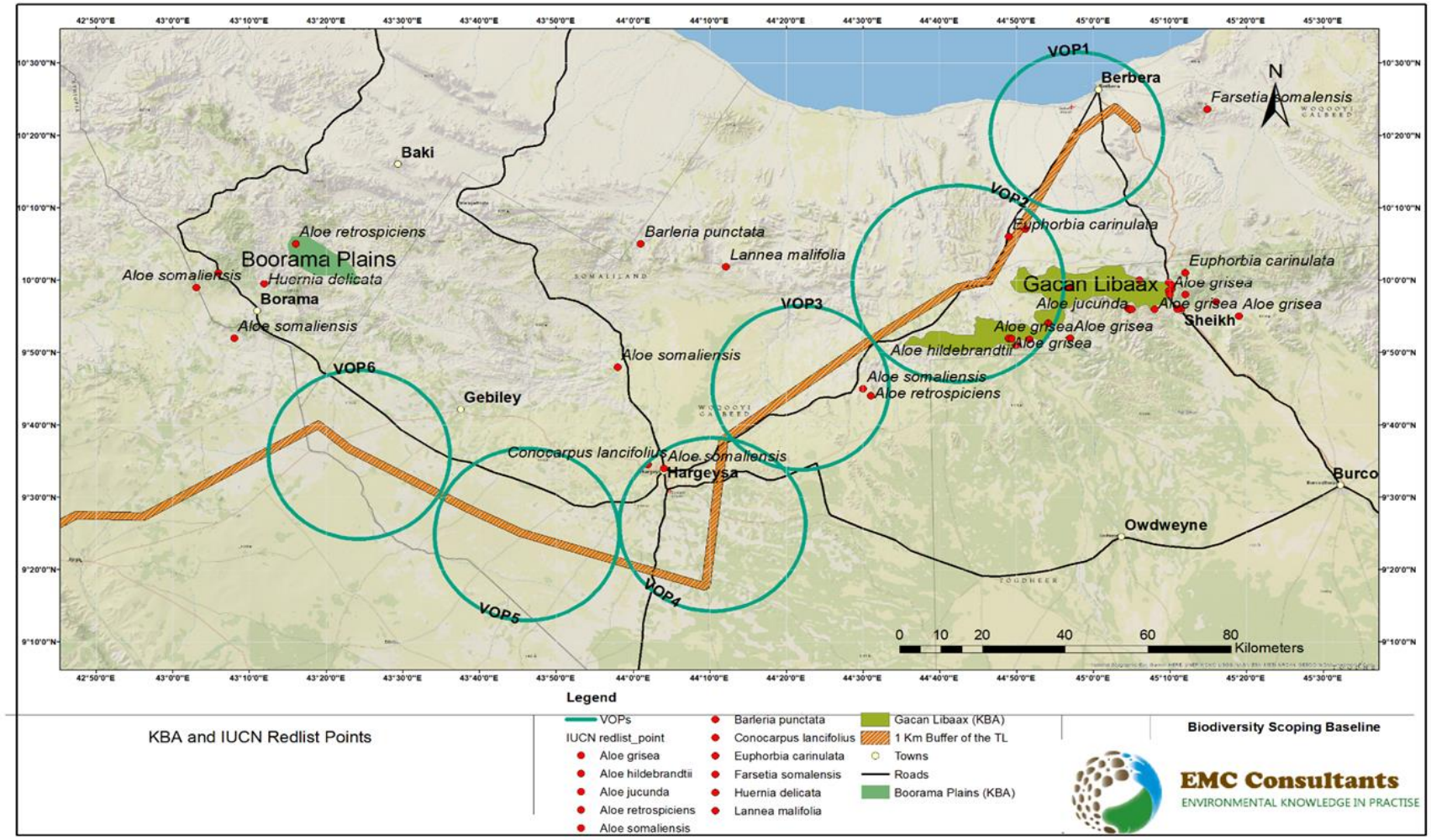
Table 3-5. Key Biodiverse Area

Area name	Distance	IBA	AZE
Boorama Plains	More than 50km from transmission line	Yes	No
Gacan Libaax	10 km from transmission line	Yes	No

Source: IBAT

[4] Key Biodiversity Areas (KBAs): Key Biodiversity Areas (KBA) are 'sites contributing significantly to the global persistence of biodiversity', in terrestrial, freshwater and marine ecosystems. Sites qualify as global KBAs if they meet one or more of 11 criteria, clustered into five categories: threatened biodiversity; geographically restricted biodiversity; ecological integrity; biological processes; and, irreplaceability. KBAs comprise an "umbrella" set of internationally recognized priority sites for biodiversity that include Important Bird and Biodiversity Areas (IBAs); and Alliance for Zero Extinction (AZE) sites. For further information please see the Key Biodiversity Areas website.

Figure 3-3. Transmission Line Route and Proximity to KBA



Source: EMC Consultants 2024.

4 RESULTS & DISCUSSION

4.1 Desktop Assessment

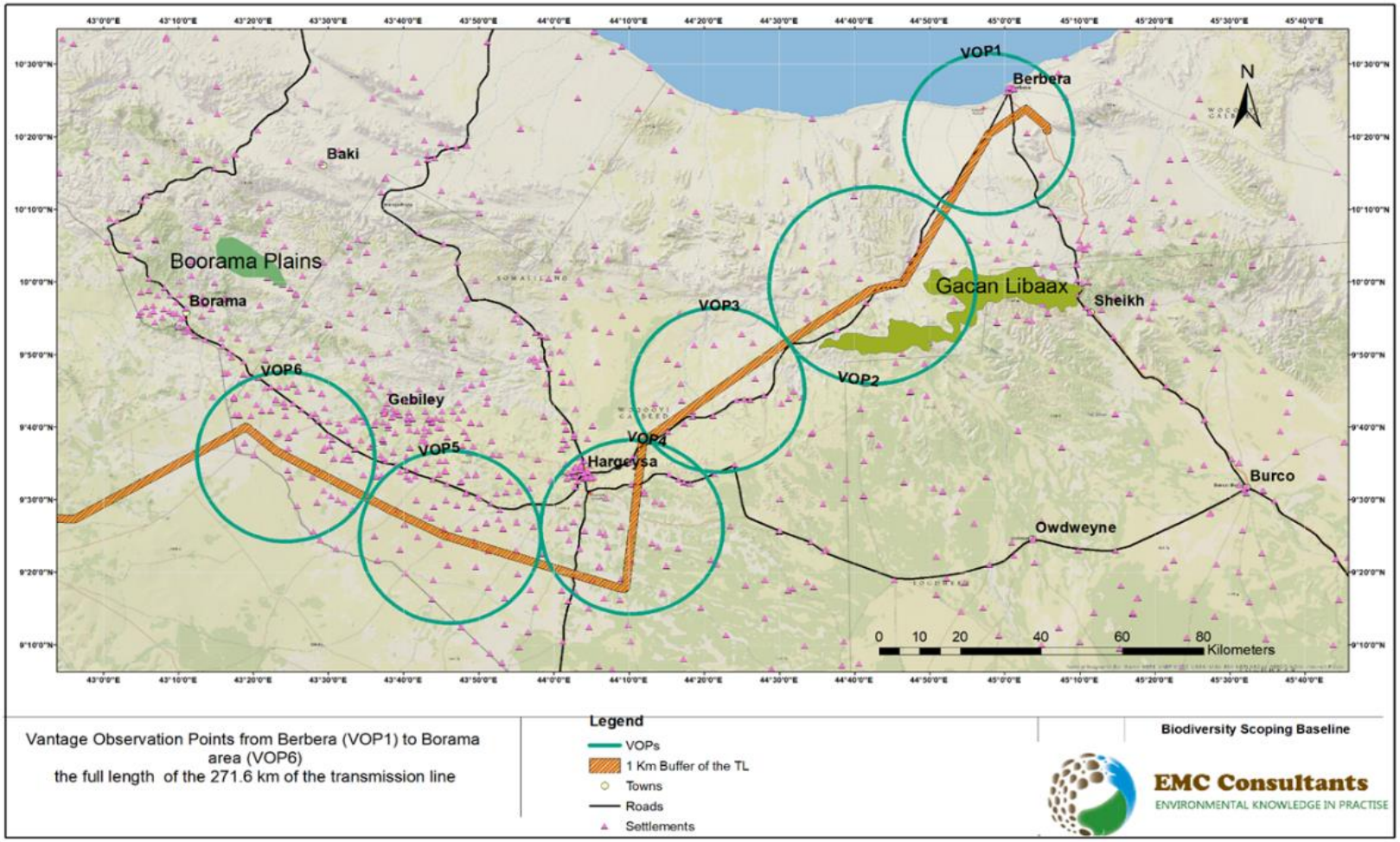
4.1.1 Vegetation Assessment

4.1.1.1 Grid System for Spatial Sampling

In this habitat field assessment, a grid system was implemented to divide the 271.6km study path into smaller, manageable segments. Each segment was 20km in length to ensure the sampling was evenly distributed along the entire route. This method helped avoid clustering of data at specific points, ensuring a more accurate representation of bird populations throughout the study area. For each grid segment, one or more VOPs (Vantage Observation Points) were selected either randomly or based on prior knowledge of the region's biodiversity. While VOPs are primarily suited for avifauna observations, they were also used during this survey as general reconnaissance points to record dominant vegetation types, notable plant species, and habitat characteristics. This integrated approach helped ensure broad spatial coverage across various habitat types and minimized sampling bias by avoiding over-representation of areas already known for high bird or plant diversity. Figure 4-1 shows the proposed transmission line (brown)/1km-and the 6 vantage VOP. The field data collection for the 15th-28th February 2024 focused on a 1km buffer around each of the 6 VOP grids along the transmission line corridor (Figure 4-2). At each of these survey points, walking surveys were conducted by the expert, who identified the dominant plant species and recorded the presence of other species (Figure 4-3). Environmental factors were also noted, including the number of people, buildings, and livestock present, which served as indicators of human influence. The presence of infrastructure, such as power lines and roads, was also recorded as part of the assessment of ongoing development in the region.

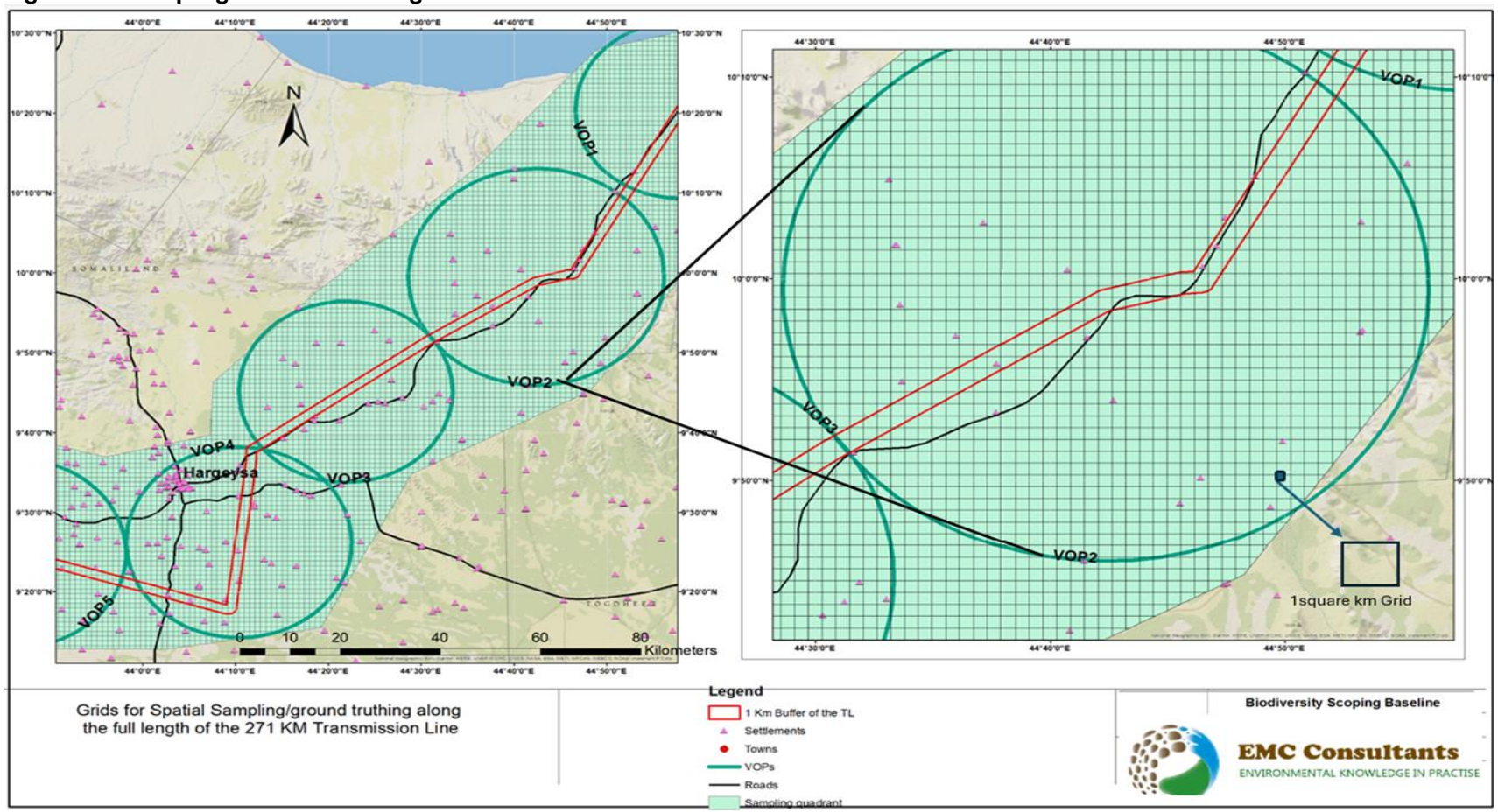
For each species recorded, a determination was made on whether it was dominant (i.e., more frequently encountered) or less common. The IUCN Red List status was checked for any threatened plant species, and their distribution was cross-referenced with data from the IUCN Red List and Plants of the World Online (https://powo.science.kew.org/). Special attention was given to species with restricted ranges, such as endemic or near-endemic species. Further analysis was conducted to determine whether plant species were native or introduced. For introduced species, the Global Register of Introduced and Invasive Species and the Centre for Agriculture and Bioscience International (CABI) Invasive Species Compendium were consulted to identify any species considered invasive in Somaliland. This approach helped identify potential ecological threats posed by invasive species to the region's ecosystems.

