ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED 400kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP) FROM IBADAKULI SUBSTATION IN SHINYANGA REGION VIA GEITA REGION, NYAKANAZI AND KYAKA SUBSTATIONS IN KAGERA REGION TO MASAKA WEST IN UGANDA

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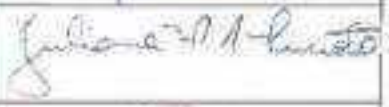
4	Juliana Peixoto	Biodiversity Expert	
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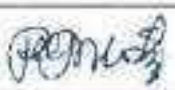
3	Reginald H. Mosha	Chief Valuer	
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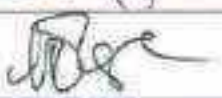
6	Vulfrida Benedict Teve	Legal Expert 1	
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1.0
Executive Summary

Justification

This Environmental and Social Impact Assessment (ESIA) was carried out to assess the environmental and social viability of the **400kV Uganda-Tanzania Interconnector Power (UTIP)** Project, of which the main objectives are to:

(i) Link generation in the area to load centres;
(ii) Enhance cross-border regional electricity trade;
(iii) Improve the security and the reliability of electricity supply;
(iv) Foster economic development and regional integration.

With the construction of the Transmission Lines - TLs and expansion of the Substations - SSs that make up the Project, Tanzania's transmission system will be interconnected to that of neighbouring Uganda, which has surplus hydroelectric power generation capacity.

As a result, the hydroelectric power generated in Uganda will be able to supply Tanzania with energy from a sustainable source, contributing to decarbonizing Tanzania's electricity system by reducing the CO_2 emissions from carbon-intensive power plants.

With the Project, Tanzania's electricity system will be reinforced, ensuring adequate performance and greater reliability.

Project Background and Description

The Project contemplates the construction of three 400 kV Transmission Lines (TLs), with a total length of 548.91 km, as shown in **Table 1.0.a** below.

Table 1.0.a
Basic information on the TLs

400 kV TL Segment	Total Length	Estimated Towers Footprint (ha)	Estimated Wayleave Footprint (ha)
Mutukula-Kyaka	31.01 km	0.75	161.25
Kyaka-Nyakanazi	235.65 km	5.82	1,225.38
Nyakanazi-Ibadakuli	282.25 km	7.05	1,467.7
Total	**548.91 km**	**13.62 ha**	**2,854.33 ha**

This ESIA only covers the Tanzanian part of the Project. The 400 kV Mutukula – Kyaka TL starts at the border between Uganda and Tanzania, not including the segment Masaka - Mutukula, which is in Ugandan territory. The 400 kV Mutukula – Kyaka runs from the border to the Kyaka Substation (SS) in the village of Kyaka. The Kyaka SS exists and is located on the side of the Road B182 and near Kagera River, on the edge of the urban area of the village of Kyaka.

The 400 kV Kyaka - Nyakanazi TL will be built between the Kyaka SS and the Nyakanazi SS. The existing Nyakanazi SS is located next to Road B3 (access between the highway and the SS is only 285 m), about 6.5 km from the village of Nyakazaki on this road.

The 400 kV Nyakanazi - Ibadakuli TL will be built to connect the Nyakanazi SS to the Ibadakuli SS. The existing Ibadakuli SS is located on the side of Road B6 and near the village of Ibadakuli.

The three SS should be extended.

The alignment of the three TLs segments (i.e., Mutukula – Kyaka, Kyaka – Nyakanazi, and Nyakanazi – Ibadakuli) will intercept 13 districts of three regions (Shinyanga, Geita, and Kagera), 47 wards, and 105 villages.

Self-supporting metal towers will be used to implement the TLs, with a spacing between towers of around 400 m. At this stage, the number of towers on each of the 3 TLs has resulted in: 75 towers for the 400 kV Mutukula – Kyaka TL, 582 for the 400 kV Kyaka – Nyakanazi TL, and 705 for the kV Nyakanazi – Ibadakuli TL. The towers will be 49.17 m to 51.06 m high.

The self-supporting towers will be erected under four concrete foundations, one on each foot. Depending on the type of tower and the characteristics of the soil where the structure will be built, foundations can be of the following types: rock anchor; reinforced concrete shaft / pad and chimney; concrete pad and chimney; concrete pad and chimney; concrete pad and chimney; raft foundation / piling; piling.

The wayleave to be established will be 52 m wide centred on the TLs' axis, that is, 26 m on each side of the axis. Considering the total extension of the 400 kV TLs, the wayleave's area will be 2,854.33 ha as shown in **Table 1.0.a**.

For the TLs, a service strip will be implemented to access and launch the cables, in the centre of the wayleave, where the vegetation will be cleared completely. This strip shall be 14 m wide, 7 m wide on each side of the axis.

The construction of the Project will entail the installation of some support infrastructures for the works, including camp sites (containing accommodation for workers, kitchen and cafeteria, bathrooms, workshop, concrete plant, solid waste centre and other facilities) and access roads to the work fronts (in places without existing access and with topography that does not allow access using the service strip). Upon completion of the construction works, the areas used to implement support infrastructures will be rehabilitated, except for some new accesses that will remain in use during the operation phase, for TLs maintenance.

To support the works, camp sites are planned at the sites of the substations to be expanded, i.e., in the villages of Kyaka, Nyakanazi, and Ibadakuli, and one at the northern end of the 400 kV TL Mutukula-Kyaka, on the border with Uganda, in the village of Mutukula. In addition, other camp sites are expected to be set up close to the TLs' route, close to

villages and with access from the main roads, and around 70 to 80 km apart. Considering these assumptions, it is estimated that, in addition to the 4 (four) camp sites initially mentioned, another 5 (five) will be needed, totalling 9 (nine) camp sites. Given the average distances and other assumptions above, it is suggested that the 5 additional camp sites be distributed in the following villages: Nyakasimbi, Nyabugombe, Busonzo, Ilogi, and Solwa.

As mentioned, expansion works will be needed for the existing SS Kyaka, SS Nyakanazi, and SS Ibadakuli, providing space for the TL and transformer bays and future expansion. The area of the existing SS Kyaka is 1.14 ha, and the area to be expanded is 8.65 ha. The area of the existing SS Nyakanazi is 2.2 ha, and the area to be expanded is 13.7 ha. The area of the SS Ibadakuli to be expanded is 12.2 ha.

The construction phase is expected to last about 36 months and, at its peak, is expected to generate 1,350 direct and 650 indirect jobs. Part of the workforce will be recruited locally.

Baseline and Existing Conditions

Areas of Influence of the Project

Indirect Area of Influence (IAI)

The IAI for the physical environment consists of a 20 km wide strip centred on the TLs, 10 km wide on each alignment side.

Regarding biodiversity, the IAI comprises a 5 km buffer to each side of the selected TLs' alignment, and also includes the boundaries of the protected areas that are intersected by this 5 km buffer, including Burigi-Chato National Park and the following Forest Reserves: Biharamulo, Lubaga, Minziro, Nindo, Nyantakara, Ruamagazi, Ruiga River, and Uyovu. Additionally, the Biotic IAI includes the potential critical habitat mapped in the Scoping Report.

Concerning social components, the IAI is formed by the wards and districts, and the regions where the DAI villages are located. As preliminarily defined, the IAI includes three regions - Shinyanga, Geita, and Kagera, 13 districts, and 47 wards.

Direct Area of Influence (DAI)

The TLs' AID included the selected alignment and a buffer at least 500 m wide on each side. Similar buffers were established at SS and should be the DAI to be considered by Contractors when searching for camp site locations.

For the social environment, the DAI consists of the 105 villages directly intercepted by the selected alignment of the project's TLs. Only the mapping of vegetation coverage and land use, including biological and socioeconomic aspects, was carried out for the 1 km DAI, 500 m each side of the route. Access roads with alignment outside the wayleave

will also be part of the DAI.

Directly Affected Area (DAA)

The DAA consists of the TLs' wayleave and SSs' expansion areas, since at this stage, the locations of the camp sites have not yet been defined, nor have any new accesses outside the wayleave that may be necessary.

Physical Environment

Geology and Geotechnical Characterization

The Project intercepts different types of rocks, with different constitutions, ages, and geotechnical characteristics. In summary, several groups of rocks with similar geotechnical behaviour along the alignment were identified: young unconsolidated sediments (continental deposits); plutonic rocks, including granite, migmatites, and granitoid; greenstones with BIFs (volcano-sedimentary complex); and metasediments.

Table 1.0.b presents the main attributes, associated soils, and geotechnical characteristics.

Table 1.0.b
Attributes, associated soils and geotechnical characteristics of areas constituted by more frequent types of rock

	TYPE OF ROCK OR SEDIMENT	RESTRICTIONS AND GEOTECHNICAL BEHAVIOR
Granites, Migmatite and Granitoids	Igneous and metamorphic rocks composed essentially of quartz, feldspar, and mica, with fine to thick granulometry, and bands of well-developed schistosity. The residual soil is sandy-clay to clay-sandy, sometimes micaceous, and rich in quartz and feldspar granules. Immersed boulders are common. The surface soil is clayey to very clayey.	- Gully erosion in the cuts and fills, more intense in the cuts due to the composition of the residual soil; - Landslide in road cuts in the soil/rock transition, commonly associated with upwellings of water; - Instability and rock falls by descaling on road cuts and slope surfaces; - Difficulty of excavation, sloping, and earthmoving due to the presence of boulders; - Possibility of differential settlements of structures due to implantation on boulders.
Cataclastic rocks and greenstone	Metamorphic rocks associated with shear zones with pronounced subvertical to vertical foliation. Superficial and residual soil clayey to very clayey and micaceous, generally deep.	- Problems of instability and sharp erosion due to vertical foliation in conjunction with sub-vertical joint systems.
Metasediments	These are metamorphic rocks made up essentially of quartz (> 80%). The alteration soil is sandy and generally shallow, with rocky outcrops frequently occurring.	- Falling blocks on cutting slopes due to fracturing and shale; - Difficulty in excavation due to the proximity of the rocky top.

Table 1.0.b
Attributes, associated soils and geotechnical characteristics of areas constituted by more frequent types of rock

	TYPE OF ROCK OR SEDIMENT	RESTRICTIONS AND GEOTECHNICAL BEHAVIOR
Unconsolidated sediments	Fine sand, clayey sand, and silty clay, organic matter, and occasionally gravel on floodplains and low terraces.	- Seasonal floods; - Presence of wetlands, elevated water table, and soft soils; - Lateral and vertical erosion of the canal and the margins; - Precarious stability of excavation walls; - Settlement of foundations; - Underground networks damaging by repression; - Road surface damaging due to soil saturation; - Risk of contamination of the water table.

Source: Compiled from Campos (1988), SHDU/CSTDE/EMPLASA/IPT (1990), and Nakazawa (1994).

Geomorphology

The main groups of landforms intercepted by the TLs are: plains, alluvial plains, hills and mountain footridges, plateuax, and depressions.

The relief types along the TLs were identified based on the interpretation of terrain characteristics, satellite images, and field work carried out in 2023. The relief types are presented in **Table 1.0.c**.

Table 1.0.c
Characteristics of the types of relief that occur along the TLs

Type of Relief Morphometrics	Morphodynamics
Alluvial plains (Fp) Slope: 0-3% Variable Altitudes	• Periodic flooding in the plains and permanent flooding in the wetlands. Deposit of fines and organic matter by decantation during floods, and of sands and pebbles by lateral addition; • Lateral and vertical erosion of the channel; • Terrain very sensitive to occupation, with risk of flooding, contamination, and silting.
Plains (P) Amplitude: 10 to 30m Slope: 3 to 10% Altitude: 1140 to 1200 m	• Run off and gully erosions, occasional and of low intensity; • Terrain not very sensitive to interference.
Plains and Wide hills (PWh) Amplitude: 20 to 60m Slope: 3 to 10% with the sector of 10 to 15% Altitudes: 1120 – 1300m	

Table 1.0.c
Characteristics of the types of relief that occur along the TLs

Type of Relief Morphometrics	Morphodynamics
Soft Hills (Sh) Amplitude: 50 to 150 m Slope: 8 to 30% Altitude: 1250 to 1350m	• Run off and gully erosions and frequent to widespread crawling, from moderate to high intensity; • River notch is generalized and of high intensity; • Frequent and high-intensity channel silting; • Terrains sensitive to very sensitive to interference, due to slopes, soil erodibility, intensity of erosion and the presence of processes.
Mounts (M) Amplitude: 100 to 280 m Slope: 15 to 30% and sectors of 30 to 45% and >45% Altitude: varied (1200 to 1350m)	
Mountains (MM) **Mountains with Flat Tops (MMt)** Amplitude: 100 to 300m Slope: varied, always up to 20% and sectors >45% Altitude: 1300 to 1700 m	• Run off and gully erosions, gullies, and frequent crawling of moderate to high intensity; • Planar landslides and frequent blocks falling at medium intensity; • River notch is generalized and of high intensity; • Deposition of debris at the foot of the slopes is occasional and of low intensity; • Improper terrain and/or very susceptible to interference due to steep slopes and erosion intensity.
Plateux (Pt) Amplitude: 20 to 100m Slope: 3 to 8% Altitude: 1200 to 1350 and 1450 to 1600 m	• Run off and gully erosions, occasional and of low intensity; • Terrain not very sensitive to interference.

Soil Characterization and Erodibility

Based on data provided by FAO (SOTERSAF) data, cambisols are found near Ibadakuli. Planosols and vertisols are found along fluvial plains. As the TLs head west, there is a widespread occurrence of cambisols and patches of rhodic ferrasols are widespread in areas of residual mountainous relief. To the north of Nyakanazi, it means, along S-N alignment, there is a predominance of leptosols and, north to Kyaka it is predominant the occurrence of gelysols and luvisols.

The erosion susceptibility classes were obtained from the relationship between soil erodibility and slope. Applying the methodology and the pedological and geomorphological conditions identified for the study area, we have the following indicators of soil erodibility (**Table 1.0.d**).

Table 1.0.d
Soil susceptibility classes

Soil	SLOPE				
	Flat (0 to 3%)	**Gently Undulating (3 to 8%)**	**Undulating (8 to 20%)**	**Steep (20 to 45%)**	**Very Steep (>45%)**
Cambisol	Moderate	Moderate / High	High	Very High	Very High
Planosol	Low	Low	Low/Moderate	Moderate / High	High
Vertisol	Low / Moderate	Moderate	Moderate	Moderate / High	High / Very High
Ferrasol	Low	Low	Low/Moderate	Moderate / High	High
Leptosol	Moderate	Moderate / High	High	Very High	Very High
Fluvisol Gleysol	Moderate	Moderate / High	High	High/ Very High	Very High

The TLs sections most vulnerable to erosion due to construction activities are mainly along the 400 kV Mutukula – Kyaka and 400 kV Kyaka – Nyakanazi routes, especially in the steep, mountainous areas. These regions have fragile soils and high gradients, increasing the erosion risk. Additionally, isolated hills and ridges along the 400 kV Nyakanazi – Ibadakuli stretch also present significant erosion risks due to shallow, sensitive soils and rugged terrain.

Climate

In summary, what characterizes the climate's behaviour in the region of the TLs' alignment is the presence of two well-defined seasons, namely hot and rainy summers and drier winters with cooler temperatures. Rainfall, therefore, is the most important element in the definition of the regional climate, influencing not only the characteristics of the active morphogenetic processes but also conditioning the cycles of the regional economy, particularly about subsistence agricultural activities.

The climate along the transmission line alignments is characterized by two distinct seasons: a rainy summer and a drier winter. The areas near Shinyanga receive about 887 mm of rainfall annually, while Geita and Kagera receive 1,023 mm and 1,328 mm, respectively. March and April see the highest rainfall, with peaks of 150.12 mm in Shinyanga, 147.50 mm in Geita, and 195.96 mm in Kagera. Wind speeds are relatively moderate throughout the year, with Shinyanga experiencing gusts approaching 5 m/s in August, while Nyakanazi and Kyaka maintain lower speeds, around 2.3 m/s to 3.2 m/s on average. Winds predominantly blow from the east-southeast, with occasional variations across the year.

Hydrology and Hydrography

Table 1.0.e shows the sub-basins intercepted by the Project at each region.

Table 1.0.e
Basin and Sub-basins intercepted by the project

River Basin	Sub-Basin
Internal Drainage	Lake Eyasi
Lake Victoria	Isanga
	Kagera
Lake Tanganyika	Malagarasi

Source: TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

In the Internal Drainage, the TL intersects areas drained by the Manoga River, one of the Lake Eyasi contributors. As it enters the areas drained by Lake Victoria, in a westerly direction, the TL intersects the tributaries of the upper course of the Isanga River. Still heading west, in the Lake Tanganyika unit, the TL intersects the basin of two of the main sources of the Malagarasi River: the Nikonga River and the Moyowosi River. Turning N-S towards Kyaka and the border with Uganda, the TL re-enters the Lake Victoria unit, intercepting several tributaries of the right bank of the Kagera River, which it intercepts near Kyaka.

Water quality assessments in the field were carried out at six sampling points, using a multiparameter probe to analyse the parameters water temperature, turbidity, dissolved oxygen and pH. The location of the points along the project route is shown in **Table 1.0.f**.

Table 1.0.f
Location of water quality field assessment points

Sampling points	Type of environment	District	Hydrographic Basin	Geographical Coordinate UTM - Zone 36	
				Longitude	Latitude
P1	lentic	Shinyanga	Manonga River	555779.00 m E	9599636.00 m S
P2	lotic	Shinyanga	Manonga River	551341.00 m E	9600960.00 m S
P3	lotic	Bukombe	Nikonga River	358119.00 m E	9634178.00 m S
P4	lotic	Biharamulo	Moyowosi River	300716.00 m E	9672478.00 m S
P5	lotic	Biharamulo	Moyowosi River	300244.00 m E	9674318.00 m S
P6	lotic	Missenyi	Kagera River	324039.00 m E	9861691.00 m S

This sampling identified that the majority of the evaluated environments had warm, turbid waters, a pH close to neutral or basic, and low levels of dissolved oxygen. The conditions observed at the evaluated points are mainly the result of anthropogenic activities in the region.

Groundwater

Most of the alignment overlaps crystalline lithologies that define low-permeability aquifer systems. These systems correspond to rocks of variable composition and ages, but predominantly Precambrian, which form the basement aquifers. The poorly developed alteration mantles of these aquifers, generally less than 20.0 m deep, limit the water stock, with the average well productivity in these areas being less than 3.0 m^3/h.

Noise

A noise measurement[1] campaign was carried out at eight (8) points that were chosen according to land use, noise sources and the presence of critical receptors in the vicinity of the future wayleave. The measurements were taken using a Brüel & Kjaer model 2250 sound level meter with statistical data analysis, set to Logging mode, which allows the measurements to be obtained as histograms.

Table 1.0.g presents the coordinates of the noise measurement points and the corresponding TL.

Table 1.0.g
Noise measurement points

Point nº	Location UTM Longitude/ Latitude	TL	Village	Ward	Region
P1	36 M 556.874 m E / 9.599.312 m S	Nyakanazi - Ibadakuli	Ibadakuli	Ibadakuli	Shinyanga
P2	36 M 520.241 m E / 9.606.627 m S		Mwamakaranga	Iselamagazi	Shinyanga
P3	36 M 432.424 m E / 9.631.807 m S		Ilogi	Bugarama	Shinyanga
P4	36 M 321.560 m E / 9.646.258 m S		Nyantakara/ Iyengamulilo	Nyantakara	Kagera
P5	36 M 302.008 m E / 9.665.736 m S		Nyakanazi	Lusahunga	Kagera
P6	36 M 293.990 m E / 9.818.586 m S	Kyaka - Nyakanazi	Bisheshe	Nyakahanga	Kagera
P7	36 M 321.796 m E / 9.859.790 m S		Kyaka	Kyaka	Kagera
P8	36 M 321.018 m E / 9.888.806 m S	Mutukula - Kyaka	Mutukula	Mutukula	Kagera

All the measurements result in the baseline campaign were in conformity with the established standards, both for GN standard nº 32 and the IFC standard, as all the results were below 50 db(A) and 55 db(A), respectively.

Seismicity

In the region intercepted by the Project, there are records of seismic events according to the US Geological Survey (USGS) and Tanzania Geological Survey (TGS), with intensities ranging from 2.8 to 6.1 M, both in Shinyanga and Geita and in Kagera, near the border with Uganda. With regard to historical events of greater magnitude in the Project region, earthquakes measuring 4.4 M in Mwanza and 4.5 to 4.8 M in Geita are recorded,

Palaeontology

Most lithostratigraphic units intercepted by the TLs are unlikely to have positive results for the occurrence of fossils. Only in the metasediments and in Fine clastic sediments the potential is medium and in peridotite, dunite, lherzolite, gabbro, norite, anorthosite the potential is low. In any case, field surveys in these areas did not result in the identification of fossil remains. In particular, little consolidated sediments were observed, which are currently mobilized by surface dynamics.

[1] Spectris Noise Meter Model 2250.

Speleology

Crystalline rocks have a low potential for caves, while areas of quaternary deposits are unlikely to contain caves because they are unconsolidated sediments. The exception is the metasediments, especially the metarenites and meta quartzites found in the N-S portion of the route, in areas of mountainous relief, which indicate a medium potential for cavities.

Mineral Resources

This consultation of the database of the Tanzanian Mining Cadastre Portal, prepared by the Ministry of Minerals (MADINI), allowed the identification of 29 mining rights affected by the Project, of which 17 are directly intercepted by the TLs the TLs directly intercept 17 and 12 are located in their DAI. Of the 17 directly intercepted, 3 are by 400 kV Kyaka - Nyakanazi TL, while 14 are by 400 kV Nyakanazi - Ibadakuli TL. There are no mining rights along the 400 kV Mutukula - Kyaka TL.

The wayleave will intercept several valuable mining resources, primarily concentrated in regions with abundant greenstone belts and gold deposits. Along the 400 kV Mutukula – Kyaka and 400 kV Kyaka – Nyakanazi routes, the Sukumaland Terrane is particularly rich in gold deposits, with active mining operations in the Biharamulo and Geita belts. These areas are known for their productive greenstone formations, where large-scale mining projects are currently exploiting significant gold resources.

In addition to gold, the diamondiferous kimberlite-rich Kahama–Mwadui Terrane, intercepted by the 400 kV Nyakanazi – Ibadakuli stretch, contains diamond resources, some of which are actively mined. The project area also passes through regions with valuable minerals, including iron from banded iron formations (BIFs) in the Nyanzian Supergroup. However, are less exploited compared to gold and diamonds. Active mining in these regions may pose challenges for construction activities, requiring coordinated efforts to manage land use and minimize conflicts with ongoing extraction efforts.

The consultations of villages along the transmission line routes revealed several areas where artisanal mining is prevalent. These activities are particularly concentrated in mineral-rich regions, such as gold-bearing greenstone belts, intersecting the 400 kV Mutukula – Kyaka and 400 kV Kyaka – Nyakanazi routes. The mining is mostly informal and small-scale, often providing crucial income for local communities. However, artisanal mining sites pose significant challenges for the transmission line construction, including land-use conflicts and potential environmental degradation. These areas require careful management to mitigate disruption to the local economy and the project's progress.

Biodiversity Baseline

Characterization of Vegetation Cover and Land Use

Six main native vegetation types have been classified in the proposed transmission line corridor: Swamp Forest, Wooded Grassland, Evergreen Dry Forest, Mixed Woodland, Miombo Woodland, and Thicket Bushland. These types of vegetation range from Geita to the Bukoba region.

Quantification of Vegetation Cover and Land Use

The quantification of vegetation cover and land use in the Project's DAI (500 m buffer zone on each side of the TLs' axis and around the SSs' expansion areas) resulted that the DAI covers a total of 55,000 hectares, made up of native formations (35%) and anthropized areas (65%).

The native vegetation identified are not exclusive to the Project's DAI, and occur in other locations, including within protected areas. Miombo woodland predominate, accounting for 28.5% of the Project's DAI. The anthropized areas are mainly cyclical agriculture (34.6%) and anthropic areas (22.9%).

Floristic Composition

The floristic survey carried out in the DAI resulted in a total of 173 plant morphospecies were being recorded, of which 01 were pteridophytes and 172 were angiosperms. The morphospecies recorded in this survey were distributed in 133 genera within 52 botanical families. The families with the largest number of species are Fabaceae (26 species, 15% of the total), Rubiaceae (13 species, 7.5%), Malvaceae and Phyllanthaceae with 12 (6.9%) species each, Poaceae and Combretaceae with 8 (4.6%) species each. Those six families represent 45.7% of the total species registered in the Project's DAI.

The composition of the species recorded in relation to their origin reveals a predominance of native species (78.6% or 136 species), 05 (2.9%) of which are endemic to Tanzania. Among the species recorded in the flora surveys, 53.8% (93 species) are trees, and 26.0% (45 species) are shrubs.

Only three species (1.7%), *Euphorbia hubertii, Dalbergia melanoxylon,* and *Pterocarpus angolensis*, are at some risk of extinction or are listed in CITES Appendix II. This list does not necessarily classify a species as endangered, but establishes criteria for international trade in species. The IUCN classifies *Euphorbia hubertii* as EN (endangered) and *Dalbergia melanoxylon* as NT (Near Threatened), while *Pterocarpus angolensis* is listed in Appendix II of CITES.

26 species with some traditional use, with several species having more than one type of use, 15 species with medicinal use, 11 with food use, 6 with economic use, and 5 used in religious activities.

Five (05) alien species were identified.

Phytosociological survey

This survey considered a total of 06 plots (0.24 ha), representing a sampling effort of 0.02% of the DAA's native forest formations. 181 individuals were recorded in the 6 plots. Of all the plots surveyed, 2 were allocated to Savannah Woodland, in addition to 1 plot in each of the following phytophysiognomies: Wooded Grassland, Evergreen Dry Forest, Woodland, and Open Miombo Woodland.

The density found was 758.33 individuals per hectare. 58 morphospecies were recorded, distributed in 46 genera from 22 botanical families.

Fauna Baseline

The fauna baseline considered the groups of wild vertebrates represented by terrestrial mammals (small, medium, and large), bats, birds, reptiles, and amphibians. To characterise the fauna, 3 (three) fauna survey campaigns were carried out, as shown in **Table 1.0.h**.

Table 1.0.h
Periods for terrestrial fauna surveys

Fauna Campaign	Schedule	*Biodiversity Sample (BS)* Points	Season
1st	3 - 15 August 2023	Birds, BS2, BS3, BS4 and BS5	Dry
2nd	21 April - 5 May 2024	BS1, BS5, BS6, BS8 and BS9	Wet
3rd	22 June - 4 July 2024	BS1, BS6, BS8 and BS9	Dry

Mastofauna

The mastofauna group was systematically sampled in the BS using non-invasive methods (recording only through observation and camera traps) and invasive methods (capture, handling, and subsequent release).

The study detected a total of 55 species of terrestrial mammals from 10 orders and 23 families. The list included some habitat specialists such as the arboreal primates Ugandan Crested Mangabey (*Lophocebus ugandae*), Angolan Colobus (*Colobus angolensis*), Ashy Red Colobus (*Piliocolobus tephrosceles*), which are listed as some degree of threat by IUCN (2024) (*Lophocebus ugandae* and *Colobus angolensis* are considered VU – Vulnerable by the IUCN, and *Piliocolobus tephrosceles* is considered EN – Endangered).

Other threatened species that deserve attention are the Lion (*Panthera leo*), the Leopard (*Panthera pardus*) and the Masai Giraffe (*Giraffa tippelskirchi*), considered VU by the IUCN, and the African Savanna Elephant (*Loxodonta africana*), considered EN.

Among the threats that affect the mammals detected, the use as food source and loss of suitable habitats are those which are the most common. Other activities, such as sports

hunting, retaliatory killing, and use in traditional medicine, also affect several species.

Some species are included in the Appendices of the Convention for Conservation of Migratory Species (CMS), indicating that they deserve specific efforts to preserve their migratory habits. These species are the Lion (*Panthera leo*), the Leopard (*Panthera pardus*), the Masai Giraffe (*Giraffa tippelskirchi*), and the African Savanna Elephant (*Loxodonta africana*).

Corridors for wildlife are essential for the maintenance of migration routes and connection between fragments and protected lands. The maintenance, conservation, and protection of wildlife corridors enhances the gene flow, avoids isolation process of populations and helps species to keep their biological interactions (BEIER & GREGORY, 2012; BERGER & CAIN, 2014).

The sampling sites from northwestern region of Tanzania (BS1, BS2, BS3, BS4, BS5, BS6) reunite most of the mammalian species detected through standardised sampling, including those that are migrant. The region presents different habitats (grasslands, shrublands, wooded forests, gallery forests) and water bodies (lakes, rivers, floodable lands). It is considered an important zone for conservation and recovery of wildlife corridors, once it connects protected lands and parks (Minziro, Akagera, Burigi-Chato).

Chiroptera

The bat inventory along the sampling points used two methodologies: mist nets and acoustic recordings. During this diagnosis, 15 taxa were recorded, distributed among seven families, of which Vespertilionidae had the highest number of species, five, followed by Molossidae, with four, Rhinolophidae with two species and the Emballonuridae, Miniopteridae, Pteropodidade and Megadermatidae families with one species each.

None of the species that could be identified down to the specific level, and consequently could be searched for in the conservation status lists, are listed as endangered. Even for the genera that have been recorded but whose species could not be confirmed, it can be said that they do not have threatened species according to the lists consulted.

No endemic species were recorded either for the biomes present in the project's areas of influence or for Tanzania. Comparing the potential richness of the development area with the results from primary field data, 23 per cent of the expected richness was obtained, demonstrating the efficiency of the method used.

Of the methods used, acoustic recordings accounted for more than 99 per cent of all records. This method is the most efficient for detecting aerial insectivorous bats, a group that is hardly captured by mist nets. Analysing the efficiency of sampling for all the areas sampled, the rarefaction curve stabilised, showing that potentially almost all the species present in the areas during the studies were detected.

In terms of conservation, the Large Eared Mastiff Bat (*Otomops martiensseni*) is classified as Near Threatened (NT) by the IUCN (2024). All other species are classified as being of lesser concern.

Considering the species with a restricted distribution, none of the species that could be identified are considered endemic. All the species recorded have wide geographical distributions, occurring in the central, southern and eastern regions of Africa, a common characteristic of this order of mammals due to their great power of locomotion.

Of the species recorded, two are reported to be persecuted by local populations, the Mauritian Tomb Bat (*Taphozous mauritianus*) and the Large Eared Mastiff Bat (*Otomops martiensseni*). In terms of epidemiological aspects, the genera *Rhinolophus. Mops, Laephotis and Epomophorus* recorded in the field are potential carriers and transmitters of viruses from the Coronaviridae, Filoviridae and Paramyxoviridae families.

Two species recorded are considered migratory or potentially migratory in Appendix II of the Convention on Migratory Species (CMS, 2024). These are *Miniopterus natalensis* and *Otomops martiensseni.* The first has this characteristic confirmed in the literature and these movements are related to the seasonal cycle. For the second species, there are no reports proving this behaviour and in the Convention on Migratory Species it is cited as potentially migratory.

The differences observed in terms of richness and abundance between the sampling areas are probably more related to climatic and/or biological factors, such as the incidence of rainfall at the time of sampling or the low activity of their prey, which greatly reduces the activity of bats and consequently their detection. In terms of seasonality, dry season sampling had more species and records, probably influenced by the incidence of rainfall during wet season sampling. Due to their great plasticity in habitat use and great power of locomotion, it is not expected that there will be very different communities between the sampling points or great variations in terms of seasonality.

Despite the uncertainties in the identifications of two genera, it is safe to say that the richness sampled was at least 15 taxa, and from these identifications it was possible to characterise this fauna, predict potential impacts, as well as having the necessary basis for monitoring its richness and activity patterns throughout the construction and operation of the project.

Avifauna

Three methods were used to diagnose terrestrial avifauna: transect census, Song Meter Micro and an invasive method, mist nets.

The bird surveys carried out in the study area resulted in a total of 3,756 records, covering 219 species distributed in 20 orders and 55 families. Of these, 3,721 records were obtained using standardised methodologies, revealing a significant diversity with 211 species identified, while 35 records using non-standardised methodologies included 30 additional species. The predominance of the order Passeriformes, with 114 species (52 per cent of

the total), reflects its wide diversity and adaptability, making it the most representative among the birds observed.

The analysis of the species' conservation status indicated that, globally, three species are classified as "Near Threatened" and four are threatened with extinction, with the Hooded Vulture (*Necrosyrtes monachus*) listed as "Critically Endangered". These figures are alarming, as they point to the impact of human activities, such as habitat loss and illegal hunting, which threaten the survival of these species. In the context of CITES, none of the species are in Appendix I, although 24 are in Appendix II, suggesting the need to control international trade to avoid their possible future threat. The Convention on the Conservation of Migratory Species of Wild Animals (CMS) reveals that 65 species are on Appendix II, highlighting the importance of international co-operation for the conservation of these migratory birds.

In terms of endemism, the study highlighted the importance of endemic areas in Tanzania and East Africa. Endemic species, such as the Swahili Sparrow (*Passer suahelicus*) and the Ashy Starling (*Lamprotornis unicolor*), are widely distributed within their areas and are not threatened, but their conservation should be prioritised due to their geographical restriction.

The analysis of migratory routes revealed the presence of 11 migratory species and 23 partially migratory species, highlighting the relevance of the East Atlantic, Mediterranean/Black Sea, and East Asia/East Africa Flyways for the region's avifauna. In addition, the project will intercept two Important Bird Areas (IBAs) - Minziro Forest Reserve and Burigi-Chato National Park. Both are essential for the preservation of the region's birdlife.

As for the sampling areas, the results indicate a significant variation in species richness and abundance between the sampling areas. Area BS1, with little disturbed Wooded Grassland vegetation, showed the highest richness (120 species) and abundance (1,079 records), reflecting the importance of preserved habitats for bird diversity. In contrast, more disturbed areas, such as BS2 and BS8, showed high species richness, but with significant variations in abundance, which suggests the birds' adaptability to different levels of environmental disturbance. Areas BS6 and BS5 showed lower richness and abundance, indicating that disturbance and environmental degradation in the region may have a negative impact on species diversity.

The seasonal analyses revealed that although the wet season was favourable for species richness and exclusivity, due to the greater availability of food resources and more favourable environmental conditions, total abundance was higher in the dry season, which can be attributed to the lower foraging activity during the heavy rains that hit the project areas in the wet season campaign.

The comparison between the primary data obtained in the field and the secondary data from the literature corroborates the high sampling sufficiency of the data obtained. The integration of primary and secondary data enriches the understanding of birdlife in the project area, providing a solid basis for future analyses and conservation actions.

Analysing the risk categories revealed that the species with the highest risk of collision represent the lowest richness, and more vulnerable species, both due to their conservation status and their characteristics, place them at potential risk of collision with the TL, such as those classified as endangered (*Aquila rapax, Necrosyrtes monachus, Balearica regulorum, Terathopius ecaudatus*). In addition, waterfowl and birds flying at heights compatible with the TL cables were also at risk of collision.

Areas BS1, BS8 and BS9 were identified as the most relevant in terms of both richness and abundance of species at high risk of collision, with BS1 standing out. These areas should be prioritised, when it is not possible to prioritise all areas, for the implementation of mitigation measures, such as the installation of cable flags or adjustments to the design of TLs to reduce the risk of collision. To summarise, the data suggests that although all the sampling areas have high-risk species, BS1, BS8 and BS9 require more attention due to their combination of high species richness and abundance vulnerable to collision with the TL.

Thus, to assess the influence of the project on the bird community, the data obtained from the survey campaigns will serve as a basis for future inferences about the variations between the different categories analysed in the subsequent stages of the project.

Herpetofauna

The herpetofauna group was sampled in the sampling areas using auditory and visual census methods and songmeter for amphibians.

Data collection in the areas of influence of the project during the dry and rainy seasons resulted in a total of 23 taxa and 349 records of herpetofauna. The amphibian group was the most abundant and diverse, accounting for around 75 per cent of all records and 52 per cent of all taxa. The reptile group accounted for around 25% of all records and 48% of all taxa.

None of the species recorded are classified as endangered, with only the Central African Rock Python (*Python sebae*) being classified as "Near Threatened". Three other species, the Nile Monitor (*Varanus niloticus*), the Central African Rock Python (*Python sebae*) and the Leopard Tortoise (*Stigmochelys pardalis*) are listed in CITES Appendix II (2024). No species endemic to Tanzania or invasive species have been recorded either.

Three species are recognised as being hunted and consumed by traditional communities throughout the African continent. Another three species of venomous snakes have been recorded, considered to be of medical importance.

Among the taxa recorded, "Anura Not Identified" was the most abundant, accounting for around 18% of all records. All the records of this taxon were made with the aid of the SongMeter Micro recorder, but it is necessary to capture specimens for identification.

In the comparison between sampling points, the number of species varied little between sampling points, with the highest values being obtained at points BS1, BS6 and BS9 with

eight species each. As for the number of species with a single record for each sampling point, the highest value was obtained at BS1, with four.

When comparing sampling points, it can be seen that the richness was similar during the two seasons, with 15 species for each, 8 of which were exclusively recorded. The high number of amphibian species recorded during the dry season indicates the low influence of seasonality on the region's reptile and amphibian community.

The comparison between sampling points and seasonality shows that the highest richness values were observed at points BS1 and BS8 during the rainy season and at points BS5 and BS6 during the dry season. The lowest values were obtained at points BS2 and BS5 during the dry season and BS8 during the rainy season.

The rarefaction curves at points BS1 and BS8 are stable, while the other curves generated, both for the points and for the total, show an ascending pattern, with no signs of reaching asymptote. The estimators indicate that the richness surveyed at point BS1 is the closest to the estimated richness when compared to the other areas and the lowest estimated values were for point BS2, results that partly corroborate the rarefaction curves.

The diversity indices, both Shannon's H' index and Fisher's Alpha, showed the greatest diversity at point BS2. Equitability, on the other hand, indicates that the community closest to a homogeneous distribution of species and records is present at point BS2.

For the similarity analyses, distinct clusters were formed, with a cluster between BS2 and BS6 for Jaccard and another cluster between BS2 and BS5 for Bray-Curtis, with a third cluster between points BS8 and BS9 for both indices.

The comparison between primary and secondary data resulted in a total of 149 reptile and amphibian species for the area of indirect influence of the buffer, while the survey of primary data in the areas of direct influence of the development resulted in a total of 23 taxa.

Finally, it is understood that the reptile and amphibian community along the route of the electricity transmission line is made up of generalist species, which are resilient to the environmental changes that occur in the region, such as livestock activities, logging, hunting and so on.

Legally Protected and Internationally Recognized Areas of High Biodiversity Value

There are 8 Protected Areas in the Project’s region: 3 of which are intercepted by the Project, the Burigi-Chato National Park, intercepted by the and the 400 kV Kyaka – Nyakanazi TL; the Biharamulo Forest Reserve and the Uyovu Forest Reserve, both intercepted by the 400 kV Nyakanazi - Ibadakuli TL. The other 5 Protected Areas are within the Project’s Indirect Area of Influence (IAI)

As for the internationally recognized area, there are 3 Important Bird Areas (IBA) in the project region. Two of these areas also coincide with Protected Areas, Burigi-Chato

National Park, and the IBA Minziro Forest Reserve, whose area coincides with that of the Minziro Nature Forest Reserve.

Critical Habitat Assessment

130 priority biodiversity values (PBV) have been identified, including the following priority triggers:

- 21 Threatened species (EN or CR)
- 21 Threatened (EN or CR) and restricted-range species
- 4 Threatened (EN or CR) and migratory species
- 6 Vulnerable migratory species
- 75 Migratory species
- Ecological functions needed to maintain the viability of the biodiversity values (1)
- Important habitat for species congregation (1)
- Natural habitats (1)

Of these 130 priority values, 12 PBVs triggered the thresholds for activating critical habitat (CH):

1. 10 species (7 of flora and 3 of fauna).
2. The entire Lago Burigi region, since it is well known that large lakes and wetlands act as aggregating environments for species, especially in arid zones.
3. The two wildlife corridors near the Projects region have an important function in terms of maintenance of gene flow and long-distance range for migratory species, and conservation of transboundary and internal connections between protected areas.

For 8 PBV (7 flora and 1 reptile, the pancake tortoise) there is no certainty regarding the activation of CH due to the lack of information on the distribution and population of these species. For these species, additional information on their occurrence in the region of the project, especially in the area of the project footprint, should be obtained during the execution of the Biodiversity Management Plan (BMP) programmes, specifically the fauna and flora rescue and relocation plan, that will be carried out before the construction of the TL. The fauna and flora monitoring programmes to be carried out during the operation of the TL (Operation Biodiversity Management) will also provide input for reviewing these analyses. The information collected during these activities should be used to revise this CHA (details of the revision process are presented in the Biodiversity Offset Plan).

For the biodiversity trigger values, the critical habitat was delimited based on an ecologically appropriate analysis area (EAAA), which considered the ecological characteristics of the CH triggers, and its delimitation was based on the continuity of phytophysiognomies and geomorphological formations in the region with the potential to sustain a viable population of these biodiversity values, including both natural and modified habitats. The final CH delimitation includes three main areas:

- Minziro Forest Reserve (in Tanzania) and part of the IBA Sango Bay (in Uganda).
- Burigi-Chato National Park, part of the Ruiga River Forest Reserve, the Akagera National Park and the IBA Kagera Swamps (in Rwanda), and the two ecological corridors which connects these Protected Areas to the Moyowosi - Kigosi Game Reserve.
- Part of the Mwantini Hill Forest Reserve, in Shinyanga region.

84% of this area is predominantly occupied by natural habitats in a good state of conservation. Small portions of modified habitats may occur, but to a lesser extent. 15% is occupied predominantly by modified habitats, with some areas of natural habitat. And 1% is occupied by natural habitats, but with more intense signs of anthropisation.

According to paragraph 24 of ESF6, in areas of critical habitat, no project activity that has potential adverse impacts can be implemented unless a few conditions are met, including, among others, that there are no viable alternatives outside of CH, that the project will not cause a reduction in the population of threatened and/or restricted species, and that a robust monitoring and management programme is implemented.

Relevant Ecosystem Services

Relevant ecosystem services are those that are available in the region and that are important to the local population. Through the sources consulted, mentioned above, the following ES were considered relevant (**Table 1.0.i**).

Table 1.0.i
Relevant ecosystem services

Service	Subcategory	Use
Provisioning	Feeding	Livestock keeping and agriculture are the main economic activities in the region.
	Natural medicine	The population extracts herbs and other plants from the forest for medicinal use.
	Biomass	The extraction of wood, mainly for energy and charcoal, is significant in the region.
	Water	The availability of drinking water is vital for any population. Specifically in the region where the project is located, a large part of the population draws water directly from rivers and lakes for their own consumption. Agricultural activity in the region is also quite significant, including crops with a high demand for water, such as rice, which is one of the region's main crops.
Regulation	Climate regulation	The ES service of climate regulation of climate is essential. Although there are uncertainties regarding carbon stocks in African savannas, studies show the potential for carbon accumulation in these native habitats, both above and below ground.
	Water regulation	The availability of drinking water is a major issue in the region, which is highly dependent on agriculture and water catchment from rivers and

Table 1.0.i
Relevant ecosystem services

Service	Subcategory	Use
		lakes for consumption.
	Disease regulation	The region has a high incidence of malaria and diseases of the intestinal tract. In this sense, a healthy ecosystem can act as vector control.
	Pest regulation	Due to the high dependence of crop populations on cyclical and perennial crops, similar to disease control, a healthy ecosystem can provide natural controls for crop pests
	Pollination	Due to the high population dependency of cyclical and perennial crops, pollination plays a key role in the success of these crops.
	Lifecycle maintenance, habitat and gene pool protection	Provide and maintain favourable ecological conditions for pollination, seed dispersal and habitats for wild plants and animals that can be useful to the population.
Cultural	Ecotourism	Although the population didn't mention it, Burigi-Chato is one of the largest national parks in the country and attracts a large number of tourists, contributing directly and indirectly to the region's economy.

Social Environment Baseline

The Project's Indirect Area of Influence - IAI includes three regions (Shinyanga, Geita and Kagera), 13 districts, 47 wards and 105 villages. **Table 1.0.j** presents the IAI that is characterized in this social baseline.

Table 1.0.j
Direct and Indirect Area of Influence – Social

Region	District	Ward	Villages
Shinyanga	Shinyanga Municipal Council (former Shinyanga Urban)	Mwamalili	Seseko
		Ibadakuli	Uzogore
			Ibadakuli
		Old Shinyanga	Ihapa
			Old Shinyanga
	Shinyanga District Council (former Shinyanga Rural)	Solwa	Mwasekagi
			Mwiseme
			Solwa
			Mwabuki
		Mwakitolyoo	Mwasenge
			Nyang'ombe
		Salawe	Nzoza
		Iselemagazi	Mwamakaranga
			Ichongo
			Iselamagazi
		Nyamalogo	Mwang'osha
		Pandagichiza	Pandagichiza
			Shilabela
		Mwenge	Mwongozo

Table 1.0.j
Direct and Indirect Area of Influence – Social

Region	District	Ward	Villages
			Zunzuli
			Ipango
	Shinyanga DC (former Shinyanga Rural)	Lyabusalu	Mwajiji
			Lyabusalu
			Bukamba
			Mwabagehu
	Msalala	Bugarama	Igwamanoni
			Ilogi
			Buyange
		Lunguya (Runguya)	Kalole
		Bulyan'hulu	Busulwangili
Geita	Geita DC	Bukoli	Ntono
		Butobela	Shahende
	Nyang'hwale	Kafita	Kayenze
			Bukulu
		Nyugwa	Isonda
		Nundu	Igeka
		Bukwimba	Kasubuya
			Bukwimba
	Mbogwe DC	Ikobe	Kagongo
			Bugalagala
			Busabaga
		Lulembela	Kashelo
		Ilolangulu	Ilolangulu
		Mbogwe	Nambubi
			Bwendanseko
			Mwanza
		Ngemo	Nyitundu
			Bwendamwizo
			Bulongo
		Ushirika	Kadoke
	Bukombe DC	Busonzo	Nampalahala
			Nalusunguti
			Busonzo
			Kabagole
			Nakayenze
		Butinzya	Butinzya
		Bulega	Ibambilo
			Bulega
	Chato DC	Iparamasa	Mnekezi
			Mwabasabi
			Songambele
Kagera	Karagwe DC	Kihanga	Katanda
			Kihanga
			Kishoju
			Mulamba
		Kayanga	Miti
		Bugene	Omurushaka
			Nyakahanga
			Chagati
			Bujuruga

Table 1.0.j
Direct and Indirect Area of Influence – Social

Region	District	Ward	Villages
			Kishao
		Ihembe	Ihembe I
		Nyaishozi	Rukale
			Nyakayanja
		Rugu	Kasheshe
		Nyakasimbi	Nyakasimbi
			Bujara
			Kahanga
			Muungano
		Nyakahanga	Rwandaro
			Bisheshe
	Biharamulo DC	Nyakahura	Nyabugombe
			Ngararambe
			Busiri
			Mabare
			Rugese
		Lusahunga	Nyakanazi
			Kabale
			Lusahunga
			Kikoma
			Nyakasenga
		Kaniha	Mavota
			Mkunkwa
		Nyantakara	Mgera
			Nyantakara/Iyengamulilo
			Nyakayenze
	Ngara	Kasulo	Rwakalemera
	Missenyi	Mutukula	Byeju
			Mutukula
		Kassambya	Bunazi
			Nyabihanga
			Omudongo
		Nsunga	Byamutemba
			Ngando
		Kyaka	Kyaka

Source: JGP/BENE based on NBS 2022. Regions and Districts Official Public Shapefiles (2019) and Wards Official Public Shapefiles (2022). The United Republic of Tanzania (URT); Ministry of Finance and Planning; Tanzania National Bureau of Statistics and President's Office-Finance Planning; Office of the Chief Government Statistician, Zanzibar. The 2022 Population and Housing Census: Administrative Units Population Distribution Report. Tanzania, December 2022.

Table 1.0.k presents the main population indicators in the IAI.