Figure 4-1. Grid System for Spatial Sampling Along Transmission Line Route



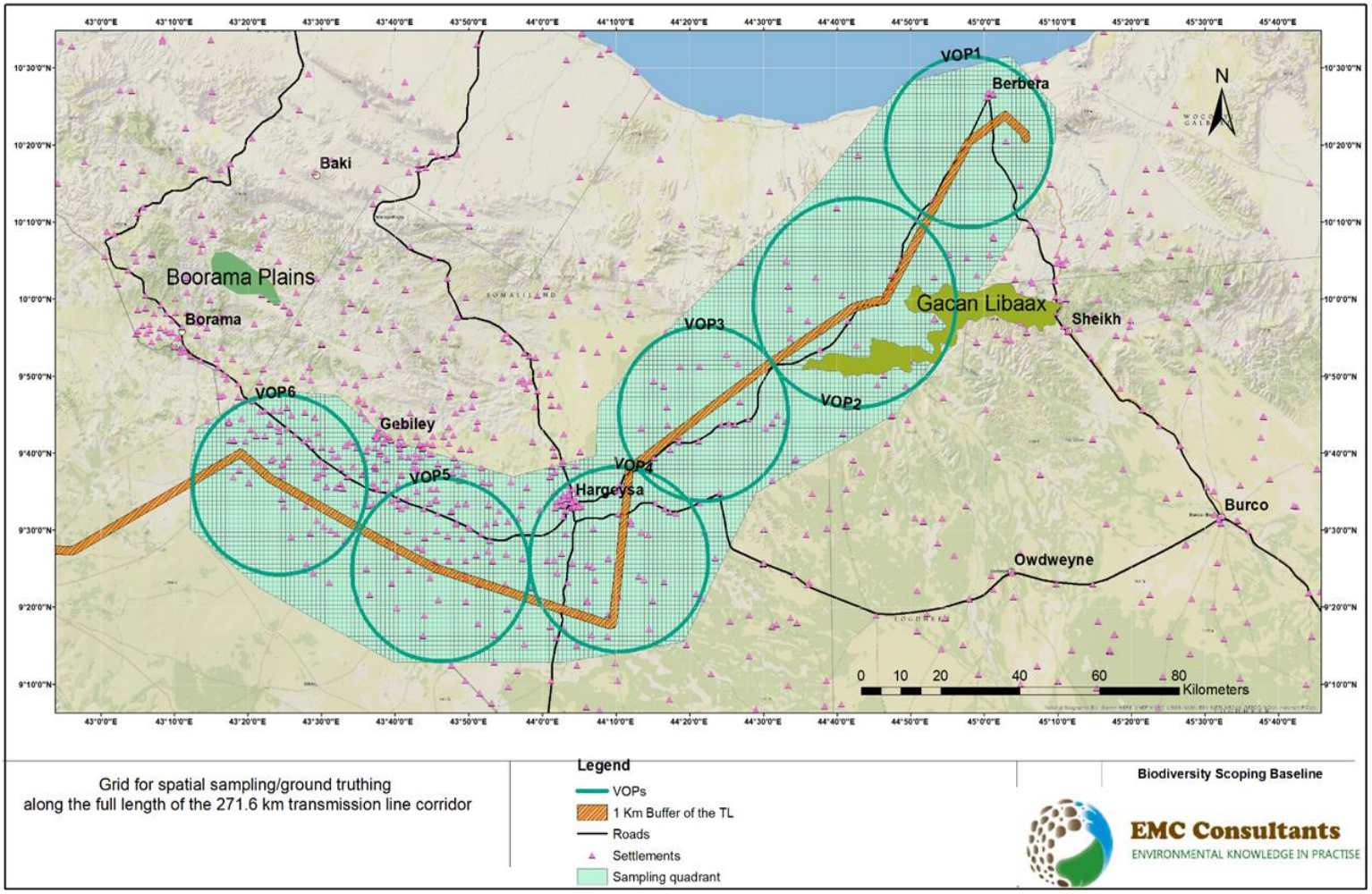
Source: EMC Consultants 2024.

Figure 4-2. Sampling/Ground Truthing Grid



Source: EMC Consultants 2024.

Figure 4-3. Proposed Transmission Line Sampling Grids



Source: EMC Consultants 2024

4.1.1.2 Stratified Sampling Based on Habitat Zones

Given the diversity of floral species across various habitats, a stratified sampling approach was employed to account for variability in species distribution. The linear study path was divided into distinct habitat zones, and VOPs were selected to represent each zone. The goal was to ensure that each habitat type was adequately represented in the study. VOP1 (Berbera) was selected to represent coastal habitats, which support unique bird populations. VOP3 (Awbarkadle) and VOP4 (Toon) were chosen for their proximity to grasslands and savannas, habitats where species like raptors are commonly found. The area is characterized by a mix of woody shrubs, trees, and grasses.

4.1.1.2.1 Important Plant Taxa

As indicated in table 4-1, 3 species of flora in the project area and within a corridor of 10-50km from the transmission line alignment was evaluated for EN species. The dominant plant species are drought-resistant trees and shrubs, many of which are adapted to conserve water and withstand the dry conditions, observed species are shown in table below. As indicated in Table 4-1 below, there are 3 species of flora categorized as EN which are likely to be present along the transmission line route and within the area of influence (AoI).

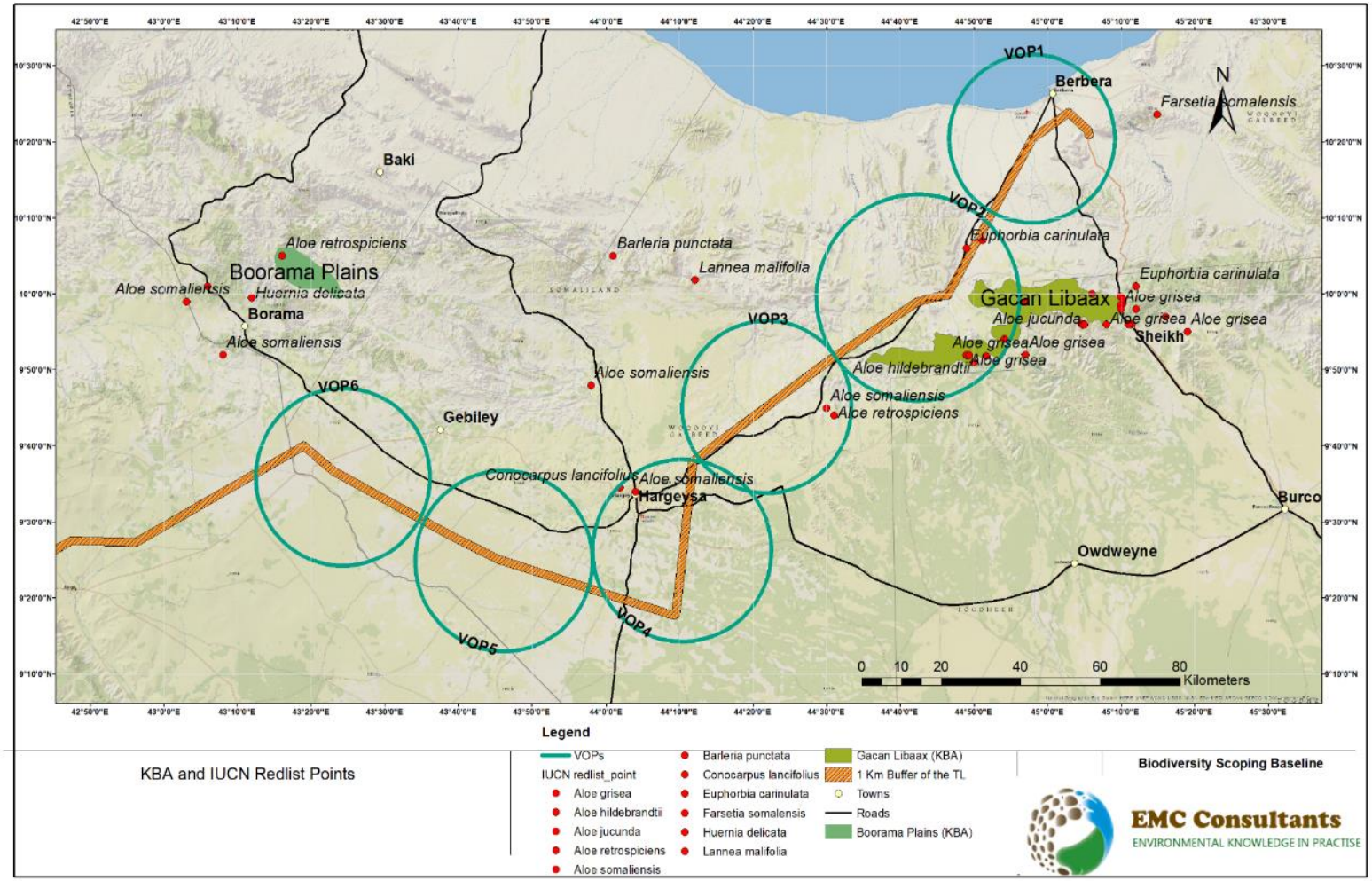
Table 4-1. Initial Screening of Flora Critical Habitat Qualifying Species Confirmed or Likely to Occur in Transmission Line Route AoI Red List Threatened Species [5]

Species Name	Common Name	IUCN Category	Population Trend	Biome
Vigna monantha	MAGNOLIOPSIDA	EN	Decreasing	Terrestrial
Aloe hildebrandtii	LILIOPSIDA	EN	Unknown	Terrestrial
Aloe grisea	LILIOPSIDA	EN	Decreasing	Terrestrial

Source: IBAT

[5] IUCN Red List of Threatened Species (IUCN RL or Red List): international standard for assessing threat status for species. The Red List is compiled by IUCN's global network of experts, specialist groups and partners. For further information, please see the IUCN Red List of Threatened Species website. Red List categories are: Critically Endangered (CR): Highest risk of extinction. A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild. Endangered (EN): Very high risk of extinction. A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild. Vulnerable (VU): Risk of extinction. A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild. Near Threatened (NT): A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered, or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future. Least Concern (LC): A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened. Widespread and abundant taxa are included in this category.

Figure 4-4. IUCN Flora RedList Points Along Transmission Line Route



Source: EMC Consultants 2024.

Table 4-2. Initial Screening of Flora CH Qualifying Species Likely to Occur in Transmission Line Route AoI.

Common Name	Scientific Name	IUCN Status
Umbrella Thorn Acacia	*Acacia tortilis*	Least Concern
African Commiphora	*Commiphora africana*	Least Concern
Frankincense	*Boswellia papyrifera*	Endangered
Desert Date	*Balanites aegyptiaca*	Least Concern
Tamarisk	*Tamarix spp.*	Not Evaluated
Acacia tortilis	*Vachellia tortilis*	Least Concern
Acacia nilotica	*Vachellia nilotica*	Least Concern
Acacia laeta	*Acacia laeta*	Not Evaluated
Commiphora africana	*Commiphora africana*	Not Evaluated
Commiphora wightii	*Commiphora wightii*	Not Evaluated
Balanites aegyptiaca	*Balanites aegyptiaca*	Not Evaluated
Tamarindus indica	*Tamarindus indica*	Least Concern
Boswellia papyrifera	*Boswellia papyrifera*	Not Evaluated
Cissus quadrangularis	*Cissus quadrangularis*	Not Evaluated
Zygophyllum simplex	*Zygophyllum simplex*	Not Evaluated
Zygophyllum album	*Zygophyllum album*	Not Evaluated
Pennisetum mezianum	*Pennisetum mezianum*	Not Evaluated
Cenchrus ciliaris	*Cenchrus ciliaris*	Not Evaluated
Acacia tortilis	*Vachellia tortilis*	Least Concern
Acacia senegal	*Vachellia senegal*	Least Concern
Acacia nilotica	*Vachellia nilotica*	Least Concern
Commiphora africana	*Commiphora africana*	Not Evaluated
Commiphora wightii	*Commiphora wightii*	Not Evaluated
Balanites aegyptiaca	*Balanites aegyptiaca*	Not Evaluated
Tamarindus indica	*Tamarindus indica*	Least Concern
Ficus sycomorus	*Ficus sycomorus*	Least Concern
Cissus quadrangularis	*Cissus quadrangularis*	Not Evaluated
Zygophyllum simplex	*Zygophyllum simplex*	Not Evaluated
Zygophyllum album	*Zygophyllum album*	Not Evaluated
Pennisetum mezianum	*Pennisetum mezianum*	Not Evaluated
Cenchrus ciliaris	*Cenchrus ciliaris*	Not Evaluated
Cymbopogon proximus	*Cymbopogon proximus*	Not Evaluated
Themeda triandra	*Themeda triandra*	Not Evaluated
Eragrostis tenuifolia	*Eragrostis tenuifolia*	Not Evaluated

Figure 4-5. Vegetation Along Transmission Line Route

Source: EMC Consultants 2024.

4.1.2 Faunal Assessment

The abundance and distribution of mammals in Somaliland, particularly the larger individuals, has been heavily impacted by hunting, beginning from the colonial days. In more recent decades, insecurity, disease, droughts, and the proliferation of guns have presented an on-going threat. Some of the iconic species that have been extirpated from the country during the early part of the twentieth century include the savannah elephant (*Loxodonta Africana*), lion (*Panthera leo*), Swayne's Hartebeest (*Alcelaphus buselaphus Swaynei*), Reticulated giraffe (*Giraffa camelopardalis*), Beisa Oryx (*Oryx beisa*) and Black Rhinoceros (*Rhinoceros bicornis*). The status of the Somali Wild Ass (*Equus africanus somaliensis*) and some others are unknown. A recent unpublished list of mammals in Somaliland contains one hundred and six (106) terrestrial mammals. (Mazuch, 2020). The mammalian species identified in secondary literature as likely to be present along transmission line route AoI are listed here below. During the biodiversity scoping field survey, species observed are shown in table 4-3.

Table 4-3. Initial Screening of Fauna CH Qualifying Species Confirmed or Likely to Occur in Transmission Line Route AoI.

#	Species	Common Name	Conservation Status	Sighted	Scoped In/Out
1	*Vulpes rueppellii*	Rüppell´s Fox	Least Concern	No	In
2	*Crocuta crocuta*	Hyaena hyaena	Near Threatened	No	

3	*Hyaena hyaena*	Stripped hyaena	Near Threatened	No	In
4	*Genetta genetta*	Common genet	Least Concern	No	In
5	*Herpestes sanguineus*	Common slender mongoose	Least Concern	No	In
6	*Orycteropus afer*	Aardvark	Least Concern	No	In
7	*Procavia capensis*	Rock Hyrax	Least Concern	No	In
8	*Phacochoerus aethiopicus*	Warthog	Least Concern	No	In
9	*Papio hamadryas*	Hamadryas Baboon	Least Concern	No	In
10	*Lepus habessinicus*	Abyssinian Hare	Least Concern	Yes	In
11	*Arvicanthus somalicus*	Somalian grass rat	Least Concern	Yes	In
12	*Hystrix cristata*	Crested porcupine	Least Concern	No	In
13	*Litocranius sclateri*	Geranug	Least Concern	No	In
14	*Gazella pelzelni*	Pelzeln´s Gazelle	Endangered	No	In
15	*Madoqua saltiana*	Salt's Dik-dik	Least Concern	No	In
16	*Gazella spekei*	Speke's gazelle	Endangered	No	In
17	*Diceros bicornis*	Black Rhino	Critically Endangered	No	In
18	*Diceros bicornis ssp. michaeli*	Eastern Black Rhino	Critically Endangered	No	In
19	*Oryx beisa*	Beisa Oryx	Endangered	No	In
20	*Oryx beisa ssp. beisa*	Beisa Oryx	Endangered	No	In
21	*Diceros bicornis*	Black Rhino	Critically Endangered	No	In

Source: IBAT

There are approximately 40 species of bats in Somaliland. While majority are in the LC of the IUCN Red List of threatened species, many are in either Data Deficient (DD) or Near Threatened categories. Some of these species are likely to be found within the vicinity of the proposed transmission line based on literature review and are summarized in the table 4-4.

Table 4-4. Bat Species Likely to be present along Transmission Line Route

Species	IUCN Red list & CMS Status	Ecological Trait that may influence	Other remarks

		vulnerability to the project	
Macinnes's mouse tailed bat, *Rhinopoma macinnesi*	Vulnerable (VU)	Prefers desertic and semi desertic habitats	Poorly understood hence and rare, especially in Somaliland where most biodiversity remains unstudied
Blasiuss horseshoe bat, *Rhinolophus blassi*	Near Threatened	Cave dependent. Like other Rhinolophid species this species is likely to be affected by artificial light	
African Long-fingered bat, *Miniopterus africanus*	Data deficient	Cave dependednt and migratory bat. Easily attracted to insects swaming artificial(flood/security) light	Some populations undergo torpor in certain months
Samburu Pipistrelle bat, *Neoromicia helios*	Data deficient	Low flying little bat with body mass below 6 grams,	There is little information on natural history of this species
Hamilton's tomb bat, *Taphozous hamiltoni*	Data Deficient	Medium size, high flying bat	Its distribution into the Somaliland is debated
African Straw-colored fruit bat, *Eidolon helvum*	Near Threatened	Migratory and high flying at levels of conductors	The range of this species is under debate

Source: IBAT

During the field survey, no observations were recorded on the presence of bats within the AoI due to the survey being carried out during the day due to security concerns associated with undertaking the survey after dark.

4.1.2.1 Avifauna

Somaliland is a part of Somaliland-Masai steppe geographic region of plant endemism (savannas and shrub lands) and has 24 important bird areas. There are 2 IBA[6]'s located approximately more than 10km and 50kms from the transmission line. These 2 sites, Boorama Plains and Gacan Libaax (see figure 4-1, 4-3, 4-4) are habitats for a number of avifauna species including 5 species that are categorized as CR and 10 EN. A desktop survey, followed by field survey screening for Critical Habitat (CH) was undertaken. The biodiversity scoping study involved assessment of critical habitats and avifauna diversity within the 1-10km corridor along the transmission line. The literature review assessment of avifauna showed 5 species of birds in the CR category and 10 species classified as EN. The avifauna likely to be present along the transmission line route based on literature review are shown tables 4-5 below.

4.1.3 Important Bird Areas

Somaliland is a part of Somaliland-Masai steppe geographic region of plant endemism (savannas and shrub lands) and has 24 Important Bird Areas. There are 2 IBA[7]'s within a 50km from the transmission line route. These 2 sites, Boorama Plains (50 km away) and Gacan Libaax (Figure 4-5) are habitats of a number of avifauna species that are categorised as CR and EN. 5 species are classified as CR and 10 species classified as EN (Table 4-5). The common avifauna observed along the transmission line route include *Lamprotornis suburbus, Lanius somalicus, Merops albicollis, Pterocles exustus.*

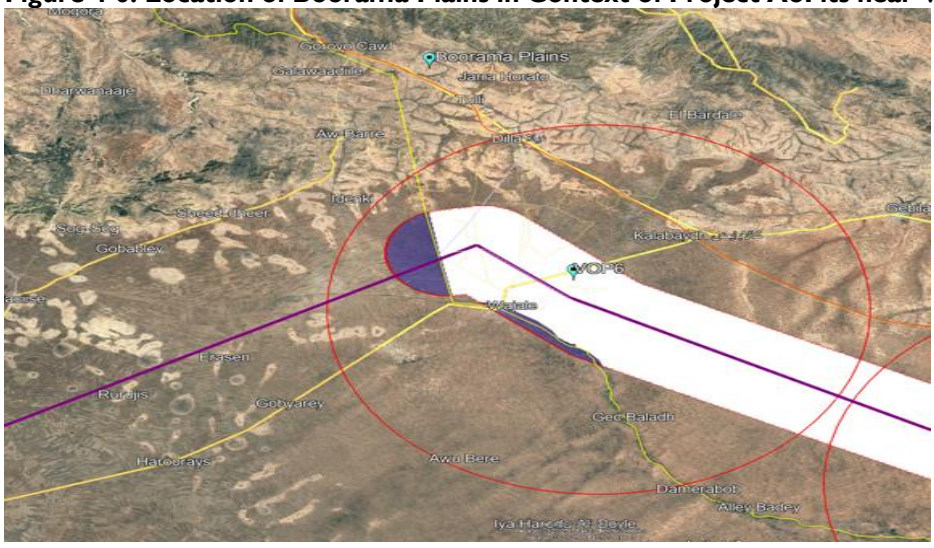
4.1.3.1 Gacan Libaax

Gacan Libaax and the Boorama Plains are both designated as Important Bird Areas (IBAs) in Somaliland, recognized for their rich biodiversity and significance to avian species. The areas supports several notable bird species, including the Sombre Rock Chat (*Cercomela dubia*), Gambaga Flycatcher (*Muscicapa gambagae*), and Somali Golden-winged Grosbeak (*Rhynchostruthus louisae*). Gacan Libaax is recognized as a protected area in Somaliland, aiming to conserve its unique flora and fauna.

4.1.3.2 Boorama Plains

The Boorama Plains are located on the border with Ethiopia, Somalia between the towns of Hargeisa, Boorama, and the frontier town of Tog Wajaale (Togo Chale).

Figure 4-6. Location of Boorama Plains in Context of Project AoI its near VOP6 Grid



Source: EMC Consultants

While specific bird species are not detailed in the available sources, the plains are recognized as an IBA, indicating their importance for bird conservation. Detailed legal status information for the Boorama Plains is not provided in the available sources. However, as an IBA, the area is acknowledged for its significance to bird conservation, which may influence land use and protection measures.

Table 4-5. Initial Screening of CH Avifauna Qualifying Species Likely to Occur in Transmission Line Route AoI.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome	Scoped Out/In
Necrosyrtes monachus	Hooded Vulture	AVES	CR	Decreasing	Terrestrial	In
Gyps africanus	White-backed Vulture	AVES	CR	Decreasing	Terrestrial, Freshwater	In
Gyps rueppelli	Rüppell's Vulture	AVES	CR	Decreasing	Terrestrial	In
Trigonoceps occipitalis	White- headed Vulture	AVES	CR	Decreasing	Terrestrial	In
Heteromirafra archeri	Liben Lark	AVES	CR	Decreasing	Terrestrial	In
Oxyura maccoa	Maccoa Duck	AVES	EN	Decreasing	Terrestrial, Freshwater	In
Neophron percnopterus	Egyptian Vulture	AVES	EN	Decreasing	Terrestrial, Freshwater	In
Torgos tracheliotos	Lappet-faced Vulture	AVES	EN	Decreasing	Terrestrial	In
Terathopius ecaudatus	Bateleur	AVES	EN	Decreasing	Terrestrial	In
Aquila nipalensis	Steppe Eagle	AVES	EN	Decreasing	Terrestrial	In
Polemaetus bellicosus	Martial Eagle	AVES	EN	Decreasing	Terrestrial, Freshwater	In
Sagittarius serpentarius	Secretary bird	AVES	EN	Decreasing	Terrestrial	In
Falco cherrug	Saker Falcon	AVES	EN	Decreasing	Terrestrial, Marine, Freshwater	In
Geronticus eremita	Northern Bald Ibis	AVES	EN	Stable	Terrestrial	In
Mirafra sharpii	Sharpe's Lark	AVES	EN	Decreasing	Terrestrial	In

Source IBAT.

4.1.3.3 Restricted Range Species

Table 4-7 below shows the restricted range species likely to be found within the range of 50km corridor from the alignment of the transmission line. 3 of the species qualify as threatened species (EN/CR namely *Heteromirafra archeri, Geronticus eremita,* and *Mirafra sharpie*.

Table 4-6. Initial Screening of Restricted Range CH Qualifying Species Likely to Occur in Transmission Line Route AoI.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Heteromirafra archeri	Liben Lark	AVES	CR	Decreasing	Terrestrial
Geronticus eremita	Northern Bald Ibis	AVES	EN	Stable	Terrestrial
Mirafra sharpii	Sharpe's Lark	AVES	EN	Decreasing	Terrestrial
Rhynchostruthus louisae	Somali Grosbeak	AVES	NT/LR/NT	Decreasing	Terrestrial
Larus leucophthalmus	White-eyed Gull	AVES	LC/LR/LC	Stable	Terrestrial, Marine

Phaethon aethereus	Red-billed Tropicbird	AVES	LC/LR/LC	Decreasing	Terrestrial, Marine
Oceanites oceanicus	Wilson's Storm-petrel	AVES	LC/LR/LC	Stable	Terrestrial, Marine
Fregetta tropica	Black-bellied Storm-petrel	AVES	LC/LR/LC	Decreasing	Terrestrial, Marine
Turdus ludoviciae	Somali Thrush	AVES	LC/LR/LC	Stable	Terrestrial
Columba oliviae	Somali Pigeon	AVES	Data Deficient (DD)	Stable	Terrestrial

Source IBAT.