Table 1.0.k
Population and demographic data – gender and age groups

Area	Total Population size/	Gender		Age		
		% male	% female	% children 0-17	% young adult 18-59	% elder 60 and above
Shinyanga Region	2,241,299	49.2	50.8	52.6	37.8	9.6
Districts	592,958	48.6	51.1	49.8	45.5	4.6
Shinyanga Municipal	214,744	48.2	51.8	45.7	48.9	5.4
Shinyanga District Council	468,611	49.6%	50.4%	NA	NA	NA
Msalala	378,214	49.5	50.5	54	42.2	3.8
Geita Region	2,977,608	49.1	50.9	55.7	36.3	8
Districts	2,645,937	49.3	50.7	56.4	40.1	3.6
Geita DC	1,035,214	49	51	55.8	40.2	4
Nyang'wale	255,803	50.2	49.8	55.7	40.6	3.7
Mbogwe	362,855	49.3	50.7	56	40.4	3.6
Bukombe	407,102	49.1	50.9	57.4	40.2	2.4
Chato	584,963	48.9	51.1	56.9	39	4.1
Kagera region	2,989,299	48.8	51.2	52	42.7	5.3
Districts	1,471,344	48.8	51.2	53.1	41.6	5.2
Karagwe	385,744	49.5	50.5	51.1	43.7	5.2
Biharamulo	457,114	49	51	58.4	37.5	4.1
Ngara	383,092	47.3	52.7	54.6	40.1	5.3
Missenyi	245,394	49.3	50.7	48.5	45.3	6.2

Elaboration: JGP/BENE Consult. Sources: Census 2022. For average household size and number of households: Socioeconomic District Profiles (use data from the Census 2012). N.A = Not available.

In all the districts of the area of influence, females make up a slightly larger percentage of the population than males. The area's population is young, with more than half of it under 17 years of age.

The area of influence is largely rural, having with at least 65.3% of their its population living in rural areas and up to 98% (Biharamulo).

According to the 2022 Census, the total population of the Direct Area of Influence – DAI is 572,062 persons, of which 49.7% are men and 50.7% are women. The total number of households is of 114,914, and the average number of persons per household is 5.6 persons per household, that which ranges between 2.97 persons per house household, which is the lowest in Ngando, in Missenyi, Kagera, and 9.79, the highest, in Mwabagehu in Labusalu, Shinyanga DC. In Kagera, households tend to be smaller, even when they are also part of rural areas. Those places with a higher number of members of each household present a higher degree of vulnerability, since it is likely that more people will depend on the sources of income or livelihood in general.

Most villages have less than 10,000 inhabitants, mainly due to their rural character. Only one village has more than 20,000 inhabitants (Nyakanazi in Biharamulo), and six have more than 10,000 but less than 20,000.

The main economic activities in the Area of Influence are agriculture, livestock keeping, and, in some areas, mining, especially small-scale.

Agriculture is the main economic activity and the main source of employment both in the DAI and the IAI. The main food crops are maize, paddy, bananas, cassava, beans, among others. The cash crops include sugarcane, paddy, coffee, and sunflower. Most agriculture are is produced in small scale small-scale areas that go from 2 ha to 10 ha. The villages of the DAI follow the same patterns as the IAI. The crops used for food are diverse, and are mainly of maize, cassava, paddy, and groundnuts. The main cash crop is cotton, except for the villages in Missenyi, Ngara, and Kassambya, in Kagera, where sugar cane is the main one. Coffee and tobacco are also important in some villages. In most cases, their products are sold in the local markets belonging to their own villages or wards.

Livestock keeping is practiced together with agriculture. Livestock keeping is practiced both in rural and urban areas. In DAI, most villages produce milk and meat and sell them. In many cases, it is also used for self-consumption. In a few ones of them they go furthers further and generate other products, such as yogurt and leather.

Industries are mainly small-scale and include commercial activities such as stores, restaurants and bars, guest houses, and banks among others.

Large, medium, and small-scale or artisanal mining can be found in the area of influence, in such as the regions of Geita and Shiyang.

Geita, Kagera, and Kigoma are the three regions with the highest proportions of people living below the poverty line.

Regarding land tenure in the Area of Influence, there is general land, village land, and reserve land. Productive land falls under village land. Village Council manages village land on behalf of the President of Tanzania. Reserved land is managed by the authority responsible for its use (such as the Tanzania Forest Service or TANROADS). General land is the land that is neither a village nor a reserve, including urban areas. It is managed by the Commissioner for Lands on behalf of the President. From what has been found, most land is public land used by small-scale farmers.

In terms of land ownership, 83 villages mentioned that they own their lands based on customary rights; 13 said that some villagers have title deeds; 35 said they do not have titles.

Regarding health, the problems faced by the area are that there are not enough health facilities, especially considering the growing population; they are particularly difficult to access for those in rural areas (due to distance and lower population density), and there are not enough drugs and health equipment.

The main causes of death, for both men and women, are malaria, anaemia, and pneumonia. Malaria is also an important cause of death among people living with

HIV/AIDS. Diarrhoea is also a cause of mortality. One of the main concerns that appear in the different district and regional profiles is HIV/AIDS.

Malaria is the most frequent disease and the main cause of death in the DAI. Most common diseases, besides malaria, include diarrhoea and urinary tract infection.

Stakeholder Consultation and Involvement

The ESIA development process involved extensive consultations with stakeholders at the national, regional, and local levels stakeholders. Public consultations were conducted in 105 villages across the project's areas of influence. These consultations were designed to:

- Inform communities about the project and its potential impacts.
- Solicit feedback on community concerns and expectations.
- Engage vulnerable populations, ensuring that their voices are heard in the decision-making process.

The consultation process has been implemented in three phases. The first one was implemented in July 2023 and consisted of the meetings held at the regional and district levels. The second phase occurred between May and July 2024, and the third **one was** between October and November 2024. The social team visited the wards and villages to collect socio-economic information and held meetings with the affected villages and other stakeholders. 107 consultation meetings with the villages of the Direct Area of Influence were held. 6,143 persons participated, of which 2,217 were women and 3,926 were men. They, and the other stakeholders (local and regional authorities, different institutions) showed their support to the project because electricity is perceived as necessary for development and economic/productive projects; there is a need to improve the quality of electricity (tension, permanent); they expect more energy will reduce its cost and they expect that the Project will create direct and indirect jobs. However, concerns were also expressed regarding the project's potential impact on land use, agriculture, livestock keeping, and timely compensation for displaced individuals. Members of the villages also demanded to be connected to the electricity grid.

Key concerns included land acquisition and whether compensation would be fair, timely, and compliant with human rights standards. The resettlement process was highlighted as a complex issue, particularly in areas affected by informal artisanal mining. Stakeholders emphasized the need for proper compensation and livelihood restoration, particularly for those reliant on agriculture and mining for income. To address these concerns, the ESIA proposes a Resettlement and Livelihood Restoration Plan (RLRP), along with other mitigation programs such as a Stakeholder Engagement Plan, Local Hiring Program, and a Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) Prevention and Response Plan.

Assessment of Impacts and Identification of Alternatives

Identification of Alternatives

The ESIA alternatives analysis studied the reasonably feasible alternatives of high-impact reaches, considering the set of factors described here and demonstrating the comparative social and environmental advantages of the preferred alternative. This evaluation contemplated at least the following aspects:

- Extension of each alternative and the number of towers.
- Accessibility and the need to open new access.
- Minimization of interference in areas of biological importance, including wetlands, large forest fragments, identified migratory bird routes, bird congregation areas, and other areas of conservation importance already registered, mapped, or recognized from the point of view of biodiversity values, with emphasis on any critical habitats whose occurrence was confirmed during the development of the ESIA.
- Minimization of interference in legally protected areas.
- Minimization of interference with KBAs (Key Biodiversity Areas), IBAs (Important Bird Areas), AZEs, IPAs (Important Plant Areas), RAMSAR Sites, World Heritage Sites, and other areas of internationally recognized biological importance.
- Hilly areas.
- Proximity to urban areas or rural communities.
- Interference with mining areas.
- Interference with areas under economic use.
- Interference with areas of speleological potential.
- Interference with archaeological, historical, cultural heritage, and areas of scenic beauty.
- Interference with bodies of water.
- Other criteria.

Where possible, the criteria have been mapped and overlaid on the alternatives considered for the analysis. This procedure allowed, data quantification and comparative analysis in addition to locational analysis, data quantification and comparative analysis.

After the project engineering team had identified the preferred routes from a technical perspective, the next task was to identify and evaluate a set of restrictions that would allow assessing more advantageous route alternatives from a socio-environmental point of view compared to those first selected routes.

The criteria considered in this phase of the study were as follows:

- Abiotic criteria
  - Hilly areas
  - Interference in wetlands
  - Interference with bodies of water
  - Longitudinal extension near perennial bodies of water

- Biodiversity criteria
  - Interference in legally protected areas
  - Interference with Key Bird Areas
  - Interference with potential Critical Natural Habitats
  - Interference with large forest fragments

- Social criteria
  - Buildings affected
  - Accessibility and the need to open new access
  - Interference with areas under agricultural uses

It is important to note that the analysis presented below was carried out for the segments between Kyaka-Nyakanazi and Nyakanazi-Ibadakuli, where the alternatives are considerably different from each other, resulting in the interception of different landscape matrices. As for the segment between Kyaka and Mutukula, the proposed alternatives are very close to each other, leaving only the need for fine-tuning the preferred route conceived by the project engineering, since there are no significant differences from a socio-environmental point of view.

Quantitative Assessment and Prior Adjustment of the Preferred Option

Table 1.0.l and **Table 1.0.m** below show the quantitative results that supported the above analysis presented for the Kyaka-Nyakanazi and Nyakanazi-Ibadakuli segments.

Table 1.0.l
Quantification of restriction criteria for the Kyaka-Nyakanazi segment

Criteria	Option A	Option B
Interference in legally protected areas	90.8	82.3
Interference with Key Biodiversity Areas (KBA)	43.6	41.3
Interference with potential Critical Natural Habitats	162.4	36
Interference with large forest fragments	104.3	53.6
Hilly areas	82.7	37.8
Interference in wetlands	65.6	24.1
Interference with bodies of water	71	92
Longitudinal extension close to perennial bodies of water	93.7	55.6
Buildings affected	487	607
Accessibility and the need to open new access	31.7	41.6
Interference with areas under agricultural uses	22.1	38.2
Interference with mining concessions	4	0

Table 1.0.m
Quantification of restriction criteria for the Nyakanazi-Ibadakuli segment

Criteria	Alt. 1	Alt.2	Alt.3	Alt.4
Interference in legally protected areas	17.1	17.1	17.1	17.1
Interference with Key Biodiversity Areas (KBA)	-	-	-	-
Interference with potential Critical Natural Habitats	-	-	-	-
Interference with large forest fragments	15.6	15.6	15.6	13.5
Hilly areas	3.3	3.3	3.3	4.4
Interference in wetlands	127	143	149	130
Interference with bodies of water	48.9	63.1	63.5	42.5
Longitudinal extension close to perennial bodies of water	-	3.4	25	-
Buildings affected	708	550	549	667
Accessibility and the need to open new access	6.9	6.9	8.8	8.8
Interference with areas under agricultural uses	165.5	169.4	167.6	159.0
Interference with mining concessions	16	16	16	0

Based on socio-environmental aspects, the results indicate that Option B (closer to Lake Victoria) is the most advantageous for the Kyaka-Nyakanazi segment. This option is particularly favourable when considering biodiversity criteria. It is evident that Option B has lower interference with Protected Areas, shorter length in KBAs, shorter length intercepted in large fragments of vegetation, and has lesser interference in areas with potential for Critical Habitats.

Furthermore, Option B is located in areas with gentler slopes, which decreases the likelihood of significant physical obstructions during construction. Another advantage of this option is that it intersects fewer floodplains and avoids approaching numerous permanent watercourses, even though it does intercept more bodies of water than Option A.

However, when considering the social factors, Option B presents certain drawbacks, such as more buildings being intercepted (607 against 487) and obstruction in regions with farming and low connectivity. After reviewing the information provided and the efforts made to adjust the alignment, it can be concluded that Option B is the best choice from a socio-environmental quantitative analysis.

It's important to assess the likelihood of impacts and the potential for mitigating them impacts. The existence of the TL Nyakanazi-Benako and its future extension to Kyaka are significant in this regard. Option A was adjusted to follow the parallelism and sharing of the right-of-way of these TLs, which greatly reduces the potential for impacts on the variables considered, when compared with Option B. Option B is designed to be implemented in a green field.

After analysing the Nyakanazi-Ibadakuli segment, it was confirmed that the project engineering's preferred option could be the best choice. Alternative 1 was found to have no direct impact on Protected Areas, KBAs, or areas of potential Critical Habitat in terms of biodiversity. The difference in length of large patches of vegetation between Alternative 1 and Alternative 4, which has a lower impact, is only about 2 km and is

insignificant.

When it comes to measuring abiotic criteria, the findings show that Alternative 1 has minimal impact on steep slope areas, the fewest crossings over bodies of water, and no route near perennial watercourses. Even in flooded areas, the amount of interference compared to Alternative 4 (which has the least interference) is not significant.

After a thorough investigation, it has been determined that the areas with limited access to capillarity do not significantly restrict the implementation of the TL in this segment, because it has a well-established network of access points despite being highly impacted by human activity. However, there may be some interference with extensive agricultural fields. Despite this, Alternative 1 has minimal losses compared to other options, as evidenced by the values being less than 10km (as shown in **Figure 8.1.4.b**).

Of the four alternatives, preferred Alternative 1 causes the most impact on construction along its alignment. During the mapping process, it was discovered that 708 buildings would be impacted. To address this issue, a proposal was made to modify the route, avoiding 118 buildings. While the adjusted Alternative 1 still affects more buildings (708) than Alternative 2 (550), Alternative 3 (549) and Alternative 4 (667), it ultimately meets all other criteria and is therefore the preferred choice.

Assessment of Impacts and Risks

First, all impacting actions of the project's planning, construction, and operation phases that may cause social, economic, cultural, and environmental changes or that will require the appropriation/use of natural resources or available infrastructure and utilities were identified. The components of the physical, biological**,** and socioeconomic environments likely to be impacted were then identified.

Based on the analysis and interpretation of the relationships between the impacting actions and the identified environmental components, the potential risks and impacts associated with the Project have been established, i.e., those that can be reasonably foreseen and are likely to occur.

Based on the description and analysis of each potential impact and risk, and by the legal specificities required under this ESIA, the environmental measures were classified as preventive, mitigation, control, monitoring, and compensatory, as presented in the Environmental and Social Management Plan - ESMP. Regarding positive impacts, the proposed measures aim to enhance their beneficial effects.

The proposed measures are structured in the Environmental and Social Plans and Programmes that make up the project's ESMP. The grouping of measures in the Plans and Programmes aims to make them operational and facilitate their management.

All potential impacts of the Project were cross-checked against the preventive, mitigation, control, and compensatory measures proposed in the ESMP to ensure that all were covered by some measure or some form of prevention, mitigation, control, and

compensation.

The objective of the detailed risk and impact assessment is to qualify and quantify (where possible) the resulting impact, i.e., the impact that may materialise even after the actual implementation of the ESMP measures.

Taking into account the implementation and effectiveness of the proposed environmental and social Plans and Programmes and respective measures, the resulting impacts were assessed and rated according to the following set of attributes selected based on state-of-the-art environmental impact assessment methods:

- Vector (positive or negative)
- Location and spatialisation
- Stage of occurrence
- Form of incidence (direct or indirect)
- Temporality – Induction (immediate, short, medium, or long term)
- Temporality – Duration (short, medium or long term, or permanent)
- Reversibility
- Probability
- Magnitude
- Cumulativeness
- Synergy

Attribution of the degree of importance and assessment of the final residual impact

Within the scope of this study, the definition of this study's scope, the degree of importance for each impact has been made defined by crossing the attributes magnitude and reversibility. Magnitude represents the extent of the possible effects of the interventions when comparing the quality of the environment interventions' possible effects when comparing the environment's quality before and after the impacting actions. On the other hand, reversibility tends to represent the vulnerability and sensitivity of each assessed component, i.e., the capacity of environmental systems to assimilate energy inputs and maintain their characteristics as close as possible to those observed before the interventions.

The analysis of the final residual impact is related to applying another rating attribute: the degree of mitigation. This attribute refers to the levels of possibility that the negative effects of an impact can be controlled. It should be noted that mitigation depends on the nature of the affected components and the possibility of technical and economic implementation, as well as the political and institutional effort to do so on the part of the Project developer. The classification of impacts about of their mitigation is considered to be the following degrees: Fully Mitigable, Highly Mitigable, Moderately Mitigable, and Low Mitigable.

Identification and Evaluation of Potential and Resulting Impacts and Environmental Mitigation Measures

Key physical impacts include soil erosion, water quality deterioration, and air pollution, while the biological impacts focus on habitat loss, biodiversity reduction, and species disruption. Socio-economic impacts are primarily related to land acquisition, displacement of communities, and disruptions to local economies and livelihoods. In total, 28 possible environmental and social impacts of the Project were identified, with 5 impacts on the physical environment, 7 on the biological environment, and 16 on the socio-economic environment, as shown in **Tables 1.0.n** to **1.0.p** below.

The construction and operation phases of the Uganda-Tanzania Interconnector Power Project will result in significant impacts on significantly impact land use and occupation within the easement strip, leading to both physical and economic displacement. Approximately 1,218.89 hectares of agricultural land will be affected, with 94.4% being cyclical crops and 6.6% perennial crops. The 400 kV Nyakanazi – Ibadakuli segment will experience the greatest impact, as it traverses regions with high levels of human activity, including subsistence agriculture and artisanal mining. The resettlement and compensation process, particularly for communities dependent on informal artisanal mining, will be complex, as restoring livelihoods in these settings is particularly challenging.

In terms of biodiversity, the project will permanently impact critical habitats, particularly in the Burigi-Chato National Park and the Biharamulo and Uyovu Forest Reserves, where the transmission line will intersect areas rich in endangered and endemic species. Despite efforts to minimize environmental disruption, it was not possible to avoid affecting these critical habitats due to the lack of a viable locational alternative. The chosen route had to balance multiple environmental and social constraints, and avoiding these sensitive areas entirely was not feasible. Consequently, the project will lead to permanent habitat loss, fragmentation, and species displacement. Despite the guideline to cut vegetation only in the service strip (14 m wide, 7 m on each side of the axis), therefore in an area smaller than the 52 m wayleave to limit habitat clearance, residual impacts remain significant. To mitigate these effects, a comprehensive biodiversity management plan will be implemented to achieve long-term conservation gains, including fauna and flora rescue operations, habitat restoration, and biodiversity offsets, will be implemented to achieve long-term conservation gains.

In addition to the impacts, 16 risks associated with the Project were identified, that which may or may not become impacts have been identified. These risks (one on the physical environment, 5 on the biological environment, and 10 on the socio-economic environment) are separated into two tables, **Table 1.0.q** with the construction phase risks and **Table 1.0.r** with those that also occur during operation. These risks include soil contamination, erosion, fire hazards, the spread of invasive species, and threats to wildlife and public health. Risks to socio-economic factors include increased demand for health services, damage to crops, the spread of diseases (between workers and from workers to the community), accidents involving workers, accidents involving the community, accidents due to the presence of landmines and UXOs, risk of social

conflict between workers and the community (including cases of gender-based violence, sexual exploitation and abuse and sexual harassment – GBV/SEA/SH, theft, physical assault, alcohol and substance abuse, others), abuse and inappropriate use of force by security personnel, and risks to cultural and archaeological heritage. These risks will be mitigated through comprehensive measures such as monitoring programs, emergency preparedness, and targeted action plans.

These risks are addressed through comprehensive mitigation measures, such as monitoring programs, emergency preparedness, and specific E&S safeguards instruments (e.g., the Biodiversity Management Plan, Gender-Based Violence Action Plan, Labour Management Procedures, and Stakeholder Engagement Plan).

The UTIP project is expected to deliver significant long-term benefits, including:

- Economic Growth: The project will improve electricity reliability, supporting industrial development and creating job opportunities in Tanzania and Uganda.

- Climate Change Mitigation: Uganda's hydroelectric power will reduce Tanzania's reliance on carbon-intensive energy sources, contributing to the region's decarbonization efforts.

- Regional Integration: The project will strengthen cross-border cooperation between Uganda and Tanzania, promoting regional energy security and economic integration.

The Uganda-Tanzania Interconnector Power Project presents an opportunity to enhance energy security, promote regional integration, and contribute to economic growth and climate change mitigation in East Africa. By leveraging Uganda's surplus hydroelectric power generation capacity, the project will enable Tanzania to reduce its reliance on carbon-intensive energy sources, helping the country meet its environmental sustainability goals and align with international climate commitments.

While the project offers numerous benefits, it also presents significant environmental and social challenges that require careful management. As mentioned, the ESIA process has resulted in developing a comprehensive set of mitigation measures designed to minimize the project's negative impacts and enhance its positive outcomes.

The proposed set of environmental and social mitigation and compensation measures outlined in the Environmental and Social Impact Assessment (ESIA) are designed to meet the requirements of the World Bank's Environmental and Social Standard 1 (ESS1), which emphasizes the need for projects to manage environmental and social risks in a way that avoids, mitigates, or compensates adverse impacts. The ESIA provides a comprehensive framework of mitigation programs, including measures to prevent, mitigate, or offset negative environmental effects and ensure compliance with international best practices.

A key component of this plan is the Environmental and Social Management Plan (ESMP), which incorporates various programs aimed at addressing both construction and operational impacts. These programs include the Resettlement Policy Framework (RPF a stand-alone document), which ensures that those affected by land acquisition and displacement will receive adequate compensation and support to restore their livelihoods.

The Resettlement and Livelihood Restoration Programme (P.11) is designed to address both physical and economic displacement resulting from the establishment of wayleave easements for the power transmission line. The Programme identifies that approximately 2854.33 hectares of land will be affected along the 548.91-kilometer line, with 1106 buildings directly impacted and over 1200 hectares of temporary and permanent agricultural land requiring clearance, of which 6.6% consists of perennial crops and 94.4% of cyclical crops. The primary objectives of this Programme include avoiding forced evictions, providing fair and timely compensation to affected persons, and assisting in the restoration or improvement of livelihoods, particularly for vulnerable groups.

The Programme is aligned with Tanzanian land legislation and the World Bank's Environmental and Social Standards (ESS 5), emphasizing the importance of fair compensation and ensuring no adverse long-term impacts on living standards. Key government ministries, including Energy, Finance, and Local Government Authorities (LGAs), will be involved in the coordination and execution of resettlement activities, supported by a dedicated implementation committee within TANESCO. This structured approach aims to ensure transparency, equitable treatment of affected populations, and a smooth execution of the resettlement and livelihood restoration activities.

The ESMP also includes the Biodiversity Management Plan, which targets the protection of critical habitats and species, ensuring that native ecosystems are conserved or offset when direct impacts cannot be avoided. The BMP emphasizes a goal of "No Net Loss" (NNL) for impacts on natural habitats and aims for a "Net Positive Impact" (NPI) for critical habitat species. This will be achieved through the implementation of six key programs: the Biodiversity Offset Plan, Ecosystem Services Impact Mitigation Plan, Fauna and Flora Rescue and Relocation Plan, Invasive Species Control Program, Landscape Protection Program, and Operation Biodiversity Management Program.

The document provides an in-depth baseline assessment of biodiversity in the project area, detailing the diverse ecosystems and species that may be affected, including threatened and migratory species. It also outlines specific risks such as habitat fragmentation, fauna disturbance during construction, and the spread of invasive species. The BMP applies a mitigation hierarchy—avoidance, minimization, restoration, and offsetting—to reduce the project's residual impacts on biodiversity.

Mitigation measures include reducing the cleared vegetation area from 52 to 14 meters and implementing fauna rescue and relocation efforts. For unavoidable residual impacts, biodiversity offsetting measures are proposed to restore degraded areas, ensuring measurable conservation outcomes. A performance monitoring framework, with defined indicators, will ensure the effectiveness of mitigation measures, and ongoing revisions

will be made as necessary based on real-time project data.

Furthermore, the ESMP covers comprehensive measures to manage pollution, including air and water quality controls, erosion control during construction, and programs to manage hazardous waste and minimize the project's carbon footprint. This holistic approach aligns with the World Bank's ESS1 standards, ensuring that the project adequately addresses all significant risks and residual impacts through prevention, mitigation, and compensation, ultimately contributing to the region's sustainable development goals.

The Stakeholder Engagement Plan (SEP) for the Uganda-Tanzania Interconnector Power Project outlines a comprehensive approach for engaging stakeholders throughout the project's lifecycle, ensuring transparency, information dissemination, and addressing concerns from various groups, including local communities, government authorities, NGOs, and other interested parties. The SEP is designed to ensure that the voices and interests of all stakeholders, particularly those directly affected by the project, are adequately considered and incorporated into the decision-making process.

A critical feature of the SEP is the grievance mechanism, which provides stakeholders with accessible, transparent, and culturally appropriate channels for raising concerns or complaints related to the project, including those related to GBV/SEA/SH. This mechanism is designed to handle grievances at any stage of the project, offering multiple entry points, including local offices, project websites, and dedicated contact points in each community. The grievance mechanism follows a clear process for registering, acknowledging, assessing, and resolving complaints, with defined timeframes for each stage to ensure prompt responses. Grievances are categorized based on their nature (e.g., environmental, social, compensation-related), and specific personnel are designated to manage and resolve them. The system also allows for anonymous submissions and ensures confidentiality when requested.

The SEP emphasizes the importance of monitoring and evaluation through performance indicators, such as the number of consultations conducted, the response time for grievances, and the level of participation by different stakeholder groups. Regular reports will be produced to track the effectiveness of engagement and grievance redressal, ensuring continuous improvement. The overall goal is to build and maintain trust between the project developers and affected communities, ensuring that stakeholder concerns are addressed throughout the project's development.

The **Tables 1.0.n** to **1.0.r** also show all the proposed prevention, mitigation, control, and compensation measures for the identified impacts and risks. These measures have been organized into Plans and Programmes to facilitate their management, either by TANESCO or by the Contractors, depending on who is responsible for their implementation.

These Plans and Programmes are consolidated in the Project's Environmental and Social Management Plan (ESMP). In addition to the ESMP, the Project also has an Environmental and Social Monitoring Plan and a Decommissioning Plan, as shown after the Tables.

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
Physical Environment	Soils / Relief	1.01 - Occurrence and/or intensification of erosion processes due to earthworks and excavations	• **P.01 - Construction Environmental Plan (CEP):** – Erosion Prevention and Control; – Vegetation Clearing; – Decommissioning and Recovery of Degraded Areas. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures.
	Superficial Water Resources	2.01 – Alterations of surface water quality and increased turbidity	• **P.01 - Construction Environmental Plan (CEP)** – Erosion Prevention and Control; – Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Water and Effluent Management; – Vegetation Clearing; – Camp sites and workforce housing management; – Waste Management; – Hazardous Materials Management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.04 - Construction Emergency Preparedness and Response Plan** – Construction emergency preparedness and response measures. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ Treated effluents monitoring – TANESCO's Environmental and Social Monitoring Programme ▪ Water quality monitoring
		2.02 - Siltation of watercourses	• **P.01 - Construction Environmental Plan (CEP)** – Erosion Prevention and Control;

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Vegetation Clearing. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures.
	Groundwater Resources	3.01 – Alteration of groundwater quality	• **P.01 - Construction Environmental Plan (CEP)** – Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Water and Effluent Management; – Waste Management; – Hazardous Materials Management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.04 - Construction Emergency Preparedness and Response Plan** – Construction emergency preparedness and response measures. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ Treated effluents monitoring.
	Air Quality	4.01 - Change in air quality during construction	• **P.01 - Construction Environmental Plan (CEP)** – Atmospheric Emissions and Noise and Vibration Control. • **P.02 - Environmental and Social Management Program:** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. – Air quality monitoring;

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Greenhouse Gas Emissions Management. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ Atmospheric emissions monitoring – TANESCO's Environmental and Social Monitoring Programme ▪ Air quality monitoring
Biological Environment	Flora and Vegetation	5.01 - Loss of vegetation cover and reduction of individual plants	• **Optimisation of the route** to avoid intervention in socio-environmentally sensitive areas • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing: ▪ reduce the clearing of native vegetation (which will be restricted to a 6-metre-wide service strip for laying cables); ▪ use the service strip for access to the towers; ▪ vegetation removal only in the authorized area; ▪ protective procedures of the surrounding vegetation; ▪ prioritise degraded areas for the camp sites and access roads; ▪ riverine vegetation should not be cleared closer to the river at a distance of 60 m while constructing the transmission line; ▪ measures to guide the correct disposal of suppressed plant material. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.07 - Fauna and Flora Rescue and Relocation Plan** – Flora rescue and relocation to surrounding vegetation patches, or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation and operation of the project; – Monitoring the dispersal of invasive species. • **P.10 - Operation Biodiversity Management** – P.10.3 – Subprogramme of Native Vegetation Restoration ▪ Native vegetation restoration. • **P.14 - Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and social education for workers.

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
		5.02 - Increased landscape fragmentation and edge effect incidence	• **Optimisation of the route** to prioritise anthropized areas, to reduce the impact of suppressing vegetation and, consequently, increasing fragmentation and the edge effect. • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing: ▪ reduce the clearing of native vegetation (which will be restricted to a 6-metre-wide service strip for laying cables); ▪ use the service strip for access to the towers; ▪ vegetation removal only in the authorized area; ▪ protective procedures of the surrounding vegetation; ▪ prioritise degraded areas for the camp sites and access roads; ▪ riverine vegetation should not be cleared closer to the river at a distance of 60 m while constructing the transmission line; ▪ measures to guide the correct disposal of suppressed plant material. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.07 - Fauna and Flora Rescue and Relocation Plan** – Flora rescue and relocation to surrounding vegetation patches, or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation and operation of the project; – Monitoring the dispersal of invasive species. • **P.10 - Operation Biodiversity Management** – P.10.3 – Subprogramme of Native Vegetation Restoration; ▪ Native vegetation restoration.
	Fauna	6.01 - Disturbance of fauna during construction	• **P.01 – Construction Environmental Plan** – Vegetation clearing; – Construction traffic control; – Camp sites and workforce housing management. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Flora rescue and relocation to surrounding vegetation patches, or intended for educational and/or research institutions.
		6.02 - Reduction of natural habitats	• **P.01 – Construction Environmental Plan** – Vegetation clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate for losses of natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches, or intended for educational and/or research institutions. • **P.09 – Landscape Protection Program** • **P.10 – Operation Biodiversity Management** – P.10.1 - Subprogramme of bird collision monitoring; – P.10.2 - Subprogramme of fauna monitoring during operation.
	Protected Areas and Internationally Recognized Areas	7.01 – Impacts on Protected Areas and Internationally Recognized Areas	• **P.01 – Construction Environmental Plan** – Vegetation Clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate for losses of natural habitat conversion.

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			• **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches, or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation of the project; – Monitoring the dispersal of invasive species. • **P.09 – Landscape Protection Program** • **P.10 – Operation Biodiversity Management** – P.10.1 - Subprogramme of bird collision monitoring; – P.10.2 - Subprogramme of fauna monitoring during operation; – P.10.3 – Subprogramme of Native Vegetation Restoration. • **P.11 – Flora Active Search Programme** • **P.14 - Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and Social Education for Workers.
	Critical Habitat	8.01 – Impacts on biodiversity in critical habitats	• **P.01 – Construction Environmental Plan** – Vegetation Clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate for losses of natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches, or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation of the project;

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Monitoring the dispersal of invasive species. • **P.09 – Landscape Protection Program** • **P.10 - Operation Biodiversity Management** – P.10.1 – Subprogramme of Bird Collision Monitoring; – P.10.2 – Subprogramme of Fauna Monitoring During Operation; – P.10.3 – Subprogramme of Native Vegetation Restoration. • **P.11 – Flora Active Search Programme** • **P.14 - Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and Social Education for Workers.
	Ecosystem Services	9.01 – Impact on the availability and quality of relevant ecosystem services	• **P.01 – Construction Environmental Plan** – Vegetation Clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate for losses of natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches, or intended for educational and/or research institutions. • **P.10 - Operation Biodiversity Management** – P.10.2 – Subprogramme of Fauna Monitoring During Operation; – P.10.3 – Subprogramme of Native Vegetation Restoration. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF2)** – Includes measures to compensate the impacts of loss or restricted access to natural resources and losses of agricultural and pasture areas.

[2] As required by TANESCO in the ToR, this is a stand-alone document that is not included as an annex to this ESIA and is presented separately for analysis.

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
Socio-Economic Environment	Employment and Local Economy	10.04 - Loss of employment and reduced demand in the local economy at the end of the construction phase	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction; – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; – Monitoring of the communication measures. • **P.13 - Local Hiring Programme** – Inform contracted workers about the duration of the construction works and the position created, so that they can plan and manage their lives in an informed manner; – During construction, train workers to enable them to perform the tasks for which they were hired and at the same time increase their skills and employability after the end of their employment contract relating to this work; – Train workers to maximise opportunities for their transition to activities associated with the operation of the Project; – Maintain close and continuous cooperation with community leaders and residents of local communities to clarify and manage opportunities for employment and procurement of goods and services in the local market.
		10.05 - Interference with mineral rights	• **P.02 - Environmental and Social Management Programme** – Coordination of Plans and Programmes of the ESMP; – Management of Interference with Mining Licences ▪ Contact with the Mining Commission; ▪ Exclusion of the area of the wayleave from the exploration concession polygon; ▪ Total or partial wayleave blockade, with mining activities relocated and operations adjusted so as not to jeopardize the TLs; ▪ Hiring of an independent valuer company or professional to value and negotiate with the holders of the mining rights. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Indemnisation measures for the impact in mining activities.
	Infrastructure, Social Equipment, and Public Services	11.01 - Interference with traffic conditions	• **P.01 - Construction Environmental Plan (CEP)** – Construction Traffic Control Program, including: ▪ scrupulously respect speed limits in populated areas; ▪ install traffic signs on the local roads and paths to be used for the works, on sections that cross populated areas; ▪ take special care in areas where there is more pedestrian traffic; ▪ reduce traffic within populated areas to what is strictly necessary; ▪ keep vehicles in good working and safe condition; ▪ repair the roads and paths, in case of serious damage;

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			▪ implement adequate signage at the cable launching at road crossing points. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction, especially those who live near the access roads, informing about the schedule of works and peak traffic periods on each section; – Coordination with the traffic department on traffic disruption during cable launching; – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; – Monitoring of the communication measures.
		11.02 - Temporary overloading of waste disposal sites	• **P.01 - Construction Environmental Plan (CEP)** – Waste Management: ▪ implementation of waste deposits in the camp sites, where waste will be temporarily stored until the final destination; ▪ sell or donate the recyclable part of the waste to duly authorised recycling companies; ▪ send to authorised final processors the hazardous waste and non-inert waste that cannot be recycled, so they can dispose of them properly. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Environmental and social education for workers ▪ explanations about rules and notions of environmental education to workers when they are hired, including the appropriate waste management practices to be followed at the camp sites and work fronts. ▪ Worker Code of Conduct.
		11.03 - Interference with airport runways	• **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during operation;

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
	Livelihoods and Quality of Life of the Population	12.01 - Generating public expectations	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Specific communication on the process of establishing the wayleave, explaining the measures that will be adopted to evaluate and compensate/indemnify for the land and improvements impacted; – Resettlement measures and compensation measures for the loss of livelihood. • **P.12 - Stakeholder Engagement Plan** – Project stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction and operation; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
		12.02 – Disturbances associated with construction activities (due to noise emissions, dust, vibrations, increased traffic)	• **P.01 - Construction Environmental Plan (CEP)** – Atmospheric Emissions and Noise and Vibration Control; – Camp Sites and Workforce Housing Management; – Construction Traffic Control Program. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures; – Environmental and Social Monitoring: • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.14 - Labour Management Procedures (LMP)**

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Environmental and social education for workers ▪ explanations about rules and notions of environmental education to workers when they are hired. – Worker Code of Conduct. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ atmospheric emissions monitoring; ▪ noise monitoring in work fronts and camp sites. – TANESCO's Environmental and Social Monitoring Programme ▪ noise monitoring in inhabited areas; ▪ air quality monitoring.
		12.04 – Changes in the landscape	• **Adjustment of the alignment of the TLs and the new accesses, and planning of the building site's location** • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing ▪ keeping vegetation suppression to a minimum, to reduce the negative effect on the landscape; – Decommissioning and Recovery of Degraded Areas. ▪ restoring areas degraded by the works at the end of construction. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Programme** – Vegetation management on the wayleave and areas under recovery. • **P.10 - Operation Biodiversity Management** – P.10.3 – Subprogramme of Native Vegetation Restoration ▪ Native vegetation restoration. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
		12.05 - Changes in land use and loss of agricultural areas	• **Adjustment of the alignment of the TLs and the new accesses to reduce the impact on crops** • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing ▪ keeping the suppression of vegetation and other land uses to a minimum; – Decommissioning and Recovery of Degraded Areas. ▪ restoring areas degraded by the works at the end of construction. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Physical cadastre, to evaluate the land and improvements impacted; – Indenisation for impacts on crops; – Specific Grievance Mechanism; – Monitoring. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
		12.06 - Interference with houses, improvements and sources of income	• **Adjustment of the alignment of the TLs and the new accesses to reduce the impact on houses, improvements, and sources of income** • **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Physic cadastre, to evaluate the land and improvements impacted; – Social cadastre; – Compensation/indenisation, including for loss of sources of income; – Relocation support;

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Post-relocation monitoring; – Specific Grievance Mechanism; – Monitoring. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
	Land	13.01 - Reduction in the available area of properties due to the land taken by the Project	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Physic cadastre, to evaluate the land impacted; – Social cadastre; – Indenisation for impacts of land taking; – Specific Grievance Mechanism; – Monitoring. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
	Historical, Cultural, and Archaeological Heritage	14.01 - Impact on graves	• **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity, and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders;

Table 1.0.n
<u>Negative impacts of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.16 - Archaeological, Historical, and Cultural Heritage Protection Plan** – Measures for removal, transportation, reinstatement and re-interment of the graves ▪ the process of removal, transportation, reinstatement, and re-interment of the grave or dead body and any placatory or expiatory rites or other ceremony accompanying such removal and re-internment is conducted and supervised by the local Authority (District Authority) through the Land and Health Department or Resettlement Action Plan - RAP expertise. ▪ Before removing graves, a leaf is obtained from the respective court (district court), which makes the local Authority (District Authority) capable of removing the graves. ▪ The relatives of the deceased (Interested Person) receive only condolences (the costs of the ceremony according to their known traditions) and receive a fixed/equal fee for all relatives of the deceased.

Table 1.0.o
<u>Negative impacts of the operation phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring, and compensation

Impacts			Measures
Physical Environment	Soils / Relief	1.01 - Occurrence and/or intensification of erosion processes due to earthworks and excavations	• **P.03 - Operation Management Program** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Monitoring of Recovered Areas; – Maintenance and Erosion Control.
	Groundwater Resources	3.01 – Alteration of groundwater quality	• **P.03 - Operation Management Program** – Supervision of Compliance with the Measures of ESMP Plans and Programs that Extend to the Operation Phase; – Waste Management; – Emergency Response Plan (ERP) Framework for the Operation Phase.
Biological Environment	Flora and Vegetation	5.01 - Loss of vegetation cover and reduction of individual plants	• **P.03 - Operation Management Programme - Responsible: TANESCO** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental Training of the Maintenance Team; – Monitoring of Recovered Areas; – Vegetation Management on the Wayleave Easement; – Access Control Plan.
		5.02 - Increased landscape fragmentation and edge effect incidence	• **P.03 - Operation Management Programme - Responsible: TANESCO** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental Training of the Maintenance Team; – Monitoring of Recovered Areas; – Vegetation Management on the Wayleave Easement; – Access Control Plan.
	Protected Areas and Internationally Recognized Areas	7.01 – Impacts on Protected Areas and Internationally Recognized Areas	**As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate for losses of natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.08 - Invasive Species Control Programme** – Control activities during the operation of the project; – Monitoring the dispersal of invasive species.

Table 1.0.o

<u>Negative impacts of the operation phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring, and compensation

Impacts			Measures
			• **P.09 – Landscape Protection Program** • **P.10 – Operation Biodiversity Management** – P.10.1 - Subprogramme of bird collision monitoring; – P.10.2 - Subprogramme of fauna monitoring during operation; – P.10.3 – Subprogramme of Native Vegetation Restoration.
	Critical Habitat	8.01 – Impacts on biodiversity in critical habitats	**As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate for losses of natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.08 - Invasive Species Control Programme** – Control activities during the operation of the project; – Monitoring the dispersal of invasive species. • **P.09 – Landscape Protection Program** • **P.10 - Operation Biodiversity Management** – P.10.1 – Subprogramme of Bird Collision Monitoring; – P.10.2 – Subprogramme of Fauna Monitoring During Operation; – P.10.3 – Subprogramme of Native Vegetation Restoration.
	Ecosystem Services	8.01 – Impact on the availability and quality of relevant ecosystem services	**As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate for losses of natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.10 - Operation Biodiversity Management** – P.10.2 – Subprogramme of Fauna Monitoring During Operation; – P.10.3 – Subprogramme of Native Vegetation Restoration.
Socio-Economic Environment	Infrastructure, Social Equipment, and Public Services	11.03 - Interference with airport runways	• **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during operation; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
	Livelihood	12.03 – Disturbance due	• **.03 - Operation Management Programme**

Table 1.0.o
<u>Negative impacts of the operation phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring, and compensation

Impacts			Measures
		to increased noise during operation	– 5.1. Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase – Protection of the wayleave easement, to ensure that the wayleave remain unoccupied; – Social communication during the operation; – Audible noise monitoring ▪ a noise measurement campaign to be carried out before energization and another in the first month of operation, covering 23 measurement points, including the 8 points measured in the baseline campaign (**Section 7.1.9**). The comparison between these two campaigns will aim to verify the need to develop studies on noise attenuation solutions. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
		12.04 – Changes in the landscape	• **P.03 - Operation Management Programme** – Vegetation management on the wayleave easement and areas under recovery. • **P.10 - Operation Biodiversity Management** – P.10.3 – Subprogramme of Native Vegetation Restoration ▪ Native vegetation restoration. • **P.12 - Stakeholder Engagement Plan** – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.

Table 1.0.p
Positive impacts of the planification and construction phases identified for the Project and targeted measures for enhancement

Impacts			Measures
Socio-Economic Environment	Employment and Local Economy	10.01 - Generation of direct and indirect jobs during construction	**P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; – Monitoring of the communication measures. • **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[3] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Definition of the project's labour Policy; – Recruitment and labour training; – Management of working conditions; – Grievance mechanism from workers; – Workers' Code of Conduct; – Environmental and social education for workers; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy.
		10.03 – Increased local consumption of goods and	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation

[3] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 1.0.p
Positive impacts of the planification and construction phases identified for the Project and targeted measures for enhancement

Impacts			Measures
		services during construction phase	of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.13 - Local Hiring Program** – Dissemination of the list of products and services with the possibility of local acquisition, in advance so that potential local suppliers are prepared to meet the increased demand; – Measures to maximise the hiring of local suppliers of inputs and services.
		10.02 - Generation of direct and indirect jobs during operation	• **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Social communication during operation. • **P.12 - Stakeholder Engagement Plan** – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; • **P.13 - Local Hiring Program** – Communication about job opportunities for the operation phase through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect4 for facilitate this stage of the project by mediating the contact between TANESCO and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites; – Training of the operation and maintenance (O&M) team. • **P.14 - Labour Management Procedures (LMP)** – Definition of the project's labour Policy; – Recruitment and labour training; – Management of working conditions; – Grievance Mechanism; – Workers' Code of Conduct;

[4] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 1.0.p
Positive impacts of the planification and construction phases identified for the Project and targeted measures for enhancement

Impacts			Measures
			– Environmental and social education for workers; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy.
	Livelihoods and Quality of Life of the Population	12.01 - Generating public expectations	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Specific communication on the process of establishing the wayleave, explaining the measures that will be adopted to evaluate and compensate/indemnify for the land and improvements impacted; – Resettlement measures and compensation measures for the loss of livelihood. • **P.12 - Stakeholder Engagement Plan** – Project stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction and operation; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.

Table 1.0.q
<u>Risks of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
Physical Environment	Soils / Relief	15.01 - Risk of soil contamination (from leaks and inadequate management of effluents and waste produced)	• **P.01 - Construction Environmental Plan (CEP)** – Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Water and Effluent Management; – Camp Sites and Workforce Housing Management ▪ provide all areas at risk of contamination at the building sites with material kits for use in emergencies; ▪ connect the sanitary facilities in the building sites to septic tanks. – Waste Management, including provide appropriate structures at the Waste Shelter (waterproof flooring, cover, retaining dike, and drainage leading to water and oil separator boxes); – Hazardous Materials Management, including provide appropriate structures on site for the storage of hazardous products (waterproof flooring, cover, retaining dike, and drainage leading to water and oil separator boxes). • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.04 - Construction Emergency Preparedness and Response Plan** – Construction emergency preparedness and response measures.
Biological Environment	Flora and Vegetation	16.01 - Increased risk of fire in adjacent vegetation	• **P.01 - Construction Environmental Plan (CEP)** – Camp sites and workforce housing management; – Hazardous materials management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.04 - Construction Emergency Preparedness and Response Plan** – Emergency Preparedness and Response Procedures (EPR) for fires and explosions, including sequential actions to respond to accidental events involving fires in the project areas. • **P.14 – Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and social education for workers, including training of construction company employees and subcontractors

Table 1.0.q
<u>Risks of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
			on appropriate environmental protection practices. • **P.17 - Occupational Health and Safety Management Programme** – Training in emergency procedures for fire workers (among other themes).
		16.02 - Expansion of invasive flora species	**As part of the Biodiversity Management Plan (BMP):** • **P.08 - Invasive Species Control Program** – Preventive and corrective measures to be implemented continuously both during the construction and operation of the project, including monitoring the dispersal of invasive species; – Inspection, quarantine, and cleaning measures for vehicles and construction equipment entering high-risk areas.
	Fauna	17.01 – Risk of an increase in hunting	• **P.14 – Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and social education for workers.
Socio-Economic Environment	Infrastructure, Social Equipment and Public Services	18.01 - Risk of increased demand for health services	• **P.01 - Construction Environmental Control Plan** – Vegetation clearing; – Construction traffic control; – Camp sites and workforce housing management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.17 - Occupational Health and Safety Management Programme** – Establishment of OHS procedures; – Establishment of Safe Work Procedures; – Recruitment of OHS management staff; – Training in occupational safety; – OHS supervision; – Worker health management; – Implementation of first aid rooms on all camp sites. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ noise monitoring in work fronts and camp sites; ▪ quality of drinking water monitoring

Table 1.0.q
<u>Risks of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
Socio-Economic Environment	Infrastructure, Social Equipment and Public Services	18.02 - Risk of unintended damage to crops and improvements during works	• **P.01 - Construction Environmental Control Plan** – Construction traffic control (avoid travelling outside the access roads, passing through cultivated areas); – Indenisation for unintended damage to crops or rural improvements by the contractors. • **P.02 - Environmental and Social Management Programme:** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Recruitment and labour training; – Workers' Code of Conduct; – Environmental and social education for workers, with a focus on the rules for driving vehicles and machinery, to avoid passing outside accesses and impacting cultivated areas, and taking care with improvements near the work fronts.
	Health and Safety of the Community and Workers	19.01 - Increasing the risk of the spread of disease during construction	• **P.01 - Construction Environmental Plan (CEP)** – Camp sites and workforce housing management. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[5] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Observation of World Bank EHS Guidelines, particularly with respect to health management;

[5] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 1.0.q
<u>Risks of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
			– Worker health monitoring, and appropriate medical assistance and first response capabilities at work fronts; – Working conditions at camp sites and work fronts aligned with international standards; – Ensure adequate hygiene conditions in camp sites; – Ensure adequate accommodation conditions for workers, including mosquito nets and insect protection; – Ensure distribution of insect repellent to workers and encourage its use; – Recruitment and labour training, including informing on risk behaviours and preventive care, such as condom use; – Workers' Code of Conduct. • **P.17 - Occupational Health and Safety Management Program** – Establishment of OHS procedures; – Recruitment of OHS management staff; OHS supervision; – Worker health management, including carrying out admission and periodic examinations; – Implementation of first aid rooms on all camp sites. • **Gender Based Violence (GBV) Action Plan** • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme – quality of drinking water monitoring
		19.02 - Risk of accidents involving workers	• **P.01 - Construction Environmental Plan (CEP)** – Camp site and workforce housing management; – Vegetation clearing and footprint management; – Hazardous materials management program; – Construction traffic control program. • **P.02 - Environmental and Social Management Programme:** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Worker training; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy; – Worker's Code of Conduct; – Grievance mechanism for workers;

Table 1.0.q
<u>Risks of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
			– Observation of World Bank EHS Guidelines, particularly with respect to OHS management; – Working conditions at camp sites and work fronts aligned with international standards. • **P.17 - Occupational Health and Safety Management Program** – Establishment of OHS procedures; – Establishment of Safe Work Procedures; – Recruitment of OHS management staff; – Training in occupational safety; – OHS supervision; worker health management; – Implementation of first aid rooms on all camp sites.
		19.03 - Risk of accidents due to the presence of landmines and UXOs (unexploded ordnances)	• **P.01 - Construction Environmental Plan (CEP)** – DAA demining. • **P.02 - Environmental and Social Management Programme** – Demining of Resettlement Areas; – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.04 - Construction Emergency Preparedness and Response Plan** – Risk assessment and emergency preparedness and response procedures (EPR) in case of fires / explosions. • **P.12 - Stakeholder Engagement Plan** – Project stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during the works; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.

Table 1.0.q
Risks of the construction phase identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
	Health and Safety of the Community	20.01 - Increasing the risk of the spread of disease among workers during construction	• **P.01 - Construction Environmental Plan (CEP)** – Camp site and workforce housing management. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[6] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Observation of World Bank EHS Guidelines, particularly with respect to health management; – Worker health monitoring, and appropriate medical assistance and first response capabilities at work fronts; – Working conditions at camp sites and work fronts aligned with international standards; – Ensure adequate hygiene conditions in camp sites; – Ensure adequate accommodation conditions for workers, including mosquito nets and insect protection; – Ensure distribution of insect repellent to workers and encourage its use; – Recruitment and labour training, including informing on risk behaviours and preventive care, such as condom use; – Workers' Code of Conduct. • **P.15 - Gender Based Violence Action Plan** • **P.17 - Occupational Health and Safety Management Program** – Establishment of OHS procedures; – Recruitment of OHS management staff; – OHS supervision; – Worker health management; – Implementation of first aid rooms on all camp sites.

Table 1.0.q
Risks of the construction phase identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
		20.02 - Risks to the health and safety of the community during construction	• **P.01 - Construction Environmental Plan (CEP)** – Construction traffic control program; – Camp sites and workforce housing management. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[7] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Worker training; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy; – Worker's Code of Conduct; – Grievance mechanism for workers. • **P.15 - Gender Based Violence Action Plan**

[6] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/
[7] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 1.0.q
<u>Risks of the construction phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
		19.04 - Risk of child labour	• **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Definition of the project's Human Resources Policy; – TANESCO supervision to monitor and verify the effective implementation of the Policy by Contractors, subcontractors, and suppliers; – Grievance mechanism for workers. • **P.15 - Gender Based Violence (GBV) Action Plan** – Stipulates that the contracts to be signed with Contractors and subcontractors and with suppliers must include clauses to inhibit and penalise acts of violence against children; – Sensitization on children labour and their protection laws; – Code of Conduct must include content about Child Abuse/Exploitation.
	Historical, Cultural and Archaeological Heritage	21.01 - Risk of damage to historical, cultural and archaeological assets	• **P.16 - Archaeological, Historical and Cultural Heritage Protection Plan** – Prospecting in the SSs' expansion areas; – Preparation of guidance material for workers and training; – Chance Findings Procedure (CFP) ▪ To be prepared and implemented during the works, including training workers to recognise possible heritage sites, and guidelines in the event of finds, which include interrupting activities on the work front, calling in the specialist, fencing the area, and implementing the measures recommended by the specialist and agreed with the competent institution to safeguard the asset, which may include fencing and signalling to keep the asset in place if it is not at risk, or proceed with the rescue. Monitoring during vegetation suppression and earthworks.

Table 1.0.r
<u>Risks of the operation phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
Physical Environment	Soils / Relief	15.01 - Risk of soil contamination (from leaks and inadequate management of effluents and waste produced)	• **P.03 - Operation Management Program** – Supervision of Compliance with the Measures of ESMP Plans and Programs that Extend to the Operation Phase; – Environmental Training of the Maintenance Team; – Waste Management (operation phase); – Emergency Response Plan (ERP) Framework for the Operation Phase.
Biological Environment	Flora and Vegetation	16.01 - Increased risk of fire in adjacent vegetation	• **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental training of the maintenance team; – Vegetation management on the wayleave easement; – Protection of the wayleave easement.
		16.02 - Expansion of invasive flora species	**As part of the Biodiversity Management Plan (BMP):** • **P.08 - Invasive Species Control Program** – Preventive and corrective measures to be implemented continuously both during the construction and operation of the project, including monitoring the dispersal of invasive species; – Inspection, quarantine, and cleaning measures for vehicles and construction equipment entering high-risk areas.
		16.03 - Increased illegal exploitation of natural resources	• **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Social Communication During the Operation, including providing for activities to disseminate relevant legislation and strengthen community awareness of the conservation of natural resources around the Project; – Access Control Plan.
	Fauna	17.01 – Risk of an increase in hunting	• **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental Training of the Maintenance Team ▪ workers will receive instructions on hunting bans and the legal implications of such acts;

Table 1.0.r
<u>Risks of the operation phase</u> identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Risks			Measures
			▪ the information will necessarily be included in the workforce's environmental training modules; ▪ the effectiveness of the training will be verified in the field and acts of hunting by workers will be repressed according to the seriousness and/or effectiveness of the act. – Social Communication During the Operation; – Access Control Plan. • **P.14 – Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and social education for workers.
		17.02 - Risk of accidents with birds during operation	**As part of the Biodiversity Management Plan (BMP):** • **P.10- Operation Biodiversity Management** – P.10.1 - Subprogramme of bird collision monitoring ▪ installation of signalling devices (flight diverters) in the stretches of the BS1, BS 8 and BS9 sampling zones and other sections with risk of bird collisions with TLs' cables (environments with alluvial influence, areas of forest vegetation and places with conglomerations of semi-aquatic or larger birds); ▪ monitoring of the chosen stretch (with and without signalling devices).
Socio-Economic Environment	Health and Safety of the Community	20.03 - Risks to the health of the population closest to the TLs due to the effect of the electromagnetic fields	• **P.03 - Operation Management Programme** – Electromagnetic field monitoring; – Protection of the wayleave; – Social communication during the operation, training of the maintenance team; – Community health and safety.

Environmental and Social Management Plan (ESMP)

The Environmental and Social Management Plan (ESMP) for the Uganda-Tanzania Interconnector Power Project serves as the primary tool for managing and mitigating the environmental and social impacts identified in the Environmental and Social Impact Assessment (ESIA). A crucial element of this plan is P.02 – the Environmental and Social Management Program, which plays a pivotal role in ensuring the correct implementation, coordination, and supervision of all the ESMP's plans and programs across the pre-construction, construction, and operational phases.

Construction Supervision (5.1) is one of the core components under P.02. It provides TANESCO with full oversight of the activities carried out by contractors and subcontractors. This supervision ensures that all preventive, mitigating, and compensatory measures are properly executed during the construction phase. The supervision team will verify compliance with environmental, social, and occupational health and safety (OHS) standards. This includes overseeing all field operations and ensuring that any non-compliance is corrected in real-time. Additionally, TANESCO's supervisory team will maintain direct communication with contractors to address potential issues as they arise, ensuring that any changes to the project are considered in light of environmental and social factors.

Coordination of Plans and Programmes (5.2) under the Environmental and Social Management Program ensures that the various ESMP components are implemented in an integrated manner. The coordination role is vital in managing interactions between the different programs, such as the Resettlement and Livelihood Restoration Plan (RLRP), the Stakeholder Engagement Plan (SEP), and the Biodiversity Management Plan. By aligning these plans, the ESMP ensures that mitigation efforts are synchronized across departments, avoiding duplication of efforts or gaps in implementation. It also facilitates efficient resource use and adherence to timelines and regulatory requirements.

Furthermore, P.02 emphasizes the importance of a robust recording and reporting system. The program mandates continuous documentation of all activities, including regular monitoring reports, compliance checks, and incident records. This ensures transparency and accountability, providing clear records for review by TANESCO, contractors, and stakeholders. The detailed reporting process also allows for adaptive management, enabling adjustments to the mitigation measures in response to on-the-ground realities. This system of coordination and supervision under P.02 is key to achieving the ESMP's objectives and ensuring that all environmental and social impacts are managed in accordance with international standards, particularly the World Bank's ESS1.

A crucial element of this plan is P.02 – the Environmental and Social Management Program, which plays a pivotal role in ensuring the correct implementation, coordination, and supervision of all the ESMP's plans and programs across the pre-construction, construction, and operational phases.

Construction Supervision (5.1) is one of the core components under P.02. It provides TANESCO with full oversight of the activities carried out by contractors and

subcontractors. This supervision ensures that all preventive, mitigating, and compensatory measures are properly executed during the construction phase. The supervision team will verify compliance with environmental, social, and occupational health and safety (OHS) standards. This includes overseeing all field operations and ensuring that any non-compliance is corrected in real-time. Additionally, TANESCO's supervisory team will maintain direct communication with contractors to address potential issues as they arise, ensuring that any changes to the project are considered in light of environmental and social factors.

Coordination of Plans and Programmes (5.2) under the Environmental and Social Management Program ensures that the various ESMP components are implemented in an integrated manner. The coordination role is vital in managing interactions between the different programs, such as the Resettlement and Livelihood Restoration Plan (RLRP), the Stakeholder Engagement Plan (SEP), and the Biodiversity Management Plan. By aligning these plans, the ESMP ensures that mitigation efforts are synchronized across departments, avoiding duplication of efforts or gaps in implementation. It also facilitates efficient resource use and adherence to timelines and regulatory requirements.

Furthermore, P.02 emphasizes the importance of a robust recording and reporting system. The program mandates continuous documentation of all activities, including regular monitoring reports, compliance checks, and incident records. This ensures transparency and accountability, providing clear records for review by TANESCO, contractors, and stakeholders. The detailed reporting process also allows for adaptive management, enabling adjustments to the mitigation measures in response to on-the-ground realities. This system of coordination and supervision under P.02 is key to achieving the ESMP's objectives and ensuring that all environmental and social impacts are managed in accordance with international standards, particularly the World Bank's ESS1.

Below is a complete list of each of the 17 Environmental and Social Programs proposed in the ESMP of the project, together with the responsible for their implementation:

Environmental and Social Management Plan (ESMP)

P.01 - Construction Environmental Plan (CEP) - Responsible: Contractors, under the supervision of TANESCO
5.1. Erosion Prevention and Control
5.2. Control Procedures for Construction in Flooded Areas
5.3. Prevention and Control of Soil Contamination
5.4. Water and Effluent Management
5.5. Atmospheric Emissions and Noise and Vibration Control
5.6. Vegetation Clearing
5.7. Camp Sites and Workforce Housing Management
5.8. Waste Management
5.9. Hazardous Materials Management
5.10. Construction Traffic Control
5.11. GHG Emission Measurement and Mitigation
5.12. Demining of DAA

5.13. Indenisation for Unintended Damage to Crops and Rural Improvements During Works
5.14. Decommissioning and Recovery of Degraded Areas

P.02 - Environmental and Social Management Programme - Responsible: TANESCO
5.1. Construction Supervision
5.2. Coordination of Plans and Programmes of the ESMP
5.3. Greenhouse Gas Emissions Management
5.4. Management of Interference with Mining Licence
5.5. Demining of Resettlement Areas

P.03 - Operation Management Programme - Responsible: TANESCO
5.1. Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase
5.2. Environmental Training of the Maintenance Team
5.3. Monitoring of Recovered Areas
5.4. Waste Management
5.5. Maintenance and Erosion Control
5.6. Vegetation Management on the Wayleave Easement
5.7. Protection of the Wayleave Easement
5.8. Social Communication During the Operation
5.9. Emergency Response Plan (ERP) Framework for the Operation Phase
5.10. Audible Noise Monitoring
5.11. Electromagnetic Field Monitoring
5.12. Access Control Plan
5.13. Community Health and Safety

P.04 - Construction Emergency Preparedness and Response Plan - Responsible: Contractors, under the supervision of TANESCO
5.1 Risk Assessment
5.2. Emergency Preparedness and Response Procedures (EPR)
5.3. Training and Drills

P.05 - Biodiversity Offset Plan - Responsible: TANESCO

P.06 - Ecosystem Services Impact Mitigation Plan - Responsible: TANESCO

P.07 - Fauna and Flora Rescue and Relocation Plan - Responsible: TANESCO
5.1. Fauna Rescue and Relocation
5.2. Flora Rescue and Relocation

P.08 - Invasive Species Control Program - Responsible: TANESCO
5.1. Control Activities During the Implementation and Operation of the Project
5.2. Monitoring the Dispersal of Invasive Species

P.09 - Landscape Protection Program - Responsible: TANESCO
5.1. Identification of Priority Areas for Monitoring

5.2. Monitoring of New Deforestation

P.10 - Operation Biodiversity Management - Responsible: TANESCO
P.10.1 – Subprogramme of Bird Collision Monitoring
P.10.2 – Subprogramme of Fauna Monitoring During Operation
P.10.3 – Subprogramme of Native Vegetation Restoration

P.11 – Flora Active Search Programme - Responsible: TANESCO

P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF) - Responsible: TANESCO
5.1. Target flora species
5.2. Priority stretches
5.3. Active search and Mitigation Measures to be Taken

P.12 - Stakeholder Engagement Plan - Responsible: TANESCO, with some activities carried out by the Contractors

P.13 - Local Hiring Programme - Responsible: Contractors, under the supervision of TANESCO
5.1. Divulgation of Vacancies, Profiles and Requirements
5.2. CV Database Formation
5.3. Interaction with Stakeholders
5.4. Training Programme for Local Labour

P.14 - Labour Management Procedures (LMP) - Responsible: TANESCO, with some activities carried out by the Contractors
5.1. Preparation of a Human Resources Policy
5.2. Recruitment and Labour Training
5.3. Management of Working Conditions
5.3.1. Personnel Welfare Facilities Standards
5.4. Grievance Mechanism
5.5. Workers' Code of Conduct
5.6. Environmental and Social Education for Workers

P.15 - Gender Based Violence (GBV) Action Plan - Responsible: TANESCO, with some activities carried out by the Contractors

P.16 - Archaeological, Historical and Cultural Heritage Protection Plan - Responsible: TANESCO, with some activities carried out by the Contractors
5.1. Prospecting in the SSs' Expansion Areas
5.2. Preparation of Guidance Material for Workers and Training
5.3. Chance Findings Procedure (CFP)
5.4. Monitoring during Vegetation Suppression and Earthworks
5.5. Relocation of Graves

P.17 - Occupational Health and Safety Management Programme - Responsible: Contractors, under the supervision of TANESCO
5.1. Occupational Health and Safety Management Procedures
5.2. Health and Safety Management Personnel
5.3. Minimum Requirements for Safe Work Procedures - SWP
5.4. Occupational Safety Training
5.5. Health and Safety Supervision
5.6. Worker Health Management
5.7. Worker Participation
5.8. Emergency Preparedness and Response
5.9. Investigation of Work-related Injuries, Ill Health, Diseases and Incidents

In addition to the Plans and Programmes set out in the ESMP, TANESCO and the Contractors will also have to implement the measures set out in two other plans, the Decommissioning Plan and the Environmental and Social Monitoring Plan.

Decommissioning Plan

- Decommissioning and Recovery at the End of the Construction Phase - Responsible: Contractors, under the supervision of TANESCO

The Decommissioning and Recovery Plan at the End of the Construction Phase in the ESMP outlines comprehensive steps for rehabilitating the areas affected by construction activities. This plan focuses on ensuring that all temporary installations, such as camp sites, equipment storage areas, and construction roads, are dismantled and removed in an environmentally sound manner. A key aspect of the plan is the restoration of disturbed areas, particularly in terms of reestablishing vegetation cover and stabilizing soil in regions prone to erosion.

Specific actions include re-contouring land where earthworks occurred, ensuring that the original hydrological patterns are restored to prevent waterlogging or erosion. For flora, revegetation efforts will prioritize native species, while fauna habitats will be restored through specific biodiversity recovery programs. The ESMP also provides for ongoing monitoring to ensure that these recovery efforts are effective, and outlines a detailed framework for reporting and documenting all decommissioning activities to ensure compliance with environmental standards

- Abandonment Plan for the Operation Phase - Responsible: TANESCO

The Abandonment Plan for the Operation Phase in the Environmental and Social Management Plan (ESMP) establishes guidelines for the safe decommissioning and dismantling of the Uganda-Tanzania Interconnector Project's infrastructure at the end of its operational life. The plan addresses the removal of all physical installations, including transmission towers, substations, and associated facilities, ensuring the restoration of affected areas to a stable, natural state. This process includes reforestation efforts in areas cleared during construction, stabilization of soils to prevent erosion, and the remediation of any contamination caused during the project's operation, particularly involving

hazardous materials.

The plan also emphasizes minimizing environmental liabilities through strict adherence to national and international environmental standards during decommissioning. It includes protocols for proper waste management, especially for hazardous substances like transformer oils and construction debris. The restoration of critical habitats, the recovery of biodiversity, and the establishment of monitoring protocols ensure that environmental recovery is prioritized. In parallel, the plan outlines provisions for stakeholder engagement and ensures that local communities are informed and involved in the decommissioning process to address potential social impacts

Environmental and Social Monitoring Plan

The Environmental and Social Monitoring Plan (ESMP) outlines a detailed framework for ongoing monitoring and compliance to ensure environmental and social mitigation measures are effectively implemented. The plan is divided into multiple monitoring programs carried out by Contractors, as part of the Contractors' Environmental Monitoring Programme, and TANESCO's Supervision Team, as part of TANESCO's Environmental and Social Monitoring Programme.

The contractors' responsibilities include monitoring atmospheric emissions (with specific parameters such as PM10, PM2.5, NOx, and CO), noise levels, treated effluents, and drinking water quality. They are tasked with conducting monitoring on a regular basis and comparing results against Tanzanian and International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) guidelines, ensuring adherence to both national and international standards.

TANESCO’s Supervision Team plays a crucial role in overseeing these activities, ensuring that the contractors' monitoring efforts are effective and that pollution control measures are not causing environmental degradation or negatively impacting the health of local populations. This includes specific noise and air quality monitoring in inhabited areas near camp sites, work fronts and access routes, and water quality monitoring upstream and downstream the effluent discharge point. The team is also responsible for additional monitoring when grievances arise or when deviations from standards are detected.

In the social monitoring component, TANESCO evaluates the effectiveness of local hiring, health indicators, violence prevention, and the management of commitments made to communities through the project’s Resettlement Action Plan (RAP) and other social programs. This plan ensures that the environmental and social impacts of the project are monitored, recorded, and managed consistently throughout the construction and operation phases.

Summary and Conclusions

The Environmental and Social Impact Assessment (ESIA) concludes that the proposed project is technically and environmentally viable, contingent upon the strict

implementation of prescribed mitigation and compensation measures. An in-depth assessment identified key impacts and risks, and an alternative analysis was conducted to select the most viable technical and locational option. This analysis incorporated socio-environmental constraints, such as minimizing vegetation clearing, reducing impact on inhabited areas, and avoiding interference with significant fauna habitats. The assessment highlights that the socio-economic and environmental benefits outweigh the adverse effects if the planned interventions are effectively applied.

Socially, the project crosses rural communities in three regions, impacting agriculture and local livelihoods. Extensive community consultations indicated strong support for the project, with local stakeholders recognizing the potential benefits of improved electricity infrastructure. Concerns raised included land and asset compensation, impact on agricultural activities, and expectations for job creation. A Resettlement and Livelihood Restoration Program was developed to address these issues, ensuring fair compensation and support in alignment with international standards, including World Bank policies.

Biodiversity considerations are significant, given the project's location within ecologically sensitive areas and near critical habitats. Identified impacts include habitat loss, potential species displacement, and vegetation clearing. To minimize these effects, the project design includes a reduction in the clearing area and a Biodiversity Management Plan with offset strategies aimed at achieving net biodiversity gains. Additional measures include fauna and flora relocation, control of invasive species, and monitoring to preserve local ecosystems.

Physical environmental impacts, particularly erosion and potential water contamination, were found to be manageable with proper control measures in place during the construction phase. Air quality impacts will be minimal and localized, mainly due to dust and emissions during construction. The ESIA also acknowledges a low likelihood of encountering speleological or paleontological features in the project area.

Overall, the ESIA recommends proceeding with the project under strict adherence to the environmental and social mitigation frameworks developed. By addressing these impacts comprehensively, the project stands to contribute positively to regional energy infrastructure, fostering socio-economic development in northwest Tanzania while maintaining environmental and social standards.

2.0
Acknowledgment

The successful completion of the Environmental and Social Impact Assessment (ESIA) study for the UTIP project was made possible by the dedicated participation, commitment, and hard work of a multidisciplinary team of specialists in ESIA studies from various countries. Over the course of more than a year, international consultants from JGP Consultoria e Participações collaborated closely with experts from BENE Consult Limited (T) in Dar es Salaam. TANESCO's continued support and involvement in all field activities was crucial to the success of this endeavour.

We are also grateful to the Regional Administrative Secretaries and staff at the secretariat of the Regional Commissions, Regional Administrative Secretaries of Shinyanga, Geita and Kagera por their technical inputs, views and for providing data of the conditions within the project area of influence. We would like to thank the offices of the District Executive Directors as well as the District Executive Officers; District Executive Directors; District Commissioners; District Economists; District Planning Officers; District Community Development Officers; Land Officers; Environmental Officers; Natural Resources Officers; District Forestry Conservation Officers; Mining Officers and Municipal Executive Directors from Shinyanga MC, Shinyanga DC and Msalala DC of Shinyanga Region; Bukombe DC, Mbogwe DC, Nyang'wale DC and Geita DC of Geita Region; Missenyi, Karagwe DC, Ngara DC and Biharamulo DC of Kagera Region.

We would also like to thank the participation in the study of the Fire and Rescue Forces, TANROADS, TARURA, Tanzania Airport Authority, Resident Mining Office, Police in the three regions that are part of the study. We also appreciate the participation of Tanzania Forest Service, OSHA – Lake Zone Office, Kagera Sugar Industry and Sugar Cane Plantation Estate, Kagera Sugar Co., Kitengule Prison Area, Ministry of Natural Resources and Tourism (Director of Forestry Conservation, Principal Forest Officer).

A special thanks to the Ward Executive Officers and Village Executive Officers, as well as to the local leaders and all the villagers where the T-line will pass through, who organized and participated in the public meetings where the project was presented, and for the information and opinions provided. The support, availability and participation of the Regional and District administrative secretaries and local government authorities was crucial for the implementation of the consultation.

Last but not least, we would like to express our sincere gratitude to the Vice President's Office, particularly the National Environment Management Council (NEMC), for their technical inputs, cooperation and guidance during the whole period of undertaking this EIA.

3.0
Acronyms

AAAC	Aluminum Alloy Conductor
ABC	Airway, Breathing, Circulation
ACS	Aluminium Clad Steel
ACGIH	American Conference of Governmental Industrial Hygienists
ACZ	Alisian Convergence Zone
AED	Automated External Defibrillator
AEO	Agriculture Extension Officer
AIDS	Acquired Immunodeficiency Syndrome
AMCOS	Agricultural Marketing Cooperative Society
AOO	Area of Occupancy
APOPO	Anti-Persoonsmijnen Ontmijnende Product Ontwikkeling
AZE	Alliance for Zero Extinction
BAP	Biodiversity Action Plan
BCNP	Burigi-Chato National Park
BIF	Banded iron formations
BMP	Biodiversity Management Plan
BOD	Biological Oxygen Demand
BS	Biodiversity Sample
BWB	Basin Water Boards
SEP	Construction Environmental Plan
CB	Code Books
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CDO	Chief Development Officer
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CFP	Chance Findings Procedure
CGV	Chief Government Valuer
CH	Critical Habitat
CH4	Methane
CHA	Critical Habitat Analysis
CHW	Community Health Worker
CIP	Carbon in pulp
CITES	Convention on International Trade in Endangered Species
CMS	Convention for Migratory Species
CO	Carbon monoxide
CO2	Carbon dioxide
COD	Chemical Oxygen Demand
CPE	Collective Protective Equipment
CPR	Cardiopulmonary resuscitation
CR	Critically endangered
CSO	Civil society organization
CV	Curriculum Vitae
DAA	Directly Affected Area

DAI	Direct area of influence
dBA	A-weighted decibels
DBH	Diameter at Breast Height
DC	District Council
DD	Data deficient
DED	District Executive Director
DH	Dense Habitats
DLS	District Land Surveyor
DMD	Disaster Management Department
DMO	District Medical Officer
DO	Dissolved oxygen
DoA	Director of Antiquities
EAAA	Ecologically Appropriate Analysis Area
EAC	East African Community
EACOP	East African Crude Oil Pipeline
EAPP	East Africa Power Pool
EBA	Endemic Bird Area
EBRD	European Bank for Reconstruction and Development
ECG	Electrocardiogram
EENS	Expected Energy Not Served
E&S	Environmental and Social
EHS	Environment, Health, and Safety
EIR	Environmental Incident Report
EIW	Early Iron Working
EMA	Environmental Management Act
EMF	Electromagnetic field
EMO	Emergency Operations
EN	Endangered
EOO	Extent of Occurrence
EPR	Emergency Preparedness and Response Procedures
ES	Ecosystem Services
ESA	European Spatial Agency
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESIRT	Environmental and Social Incident Report Toolkit
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
FAO	Food and Agriculture Organization
FGM	female genital mutilation
FTEA	Flora of Tropical East Africa
FYDP	Tanzania Five Year Development Plans
GBIF	Global Biodiversity Index Information
GBV	Gender-based violence
GHG	Greenhouse Gas
GIS	Geographic Information System
GN	Government Notice
GN	Guidance Note

GOT	Government of Tanzania
GPN	Good Practice Notes
GPS	Global positioning system
GRM	Grievance Redress Mechanism
GWh	Gigawatt-hour
HIV	Human Immunodeficiency Virus
HPP	Hydropower potential
HV	high voltage
IACG-MA	Inter-Agency Coordination Group on Mine Action
IAI	Indirect Area of Influence
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
ICBAE	Integrated Community-Based Adult Education
ICNIRP	International Commission of Non-Ionizing Radiation Protect
IFC	International Finance Corporation
ILO	International Labour Organization
ILO-OSH	ILO Guidelines on Occupational Safety and Health Management Systems
IMAS	International Mine Action Standards
IPA	Important Plant Area
ISO	International Organization for Standardization
ITC	International Institute for Geo-Information Science and Earth Observation
ITCZ	Intertropical Convergence Zone
ITU	International Telecommunications Union
IUCN	International Union for Conservation of Nature
IWRMDP	Integrated Water Resources Management Development Plan
KBA	Key Biodiversity Area
KIWOHEDE	Kiota Women's Health and Development Organization
kV	kilovolt
LAF	A-weighted sound level, fast time weighting
LC	Least concern
LEAP	List of East African Plant
LFA	Late Stone Age
LGA	Local Government Authority
LHRC	Legal and Human Rights Centre
LMP	Labour Management Procedures
LSA	Late Stone Age
MADINI	Ministry of Minerals
MAS	Middle Stone Age
MC	Municipal council
MCDGC	Ministry of Community Development, Gender and Children
MCM	million cubic meters
MDA	government agencies
MDD	Mine Detection Dogs
MHz	megahertz
MODANS	Ministry of Defence and National Service

MoF	Ministry of Finance
MSDS	Material Safety Data Sheet
MW	Mega watt
NASA	National Aeronautics and Space Administration
NBI	Nile Basin Initiative
NEMC	National Environment Management Council
NEP	National Environmental Policy
NGO	Non-Governmental Organisation
NI	No information
NNC	Notification of Non-Conformity
N2O	nitrous oxide
NOG	National Operational Guidelines for Disaster Management
NOx	nitrogen oxides
NPA-VAWC	National Plan of Action to End Violence Against Women and Children
NSGD	National Strategy for Gender Development
NT	Near threatened
NTFP	Non-Timber Forest Products
NW	Northwest
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OECD	Organisation for Economic Co-operation and Development
OH	Open Habitats
OHS	Occupational Health and Safety
OHSMP	Occupational Health and Safety Management Programme
OMP	Operation Management Programme
OPGW	Optical Ground Wire
OSHA	Occupational Health and Safety Authority
PAP	Project affected people
PBV	Priority Biodiversity Values
PCCA	Prevention and Combating of Corruption
PCCB	Prevention and Control of Corruption Bureau
PDO	Project Development Objective
PFM	Participatory Forest Management
pH	potential of Hydrogen
PID	Project Information Document
PM	Particulate Matter
PMO	Prime Minister's Office
PMO-LYED	Prime Minister's Office (Labour, Youth, Employment & Persons with Disability)
PO-RALG	President's Office Regional Administration and Local Government
POWER	Prediction of Worldwide Energy Resource
POWO	Plants of the Word Online
PPE	Personal Protective Equipment
PS	Performance Standard
PSMP	Power System Master Plan
QM	Mixture Quotient
RAP	Resettlement Action Plan
R&R	rehabilitation and resettlement

RMO	Resident Mining Officer
ROW	Right of Way
RPF	Resettlement Policy Framework
SACCOS	Savings and Credit Cooperative Societies
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SASA	South Atlantic Subtropical Anticyclone
SDG	Sustainable Development Goal
SEA/SH	Sexual Exploitation and Abuse / Sexual Harassment
SEP	Stakeholder Engagement Plan
SH	Semi-open Habitats
SIA	South Indian Anticyclone ENSO - El Niño Southern Oscillation
SICZ	South Indian Convergence Zone
SO2	Sulfur dioxide
SOTER	Soil and Terrain Database
SRTM	Shuttle Radar Topography Mission
SS	Substation
SSP	Shared Socio-economic Pathways
SST	Sea Surface Temperature
STD	Sexually Transmitted Disease
STI	Sexual Transmitted Infections
SWP	Safe Work Procedures
TANDREC	Tanzania Disaster Relief Committee
TANESCO	Tanzania Electric Supply Company Limited
TAMWA	Tanzania Media Women Association
TARURA	Tanzania Rural and Urban Roads Agency
TAWLA	Tanzania Women Lawyers Association
TAZA	Tanzania – Zambia
TBA	Traditional Birth Attendant
TBS	Tanzania Bureau of Standards
TC	Third Party Collaboration
TEPRP	National Emergency Preparedness and Response Plan
TFRF	Tanzania Fire and Rescue Force
TFS	Tanzania Forest Service
TIDP	Tropical Indian Dipole Pattern
TL	Transmission Line
TMA	Tanzanian Meteorological Authority
ToR	Term of Reference
TPDF	Tanzania People's Defence Force
TRCS	Tanzania Red Cross Society
TWh	Terawatt hours
UK	United Kingdon
UN	United Nations
UNDP	United Nations Development Programme
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNESCO	United Nations Educational, Scientific and Cultural Organization

UNFCCC	UN Framework Convention on Climate Change
UNICEF	United Nations children's Fund
UNMAS	United Nations Mine Action Service
URT	United Republic of Tanzania
USGS	US Geological Survey
UTIP	Uganda-Tanzania Interconnector Project
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
VAC	Violence Against Children
VEO	Village Executive Officer
VU	Vulnerable
W	West
WB	World Bank
WEO	Ward Executive Officer
WHO	World Health Organization
WoWAP	Women Wake Up
WSW	West-Southwest
WUA	Water User Association
WWF	World Wide Fund for Nature

4.0
Introduction

This Environmental and Social Impact Assessment (ESIA) provides the necessary elements to analyse the environmental and social viability of the **400kV Uganda-Tanzania Interconnector Project (UTIP)** Project on the Tanzania side. This ESIA has been prepared to align with ESCP and A-ESRS to be prepared.

According to the Project Information Document (PID) (BID, 2021), the UTIP Project Development Objective (PDO) is to establish regional transmission interconnector capacity between Uganda and Tanzania, in order to: (i) enhance electricity trade; (ii) improve security and reliability of electricity supply; (iii) foster economic development and regional integration.

The UTIP comprise of the following main activities: (a) the construction of a 605 km 400 KV double circuit transmission line to interconnect Ugandan and Tanzanian national grids (Uganda side Masaka-Mutukula 80KM) and (Tanzania side Mutukula-Kyaka-Nyakanazi-Mabuki 548.9 KM) and associated substation at (i) Masaka and Mutukula in Uganda and (ii) Kyaka, Nyakanazi and Mabuki (Tanzania); (b) Uganda Electricity Transmission Company Limited (UETCL) Interconnection Compliance (IC) and Readiness that will include (i) Technical assessment of the Uganda transmission system to identify the operational, planning, and technical gaps in meeting the requirements for operational integration in the EAPP and the SAPP to comply with the requirements for power system stability, operational ancillary enabling services, frequency synchronization, tie-line control, protection, metering, and other technical standards, and (ii) Procurement and installation of necessary system infrastructure to ensure that the national grid meet all operating requirements of the interconnected networks; and (iii) Technical assistance and Project Implementation support to the UETCL, TANESCO and EAPP including associated sector institutions in readiness for operation of the integrated transmission systems and power trade. The capacity building will also include activities in the gender action plan to improve female employment. In addition, this component will support project implementation including the detailed line design, contractor procurement and implementation supervision.

In Tanzania, UTIP will increase access to reliable energy to enhance productivity in the region, improve connectivity in rural areas, and expand energy access to unserved and underserved areas, specifically, in the relatively poor northwestern regions of the country. In the country, just under two-thirds of the population remain without access and a large disparity exists between electricity access rates in urban (73.2 percent) and rural areas (24.5%). The government of Tanzania aims to increase the country's overall electricity connectivity level to 50% by 2025 and at least to 75% by 2033 (BID, 2021).

Regional energy trade has received increased political attention since the mid-1990s. The growing need to address national electricity supply-demand imbalances in the most cost-effective manner boosted interest in crossborder electricity trade and resulted in the establishment of the South Africa Power Pool (SAPP) in 1995 and the East Africa Power Pool (EAPP) in 2005 under the umbrellas of Southern African Development Community

(SADC) and the Nile Basin Initiative (NBI), respectively. The objective of the SAPP and EAPP is to coordinate power pool operations and implement regional power trade in the respective economic blocs. The SAPP covers 12 countries with a population of 280 million people, with an installed capacity of 56 gigawatt (GW) and annual energy consumption of 400 terawatt hours (TWh). The EAPP covers a region with a population of about 550 million (2019), with an installed capacity of over 80 GW and annual energy consumption of 315 TWh (2019). Uganda is exclusively a member of EAPP while Tanzania is a member and the gateway to both EAPP and SAPP (BID, 2021).

The proposed UTIP will support construction of a transmission line that will interconnect Uganda and Tanzania power grids and forms an integral part of the EAPP backbone transmission grid in addition to enhancing the reliability of the power interchanges with the SAPP.

In Tanzania, The UTIP comprises the following Transmission Lines (TLs):

- 400 kV Mutukula – Kyaka TL, 31.01 km long, between the border with Uganda and the Mutukula Substation (SS), located in the village of Mutukula;
- 400 kV Kyaka – Nyakanazi TL, 235.65 km long, between the Kyaka SS and the Nyakanazi SS, respectively located in the villages of Kyaka and Kabale;
- 400 kV Nyakanazi – Ibadakuli TL, 282.25 km long, between the Nyakanazi SS and the Ibadakuli SS, the latter, located in the village of Ibadakuli;

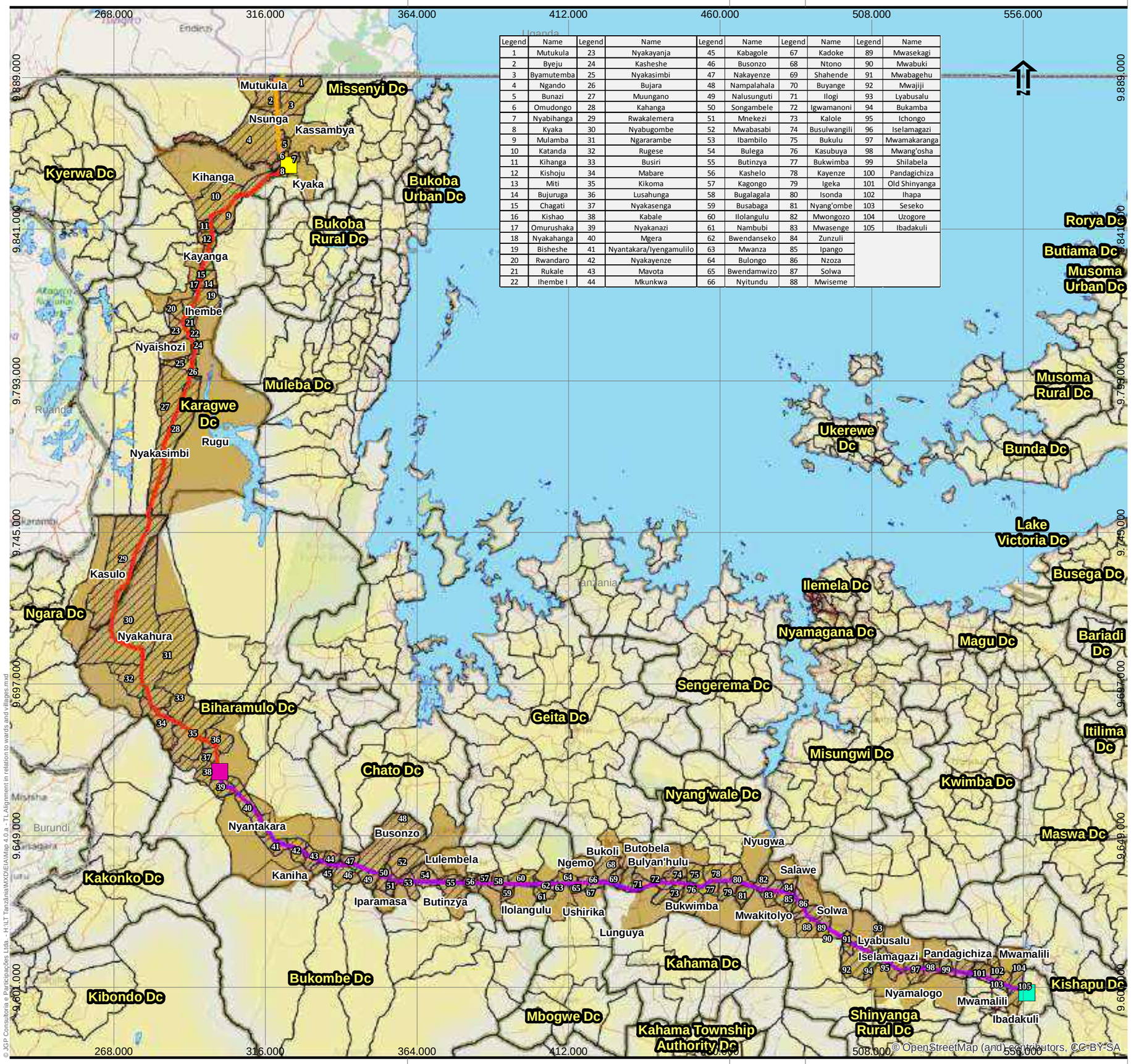
Map 4.0.a - TL Alignment in relation to wards and villages, below, shows the preferred route proposed for the Project's TLs, as well as the wards and villages they will intercept.

In addition to the construction of the TLs, the Project also includes the expansion of the 3 existing Kyaka, Nyakanazi and Ibadakuli SS.

This ESIA only covers the Tanzanian part of the Project. Therefore, this ESIA analyses the 400 kV Mutukula – Kyaka TL not between two SSs, but between Uganda's border with Tanzania and SS Kyaka.

In addition to the permanent structures that comprise the project (TLs and SSs), the ESIA also covers support facilities for the works, including camp sites, access roads, and associated facilities. It is estimated that 9 camp sites will be set up at average distances of 70 to 80 km along the TLs, initially planned in the villages of Kyaka, Nyakanazi, Ibadakuli, Mutukula, Nyakasimbi, Nyabugombe, Busonzo, Ilogi and Solwa.

The proposed TLs, SSs and ancillary facilities at the Tanzania side fall as project categories for which mandatory ESIA is required, in terms of Tanzania Environmental Management Act of 2004 and the ESIA and Audit Regulations of 2005 and its amendment of 2018, that emphasize the importance of conducting an Environmental and Social Impact Assessment (ESIA) before implementation of any development project. The Act also gives an outline of the nature of development projects that need an ESIA study. According to the Act, all energy development projects including Transmission Lines require a mandatory ESIA.



Legend	Name	Legend	Name	Legend	Name	Legend	Name	Legend	Name
1	Mutukula	23	Nyakayanja	45	Kabagole	67	Kadoke	89	Mwasekagi
2	Byeju	24	Kasheshe	46	Busonzo	68	Ntono	90	Mwabuki
3	Byamutemba	25	Nyakasimbi	47	Nakayenze	69	Shahende	91	Mwabagehu
4	Ngando	26	Bujara	48	Nampalahala	70	Buyange	92	Mwajiji
5	Bunazi	27	Muungano	49	Nalusunguti	71	Ilogi	93	Lyabusalu
6	Omudongo	28	Kahanga	50	Songambele	72	Igwamanoni	94	Bukamba
7	Nyabihanga	29	Rwakalemera	51	Mnekezi	73	Kalole	95	Ichongo
8	Kyaka	30	Nyabugombe	52	Mwabasabi	74	Busulwangili	96	Iselamagazi
9	Mulamba	31	Ngararambe	53	Ibambilo	75	Bukulu	97	Mwamakaranga
10	Katanda	32	Rugese	54	Bulega	76	Kasubuya	98	Mwang'osha
11	Kihanga	33	Busiri	55	Butinzya	77	Bukwimba	99	Shilabela
12	Kishoju	34	Mabare	56	Kashelo	78	Kayenze	100	Pandagichiza
13	Miti	35	Kikoma	57	Kagongo	79	Igeka	101	Old Shinyanga
14	Bujuruga	36	Lusahunga	58	Bugalagala	80	Isonda	102	Ihapa
15	Chagati	37	Nyakasenga	59	Busabaga	81	Nyang'ombe	103	Seseko
16	Kishao	38	Kabale	60	Ilolangulu	82	Mwongozo	104	Uzogore
17	Omurushaka	39	Nyakanazi	61	Nambubi	83	Mwasenge	105	Ibadakuli
18	Nyakahanga	40	Mgera	62	Bwendanseko	84	Zunzuli		
19	Bisheshe	41	Nyantakara/Iyengamuliilo	63	Mwanza	85	Ipango		
20	Rwandaro	42	Nyakayenze	64	Bulongo	86	Nzoza		
21	Rukale	43	Mavota	65	Bwendamwizo	87	Solwa		
22	Ihembe I	44	Mkunkwa	66	Nyitundu	88	Mwiseme		

Legend

SE - Ibadakuli
SE - Nyakanazi_
SE - Kyala

Name

LT_Kyaka - Nyakanazi (Option A) - Optimized
LT_Mutukula-Kyaka (Option B)
LT_Nyakanazi_Ibadakuli (Option 1) - Optimized
Roads
Lakes
Villages Crosed by the T-Line
Villages within DAI
Districts
Tanzania Wards

Source:
This shapefile provides information about Tanzania Wards. It was created in 2012 by the National Bureau of Statistics while preparing data for the National Population and Housing Census. Tanzania National Bureau of Statistics (NBS), 2019

UTM- Zona 36S
Datum: WGS 84 - EPSG 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
5/28/2025	1:1.200.000	Location map of the preferred route guideline	Ø

Project:
PROPOSED 400kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 4.0.a:
TL Alignment in relation to wards and villages

Regions:
Kagera, Geita and Shinyanga - Tanzânia

Lead E&S Consultant:
JGP Consultoria e Participações Ltda.

© JGP Consultoria e Participações Ltda. - H:\LT Tanzânia\MXD\EIA\Map 4.0.a - TL Alignment in relation to wards and villages.mxd

Beyond national regulation, this ESIA was prepared to achieve World Bank requirements, including specific application of the Environmental and Social Framework notably the following Environmental and Social Standards (ESS): ESS1: Assessment and Management of Environmental and Social Risks and Impacts (which includes the Environmental and Social Assessment, Environmental and Social Commitment Plan and Management of Contractors) , ESS2: Labour and Working Conditions, ESS3: Resource Efficiency and Pollution Prevention and Management, ESS4: Community Health and Safety, ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement, ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, ESS8: Cultural Heritage, and ESS10: Stakeholder Engagement and Information Disclosure. The ESIA took into consideration the provisions of the World Bank Group (WBG) Environmental, Health and Safety (EHS) General Guidelines and EHS Guidelines that are industry specific to Transmission Lines. Based on the type of project, location, scale, and potential impacts on communities, the Environmental and Social risk rating for the project is High.

The ESIA followed the best practices recommended by international literature on environmental impact analysis. The initial chapters of the ESIA (Chapters 1 to 4) present the executive summary with the main results obtained, as well as the list of acronyms, acknowledgments, introduction and justification for the project. The main features relating to the project's engineering, construction phases, ancillary facilities, labor and schedule are presented in Chapter 5. Chapter 6 presents a survey of the legal regulations applicable to the project, considering various issues; a gap analysis between Tanzania's laws and the World Bank Environmental and Social Standards (WB ESS) and a summary of the institutions relevant to the project.

Chapter 7 details the baseline conditions of the project area of influence, including a detailed description of the physical, biotic and social environment components.

The identification and assessment of social and environmental impacts are presented in Chapter 8, including a cumulative impacts and alternative assessment. The set of programs and measures to prevent, control, mitigate, monitor and compensate for the impacts identified is presented in sequence in Chapter 9, Chapter 10 and Chapter 11. The resource evaluation is covered in Chapter 12 and the decommissioning plan in Chapter 13. The main conclusions and recommendations of the ESIA are summarized in Chapter 14, while the bibliographical references are presented in Chapter 15. The Annexes complete the content of the ESIA, including important documents such as the following: Biodiversity Management Plan (BMP); Stakeholder Engagement Plan (SEP); Labour Management Procedures (LMP); Gender Based Violence (GBV) Action Plan; and the Archaeology and Cultural Heritage Impact Assessment.

The total investment planned for the implementation of the project will be USD 372,254,927, with the costs broken down by infrastructure shown below:

- 400 kV Mutukula – Kyaka TL: USD 23,478,650
- 400 kV Kyaka – Nyakanazi TL: USD 148,252,000
- 400 kV Nyakanazi – Ibadakuli TL: USD 138,922,777

- Kyaka SS expansion: USD 33,432,000
- Nyakanazi SS expansion: USD 18,774,000
- Ibadakuli SS expansion: USD 9,397,500

These costs do not include the costs of implementing the ESMP Plans and Programmes.

4.1
Justification

The Governments of the East Africa Community Member States agreed to interconnect their power systems by constructing a high voltage TL system. The main objectives of the UTIP Project are to:

(i) Link generation in the area to load centres;
(ii) Enhance cross border regional electricity trade;
(iii) Improve security and reliability of electricity supply;
(iv) Foster economic development and regional integration.

Previously, a number of technical feasibility studies, environmental and social studies were undertaken on the national, regional and sub-regional level and the voltage levels considered and recommended included 220 kV, 330 kV and 400 kV. Most recently, the bulk-transmission line Interconnectors, such as ZTK-interconnector are being considered at 400 kV double circuit.

Traditionally, countries in the region have planned and implemented their power systems in an isolated manner with a view to satisfy their national demand growth. Bilateral power exchange agreements existing between some countries in the region including Uganda and Tanzania. Currently, there is cross border electrification between Uganda and Tanzania via a 132 kV TL from Uganda to Kagera region in Tanzania via Kyaka Substation (SS).