4.1.4 Summary Details of Avifauna Critical Habitat Qualifying Species Likely to Occur in Transmission Line Route AoI.

Hooded Vulture (*Necrosyrtes monachus*)

The hooded vulture (*Necrosyrtes monachus*) is an old-world vulture endemic to Africa. It is found in the Boorama plains and Gaacan Libaax in Somaliland and is also distributed widely throughout sub-saharan Africa's urban centers and savannas. Their adaptations to increased human populations have allowed hooded to vultures to stay fairly stable throughout their geographic range compared to most vultures (Gbogbo, et al., 2016; Kibuule, 2016; Thiollay, 2006).

Hooded vultures occupy a wide variety of habitats, and their familiarity with humans makes them a large presence in urban centers and near agriculture. Their more typical habitat would include open grassland, forest edge, wooded savanna, deserts and along coasts. Anywhere with trees high enough (hooded vultures prefer to nest >15m high) and sufficient carrion can support the hooded vulture. Found as high as 4,000m above sea level, hooded vultures are most abundant below 1,800m. (Adang, et al., 2019; Campbell, 2009)

Hooded vultures nest in just below the canopy of tall trees and build their nests out of sticks and line it with fresh vegetation at the beginning of the nesting season. Nests are then re-used year after year. Each year the female lays a single egg, and it is incubated for about 46 days. Females typically spend most of their times sitting on the egg while the male will bring back food. Upon hatching, the chick requires constant attention, and it is totally reliant upon its parents for food. The chick will stay reliant on its parents for food for about 6 months. After around 120 days, the fledged vulture will be about the same size as its parents and will soon complete its first flight. The vulture will then strike out on its own, generally at about 6 months of age. Sexual maturity in hooded vultures is not provided in the literature, but we can assume maturity will be around 3 or 4 years based on other vultures. (Adang, et al., 2019; Monadjem, et al., 2016; Reading, et al., 2018). The hooded vulture does not migrate, and they prefer to move very little. They stick mostly to their

own patch and rarely venture beyond the necessary searches for food. The home range of the hooded vulture is small for the most part, and this scavenging bird finds few reasons to leave it.

White-Backed Vulture (*Gyps africanus*)

The white-backed vulture is the most common and widespread vulture in sub-Saharan Africa. It is common in Boorama plains and Gaacan Libaax and is recognizable by its dark-brown face, long, white neck, and of course, a white backside that can only be seen when the bird is in flight. Its wings which are white on top and brown on the bottom, can reach a span of up to 7.5 feet. It is mostly bald held helps the white-backed vulture regulate its body temperature during hot days and cool nights, as well as stay clean while it eats because feathers can trap germs.

This species occurs in open woodlands, savannas, steppes, open swamps, riverine trees, and thornbush. Mostly in lowlands from sea-level to 1,500m but recorded up to 3,500m in Ethiopia. White-backed vultures prefer to nest in tall trees, often along watercourses, in open woodlands and savannas. They are more likely to choose Acacia species. These vultures build large platform nests out of sticks and line them with leaves and grasses. Nests are usually 34–100 cm in diameter. The vultures are monogamous and usually breed once a year. At about four months old, the chick becomes a fledging and is ready to leave the nest. Nonetheless, parents spend several more months caring for their offspring. Breeding season varies by region, with East and southern Africa breeding from April–January. White-backed vultures often nest in loose colonies of 5–20 pairs but can also nest singly. White-backed vultures are known to travel great distances, and juveniles may travel even further as they leave their parents' territory.

Rüppell's Vulture (*Gyps rueppelli*)

The Rüppell's Vulture is found within the region of Africa known as the Sahel Region, the area between the Sahara in the north and the Sudanian Savanna to the south. Its range crosses through a number of countries and regions including, Somaliland, Sudan, and Ethiopia. In Somaliland, it is found in the Boorama plains and Gacaan Libaax areas. It can also be found in parts of Kenya, Tanzania and Mozambique. These vultures often live in open ledges. Breeding takes place on cliff faces, with pairs historically numbering in the thousands. On an open ledge, Rüppell's griffon vultures create a platform of sticks and grass on which they lay a single egg,

traditionally after the rainy season. Trees can also sometimes provide a nesting option. Females will often take sticks from other nests, while males arrange them into their own formation. Incubation lasts 55 days, and once hatched, both parents will take care of the chick. A down-covered gray hatchling, the chick will fledge around 150 days, gaining independence just before the next breeding cycle begins. Generally, Rüppell's Vulture is considered as non-migratory (Cramp and Simmons 1980), although daily foraging movements of up to 150–200km have been recorded (see Ferguson-Lees and Christie 2001). However, in the last 15 years the species has been recorded far away from its breeding colonies reaching the Iberian Peninsula and north-eastern South Africa (Ferguson-Lees and Christie 2001, De Juana 2006, Kemp and Kemp 2006).

White-Headed Vulture (*Trigonoceps occipitalis*)

This species has a very large range in sub-Saharan Africa, from Ethiopia, Somalia, Somaliland, South Africa and many more countries. In Somaliland, the vulture is noted in Boorama plains and Gacaan Libaax regions.

White-headed vultures inhabit savannas, thorny bushlands or slightly wooded areas but they can also be found in completely open areas, such as semi-deserts. They sometimes venture into dense forests. They live at very varied elevations, from sea level up to 4,000 meters as noted in Ethiopia and Somalia. This species is a long-lived resident that maintains the territory. It is mostly absent from unprotected lands where it is rarely seen. They fly lower than other vultures and are often the first to arrive at a carcass.

White-headed Vultures build a nest with branches of 80 to 170 centimeters in diameter and 20 to 60 centimeters in height. The interior is lined with straw and herbs. It is placed in plain view on the crown of a large, flat-topped tree, often an acacia or baobab tree, at a height of 5 to 20 meters. The White-headed Vulture usually lives solo. It usually nests in isolated pairs. However, up to ten individuals may be found around a carcass. An adult is sometimes accompanied by an immature. The White-headed Vulture breeds every year. Unlike many other African vulture species, the White-headed Vulture is not a colonial nester, preferring instead to establish its nest at least 5-9 miles (8-15 km) away from any other White-headed Vulture pair. The vultures build a large nest made out of sticks, and it is usually placed in the crown of a tall, solitary acacia or baobab tree. It has been discovered that some pairs will have two or more nests, alternating among them each year. The breeding season varies depending on the region. In Somalia and Ethiopia, the breeding season occurs in October to June. The female will lay one egg, which must be incubated for around 55 days. The young vulture takes flight after about 4 months (110 to 120 days). Adult White-Headed Vultures tend to be more territorial and as a result, tend to stay in their area and avoid traveling long distances but they do not migrate. However, immature White-Headed Vultures are more likely to move around more due to a desire to wander, they can reach up to 90km per hour in flight.

Liben Lark (*Heteromirafra archeri*)
The species occupies mid-altitude grassland in Ethiopia, Somaliland and Somalia. In Somaliland, this species was historically known from a very restricted area, the Waajale plain, from Jifa Medir to Ban Wujaleh, west of Hargeisa, along the Ethiopian frontier (Spottiswoode *et al*. 2013).

Its natural habitats are subtropical or tropical dry shrubland and subtropical or tropical dry lowland grassland. It is threatened by habitat loss. The birds are largely terrestrial, and their behavior is secretive. Though quite capable of flight, they often prefer to conceal themselves in vegetation. The bird's preferred habitat is open grassland and rocky country, vegetated with tussocky perennial grasses and having an annual rainfall of 300-400 mm (12–16 in). The total area in which Liben lark can be found is estimated to be only 52 km^2 (20 sq mi), largely in Ethiopia. It avoids open spaces, creeping through grass cover, and flies reluctantly (Ash and Miskell 1998). Its diet is unknown. Nests have been observed in June, and clutch-size is three (Ash and Miskell 1998). Nests are woven from grass and usually located under small shrubs. Currently, nest success is likely to be low, due to the lack of dense grass to conceal the nests. Surveys also suggest there is a heavily male-skewed adult sex ratio (Spottiswoode *et al.* 2009, Donald *et al.* 2010, Collar and Donald 2018). Liben Lark may have two 'peaks' in breeding each year-one during June and another in November each year. These periods follow the onset of the rains and that as grassland habitat quality continues to be eroded, thus Liben Larks are forced to nest in poorer and poorer quality habitat, which carries additional risks from increased rates of predation and trampling by cattle and other livestock. Liben Larks are known to sing during both the rainy and dry seasons of the year. Individuals which are thought to be males have a relatively short aerial song display during which they seem to be incapable of retracting their legs, which suggests that they may not be able to migrate or fly very far (Donald et al., 2010b).

Egyptian Vulture (*Neophron percnopterus*)
The Egyptian vulture (*Neophron percnopterus*), also called the white scavenger vulture, is a small Old-World vulture and the only member of the genus Neophron. It is widely distributed; the Egyptian vulture is found from northern Africa, southwestern Europe to India. The African range of Egyptian Vulture is huge, concentrated along a broad band of the Sahel from Sudan (Nikolaus 1987), Ethiopia, Somalia, Eritrea and Djibouti in the east to Senegal in the west. It has been noted in Somaliland in the Boorama plains and Gacaan Libaax. The Egyptian vulture is usually seen singly or in pairs, soaring in thermals along with other scavengers and birds of prey, or perched on the ground or atop a building. Egyptian vultures nest communally on large trees, buildings or on cliffs. Nesting sites are usually chosen close to a dump site or other suitable foraging area.

The breeding season is in spring. The birds are monogamous and pair bonds may be maintained for more than one breeding season and the same nest sites may be reused each year. The nest is an untidy platform of twigs lined with rags and placed on a cliff ledge, building, or the fork of a large tree. Old nest platforms of eagles may also be taken over. Nests placed on the ground are rare but have been recorded in subspecies *N. p. ginginianus* and *N. p. majorensis*. The typical clutch consists of two eggs which are incubated in turns by both parents. e parents begin incubating soon after the first egg is laid leading to asynchronous hatching. The first egg hatches after about 42 days. The second chick may hatch three to five days later, and a longer delay increases the likelihood that it will die of starvation. The Egyptian Vulture is Europe's only long-distance migratory vulture. Flying up to 640 km per day, it can travel 5000 km when migrating between its European breeding sites and its wintering grounds at the southern edge of the Sahara. During the breeding season, you can find Egyptian Vultures nesting on cliffs and in mountainous areas across southern Europe, North Africa, and parts of Asia.

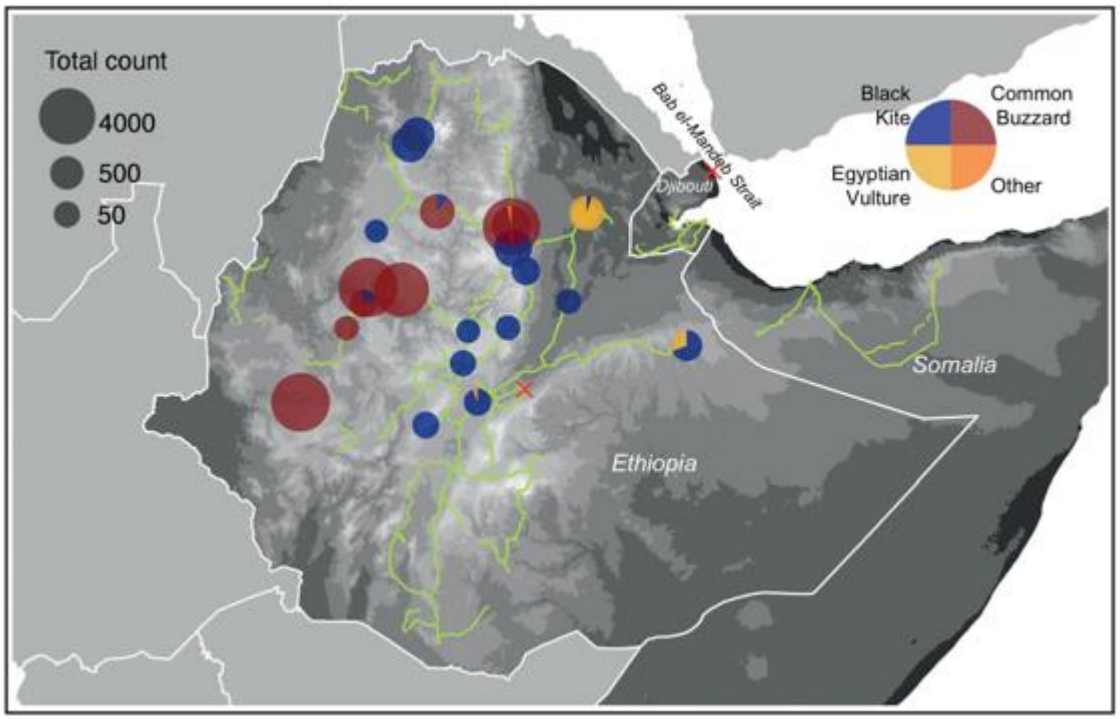


Figure 1. Raptor surveys in the Horn of Africa during autumn (southwards) migration, 2013–2019. Topography (grey-scale; paler indicates higher altitudes) is shown for Ethiopia, Djibouti and Somalia. Road survey routes are shown in green. The location of the Ras Siyan Peninsula, Djibouti and Abomsa, Ethiopia, which were sites that were pre-determined to be geographically favorable for migration are shown by red crosses. Large-scale counts including more than 20 individuals of any Palearctic migrant raptor species are shown as pie charts, centered on the survey location. Pie sizes are scaled by the logarithm of total counts at each location.