Over the last decade, considerable efforts have been undertaken to allocate a stronger importance to power trade among East African countries. The EAC Master Plan (2003, ACRES), EAPP Masterplan of 2011 (SNC Lavalin) (update concluded in 2014), NELSAP power trade studies considered power trade among member countries. The overall objective of the studies was to determine whether further interconnection of the power systems of Uganda, Kenya, Tanzania and the Great Lake Countries is technically feasible and economically viable as growth in demand has occurred since the early 2000 which is expected to last over the next 20 years.

One of the priority projects has been the transmission interconnection between Uganda and Tanzania along the Lake Victoria. Hydropower potential in that area (i.e., 80 MW Rusumo Falls and 35 MW Nsongezi HPP in Tanzania, and 87 MW Kakono HPP and 14 MW Kikagati HPP in Uganda) as well as low access to power services by the population have underscored the interest for such power transmission facilities which would also cover power distribution services.

The Final Feasibility Report – Volume III of the Feasibility Study Update[1] presented a comparative analysis of the expected demand with the expansion of generation in Uganda and Tanzania in order to verify:

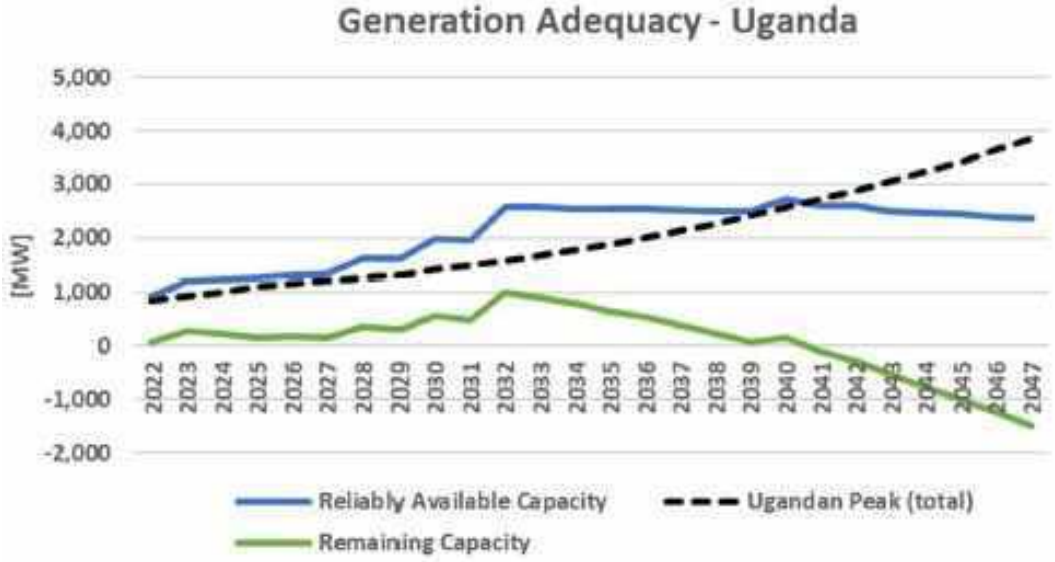
- The capacity of each country to supply its internal demand with its own installed capacity during the study period (2022 to 2047);
- The impact of the new interconnection between Uganda and Tanzania on the expected energy exchanges in terms of energy transit and fuel costs for the two systems.

The analysis takes into account the assessment of the availability of hydroelectric and renewable resources and the scheduled and forced outages of renewable resources.

In both countries, the remaining renewable capacity was analysed, and the scheduled and forced outage rates of power plants were taken into account.

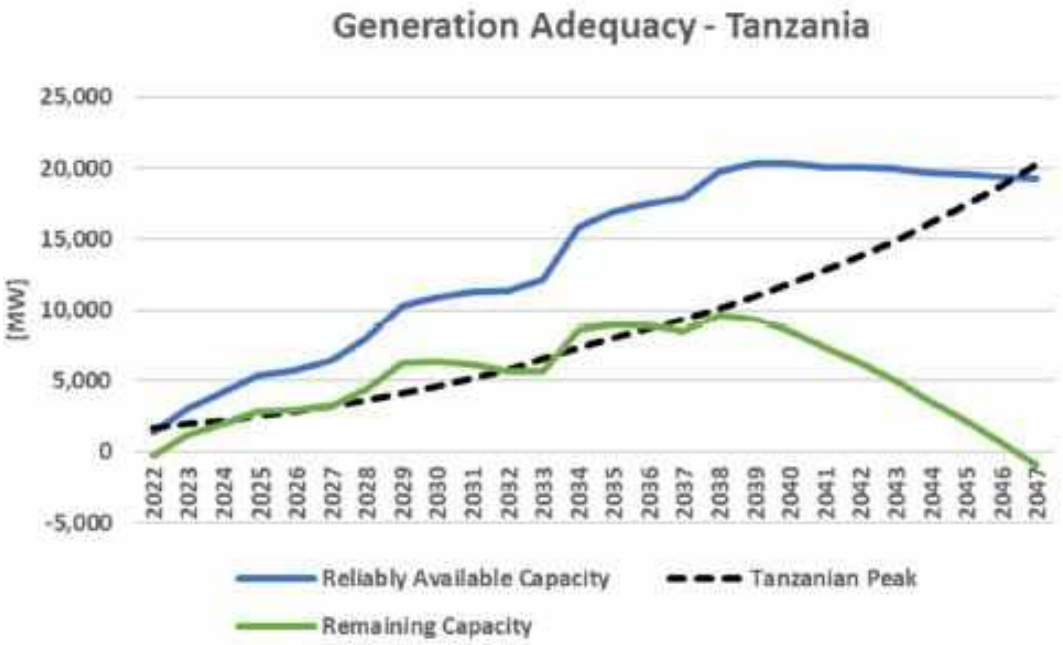
In both countries, the remaining capacity[2] is positive (surplus to domestic demand) for most of the study period, as can be seen in the **Figure 4.1.a** below. In Uganda, remaining capacity increases from 2022 to 2032 (up to 1,008 MW), then decreases and becomes negative from 2041 onwards (the maximum negative value is 1,503 MW in 2047). In Tanzania, the remaining capacity increases to 9,600 MW in 2038, then begins to decrease and becomes negative in 2047 (-974 MW). The results are consistent with the fact that both countries have yet to define generation investments for the long term (beyond 2040 for Uganda and 2044 for Tanzania).

Figure 4.1.a
Generation Adequacy



[1] Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Final Feasibility Report – Volume III. June, 2024.
[2] Difference between the available capacity (the installed capacity net of maintenance, outages and non-usable capacity) and the peak demand.

Figure 4.1.a
Generation Adequacy



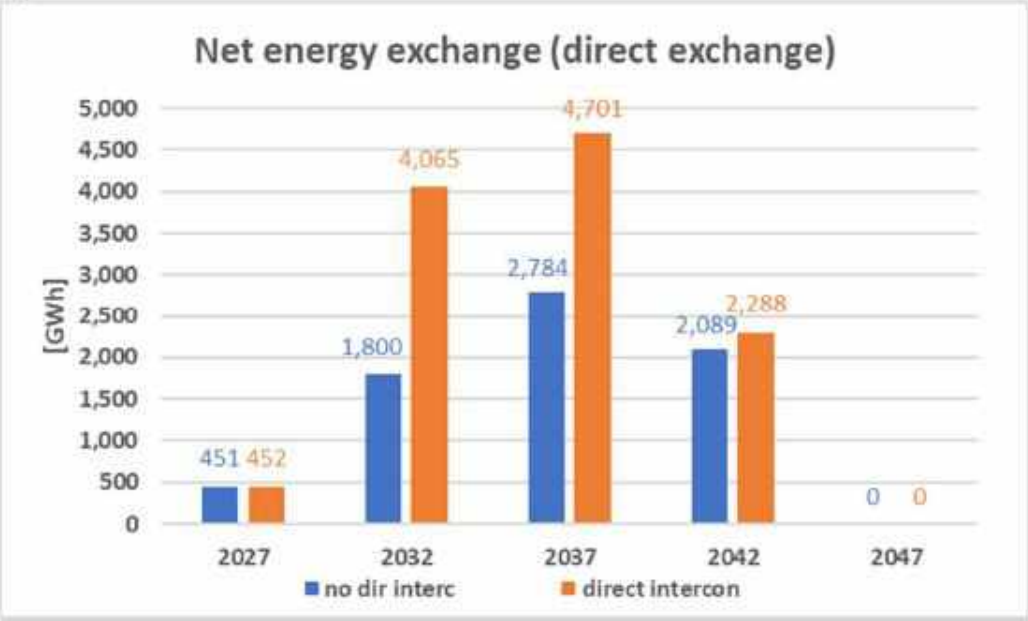
Source: Final Feasibility Report – Volume III. June, 2024.

A 1,000 MW interconnection capacity has been considered between the two countries. For comparison, the scenarios without direct interconnection between the countries have been taken.

According to the analysis, more significant is the impact of the new interconnection for better exploiting the internal resources between the two countries, with related economic benefits. The power exchanges between the two countries increase from 1,800 GWh to 4,65 GWh in 2032 (+125%), from 2,784 GWh to 4,701 GWh in 2037 (+69%), from 2,089 GWh to 2,288 GWh in 2042 (+10%), as shown in the **Figure 4.1.b** below. Mostly Tanzania imports from Uganda until 2042, then both countries import from third countries (Kenya, Zambia, Mozambique).

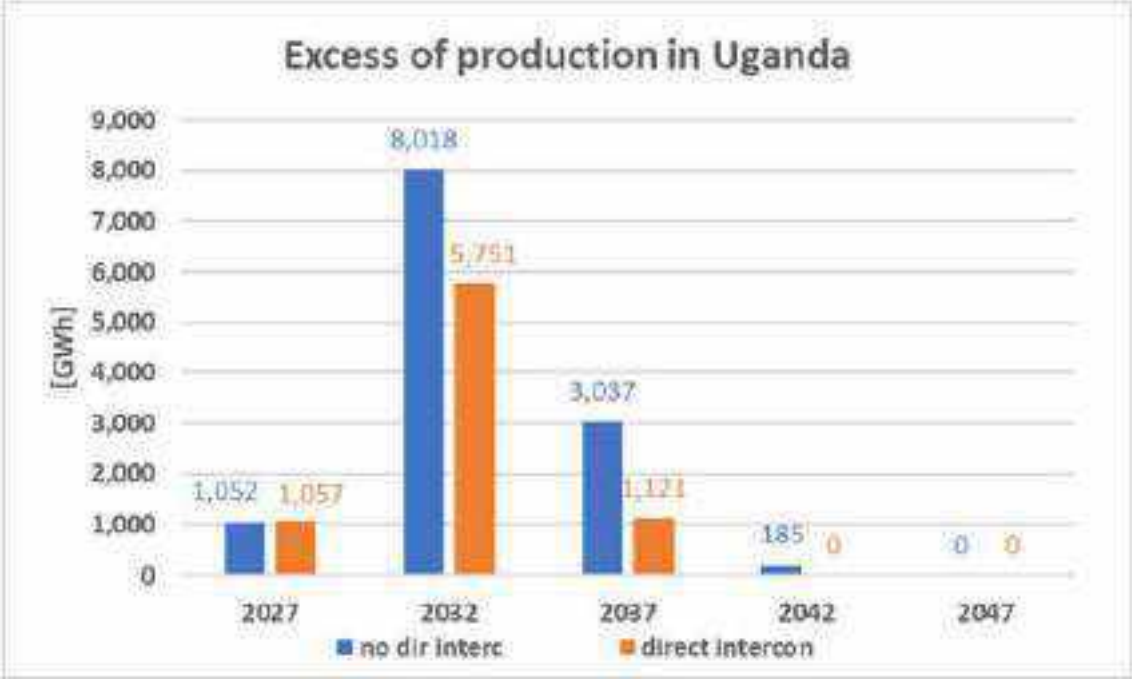
The higher transfer capacity between the two countries allows to reduce the excess of production in Uganda (mainly related to hydro resources), especially in 2032 (-2,267 GWh, -28%) and 2037 (-1,917 GWh, -63%), as shown in the **Figure 4.1.c**.

Figure 4.1.b
Net energy exchanges between Uganda and Tanzania with and without the direct interconnection



Source: Final Feasibility Report – Volume III. June, 2024.

Figure 4.1.c
Excess of production in Uganda, with and without the direct interconnection with Tanzania



Source: Final Feasibility Report – Volume III. June, 2024.

This leads to a reduction of the fuel costs.

The impact of the new direct interconnection between Uganda and Tanzania on the secure operation of the two power systems was also assessed. Network analyses were carried out, taking into account the expected load forecast, generation expansion and transmission development plans.

Although the project under study is a direct interconnection between Uganda and Tanzania, its interconnection with other neighbouring countries such as Kenya, Rwanda, Burundi, Zambia, Mozambique and Malawi were also considered in the analysis. This is because the effect of the meshed system means that the total energy exchange between Uganda and Tanzania doesn't just flow through the new direct interconnection.

For the analysis presented in the Final Feasibility Report – Volume III, reference is done to the available capacity to feed the peak, which is the planned capacity minus the part unavailable due to overhauls, forced outages and the part needed to provide the system reserve. The generation adequacy is measured by the Remaining Capacity, which is the difference between the available generation and the increased peak. If positive, the generation fleet is able to cover the country peak, otherwise, the country is forced to import power in order to cover the peak or to shed the load. **Table 4.1.a** shows the adequacy analysis carried out for Tanzania and Uganda during the period 2022 to 2047.

Table 4.1.a
Generation adequacy from 2022 to 2047

Tanzania

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Tot. Thermal Generation Capacity	1,295.8	1,295.8	2,425.8	3,570.8	4,005.1	4,276.1	5,410.1	7,708.1	8,328.1	8,586.7	8,807.7	9,028.7	13,544.9
Tot. Hydro Generation Capacity	575.3	2,694.3	2,743.8	2,881.2	2,942.1	3,531.2	4,231.2	4,616.9	4,663.9	4,871.7	4,870.7	4,990.7	4,990.7
Tot. PV and WF Generation Capacity	0.0	465.0	865.0	1,215.0	1,615.0	1,815.0	1,815.0	1,865.0	1,965.0	1,915.0	1,915.0	1,915.0	2,315.0
Overhauls	48.0	48.0	97.3	147.1	163.9	182.0	225.6	337.3	360.9	378.7	391.2	427.8	546.8
Outages (FOR)	64.9	64.9	122.5	180.4	202.9	237.5	275.0	380.9	421.8	434.7	446.6	487.4	693.1
Non/Usable Capacity at Peak	138.8	1,017.3	1,367.5	1,705.6	2,078.1	2,376.8	2,539.9	2,643.5	2,651.1	2,733.7	2,733.5	2,758.3	3,078.1
Solar	0.0	465.0	565.0	715.0	915.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0
Wind	0.0	0.0	340.0	400.0	560.0	640.0	640.0	680.0	680.0	720.0	720.0	720.0	1,040.0
Hydro	138.8	552.3	502.5	590.6	603.1	721.8	884.9	948.5	956.1	998.7	998.5	1,023.1	1,023.1
System Services (Reserves+Losses)	240.1	260.7	287.3	318.9	353.2	388.2	425.7	515.3	515.8	561.0	611.8	668.8	734.9
Reliably Available Capacity	**1,403.4**	**3,064.3**	**4,160.1**	**5,315.0**	**5,764.2**	**6,447.7**	**7,998.0**	**10,306.2**	**10,907.3**	**11,267.3**	**11,410.1**	**12,172.3**	**15,877.6**
Tanzanian Peak	**1,702.0**	**1,914.0**	**2,189.0**	**2,514.0**	**2,868.0**	**3,229.0**	**3,615.0**	**4,059.0**	**4,573.0**	**5,137.0**	**5,772.0**	**6,485.0**	**7,311.0**
Remaining Capacity	**-298.6**	**1,150.3**	**1,971.1**	**2,801.0**	**2,896.2**	**3,218.7**	**4,383.0**	**6,247.2**	**6,334.3**	**6,130.3**	**5,638.1**	**5,687.3**	**8,566.6**

Year	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Tot. Thermal Generation Capacity	14,444.9	15,228.2	15,628.2	17,628.2	18,228.2	18,228.2	18,078.2	18,078.2	18,078.2	17,830.0	17,830.0	17,830.0	17,830.0
Tot. Hydro Generation Capacity	5,230.7	5,325.7	5,386.0	5,424.5	5,344.5	5,344.5	5,344.5	5,342.8	5,342.8	5,342.8	5,342.8	5,274.8	5,274.8
Tot. PV and WF Generation Capacity	2,315.0	2,315.0	2,315.0	2,315.0	2,515.0	2,515.0	2,515.0	2,515.0	2,515.0	2,515.0	2,515.0	2,515.0	2,515.0
Overhauls	581.4	611.7	654.7	664.7	699.4	699.4	699.6	699.6	699.8	684.0	684.0	684.0	684.0
Outages (FOR)	670.2	709.4	729.4	759.4	799.4	799.4	799.9	799.9	799.9	779.5	779.5	779.5	779.5
Non/Usable Capacity at Peak	3,147.8	3,146.8	3,159.1	3,167.0	3,210.6	3,210.6	3,210.6	3,210.3	3,210.3	3,210.3	3,210.3	3,206.3	3,206.3
Solar	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0	1,015.0
Wind	1,040.0	1,040.0	1,040.0	1,040.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0
Hydro	1,092.8	1,091.8	1,104.1	1,112.0	1,095.6	1,095.6	1,095.6	1,095.3	1,095.3	1,095.3	1,095.3	1,091.3	1,091.3
System Services (Reserves+Losses)	786.9	841.9	920.9	962.8	919.9	930.7	1,046.4	1,117.9	1,194.9	1,277.8	1,367.6	1,464.1	1,568.9
Reliably Available Capacity	**16,904.5**	**17,559.2**	**17,905.1**	**19,803.8**	**20,358.9**	**20,297.6**	**20,095.2**	**20,022.3**	**19,945.3**	**19,636.2**	**19,546.6**	**19,395.8**	**19,291.3**
Tanzanian Peak	**7,958.0**	**8,648.0**	**9,386.0**	**10,160.0**	**10,992.0**	**11,867.0**	**12,806.0**	**13,827.0**	**14,927.0**	**16,111.0**	**17,391.3**	**18,773.3**	**20,265.2**
Remaining Capacity	**8,946.5**	**8,910.2**	**8,519.1**	**9,643.8**	**9,366.9**	**8,430.6**	**7,289.2**	**6,195.3**	**5,018.3**	**3,525.2**	**2,155.3**	**622.5**	**-973.8**

Table 4.1.a
Generation adequacy from 2022 to 2047

Uganda

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Tot. Thermal Generation Capacity	202.4	202.4	225.4	225.4	274.4	284.4	319.4	319.4	368.4	388.4	438.4	438.4	438.4
Tot. Hydro Generation Capacity	1,295.8	1,505.9	1,505.9	1,522.5	1,566.2	1,592.2	1,864.3	1,986.5	2,490.2	2,490.2	3,330.7	3,330.7	3,330.7
Tot. PV and WF Generation Capacity	80.0	93.5	93.5	93.5	93.5	143.5	143.5	223.5	223.5	223.5	223.5	223.5	223.5
Overhauls	2.9	2.9	3.2	3.2	3.7	4.1	5.4	5.4	7.3	7.3	10.0	10.0	10.0
Outages (FOR)	10.1	10.1	11.3	11.3	13.7	14.4	18.9	18.9	20.4	20.4	25.3	25.3	25.3
Non/Usable Capacity at Peak	433.2	361.3	357.8	364.3	381.3	436.9	568.5	653.5	841.5	841.5	1,110.8	1,110.8	1,110.8
Solar	80.0	93.5	93.5	93.5	93.5	123.5	123.5	203.5	203.5	203.5	203.5	203.5	203.5
Wind	0.0	0.0	0.0	0.0	0.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Hydro	354.2	267.8	264.3	270.8	287.8	299.4	429.0	434.0	622.0	622.0	891.3	891.3	891.3
System Services (Reserves+Losses)	213.8	230.9	235.7	239.2	247.6	239.1	220.8	229.6	240.1	230.8	262.1	274.8	288.2
Reliably Available Capacity	**920.1**	**1,236.5**	**1,236.9**	**1,246.5**	**1,317.8**	**1,343.6**	**1,615.8**	**1,625.1**	**1,973.9**	**1,963.2**	**2,585.3**	**2,572.8**	**2,559.4**
Ugandan Peak	**723.5**	**761.3**	**802.2**	**846.5**	**893.8**	**945.0**	**1,000.4**	**1,060.4**	**1,137.2**	**1,218.8**	**1,307.0**	**1,402.4**	**1,505.4**
Industrial Load	**126.6**	**174.2**	**193.6**	**259.1**	**259.1**	**259.1**	**259.1**	**259.1**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**
Remaining Capacity	**70.0**	**281.0**	**241.1**	**140.9**	**164.9**	**139.5**	**356.3**	**305.6**	**566.2**	**473.9**	**1,007.8**	**899.9**	**783.5**

Year	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Tot. Thermal Generation Capacity	438.4	458.4	459.4	459.4	459.4	459.4	339.4	359.4	293.9	293.9	293.9	282.0	282.0
Tot. Hydro Generation Capacity	3,330.7	3,330.7	3,330.7	3,330.7	3,330.7	3,730.7	3,730.7	3,730.7	3,730.7	3,730.7	3,730.7	3,730.7	3,730.7
Tot. PV and WF Generation Capacity	223.5	223.5	223.5	223.5	223.5	223.5	223.5	223.5	223.5	223.5	223.5	223.5	223.5
Overhauls	10.0	10.8	10.8	10.8	10.8	10.8	8.9	8.9	8.2	8.2	8.2	8.1	8.1
Outages (FOR)	25.3	26.7	26.7	26.7	26.7	26.7	21.7	21.7	18.4	18.4	18.4	17.9	17.9
Non/Usable Capacity at Peak	1,110.8	1,110.8	1,110.8	1,110.8	1,110.8	1,242.8	1,242.8	1,242.8	1,242.8	1,242.8	1,242.8	1,242.8	1,242.8
Solar	203.5	203.5	203.5	203.5	203.5	203.5	203.5	203.5	203.5	203.5	203.5	203.5	203.5
Wind	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Hydro	891.3	891.3	891.3	891.3	891.3	1,023.3	1,023.3	1,023.3	1,023.3	1,023.3	1,023.3	1,023.3	1,023.3
System Services (Reserves+Losses)	308.8	324.5	341.4	359.6	379.2	400.6	421.5	454.9	477.7	509.0	542.1	571.7	603.2
Reliably Available Capacity	**2,538.8**	**2,540.9**	**2,524.1**	**2,505.9**	**2,486.3**	**2,722.8**	**2,608.8**	**2,586.5**	**2,501.1**	**2,475.7**	**2,436.7**	**2,395.0**	**2,364.4**
Ugandan Peak	**1,616.8**	**1,733.5**	**1,859.4**	**1,995.2**	**2,141.6**	**2,299.4**	**2,451.2**	**2,613.0**	**2,785.4**	**2,969.3**	**3,165.2**	**3,374.2**	**3,596.8**
Industrial Load	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**	**270.5**
Remaining Capacity	**651.5**	**536.9**	**394.2**	**240.2**	**74.2**	**152.9**	**-112.9**	**-297.0**	**-554.8**	**-764.1**	**-999.0**	**-1,348.8**	**-1,502.9**

	The planned and unavailable capacity and thus the Reliably Available Capacity (RAC)
	The peak and the security margin and thus the Severe Peak Load (SPL)
	The Remaining Capacity, which is the difference between the RAC and the SPL

Source: Final Feasibility Report – Volume III. June, 2024.

Figure 4.1.d shows the installed capacity and the peak load of Tanzania and Uganda. The total installed capacity is higher than the peak for both countries, although, both generation expansion plans have been assessed for a shorter period. The maximum installed capacity in Tanzania is in 2039 and 2040 and in Uganda in 2040. Then, the installed capacity decreases while the peak load continue to increase.

Figure 4.1.d
Installed Capacity and Peak

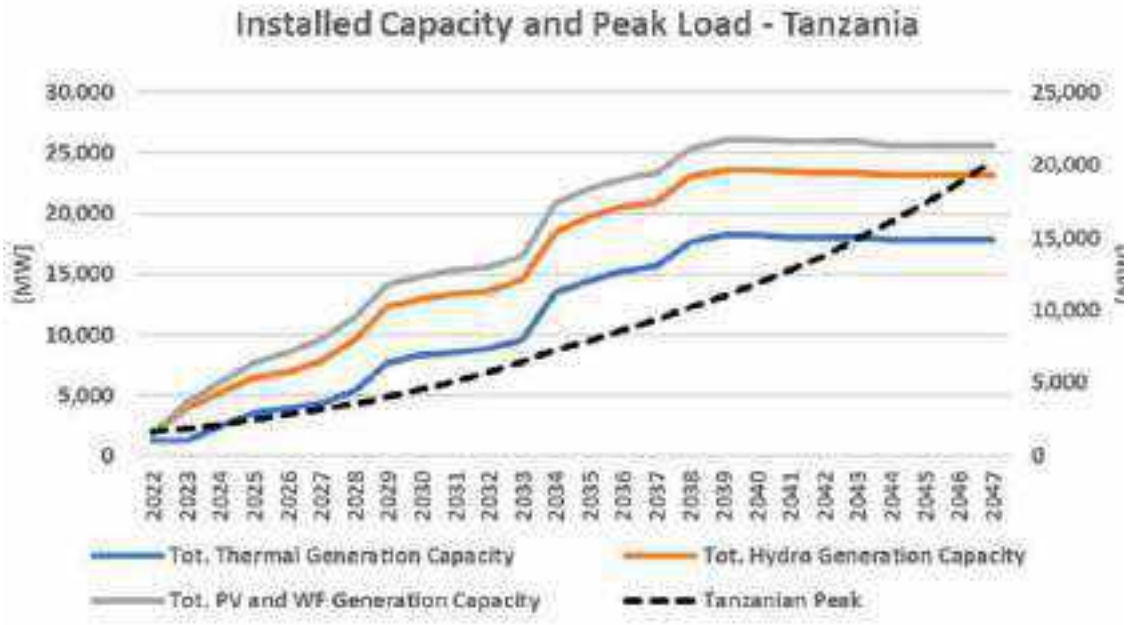
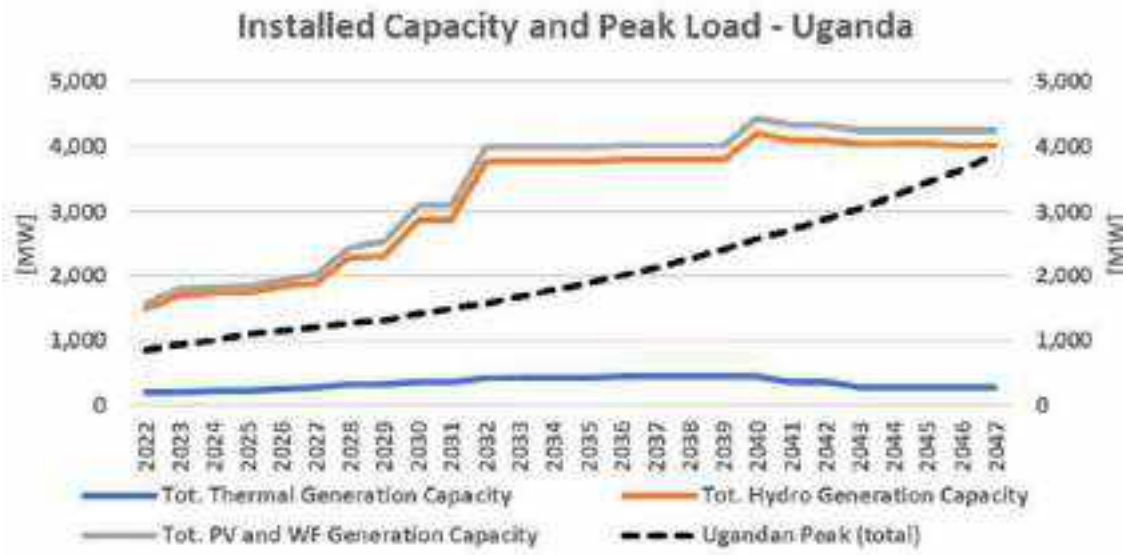


Figure 4.1.d
Installed Capacity and Peak



Source: Final Feasibility Report – Volume III. June, 2024.

For the analysis, reference has to be done to the reliably available capacity, which takes into account the part of the capacity not available for covering the peak. For Tanzania, the available capacity is around 74% of the installed capacity. For Uganda, the available capacity is even lower (63%), due to the higher share of the hydropower capacity in the generation fleet.

As a result, for both countries the remaining capacity is negative at the end of the study period. Thus, both Tanzania and Uganda need to integrate the resources to cover the peak, either internal or imported.

Uganda and Tanzania are currently implementing various programmes to increase their generation resources and transmission networks. Following the recent discovery of gas reserves, water resources and other source of power generation in Tanzania, the country is at various stages of implementing about 3,227.5 MW from various sources up to year 2025 (as per PSMP, 2020). Uganda will be implementing up to about 2,750 MW of hydro based generation by 2035. In addition, potential sites for power generation in the region will open up opportunities for power trade between the two countries and other neighbouring countries in the region. Therefore, the need for an interconnector between the two countries is of paramount importance in sharing the produced electricity.

Benefits for both countries with project

According to the Final Feasibility Report – Volume III, the first benefit of the direct interconnection between Tanzania and Uganda is the higher power exchange capacity and the consequent most economic exploitation of the resources, in particular the dispatchable

thermal power plants. The result is the decrease in the total fuel costs compared to the cases without direct interconnection between Uganda and Tanzania, as shows in the **Table 4.1.b** below.

Table 4.1.b
Reduction of fuel costs countries isolated and interconnected

Year	Without direct interconnection (M$)	With direct interconnection (M$)	Reduction (M$)
2027	81.7	81.8	-0.1
2032	194.7	133.3	61.4
2037	428.6	383.9	44.7
2042	1,078.1	1,073.8	4.3
2047	2,731.6	2,723.2	8.4

Source: Final Feasibility Report – Volume III. June, 2024.

The direct interconnection allows also to reduce the Expected Energy Not Served (EENS) from 2042 and onwards, as shown in the **Table 4.1.c**. This parameter is useful to measure the generation adequacy but also for economic considerations. An economic penalisation can be associated to the scenario "without project", which reflects the loss in the economy caused by the load not supplied. The net effect of this represents a benefit for the project.

Table 4.1.c
EENS without and with the direct interconnection

Year	Country	Not directly interconnected (MWh)	Directly interconnected (MWh)	Reduction (MWh)
2027	Tanzania	0	0	0
	Uganda	0	0	0
2032	Tanzania	0	0	0
	Uganda	0	0	0
2037	Tanzania	0	0	0
	Uganda	0	0	0
2042	Tanzania	1	2	-1
	Uganda	286	38	248
2047	Tanzania	386	233	153
	Uganda	6.256	5.014	1.242

Source: Final Feasibility Report – Volume III. June, 2024.

Interconnection between countries provides the opportunity to balance electricity demand and supply on a larger scale. By sharing electricity resources, countries can optimize their power generation to match demand patterns more effectively. This flexibility reduces the reliance on fossil fuel power plants that often operate at steady outputs. Instead, countries can tap into cleaner and more flexible energy sources, such as hydropower or natural gas plants, to meet varying demand levels. This results in lower CO_2 emissions by minimizing

the use of carbon-intensive power plants during periods of low demand.

Taking into consideration the reduction of the fuel costs, the reduction of EENS and the CO_2 emission saving due to the interconnection, the benefits of the interconnexion for both countries is summarized in the table below.

Table 4.1.d
Benefits for both countries with project

Benefits	0	1	2	3	4	9	14	19	24
	2023	2024	2025	2026	2027	2032	2037	2042	2047
Fuel costs interconnected (M$)	0.0	81.7	81.7	81.7	81.7	133.3	383.9	1,073.8	2,723.2
Fuel costs isolated (M$)	0.0	81.7	81.7	81.7	81.7	194.7	428.6	1,078.1	2,731.6
Gain from Project fuel saving (M$)	0.0	0.0	0.0	0.0	0.0	61.4	44.7	4.3	8.4
EENS reduction with Project (MWh)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	247.0	1,395.0
Economic gain from reduction of EENS (M$)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.8
CO_2 variation (t)	0	0	0	0	1,742	-1,127,585	-679,811	-46,215	131,568
CO_2 savings (carbon credit) (M$)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	-3.3
Benefits for both countries with Project (M$)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**89.6**	**61.7**	**5.9**	**7.9**

Source: Final Feasibility Report – Volume III. June, 2024.

In addition to the benefits aforementioned, directly related to Uganda and Tanzania, with a regional perspective, it can be highlighted that the Uganda-Tanzania interconnection allows also to increase the transfer capacity usable by other countries for power exchanges. On a regional perspective, Uganda and Tanzania are part of the Eastern Africa Power Pool (EAPP), with other countries interested in power trading. There is also an interest in interconnecting the EAPP with the Southern African Power Pool (SAPP), with interconnections between Tanzania and Zambia, Mozambique and Malawi.

5.0
Project Background and Description

This chapter of the ESIA includes, on one hand, the description and main technical specifications of the permanent energy works (transmission lines - TL and substations - SS), and on the other hand, the logistical planning of the works, including the description of the infrastructure to support construction and operation.

A Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Ibadakuli) – Uganda (Masaka-Mutukula) Transmission Line. Interim Report (Task 2) - Project Conceptual Design, have been performed by CESI S.p.A. Italy (Contract No. ET-EAPP-165640-CS-QCBS) and the corresponding report was issued on 10 February 2023. As per Feasibility Study Update (CESI, 2023), the Project comprises:

- Construction of a new 548.91 km long TL premised on 400 kV and double circuit. The line will connect Mutukula, on the Uganda - Tanzania Border, Kyaka, Nyakanazi and Ibadakuli. Therefore, the project covered by this ESIA only includes the structures within Tanzania;
- Clearing of the wayleave (52 m for 400 kV TL as per TANESCO standards);
- Expansion of the Kyaka, Nyakanazi and Ibadakuli SS;
- Construction of access roads, that in some cases will need to be implemented along alignments that extrapolate the limits of the t-line wayleave.
- Construction of camp sites;
- Other construction support infrastructure (conductor launching sites, surplus soil deposits, borrow areas for fill material, quarries, other).

Chapter 4.0 includes a map showing the location of the TLs and SSs that make up the project (**Map 4.0.a - TL Alignment in relation to wards and villages**).

Table 5.0.a shows the basic information on the alternatives selected by this ESIA. The wayleave will be 52 meters wide, totalling around 2,854.33 ha along the entire length of the project route.

Considering an average distance between towers of around 400 meters and a footprint per tower of around 100 square meters, this gives an approximate area of 13.62 ha to be permanently occupied by the base of the towers.

Table 5.0.a
Basic information on the routes selected

400 kV T-line Segment	ESIA Selected Alternative	Total Length	Estimated Towers Footprint (ha)	Estimated Wayleave Footprint (ha)
Mutukula-Kyaka	Option B	31.01 km	0.75	161.25
Kyaka-Nyakanazi	Option A	235.65 km	5.82	1,225.38
Nyakanazi-Ibadakuli	Option 1	282.25 km	7.05	1,467.7
Total		**548.91 km**	**13.62 ha**	**2,854.33 ha**

Source: Adaptation JGP Consultoria, 2023 based on: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi) – Uganda (Masaka-Mutukula) Transmission Line. Interim Report (Task 2) - Project Conceptual Design, issued 10 February 2023 by CESI S.p.A. Italy (Contract No. ET-EAPP-165640-CS-QCBS). Notes (a): JGP estimates from satellite imagery.

5.1
Technical Characteristics of the TLs

Tables 5.1.a, **5.1.b** and **5.1.c** below show the coordinates of the vertices of the TLs in the alternatives chosen.

Table 5.1.a
Coordinates of the 400 kV TL Mutukula-Kyaka (Option B) vertices

Vertex	UTM - WGS-84 36M - EPSG 32736		UTM - ARC 1960 36M - EPSG 21036	
	X	Y	X	Y
0	321,972.46	9,889,511.70	321,890.943	9,889,814.089
MK-1	318,878.00	9,887,437.00	318,796.490	9,887,739.399
MK-2	320,183.00	9,865,296.00	320,101.457	9,865,598.465
MK-3	321,540.00	9,864,156.00	321,458.451	9,864,458.467
MK-4	323,544.00	9,861,999.00	323,462.443	9,862,301.471
Kyaka Portico	323,377.00	9,861,648.00	323,295.443	9,861,950.472

Table 5.1.b
Coordinates of the 400 kV TL Kyaka-Nyakanazi (Option A) vertices

Vertex	UTM - WGS-84 36M - EPSG 32736		UTM - ARC 1960 36M - EPSG 21036	
	X	Y	X	Y
Kyaka Portico	323,363.418	9,861,482.469	323,281.863	9,861,784.936
KN-1	322,094.297	9,860,060.673	322,012.743	9,860,363.145
KN-2	321,830.488	9,859,844.701	321,748.934	9,860,147.174
KN-3	318,618.515	9,857,993.861	318,536.969	9,858,296.344
KN-4	317,437.306	9,857,940.684	317,355.763	9,858,243.168
KN-5	313,574.671	9,854,709.458	313,493.135	9,855,011.957
KN-6	311,325.930	9,852,277.953	311,244.397	9,852,580.461
KN-7	306,833.173	9,851,770.322	306,751.652	9,852,072.838
KN-8	303,693.835	9,847,210.371	303,612.316	9,847,512.905
KN-9	298,427.447	9,844,963.485	298,345.940	9,845,266.032
KN-10	298,664.603	9,837,584.190	298,583.085	9,837,886.757
KN-11	295,328,957	9,827,377.589	295,247.432	9,827,680.190
KN-12	294,923.202	9,824,902.246	294,841.676	9,825,204.854
KN-13	294,339.929	9,819,068.901	294,258.396	9,819,371.526
KN-14	289,358.785	9,811,864.261	289,277.254	9,812,166.911
KN-15	293,554.983	9,803,570.821	293,473.429	9,803,873.486
KN-16	291,447.489	9,792,344.369	291,365.923	9,792,647.065
KN-17	283,319.575	9,772,090.913	283,237.999	9,772,393.669
KN-18	283,914.962	9,766,943.343	283,833.376	9,767,246.109
KN-19	278,466.220	9,750,606.258	278,384.621	9,750,909.069
KN-20	279,293.559	9,749,180.162	279,211.957	9,749,482.975
KN-21	278,447.833	9,746,347.829	278,366.228	9,746,650.649
KN-22	274,730.613	9,738,515.208	274,649.003	9,738,818.050
KN-23	272,121.479	9,729,065.631	272,039.860	9,729,368.497
KN-24	268,804.624	9,725,815.872	268,723.006	9,726,118.748
KN-25	266,807.935	9,714,223.878	266,726.303	9,714,526.780
KN-26	267,529.321	9,711,650.851	267,447.683	9,711,953.756
KN-27	268,491.592	9,710,749.076	268,409.951	9,711,051.982
KN-28	273,588.372	9,708,485.590	273,506.719	9,708,788.492
KN-29	274,100.142	9,708,424.735	274,018.487	9,708,727.637

Table 5.1.b
Coordinates of the 400 kV TL Kyaka-Nyakanazi (Option A) vertices

Vertex	UTM - WGS-84 36M - EPSG 32736		UTM - ARC 1960 36M - EPSG 21036	
	X	Y	X	Y
KN-30	276,880.585	9,708,008.093	276,798.925	9,708,310.991
KN-31	276,45.464	9,698,478.063	276,363.789	9,698,780.979
KN-32	276,825,353	9,696,606.701	276,743.675	9,696,909.620
KN-33	278,047.000	9,695,392.000	277,965.318	9,695,694.919
KN-34	279,205.000	9,692,136.000	279,123.311	9,692,438.923
KN-35	279,125.302	9,691,197.666	279,043.612	9,691,500.591
KN-36	282,060.056	9,687,172.856	281,978.355	9,687,475.783
KN-37	284,169.119	9,686,347.247	284,087.413	9,686,650.172
KN-38	288,023.613	9,684,879.400	287,941.899	9,685,182.323
KN-39	292,102.000	9,681,956.000	292,020.275	9,682,258.922
KN-40	293,764.265	9,679,952.431	293,682.534	9,680,255.354
KN-41	299,994.643	9,677,713.895	299,912.899	9,678,016.812
KN-42	300,664.880	9,670,436.415	300,583.124	9,670,739.344
Nyakanazi Portico	301,492.477	9,669,413.697	301,410.720	9,669,716.626

Table 5.1.c
Coordinates of the 400 kV TL Nyakanazi-Ibadakuli (Option 1) vertices

Vertex	UTM - WGS-84 36M - EPSG 32736		UTM - ARC 1960 36M - EPSG 21036	
	X	Y	X	Y
Nyakanazi Portico	301,457.350	9,668,910.535	301,375.592	9,669,213.465
NI-1	301,981.269	9,665,704.404	301,899.504	9,666,007.344
NI-2	302,908.391	9,664,653.121	302,826.625	9,664,956.056
NI-3	305,467.946	9,663,635.841	305,386.174	9,663,938.774
NI-4	311,571.561	9,657,993.641	311,489.771	9,658,296.580
NI-5	318,912.089	9,646,965.300	318,830.276	9,647,268.240
NI-6	326,736.746	9,644,684.905	326,654.920	9,644,987.840
NI-7	329,671.749	9,642,258.089	329,589.915	9,642,561.024
NI-8	338,064.312	9,639,186.614	337,982.462	9,639,489.549
NI-9	343,362.388	9,640,096.581	343,280.532	9,640,399.509
NI-10	356,584.821	9,634,508.023	356,502.943	9,634,810.940
NI-11	398,290.826	9,633,426.888	398,208.890	9,633,729.773
NI-12	423,725.644	9,634,232.029	423,643.673	9,634,534.898
NI-13	432,534.938	9,631,536.025	432,452.954	9,631,838.893
NI-14	440,166.887	9,634,015.153	440,084.894	9,634,318.015
NI-15	448,043.997	9,633,799.109	447,961.993	9,634,101.968
NI-16	453,912.118	9,632,571.835	453,830.105	9,632,874.694
NI-17	456,680.225	9,634,418.006	456,598.208	9,634,720.867
NI-17A	460,252.439	9,634,500.193	460,170.416	9,634,803.053
NI-17B	461,015.790	9,634,580.000	460,933.766	9,634,882.859
NI-17C	461,824.224	9,634,526.140	461,742.200	9,634,828.999
NI-18	465,797.804	9,634,568.517	465,715.774	9,634,871.375
NI-19	468,538.435	9,633,183.990	468,456.402	9,633,486.844
NI-20	473,032.332	9,631,896.449	472,950.293	9,632,199.305
NI-21	480,655.546	9,631,122.184	480,573.496	9,631,425.039
NI-22	484,836.844	9,628,397.242	484,754.789	9,628,700.100
NI-23	487,748.911	9,623,162.541	487,666.851	9,623,465.407

Table 5.1.c
Coordinates of the 400 kV TL Nyakanazi-Ibadakuli (Option 1) vertices

Vertex	UTM - WGS-84 36M - EPSG 32736		UTM - ARC 1960 36M - EPSG 21036	
	X	Y	X	Y
NI-24	503,431.179	9,613,730.048	503,349.099	9,614,032.924
NI-25	508,906.330	9,611,202.522	508,824.243	9,611,505.402
NI-26	516,574.582	9,606,338.445	516,492.486	9,606,641.332
NI-27	522,101.348	9,606,936.849	522,019.246	9,607,239.736
NI-28	527,925.931	9,606,457.497	527,843.822	9,606,760.385
NI-29	534,379.103	9,605,975.653	534,296.986	9,606,278.543
NI-30	543,108.514	9,604,408.139	543,026.387	9,604,711.034
NI-31	552,089.044	9,600,783.552	552,006.908	9,601,086.453
NI-32	556,115.652	9,600,202.290	556,033.512	9,600,505.193
NI-33	556,844.081	9,599,474.050	556,761.940	9,599,776.955
Ibadakuli Portico	557,039.484	9,599,272.711	556,957.343	9,599,575.616

5.1.1
Towers

For the implementation of the TLs at 400 kV, self-supporting metal towers will be used, divided between the following types (**Table 5.1.1.a**).

Table 5.1.1.a
Type of towers – 400kV

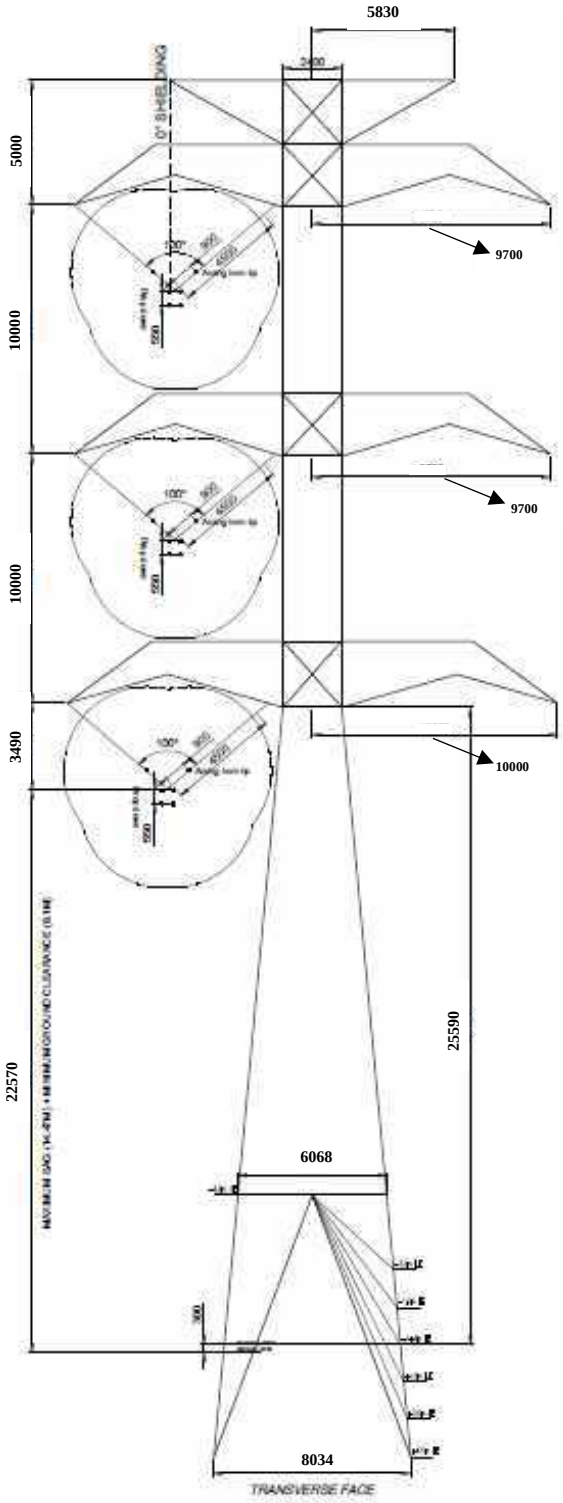
Tower Designation	Deviation Limits	Type of Duty
	(For double Circuit)	
NS	$0^0 - 2^0$	To be used as a line Tangent Suspension Tower and for minor deviation angles of 2º or less.
LA	$0^0 - 15^0$	Light Angle Tension Tower
MA	$15^0 - 30^0$	Medium Angle Tension Tower
HA	$30^0 - 70^0$	Heavy Angle Tension Tower
DE	$0^0 - 90^0$ $0^0 - 45^0$	Very Heavy Angle Tension Tower (with up to 9 cross arms) Dead end Tower
CT	$0^0 - 30^0$	Cable tap-off angle tower
400TR	$0^0 3^0$	Transposition

Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Final Feasibility Report – Volume III. June, 2024.

The spam length between towers is around 400 m. Taking this average spam into account, a distribution of towers was made along the routes, which will be reviewed during the elaboration of the executive project. At this stage, the number of towers on each of the 3 TLs has resulted in: 75 towers for 400 kV Mutukula – Kyaka TL, 582 for 400 kV Kyaka – Nyakanazi TL and 705 for kV Nyakanazi – Ibadakuli TL.

Figures 5.1.1.a to **5.1.1.d** illustrate the types of towers to be used.

Figure 5.1.1.a
Geometry of the suspension tower (NS)



Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Final Feasibility Report – Volume III. June, 2024.

The towers will be 49.17 m (HA and DE), 49.69 m (MA), 50.07 m (LA) and 51.06 m (NS) high. According to the project information, the line clearance, or minimum distance required between conductors and ground, vegetation or other structures, is 8.10 m.

The self-supporting towers will be erected under four concrete foundations, one on each foot. The size of the excavation and respective foundation will depend on the type of tower and characteristics of the soil where the structure will be built.

According to the Final Feasibility Report Volume III (June, 2024), foundations can be of the following types, depending on the type of soil (**Table 5.1.1.b**).

Table 5.1.1.b
Details of foundation types

Foundation Class	Soil Conditions	Type of soil or rock	Foundation Type
Class 1	Hard Rock	Homogenous rock	Rock anchor
Class 2	Soft Rock / Very Good Soil	Weathered rock / dense gravel and sand / very hard clay	Reinforced concrete shaft / pad and chimney
Class 3	Good Soil	Dense sand / stiff clay	Concrete pad and chimney
Class 4	Poor soft soil / backfill material (no water)	Medium dense sand / firm clay	Concrete pad and chimney
Class 5	Poor soft soil / backfill material (with water)	Medium dense sand / firm clay	Concrete pad and chimney
Class 6	Very poor soil (with water)	Loose sand/ soft clay	Raft foundation / piling
Special Foundation	Very poor soil (with water)	Loose sand/ soft clay	Piling

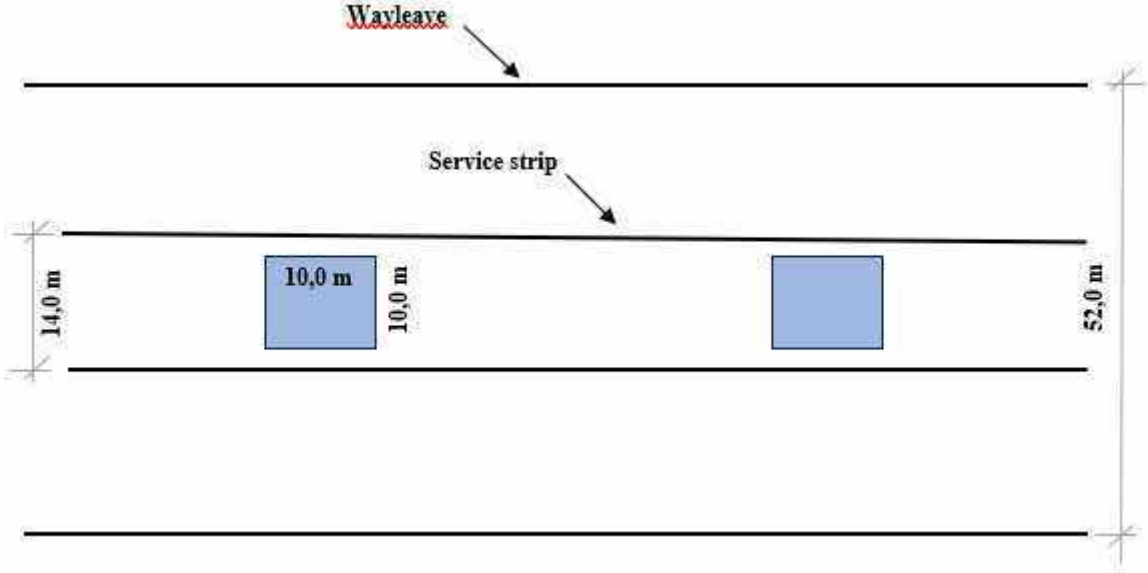
Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Final Feasibility Report – Volume III. June, 2024.

The maximum distance between the feet of the towers is 8.03 m (tower NS, shown in the **Figure 5.1.1.a**). To ensure a sufficient area for construction and assembly, the cleaning area proposed for each tower is of 10 x 10 m (100 m^2). Considering the estimated 1,385 towers, the total area to be cleared for the tower construction and assemble will be 13.9 hectares.

As will be seen in **Section 5.3.1** (item *Vegetation clearing*), it is proposed to open (with shallow cutting of vegetation) a 14.0 m strip along the axis of the wayleave (service strip) for cable launching and access. These 14.0 m (7.0 m on each side of the axis) will be opened in the rest of the strip, except for the areas to be cleared for the construction of the towers, as shown in the diagram in **Figure 5.1.1.e**.

Also, as can be seen in **Section 5.1.3**, the wayleave will be 52.0 m wide. Excluding the 6.0 m where all vegetation will be removed, in the remaining 46.0 m, 23.0 m on each side of the axis, selective pruning will be carried out, removing all trees that, due to their height, may endanger the safety of the TL.

Figure 5.1.1.e
Diagram of the intervention area (wayleave, service strip and tower sites)



5.1.2
Conductors, Earth wire and Optical Ground Wire (OPGW)

According to the Feasibility Study, the recommended conductor for the TL is the Twin AAAC Sorbus, whose characteristics are shown in **Table 5.1.2.a** below.

Table 5.1.2.a
Properties of proposed phase conductor

Properties	Unit	Conductor type: AAAS Sorbus (AL5)
Rated Voltage	kV	400
Highest System Voltage	kV	420
Stranding	No.x mm	61/3.71 AL
Nominal cross section	mm^2	659.4
Conductor diameter	mm	33.4
DC Resistance	ohms	0.0484
Weight	kg/m	1.822
Ampacity	A	867
Thermal transfer limit	MVA	600.7

Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi- Ibadakuli) – Uganda (Masaka-Mutukula) Transmission Line. Interim Report (Task 2) - Project Conceptual Design. CESI S.p.A. Italy, February, 2023.

Insulators: Power conductors need electrical insulation from their supports and from the ground, which in transmission lines is basically done by air, aided by insulators. In this Project, insulators will be polymeric, suspension V string / double tension string, with a specified mechanical load of 160 kN.

As for the earth wire, the type to be used is the ACS ground wire (117 mm^2) whose characteristics are shown in **Table 5.1.2.b** below.

Table 5.1.2.b
ACS ground wire (117 mm^2) properties

Description	Unit	Data
Outer diameter of conductor	mm	14
Total section area of conductor	mm^2	117
Nominal mass of ASC	kg/km	784.9
Modulus of elasticity	N/mm^2	112,000
Minimum rated strength of ASC	kN	141.1
Maximum DC resistance of conductor at 20oC	Ω/km	0.7379

Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi- Ibadakuli) – Uganda (Masaka-Mutukula) Transmission Line. Interim Report (Task 2) - Project Conceptual Design. CESI S.p.A. Italy, February, 2023.

Fiber optic cable links are not influenced by electromagnetic fields and do not show any crosstalk, which is very important for installations on high voltage (HV) lines. The optical fiber within the cable can be used for high-speed transmission of data, either for the electrical utility's own purposes of protection and control of the TL. The OPGW to be used in the project is 48 fibers.

5.1.3
Wayleave

The wayleave corridor (or Right of Way – ROW) will have a maximum width of 52 m, in accordance with Tanzanian 400 kV TL standards. Considering the length of the TLs, the total area of the ROW to be established is about 2,854.33 hectares (548.91 km x 52 m). The wayleave will be used permanently by the project and must be kept free, then the total area will be acquired by TANESCO and the crops and improvements within this area will be indemnified to the owners according to the measures established in the P.11 - Resettlement and Livelihood Restoration Programme (see **Chapter 10.0**).

Audible Noise

According to the Final Feasibility Report Volume III (June, 2024), in the absence of defined requirements for specific local standards and guidelines for transmission lines, internationally accepted practices in the field of 400 kV TLs were considered. This included Utilities such as the National Grid in the UK, Utilities in the Americas and Eskom in South Africa as well as some Southern African utilities utilizing 400 kV to some extent.

To generally meet the requirements and generally good international practice, the adopted design corona parameters for 400 kV were:

- Corona inception gradient 17.5kV/cm
- Radio Interference limit 1μV/m at 0.5 MHz
- Radio interference Voltage (RIV) 1μV/300Ω at 0.5 MHz
- Audible Noise (AN) (wet condition & Um) 53dBA at a height of 1.8 m above ground at servitude boundary (Noisy zones)
- Audible Noise (AN) (wet condition & Um) 42dBA at a height of 1.8 m above ground

at servitude boundary (quite rural areas)
- OPGW surface gradient less than 10kV/cm on the ground wire.

The method used to calculate the audible noise was the Bonneville Power Administration. As a result, the following values were obtained: 50.03 dB in heavy rain and 39.25 with wet conductor, at the edge of the wayleave.

Radio Frequency Interference

Transmission line related radio frequency interference is one of the indirect effects of transmission line operation and is produced by the physical interactions of line electric fields (generation of unwanted harmonics of the power frequency that can interfere with electrical and wireless devices). Such interference is due to the radio noise produced by the action of the electric fields on the surface of the energized conductor.

For the TLs in this Project, according to the Final Feasibility Report Volume III (June, 2024), the radio frequency interference values calculated in the centre and at the edge of the wayleave are 16.20 and 37.59 dB respectively. The calculated value of 16.2 dB is below the threshold of 50 dB at 2 m height at the edge of the wayleavet of 52 m and 37.59 dB are below the threshold of 50 dB under the cables.

Electric Field and Magnetic Field

Power line electric fields are produced by the presence of electric charges and therefore the Voltage (V) applied to a conductor of a power line. Overhead transmission lines are designed to meet a maximum electric field level of 10 kV/m (exposure 8 hours) within the wayleave and directly below the TL. This level falls to lower levels and must meet the level of 5 kV/m allowed for public exposure at the edge of the wayleave.

In the absence of national standards regarding Electromagnetic field (EMF) radiation from TLs, the International Commission of Non-Ionizing Radiation Protection (ICNIRP) guidelines have been considered. These guidelines are recommended by World Health Organization (WHO) and International Telecommunications Union (ITU) as best practice worldwide. **Table 5.1.3.a** shows the ICNIRP limits for TLs with a frequency of 50 Hz.

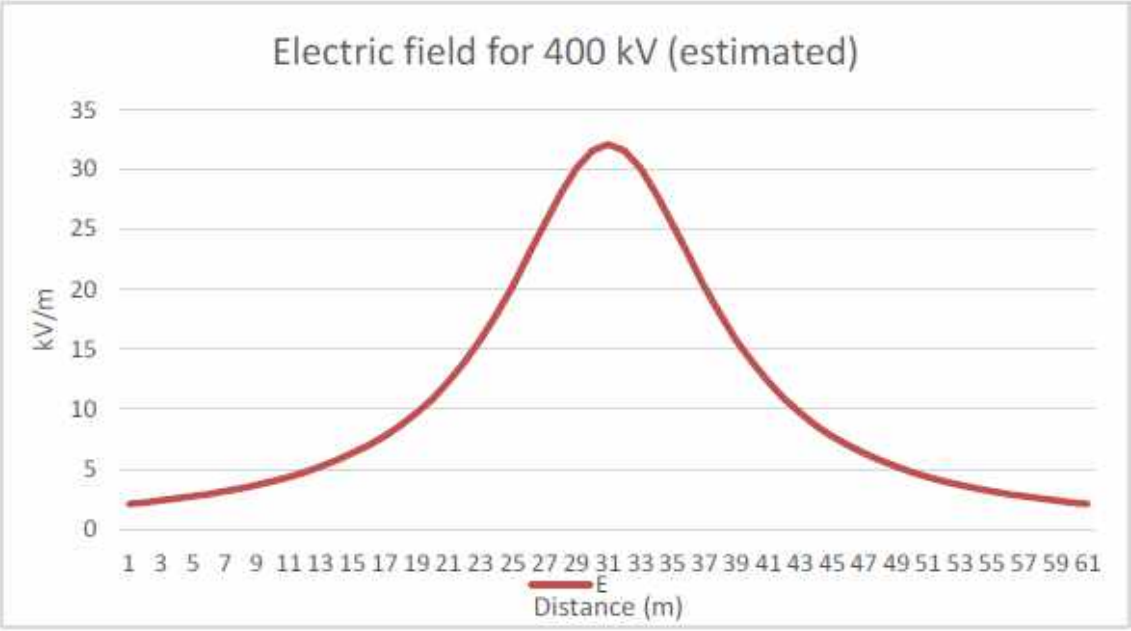
Table 5.1.3.a
ICNIRP occupational and public exposure limits

Occupational exposure	
Basic restriction: 10mA/m2 in the central nervous system	
Magnetic Field	Electric Field
ICNIRP reference level: 500 µT	ICNIRP reference level :10 kV/m
Field actually required: 1800 µT	Field actually required: 46kV/m
Public exposure	
Basic restriction: 2mA/m2 in the central nervous system	
Magnetic Field	Electric Field
ICNIRP reference level: 100 µT	ICNIRP reference level ;5 kV/m
Field actually required: 360 µT	Field actually required: 9 kV/m

Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Final Feasibility Report – Volume III. June, 2024.

Considering the characteristics of the TLs in this Project, the electric field estimated is shown in **Figure 5.1.3.a** below.

Figure 5.1.3.a
400 kV Overhead TL – estimated electric field



Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Final Feasibility Report – Volume III. June, 2024.

As can be seen in **Figure 5.1.3.a**, the electric field specified at the ± 5 m of the wayleave (2.09 kV/m) are less than the 5kV/m specified by the ICNIRP.

Magnetic fields are produced by the current flowing (movement of electric charge) on the conductors of a TL. Overhead TLs are designed to meet a maximum magnetic field level of 100 µT allowed for public exposure at the wayleave boundary.

The **Table 5.1.3.b** below presents the recommended magnetic field levels for 400 kV TLs.

Table 5.1.3.b
Characteristic values of the electric and magnetic fields

Tension level (KV)	ICNIRP maximum set limits (µT)	Limits recommended for the Project		
		Maximum-M field under TL (µT)	Maximum-M field boundary of wayleave (µT)	Typical wayleavewidth
400 kV	500 µT for occupational limits such as live line work 100 µT for public exposure	20	3	60 m

Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Final Feasibility Report – Volume III. June, 2024.

Minimum Clearances

According to the Wayleave Code of Practice (2011), for safety considerations, power conductors along the route of the TL should maintain requite clearance to ground in open country, national highways, rivers, railways tracks, telecommunication lines, other power lines, etc., as laid down in the Electricity Regulations, or Standards or codes of practice.

For 400 kV TLs, the Minimum Ground Clearance is 8.84 m. The minimum heights crossing over railway tracks are shown in **Table 5.1.3.c**.

Table 5.1.3.c
Minimum Heights - Crossing Over Railway Tracks

Voltage Level (kV)	Broad Gauge Metre and Narrow Gauge			
	Inside station Limits (m)	Outside station Limits (m)	Inside station limits (m)	Outside station Limits (m)
400	13.6	11.2	12.4	10.0

The vertical separation between circuits to be maintained at all TL crossing is shown in **Table 5.1.3.d**.

Table 5.1.3.d
Minimum Vertical Clearances

Description of clearance	Minimum clearance (m) – 400 kV
Lowest line conductor or earth wire of upper line to highest line conductor of lower line	7.1
Lowest line conductor or earth wire of upper line to earth wire of lower line where erected (Note 1)	7.1
Lowest line conductor or earth wire of upper line to any point on a support of the lower line in which a person may stand	8.3

(Note 1) The span crossing another line shall be as short as is reasonably practicable and no earth wires shall be installed on the lower line. Greater clearance may be provided when practical, and in every case, clearance requirements of the national Electrical Safety Code (ZS 418) shall be met.

For the Project's LTs, the line clearance, or minimum distance required between conductors and ground, vegetation or other structures, is 8.10 m.

5.2
Technical Characteristics of the Substations

Expansion works will be needed for the existing substations (SS), the SS Kyaka, SS Nyakanazi, and SS Ibadakuli, providing space for the TL and transformer bays and for future expansion.

400/220 kV Kyaka Substation (Kyaka SS)

The Kyaka SS exists and is located on the side of the Road B182 and near Kagera River, on the edge of the urban area of the village of Kyaka. **Figure 5.2.a** shows the area of the existing SS (1.14 ha) and the area to be expanded (8.65 ha). The 8.65 ha to be expanded will be used permanently by the project and must be acquired by TANESCO.

Table 5.2.a below shows the coordinates of the vertices that delimit the area to be occupied by the 400/220kV Kyaka SS after expansion (vertices shown in **Figure 5.2.a**).

Table 5.2.a
Coordinates of the 400/220kV Kyaka SS after expansion

Vertices	UTM coordinates (zone 36M)	
	x	y
V1	323382.00 m E	9861657.00 m S
V2	323356.79 m E	9861576.28 m S
V3	323283.22 m E	9861597.16 m S
V4	323253.95 m E	9861502.15 m S
V5	323296.35 m E	9861488.88 m S
V6	323202.16 m E	9861179.33 m S
V7	323385.16 m E	9861124.66 m S
V8	323455.00 m E	9861351.76 m S
V9	323505.37 m E	9861337.54 m S
V10	323535.91 m E	9861436.03 m S
V11	323512.36 m E	9861443.61 m S
V12	323516.57 m E	9861457.77 m S
V13	323481.71 m E	9861467.99 m S
V14	323476.00 m E	9861454.00 m S
V15	323438.00 m E	9861465.00 m S
V16	323457.00 m E	9861528.00 m S
V17	323487.00 m E	9861625.00 m S

In the case of SE Kyaka, the layout of the expansion is shown superimposed on the satellite image (**Figure 5.2.b**).

According to the Feasibility Study, the extension of 400/220kV Kyaka SS includes:

- Diameter C01: Diameter with line bay Nyakanazi 1, one variable line shunt reactor 400kV, 70 Mvar, one step down transformer 400/220/33kV, 250 MVA and 220kV line gantry to existing 220kV substation
- Diameter C02: Diameter with line bay Nyakanazi 2, one variable line shunt reactor 400kV, 70 Mvar, one step down transformer 400/220/33kV, 250 MVA and 220kV line gantry to existing 220kV substation
- Diameter C03: Diameter with line bay Masaka 1 and space for a future line bay
- Diameter C04: Diameter with line bay Masaka 2 and space for a future line bay
- Diameter C05: Space for a future diameter with two line bays
- Diameter C06: Busbar voltage measurement.

Figure 5.2.a
Area occupied by the 400/220kV Kyaka SS after expansion

Figure 5.2.b
400/220kV Kyaka SS - Geo Location

Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Document TZ-KYA-GEO-3011.

400 kV Nyakanazi Substation (Nyakanazi SS)

The Nyakanazi SS exists and is located in the village of Kabale, neighbouring the village of Nyakanasi. It is located next to the Road B3 (access between the highway and the SS is only 285 m), about 6.5 km from the village of Nyakazaki on this road. **Figure 5.2.c** shows the area of the existing SS (2.2 ha) and the area to be expanded (13.7 ha). The 13.7 ha to be expanded will be used permanently by the project and must be acquired by TANESCO.

Figure 5.2.d shows the layout of the 400 kV Nyakanazi SS after expansion. **Table 5.2.b** below shows the coordinates of the vertices that delimit the area to be occupied by the 400 kV Nyakanazi SS (vertices shown in **Figure 5.2.b**).

Table 5.2.b
Coordinates of the expanded Nyakazaki SS

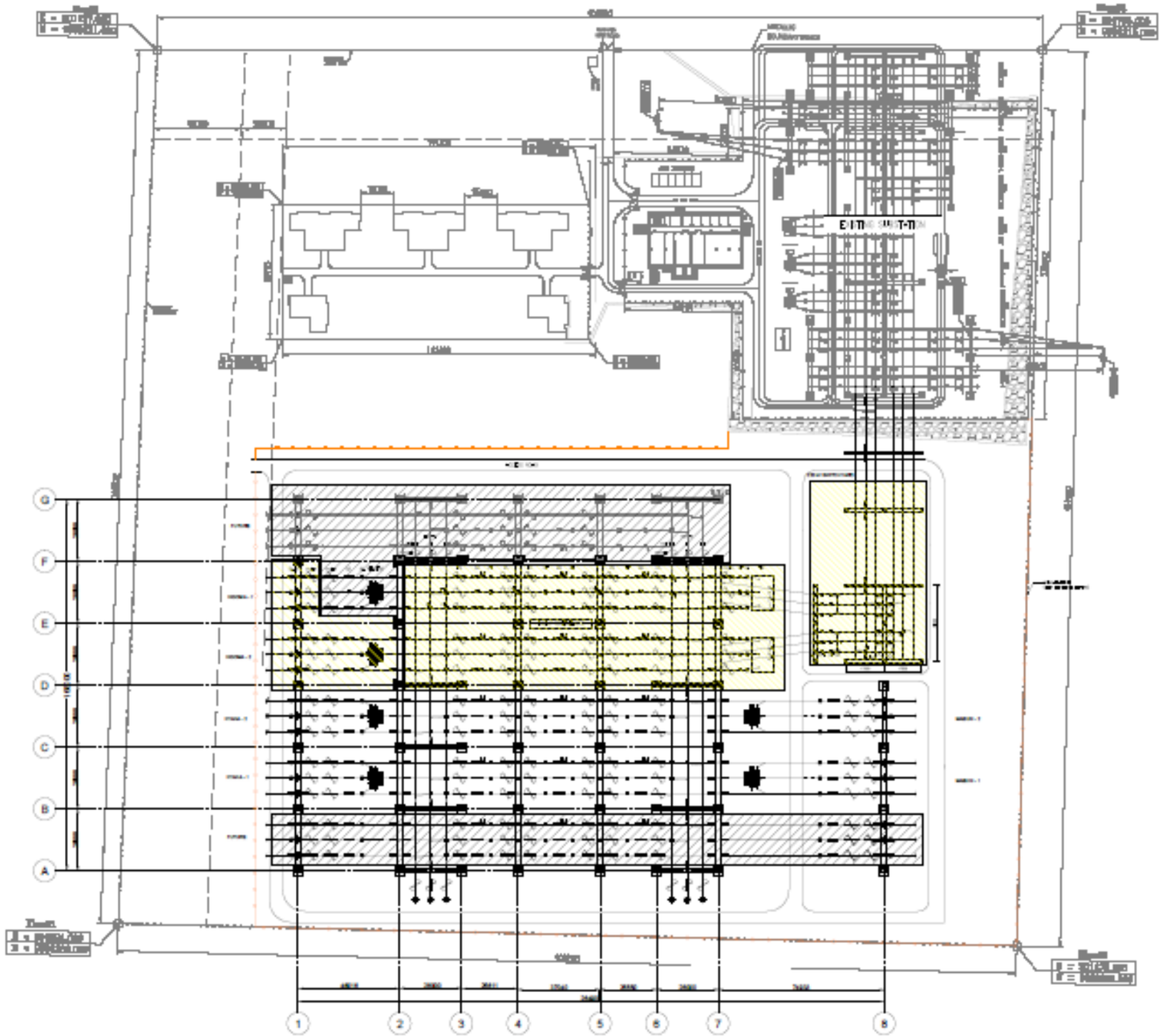
Vertices	UTM coordinates (zone 36M)	
	x	y
V1	301,795 m E	9,669,315 m S
V2	301,478 m E	9,669,063 m S
V3	301,224 m E	9,669,380 m S
V4	301,537 m E	9,669,621 m S

According to the Feasibility Study, the extension of 400kV Substation Nyakanazi includes:

- Diameter C02: Diameter with line bay Kyaka 1, variable line shunt reactor 400kV, 70 Mvar and line bay Mabuki 2, variable line shunt reactor 400kV, 70 Mvar;
- Diameter C03: Diameter with line bay Kyaka 2, variable line shunt reactor 400kV, 70 Mvar and line bay Mabuki 1, variable line shunt reactor 400kV, 70 Mvar.

Figure 5.2.c
Area occupied by the 400 kV Nyakazaki SS after expansion

Figure 5.2.d
400 kV Nyakazaki SS – General Layout



Source: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Document TZ-NYA-LAY-2002.

400/220kV Ibadakuli Substation (Ibadakuli SS)

The Ibadakuli SS exists and is located on the side of the Road B6 and near the village of Ibadakuli. **Figure 5.2.e** shows the area of the existing SS (3 ha) and the area to be expanded (12.2 ha). The 12.2 ha to be expanded will be used permanently by the project and must be acquired by TANESCO.

Table 5.2.c below shows the coordinates of the vertices that delimit the area to be occupied by the 400/220kV Ibadakuli SS after expansion (vertices shown in **Figure 5.2.e**).

Table 5.2.c
Coordinates of the 400/220kV Ibadakuli SS after expansion

Vertices	UTM coordinates (zone 36M)	
	x	y
V1	556833.65 m E	9599662.51 m S
V2	556941.94 m E	9599370.06 m S
V3	557215.85 m E	9599430.52 m S
V4	557283.26 m E	9599129.03 m S
V5	556942.92 m E	9599051.24 m S
V6	556811.02 m E	9599653.36 m S

Figure 5.2.e
Area occupied by the 400/220kV Ibadakuli SS after expansion

According to the Feasibility Study, the extension of 400/220kV Ibadakuli SS includes:

- Diameter C00: Busbar voltage measurement
- Diameter C01: Diameter with line bay Nyakanazi 1, one variable line shunt reactor 400kV, 70 Mvar, one step down transformer 400/220/33kV, 250 MVA and 220kV line gantry to existing 220kV substation
- Diameter C02: Diameter with line bay Nyakanazi 2, one variable line shunt reactor 400kV, 70 Mvar, one step down transformer 400/220/33kV, 250 MVA and 220kV line gantry to existing 220kV substation
- Diameter C03: Diameter with line bay Kilgoris 1, one variable line shunt reactor 400kV, 70 Mvar and line bay Ibadukuli 1
- Diameter C04: Diameter with line bay Kilgoris 2, one variable line shunt reactor 400kV, 70 Mvar and line bay Ibadukuli 2
- Diameter C05: Space for a future diameter with two-line bays
- Diameter C06: Space for a future diameter with two-line bays

5.3
Support Facilities

This section describes the main support facilities planned for the construction of the TLs and SSs. These areas will be used by the project on a temporary basis, only during the works.

5.3.1
Camp Sites

To support the works, camp sites are planned at the sites of the substations to be expanded, i.e. in the villages of Kyaka, Nyakanazi and Ibadakuli, and one at the northern end of the 400 kV TL Mutukula-Kyaka, on the border with Uganda, in the village of Mutukula. In addition to these, it is expected that other camp sites will be set up close to the TLs route, close to villages and with access from the main roads, and around 70 to 80 km apart. Considering these assumptions, it is estimated that, in addition to the 4 (four) camp sites initially mentioned, another 5 (five) will be needed, totalling 9 (nine) camp sites. Given the average distances and other assumptions set out above, it is suggested that the 5 additional camp sites be distributed in the following villages: Nyakasimbi, Nyabugombe, Busonzo, Ilogi and Solwa.

The distribution of these camp sites along the TLs route is shown in the **Figure 5.3.1.a** below.

The camp sites will comprise the following facilities:

- Administrative offices
- Warehouse
- Accommodation
- Kitchen and cafeteria
- Bathrooms and changing rooms

- Laundry
- Living area
- Carpentry
- Frame plant
- Ironwork shop
- Concrete plant
- Workshop and washer
- Vehicle parking area
- Materials yard (storage areas)
- Vehicle supply centre
- Solid waste centre
- Guardhouse
- Equipped first-aid station

Figure 5.3.1.a
Estimate of the possible distribution of camp sites along the TLs route

At this stage, only the villages where the camp sites are estimated to be located are indicated. The Contractors will be responsible for defining the land where the camp sites will be built. In any case, some possible alternatives for their positioning have been identified, which are shown in **Figure 5.3.1.b** below, but this is only an exercise, since the exact areas they will occupy are not known and their location will depend on negotiations between the Contractors and the owners or occupiers of the land.

Figure 5.3.1.b
Possible alternatives for positioning the camp sites

Near Kyaka SS

Figure 5.3.1.b
Possible alternatives for positioning the camp sites

Near Nyakanazi SS

Figure 5.3.1.b
Possible alternatives for positioning the camp sites

In the region of the village of Ilogi, near vertex KI-13

In the region of the village of Solwa, near vertex KI-23

After the final selection of the villages where the camp sites will be installed, based on the premises described above, the Contractors must look for specific locations to install the camp sites. This search should give preference to areas that meet the following criteria:

i. Areas located preferably on the banks of paved access roads, and that do not require crossing urban areas and communities on the way to the construction fronts, avoiding inconvenience and risks to the population living near the access roads;
ii. Areas with no native vegetation, although the presence of isolated trees may be permitted in some cases;
iii. Areas with flat topography, without the need to significant earthwork, and with a relative distance from water bodies and floodplains;
iv. Areas close to the TLs route and at the same time relatively close to the villages, but maintaining a minimum distance from occupied areas, mainly from health and school establishments;
v. Areas that maintain a minimum distance of 200 m from isolated houses.

Water supply to the camp sites will be provided by wells or from nearby watercourses, provided that the appropriate permits are obtained. Drinking mineral water will be purchased in large bottles for workers' consumption.

Considering the following calculation assumptions:

- 1,350 workers estimated at peak construction (see **Section 5.6.1**);
- 70% of workers hired locally;
- 30% of workers coming from outside the region (staying in the camp sites accommodation);
- Average consumption of 45 litres of water per worker not staying at the camp site and 80 litres of water per worker staying at the camp site[1];
- Volume of sewage generated per day: 85% of water consumption[2];

The following estimate of water consumption and sewage generation was obtained:

For human activities: 945 workers x 45 l/day + 405 workers x 80 l/day = 74,925 l/day = 74.93 m^3/day

Domestic sewage generation: ~ 63.70 m^3/day

Sanitary effluents will be directed to the public sewage system, if available, or to septic tanks. In workshops and vehicle refuelling areas, effluents (oily water) from washing and lubricating equipment and vehicles will be sent to collection and oil-water separation tanks, for subsequent removal of the oil for appropriate final disposal.

As verified[3][4], there are no sanitary landfill and incineration facilities in Tanzania. Therefore, in order to pr operly dispose of the waste generated during the works, the Contractors will either have to install trenched landfills with due care on each camp site itself, or temporarily store the waste and transport it to Kiteezi Landfill, in Kampala, Uganda, about 200 km from the border.

Patterns to be adopted for sizing of facilities and services for workers will be the local legislation and guidelines established by IFC and EBRD - European Bank for Reconstruction and Development in "Worker's Accommodation: Processes and Standards" - 2009.

[1] https://www.engwhere.com.br/estimativa-do-consumo-de-agua/

[2] Esgotamento Sanitário. Processos de tratamento de esgotos. Guia do profissional em treinamento. https://antigo.mdr.gov.br/images/stories/ArquivosSNSA/Arquivos_PDF/recesa/processosdetratamentodeesgoto-nivel2.pdf

[3] IUCN, UN Environment Programme & Life Cycle Iniciative. National Guidance for Plastic Pollution Hotspotting and Shaping Action. Final Report for Tanzania. 2021. Access in https://plastichotspotting.lifecycleinitiative.org/wp-content/uploads/2021/05/Tanzania_final_report_2021.pdf

[4] CSE - Centre for Science and Environment. TANZANIA Development of Environmental Management Strategy Towards Sustaining Ecological Integrity of Lake Victoria. 2022. https://www.nemc.or.tz/uploads/publications/sw-1683879526-Development%20of%20Environmental%20Management%20Strategy%20for%20Lake%20Victoria%20Discussion%20Paper%202022.pdf

5.3.2
Support Facilities at the Work Fronts

In addition to the camp sites, other support areas may be necessary during the works, including material storage yards and workers' rest areas in the stretches between camp sites. To select these areas, the Contractors must follow the same criteria above.

The workers' rest areas should be covered areas with tables and chairs, water, trash cans and sanitary tents. The support points should be chosen in flat areas, without native vegetation, preferably on degraded land.

Access roads are also considered support facilities. As mentioned in **Section 5.4.2.3** below, the existing access network, including highways, secondary roads, local roads and trails, will be used primarily for the works. The 14.0 m wide service strip will also be used for access where the flat topography allows. When existing access is not available and it is not possible to use the service strip, new access sections will be built to connect the nearest existing road to the workfront.

5.3.3
Borrow Areas and Surplus Soil Deposits

The material removed during the excavation of the tower foundations and earthworks in the substation areas will be removed and stored in an area close to the work fronts for later use in backfilling or to be spread in a controlled manner in the wayleave itself. The unserviceable material and the surplus soil may be disposed of in surplus soil deposits authorized by the environmental agency, or used for the eventual recovery of access roads.

5.4
Constructive Aspects

This section describes the main aspects of the constructive activities to be used in the construction of TLs and expansion of SSs, with emphasis on those with greater impact potential. This description only covers standardized executive procedures for transmission lines and substation works, excluding the complementary tasks and/or the adequacy of the procedures for impact mitigation purposes, which will be specified in detail in the description of the Construction Environmental Plan (CEP) (**Chapter 10.0**).

The following sections briefly describe the most relevant aspects of each of these activities.

5.4.1
Preliminary Services

Surveys and topographical markings

The topographic surveying services include the field surveys necessary for the final marking of the proposed preferred route, with the definitive location of the TL line axis and the positioning of the towers. The occupants of the areas in the projection of the wayleave to be implemented must be notified in advance of the start of the topographic marking services. The surveying services must comply with environmental constraints, in order to minimize impacts in addition to those intrinsically related to the implementation of the TL.

Delimitation of the wayleave

The occupants of the areas affected by the establishment of the wayleave will be contacted to apply for a Passing Authorization for the Transmission Line and to carry out the topographical surveys. The areas located in the projection of the wayleave will be considered to be under wayleave and will have their demarcation established in accordance with local regulations. Affected occupants will be compensated in accordance with the Resettlement Policy Framework.

TANESCO is responsible for the detailed design of the wayleave. Typically, the various stages in the development of the wayleave delimitation process are described below:

- Definition of the transmission line wayleave;
- Development of the topographical and property surveys at land registry offices, or other relevant registry offices;
- Development of a research into real estate market values in the region;
- Assessing compensation with landowners;
- Drawing up agreements with the occupants.

As detailed in the Resettlement Policy Framework, all negotiations with the owners will be conducted in such a way as to ensure that agreements are reached for the payment of the compensation due. The release of the areas for the implementation of the TLs be simultaneous with the compensation agreement.

Mobilization of workforce

During the planning phase, workers will be hired for the initial activities of the project. Hiring will continue throughout the construction phase as necessary to meet the construction schedule, until peak activity is reached, when the maximum number of workers will have been hired.

5.4.2
Civil Construction Works

5.4.2.1
Vegetation Clearing

Preliminary vegetation suppression services, clearing tree roots and general cleaning to remove any obstacles, are the set of operations designed to free up areas for laying new accesses, service strip for laying cables, tower installation sites, camp sites and substation construction/expansion areas.

The removal of vegetation consists of cutting down trees and shrubs of any size, mowing and removing branches. Clearing, which will only be carried out on the new access roads, includes excavation and total removal of tree stumps with a diameter of more than 30.0 cm and roots. Typically, the sequence of services will be:

- Suppression of vegetation, clearing of tree roots (only on the new accesses) and general cleaning to remove obstacles;
- Suppression of vegetation in the areas where the towers will be installed, which, due to their size, will also serve as areas for assembling the tower structures;
- Suppression of vegetation in a strip about 14.0 m wide in the centre of the wayleave (service strip), for complementary surveying and probing activities, laying the cables and circulation, in areas where the topography allows access to the towers using the wayleave itself. This service strip will be within the limits of the wayleave, with no need to clear additional areas;
- Clearance of the wayleave (negotiation with occupants, suppression of vegetation and removal of improvements, if any), in order to allow the construction, operation and maintenance of the TL. Apart from the 14.0 m service strip for laying cables and circulation, where vegetation must be cleared, the rest of the wayleave must be cleared selectively to ensure the safety of the TL and its components.

5.4.2.2
Implementation of Support Facilities

The camp sites will be set up in areas previously selected based on technical and environmental criteria, prioritising flat land (to reduce the need for earthworks), already degraded (to avoid the removal of native vegetation), with natural shade and away from homes, schools, health centres and areas of historical or cultural interest. Unoccupied areas will also be chosen so as not to cause the involuntary displacement of residents.

As mentioned in **Section 5.3.1**, each camp site will include accommodation for workers, as well as offices, kitchen and cafeteria, laundry, bathrooms and changing rooms, living area, warehouse, carpentry, frame plant, ironwork shop, vehicle parking area, materials yard, guardhouse, solid waste centre, equipped first-aid station, concrete plant, workshop and washer and vehicle supply centre.

All spaces will be equipped with sanitation, drainage, waste control and drinking water supply infrastructure in accordance with WHO guidelines. Effluents will be treated in septic tanks or sent to the public network, and solid waste will be segregated and disposed of appropriately.

The camp site facilities will comply with strict hygiene, safety and comfort standards and will be compatible with the number of workers, in addition to having adequate ventilation, noise control and ambient temperature control. Workshops and vehicle refuelling areas will have a drainage system connected to water and oil separators. Storage tanks for fuel (if any), lubricants, chemical or hazardous products shall be installed over covered and impermeable areas with secondary containment with a capacity greater than the largest tank or container stored, and with fire control equipment.

The hazardous waste storage area at the Waste Deposit must also be impermeable, covered and have secondary containment.

The complete set of procedures for the establishment and operation of the camp sites are presented in the P.01 - Construction Environmental Plan (CEP), under the ESMP (**Chapter 10.0**).

5.4.2.3
Implementation/Improvement of Accesses

For the purposes of the ESIA, the accesses needed for the construction of the TLs will include both specially built roads and those of the existing road network. These roads will be used to allow the transit of equipment and vehicles used for construction works, with the aim of interconnecting the existing accesses to the work fronts and camp sites (provisional accesses). This also includes access through the wayleave itself, where the topography allows, which will be maintained in the operation stage, enabling vehicle traffic and maintenance activities (definitive).

As provided for in measure 5.10 - Construction Traffic Control of P.01 - Construction Environmental Plan (CEP) (see **Chapter 10.0**), before work begins, the Contractors will define the accesses to be used, identifying the main and secondary roads, paths and trails, which will be used to access each tower and the construction sites. After this definition, they will inform the TANESCO Environmental and Social (E&S) Team for validation and approval. Considering that the areas where the TLs will be built are mostly flat, the Contractors will also take into account in its planning those sections that do not have existing access, but where the 14.0 m wide service strip itself can be used as access to the towers.

If it is identified that there are sections of the TLs without existing roads and where the service strip cannot be used, new access sections will be constructed to connect existing roads to the work fronts. This activity will include preliminary services for clearing, stump removal and vegetation cleaning, as well as land levelling through earthworks. To this end, wheel loaders, backhoe loaders, excavators and dump trucks will be used when necessary.

By giving priority to the use of existing paths and the wayleave, avoiding as far as possible the construction of new accesses, the aim is to reduce the impacts related to the removal of vegetation, erosion and silting up of watercourses.

Where the characteristics of the soil do not support the transit of equipment and vehicles, the logs resulting from the clearing of vegetation will be used.

Accesses will be prepared using suitable equipment and manual labour. The accesses must have the ramp, development and drainage conditions necessary for the rational use of equipment and vehicles. The maximum width will be 4.0 m, with a maximum ramp of 15% and a minimum radius of curvature of 45º. Access roads will be properly maintained throughout the construction of the TLs.

In order to use the existing roads, a maintenance plan must be drawn up to ensure that they can be used in a safe and trafficable manner.

The implementation of new accesses will include the preliminary services of vegetation clearing, as well as the regularization of the subsoil, with the aim of shaping the final layer of earthworks through cuts and/or embankments of up to 0.20 m, ensuring suitable conditions in terms of geometry and compaction. To this end, tracked tractors, patrollers, disk harrows, wheel loaders and dump trucks will be used when necessary.

5.4.2.4
Execution of Foundations

The execution of the foundations is mainly conditioned by the stresses and the type of local soil. Typically, the main construction procedures may include:

- Trench excavation

The trenches will be excavated in accordance with the dimensions, levels and slopes indicated in the project. Excavation will include the removal of different types of soil, from the ground surface to the level indicated in the project. In the case of work near urban areas, the contractor must check for possible interference with pipes, cables or other elements in the excavation area before starting work.

Excavated material that can be used for backfill will be stockpiled on the side of the trench, at a distance of 2.0 m from it. Unserviceable or surplus materials for backfilling operations will be spread on the wayleave itself, to eliminating the need for surplus soil deposits.

The use of borrow material to backfill the foundations trenches, when necessary, will be done from previously authorized areas and under special conditions, so as not to cause environmental damage to them.

When the excavation in good quality soil reaches the design level, the bottom of the trench will be regularized and cleaned.

While the trench is open, before concreting, it must be fenced off or covered to prevent wildlife from falling in.

- Trench shoring

Where the soil cannot support the excavation walls, shoring with wooden planks will be used. Basically, two types of shoring will be used: continuous and discontinuous.

The continuous shoring will be used when the local soil shows low shear strength and/or is situated below the water table and/or when other circumstances require watertight containment of the trench walls. In this case, wooden piles with interlocking edges (male-female type) or metal-wood shoring with stringers and struts will be used.

The discontinuous shoring will be used where the local soil has some cohesion and is above the water table. In this case, planks spaced a maximum of 50.0 cm apart will be used, with stringers and struts.

- Water drainage

When the excavation reaches the water table, the trench will be permanently drained until the services are completed. The bottom of the excavation trench will be drained by installing trenches in which perforated pipes will be placed and filled with gravel. The trenches will slope towards a drainage pit, where a submersible drainage pump will be installed. The pump will remove the excess water accumulated inside the excavation and, through a flexible pipe, will discharge the captured volume outside the camp site.

- Backfill

The material to be used to backfill the excavations must be homogeneous, free of organic matter and micaceous material. Material that is unsuitable for backfill will be sent to a surplus soil deposit.

Backfill will be carried out in layers of a thickness compatible with the equipment used.

The backfill material should be mechanically compacted until it reaches a degree of 95% of the dry density of the Normal Proctor, with the thickness of the final layer being equal to 20.0 cm.

- Construction of footings and pile cap blocks

The blocks must be built on a bed of thin concrete at least 5.0 cm thick, to regularize the ground. The application of thin concrete and the rest of the work must be carried out in drained areas, and pumping is not allowed during the concreting period. Once the regularization layer has been laid, the reinforcement and wooden forms will be assembled. The inside of the formwork will then be cleaned for concreting. The concrete will be poured into the formwork using a wooden chute, fed directly from the mixer truck. After pouring the concrete, the curing period will be observed so that it can be removed.

- Construction of precast piles

The piles to be used will be precast, made of vibrated, centrifuged or prestressed concrete. The execution process for deep foundations with precast piles will be as follows:

- Checking the verticality of each pile;
- Positioning and driving the piles with a gravity or diesel piling machine. After driving, the pile head should be above the planned drag level, so that the longitudinal reinforcement of this part can be embedded in the foundation blocks;
- Removal of the pile head by removing the existing concrete from the piles above the dragging level, leaving the reinforcement free and clean to be embedded in the foundation block.

5.4.2.5
Use of Surplus Soil Deposits and Borrow Areas

The material from the excavation of the tower foundations will be removed and stored in an area close to the camp site for later use in backfilling, to recover areas degraded by construction work or to be spread in a controlled manner in the wayleave itself. Exceptionally, unserviceable material may be disposed of in a surplus soil deposit authorized by the Environmental Agency, or used for the eventual recovery of access roads.

If it is necessary to remove material from borrow areas, an area authorized by the Environmental Agency will be chosen.

5.4.2.6
Watercourse Crossings and Works in Flooded, Swampy and Floodable Areas

Works on stretches subject to seasonal flooding will primarily be carried out during the dry season. Whenever possible, the TL will cross the watercourse at right angles.

Wet crossings will be used in places with a low water flow, but sufficient to prevent heavy vehicle traffic related to the works. The wet crossing (see **Photos 01** and **02**) consists of arranging rocks in such a way as to allow vehicles to pass through without interrupting the flow of water. This alternative also prevents sediment being carried away and consequent soil movement.

Photos 01 and 02: Examples of wet passage.

Bridges will only be used for accesses that cross a watercourse with a high depth and which does not allow the passage of construction equipment and machinery. For existing accesses that cross watercourses, the need to reinforce bridge structures will be assessed.

If culverts need to be installed, they will be properly headed and adequately sized to handle the drainage flow. Embankments will be avoided and will be considered as a last resort when building accesses. If necessary, attempts will be made to maintain the connectivity of flooded areas using drains, allowing the flow of water to pass through.

Construction in areas that are periodically flooded will be made possible using parts of the cable reels or wood resulting from the suppression of vegetation. This material will be removed at the end of construction. The system is illustrated in **Photos 03** and **04** below.

Photos 03 and 04: Examples of measures to allow access through flooded areas.

5.4.2.7
Main Construction Materials and Equipment

This information has not yet been defined by engineering and has been estimated to be as follows:

- Concrete: approximately 200-300 cubic meters per kilometer for foundations and structures.
- Sand: around 100-150 cubic meters per kilometer, mainly for concrete mix.
- Water: about 50-100 cubic meters per kilometer for concrete mixing and other construction needs.
- Steel: roughly 20-30 tons per kilometer for towers and other structures.
- Copper or aluminum conductors: approximately 10-15 tons per kilometer, depending on the configuration.

The main types of equipment normally required for the construction and electromechanical assembly of a 400 kV transmission line are as follows:

- Excavators and Backhoes: For digging foundations and trenches.
- Bulldozers: To clear and level the construction site.
- Cranes: Necessary for lifting and placing heavy tower components.
- Concrete Mixers: For preparing and transporting concrete to the site.
- Tower Erection Equipment: Specialized trucks and winches for assembling and erecting towers.
- Cable Stringing Equipment: Cable tensioners and pullers to install the electrical conductors.
- Drilling Rigs: For drilling holes for foundations, especially in rocky terrain.
- Transport Vehicles: Trucks and trailers to move materials and equipment to and from the site.
- Generators: To provide electricity for tools and equipment in remote areas.
- Safety Equipment: Harnesses, helmets, gloves, and other personal protective equipment (PPE) for workers.
- Surveying Equipment: GPS, total stations, and other tools to ensure precise alignment and placement of structures.

To ensure that construction material and service providers in Tanzania are legally authorized to operate, they must comply with regulations such as the Contractors Registration Act and obtain necessary permits from relevant authorities like the National Construction Council (NCC). These regulations ensure that contractors and suppliers meet specific standards and legal requirements.

Verification of compliance with these and other suppliers must be carried out by the contractor during the homologation and procurement process and this requirement is part of the ESMP established by this ESIA.

5.4.3
Electromechanical Assemblies

5.4.3.1
Erection of TL Towers

The towers can be assembled using a crane or manually. In manual assembly, the tower is pre-assembled in parts, which are lifted by means of a load mast and the use of pulleys and ropes. In crane assembly, the tower is also pre-assembled on the ground, but the lifting is done using machinery.

Parallel to the installation of the structures, the areas should have small drainage works in their surroundings in the event of water erosion, such as ditches and rainwater drainage channels, in order to minimize or even prevent the effects of erosion, preserving the structures from any tilting due to possible stripping of the base. To this end, the immediate surroundings of the towers should be re-vegetated with herbaceous species.

The environmental and safety procedures and recommendations to be adopted for self-supporting towers are presented below:

- The assembly services will be carried out within the area stipulated for the assembly area, which must be kept clean and organized;
- Only those employees required to carry out the services may remain inside the assembly area;
- When carrying out these services in the vicinity of urban/housing areas, adequate protection will be provided to avoid accidents, such as siding, insulating fences, signs, etc.

5.4.3.2
Launching of Conductors

The earth wires will be installed before the OPGW, in trenches between 0.5 and 0.80 m deep, in order to make the grounding resistance compatible with the desired performance and the public safety.

For crossings over navigable rivers, specific crossing projects must be drawn up and approved by the competent authorities. Where existing TLs, roads, railways, pipelines and watercourses are crossed, a specific signalling system will be implemented, enabling work to be carried out safely, for workers, community and users.

The conductor cables and OPGW will be assembled from launching fronts, under automatically controlled mechanical tension or by dragging, depending on the location, until the levelling recommended by the project is obtained for each span of the TL, and then they will be stapled.