Lappet-faced Vulture (*Torgos tracheliotos*)

The lappet-faced vulture is a large bird with a heavy head and massive bill. It has mainly dark feathers and is easily identified by its bare pink head and large, fleshy folds of skin on the sides of its neck. In Somaliland, it has been noted in Boorama plains and Gacaan Libaax. Lappet-faced vultures are monogamous breeders and pairs mate for life. They are solitary nesters, preferring to be far distant from other pairs that are nesting. It builds solitary nests (containing just one egg), often in Acacia (its distribution sometimes being limited by these trees' distribution [Boshoff et al. 1997]), but also in Balanites and Terminalia (Shimelis et al. 2005). It does not breed until at least six years old, then fledging c.0.4 young/pair/year (Mundy et al. 1992). The time of the breeding season is different, depending on the location. In East Africa Lappet-faced vultures breed throughout the year. A pair builds a large, bulky, flat nest out of small sticks, lined with dry grasses, at the top of a thorny tree. One egg is laid and incubation is by both parents for around 7 to 8 weeks. Lappet-Faced Vultures do not migrate regularly in most areas. However, Lappet-Faced Vultures that live in West Africa have been observed to migrate temporarily southward when the weather is dry, and northward at the onset of the rainy season.

Bateleur (*Terathopius ecaudatus*)

The Bateleur eagle is the most famous of the snake eagles. Bateleur is French for 'tightrope-walker'. This name was probably chosen because of its distinctive aerial acrobatics. The bateleur ranges over most of Africa south of the Sahara Desert where there is no thick forest. It wants open land-grassland and acacia savannah. In Somaliland, it has been noted in Boorama plains and Gacaan Libaax.

Nests are located in fairly large trees, sometimes near a watercourse, either in hilly terrain or open flat country. At times, bateleurs are adaptable and perhaps even favor towards nesting near manmade openings such as roads or paths. Nests are typically at 10 to 15 m (33 to 49 ft) above the ground but in extreme may be from 7 to 25 m (23 to 82 ft) high. The nest is normally within the canopy in the fork of the main trunk or a large lateral branch so that it is shaded for much of the day. Nests tend to be lined with green leaves by the bateleur pair. The bateleur is usually rather monogamous and likely, with the survivorship of each mate, mates for life. During breeding, it tends to require closed-canopy savannah-woodland habitats, including Acacia savanna as well as mopane and miombo woodlands. At breeding, a female will lay a single egg in a nest that sits in a large tree, which offers protection. Mother incubates the egg while father collects food and sticks for the nest. Sometimes, however, the father incubates. Generally,

as in most eagles found as breeding residents in Africa, the bateleur is considered sedentary and territorial but it is a species that requires very large home ranges.

Steppe Eagle (*Aquila nipalensis*)

The steppe eagle is a large bird of prey. Like all eagles, it belongs to the family Accipitridae. The steppe eagle's well-feathered legs illustrate it to be a member of the subfamily Aquilinae, also known as the "booted eagles". The steppe eagle is entirely migratory, wintering in east and, to a lesser extent, southern Africa. Their African range can extend western to southern Sudan, almost throughout east Africa, to the easternmost part of Democratic Republic of the Congo. In Somaliland, the species has been noted in Boorama plains and Gacaan Libaax.

The steppe eagle tends to breed in open dry country, within the characteristic habitat it is named after: the steppe both in both upland and lowland areas. Associated habitats are frequented when breeding such as flat plains, arid grassland, semi-desert and even desert edge. Steppe Eagles build relatively flat stick nests that they line with rags, feathers, and even dung. Historically, they constructed their nests directly on the ground, but more recently, they tend to nest higher off the ground on rock columns, in bushes and trees, on power poles, and even in old, abandoned cars. The female lays 1-4 white eggs, usually with yellowish-brown markings. The eggs must be incubated for 45 days, at which time, nestlings covered in fluffy white down will hatch. The young eagles will grow quickly, and they will leave the nest when they are around 55–65 days. The steppe eagle is a migratory bird and spends the winter months in Eastern and Southern Africa, the Arabian Peninsula, and India. They fly south for the winter and only return to their country of origin and native land(s) when the seasons change.

Martial Eagle (*Polemaetus bellicosus*)

Martial eagles are Africa's largest eagle. Adults range in size from 78 to 96 cm in length, weighing between 3.1 and 6.2 kg, with a wingspan from 188 to 260 cm. In Somaliland, these birds have been noted in Boorama plains and Gacaan Libaax. Martial eagles prefer open habitats including savanna, steppe, semidesert and scrubby woodlands. These eagles require trees for nesting and are absent from arid or cleared areas, although there have been cases of martial eagles in the Karoo region of South Africa using power line supports to form nests. Martial eagles are spread sparsely throughout their geographical range punctuated with pockets of higher densities found in large, protected areas, especially in South Africa and Zimbabwe. They can be found at all altitudes under 3000 meters. (Burton and Burton, 2002; Machange, et al., 2005; Thiollay, 1994; de Goede and Jenkins, 2001). Martial eagles'

nest in large trees or pylons often located on hill sides. The nest is a large structure (4 –6 feet in diameter) made of sticks up to 1.5 inches in diameter and lined with green leaves. Pairs may build multiple nests (up to 7 nests in a given territory) and alternate between nests on successive years. The nests are often re-used from year to year with the female repairing parts of the structure and re-lining the interior with leaves. Mating seasons vary across the geographic range, although it generally occurs during the dry season: from February until November in South, Central and East Africa, from August till January in Northeast Africa, and in November in West Africa. Martial eagles more often breed once every two years, than once every year. The female lays generally 1, sometimes 2 eggs. Incubation lasts for 45 to 50 days, and chicks fledge 90 to 100 days after hatching. Juveniles remain close to the nest for up to 6 months, and do not reach full independence until 2 to 3 years of age. Martial eagles reach reproductive maturity at 4 to 5 years of age. (Allan, 1996; Burton and Burton, 2002; Machange, et al., 2005; Simmons. The female incubates the egg for the 45 to 50 days it takes for a chick to hatch, although males have been observed incubating. Males rarely bring food to incubating females until the egg hatches, after which males will hunt and feed females for approximately 2 months. A pair of adults can occupy a range up to 300 square kilometers, although in high densities a pair's territory is often less than 20 square kilometers. (Machange, et al., 2005; Thiollay, 1994).

Secretary Bird (*Sagittarius serpentarius*)

The Secretary bird is an Afrotropical species occurring throughout the savanna regions of Africa. It avoids the Sahara Desert of north Africa, the central and west African rain forest belt and the most arid parts of north-east Africa. It is widely distributed across Southern Africa. In Somaliland, the Secretary bird is found in Boorama plain and Gacaan Libaax.

Secretary birds prefer open savannahs and grasslands, although they also live in semi-deserts and lightly wooded or scrub areas. In grasslands, secretary birds choose areas where the grass is one meter or less in height, so their view is not obstructed. They are common near agricultural areas that offer hunting opportunities. Secretary birds are never found in true deserts with extreme aridity, or heavily wooded areas. These birds are found from sea-level to around 3,000m. (Ferguson-Lees and Christie, 2001; Hosking, et al., 1988; Steyn, 1983). Secretary birds are monogamous and are thought to pair for life. In courtship, they give a croaking call while displaying in the air and on the ground. *Sagittarius serpentarius* may breed throughout the year, although there are peaks in breeding from August to March. Both the male and female will construct a large nest on a flat-topped tree (usually an acacia tree or some other thorny tree). The nest is usually a saucer-shaped platform made of sticks and lined with a thick layer of grass, wool, dung, and other such materials. A pair of secretary birds will usually reuse the same nest for many years, adding to the structure each year to create a nest that can range from 1.5 to 2.5 meters in diameter. The female lays a

clutch of 1 to 3 eggs, with each egg laid two to three days apart. The eggs are chalky-white with reddish-brown streaks and are pyriform in shape. Eggs are variable in size and can range from 68 to 92 mm in length and 52 to 61 mm in width. Incubation of the eggs begins as soon as the first egg is laid. Incubation duties are shared by both the male and female, although more frequently by the female. The male brings food to the nest for the female during this time. In 42 to 46 days, the semi-altricial young hatch. A pair of secretary birds defends an area that can range from 20 to 500 square kilometers depending on the density of secretary birds and food resources in the area. Any conspecifics caught intruding in a pair's territory will be chased out forcefully. *Sagittarius serpentarius* is generally sedentary and will remain in its own territory, but they are sometimes nomadic. In most cases, these nomadic tendencies are caused by a search for food. (Ferguson-Lees and Christie, 2001; Steyn, 1983). The Secretary bird is endemic to sub-Saharan Africa and is generally non-migratory, though it may be locally nomadic as it follows rainfall and the resulting abundance of prey. Its range extends from Senegal to Somalia and south to Western Cape, South Africa.

Saker Falcon (*Falco cherrug*)

The Saker Falcon is a large species of falcon. This species breeds from central Europe eastwards across the Palearctic to Manchuria. Saker falcons (often simply called "sakers") occur in the semi-desert and forest regions from Eastern Europe to central Asia, where they are the dominant "desert falcon." Saker falcons migrate as far as northern parts of southern Asia and parts of Africa for the winter. In Somaliland, Saker Falcon is noted in Boorama plains and Gacaan Libaax. The Saker Falcon has a wide range across parts of Europe, Asia, and northern Africa. The Saker Falcon is predominantly a bird of open landscapes, occupying a diverse range of habitats from agricultural land, steppe, forest steppe, deserts and semi-deserts, mountains, foothills and montane plateaus. It can also be found on other dry country habitat with scattered trees, cliffs, or electricity pylons, particularly near water. Sakers occupies stick nests in trees, about 15 to 20 meters above the ground, in parklands and open forests at the edge of the tree line. No one has ever observed a saker falcon building its own stick nest; they generally occupy abandoned nests of other bird species, and sometimes even drive owners from an occupied nest. In the more rugged areas of their range, sakers have been known to use nests on cliff ledges, about 8 to 50 meters above the base. In order to attract females, male sakers engage in spectacular aerial displays, in common with many other members of the genus Falco. Male sakers soar over their territories, calling loudly. They end their display flights by landing on or near a suitable nesting site.

Sakers are generally two to three years old before they begin breeding. There can be 2 to 6 eggs per brood, but generally the number is between 3 and 5 (on average 4). After the third egg is laid, full incubation begins and usually lasts for about 32 to 36 days. In general, as is true for most falcons, males offspring develop faster than females. The young hatch with their eyes closed, but they open in a few days.

Females reach sexual maturity about a year before males; they occasionally breed in their first year, but usually not until their second or third year, and some wait until their fourth year. Males, on the other hand, begin breeding in their second year at the very earliest; most wait until the third or fourth year, and some males do not begin breeding until their fifth year. Sakers are not social birds; they prefer not to establish their nests close to other nesting pairs. Unfortunately, due to habitat destruction, sakers are being forced to nest closer and closer together, much more so than they ever would otherwise. However, in areas where food is plentiful, sakers will nest closer together than in areas where food is scarce. Space between pairs ranges from three to four pairs in three acres to pairs being six miles or more apart in the mountainous areas and steppes. The average spacing is one pair every 2.5 to 3.5 miles. Saker Falcons are partial migrants i.e., some individuals within a population migrate whereas others do not. Adult territory holders tend to have less inclination to migrate than others, especially juveniles. What causes variation in migration behaviour within and between populations is unclear, though it is probably determined by both genetic and environmental factors. Sakers do not form large migratory flocks like some other migratory birds of prey, nor do they appear in large numbers at migration bottleneck sites because their migration occurs over a broad front and over an extended time period.

Northern Bald Ibis (*Geronticus eremita*)

The Northern Bald Ibis (*Geronticus eremita*) was historically located in the European Alps, Northern Africa, and the Middle East until the start of the 1900's. As of 2004 there were only two remaining populations of the ibis in Morocco and Turkey. Ninety-nine percent of the wild population could be found in Morocco. Unlike many other ibises, which nest in trees and feed in wetlands, the northern bald ibis breeds on undisturbed cliff ledges, and forages for food in irregularly cultivated, grazed dry areas such as semi-arid steppes, and fallow fields. The close proximity of adequate steppe feeding areas to breeding cliffs is an important habitat requirement. The northern bald ibis breeds in loosely spaced colonies, nesting on cliff ledges or amongst boulders on steep slopes, usually on the coast or near a river. Volunteer climbers have created extra ledge spaces in the Souss-Massa colonies to ensure that breeding population is not limited by the availability of nest ledges, and artificial nest boxes are used in the managed colony at Birecik. In the past, the birds also nested in buildings. This ibis starts breeding at three to five years of age, and pairs for life. The male chooses a nest site, cleans it, and then advertises for a female by waving his crest and giving low rumbling calls. Once the birds have paired, the bond is reinforced through bowing displays and mutual preening. The nest is a loose construction of twigs lined with grass or straw. *G. eremita* normally lays two to four rough-surfaced eggs, which weigh an average of 50.16 g (1.769 oz), and are initially blue-white with brown spots, becoming brown during incubation. The clutch is incubated for 24–25 days to hatching, the chicks fledge in another 40–50 days, and the first flight

takes place at about two months. Both parents incubate and feed the chicks. The Northern Bald Ibis is a migratory bird. They migrate from Europe to east and northern Africa during winter.

Sharpe's Lark (*Mirafra sharpie*)

The russet lark (*Corypha sharpii*), also known as Sharpe's lark, an endemic bird species native to the grasslands and open savannahs of eastern and southern Africa. In eastern Africa, the species is found in Somalia, Somaliland and Ethiopia. This species is assumed to have a single, very small population which is inferred to be declining due to degradation of its habitat, especially as recent surveys have failed to locate this species within known historical sites. It is therefore classified as Endangered. In Somaliland, Sharpe's Lark has been noted in Boorama plains and Gacaan Libaax.

Sharpe's Lark is known for its melodious voice; the lark is often found singing from perches among tall grasses or shrubs. With a reliance on specific habitats, its presence serves as an important indicator of grassland ecosystem health. The natural habitat of Sharpe's Lark encompasses the grasslands and sparsely wooded areas of eastern and southern Africa. It is primarily found in countries such as Somaliland, Somalia, Ethiopia, Zambia, Zimbabwe, and South Africa. These regions provide the necessary features—open spaces, tall grasses, and limited human interference—that support their populations. Nesting typically occurs in the ground, where females create shallow depressions lined with grasses and leaves. The typical clutch contains 2 to 3 eggs, and both parents may take part in feeding the chicks after hatching. The nesting strategy of this lark helps protect its young from potential predators. Sharpe's Lark is not a migratory bird species.

Somali Grosbeak (*Rhynchostruthus louisae*)

The Somali Grosbeak, scientifically known as *Rhynchostruthus louisae*, is a small passerine bird that is endemic to the Horn of Africa region. This bird species is primarily found in two countries: Somalia and Djibouti. The species has been noted in the Boorama plains and Gacaan Libaax regions of Somaliland. They inhabit dense shrublands, woodlands, and thickets, preferring areas with abundant vegetation cover. These birds are generally solitary or found in small family groups, although they may congregate in larger flocks during the non-breeding season. They are known to be territorial, defending their feeding and nesting areas from other individuals.

Breeding behavior among Somali Grosbeaks is quite interesting. They form monogamous pairs during the breeding season, which typically occurs between March and July. Males engage in courtship displays, including singing and aerial acrobatics, to attract a mate. Once a pair is formed, they build a cup-shaped nest made of twigs, grass, and leaves, usually placed in the dense vegetation. The female lays 2-4 eggs, which are incubated by both parents for about two weeks. After hatching, the chicks are fed by both parents until they fledge and become independent.

The Somali Grosbeak is also known to undertake seasonal movements within its range. During the breeding season, which typically occurs from April to July, the birds can be found at higher elevations in the mountains, where they build their nests and raise their young. As the breeding season ends, they may move to lower elevations or even migrate to more favorable habitats in search of food resources. The Somali Grosbeak is thus predominantly a resident species, meaning they do not migrate long distances.

4.1.5 Avi Fauna Scoping Field Survey

Vantage point surveys were conducted to primarily assess species diversity and abundance, with a particular focus on large soaring birds, including migratory species, along the transmission line corridor in Somalia. These surveys aimed to capture bird activity across different habitats, offering valuable insights into the local and migratory bird populations in the region. The surveys were carried out at six selected Vantage Observation Points (VOPs) along the study corridor. Surveys were performed twice a day, once in the morning and once in the afternoon, each lasting for six hours at each survey point. This methodology was consistent following the standard protocol outlined by Buechley et al. (2021). The surveys were conducted by observers who followed the protocols recommended in key guidelines, such as guidance on appropriate means of impact assessment of electric power grids on migratory soaring birds in the Rift Valley/Red Sea Flyway (BirdLife International, 2015) and guidelines on how to avoid or mitigate the impact of electric power grids on migratory birds in the African-Eurasian region (Prinsen et al., 2012). These guidelines emphasize accurate methods for evaluating threats to migratory bird species, with a focus on migratory soaring birds.

Each VOP was carefully chosen to provide optimal visibility of the surrounding landscape. Observers recorded key data including:

- Species identification: To understand which bird species are prevalent in the area.
- Number of birds: To assess abundance.
- Flight height: Classifying birds as flying below at, or above the power line height (7–35 meters above ground, as per technical specifications for the infrastructure).
- Flight type: Identifying if the birds were migrating or making local movements.
- Flight routes: Mapping the routes followed by the birds to understand migration patterns.

The survey cycle was designed to ensure that data was collected across all daylight hours, with alternating survey times to cover morning and afternoon periods. All the VOP were surveyed over the 14 days, alternating between morning and afternoon surveys. This resulted in a total of 12 hours of survey time at each point, as recommended by Prinsen et al. (2012). The methodology allowed for the collection of comprehensive data on both resident and migratory bird species, providing valuable insights into bird populations and potential threats posed by transmission lines to migratory soaring birds.

4.1.5.1 Resident Bird Surveys

Resident bird surveys were designed to document the species present, their conservation status, abundance, flight height, and evidence of breeding along the transmission line corridor in Somalia. These surveys focused on understanding the resident bird populations at the selected VOPs, following the same methodology used for the vantage point surveys to ensure comparability. The surveys were conducted at the same six VOPs along the study area, using an "area search" methodology (Siegel, 2009). This approach allowed the surveyor to roam freely within a fixed area for a specified period, tallying the number of each bird species detected. This method is particularly effective in identifying birds that are actively singing, foraging, or exhibiting other behaviors such as flocking or migrating. Area searches are valuable for identifying rare or potentially endangered species, contributing to the identification of critical habitats.

At each survey point, four area search plots (ASP) were selected within the surrounding habitat. The plots were strategically selected to represent the key habitats surrounding each VOP, ensuring broad ecological coverage across the study area. To maximize coverage, the plots were spaced at least 400 meters apart. Each plot was surveyed for exactly 20 minutes, during which the observer recorded all species seen and heard, as well as details on their abundance and behavior, including signs of breeding (e.g., territorial defense, courtship, nest building, feeding young).

Two observers surveyed the four ASPs around each VOP. Surveys were conducted twice at each site, only in the morning when resident birds are most active. A total of 6 resident bird surveys were completed at each VOP, enhancing the likelihood of recording a wide range of species (Field et al., 2002). These surveys were alternated with the vantage point surveys, taking 6 survey days to complete the entire survey cycle between 15th-28th February 2024.

The VOPs were selected based on the land cover types, ensuring representation across the major ecosystems along the transmission line corridor. These land cover types served as a basis for identifying and stratifying the key habitat types, in line with ESS6 requirements. The habitat types and land cover data are therefore complementary, supporting a systematic assessment of biodiversity values within the project area.

Table 4-7. VOP1 (Berbera) - Coastal Habitat

Species	Common Name	Migratory Behaviour	IUCN Status	Flight Height	Circadian Behaviour	Sighted
Brown-necked Raven	(*Corvus ruficollis*)	Sedentary/non migratory	Least Concern	Below power line height (7–35m)	Diurnal	Yes
Lesser Kestrel	(*Falco naumanni*)	Full Migrant	Least Concern	Below power line height (7–35m)	Diurnal	No
Osprey	*Pandion haliaetus*)	Largely Migratory	Least Concern	Below power line height (7–35m)	Diurnal	No
Western Reef Heron	(*Egretta gularis*)	Partially Migratory	Least Concern	Below power line height (7–35m)	Diurnal	No

Table 4-8. VOP 2 (Mandera and Wajaale)–Arid with Seasonal Wetland Habitat

Species	Common Name	Migratory Behaviour	IUCN Status	Flight Height	Circadian Behaviour	Sighted
Marsh Harrier	(Circus aeruginosus)	Full Migrant	Least Concern	Below power line height (7–35m)	Diurnal	No
Grey Heron	(Ardea cinerea)	Partial Migrant	Least Concern	Below power line height (7–35m)	Diurnal	No
White-headed Vulture	(*Trigonoceps occipitalis*)	Sedentary/non migratory	Critically Endangered (CR)	Below power line height (7–35m)	Diurnal	No
African Fish Eagle	(Haliaeetus vocifer)	Sedentary/non migratory	Least Concern	Below power line height (7–35m)	Diurnal	No
Common Kestrel	(Falco tinnunculus)	Partial Migrant	Least Concern	Below power line height (7–35m)	Diurnal	No

Table 4-9. VOP3 (Awbarkadle)-Grassland/Savanna Habitat

Species	Common Name	Migratory Behaviour	IUCN Status	Flight Height	Circadian Behaviour	Sighted
Secretary bird	*Sagittarius serpentarius*	Sedentary/non migratory	Vulnerable	Above power line height (7–35m)	Diurnal	No
Lesser Kestrel	*Falco naumanni*	Full Migrant	Least Concern	Below power line height (7–35m)	Diurnal	No
Black-chested Snake Eagle	*Circaetus pectoralis*	Partially Migrant	Least Concern	Below power line height (7–35m)	Diurnal	No
Tawny Eagle	*Aquila rapax)*	Partial Migrant	Least Concern	Above power line height (7–35m)	Diurnal	No
Bateleur	*Terathopius ecaudatus*	Sedentary/non migratory	Least Concern	Above power line height (7–35m)	Diurnal	No

Table 4-10. VOP4 (Toon)-Grassland/Savanna Habitat

Species	Common Name	Migratory Behaviour	IUCN Status	Flight Height	Circadian Behaviour	Sighted
Steppe Eagle	*Aquila nipalensis*	Full Migrant	Least Concern	Above power line height (7–35m)	Diurnal	No
Booted Eagle	*Aquila pennata*/Hieraaetus pennatus.	Full migrant	Least Concern	Above power line height (7–35m)	Diurnal	No
Brown Snake Eagle	*Circaetus cinereus*	Sedentary/non migratory	Least Concern	Below power line height (7–35m)	Diurnal	No
African Hawk-Eagle	*Aquila spilogaster*	Sedentary/non migratory	Least Concern	Above power line height (7–35m)	Diurnal	No
Rüppell's Vulture	*Gyps rueppelli*	Sedentary/non migratory	Endangered	Below power line height (7–35m)	Diurnal	No

Table 4-11. VOP5 (Sheik Moldhe) - Urban Habitat

Species	Common Name	Migratory Behaviour	IUCN Status	Circadian Behaviour	Sighted
House Sparrow	*Passer domesticus*	Sedentary/non migratory	Least Concern	Diurnal	Yes
Laughing Dove	*Spilopelia senegalensis*	Partially Migratory	Least Concern	Diurnal	Yes
Black-winged Stilt	*Himantopus himantopus*	Fully Migratory	Least Concern	Diurnal	No
Pied Crow	*Corvus albus*	Sedentary/non migratory	Least Concern	Diurnal	No
African Pied Wagtail	*Motacilla aguimp*	Sedentary/non migratory	Least Concern	Diurnal	Yes

Table 4-12. VOP6 (Toon) - Arid Grassland Habitat

Species	Common Name	Migratory Behaviour	IUCN Status	Flight Height	Circadian Behaviour	Sighted
African Fish Eagle	*Haliaeetus vocifer*	Sedentary/non migratory	Least Concern	Below power line height (7–35m)	Diurnal	No
White-backed Vulture	*Gyps africanus*	Sedentary/non migratory	Near Threatened	Below power line height (7–35m)	Diurnal	No
Eurasian Hobby	*Falco subbuteo*	Full migrant	Least Concern	Below power line height (7–35m)	Diurnal	No
Northern Raven	*Corvus corax*	Sedentary/non migratory	Least Concern	Below power line height (7–35m)	Diurnal	No
Gabar Goshawk	*Micronisus gabar*	Sedentary/non migratory	Least Concern	Below power line height (7–35m)	Diurnal	No

These species are particularly at risk due to habitat loss, poisoning, and disturbances from human activities, including infrastructure development. The construction of a transmission line in these areas may pose a risk to these birds, especially if the line interferes with their migration or nesting areas. Monitoring and mitigation measures should be considered during the planning stages to reduce potential impacts on these vulnerable species.