The following procedures will be adopted in the cable-laying process:

- The area occupied by each cable-laying front will be restricted to the minimum necessary;
- Once the area has been used by the cable-laying front, the original conditions of the site will be re-established;
- Specific work safety signage will be adopted;
- Cable-laying will be carried out using a tracked tractor and only in the laying area, in order to avoid interventions in external areas;
- Protective structures will be installed between the cables to be laid and interferences, such as roads, watercourses, other transmission and distribution lines. Specific signage will also be installed in these cases.

5.4.4
Commissioning

During the commissioning phase, the final condition of the construction components and the items listed below will be inspected:

- Remaining forest areas;
- Preservation of agricultural crops located within the wayleave until they are harvested;
- Safety clearances, vertical and lateral, between trees and the TL;
- Fire protection clearance;
- Protection against erosion and rainwater action;
- Backfilling the bases of structures;
- Condition of watercourses.

5.4.5
Solid Waste Generated During Construction

In an initial estimate, the following types of waste are expected to be generated during the construction phase:

- Ordinary waste (office supplies, leftover food, food packaging, toilet paper, paper towels, leftover PPE);
- Health service waste (infectious material resulting from the operation of first-aid stations and unused or expired medicines);
- Workshop waste (used oil, oil from oil and water separation devices, packaging, used towels, tows, parts, tyres, car batteries, light bulbs);
- Miscellaneous waste (paper, cardboard and plastic packaging, leftover electrical material, ironmongery, wood, leftover concrete, masonry, inputs and unserviceables, cable reels);
- Concrete rests and sediment accumulated in the concrete mixer washing area;
- Dust and other materials retained in bag filters or other emission control devices to be cleaned periodically;
- Contaminated soil resulting from any leaks or spillages of petrol, oil and oil derivatives, fats and other chemical products.

As there is no data at this stage on the quantities of waste to be generated, the following are some average quantities obtained from publications[5], including one specific to a transmission line project:

- 13 m^3 of leftover concrete/month
- 5 m^3 of leftover wood/month
- 1.30 m^3 of common waste/month
- 0.24 m^3 of hazardous waste/month
- 1.02 kg of waste/worker.day[6][7]

The waste management measures, including disposal at work sites, classification and segregation, temporary storage at camp sites, transport (including permits required) and final disposal, are set out in Section 5.8 of P.01 of the ESMP, in **Chapter 10.0**.

5.4.6
Demobilization and Recovery of Work Areas

In all the work areas, the environmental recovery of the affected areas will be carried out, with the removal of all equipment and leftover materials. This will be followed by the restoration of the original vegetation cover or lining, in the case of areas within the wayleave. The restoration of the work areas used is an integral part of the construction services and is the responsibility of the respective contractor.

5.5
Operation and Maintenance

The operation and control of the TLs will be carried out by the substations. During operation, technical inspections will be carried out by the TL maintenance team.

The periodic inspection of the TLs will be carried out by land, using existing roads and paths or the wayleave itself, or using drones.

Inspections can be detailed, including climbing the towers to assess the condition of the structures. The frequency of these inspections varies. Preventive (periodic) and corrective (restoration of interruptions) maintenance services will be the responsibility of the TANESCO's maintenance teams, who will work on call and will be allocated to regional and offices, in a position to respond promptly to incidents.

During inspections of the TLs, the condition of the equipment, access to the towers and the situation of the wayleave must be observed, in order to preserve the installations and operation of the system.

[5] FARIA, P. M. B. Gerenciamento de Resíduos Sólidos na Construção Civil – Estudo de caso na construção e montagem de uma linha de transmissão de energia elétrica. 2011. Dissertação de Mestrado. Programa de Pós Graduação em Engenharia Ambiental. Universidade do Estado do Rio de Janeiro. Accessed in: http://www.peamb.eng.uerj.br/trabalhosconclusao/2011/PriscilaMarquesBragaFaria_PEAMB2011.pdf

[6] https://sinir.gov.br/relatorios/nacional/

[7] https://abespb.com.br/wp-content/uploads/2023/12/Panorama_residuos_BR_2022.pdf

Accesses will be maintained to keep them passable, with drainage systems, gates and brackets in a good state of repair and compatible with local demands.

5.5.1
Solid Waste Generated During Operation

In an initial estimate, the following types of waste are expected to be generated during the operation phase:

- Household and recyclable non-segregated waste, both produced at facilities operated by TANESCO, as well as waste disposed of in the wayleave by neighbouring communities;
- Waste from vegetation clearing activities and maintenance of the wayleave (clearing and pruning operations);
- Metal scrap and defective parts (replacements), which may include conductors, insulators, components of metallic structures;
- Miscellaneous waste contaminated with oils, lubricants, greases, paints and varnishes (parts resulting from maintenance, packaging, cloths and personal protective equipment – PPE contaminated).

The waste management measures, including classification, collection and segregation, transport and final disposal are set out in Section 5.4 of P.03 of the ESMP, in **Chapter 10.0**.

5.6
Construction Logistics

5.6.1
Construction Schedule

The work to install the Transmission Lines and expand the Substations will be carried out over a total period of 36 months.

5.6.2
Workforce

The estimated amount of direct labour required to implement the project will be up to 1,350 workers at the peak of construction. These workers will be mobilized at camp sites or work fronts.

Of the total workforce, it is estimated that between 20% and 30% will be local workers.

The involvement of approximately 650 indirect workers is also estimated. Indirect workers will be related, for example, to the following activities and services:

- Supply of materials (towers, cables and insulators, cement, concrete and steel, other construction materials);

- Logistics and transport (companies that transport materials, equipment and workers);
- Engineering and consultancy services (companies contracted to carry out the ESMP programmes, surveying and geotechnical companies, others);
- Food and accommodation services (providing food for workers and accommodation for engineers, technicians and other professionals who do not stay on camp sites);
- Security services (to protect equipment and materials on camp sites);
- Equipment maintenance services (maintenance and repair of machinery used in construction, such as cranes, tractors and lorries);
- Local commerce (establishments such as markets and pharmacies that will cater for workers' consumption).

5.7
Estimation of the Project's Greenhouse gas (GHG) Emissions

Annex 1 presents the calculation of the amount of greenhouse gas (GHG) emissions during construction, considering direct emissions (Scope 1).

6.0
Policy, Administrative and Legal Framework

This Chapter presents the pertinent policies, legislation, regulations, international agreements, and institutional arrangements that are relevant to the proposed construction of 400kV power transmission line interconnector (548.8km) from Ibadakuli substation via Nyakanazi and Kyaka substations to Mtukula village.

The International Agreements such as the World Bank's policies related to Environmental and Social Standards are outlined and their relevance to the project is explained. A gap analysis between Tanzania's laws and the World Bank Environmental and Social Standards (WB ESS) is also presented. At the end of this chapter, a summary of the institutions relevant to the proposed project and their respective responsibilities is provided.

6.1
Policy Framework

Tanzania Development Vision (2025)

Tanzania Development Vision 2025 outlines broad national long-term goals and aspirations. It set three principal objectives: achieving quality of life; good governance and the rule of law; and building a strong and competitive economy. The Vision provides national direction and pre-development priority that guides all other sector strategic plans. The sector strategic plans also consider other sectoral policies and national strategies and plans such as the Tanzania Five Year Development Plans (FYDP) which are fundamental in implementing the Vision.

The Vision articulates that by 2025 the society of Tanzanians will be substantially developed with high-quality livelihoods, with the key priority of alleviating poverty. The Vision 2025 seeks to mobilise the people, the private sector and public resources towards achieving shared goals and achieving a sustainable semi-industrialised middle market economy by the year 2025. The proposed power transmission interconnector project is among the strategic projects for Tanzania to increase power transmission capacity to southern regions of Tanzania and strengthen institutional capacity in Tanzania and of the Eastern Africa Power Pool for regional power trade.

National Environmental Policy (2021)

This Policy is an overarching national framework for environmental management in the country. It recognises the role of sectorial policies in pursuit of effective environmental conservation and sustainable socio-economic development. The policy identified key environmental challenges requiring priority actions to address; among these is Land degradation.

The land is one of the most valued natural assets in the country supporting the livelihoods of millions of Tanzanians. This valued resource is under increasing pressure resulting in

different forms of land degradation in many parts of the country which include loss of vegetation cover, loss of biodiversity, soil erosion, soil pollution and deforestation. The UTIP is a strategic project aiming at improving the socio-economic well-being of society through accessing modern and sustainable energy.

The policy identifies several interventions for effectively combating the rate of land degradation in the country. These include strengthening security in land tenure systems to make the ownership of land more secure and permanent; promoting integrated environmental awareness approaches on land degradation; enhancing land management by promoting the integration of environmental issues in land use plans; strengthening enforcement and compliance to various pieces of legislation addressing land degradation; and promoting economic incentives to encourage investments in restoration of degraded lands.

The main objective is to enhance environmentally sound management of land resources for socio-economic development. The project implementation will observe these provisions, particularly when undertaking RAP processes; therefore, the project should not aim at destroying land resources but rather improving them in tandem with livelihood restoration. The Environmental Impact Assessment (EIA), one of the instruments for environmental policy, is critical in achieving this overriding objective.

National Land Policy (1995) Revised in 1997

The National Land Policy calls for the securing of land tenure and optimal utilization of land for the public interest. Additionally, all land in Tanzania is considered public land, under the trusteeship of the President of Tanzania. Both customary and statutory rights of occupancy are seen as equal.

Regarding land acquisition, the National Land Policy recognises the following.

- The President's power to acquire land for public interest will be maintained. However, reasons for acquisition must be clearly defined and can be challenged in a court of law.
- The rights and interests of citizens in the land shall not be infringed upon without due legal process; and
- Customary land ownership is legally recognised.

The Land Policy Statement stipulates that the compensation of land will be full, fair and promptly paid when land is acquired. As such, compensation for land acquired in the public interest will be based on the principle of opportunity cost which includes:

- The market value of the real property.
- Disturbances allowance.
- Transport allowance.
- Loss of profits or accommodation.
- Cost of acquiring or getting the subject land; and

- Any other cost or capital expenditure incurred for the development of the subject land.

Taking into account the World Bank ESS, the principles laid down in the land policy will be adhered to in this project as land acquisition and resettlement is inevitable.

The National Energy Policy (2015)

The National Energy Policy of 2015 provides comprehensive legal and institutional frameworks for petroleum, electricity, renewable energies, and energy efficiency as well as local content issues including safety, health and environment.

The policy aligns with the National Development Vision 2025 to transform Tanzania into a globally competitive, industrialized, middle income and prosperous country. Increased access to modern energy is one of the important pillars of socio-economic transformation. This can be achieved through an adequate, affordable, and reliable energy supply which is a prerequisite for the proper functioning of the economy and other social settings. However, to enhance energy security, mitigate climate change, generate income, and create employment, the UTIP project is significant to exploit energy resources in a diversified manner. The project implementation will put the policy provisions into practice, yet ensuring the sustainability of the project, in the long run, should remain a priority.

National Human Settlements Development Policy (2000)

The National Human Settlements Development Policy defines human settlement as not merely physical structures of a city, town, or village but as an integrated combination of all human activity processes – residence, work, education, health, culture, and leisure - and the physical structures that support them.

The policy includes the following objectives relevant to the UTIP Project and the preparation of the RPF which will guide the RAP process and livelihood restoration of the affected persons:

- To make serviced land available for shelter and human settlements development in general to all sections of the community including women, youth, elderly, disabled and disadvantaged.
- To improve the provision of infrastructure and social services for sustainable human settlement development; and
- To assist the poor to acquire decent shelter.

The proposed project will affect several houses which are critical for human settlement. The provision of this policy needs to be adhered to ensure decent shelter and sustainable settlement are provided for all project-affected persons.

National Investment Promotion Policy (1996)

The policy, among other things, seeks to promote the development of industries, minerals and energy as a means of attracting potential investors. The policy recognises that adequate and reliable transport infrastructure contributes significantly to catalysing the development of the country. Section 3.4, d, iii-v entails the improvement of the quality and competitiveness of transport services and facilities; regular maintenance of the transport infrastructures; and promotion of an integrated and linked national, regional and international road, railway and air transport network. This power line project is in line with the policy aspirations.

National Women and Gender Development Policy (2023)

The key objective of this policy is to provide guidelines that will ensure that gender-sensitive plans and strategies in all sectors and institutions are developed. While the policy aims at establishing strategies to eradicate poverty, it emphasizes gender quality and equal opportunity for both men and women to participate in development undertakings and to value the role played by each member of society.

On employment strategies for women, Section 30 of the Policy requires the presence of equal employment opportunities between men and women depending on required qualifications at all levels. In addition, there should be records of the exact number of women and men at levels to assist monitoring and follow-ups, and the presence of a less bureaucratic special system in the provision of business licences especially to women working in the informal sector. Gender issues will be well attended to during the implementation of the project. The project should also provide specific mitigation measures to ensure gender inclusion in the project is adhered to.

Additional key policy statements to be considered for the UTIP Project and preparation of the RPF include but are not limited to the following:

- Decision-making and power.
- Access and ownership of resources.
- Community participation; and
- Economic empowerment.

The Policy stipulates that the land acquisition and resettlement activities should ensure the full restoration of the livelihoods of women who are affected by the implementation of the Project by promoting equal participation and opportunities for the duration of the project.

National Mechanism on Gender Based Violence/Sexual Exploitation and Abuse

The National Mechanism on Gender-Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) in Tanzania is anchored in a robust legal and policy framework that includes the National Plan of Action to End Violence Against Women and Children (NPA-VAWC 2017–2022), which establishes coordinated, multisectoral responses to prevent and

address GBV and SEA. This mechanism is implemented through collaboration between central government ministries, local government authorities, law enforcement, health and social welfare services, and civil society organizations. Key components include survivor-centered referral systems, community sensitization, legal aid services, and the integration of GBV response protocols in public institutions. For the UTIP Project, this national mechanism provides the institutional foundation for addressing risks of GBV and SEA associated with the presence of a large, mostly male construction workforce in rural areas. The project will align with national procedures by strengthening community-based grievance redress mechanisms, ensuring access to referral pathways for survivors, and enforcing codes of conduct for all workers, in accordance with the provisions of the Labour Management Procedures (LMP) and Stakeholder Engagement Plan (SEP), and in compliance with World Bank ESS1, ESS2, and ESS4.

National Cultural Heritage Policy (2008)

The policy has an overall objective of increasing the cultural heritage sector contribution to the economy through tourism, by conserving and developing cultural heritage resources. Key elements of the policy include the following:

- Defines the roles and responsibilities of different cultural heritage stakeholders.
- An analysis of the ways in which cultural heritage activities are managed and administered by the government.
- Clarifies measures by which cultural heritage resources will be protected, managed, preserved, conserved, and developed; and
- An analysis of best practices for conducting research and conservation of cultural heritage resources.

The UTIP project will be implemented in areas that are potential culturally rich areas hence measures to address the chance find of artefacts should be provided together with a preliminary cultural/ archaeological survey of the way leave. In addition, consideration of the cultural heritage of the project-affected persons and surrounding community should be considered and measures to preserve the same need to be stipulated in the RAP report.

National Agricultural Policy (2013)

The Policy (URT, 2013) aims at addressing challenges that continue to hamper the development of the agricultural sector including low productivity, overdependence on rain-fed agriculture, inadequate participation of the private sector, environmental degradation and crop pests and diseases. The Policy promotes environmental conservation by discouraging unsustainable agricultural practices including slashing and burning practices, and cultivation in sensitive and marginal lands. It further fosters the improvement of land husbandry through soil erosion control and soil fertility improvement activities contributing to sustainable land management and addressing climate change. The proposed project will traverse through agricultural land which the majority of the project-affected persons depend on for their livelihood and food security. Taking this significant important, proper mitigation measures should be put in place to minimise or avoid significant impacts that will be caused by the project on the agricultural

land which is critical to the livelihoods and food security of the majority of the people in those areas.

The National Livestock Policy (2006)

The rationale of the National Livestock Policy is to commercialize the industry and stimulate its development while conserving the environment. The aim is to support the livelihoods of livestock farmers through increased incomes and self-sufficiency in food of animal origin and thus addressing the goals set in the Vision 2025.

The Policy has considered the comparative advantage the country has as regards to the large livestock population compared to most African countries. It has also considered current developments in trade liberalization, globalization, privatization and divestiture of state enterprises, enhancement public-private partnership, advances in science and technology, which have direct impact on the development of the livestock industry. The Policy further emphasizes on the importance of value addition in order to access competitive markets and to prolong shelf life of livestock products.

The proposed power line project will support livestock production and promote value addition in livestock products which is critical in livelihoods to the majority of population along the project areas.

National Forestry Policy (1998)

The Policy aims to enhance the contribution of the forest sector to the sustainable development of Tanzania and the conservation and management of natural resources for the benefit of the present and future generations. The policy provides the foundation for Participatory Forest Management (PFM) and encourages the involvement of the communities and private sector in forest management through village land forest reserves, and individual, group and community forests. The objectives of the Policy provide opportunities for climate change adaptation and mitigation and how to address the challenges related to climate change and variability. The UTIP project will traverse different parts of the forest reserve along the proposed transmission line corridor. The project needs to take into account the policy directives to avoid a significant impact on the forest cover and forest reserve in these areas.

The Forest Policy recognizes the importance of trade in non-wood and wood products as sources of income, and the Forest Act provides for the harvest and trade of forest products based on licenses issued to authorized users at the district level. In addition, the subsistence uses of forest products are permitted to the villages inside the village where forest reserves are located, but not to the neighbouring communities adjacent to or near the forest resources. The current policy framework does create administrative hurdles for the local communities in exercising commercial activities on their forest resources. Although the government encourages forest use as a pathway for economic benefit and poverty reduction, it remains under the auspices of a state-managed system. The enactment of Forest (Sustainable Utilization of Logs, Timber, Withies, Poles or Charcoal) Regulations GN. No. 417 of 2019 is vivid in this matter.

The regulations provide for sustainable utilization of logs, timber, withies, poles or charcoal in the forest reserves including the Village Forest Reserves and community-based Forest Reserves. The regulations established a Committee known as the District Forest Produce Harvesting Committee, which is normally referred to as the District Committee. The District Committee is composed of different officials from the district level and the District Commissioner serves as a Chairperson. Only two officials, the Village Chairman and Executive Officer of the village where the forest produce is to be harvested represent the local communities in the committee. However, the regulations have no provisions on how the local communities will socially and economically benefit from sustainable utilization of logs, timber, withies, poles or charcoal.

The Wildlife Policy of Tanzania (2007)

Wildlife conservation in Tanzania is governed by several policy documents, which include the Wildlife Policy of Tanzania, 2007, National Policies for National Parks in Tanzania of 1994, the National Forest Policy of 1998 the National Environmental Policy, 2021, and the National Biodiversity Strategy and Action Plan of 2001. The Wildlife Policy of Tanzania was adopted in 2007 to guide the protection and conservation of wildlife and wetlands, sustainable utilization of wildlife and wetlands, management and development of wildlife and wetlands resources, strengthening resource monitoring and research and enhancing communication, education and public awareness. The Wildlife Policy defines the government's priorities in wildlife conservation through the regulation of utilization of wildlife and wetland resources, monitoring of wildlife and wetland resources, strengthening human resource base and capacity building, developing infrastructure and modernizing equipment and enhancing international cooperation. The UTIP project will traverse in areas where there is wildlife such as Burigi National Park in Kagera and Geita regions. Proper consultation with the responsible authorities is needed to ensure the policy directives are adhered to during and after the implementation of the project.

The National Policy for National Parks in Tanzania (1994)

The Policy for National Parks in Tanzania was adopted in 1994 and focuses on the management of national parks. The purpose of this policy is to preserve national parks and to ensure that national parks retain a high degree of integrity in wildlife conservation. The policy covers a wide range of issues related to national parks including park planning, natural resource management, cultural resource management, wilderness preservation and management, public information and education and benefit sharing. The policy spells out the government's policy direction on the use of parks, developments within national parks, tourism and concessions and law enforcement. The UTIP project will traverse areas reserved for national parks such as Burigi National Park in Kagera and Geita regions. Proper consultation with the responsible authorities is needed to ensure the policy directives are adhered to during and after the implementation of the project.

National Water Policy of (2002)

The policy stresses on the sustainable use of water to maintain environmental flow which is essential for riparian biodiversity, wetland systems, and the freshwater-seawater balance in deltas and estuaries. This can be accomplished by controlled exploitation of water and treatment of wastewater (effluent) before emptying it into the environment. Section 5 (v) of the policy is relevant as well in the construction of the proposed transmission line regarding water extraction from various sources along the right of way during construction. Project proponent is to abide by the regulatory instruments and procedures at all administrative levels to ensure there is no potential or actual water conflict among users and/or uses. Water policy issues particularly in water resources management underscore the disaster management from accidental pollution of water sources, Clause 4.8.4.

Water supply is a critical problem in village along the right of way and some of the shallow wells and rivers are located within or too close to proposed alignment. This ESIA has addressed water supply availability and water resources protection issues and proposed changes where water sources or distribution points are in danger of being negatively affected by the proposed power line development. The proposed project will implement the measures recommended by this policy to ensure sustainability of the water resources in the entire project.

National Health Policy (2007)

The National Health Policy is aimed at improving the provision of health services and providing a direction to sustain the quality of health services to all people by reducing disability, morbidity and mortality, improving nutritional status and raising life expectancy. The policy recognises that good health is a major resource essential for poverty eradication and economic development. The mission of the health policy is to facilitate the provision of equitable, quality and affordable basic health services, which are gender sensitive and sustainable. Projects like UTIP will attract an influx of people in the project area hence imposing health challenges in terms of health services and the spread of diseases. Diseases like HIV/AIDS, STDs, and other transmission diseases are common in areas where there is high interaction of people. Proper mitigation measures are needed to ensure there is sustainable health provision in the project areas during the implementation and operation of the project.

Mineral Policy of Tanzania (1997)

The mineral policy was specifically set for the mineral sector and aimed to attract and enable the private sector to take the lead in exploration, mining development, mineral beneficiation and marketing. The policy identifies the role of the public sector as to stimulate and guide private mining investment by administering, regulating and promoting the growth of the sector. With specific regard to the infrastructure development sector, the policy stresses on the creation and maintenance of reliable social and economic infrastructure facilities such as transport; water supply, power supply; communications; education and health services; and recreation, are vital for the mineral sector's

development. The proposed project will traverse areas where there is mining exploration especially the artisanal and small miners whose livelihood depends on mineral extraction. Specific measures and procedures need to be taken to ensure they are consulted and proper mitigation measures are implemented in the mining areas that will be affected by the project.

National Employment Policy (2003)

The most relevant sections of this policy are (ii) 10.6 which stresses the employment of special groups, i.e. women, youth, and persons with disabilities, and (iii) 10.8, which discourages the tendency of contractors to employ expatriates, when there are equally competent nationals. The contractor and operator will abide by the employment policy and ensure that all qualified nationals are afforded equal employment opportunities.

Further, The Project Proponent intends to supplement these efforts by employing the project implementation. During this period, transfer of technology can be attained among those who will be employed and after their contract terms they can engage in self-employment activities in the informal sector, especially in the construction sector.

National HIV and AIDS Policy (2001)

The policy recognises HIV/AIDS as an impediment to development in all sectors, in terms of social and economic development with serious and direct implications for social services and welfare. Relevant objectives of the policy concerning the proposed project are prevention of transmission and spread of HIV/AIDS, enhancement of sectoral roles through participation and financial support; promotion and participation in the research on HIV/AIDS, including dissemination of scientific information and development of a vaccine. Further, all stakeholders have to be actively involved in the fight against HIV/AIDS.

The proposed project will result in a population influx during the implementation. In this regards the contractor shall be required to prepare the HIV/AIDs awareness programme aimed at promoting awareness of HIV/AIDs among its service providers, communities and its employees.

National Construction Industry Policy (2003)

The policy recognizes the importance of involving various organizations and persons including companies, firms and individuals working as consultants, main contractors and sub-contractors, materials and equipment producers, plant and equipment suppliers, builders and merchants. With respect to environmental protection and conservation, section 8.2.2 of the National Construction Industry Policy addresses several issues regarding the environment. The construction industry is generally said to be a major source of environmental damage and occupational health problems. The project construction activities will affect the environment in many ways such as biodiversity and environmental resource deterioration, vegetation and habitats loss, physical disturbance,

earth grabbing and pollution including dust production will pollutes the atmosphere. The project will implement the mitigation measures recommended by this ESIA study.

National Transport Policy (2003)

The Policy aims to develop safe, reliable, effective, efficient and fully integrated transport infrastructure and operations which will best meet the needs of the population. It also aims to support short and long-term national development programmes for sustainable economic growth, economic reforms, meeting basic needs, human resource development and creation of employment. It ensures private sector participation in the provision of services while the government continues to retain the role of ownership and development of the key strategic transport infrastructure. The Policy emphasis to apply a participatory approach in the provision of transport infrastructure and services by involving all the stakeholders (i.e. government, operators and users) in playing their role in the development of the sector. Equally, the Policy facilitates sustainable development by ensuring that all aspects of environment protection and management are given sufficient emphasis at the design and development stages of transport infrastructure and when providing services. The project will utilise various infrastructure such as roads and railways to transport materials and equipment during construction and operation of the project.

National Occupational Health and Safety Policy (2010)

The long-term development goal of Tanzania is to reduce the poverty of her people and improve the working conditions of the entire workforce, at all workplaces, through the provision of quality occupational health and safety services. This should, in turn, lead to raised standards of living consequential to prevention and/or elimination of occupational hazards and enhancement of all productive and service sectors as envisaged in the Development Vision 2025. For the development of a Nation is also measured, among other indicators, through the availability of safe and healthy working conditions within the entire diversity of the working population who transforms, through equipment and machines, crude resources into goods, products and services. This Policy, therefore, aims to prevent and control of hazards at workplaces and adaptation of work processes and environment to workers to increase their productivity. The UTIP project will engage unskilled and skilled workers, therefore contractor and client will require to abide to this policy requirements.

National Community Development policy (1997)

The policy puts in place measures that enables communities to realise their potential through wise utilisation of natural resources. The major objective of the Policy is to enable Tanzanians as individuals or in their families and/or groups/associations to contribute more to the government objectives of self-reliance and therefore bring about development at all levels

The UTIP project has several undertakings which are directly linked to the community and their respective development such as employment, business, improvement of

infrastructure, access to clean energy as well as accelerate communities and township development.

6.2
Tanzanian Legislative Framework

The Tanzanian Constitution of 1977

Tanzanian Constitution is the mother law of the country. It establishes the institutions and the apparatus of government, defines the content and limits of government powers, and protects fundamental human rights and freedoms. The Constitution makes specific reference to resettlement. The Constitution provides that every person has the right to own property and the right to have his or her property protected following the law. However, the Constitution allows for the State to compulsorily acquire property for a list of broadly defined public purposes, including "enabling any other thing to be done which promotes, or preserves the national interest in general." Lastly, the Constitution requires that no person can be deprived of property for purposes of nationalization or other purposes except following law and upon the government's payment of fair and adequate compensation. Therefore, the UTIP project needs to adhere to the fundamental principles of the Constitution of the United Republic of Tanzania.

The Environmental Management Act (EMA) No. 20 of 2004

The Environmental Management Act (Cap. 191) (EMA) of 2004 is the principal legislation governing environmental management in the country. The Act provides the legal and institutional framework for environmental management in Tanzania and recognises "the right of every citizen to a clean, safe and healthy environment, and the right of access to environmental resources for recreational, educational, health, spiritual, cultural and economic purposes". The EMA links with the EIA and Audit Regulation of 2005 as amended in 2018 to detail requirements for Environmental and Social Impact Assessment (ESIA), along with monitoring requirements. The EMA specifies, "Environmental experts or firm of experts prepare a Monitoring Plan and Environmental and Social Management Plan with details about institutional responsibilities, monitoring framework, parameters, indicators for monitoring and costs of monitoring where appropriate".

The EMA identifies and outlines specific roles, responsibilities and functions of various key players in the ESIA process, comprised of:

- Minister Responsible for Environment.
- National Advisory Committee.
- Director of Environment.
- National Environment Management Council (NEMC).
- Sector Ministries; Regional Secretariat; and
- Local Government Authorities (City, Municipal, District and Town Councils).

Of much relevance to the proposed transmission line project, is Section 46 (4) (b), which requires project developers to undertake initial baseline studies, to provide baseline information upon which subsequent environmental control and audit studies shall be based.

Section 81 of the Act also refers to the obligation to undertake ESIA by the project Proponent at his/her own cost prior to commencement or financing of a project or undertaking. The Act prohibits any development to be initiated without an EIA Certificate. The proposed 400 kV project falls under category of EIA mandatory list. By undertaking this ESIA study, TANESCO complies with the stipulated requirements under the Act.

The Land Acquisition Act Cap 118 R.E 2002

The Land Acquisition Act Cap 118 R.E 2002 is the principal legislation governing the compulsory acquisition of land in Tanzania. Sections 3 and 4 of the Act empower the President to acquire land in any locality provided that the land is required for public purposes such as for exclusive government use, general public use, any government scheme, development of social services or commercial development of any kind.

The Act (Sections 5 to 18) provides the procedures to be followed when a compulsory land acquisition occurs, including the notice provided to all interested persons or those claiming to be interested in the land (Section 6); the investigation of the land to confirm suitability for the intended purpose; notification to the landowner(s) to inform them of the decision to acquire their land; and payment of compensation to those who will be adversely affected.

The Land Act Cap 113 R.E 2019

The Land Act Cap 113 R.E of 2019 provides the legal framework for two of the three categories of land in Tanzania: General Land and Reserved Land. The Forest Reserve along the right of way falls under the category of Reserved Land, while land in urban areas / small towns falls under the category of General Land (i.e. any land which does not fall under the category of Reserved Land or Village Land). It provides the basic law concerning the management of land, the settlement of disputes and related matters. It also stipulates requirements for land acquisition and takes precedence over many of the provisions of the Land Acquisition Act.

One of the fundamental principles of the Land Act is “to pay full, fair and prompt compensation to any person whose right of occupancy or recognised longstanding occupation or customary use of land is revoked”. Section 3(f) and (g) of the Act also require the "prompt payment of full compensation for loss of any interests in land and any other losses that are incurred due to any move or any other interference with their occupation or use of land”.

The Act outlines the administrative framework for managing land, acknowledging the authority of the Commissioner for Lands as the principal administrative officer reporting

to the Minister of Lands (section 10 (1)), and establishes Land Allocation Committees within Central, Urban and District government authorities. The Land Act states that local government authorities are not authorised to grant rights of occupancy but may make applications and recommendations to the Commissioner for approval.

The Village Land Act (1999) Cap 114 R.E 2019

Most of the land to be acquired by the Project is classified as Village Land. The Village Land Act (Cap 114) provides details on the governance and administration of Village Land. The purpose of the Act is to recognize and secure customary rights in land in rural communities. As such, the Act vests all village land in the Village Assembly, while the Village Council administers the land through the authority of the Village Assembly.

The Act provides for equal rights to access, use and control of land, recognises, and protects the rights of women and vulnerable groups concerning land access. It also includes information on the application of the National Land Policy on Village Land, management and administration, dispute resolution and transfers of land. Under the Act, Village Land shall be divided into communal village land (Section 13), land that is occupied or used by an individual or family under customary rights of occupancy (Section 14) and land that may be available for communal or individual occupation and use through allocation by the Village Council. The Act also defines parties that can claim land under a customary or granted right of occupancy. Once allocated, those with customary rights of occupancy are entitled to receive full, fair and prompt compensation from the loss or diminution of the value of the land and the buildings and other improvements on it.

The Land Registration Act (Chapter 334)

The Land Registration Act provides for procedures for Land registration and administration of the Land Registry. The act provides for an official record of the right defined in the area of land or an authoritative record of information concerning land for legal purposes and establishment rights in land. The act provides for the registration of the title to land in Tanzania and the recording of dispositions, transmissions and encumbrance of and over registered land. Land acquisition for the UTIP project should follow the requirement of this act by inquiring about the status of the surveyed land if it has been registered and whether there is any encumbrance that may impose complications during the compensation process.

The Law of Marriage Act. No. 5 of 1971

The Act regulate the law relating to marriage, personal and property rights between husband and wife, separation, divorce and other matrimonial reliefs and other related matters. The rights of women and children especially regarding property rights during marriage, death of a spouse, and divorce are well protected. Section 60 of the Act provides presumptions as to property acquired during marriage. It states that where the property is acquired in the names of the husband and wife jointly, there shall be a rebuttable presumption that their beneficial interests therein are equal. Moreover, section 114 of the

act empowers the court, upon the grant of the decree of separation or divorce, to order the division of matrimonial assets acquired by the spouses during the marriage by their joint efforts. The court may also order the sale of any such asset and the division between the parties of the proceeds of the sale. The land acquisition process for the UTIP project should take into account the provisions of these acts by making a proper inquiry during valuation to determine the marriage status of the spouse to ensure compensation and other related rights a fully protected.

The Forest Act No. 12 of 2002

The Forest Act (2002) provides for the management of forests to enhance the contribution of the forest sector to the development of Tanzania and the conservation and management of natural resources.

Section 18 of the Act states:

> *…any proposed development in a forest reserve, private forest or sensitive forest area including watersheds, whether that development is proposed by, or is to be implemented by a person or organization in the public or private sector, the developer of the development shall prepare and submit to the Director an Environmental Impact Assessment of the proposed development.*

Section 49 of the Act outlines various permits that are required when certain activities are undertaken. These activities include:

- Those activities are carried out in national and local authority forest reserves.
- Felling or extraction of timber (for domestic use; export; mining purposes, or for prospecting and exploitation of mineral resources).
- Gathering and picking parts or extracts of any protected plant for research or the production manufacture of any medicine or product.
- Erecting buildings or other structures.
- Constructing roads, bridges, paths, waterways or runways.
- Sowing, planting or cultivating trees, crops or other vegetative matter; and
- Entering to hunt or fish.

The proposed project will traverse forest areas which need to consider the provision of this act. Areas with critical ecosystem services depended on by the local communities should be avoided or proper mitigation measures to be implemented to avoid significant damage to these resources.

During implementation of the proposed project, TANESCO together with project's contractor should involve Tanzania Forest Service (TFS) when clearing way leave. Indigenous trees need special ways of removing it once encountered, hence TFS should be informed.

The Wildlife Conservation Act [Cap 283 RE 2022]

An Act to repeal and replace the Fauna Conservation Ordinance, to make provision for the protection, conservation, development, regulations and control of fauna products and for matters incidental thereto and connected therewith. It stipulates the conditions upon which areas could be declared protected zones, restrictions on entry, use and residence within such areas. It also gives restrictions on grazing livestock within game reserves, and regulates on hunting within the controlled game reserves.

The proposed project will traverse protected areas such as Burigi national park and various village and district forest reserves. The proposed project must therefore abide with the stipulated act goals as to safeguard fauna biodiversity within and adjacent project areas. Further, the project will implement the mitigation measures recommended by this ESIA Study.

The Road Act No. 13 of 2007

The Act provides for road financing, development, maintenance, management and other related matters on finance, offences, penalties and recovery. It set out the categories of road and prescribes the road reserve area and utilisation. Furthermore, it allows road authorities to prohibit any class of traffic on a road of access in public interest. Part V of the Act stipulates safety measures such as speed limits, erection of the road furniture and safety of the road users in the daily road operations.

Section 16 of the Act address the issue of compensation for any acquired land for road development. The Section emphasizes that, where it becomes necessary for the road authority to acquire a land owned by any person for the purpose of this act, the owners of such land shall be entitled to compensation for any development on such land in accordance with the Land Acquisition Act, Land and Village Land Acts and any other written law.

The proposed 400kV transmission line project will need access roads to construction sites and during operation and maintenance phases of the project. The project will adhere to the provisions of this act.

The Graves (Removal) Act No. 9 of 1969

The Graves Removal Act (1969) (revised in 2002) is an Act to provide for the removal of graves from land required for public purposes. Subject to the provisions of this Act under section 3, “where any land on which a grave is situated is required for a public purpose the Minister may cause such grave and any dead body buried therein to be removed from the land and, in such case, shall take all such steps as may be requisite or convenient for the reinstatement of the grave and the re-interment of the dead body in place approved by him for the purpose”. The definition of “public purpose” is contained in Section 4 of the Land Acquisition Act Cap 118 R.E 2002 - i.e. for exclusive Government use, for general public use, of sites for industrial, agricultural or commercial

development, social services or housing, for use by the Community or a corporation within the Community. Section 3 states,

> *...where any land on which a grave is situated is required for a public purpose the Minister may cause such grave and any dead body buried therein to be removed from the land and, in such case, shall take all such steps as may be requisite or convenient for the reinstatement of the grave and the re-interment of the dead body in place approved by him for the purpose.*

The process of land acquisition for the establishment of the proposed UTIP project shall observe the requirements of this Act.

The Court (Land Disputes Settlements) Act (No. 2), 2002

The Land Disputes Courts Act provides for the establishment of land courts. Section 3 (1) of the Act stipulates that subject, to section 167 of the Land Act, Cap 113, and section 62 of the Village Land Act, Cap114, every dispute or complaint concerning land shall be instituted in the Court having, jurisdiction, to determine land disputes in a given area. It provides for the establishment and jurisdiction of:

(a) The Village Land Council;
(b) The Ward Tribunal;
(c) The District Land and Housing Tribunal;
(d) The High Court (Land Division);
(e) The Court of Appeal of Tanzania.

Section 5(1) stipulates that the Village Land Council shall consist of seven members of whom three shall be women, and each member shall be nominated by the village council and approved by the Village Assembly. The functions of the Village Council according to Section 7 include:

(a) to receive complaints from parties in respect of the land;
(b) to convene meetings for hearing of disputes from parties; and
(c) to mediate between and assist parties to arrive at a mutually acceptable settlement of the disputes on any matter concerning, land within its area of jurisdiction.

Section 9 stipulates that where the parties to the dispute before the Village Land Council are not satisfied with the decision of the Council, the dispute in question shall be referred to the Ward Tribunal under section 62 of the Village Land Act, Cap 113. The primary function of each Tribunal is to secure peace and harmony, in the area for which it is established, by mediating between and assisting parties to arrive at a mutually acceptable solution on any matter concerning land within its jurisdiction. Section 15 however limits the jurisdiction of the Tribunal to handling cases of disputed land or property valued at three million shillings.

Where a party to the dispute fails to comply with the order of the Ward Tribunal, the Ward Tribunal shall refer the matter to the District Land and Housing Tribunal for

enforcement. Any party, who is aggrieved by a decision or order of the District Land and Housing Tribunal in the exercise of its appellate or provisional jurisdiction, may within sixty days after the date, of the decision or order, appeal to the High Court (Land Division) as stated in Section 38 (1).

The Valuation and Valuers Registration Act No. 7 of 2016

Valuation and Valuers Registration Act No. 7 of 2016 is An Act to provide for the powers and functions of the Chief Valuer of the Government; to establish the Valuers Registration Board; to provide for the functions and management of the Board; to provide for regulation and control of valuation profession and practice; and to provide for related matters.

This Act provides concerning the process in which the value of an interest in real property is assessed by a registered valuer (section 25-(1)). The Act requires every registered valuer or person practising valuation to comply with guidance on valuation practice set out under this Act and Regulations made under this Act. The carrying out of valuation shall be for the specified purposes including, among other things: (a) rating; (b) compensation; (c) land rent assessment; (d) probate and administration; (e) capital gains tax; (f) sale or purchase; (g) mortgage; (h) rental value assessment.

Section 51-(1) of the Act guides on the methods to be applied to the valuation process and states that a registered valuer shall apply the appropriate method of valuation and shall include-

a) Direct market comparative method.
b) Replacement cost or contractors test method.
c) Income approach or investment method.
d) Profit method; and
e) Residual method.

With regards to the cut-off date section 53-(1) states explicitly that, the cut-off date shall be the date of commencement of valuation.

The Local Government (District Authorities) Act, 1982

This Act provides for a detailed responsibility for the District Councils on the administration of day-to-day activities within its area of jurisdiction. The Act applies to every district authority established under the Act.

Part V of the Act provides for the functions of the local government authorities. Under Section 111 the following basic functions are spelt out.

(a) to maintain and facilitate the maintenance of peace, order and good governance within its area of jurisdiction.
(b) to promote the social welfare and economic well-being of all persons within its area of jurisdiction.

(c) Subject to the national policy and plans for rural and urban development, to further the social and economic development of its area of jurisdiction.

Section 118 (1) states that in addition, to the functions and duties conferred or imposed on local government authorities under section 111, it shall be the function of every district council, concerning its area of jurisdiction - '(a) "to formulate, coordinate and supervise the implementation of all plans of the economic, commercial, industrial and social development in its area of jurisdiction.

The Mining Act, 2010 and amendments of 2018

This Act is set to provide amendments to the principal act of 1998. The main objective of the act is to make amendments to the provisions that regulate the law relating to the physical search for minerals, processing and dealing in minerals. The Act also puts forward the procedures for granting, renewal and termination of mineral rights, payment of royalties, fees and charges.

Part II Section 95 (1) of the Act allows any person engaged in construction works related to roads, dams, tunnels, aerodromes and similar public act to use minerals as building materials provided an approval is obtained in writing from the Minister.

This act is highlighted here because the proposed project will traverse different areas with mining activities. The project will also require crushed rock materials for the construction of the 400kV transmission line, as well as the construction of the access roads will have to be quarried. The project will be required to adhere to the provisions of this Act.

The Explosive Act No. 56 of 1963

This Act was set to allow for better provision of control measures for the manufacture, import export, purchase, sale, possession, use and disposal of explosives

Of relevance to the construction activities of the 400kV transmission line are sections 40 to 43 under Part VIII on use of explosives. The provisions require any person supervising or carrying out any blasting activities to be in possession of a blasting certificate. It is preferred that the experienced person at the blasting operations to be the holder of this certificate and in cases where he/she is not directly doing the blasting, he/she still is required by this Act to supervise the operations.

Section 42 (1) indicates the clear role of an inspector in issuing and renewing blasting certificates and his role in assessing the applicant before renewal of this certificate. Both these processes require payment of a prescribed fee.

Finally, under the use of explosives, the responsibility is placed on every employer of labour, manager, foreman and other persons in charge of labour to ensure every holder of a certificate has a copy of this Act (English or Swahili versions) and that regulations regarding blasting operations are followed. For the proposed project this applies to use of material from any quarry and borrow pit where blasting is to be employed.

The Land Use Planning Act No. 6 of 2007

This Act governs matters that are related to the preparation, administration and enforcement of land use plans. It provides for the procedures for preparation, administration and enforcement of land use plans; to facilitate an orderly management of land use, empower land occupiers and users to make better and more productive use of lands, to enhance security and equity in accessing land and its resources.

TANESCO will observe the provisions of this act in conjunction with the Land Act and Village Land Act in the process of acquiring the land for the proposed 400kV transmission line project. Additionally, the proponent will abide by adhering to the existing plans and provisions at different administrative levels during designing and planning of the transmission line and associated facilities/infrastructures.

The Urban Planning Act No. 8 of 2007

The Act provide for the orderly and sustainable development of land in urban areas to preserve and improve amenities. It provides for the grant of consent to develop land and powers of control over the use of land. The act also provides for procedures for enforcement of Urban Planning; address different issues related to urban planning and to promote conservation and environmental protection to enhance social justice in the acquisition of land for planning purposes. Project developer will comply with the requirements stipulated in the act especially during construction phase of the project.

The Engineers Registration Act No. 15 of 1997 R.E. 2002

This is an act, which formed the Engineers Registration Board, a statutory body with the responsibility of monitoring and regulating engineering activities and the conduct of engineers and engineering consulting firms in Tanzania through registration of engineers and engineering consulting firms.

The 400kV transmission line project is an engineering assignment and TANESCO is observing all the requirement of this act through engaging qualified personnel and firms that are registered with the Engineers Registration Board.

The Contractors Registration Act No. 17 of 1997 [R.E 2002]

The act provides for registration of contractors and establishment of the Contractors Registration Board, the body responsible for regulating the conduct of contractors in Tanzania. Project proponent will ensure that registered contractors are undertaking works; and that the works comply with all governing regulations and laws of the country.

The Standards Act No. 2 of 2009

An act to provide for the promotion of the standardization of specifications of commodities and services, to re-establish the Tanzania Bureau of Standards (TBS) and to

provide better provisions for the functions, management and control of the Bureau, to repeal the standards Act, Cap.130 and to provide for other related matters.

This act is relevant to this project as the quality of all the construction materials and other products (both local and imported) shall have to abide to the standards set by TBS.

The Workers Compensation Act, 2008

The act governs adequate and equitable compensation for all employees on grounds of injury, rehabilitation for occupational illnesses or injury and compensation to dependents and relatives upon fatality. The Act subsumes international standards and frameworks for compensation and promotion for prevention of accidents and occupational diseases.

Employment contracts for all labour engaged in the proposed transmission line project must stipulate compensation arrangements for incidental work-related injury or sickness.

The Occupational Health and Safety Act No. 5 of 2003

The Act provides for safe access to and a safe workplace (Section 43 (1)). In view of these specific provisions and the Act in general the contractor and Proponent are obliged to ensure a safe working environment for all its workers, provide clean and safe water, as well sanitary and first aid services. The Act also provides for the protection of persons other than those at work against hazards to health and safety arising out of or in connection with activities of persons at work.

TANESCO and the contractor of this project will adhere to the safety standards laid out in the legislation and guidelines in addition to their own company policies which need to be presented to the Occupational Health and Safety Authority (OSHA).

The Water Supply and Sanitation Act, 2019

The act provides for sustainable management and adequate operation and transparent regulation of water supply and sanitation services to community owned water supply organizations and other service providers. Section 52 ensures that one is liable to a fine of at least 1 million Tanzanian shillings or jail time for a period of 12 months or both, if deposits of any earth, material or liquid used are permitted to wash away and carried into the waterworks. During project implementation, TANESCO will abide with the provisions of this act.

The Water Resources Management Act No.11 of 2009

The water resources management Act of 2009 enacted to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled. The legislation defines water as all water flowing over the surface of the ground or contained or flowing or from a spring or stream or natural lake, swamp or beneath a watercourse.

Section 9 requires any proposed development in water resource area or watershed to which this Act applies, whether that development is proposed by or is to be implemented by a person or organization in the public or private sector shall carry out an Environmental Impact Assessment in accordance with the provisions of the EMA, 2004.

Article 39 elaborates on the need to prevent pollution and the penalties to be taken against one who pollutes the water resources. Section 63(1) stipulates that a Discharge Permit is required for any person who wishes to discharge effluents from any commercial, industrial or agricultural source or from any sewerage works or trade waste systems or from any other source into surface water or underground strata. The discharge permits is to be granted by a Water Officer.

The act also contains two schedules which, set standards for receiving waters and effluents. The new Act also emphasises the need to protect aquatic biological diversity stipulating a need for integrated planning and management of ground and surface sources.

If at any point, some of the water bodies around the project area are used as sources of water, the contractor and TANESCO will ensure that the requirements of the act are observed. The project also shall be implemented with due consideration to avoid pollution or mismanagement of water sources.

The HIV and AIDS (Prevention and Control) Act No.28 of 2008

This Act requires the employer, in consultation with the responsible Ministry, to establish and coordinate a workplace programme on HIV and AIDS for employees under the proponent's control and such programme shall include the provision of gender-responsive HIV and AIDS education, the distribution of condoms and support for people living with HIV and AIDS.

TANESCO and contractor, therefore, shall be responsible for raising the awareness of its workers of the causes, modes of transmission, the consequences, prevention and control of HIV and AIDS. The construction workers are likely to interact with the local communities, hence increasing chances or risks of HIV/AIDS and STIs. Thus, the contractor will be required to develop and implement HIV/AIDS prevention and control programme during construction.

The Public Health Act, 2009

The central theme of this Act is to provide for the promotion, preservation and maintenance of public health with a view to ensuring the provisions of comprehensive, functional and sustainable public health services to the general public and to provide for other related matters. Major issues addressed in this Act include operation of housing and hygiene, human settlements, solid and liquid waste, food and nutrition, control of diseases and workers' health. The Act specifies that a person shall not dispose hazardous waste on land or in a water body unless the Environmental Health Impact Assessment is carried out in accordance with the Environmental Management Act.