4.1.5.2 Raptor Surveys

Raptor surveys were conducted along the transmission line corridor, aiming to maximize the number of raptor observations. Data was collected throughout the day, with a particular focus on early to mid-morning and late afternoon when raptors are most active. Raptors were surveyed via transects, either walking or driving, depending on accessibility and the presence of infrastructure. Road transects were conducted:

- Road Transects: These transects were conducted mostly from a vehicle, with 1-4 observers and a driver. The vehicle moved at a speed of <40 km/h, depending on road conditions. When raptors or other species of interest were spotted, the vehicle would stop, and the observers would exit to record the observation, noting the time, location, species, and behavior. The vehicle would stop regularly to allow observers to scan for perched or soaring raptors.

Figure 4-7. Avifauna Along Transmission Line Route

Lamprotornis suburbus

Lanius somalicus

Merops albicollis

Pterocles exustus

Source : EMC Consultants 2024.

4.1.6 Herpetofauna (Reptiles & Amphibians)

Based on the IUCN Red List reptile species are expected to occur in the AoI. No reptile species of conservation concern are expected to be present in the project area AoI other

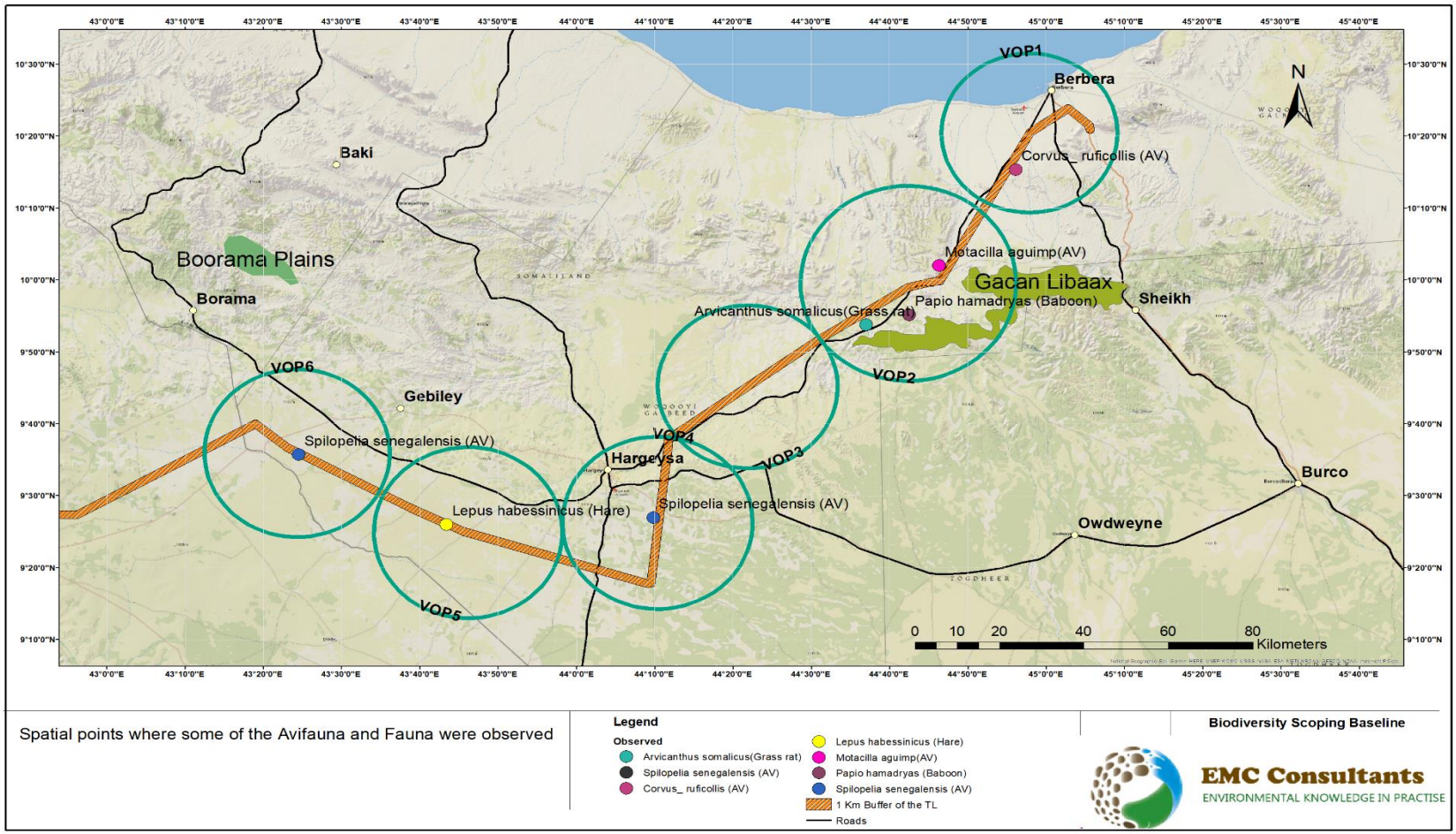
than 2 species of turtles which are marine and are likely to be outside of the AoI possibly present in Berbera's Indian Ocean which is away from the transmission line route.

Table 4-13. IUCN Red List Threatened Species

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Eretmochelys imbricata	Hawksbill Turtle	REPTILIA	CR	Decreasing	Terrestrial, Marine
Chelonia mydas	Green Turtle	REPTILIA	EN	Decreasing	Terrestrial, Marine

Source IBAT.

Figure 4-8. Sighting Locations for Flora and Fauna Along Transmission Line Route



Source: EMC Consultants 2024.

5 POTENTIAL IMPACTS

This report represents the Scoping Phase assessment only. A complete will be generated following the completion of additional field surveys. As such, the below is a generic representation of possible impacts regarding the proposed project and cannot therefore be considered an exhaustive list nor comprehensive representation of potential impacts. Transmission related activities have significant impacts on biodiversity and ecosystem services, often causing irreversible and large-scale habitat loss across large areas or areas important.

The results presented here are preliminary and may change significantly following the results of field surveys and further information (such as input from other specialist studies or information from interested and affected parties). From the summary it is clear that the overall impact significance is Substantial without mitigation for the construction phases of the project, and this changes to a significance of Moderate or High for most of the listed activities following the implementation of mitigation measures and recommendations.

During the operational phase of the project, all listed activities are considered to pose a Substantial level of risk without mitigation. Some of the impacts considered for the operational phase of the project could be mitigated, and the significance rating decreases to a Moderate level. Similarly, as for the operational phase, selected impacts anticipated for the decommissioning, closure and rehabilitation phase could be mitigated and the significance decreases to a low level for the listed activities.

5.1 Preliminary Impact Assessment

The proposed activities will result in direct loss and destruction of habitats, direct mortalities and displacement of fauna and flora. The removal of natural vegetation to accommodate mining will reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. Some sections of the project AoI provides possible habitat and shelter to a number of endemic and protected mammal and bird species. Although it is assumed that the majority of fauna species will move to different areas as a result of disturbance, many protected and endemic fauna or flora species have very specific habitat requirements, and the destruction of their habitats could result in displacement to less optimal habitats. This will result in a decline in species numbers which may ultimately affect the conservation status of specific species on global, national and provincial scales.

5.1.1 Construction Phase

5.1.1.1 Displacement and Fragmentation of the Faunal Community

Continued displacement and fragmentation of the faunal community (including possible threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching). Within the area directly impacted by infrastructure development (access road, transmission lines, temporary access roads, workers' accommodation etc.), land clearing in those parts will

not lead to or result to any net loss since they are not expected to be in forested/protected areas. A broader land cover analysis of the region shows that mosaic shrubland, and grassland dominate the landscape, covering approximately 75.0% of the area and representing largely natural or semi-natural habitats. Sparse vegetation, typically found in arid zones with scattered ground cover and commonly used for extensive grazing, accounts for 10.2%. Bare areas, including both consolidated and patchy types, make up 11.7%, indicating zones that are either naturally unvegetated or degraded due to factors such as overgrazing or erosion. In contrast, cropland and mosaic vegetation/cropland cover only 3.0%, highlighting the limited extent of crop-based land use in the region. Open grasslands are virtually absent, comprising just 0.08% of the land cover.

Land clearing along the RoW will impact the 40m width but impacts on biodiversity differs depending on the type of vegetation. Land clearing will primarily occur in settlement, farmlands, shrublands land cover types. Plant species that will be lost due to understory clearing, tree felling or brush cutting will primarily include cultivated plant species with economic value to the communities. Land clearing will not lead to the loss of any natural forest. No protected plant species were found in the direct AoI with 3 EN species located within 10-50km corridor of the transmission line. The project footprint will not create barriers to wildlife movements, as well as the loss of habitat.

This impact is considered highly probable, and the consequence could be very severe since permanent loss of natural habitat cannot be mitigated. The significance of the impact would be high. Assuming that the mitigation hierarchy is implemented at design stage to ensure that the potential footprint of infrastructure/activities within natural habitat areas is avoided/minimised to the maximum extent possible, it is expected that high significance impacts will be restricted to a relatively small proportion of the Project area. The residual impact is therefore reduced to medium.

5.1.1.2 Habitat Loss, Disturbance (noise, dust, poaching and vibration) and/or Direct Mortalities.

A final threat related to land clearing during the construction phase comes from project workers who could engage in wildlife poaching and collection of timber from protected areas for construction or other purposes. This primarily concerns areas where construction occurs adjacent to protected areas. These workers also increase the risk of fires that, especially during the dry season, could go out of control and affect protected areas.

Reduction in availability of quality habitats for breeding birds and foraging areas is most likely to occur during the construction phase. These activities should thus be timed to take place outside the breeding season. On the other hand, transmission lines have proven to be partially beneficial to many birds, including the larger species such as Martial Eagles *Polemaetus bellicosus*, African White-backed Vultures *Gyps africanus*, by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce (van Rooyen 2004). Although this provision of nesting and roosting substrate can be beneficial, it could also simply place these birds at greater risk of collision with the power lines. Raptor populations may benefit from the presence of power poles (Steenhof *et al*. 1993). Both Pied Crow and Ravens are ubiquitous and nest freely on human-made structures, often using pieces of scrap wire which can cause shorts.

Workers' accommodation if located close to such areas could lead to wildlife poaching and collection of timber. As a result, contractors will not be allowed to establish worker's accommodation close or adjacent to protected areas. Without mitigation, the likelihood of this impact occurring is moderate and the consequence of the potential impact could be severe, amounting to an impact of medium significance. Once mitigation measures are implemented, principally avoiding/minimising construction/excavation in high-risk habitats for ground-dwelling species, the probability of the impact occurring can be reduced, resulting in a residual impact of low significance.

5.1.1.3 Establishment and Spread of Alien and Invasive Species

Disturbances caused by vegetation clearing and earth works during construction could exacerbate the establishment and spread of Alien Invasive Species (AIS). Alien plant infestations can spread exponentially, suppressing, or replacing indigenous vegetation. This may result in a breakdown of ecosystem functioning and a loss of biodiversity. Without mitigation, the consequence of the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of medium significance. With the development of an auditable AIS Management Plan for the project, and the strict implementation of the recommended active control and monitoring measures throughout the construction phase, the probability of the impact occurring can be reduced, resulting in a residual impact of low significance.

5.1.2 Operation Phase

Several of the risks to terrestrial biodiversity expected during the construction phase, will extend to the operation phase of the project. The impacts relate to the spread of the alien and invasive plant species that may have colonised new areas during the construction phase; fragmentation of fauna habitats/barriers to movement, and the risk of injury/mortality presented to fauna by vehicular traffic utilising the access roads. These are discussed below. The environmental and biodiversity impacts of the transmission lines can be categorized into three main problems, each requiring specific mitigation strategies.

5.1.2.1 Electrocution Risks

Electrocution of birds is caused when a bird bridges the gap between either a live phase or an earth component (phase-earth electrocution) or two live phases (phase-phase electrocutions) (Harness and Wilson 2001). Several species of large birds suffer losses to electrocution. This would mainly affect birds associated with the site; and electrocutions on power supply structures by raptors and other medium sized birds on passage.

Birds sitting on power poles and/or conducting cables could cause short circuits between energized wires or short to ground especially for numerous medium sized birds and large birds using the power poles as perching, roosting and even nesting sites. Birds are able to cause electrical faults (short circuits on power lines through bird pollution). A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs, and a flashover results. Nests may also cause

faults through nest material protruding and constituting an air gap intrusion. Crows in particular often incorporate wire and other conductive material into their nests.

Avian electrocution can occur if a bird simultaneously contacts either two-phase wires or an energized phase wire and a grounded (earthed) contact, such as a steel member. Avian electrocutions can cause line faults and outages that negatively impact system reliability and power quality. Because of behavioral factors, raptors are more susceptible to electrocution than other groups of birds, although many other bird species are larger than raptors (Eccleston & Harness 2018). Vultures are at risk on power line structures in terms of both collisions and electrocutions (Van Rooyen 2010) due to their far-ranging nomadic habits and their colonial nature. They are gregarious and often attempt to perch together on one structure. The raptor species that are most likely to be affected are Hooded Vulture (*Necrosyrtes monachus*), White-Backed Vulture (*Gyps africanus*), Rüppell's Vulture (*Gyps rueppelli*), White-Headed Vulture (*Trigonoceps occipitalis*), Liben Lark (*Heteromirafra archeri*), Maccoa Duck (*Oxyura maccoa*), Egyptian Vulture (*Neophron percnopterus*), Lappet-faced Vulture (*Torgos tracheliotos*), Bateleur (Terathopius ecaudatus), Steppe Eagle (*Aquila nipalensis*), Martial Eagle (*Polemaetus bellicosus*), Secretary bird (*Sagittarius serpentarius*), Saker Falcon (*Falco c*herrug), Northern Bald Ibis (*Geronticus eremita*), Sharpe's Lark (*Mirafra sharpie*), Somali Grosbeak (*Rhynchostruthus louisae*) that might perch or nest on power infrastructure, and which have all been identified as present in between 10-50km corridor of transmission line area. None of the cited bird species were observed during the scoping survey.

5.1.2.2 Collision Risks

Collisions with transmission infrastructure are mostly a problem for birds. Bird collisions most often occur in raptors, species with either poor maneuverability (e.g., egrets), fast fliers, such as imperial pigeons (Ducula spp.) and quails (Janss 2000), or waterbirds, such as ducks and rails (MWH and Stantec 2018). Collision with power lines is a lesser-known problem than electrocution and is harder to detect because it can occur at any point along the transmission line, the bird collides with the earth wire, which is less visible. Collision risk is influenced by the topography of surrounding terrain and the proximity of lines and pylons to nests and other areas used frequently by local species. Potential impact through collision is anticipated to occur along river valleys that are mostly utilized by birds especially during the dry season. In most cases the impact of collision leads to immediate death or fatal injuries.

For the project, the raptor species that is of most concern for being affected by the transmission infrastructure are Hooded Vulture (*Necrosyrtes monachus*), White-Backed Vulture (*Gyps africanus*), Rüppell's Vulture (*Gyps rueppelli*), White-Headed Vulture (*Trigonoceps occipitalis*), Liben Lark (*Heteromirafra archeri*), Maccoa Duck (*Oxyura maccoa*), Egyptian Vulture (*Neophron percnopterus*), Lappet-faced Vulture (*Torgos tracheliotos*), Bateleur (Terathopius ecaudatus), Steppe Eagle (*Aquila nipalensis*), Martial Eagle (*Polemaetus bellicosus*), Secretary bird (*Sagittarius serpentarius*), Saker Falcon (*Falco c*herrug), Northern Bald Ibis (*Geronticus eremita*), Sharpe's Lark (*Mirafra sharpie*), Somali Grosbeak (*Rhynchostruthus louisae*) that might perch or nest on power infrastructure, and which have all been identified as present in between 10-50km radious of transmission line area. Furthermore, the few migratory species that, especially during the September to November migration could collide with towers or powerlines. Based on

the VOPs field surveys and migratory patterns, the following migratory species are most likely to be at risk of colliding with towers or powerlines over the September to November migration period:

- Egyptian Vulture (*Neophron percnopterus*)-Endangered (IUCN Red List)
- Griffon Vulture (*Gyps fulvus*)-LC (IUCN Red List
- Steppe Eagle (*Aquila nipalensis*)-EN (Global), CR (Europe)
- Pallid Harrier (*Circus macrourus*)-NT (IUCN Red List)
- Montagu's Harrier (*Circus pygargus*)-Least Concern (IUCN Red List)

These species are known to use the Rift Valley/Red Sea Flyway and could potentially be at risk of collision with powerlines and towers during their migration from September to November.

5.1.3 Mitigation Measures

5.1.3.1 Mitigating Electrocution

Reducing power line electrocutions is a raptor conservation priority worldwide. The best strategy is to bury the power lines underground, but this is estimated to be 3 to 20 times more expensive than above ground infrastructure, especially for high voltage lines (Prinsen et al. 2012). If burying power lines is not an option, physical separation between distribution structures that avoid animals from touching two structures simultaneously is a key mitigation strategy.

Avian Powerline Interaction Committee (APLIC 2006) recommends a minimum of 152 horizontal centimeters (cm) and 102 vertical cm of separation between phase-to-phase and phase-to ground contacts in the vicinity of a likely perch. Structures meeting APLIC's recommendations for eagles are described as "avian friendly." Above 230kV, engineering considerations usually dictate operational safety clearances that exceed recommended avian spacing recommendations (MWH and Stantec 2018). Designing for avian-safe structures can include one or more of the following strategies (APLIC 2006):

- Line design or configuration: increasing separations to achieve adequate separation for the species involved. When the power line is located within the distribution area of large raptors or storks, this distance should be increased to 1.4m.
- Insulation: covering energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. It is best to use suspended insulators and vertical disconnectors, if upright insulators or horizontal disconnectors are present, these should be covered. The length of insulated chains should be higher than 0.70m.
- Applying perch management techniques. Avian electrocution risk is lower for transmission structures than distribution poles because engineering requirements necessitate larger clearances (APLIC 2006). For transmission lines, APLIC (2006) recommends an additional 0.5m of separation for each additional 1kV over 60kV. Transmission line ratings reflect the phase-to-phase voltage differential; the phase-to-ground voltage differential is smaller. The phase-to-ground voltage can be calculated by dividing the line voltage by the square root of three (1.732) and should

be used to determine the appropriate phase-to-ground clearance for transmission lines (MWH and Stantec 2018).

The following structures require different insulation measures (Prinsen et al. 2012):

- Terminal structures-All terminal structures should be constructed with sufficient insulation on jumper wires and surge arrestors.
- Strain structures (where jumpers are used)-At least two jumper wires should be suspended below the cross-arm, and the third jumper insulated. Alternatively, all jumpers should be insulated.
- Take-off structures-Switches should be designed so that perching by birds on switch gear is unlikely, and/or all dangerous components are insulated. Switch gear should preferably be mounted below the cross-arm. Alternatively, insulated perch sites are installed way above the switch gear over the whole length.
- Intermediate structures with horizontal configuration of lines-Large enough to accommodate the wingspan (or 'wrist-to-wrist') of the largest perching bird species in the country if all three phases are above the cross-arm. Alternatively, two outer conductors should be suspended below cross-arm.
- Anti-perch devises can be useful to prevent birds from perching and potentially getting electrocuted, but they need to be carefully positioned and shaped so that they do not force birds to perch even closer to energized parts. Alternatively, if many birds are attracted to the nesting opportunities provided by transmission towers, and removal of such nests is costly, the provision of artificial nests has shown to be a cost-effective way to reduce natural nests in Japan (natural nests decay quickly and can cause short circuits) (Shimbun 2017).
- Undertake regular (at least annual) monitoring of the transmission line for evidence of birds nesting on the pylons. In the event of nesting, anti-perch and nest devices will be installed to discourage birds from regularly visiting these structures. These will be replaced when necessary.
- No hunting by Project personnel is to be tolerated under any circumstances (this measure should be a part of worker codes of conduct). Guidance shall be given to all staff that they are not allowed to harm any animals during any routine maintenance of the project's infrastructure.
- Artificial bird-safe perches and nesting platforms placed at a safe distance from the energized parts of transmission infrastructure.
- Cross-arms, insulators and other parts of the power lines to be constructed such that there is no space for birds to perch where they can come into contact with energized wires.
- Install Bird Flight Diverters (BFD) in sections with presence of critical habitat triggering species. BFD Are crucial for protecting these birds, as they can significantly reduce the risk of fatal collisions and help conserve raptor populations. Raptors, with their powerful eyesight, are particularly vulnerable to collisions with power lines, especially when hunting near open areas or when flying at high speeds.
- Install line marking to increase the visibility of the line.
- Install line marking to increase the visibility of the transmission line. There are three general types of line marking devices: aerial marker spheres, spirals, and

suspended devices. Aerial marker spheres, also known as aviation warning spheres, are used to make power lines and other overhead structures more visible to birds, reducing the risk of collisions, especially with raptors which are often large and powerful birds. These spheres are typically large, brightly colored (often orange or red/white), and placed at intervals along power lines or other structures. Raptors, being larger birds, are particularly vulnerable to collisions with power lines. Aerial markers can be crucial in protecting these birds.

- Spiral and suspended devices spin in the wind and reflect sunlight, creating a visual barrier that discourages birds from approaching spirals, and suspended devices.

5.1.3.2 Mitigation of Bird Collision

Although different bird species fly at different heights above the ground, there is general consensus that the lower power line cables are to the ground, the better for preventing bird collision. There is also consensus that less vertical separation of cables is preferred as it poses less of an 'obstacle' for birds to collide with. Horizontal separation of conductors is therefore preferred (Prinsen et al. 2012).

The most frequently used measure is wire-marking, which alerts birds to the presence of power lines and provides them with more time to avoid the collision (Janss 2000). Since the assumption is that birds collide with overhead cables because they cannot see them, fitting the cables with devices to make them more visible to birds in flight has become the preferred mitigation option worldwide. Besides thickening, coating or colouring the often least visible thin ground wires, a wide range of potential 'line marking' devices has evolved over the years, including spheres, swinging plates, spiral vibration dampers, strips, bird flappers, aerial marker spheres, ribbons, tapes, flags, fishing floats, aviation balls and crossed bands. Recent studies on bird collision mitigation devices for powerlines continue to highlight the importance of effective solutions, though high-quality, comprehensive evaluations remain limited. However, recent literature generally supports positive outcomes for these mitigation methods. A recent study by Bernardino et al. (2019) found that wire marking reduced bird collisions by approximately 50.4%, with variability depending on factors like the type of marker and environmental conditions. In addition, Gális et al. (2019) found that installation of bird flight diverters on power lines significantly reduced bird fatalities by up to 93.5%, further supporting the effectiveness of such devices. Furthermore, Baasch et al. (2022) showed that ultraviolet (UV) illumination on powerlines could reduce bird collisions by 88%, demonstrating the potential of alternative methods. These studies collectively suggest that mitigation devices, including wire marking and diverters, are generally effective in reducing avian mortality from powerlines, though the effectiveness can vary based on several factors.

5.1.3.3 Managing Impacts of Traffic on Fauna

To prevent negative impacts of vehicle traffic on wildlife (animal collisions, disturbance etc.) the following actions will be implemented by Contractors:

- Information campaigns to explain to drivers about the biodiversity management objectives that seek to avoid wildlife collisions and disturbance, including:

    - Explanations of the kind of animals likely to be encountered on roads (snakes, nocturnal wildlife etc.), and the appropriate action to be taken to avoid road kills.
    - The importance of adhering to local vehicle speed limits, and the consequences of not doing so.
    - The need to report when animals have been hit, and clarity about where these reports are kept and who they need to be reported to.
- Install and maintain signs in areas of frequent wildlife crossings, saying “beware of animal crossing” (complete with pictures of animals).
- Develop a system in which drivers report locations of wildlife crossing and wildlife sightings.

6 RECOMMENDATIONS AND CONCULSION

This report represents the Scoping Phase assessment only. A complete Biodiversity Assessment Report will be generated. The following steps are recommended:

6.1 Terrestrial Biodiversity

The intactness of Critical Biodiversity Areas that overlap with the Project AoI will be assessed and reported on after the Wet season survey to ensure species composition and abundance is accounted for as many species are senescent during the dry season. Development within natural state areas (areas of high sensitivity) should be avoided to the degree possible. If development is to commence in these areas, a biodiversity offset strategy will be required during the ESIA phase and will be relevant to all species themes.

6.2 Plant Species

A detailed botanical field survey to confirm the presence of these EN/CR species on site will be undertaken during the wet season. The survey will also be used to map vegetation communities and assess their ecological condition, to inform the assessment of Site Ecological Importance (SEI) and inform the need for design mitigation (avoidance) plus identification of any requirement for offset where significant residual impacts are unavoidable.

6.3 Animal Species

Baseline animal species field surveys to establish the presence of EN/CR species along the transmission line route AoI, with a focus on mammal and herpetofauna species should be conducted during the dry season and wet seasons.

6.4 Conclusion

This report represents the Scoping Phase assessment only. A complete Environmental Impact Assessment report will be generated and will be updated following the completion of full biodiversity assessment which will include additional field surveys and inclusion of additional information (such as feedback from interested and affected parties). From an ecological perspective the development is not situated close to, and within, sensitive or protected habitats. Additional field surveys will increase the robustness of the results, and a comprehensive wet season survey will be conducted in order to complete a detailed floral survey.

The proposed development and associated activities will result in direct loss and destruction of habitats (not likely to include Endangered vegetation type), direct mortalities and displacement of fauna and flora. The removal of natural vegetation to accommodate the transmission line will reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features.

The level of disturbance emphasizes the need to recommend relevant mitigation measures (including adhering to the recommended buffer zones) to limit the impact significance rating. Relevant mitigation measures can then be applied to ensure that these significance ratings be decreased (if possible).

7 REFERENCES

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