The ESIA study has taken into consideration the potential impacts that the project may have on the public health and the appropriate mitigations have been outlined.

Antiquities Act (No. 22 of 1979) as amended in 2022

The Antiquities Act is the principal cultural heritage legislation in Tanzania. The purpose of the act is to provide legal statutes for the preservation and protection of sites and articles of paleontological, archaeological, historical, or natural interest. The act provides legal protection for relics, monuments, and protected objects.

Relic: any movable object made, shaped, painted, carved, sculptured, inscribed or otherwise produced or modified by human agency before the year 1863, whether or not it shall have been modified, added to, or restored at a later date, and any human or other vertebrate faunal or botanical fossil remains or impressions found in Tanganyika.

Monument: (i) any building, fortification, internment, midden, dam or structure erected, built, or formed by human agency in Tanganyika before the year 1863; (ii) any rock painting or any immovable object painted, sculptured, carved, incised, or modified by human agency in Tanganyika before the year 1863; and (iii) any earthwork, trench, edit, well, cave, tunnel, or other modification of the soil or rock, dug, excavated, or otherwise engineered by human agency before the year 1863.

Protected object: an ethnographic object or any wooden door or door frame carved in Tanganyika in any African oriental style, before the year 1940, and includes any object declared to be a protected object. The Act and its subsequent amendments and implementing rules and regulations establishes the Antiquities Division within the Ministry of Natural Resources and Tourism as the cultural heritage regulator within Tanzania. The act empowers the Director of the Antiquities Division (the Director) to declare any place or structure of historical interest as a monument and acquire monuments and relics in accordance with other applicable legislation such as the Land Acquisition Act. The Director is responsible for listing protected monuments, relics, and objects in the national Gazette. The Act includes penalties for destroying or damaging protected monuments, relics, and objects listed in the national Gazette or any resource that could reasonably be assumed eligible for protection as a monument, relic, or protected object. The Act also requires any individual or organization that discovers a monument, relic, or protected object to report the discovery to an administrative officer, the Antiquities Division, and the Conservator or the Curator of the National Museum of Tanganyika.

The 400kV project will abide by all provisions of this act should relic, monument or protected object discovered in the project areas.

Employment and Labour Relations Act No 6 of 2004

This Act aims at promoting economic development through economic efficiency, productivity and social justice and provides a legal framework for effective and fair employment relations and prohibits the client from employing a child under the age of 14. The Act allows conditional employment for a child of 14 years of age to do light work

provided it does not affect the child's health status, development, school attendance or participation of the child in any form of training.

In addition to that the act caters to workers by providing minimum conditions of work and sections 6 (1) & 7 (1) further prohibit one from imposing/demanding forced labour and discrimination of those employed respectively. It requires every employer to promote equal opportunities in employment.

Section 9 and 10 of the Act cater to the rights of employees and employers to both form and join any employee and/or employers' associations and participate in any activities within the associations provided that they are legal.

In addition to that, the Act looks at employee working hours for day and nighttime and sets standards for rest periods. Unless set on an agreement an employer should not over-work an employee and he/she cannot require an employee to work more than 12 hours in any day. Restrictions and rights to strike and lockouts are also addressed in Part VII Section 75 to 85 of the Act.

The contractor and TANESCO will abide to the legal requirements within this act by abiding to the adequate provision for rights of all employees to the project.

The Persons with Disability Act, 2010

The Act outline basic principles such as respect for human dignity; non-discrimination; full and effective participation and inclusion of persons with disabilities in all aspects in the society; equality of opportunity; as well as accessibility to education, physical places and information.

Thus, the Act promotes health care, social support, accessibility, rehabilitation, education, vocational training, communication, employment, work protection, and basic rights to all persons with disabilities.

The relevance of this act to the project is to allow and give priorities to disabled persons whenever they are qualified to work and not disregard their abilities to perform certain jobs in which they are qualified.

6.3
Subsidiary Legislations

Environmental Management (EIA and Audit Regulations) (Amendment), 2018

The Environmental Impact Assessment and Audit Regulations (2005) were developed following the Environmental Management Act (2004). The regulations provide the basis for undertaking Environmental Impact Assessments and Environmental Audits for various types of development projects with significant environmental impacts.

The regulations provide the procedures and requirements for undertaking EIA for various types of development projects with significant environmental impacts. In addition, the Regulations provide a list of projects that qualify for Environmental Assessment procedures in Tanzania. Regulation 4 Part III classifies projects into four types: (I) Type "A" Projects requiring a mandatory EIA; (ii) Type B1- Borderline projects; Type B2 - Projects that are not mandatory and a category for Special Projects.

The Fourth Schedule of Regulations provides steps that must be taken to conduct an EIA and Regulation 16 directs the EIA study to take into account environmental, social, cultural, economic and legal considerations as well as identify environmental impacts, analyse project alternatives, propose mitigation measures to be taken during and after implementation of the project and develop an environmental management plan with mechanisms for monitoring and evaluating the compliance and environmental performance which shall include the cost of mitigation measures and the time frame of implementing the measures.

Regulation 7 establishes that electricity production and distribution projects require an environmental impact assessment (EIA). Regulation 22 specifically mentions resettlement and relocation of people and animals as activities that should undergo a mandatory environmental impact assessment (EIA).

Article 18 establishes the minimum content for the environmental impact statement.

The Council shall within fourteen days of the receipt of the environmental impact statement submit a copy to any relevant Ministry and public institution and shall notify and invite the public for comment. Upon receiving the environmental impact statement, the Ministry and public institution shall review the report to ensure that it complies with the terms of reference and send the comments to the Council (art. 23). The Council shall undertake review of an environmental impact statement (art. 24).

The Council may arrange for on-site visits with the developer or proponent for purposes of inspecting the project or undertaking which is the subject of review (art. 25). The Council shall consider an environmental impact statement, and all the comments received and shall proceed to determine whether to hold or not to hold a public hearing (art. 26). Upon completion of the review process, the Council shall prepare a report on the review of environmental impact statement and submit it to the Minister (art. 30). Where the Minister approves an environmental impact statement, he shall issue an environmental impact assessment certificate (art. 34).

Environmental Management (Water Quality Standards) Regulations, 2007

The Environmental Management (Water Quality Standard) regulation, 2007 mainly focuses on three areas of water management namely, Minimum quality standards and prohibitions, discharge permits, compliance and enforcement. In terms of set minimum water quality standards important clauses are; part 6 (1) which states " No person shall discharge any hazardous substance, chemical, oil or mixture containing oil in any waters

except in accordance with what is prescribed under these regulations or any other written law".

Other sections of this regulation relevant to the construction work is 18 (1) that relates to "duty to comply with environmental quality standards" which stressed the importance of complying to the standards outlined in these regulations such as prohibition of the discharge of hazardous substances, and any other harmful materials.

TANESCO and contractor henceforth shall comply with the provisions of these regulations to minimise potential negative impacts of the project activities on groundwater and nearby surface water sources.

Environmental Management (Air Quality Standards) Regulations, 2007

These regulations provide insight into issues regarding compliance to minimum air quality standards, air pollutants emission permits, air quality compliance and enforcement and the offenses and penalties for not complying with the requirements of the regulations.

The National Environmental Standards Committee is the body responsible for establishing criteria and methods for measurement of air quality. It also sets standards for different pollution sources and provides guidelines for controlling air pollution from both stationary and mobile sources.

Section 8 (1) of the regulations clearly prohibits release of hazardous substances, chemical, gas or mixture containing gaseous and hazardous substances into the environment unless the release or emission is permitted under these regulations.

The regulations have four schedules that are relevant to the transmission line project:

Schedule 1: Permissible weight concentration of emission limits from the atmosphere to a receptor and respective test methods are provided in this schedule to limit emissions with sulphur oxides, carbon monoxide, black smoke, nitrogen dioxide, ozone, black smoke and suspended particulate matters.

Schedule 2: Highest permissible quantity of emission and test methods. These limits are set for any person undertaking an activity that might emit sulphur oxides, carbon monoxide, hydrocarbon (as total organic carbon), dust, nitrogen oxides or lead.

Schedule 3: Tolerance limits of inactive dust, oxides of nitrogen and sulphur dioxide emissions from cement factories into the air.

Schedule 4: Emission limits for motor vehicles. Therefore, a person owning, driving or controlling motor vehicles has to ensure that the vehicle comply with permissible limits of substances found in exhaust emissions of motor vehicles and as specified in this particular schedule of the regulations.

Environmental Management (Standards for the Control of Noise and Vibration Pollution) Regulations, 2011

These regulations are set to provide for the implementation of sections of the EMA (2004) related to noise and vibration pollution. According to section 4 of the regulations the National Environmental Standards Committee is the body responsible for setting the standards for the control of noise and vibration pollution and ensuring the standards are published.

They also establish noise levels and noise emission standards applicable to construction sites, plants, machinery, motor vehicles, and aircrafts, including sonic booms, industrial and commercial activities.

Abatement and control measures from construction sites have standards that are also established by the National Environmental Standards Committee, and they also measure the levels of noise from the construction sites.

The maximum permissible noise levels for some activities are specified in the First Schedule of the regulations; and specific to construction sites is 75 dBA and 65 dBA during the day and night respectively. The contractor and TANESCO will adhere to the provisions of this regulation.

Environmental Management (Solid Waste Management) Regulations, 2009

These regulations provide for the implementation of the EMA (2004). The regulations are guided by three principles; the precautionary principle, the polluter pays principle, and the producer extended responsibility principle. Local governments enforce these regulations.

Regulation 53 makes it clear that any permits or licenses for activities under these regulations do not automatically cancel of the legal requirement of an environmental impact assessment certificate for projects requiring it.

Schedule 1 of the regulations highlights the types of waste and recommended modes of treatment for the same. To mention a few, schedule 1 suggests that plastic waste should be recycled, and any industrial solid waste should be incinerated at high temperatures. The contractor and TANESCO will comply with these regulations when dealing with solid waste.

Environmental Management (Hazardous Waste Control and Management) Regulations, 2009

These regulations look at hazardous waste management and handling, trans-boundary movement of hazardous waste, biomedical wastes, pesticides and toxic substances, radioactive substances and industrial and consumer chemical waste.

Part III of the regulations provide a classification of hazardous waste and a guidance on how to label, package, transport and storage. This part of the regulations also stressed on issues regarding obtaining of licenses for either disposal of hazardous wastes or operation of a waste treatment plant.

An EIA Certificate and an emergency plan are required for any person applying for a license for disposal or treatment of hazardous waste. In relation to the project, should industrial chemical waste be used or transported during the operation phase, these regulations will need to be observed.

The Environmental Management (Control and Management of Electrical and Electronic Equipment Waste) Regulations, 2021

These Regulations apply to all categories of electrical and electronic equipment wastes with respect to generation, collection, storage, transportation, importation, exportation, distribution, selling, purchasing, recycling, refurbishing, assembling, dismantling and disposal of electrical and electronic equipment waste or components, and their movement into or outside Mainland Tanzania.

These regulations defined “electrical and electronic equipment” to mean equipment which is dependent on electric currents or electromagnetic fields to be fully functional. It also defined “electrical and electronic equipment waste or e-waste” to mean waste resulting from electrical or electronic equipment, whole or in part or rejects from their manufacturing and repair process, which are intended to be discarded. The regulations provide also procedures for handling electrical and electronic equipment and their associated waste which this project will generate during construction and operation phases.

The Urban Planning (Planning and Space Standards) Regulations, 2018

These regulations defined "Urban Planning Space Standards" to include standards for residential areas, unplanned settlements, building height, building lines and setbacks, floor are, plot coverage and plot ratio, health facilities, education facilities, recreation facilities, beach facilities, golf course, passive and active recreation, public facilities by planning levels, public facilities by population size, parking and road width and agricultural show grounds.

Schedule 13 provides for minimum planning and space standards for electric supply substations (200m x 200m) and schedule 14.1 provide for planning and space standards for public utility way leaves electricity supply (30m distance from centre line). The 400kV transmission line project will abide with the provisions of these regulations and its relevant schedules.

Land (Assessment of the Value of Land for Compensation) Regulations, (2001)

These regulations guide in determining compensation, providing the basis for assessment of the value of any land taking into consideration unexhausted improvements. Unexhausted improvements are defined under the Land Act Cap 113 R.E 2019 as:

Anything or any quality permanently attached to the land directly resulting from the expenditure of capital or labour by an occupier or any person acting on his behalf and increasing the productive capacity, the utility, the sustainability of its environmental quality and including trees, standing crops and growing produce whether of an agricultural or horticultural nature.

These regulations state that "the basis for assessment of the value of any land shall be the market value of such land". Market value is arrived at through the comparative assessment of recent sales of similar properties, or assessment of income or replacement cost. The assessment of the value of land and any improvements must be undertaken by a Qualified Valuer and verified by the Chief Valuer of the Government.

According to the Regulation, the following are eligible for compensation /resettlement:

- Holder of the right of occupancy.
- Holder of customary right of occupancy whose land has been declared a hazard land.
- Holder of customary land who is moved or relocated because his/her land is granted to another person.
- Holder of land obtained as a consequence of disposition by a holder of granted or customary right of occupancy, but which is refused a right of occupancy; and
- Urban or peri-urban land acquired by the President.

Regulation 7 of these regulations' states that compensation for the land shall include the value of unexhausted improvement, disturbance allowance, transport allowance, accommodation allowance, and loss of profits. If the right holder does not agree with the amount or method of payment or is dissatisfied with the time taken to pay compensation, he/she may apply to the High Court. The High Court determines the amount and method of compensation payment and determines any additional costs for inconveniences incurred.

Land (Compensation Claims) Regulations (2001)

These regulations outline parties that can claim compensation for loss of land and define the role of the Commissioner for Land in publishing a public notice notifying the land occupant of their right to claim compensation. Regulation 7 states that the Commissioner must also initiate the valuation process for compensation.

Regulation 10 states that compensation can take two forms: monetary compensation; or at the option of the government, compensation shall form all or a combination of the following:

- The plot of land of comparable quality, extent and productive potential to the land lost.
- Building or buildings of comparable quality, extent and use comparable to the building or buildings lost.
- Plants and seedlings; and
- Regular supplies of grain and other basic foodstuffs for a specified time.

Village Land Regulations (2001)

This Act is implemented through the Village Land Regulations, which are divided into seven sections: Preliminary; Management and Administration; Compensation; Joint Management of Village Land; Register of Village Land; Adjudication; Miscellaneous.

The compensation process outlined in Regulation 3 has the same principles as those set out under the Land (Assessment of the Value of Land for Compensation) Regulations. There is more detail in terms of compensation claims, assistance to prepare claims and acceptance of claims as well as mediation on claims and forms of compensation (all contained within Regulations 20 to 25 of the Regulations). Regulations 25 describes the forms that the claims may take.

Valuation and Valuers (General) Regulations (2018)

The Valuation and Valuers Registration Act No. 7 of 2016 is implemented through the Valuation and Valuers (General) Regulations. Party III Regulations 10-11 These regulations outline, Assessment of value for compensation and define roles for the registered valuer and chief valuer; Preparation of assessment of value for land –All of the land and unexhausted improvements of this Act shall be prepared by a Registered Valuer. Verification and approval of value for land as such; every assessment for land and unexhausted improvements for payment of compensation shall be verified and approved by the Chief Valuer.

Regulation 54 under Part IX describes the compensable items which include land, and all unexhausted improvements permanently affixed to land. The execution of project RAP abides by the Regulations.

6.4
Applicable International Standards

Various international standards related to social and environmental are applicable in this project as presented in below sub-sections. The main instrument which needs to be followed in this project is the World Bank Environmental and Social Standards (ESS).

<u>World Bank Environmental and Social Standards (ESS)</u>

The Environmental and Social Standards (ESS) set out the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts associated with projects supported by the Bank through Investment Project Financing.

The Bank believes that the application of these standards, by focusing on the identification and management of environmental and social risks, will support Borrowers in their goal to reduce poverty and sustainably increase prosperity for the benefit of the environment and their citizens. The standards aim at the following: (a) support Borrowers in achieving good international practice relating to environmental and social sustainability; (b) assist Borrowers in fulfilling their national and international environmental and social obligations; (c) enhance non-discrimination, transparency, participation, accountability and governance; and (d) enhance the sustainable development outcomes of projects through ongoing stakeholder engagement.

The Bank requires that the Borrower and the project apply the ESS through the project life cycle to manage environmental and social risks and impacts so that development opportunities are enhanced. The Bank ESS are summarised below:

- ESS 1: Assessment and Management of Environmental and Social Risks and Impacts.
- ESS 2: Labour and Working Conditions.
- ESS 3: Resource Efficiency and Pollution Prevention and Management.
- ESS 4: Community Health and Safety.
- ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement.
- ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- ESS 7: Sub-Saharan African Historically Underserved Traditional Local Communities.
- ESS 8: Cultural Heritage.
- ESS 10: Stakeholder Engagement and Information Disclosure.

The World Bank Environmental and Social Standards (ESS), and each of their applicability to the proposed project and this ESIA, are outlined in the below Table.

<u>WBG General Environmental, Health, and Safety Guidelines, April 2007</u>

The World Bank Group (WBG) General Environmental, Health, and Safety (EHS) Guidelines were established to set performance levels and measures for environmental, health, and safety hazards that clients and borrowers of the World Bank Group must meet. These guidelines are designed to ensure that projects funded by the World Bank Group adhere to high standards of environmental protection, health, and safety. Key points of the guidelines include:

- Performance Levels: The guidelines outline acceptable performance levels and measures for various environmental, health, and safety hazards.
- Good International Industry Practice (GIIP): The guidelines provide examples of good international industry practice, which are considered achievable in new facilities at reasonable costs by existing technology.
- Host Country Regulations: When host country regulations differ from the EHS Guidelines, projects are required to meet whichever is more stringent.

- Industry-Specific Examples: The guidelines include both general and industry-specific examples to help clients and borrowers implement best practices.

This guide was used to ensure that both the assessment of impacts and risks, and especially the mitigation measures, are in line with international best practice.

Construction and decommissioning phases of power transmission and distribution systems are provided in the General EHS Guidelines. Examples of the impacts addressed in the General EHS Guidelines include: (i) Construction site waste generation; (ii) Soil erosion and sediment control from materials sourcing; (iii) areas and site preparation activities; (iii) Fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles); (iv) Noise from heavy equipment and truck traffic; (v) Potential for hazardous materials and oil spills associated with heavy equipment operation and fuelling activities.

WBG Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, April 2007

The World Bank Group (WBG) Environmental, Health, and Safety (EHS) Guidelines for Electric Power Transmission and Distribution (April 2007) provide performance levels and measures for environmental, health, and safety hazards in the electric power transmission and distribution sector. These guidelines are designed to ensure that projects funded by the World Bank Group adhere to high standards of environmental protection, health, and safety.

Environmental issues during the construction phase of power transmission and distribution projects specific to this industry sector include the following: (i) Terrestrial habitat alteration; (ii) Aquatic habitat alteration; (iii) Electric and magnetic fields; (iv) Hazardous materials.

Community health and safety impacts during the construction and decommissioning of transmission and distribution power lines are common to those of most large industrial facilities and are discussed in the General EHS Guidelines. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable diseases associated with the influx of temporary construction labour. In addition to general health and safety standards outlined in the General EHS Guidelines, the operation of live power distribution lines and substations may generate the following industry-specific impacts: (i) Electrocution; (ii) Electromagnetic interference; (iii) Visual amenity; (iv) Noise and Ozone; (v) Aircraft Navigation Safety.

This guide was used to ensure that both the assessment of impacts and risks, and especially the mitigation measures, are in line with international best practice.

Good Practice Note (GPN) on Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Major Civil Works Projects

The World Bank's Good Practice Note on Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works (first issued in February 2020) provides essential guidance for identifying, preventing, and responding to SEA/SH risks in the context of large-scale infrastructure projects. This GPN is applicable to this Project due to its scale, the use of a sizable temporary and migrant labour force, and its potential interactions with local communities, including vulnerable groups.

The GPN outlines recommended measures for Borrowers and contractors to mitigate SEA/SH risks, including but not limited to:

- Integrating SEA/SH provisions in procurement documents to ensure that contractors are contractually required to implement SEA/SH prevention and response measures;
- Developing and enforcing Codes of Conduct (CoCs) for workers that clearly prohibit SEA/SH and are actively communicated and monitored;
- Establishing grievance mechanisms that are SEA/SH-sensitive, confidential, and accessible to survivors;
- Training and capacity building for all personnel involved in project implementation, with specific modules on SEA/SH prevention and response;
- Engaging with communities through information dissemination and participation mechanisms that raise awareness and strengthen prevention.

Implementation of the GPN is aligned with the World Bank's Environmental and Social Framework, particularly ESS 2 (Labour and Working Conditions), ESS 4 (Community Health and Safety), and ESS 10 (Stakeholder Engagement and Information Disclosure). Its integration into project planning and execution enhances protection for vulnerable populations, promotes safe and respectful work environments, and strengthens overall project sustainability.

In the context of this ESIA, the principles of the GPN are incorporated in the risk analysis and mitigation strategy, particularly in regard to labour influx, workforce management, and stakeholder engagement processes.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts - sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing, to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs).	• **Applicable.** The project is a large transmission line that requires a full-scale ESIA, so the recommendations related to the process of assessing risks and impacts and establishing mitigation and compensation measures, including an environmental and social management system, will apply to both the construction and operation phases. This ESS1 is therefore applicable: • To identify, evaluate and manage the environmental and social risks and impacts of the project. • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. • To promote improved environmental and social performance of clients through the effective use of management systems. • To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that	The overarching laws governing Tanzania's environmental management are the National Environmental Policy (NEP) of 1997 and the Environmental Management Act (EMA) of 2004. The NEP, which is currently under review, enables sectoral and cross-sectoral policy analysis to mainstream environmental considerations into all aspects of planning and development, although the World Bank pointed out in its latest 'Tanzania Systematic Country Diagnostic (SCD)[1]' that the existing legislation also needs to be harmonized across sectors. The EMA outlines principles for management, impact and risk assessments, prevention and control of pollution, waste management, environmental quality standards, public participation, compliance, and enforcement. The NEP and EMA are implemented through secondary legislation, regulations, guidelines, standards, etc. However, not all the laws and documents necessary for implementation have yet been developed and/or adopted. While the EMA is the main instrument for environmental management, it is incomplete, with a significant number of secondary legislation pieces still required for its full implementation (e.g., regulations, rules, notices, orders, guidelines, and environmental quality standards). Elaborating these tools is key for the EMA to be fully effective and for Division of Environment (DoE) and NEMC to be fully empowered to carry out their mandate. Environmental Impact Assessment (EIA) became a legal requirement in Tanzania in 2004 under the Environmental Management Act (EMA). These instruments, which include the EIA, Environmental Audit, and Strategic Environmental Assessment (SEA), are currently in various stages of development and application. Regulations on environmental management in the country are mainly established under the National Environment Management Council (NEMC). The

[1] https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/510681488823616126/tanzania-systematic-country-diagnostic

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
	could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.	Environmental Impact Assessment and Audit Regulations of 2005 and its amendments of 2018, include a project categorization. ESIA is mandatory for Category "A", based on a Scoping Study that includes a proposed ESMP. The EMA (Section 83) requires that EIAs be done by qualified, experienced experts, following the code of conduct found in the Environmental Management (Registration and Practice of Environmental Experts) Regulations (2021). To ensure compliance, project must be issued an environmental license or permit, which confirms that all necessary E&S due diligence requirements have been fulfilled. NEMC also provides periodic oversight, monitoring the national portfolio of activities to ensure that no adverse cumulative effects are caused. Based on the above, this is a legal approach that is generally compatible with the fundamental objectives and principles of risk assessment required by the WB ESS1. However, there are some gaps to be highlighted. The ESIA process in Tanzania does take into account social issues in screening, impact assessment, and mitigation measures. Part of NEMC's screening criteria for ESIAs is to assess if impacts vary by social group or gender, and if resources are impacted that vulnerable groups depend upon. Additionally, there is currently an initiative within NEMC to better mainstream social issues such as gender and HIV/AIDS in the ESIA process. Vulnerable and marginalized groups are not explicitly included in the screening process for ESIA through EMA nor in the Tanzanian system for land acquisition and resettlement. Other than the constitutional provisions, Tanzania does not have any specific

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
		legislation on the freedom of access to various types of information, but the EIA and Audit Regulations have established that any project brief, ESIA, ToR, public comments, report of a person presiding at a public hearing, decision letter or any other information submitted to NEMC are all public documents accessible to all. There is no system in place that defines Indigenous Peoples in Tanzania. Regarding the E&S Management System, the *Tanzania Bureau of Standards (TBS) Management Systems Certification Body*, under Tanzania Bureau of Standards (TBS), provides an assessment based around the chosen standard of an organization e.g. ISO 9001, ISO 14001, ISO 45001 etc. The Certification Body will award a certificate to organizations to show that they have complied with the requirements set out in the standard.
ESS 2: Labour and Working Conditions – recognises the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth.	• **Applicable.** Especially during construction, the project will employ a significant amount of workforce, both those directly related to the project (i.e., to be hired by the contractor and subcontractors), as well as suppliers and service providers, for both the construction and operation stages. This ESS 2 is therefore applicable: • To promote safety and health at work. • To promote fair treatment, non-discrimination and equal opportunity for project workers. • To protect project workers, including vulnerable workers such as women, persons	*Occupational Safety and Health Authority (OSHA)* was established in 2001 under PMO-LYED to administer occupational health and safety at workplaces in the country. The enforcement of occupational health and safety standards (*Occupational Health and Safety Act No. 5, 2003*) is accomplished through: (i) workplace registration; (ii) undertaking statutory inspections (electrical inspection, pressure vessels inspection and lifting equipment inspection); (iii) risk assessment; (iv) training and information on occupational health and safety; (v) scrutiny and approval of workplace drawings/ plans. Other activities include; diagnosis of occupational diseases; occupational health surveillance, work environment monitoring, investigation of accidents; authorization of private OHS Providers. However, an important requirement, established by ILO Convention 155 on the right of workers to refuse unsafe work, has not been adopted by Tanzania's H&S regulations. The Occupational Safety and Health (Building and Construction Industry) Rules, 2015, include regulations aimed at ensuring the safety and health of workers in the

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
	with disabilities, children (of working age, under this ESS) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate. • To prevent the use of all forms of forced labour and child labour. • To support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. To promote safety and health at work.	building and construction sector. These rules cover various aspects such as: (i) Safety Measures: Guidelines on the use of personal protective equipment (PPE), safe operation of machinery, and handling of hazardous materials; (ii) Health Provisions: Requirements for sanitation, access to clean drinking water, and medical facilities on construction sites; (iii) Training and Supervision: Mandates for proper training of workers and the presence of qualified supervisors to oversee safety practices; (iv) Accident Reporting: Procedures for reporting and investigating accidents and incidents on construction sites; (v) Inspection and Compliance: Regular inspections by authorities to ensure compliance with safety standards. In general, it can be concluded that this legislation is compatible with the fundamental requirements of the WB ESS2 and WB/IFC General EHS Guidelines, 2007. The maximum permissible exposure limits for workers to occupational agents must comply with those recommended by the ACGIH. The ESIA process involves procedures for worker safety, requiring plans for accident prevention as well for health and safety of workers and communities, which should be also part of the contracts for civil works. The Occupational Health and Safety Act and TANESCO's safety instructions cover workplace and electrical safety. TANESCO publishes a brochure on electrical safety that is also available on its website. Based on the above, it can be concluded that worker health and safety is adequately covered in the EMA and its regulations, the OSHA Act, TANESCO's safety instructions, and the Contractor Registration Board (CRB)[2] and there are no major inconsistencies between the WB ESS 2.

[2] Tanzania has a Contractor Registration Board (CRB) that enforces best practice and monitors and enforces occupational health and safety regulations regarding construction works. The Rules of Conduct require that contractors must keep accident registers, and provide workers with protective gear, and standards for construction sites and post warning signs visible to the public and workers about requirements for personal protective equipment.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
		Building on land where there is a risk of encountering mines or bomb remains requires strict adherence to safety protocols to protect workers and the public. When working in such areas, organizations and individuals must be aware of the physical threats posed by a huge variety of armaments left during and after armed conflict. In northwestern Tanzania, particularly near the border with Uganda, the Kagera Region is one of the areas most at risk of finding mines or bomb remnants. This region was significantly affected during the Uganda–Tanzania War (1978-1979), where heavy fighting and military activities took place. The Landmines, Explosive Remnants of War and Improvised Explosive Devices Safety Handbook (3rd Edition 2015) draws upon information found in International Guidelines for Landmine and Unexploded Ordnance Awareness Education developed by the United Nations Children's Fund (UNICEF) in 1999, and International Mine Action Standards published by the United Nations (www.mineactionstandards.org). The Landmine, Explosive Remnants of War and Improvised Explosive Devices Safety Handbook is part of the UNMAS. Regarding labour conditions, *Employment and Labour Relations Act, Act No. 6 of 2004* and the *Labour Institutions Act, Act No. 7 of 2004*, sets out provisions for fundamental rights and protections, which include forced labour, child labour, discrimination, and freedom of association. It also sets out employment standards, wage parameters, working hours, and dispute regulations, among others, and is therefore generally compatible with WB ESS2. *Section 7 of the Employment and Labour Relations Act (2004)* prohibits direct and indirect discrimination in the workplace including discrimination based on sex, gender, pregnancy, marital status, disability, HIV/AIDS, and age. Sexual harassment is also prohibited as articulated in Section 7(5). The law also prohibits night work for pregnant mothers under certain circumstances, whilst guaranteeing

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
		the right to maternity leave for mothers and paternity leave for fathers. This objective intended to strengthen the implementation of national ILO Minimum Labour Standards, and therefore compatible with the WB's ESS2. *Law of the Child Act (2009):* The act provides standards for identifying, referring, and responding to cases of child abuse and other forms of violence. They incorporate the essential elements required to build a protective environment, including a child-friendly justice system. Child abuse is defined in detail as "contravention of the rights of the child which causes physical, moral or emotional harm including beatings, insults, discrimination, neglect, sexual abuse and exploitative labour", thus being generally compatible with WB ESS2. *National Mechanism on Gender Based Violence/Sexual Exploitation and Abuse* include a set of policies and laws that emphasize and provide strategies for gender equity in all aspects of social, political and economic life; gender equity in decision making; rights of the girl child to education; protection of minors against sexual abuses and other forms of violence; and establishment of anti-VAWC platforms at the community level, thus being generally compatible with WB ESS2.
ESS 3: Resource Efficiency and Pollution Prevention and Management - recognises that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels.	• **Applicable.** The project's construction, operation and decommissioning activities will generate waste and effluents, as well as potentially generating temporal impacts of noise, dust and vibrations, which are regulated by ESS3 and will be applicable: • To promote the sustainable use of resources, including energy, water and raw materials.	Tanzania is party to several international agreements on pollution prevention that are referenced by WB ESS3, including: (i) Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (1989); (ii) Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and Their Destruction, London (1972); (iii) Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement and Management of Hazardous Wastes within Africa, Bamako, Mali (1991); (iv) Montreal Protocol on Substances that Deplete the Ozone Layer (1987); (v) United Nations Framework Convention on Climate Change (1983); (vi)Vienna Convention for the Protection of the Ozone Layer, in line with the WB ESS3 principles.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
	• To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • To avoid or minimize project-related emissions of short and long-lived climate pollutants. • To avoid or minimize the generation of hazardous and non-hazardous waste. • To minimize and manage the risks and impacts associated with pesticide use.	The Environmental Management Act (EMA) (Cap. 191) provides for legal and institutional framework for environmental management in the country. The Act mandates the Minister responsible for Environment to make regulations prescribing the best possible ways of handling hazardous and non-hazardous waste as provided in Section 133 (4) (a)-(h). Tanzania has made efforts, with the construction of sanitary landfills through the World Bank-financed Tanzania Strategic Cities project. Also, Tanzania has taken various initiatives towards addressing the challenge of hazardous waste including establishment of policies and legislations. However, as mentioned, Tanzania has not yet implemented secondary legislation, regulations, guidelines on environmental quality standards (except for the maximum permitted limits for noise emissions and air quality), and the maximum permissible limits for pollution control established by the WB/IFC General EHS Guidelines, 2007, should be adopted. The East African Community (EAC) published a draft standard for public consultation only in 2021 (DEAS 751:2021) which has not yet been made official. This draft Standard gives permissible limits of some common pollutants found in polluted air and covers both the ambient air quality and emission limits for several type of sources. The EAC Wastewater discharged on land and into water bodies — Specification Standard (DEAS 751:2021 / ICS: 13.040), published in 2023 has stablished the quality of wastewater permitted to be discharged on land and into water bodies. However, the maximum permissible limits for BOD, total suspended solids, total nitrogen and phosphorus and coliform bacteria, do not comply with the World Bank / IFC General EHS Guidelines, 2007 (table 1.3.1 Indicative Values for Treated Sanitary Sewage Discharges). It is therefore necessary for the project to adopt the WB/IFC standards, which are more restrictive and complete.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
		The Environmental Management (Standards for the Control of Noise and Vibrations Pollution, 2015) regulates noise and vibration levels, prescribing the maximum permissible noise and vibration levels. This legal standard is 5 dBA more restrictive during the day and 10 dBA more restrictive at night compared to the maximum limits adopted by the World Bank (WB/IFC General EHS Guidelines, 2007 - Table 1.7.1- Noise Level Guidelines[3]) for residential areas. In the case of sensitive receptors (according to local legislation, any building used as a hospital, convalescent home, home for the elderly, sanatorium and institutes of higher education, conference rooms, public library, environmental or recreational sites), the local standard is 10 dBA more restrictive than the reference adopted by the World Bank, both during the day and at night. The Environmental Management (Air Quality Standards) Regulations, 2007, set out baseline parameters on air quality and emissions and enforce minimum air quality standards for sulphur oxide, carbon monoxide, black smoke and suspended particulate matters, nitrogen oxide, ozone, hydrocarbons, dust and lead. Test methods for these are also specified. In the case of particulate matter (PM_{10}), the local standard sets a limit of 90 mg/m^3, while the World Bank (WB/IFC General EHS Guidelines, 2007 - Table 1.1.1: WHO Ambient Air Quality Guidelines[4]) sets a limit of 50 mg/m^3, and the World Bank standard, which is more restrictive, should be adopted. There is no local legal standard for $PM_{2.5}$ and the World Bank's maximum permissible limit of 50 mg/m^3 should be adopted. Environmental Management (Hazardous Waste Control and Management)

[3] Guidelines for Community Noise, World Health Organization (WHO), 1999.
[4] World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
		Regulations (2009) control all categories of hazardous waste and address generation, storage, transportation, treatment and disposal of hazardous waste and their movement into and out of Mainland Tanzania. They require hazardous waste management be guided by principles of environment and sustainable development namely, the precautionary principle; polluter pays principle; and the producer extended responsibility. The Regulations places responsibility to the generator of hazardous waste for the sound management and disposal of such waste and shall be liable for damage to the environment and injury to human health arising thereby. The regulations further recognize management and control of pesticides, radioactive and industrial and consumer chemical waste to regulated under respective legislation. The Local Government (Urban Authorities) Act No. 8 of 1982 and the Local Government (District Authorities) Act No. 7 of 1982, mandate Local Government Authorities, among others, to facilitate provision of sanitation and waste management services. In this regard, the management of hazardous waste is implicitly addressed although there is no specific reference to hazardous waste management issues. Being a Party to the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal and Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement of Hazardous Wastes within Africa, the country is also obliged to take necessary measures to ensure environmentally sound management of hazardous waste. Although these initiatives have been in place, challenges towards effective management and control of hazardous waste still exist. Inadequate enforcement of waste management laws and waste disposal facilities as a result the hazardous wastes are mostly disposed through the readily available means to the waste generator such as mixing with municipal waste; open dumping; incineration in Kiln

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
		plants and burning in self-designed incinerators. In some cases, hazardous and non-hazardous wastes are often not segregated; hence are mixed together with municipal waste at disposal sites. Also, there are minimal recovery and recycling activities for some types of industrial related waste materials. Regarding emergency response plans al national level, the Disaster Management Department (DMD), in the Prime Minister's Office (PMO) has the responsibility of identifying and anticipating hazards and to the greatest extent possible prepares plans to effectively respond to disasters so as to save lives and protect property. In order to effectively respond to disasters, the DMD through consultation with key stakeholders has developed a National Emergency Preparedness and Response Plan (TEPRP) that provides guidelines for coordination and response to all types of disasters and emergencies at all levels of the government. The TEPRP is a Multi-Hazards functional plan that sets forth appropriate actions to be taken in response to an emergency or major disaster including potential or imminent threat of any event. The TEPRP aims to facilitate the coordination for the delivery of resources and services necessary to deal with the consequences of an emergency or major disaster. The TEPRP describes the disaster situation and planning assumptions, concept of operations, response and recovery actions, organizational and specific assignments of responsibilities to the departments and government agencies tasked with local response efforts. The TEPRP conforms to the Disaster Relief Coordination Act, No. 9, of 1990 and the National Operational Guidelines for Disaster Management (NOG). The TEPRP has three main components namely: Basic plan, Functional Annexes, and Appendices. A basic plan serves as an overview of the government's approach to emergency management; Annexes describe specific activities critical to emergency preparedness and response; and Appendices support each Annex and contain technical information, details, and methods for use in emergency operations.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
ESS 4: Community Health and Safety - recognises that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration or intensification of impacts due to project activities.	• To anticipate and avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from both routine and non-routine circumstances. • To promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructures. • To avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials. • To have in place effective measures to address emergency events. • To ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.	There is no specific Regulatory Framework on community health and safety aimed at dealing with the impacts and risks generated by investment projects in the country. However, over the years, a wide range of community-based health programmes and initiatives have been carried out throughout the country, addressing critical health issues such as maternal, child and neonatal health, HIV and AIDS, Nutrition, Malaria, Tuberculosis and adolescent sexual and reproductive health. National Operational Guideline for Community-Based Health Services, 2021 outlines an integrated and coordinated national approach to community-based health services. The project must comply with the requirements of WB ESS 4, especially with regard to community risks related to construction work (excavation of trenches, intrusion of unauthorized personnel into risk areas, risks of transporting loads, property security), as well as the exposure of the surrounding community to electrical risks during operation (land use and occupation rules for the easement strip to ensure safe coexistence with the line and substations).
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement - recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons. Project-related land acquisition or restrictions on land use may cause physical displacement	• **Applicable.** The establishment of the wayleave will cause the physical and economic displacement of the population and therefore this ESS5 is applicable: • To avoid involuntary resettlement or, when unavoidable, minimize involuntary resettlement by exploring project design alternatives.	This analysis is presented in an independent document named "Project Resettlement Policy Framework (RPF)".

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
(relocation, loss of residential land or loss of shelter), economic displacement (loss of land, assets or access to assets, leading to loss of income sources or other means of livelihood), or both.	• To avoid forced eviction. • To mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use by: (a) providing timely compensation for loss of assets at replacement cost and (b) assisting displaced persons in their efforts to improve, or at least restore, their livelihoods and living standards, in real terms, to pre-displacement levels or to levels prevailing before the beginning of project implementation, whichever is higher. • To improve living conditions of poor or vulnerable persons who are physically displaced, through the provision of adequate housing, access to services and facilities, and security of tenure. • To conceive and execute resettlement activities as sustainable development programs, providing sufficient investment resources to enable displaced persons to benefit directly from the project, as the nature of the project may warrant. • To ensure that resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation, and the informed participation of those affected.	

Table 6.4.a
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World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
SS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources - recognises that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development.	• **Applicable.** The alignment will intercept both natural and modified habitat, including critical habitats, so this ESS 6 is applicable to: (i) protect and conserve biodiversity and habitats; (ii) to apply the mitigation hierarchy and the precautionary approach in the design and implementation, and (iii) to promote the sustainable management of living natural resources.	Apart from the provisions of the EMA, National Environmental Action Plan (2013-18), there are other sectoral laws that govern management of natural resources such as: Forest Policy 2007 and Wildlife Policy 200 among others. EMA regulations are straightforward about the objectives of an ESIA to protect natural systems (Part IV) - project screening criteria account for natural habitats, screens for projects in national parks, areas containing endangered flora and fauna, and scenic areas (Second Schedule). If impacts are found, mitigation measures are required in an ESIA. There are no significant inconsistencies between the World Bank ESS6 and Tanzania's policies, laws, and regulations related to natural habitats, however, the local legislation is not compatible with the concept of critical habitat and does not define clear rules for achieving no net loss in natural or modified habitat and net positive gain in natural habitat, and the requirements set out in WB ESS 6 must be observed. The local regulations provide for sustainable utilization of logs, timber, withies, poles or charcoal in the forest reserves including the Village Forest Reserves and community-based Forest Reserves. The regulations established a Committee known as the District Forest Produce Harvesting Committee, which is normally referred to as the District Committee. The District Committee is composed of different officials from the district level and the District Commissioner serves as a Chairperson. Only two officials, the Village Chairman and Executive Officer of the village where the forest produce is to be harvested represent the local communities in the committee. However, the regulations have no provisions on how the local communities will socially and economically benefit from sustainable utilization of logs, timber, withies, poles or charcoal.
ESS 7: Sub-Saharan African Historically Underserved	• **Not applicable.**	No applicable. The ESIA has confirmed that no Indigenous Peoples and Sub-Saharan African Historically Underserved or Traditional Local Communities exist

Table 6.4.a
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World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
Traditional Local Communities - applies to a distinct social and cultural group identified under paragraphs 8 and 9 of this ESS. The terminology used for such groups varies from country to country and often reflects national considerations. ESS7 uses the term "Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities,"1 recognizing that groups identified under paragraphs 8 and 9 may be referred to in different countries by different terms. Such terms include "Sub-Saharan African historically underserved traditional local communities," "indigenous ethnic minorities," "aboriginals," "hill tribes," "vulnerable and marginalized groups," "minority nationalities," "scheduled tribes," "first nations" or "tribal groups.	• The ESIA has confirmed that no Indigenous Peoples and Sub-Saharan African Historically Underserved or Traditional Local Communities exist in the Project area.	in the Project area.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
ESS 8: Cultural Heritage - recognises that cultural heritage provides continuity in tangible and intangible forms between the past, present and future.	• **Applicable.** The project will intercept terrain that has generally not been altered and regions where archaeological finds have been found in and around the direct area of influence - DAI (lithic remains from the Middle Stone Age (MAS) and the Late Stone Age (LFA), potsherds belonging to Early Iron Working (EIW) pottery and slags). Ritual sites were also identified on the DAI of the T-line. So ESS 8 is applicable: • To protect cultural heritage from the adverse impacts of project activities and support its preservation. • To address cultural heritage as an integral aspect of sustainable development. • To promote meaningful consultation with stakeholders regarding cultural heritage. • To promote the equitable sharing of benefits from the use of cultural heritage.	The Tanzanian ESIA process considers physical cultural resources, including screening for archaeological, historical and cultural sites. National guidelines include assessing impacts on sites of cultural, traditional, religious, and historical importance, the procedures outline that community consultations and communication with the Ministry of Natural Resources and Tourism's Department of Antiquities is required to develop mitigation measures. There are therefore no major gaps with the WB ESS 8.
ESS 10: Stakeholder Engagement and Information Disclosure - recognises the importance of open and transparent engagement between the Borrower and project stakeholders as an essential	• To establish a systematic approach to stakeholder engagement that will help Borrowers identify stakeholders and build and maintain a constructive relationship with them, in particular project-affected parties. • To assess the level of stakeholder interest and support for the project and to enable	*Public Participation and Accountability:* For those projects requiring a full ESIA, public availability of the documents is required by EMA. However, the actual process of public review and comment outlined in the law could be onerous and result in ESIAs being relatively inaccessible (e.g. payment of a fee to access documents). While consultations are required during the preparation of the ESIA between communities and the project proponent, public hearings are at NEMC's discretion during the ESIA review and approval process.

Table 6.4.a
World Bank Environmental and Social Standards (ESS) and main gaps against Tanzanian laws

World Bank Environmental and Social Standards (WB ESS)	Applicability to the UTIP Project	Gap analysis against Tanzanian laws
element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.	stakeholders' views to be taken into account in project design and environmental and social performance. • To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them. • To ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format. • To provide project-affected parties with accessible and inclusive means to raise issues and grievances, and allow Borrowers to respond to and manage such grievances.	*Grievance Redress Mechanism:* Under EMA, there is a grievance procedure with respect to decisions about granting the EIA certificate. There is no requirement that Environmental and Social Management Plans (ESMPs) include a mechanism for handling grievances, thus generating an important gap against WB ESS 10.

6.5
Other International Standards and Instruments

International Labour Organization (ILO) conventions

Tanzania has ratified several International Labour Organization (ILO) conventions. These conventions cover a range of issues including forced labour, freedom of association, equal remuneration, child labour, occupational safety and health, and maritime labour. A list of some of the key conventions that Tanzania has signed is presented below:

Fundamental Conventions

- Forced Labour Convention, 1930 (No. 29)
- Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
- Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- Equal Remuneration Convention, 1951 (No. 100)
- Abolition of Forced Labour Convention, 1957 (No. 105)
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- Minimum Age Convention, 1973 (No. 138)
- Worst Forms of Child Labour Convention, 1999 (No. 182)

Governance Conventions

- Labour Inspection Convention, 1947 (No. 81)

Technical Conventions

- Occupational Safety and Health Convention, 1981 (No. 155)
- Seafarers' Identity Documents Convention (Revised), 2003 (No. 185)
- Maritime Labour Convention, 2006 (MLC 2006)

ILO Tripartite Declaration of principles concerning multinational enterprises and Social Policy of 1977

The ILO Tripartite Declaration aims to encourage the positive contribution that multinational enterprises can make to economic and social progress and the realization of decent work for all. The declaration also requires the enterprises to minimize and resolve the difficulties to which their various operations may give rise. This aim will be attained by government efforts to develop appropriate laws and policies, as well as undertake necessary measures and actions to ensure sound economic and social progress is realized at all levels.

The principles of this Declaration are intended to guide governments, employers' and workers' organizations of home and host countries and multinational enterprises in taking measures and actions and adopting social policies, including those based on the principles

laid down in the national legal frameworks and other relevant Conventions to further social progress and decent work.

UN Framework Convention on Climate Change (UNFCCC)

The UNFCCC is a non-binding global agreement on climate change. It sets an overall framework for intergovernmental efforts to address challenges posed by climate change. It recognises that the climate system is a shared resource whose stability can be affected by industrial and other project activities that emit carbon dioxide and other greenhouse gases. The ultimate objective of the UNFCCC is to achieve stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate ecosystem. The UNFCCC together with the Kyoto Protocol provides legally binding emission reduction commitments for developed countries, which are relevant to ensure that project such as UTIP is implemented with less pollution and without endangering the ecosystem resources and services.

The Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD) is the international legal instrument for the conservation of biological diversity. It provides for sustainable use of its components as well as fair and equitable sharing of the benefits arising out of the utilization of genetic resources. The CBD covers biodiversity at all levels: ecosystems, species and genetic resources. It also covers all possible domains that are directly or indirectly related to biodiversity and its role in development, ranging from science, politics and education to agriculture, business, culture and much more. The CBD is relevant to the project and RAP processes to ensure the ecosystem services are preserved and any damage that occurred is restored.

The United Nations Declaration on the Rights of Indigenous Peoples

The declaration provides for the rights of the Indigenous peoples recognizing their rights to the full enjoyment, as a collective or as individuals, of all human rights and fundamental freedoms as recognised in the Charter of the United Nations, the Universal Declaration of Human Rights and international human rights law. It emphasizes that Indigenous peoples and individuals are free and equal to all other peoples and individuals and have the right to be free from any kind of discrimination, in the exercise of their rights, in particular, that based on their indigenous origin or identity.

Equally, Indigenous peoples have the right to self-determination. Under that right, they are free to determine their political, economic, social and cultural development. However, the project developer should consider that the situation of indigenous peoples varies from region to region and from country to country. The significance of national and regional particularities and various historical and cultural backgrounds should be taken into account as well.

The Declaration on the Rights of Persons Belonging to National or Ethnic, Religious and Linguistic Minorities

This declaration is inspired by the provisions of Article 27 of the International Covenant on Civil and Political Rights concerning the rights of persons belonging to ethnic, religious and linguistic minorities. Considering that the promotion and protection of the rights of persons belonging to national or ethnic, religious and linguistic minorities contribute to the political and social stability of the States in which they live. As such, States are obliged to protect the existence and the national or ethnic, cultural, religious and linguistic identity of minorities within their respective territories and shall encourage conditions for the promotion of that identity. The declaration is relevant to ensure that the project takes into account these rights that touch some of the project-affected persons along the alignment.

UNESCO - World Heritage Convention

Tanzania is a signatory to several UNESCO conventions that appeal to the safeguarding of cultural heritage. Among these is the 1972 UNESCO Convention concerning the Preservation and Protection of World Cultural and Natural Heritage ratified in 1977, the 2003 UNESCO Convention on the Safeguarding of Intangible cultural heritage ratified in 2011 and the 2005 UNESCO Convention on the Protection and Promotion of the Diversity of cultural expressions that was ratified in 2011. The process of land acquisition for the establishment of the proposed project shall observe the provision of the World Heritage Convention.

United Nations Mine Action Service (UNMAS)

UNMAS is mandated to coordinate the mine action work of the United Nations system as Chair of the Inter-Agency Coordination Group on Mine Action (IACG-MA) and its subsidiary groups, a responsibility established by the General Assembly (A/RES/72/75) and confirmed by the Security Council in SCR 2365 (2017). UNMAS is also the global lead for the Mine Action Area of Responsibility within the Global Protection Cluster, the Chair of the International Mine Action Standards (IMAS) Review Board and its Steering Committee and leads the United Nations Coordinating Task Force on a Whole-of-System Approach to IEDs, consistent with the Disarmament Agenda of the Secretary-General.

Building on land where there is a risk of encountering mines or bomb remains requires strict adherence to safety protocols to protect workers and the public. When working in such areas, organizations and individuals must be aware of the physical threats posed by a huge variety of armaments left during and after armed conflict. In northwestern Tanzania, particularly near the border with Uganda, the Kagera Region is one of the areas most at risk of finding mines or bomb remnants. This region was significantly affected during the Uganda–Tanzania War (1978-1979), where heavy fighting and military activities took place.

The Landmines, Explosive Remnants of War and Improvised Explosive Devices Safety Handbook (3rd Edition 2015) draws upon information found in International Guidelines

for Landmine and Unexploded Ordnance Awareness Education developed by the United Nations Children's Fund (UNICEF) in 1999, and International Mine Action Standards published by the United Nations (www.mineactionstandards.org). The Landmine, Explosive Remnants of War and Improvised Explosive Devices Safety Handbook is part of the UNMAS.

Institutional Framework

Institutional framework for this ESIA refers to administrative and institutional actors in which the project interacts and guided through. The administrative framework for environmental management in Tanzania is well articulated and structured in EMA, 2004.

All environmental issues in Tanzania are regulated, controlled and guided through the Minister for Environment and Union Affairs under the Vice President's Office (VPO). Under the Ministers' command is the Division of the Environment (DoE), which is the authority that issues all environmental guidelines, policies and certificates based on advice from the Technical Advisory Committee (TAC) at NEMC.

The EIA procedure and reports are reviewed by NEMC as are the management plans. Other ministries, sectors and departments are also involved as stakeholders in EIA process in particular central and local government, district and village authorities, NGOs, private and non-private institutions.

National Environmental Advisory Committee

The National Environmental Advisory Committee (NEAC) is composed of members whose experience reflect the various fields of environmental management in the public, private sector and the civil society.

The NEAC is responsible for advising the Minister or any sector ministry on any matter which may be referred to it, and in particular, it shall examine any matter which may be referred to it by the Minister or any sector Ministry relating to the protection and management of the environment and shall recommend to the Minister or the sector Ministry, as the case may be, such action as is necessary for achieving the objectives of EMA, 2004.

Technical Advisory Committee (TAC) review and advice the minister regarding the legal compliance of this ESIA.

Minister Responsible for Environment

Approval of EIA report is necessary to obtain an EIA Certificate. NEMC prepares terms and conditions for issuance of the EIA Certificate and recommends to the Minister responsible for Environment in the Vice President's office. The Minister in turn approves the projects by signing the EIA Certificates, as stipulated in EMA 2004 section 92 (1).

The minister is required to communicate decisions and the reasons thereof to the proponent in writing with reference to the EIA.

The EIA and Audit Regulations require that the decisions by the minister be made public. A copy of the decision document is supposed to be availed for inspection by the public at NEMC offices. The minister will sign the EIA certificate for the proposed 400kV transmission line project.

Director of Environment

The Director of Environment is appointed by the President of the United Republic of Tanzania and hosted at the Vice President's Office. There are three sections under his office (i) Biodiversity Conservation (ii) Environmental Management of Pollution and (iii) Environmental Assessment and Climate Change Management. The office of the director is responsible for the following:

- To co-ordinate and oversees Environmental Management Policy, Environment Management Act and EIA guidelines.
- To approve, sign and issue Environmental Certificate.
- To advise Government on all environmental matters.
- To enforce and ensure compliance with the national environmental quality standards.
- To provide policy direction and leadership in all matters, particularly those pertaining to hazardous waste management under the Environmental Management Act.

The office of the director will participate in the TAC meeting of the 400kV transmission line project and advice the minister responsible for environment regarding issuance of an EIA certificate.

National Environment Management Council

The National Environment Management Council (NEMC) came into being in 1983 when the Government of Tanzania enacted the National Environment Management Act No. 19 of 1983. NEMC was established with a broad mandate in response to the national need for such an institution to oversee environmental management issues and implement the resolutions of the Stockholm conference (1972), which called upon all nations to establish and strengthen national environmental Councils to advise governments and the international community on environmental issues.

The enactment of Environmental Management Act No. 20 of 2004 by Parliament in October 2004, repealed the National Environmental Management Act No.19 of 1983 and re-established NEMC. EMA 2004 provides for a legal and institutional framework for sustainable management of the environment, prevention and control of pollution, waste management, environmental quality standards, public participation, environmental compliance and enforcement. Furthermore, it gives NEMC mandates to undertake enforcement, compliance, review and monitoring of environmental impacts assessments, research, facilitate public participation in environmental decision-making, raise environmental awareness and collect and disseminate environmental information.

The project is already registered by NEMC and its ToRs approved. The council has also convened a Technical Advisory Committee meeting to review the ESIA report.

The Overall Management of the Project

TANESCO is the project proponent/developer and has the following responsibilities:

- Project investment and project cycle implementation, monitoring and auditing.
- Conducting ESIA study and follow-up on EIA certificate.
- Land acquisition and payment of compensations.
- Paying of applicable taxes and charges.
- Project operation and decommissioning.

Environmental and Social Permits Required During Project Implementation

Various permits/license and certificates will be required during project implementation. Project developer will request some of the permits such as ESIA certificate and construction permit. Other permits such water test and use, the contractor depending with needs and requirement of the contraction activities will request blasting permit etc. The following are some of the key permits/license and certificates that will be required during project implementation.

Table 6.5.a
Environmental and Social Permits Required During Project Implementation

S/N	Permit/certificate	Description	Responsible Institution/Authority	Timeframe
1	Environmental and Social Impacts Assessment (ESIA) Certificate	The certificate needed to comply with environmental and social impact that may be caused by project implementation	National Environment Management Council (NEMC)	3 to 6 months
2	Construction Permit	For the compliance with construction activities	TANESCO	Within a month
3	Operational Permit	For compliance with project operation	TANESCO	Within a month
4	Fire Safety Certificate	For the compliance again fire and rescue issues	Fire and Rescue Force Tanzania	Within a month
5	OSHA Compliance Certificate	For compliance with occupational, safety and health issues	Occupational, Safety and Health Authority (OSHA)	Within a month

Table 6.5.a
Environmental and Social Permits Required During Project Implementation

S/N	Permit/certificate	Description	Responsible Institution/Authority	Timeframe
6	Permit to Collect and Transport Hazardous waste	For compliance with the collection and transportation of hazardous waste generated during construction	NEMC and Respective District/Municipal or Town Councils	Within a month
7	Permit to transport Liquid waste and disposal	For the compliance with the transportation and disposal of liquid materials generated during contraction phase	NEMC and Respective District/Municipal or Town Councils	Within a month
8	Water test and use permit	For compliance with laboratory test and use of the water during construction phase	Lake Victoria Basin Authority and respective regional water authorities	1 to 2 months
9	Mining permit	For compliance with mining of the construction materials such as sand, gravel etc.	Mining Commission	1 to 2 months
10	Blasting permit	For compliance with blasting of the construction materials	Geological Survey of Tanzania	1 to 2 months
11	Working permit	For compliance with labour laws and regulation for foreign employees	Prime Minister's Office – Labour, Youth, Employment and Persons with Disabilities.	1 to 2 months

Source: Elaboration by JGP-Bene Consult, 2024.

7.0
Baseline and Existing Conditions

The environmental and social baseline of the areas where the Project will be implemented, developed in **Sections 7.1** to **7.3** below, aims to facilitate a systemic understanding of the various components of the physical, biological and socioeconomic environments, facilitating the identification of their interrelationships and the dynamics of the transformation processes underway. In accordance with this general guideline, the environmental and social baseline is structured by the system of successive approximations, that is, all aspects of interest on a regional scale are analysed first, in order to contextualize and facilitate, in a second instance, a more detailed analysis at the local level.

Thus, distinct levels of approach were considered, in which the pertinent aspects of the physical, biological and socioeconomic environments were treated on different scales. From this perspective, three levels of "area of influence" were established for the baseline development effort:

- Indirect Area of Influence (IAI)
- Direct area of influence (DAI)
- Directly Affected Area (DAA).

Definition of these areas provided focus for the baseline survey design as well as the impact assessment process. They provide the baseline against which data collected as part of monitoring during construction and operation can be compared to assist in definition and implementation of mitigation actions, if needed.

The baseline survey methodology also varies according to scale of analysis. Within the IAI, information uses for environmental and social baseline characterization relies primarily on secondary sources, including regional studies, quantitative information, and cartography. On the other hand, characterization of the environmental and social baseline within de DAI relies on primary data collection and includes a substantially higher level of detail. These field baseline surveys also served to characterize baseline conditions in DAA, because the DAA is fully included in the DAI.

Indirect Area of Influence (IAI)

The IAI is intended to encompass the area where the Project's indirect impacts are expected to occur. Some of the impacts may be more geographically diffuse than others that are spatially discrete and more geographically limited. Physical and biological environment impacts typically have different spatial patterns of distribution from socioeconomic impacts, therefore, different IAI limits were adopted for each case.

The IAI for the physical environment consists of a 20 km wide strip centered on the TLs, being 10 km for each side of the alignment. This strip is large enough to encompass the main features of the region, including the main river basins and the different landscape matrices

Regarding biodiversity, the IAI comprises a 5 km buffer to each side of the selected TLs' alignment, and also includes the boundaries of the protected areas that are intersected by this 5 km buffer, including Burigi-Chato National Park and the following Forest Reserves: Biharamulo, Lubaga, Minziro, Nindo, Nyantakara, Ruamagazi, Ruiga River and Uyovu. Additionally, the Biotic IAI includes the potencial critical habitat mapped in the Scoping Report.

With respect to social components, the IAI, where indirect impacts will occur, is formed by the wards and districts, together with the regions where the DAI villages are located. As preliminarily defined, the IAI includes three regions - Shinyanga, Geita and Kagera, 13 districts and 47 wards. **Table 7.0.a** presents the IAI that is characterized in the social baseline (**Section 7.3**).

Table 7.0.a
Direct and Indirect Area of Influence – Social

Region	District	Ward	Villages
Shinyanga	Shinyanga Municipal Council (former Shinyanga Urban)	Mwamalili	Seseko
		Ibadakuli	Uzogore
			Ibadakuli
		Old Shinyanga	Ihapa
			Old Shinyanga
	Shinyanga District Council (former Shinyanga Rural)	Solwa	Mwasekagi
			Mwiseme
			Solwa
			Mwabuki
		Mwakitolyoo	Mwasenge
			Nyang'ombe
		Salawe	Nzoza
		Iselemagazi	Mwamakaranga
			Ichongo
			Iselamagazi
		Nyamalogo	Mwang'osha
		Pandagichiza	Pandagichiza
			Shilabela
		Mwenge	Mwongozo
			Zunzuli
			Ipango
	Shinyanga DC (former Shinyanga Rural)	Lyabusalu	Mwajiji
			Lyabusalu
			Bukamba
			Mwabagehu
	Msalala	Bugarama	Igwamanoni
			Ilogi
			Buyange
		Lunguya (Runguya)	Kalole
		Bulyan'hulu	Busulwangili
Geita	Geita DC	Bukoli	Ntono
		Butobela	Shahende
	Nyang'hwale	Kafita	Kayenze
			Bukulu
		Nyugwa	Isonda
		Nundu	Igeka

Table 7.0.a
Direct and Indirect Area of Influence – Social

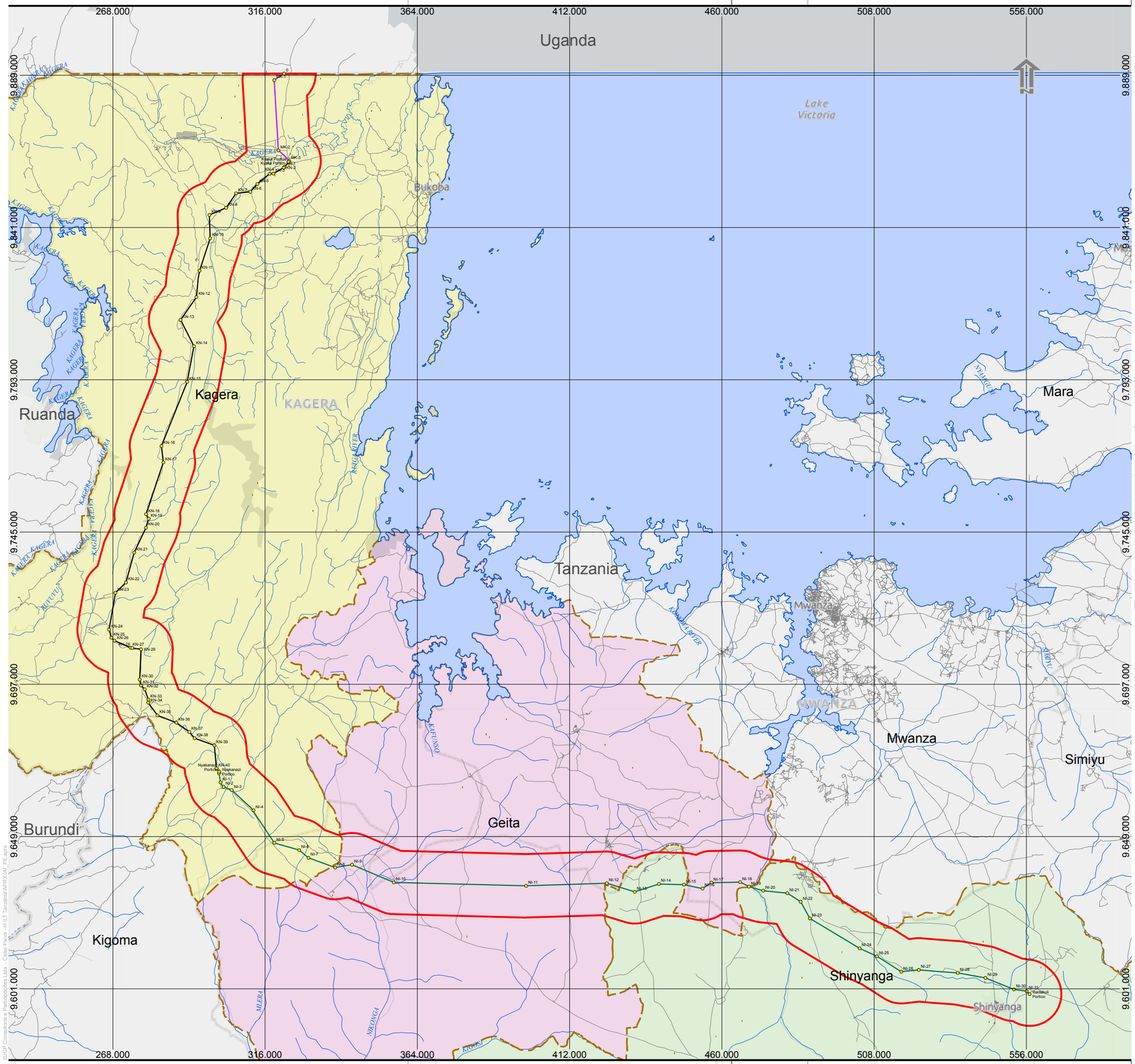
Region	District	Ward	Villages
		Bukwimba	Kasubuya
			Bukwimba
	Mbogwe DC	Ikobe	Kagongo
			Bugalagala
			Busabaga
		Lulembela	Kashelo
		Ilolangulu	Ilolangulu
		Mbogwe	Nambubi
			Bwendanseko
			Mwanza
		Ngemo	Nyitundu
			Bwendamwizo
			Bulongo
		Ushirika	Kadoke
	Bukombe DC	Busonzo	Nampalahala
			Nalusunguti
			Busonzo
			Kabagole
			Nakayenze
		Butinzya	Butinzya
		Bulega	Ibambilo
			Bulega
	Chato DC	Iparamasa	Mnekezi
			Mwabasabi
			Songambele
Kagera	Karagwe DC	Kihanga	Katanda
			Kihanga
			Kishoju
			Mulamba
		Kayanga	Miti
		Bugene	Omurushaka
			Nyakahanga
			Chagati
			Bujuruga
			Kishao
		Ihembe	Ihembe I
		Nyaishozi	Rukale
			Nyakayanja
		Rugu	Kasheshe
		Nyakasimbi	Nyakasimbi
			Bujara
			Kahanga
			Muungano
		Nyakahanga	Rwandaro
			Bisheshe
	Biharamulo DC	Nyakahura	Nyabugombe
			Ngararambe
			Busiri
			Mabare
			Rugese
		Lusahunga	Nyakanazi

Table 7.0.a
Direct and Indirect Area of Influence – Social

Region	District	Ward	Villages
			Kabale
			Lusahunga
			Kikoma
			Nyakasenga
		Kaniha	Mavota
			Mkunkwa
		Nyantakara	Mgera
			Nyantakara/Iyengamulilo
			Nyakayenze
	Ngara	Kasulo	Rwakalemera
	Missenyi	Mutukula	Byeju
			Mutukula
		Kassambya	Bunazi
			Nyabihanga
			Omudongo
		Nsunga	Byamutemba
			Ngando
		Kyaka	Kyaka

Source: JGP/BENE based on NBS 2022. Regions and Districts Official Public Shapefiles (2019) and Wards Official Public Shapefiles (2022). The United Republic of Tanzania (URT); Ministry of Finance and Planning; Tanzania National Bureau of Statistics and President's Office-Finance Planning; Office of the Chief Government Statistician, Zanzibar. The 2022 Population and Housing Census: Administrative Units Population Distribution Report. Tanzania, December 2022.

Maps 7.0.a, **7.0.b** and **7.0.c** below show the three different IAIs thus defined.



Legend

T-line Alignment

- Vertex
- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Waterways
- Roads
- Indirect Area of Influence of Physical Environment
- Water Bodies

Regions

- Kagera
- Geita
- Shinyanga

Source:

Lead E&S Consultant

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
09/2/2024	1:1.200.000	PE_IAI.aprx	Ø

Developer:

Tanzania Electric Supply Company Limited (TANESCO)

Project:

PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.0.a:

Physical Environment IAI

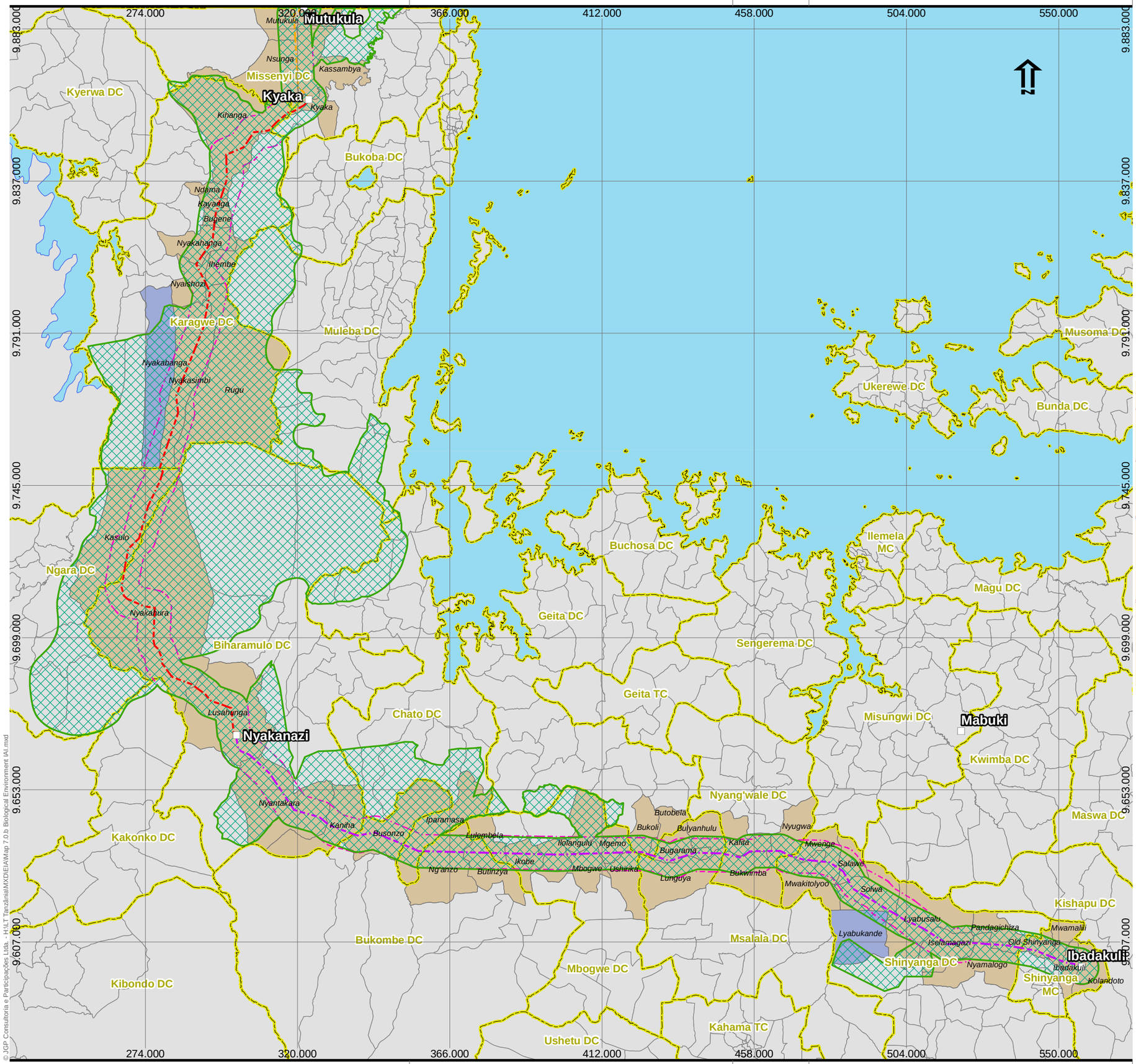
Regions:

Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:

JGP Consultoria e Participações Ltda.

JGP Consultoria e Participações Ltda. - Cidão Pavia - H:\LT Tanzania\APRX\IAI_PE.aprx



Legend

- Subestation
- LT Kyaka - Nyakanazi (Option A) - Optimized
- LT Mutukula-Kyaka (Option B)
- LT Nyakanazi_Ibadakuli (Option 1) - Optimized
- Biological Environment IAI
- Indirect Influence Area (buffer 10 km)
- Districts
- Wards
- Indirect Influence Area Wards (buffer 1000m)
- Tanzania Wards
- Water

Source:
This shapefile provides information about Tanzania Wards. It was created in 2012 by the National Bureau of Statistics while preparing data for the National Population and Housing Census. Tanzania National Bureau of Statistics (NBS), 2019

UTM- Zona 36S
Datum: WGS 84 - EPSG 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
9/2/2024	1:1.150.000	Location map of the preferred route guideline	Ø

Project:

PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.0.b:

Map of Biological Environment IAI

Regions:
Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:
JGP Consultoria e Participações Ltda.

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Direct Area of Influence (DAI)

The Direct Area of Influence (DAI) is the area in which the incidence of the impacts occurs directly on the environmental resources or social receptors, modifying their quality or diminishing their potential quality for conservation and use. The network of social, economic, and cultural.

In the case of the transmission line, the DAI included the selected alignment and a buffer at least 500 m wide to each side. Similar buffers were established at substations and should be the DAI to be considered by Contractors when searching for the location of construction sites, avoiding sites with watercourses in the DAI, or with densely occupied DAI and where there are critical receptors of social impacts, such as schools, health facilities, etc.

For the baseline of the social environment, the DAI, as already mentioned in the previous section, is made up of the 105 villages directly intercepted by the selected alignment of the project's TLs. Only the mapping of vegetation coverage and land use, which includes both biologic and socio-economic aspects, was carried out for the 1 km DAI, 500 m each side of the route.

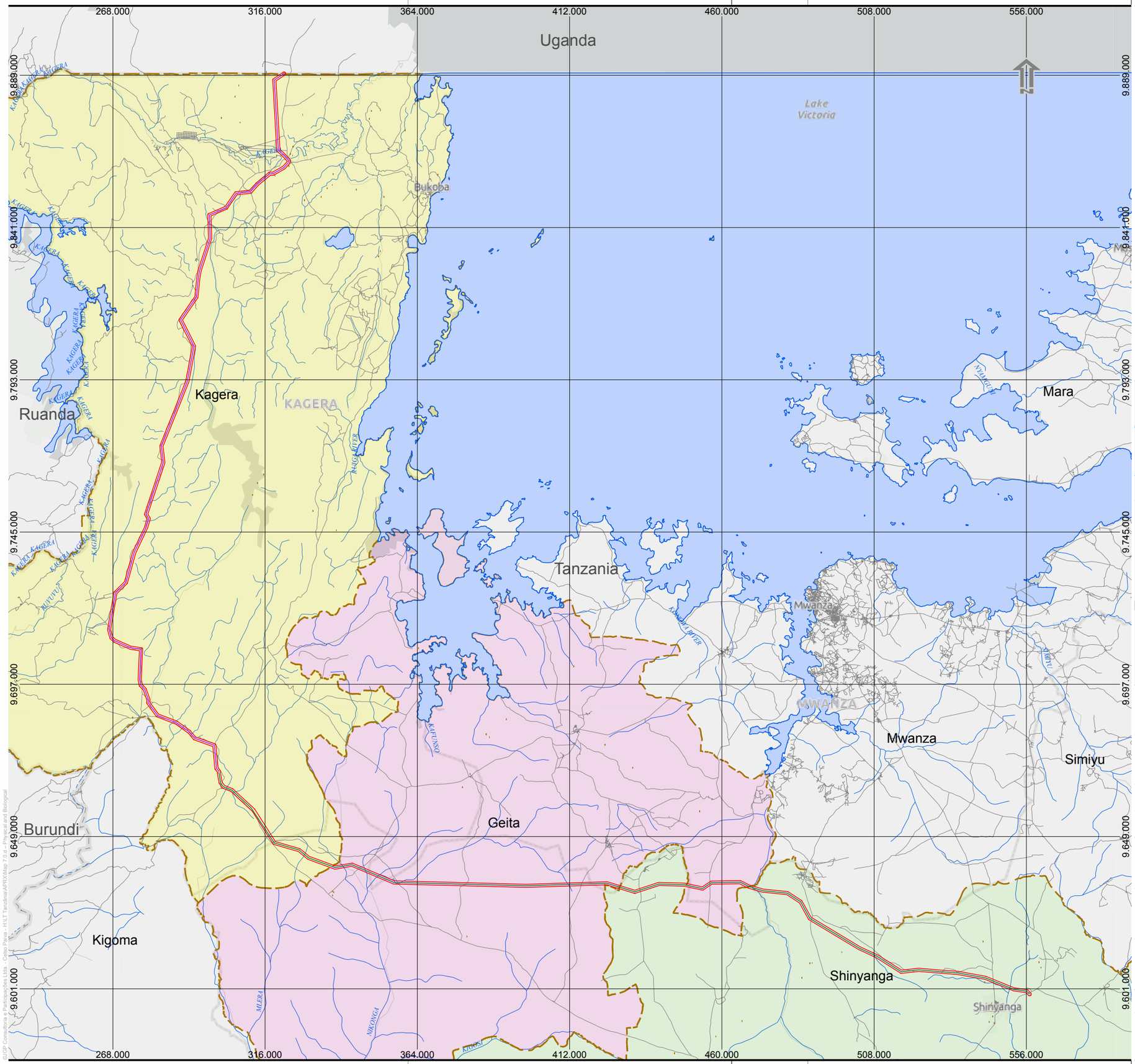
Access roads with alignment outside the easement will also be part of the DAI.

Maps 7.0.d and **7.0.e** below show the two different DAI.

Directly Affected Area (DAA)

The portion of land directly affected by the Project, including the TLs' easement, SSs' expansion areas, construction sites and other support facilities, accesses, surplus soil deposit and borrow areas (if necessary) and others, will constitute the DAA (Directly Affected Area or "footprint"). The DAA will be fully included in the DAI.

In the case of the DAA, the limit considered in the baseline and impact assessment consists of the TLs' easement and SSs' expansion areas, since at this stage the locations of the construction sites have not yet been defined, nor have any new accesses outside the easement that may be necessary.



Legend

- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Waterways
- Roads
- Physical and Biological Environment DAI
- Water Bodies

Regions

- Kagera
- Geita
- Shinyanga

Source:

Lead E&S Consultant

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
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Developer:

Tanzania Electric Supply Company Limited (TANESCO)

Project:

PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.0.d:

Physical and Biological Environment DAI

Regions:

Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:

JGP Consultoria e Participações Ltda.

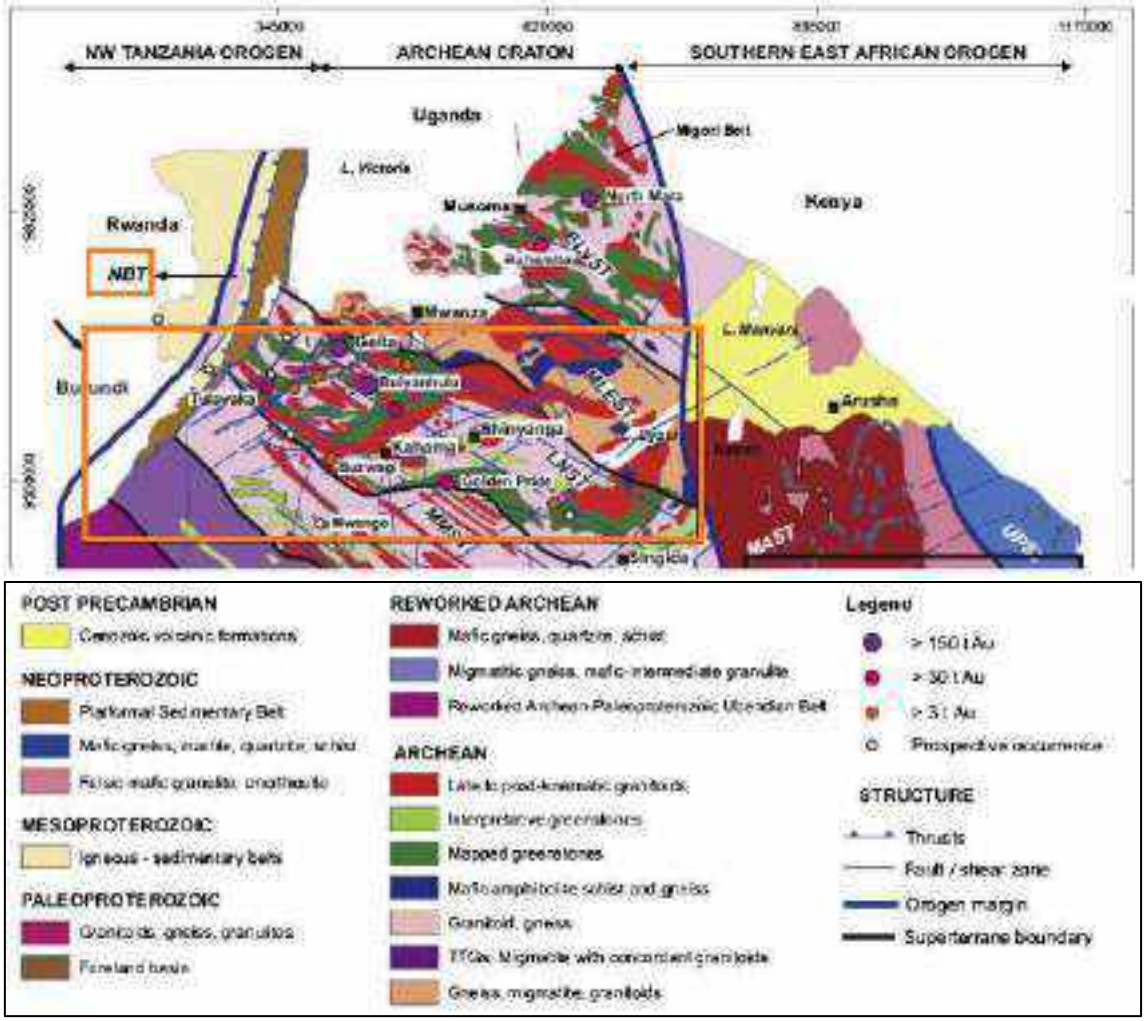
JGP Consultoria e Participações Ltda. - Cidão Paiva - HVLT Tanzânia\APRX\Map 7.0.d - Physical and Biological

7.1
Physical Environment Baseline (Abiotic Components)

7.1.1
Geology and Geotechnical Characterization

According to Geologic Map of Tanzania (BRGM *et al*., 2004; KABETE *et al*., 2012), the Project intersects two large crustal blocks of national territory: Lake Nyanza Superterrane and Kalenge–Burigi (Nyakahura–Burigi Terrane), as well as the igneous-sedimentary belt located in the extreme northwest of the country (**Figure 7.1.1.a**).

Figure 7.1.1.a
Solid geological map illustrating the major lithotectonic-geologic regions intercepted by the Project



Source: Modified from Kabete *et al*. (2012).

The Lake Victoria Region is composed of three superterranes, namely the East Lake Victoria, Lake Nyanza, and Mwanza-Lake Eyasi Superterranes. The first two superterranes are rich in greenstone and gold deposits, while the third one, Mwanza-Lake

Eyasi, is low in gold concentration. The greenstone-abundant superterranes are made up of granitoid-greenstone terranes that were formed about 2.6-2.85 billion years ago. These terranes comprise supracrustal rocks, syn-volcanic, and orogenic granitoids. They were formed on rifted continental crust that is over 3.11 billion years old (KABETE *et al*., 2012).

The Lake Nyanza Superterrane comprises, from west to east: 1) the Nyakahura–Burigi Terrane, mostly covered by the Mesoproterozoic Karagwe–Ankolean Belt (TACK *et al*., 2010); 2) the gold-endowed Sukumaland Terrane; 3) the diamondiferous kimberlite-rich Kahama–Mwadui Terrane; 4) the greenstone-abundant Nzega–Sekenke Terrane; and 5) the schist-belt dominant Singida–Mayamaya Terrane.

The 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL routes are mainly located in the Nyakahura-Burigi Terrane., that comprises inliers of Archean granitoid-greenstone belts in the Mesoproterozoic Kibaran Orogen of north-western Tanzania. There are magnetized volcanic–sedimentary rocks, metasandstone, quartz–sericite schist (strongly deformed granitoids), granodiorite and biotite granite.

Photo 01: Metasandstone outcrop near Kagera region. Nyakahura–Burigi Terrane.

Photo 02: Metasandstone of Kagera region. Nyakahura–Burigi Terrane.

The 400 kV Nyakanazi – Ibadakuli TL route, which is in the direction E-W, is based on distinct three terrains (KABETE *et al*., 2012):

- The Sukumaland Terrane (SKT) comprises the thick, complexly folded and faulted Biharamulo-Geita, Sarama-Rwamagaza, Ushirombo-Bulyanhulu and Siga-Mabale Belts (BARTH, 1990; BORG, 1994; WELLMER & BORG, 1992), which, together, define a concave geometry as they disappear under the curvilinear fault-bounded Bukoba Group of sedimentary rocks, layered gabbro and dolerite sills.

- The Nzega–Sekenke Terrane (NST) is largely underlain by chemical and siliciclastic rocks of the Nzega Belt (NZB; GEOSURVEY, 1985A; GEOSURVEY, 1985B; TANZANIA, 2005; VOS *et al*., 2009) and extensive mafic volcanic rocks of the Iramba-Sekenke Belt.

- The Archean Kahama-Mwadui Terrane (KMT) is largely covered by transported sediments and black soils, and there are virtually no greenstone supracrustal rocks in the terrane. However, migmatitic granite gneiss domains are intruded by NE–SW-trending granitoids, whose eastern boundary marks the tectonic contact with the Nzega-Sekenke Terrane.

Photo 03: Granite outcrop of Archean Kahama–Mwadui Terrane. Shyninanga region.

Photo 04: Granite of Archean Kahama–Mwadui Terrane. Shyninanga region.

Lithoestratigraphy

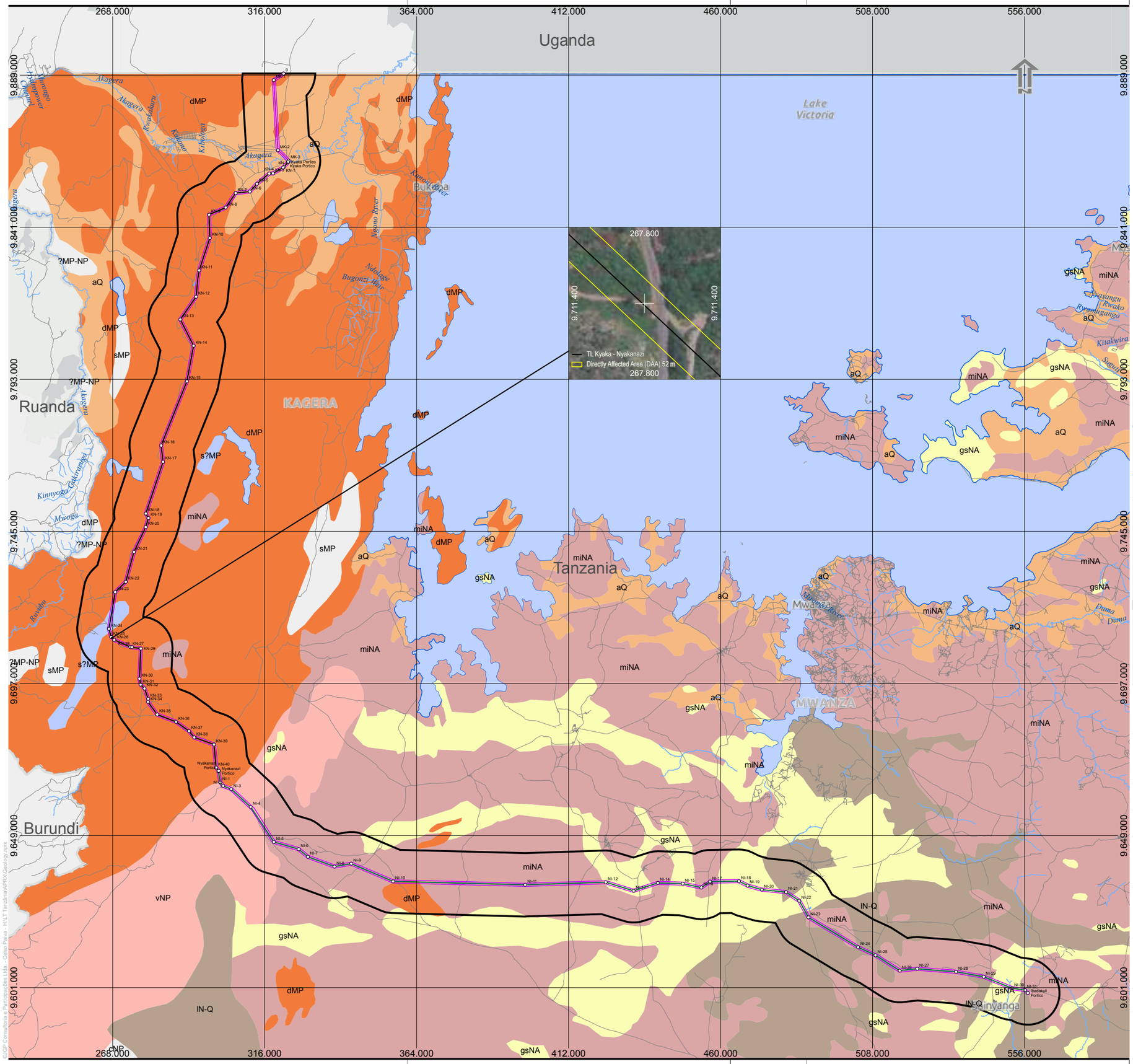
The main lithostratigraphies intercepted by the Project are shown in the **Map 7.1.1.a** and described below.

- Quaternary deposits (2.6-0 Ma)

Characterized by the deposition of fluvial (river) and alluvial (floodplain) sediments. These deposits include conglomerates, sandstones, and mudstones, which were transported and deposited by rivers and streams flowing through the rift valleys.

- Neogene-Quaternary lacustrine deposits (23-0 Ma)

Consistent of thick sequences of lacustrine (lake) sediments, including clays, silts, and carbonates. Deposits often display well-laminated layers, reflecting seasonal or climatic variations in sediment input. These layers can be very detailed records of past environmental conditions, often preserving organic material, pollen, and microfossils.



Legend

T-line Alignment

- Vertices
- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Waterways
- Roads
- Direct area of influence (DAI) - 1 km
- Indirect Area of Influence of Physical Environment - 20 km

Geology

- aQ — Predominantly alluvial and eluvial sediments
- dMP — Detrital meta-sediments (includ. newly defined Bukoban Group)
- s?MP — Mafic-ultramafic layered intrusive complex (Kabanga-Musongati)
- gsNA — Volcano-sedimentary complex (Greenstone Belt with BIF)
- vNP — Volcano-sedimentary formation (Gagwe lavas, Ilagala dolomites)
- miNA — Migmatite - granitoide - meta-sediment complex
- lN-Q — Predominantly fine clastic lacustrine sediments and evaporites
- WB — Water Body

Source:

Geological Survey of Tanzania
https://www.gmis-tanzania.com/ - accessed on 08/07/2024

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
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Developer:

Tanzania Electric Supply Company Limited (TANESCO)

Project:

PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.1.a:

Map of Geology

Regions:

Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:

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JGP Consultoria e Participações Ltda. - Celso Paiva - H:\LT Tanzania\APRX\Geology.aprx

Photo 05 and Photo 06: Lacustrine and fluvial deposits outcrops near Solwa – Shinyanga.

- Nyamori Supergroup (850-635 Ma)

The Nyamori Supergroup may have formed in a tectonically active environment, such as a continental rift or basins associated with continental margins. These environments would be conducive to the deposition of thick sequences of sediments and volcanic rocks. Associated lithologies:

- Sedimentary Rocks: Similar to other supergroups in the region, the Nyamori Supergroup likely includes a variety of sedimentary rocks, such as conglomerates, sandstones, shales, and possibly banded iron formations (BIFs), indicating deposition in marine or lacustrine environments.
- Volcanic Rocks: This supergroup may also contain volcanic rocks such as basalts and andesites, which would indicate periods of volcanic activity associated with rift tectonics or volcanic arc activity.

- Bukoba Group (1.6-1.2 Ma)

The Bukoba Group is an important lithostratigraphic unit in Tanzania, associated with sedimentary and volcanic rocks from the Proterozoic era (approximately 1.8 to 1.2 billion years ago). This group is related to the evolution of the Tanzanian Craton and is primarily found in the northwestern part of the country, especially around Lake Victoria. consists of a sequence of sedimentary and volcanic rocks that formed in a rift environment associated with crustal extension. This tectonic activity created basins where sediments were deposited and volcanic activity occurred. The rock sequences of the Bukoba Group are generally divided into several formations with different lithological characteristics, including conglomerates, sandstones, shales, and basalts. Main lithologies:

- Conglomerates: These occur at the base of the Bukoba Group and are generally composed of quartz clasts and volcanic rock fragments, indicating deposition in high-energy environments like alluvial fans.
- Sandstones: The sandstones of the Bukoba Group are often well-sorted, indicating deposition in fluvial or lacustrine environments. They can be feldspathic or quartz-rich, depending on the origin of the sediments.

- Shales and Phyllites: Shale layers are common in the intermediate parts of the Bukoba Group, suggesting deposition in calmer environments like lakes or shallow seas. In some locations, these rocks have undergone metamorphism, transforming into phyllites.
- Volcanic Rocks: Basalts and andesites are common volcanic rocks in the Bukoba Group, indicating episodes of volcanism during sediment deposition. These lava flows are interbedded with the sedimentary sequences, pointing to a tectonically active environment.

- Kavirondian-Nyanzian Supergroup (2.9-2.5 Ma)

The Kavirondian-Nyanzian Supergroup is an important lithostratigraphic unit comprising sedimentary and volcanic rocks from the Archean, particularly in the Tanzanian Craton region and around Lake Victoria. This supergroup is subdivided into two main sequences: the Nyanzian Group and the Kavirondian Group, each with distinct lithostratigraphic characteristics.

Nyanzian Group

The Nyanzian Group is believed to have formed in a volcanic arc environment, with deposition of volcanic and sedimentary rocks in marine or lacustrine basins associated with active continental margins. The Nyanzian Group dates back to the Archean, with estimated ages around 2.7 to 2.9 billion years. The Group is one of the oldest sequences in the region and provides insights into the initial formation and stabilization of the Tanzanian Craton during the Archean. The banded iron formations (BIFs) are also of economic interest. The main lithologies are indicated below:

- Volcanic Rocks: The Nyanzian Group is dominated by mafic and felsic volcanic rocks, including basalts, andesites, and to a lesser extent, rhyolites. These volcanic flows are typical of arc volcanic environments, suggesting that deposition occurred in a tectonically active setting.
- Banded Iron Formations (BIFs): Within the Nyanzian Group, banded iron formations are common, consisting of alternating layers of silica and iron oxides. These formations indicate deposition in anoxic marine environments and are economically significant due to their iron content.
- Sedimentary Rocks: The sedimentary rocks associated with the Nyanzian Group include shales and phyllites, which formed in deeper marine or lacustrine environments.

Kavirondian Group

The Kavirondian Group is slightly younger than the Nyanzian Group, with approximate ages of 2.5 to 2.7 billion years. Deposition of the Kavirondian Group occurred in a continental setting, associated with tectonic stabilization following the volcanism of the Nyanzian Group. This may reflect a post-orogenic scenario where the erosion of previously formed mountains deposited sediments in surrounding basins. Deposition of the Kavirondian Group occurred in a continental setting, associated with tectonic

stabilization following the volcanism of the Nyanzian Group. This may reflect a post-orogenic scenario where the erosion of previously formed mountains deposited sediments in surrounding basins. Main lithologies:

- Sedimentary Rocks: The Kavirondian Group is dominated by clastic sedimentary rocks, including conglomerates, sandstones, and shales. These sediments indicate deposition in continental environments such as alluvial fans, rivers, and lakes.
- Conglomerates and Sandstones: The conglomerates and sandstones of the Kavirondian Group are indicative of deposition in high-energy environments like alluvial fans and fluvial channels. These sediments often contain fragments of older rocks, including those from the Nyanzian Group, suggesting significant erosion and reworking.

Geological-Geotechnical Characteristics

As presented above, the Project intercepts different types of rocks, with different constitutions, ages and geotechnical characteristics. In summary, were identified several groups of rocks with similar geotechnical behaviour along the alignment: young unconsolidated sediments (continental deposits); plutonic rocks, including granite, migmatites and granitoids; greenstones with BIFs (volcano-sedimentary complex); metasediments.

The set of archaean rocks occurs in practically the entire length of the 400 kV Nyakanazi – Ibadakuli TL (E-W alignment), whereas the set Proterozoic rocks (metasediments) occur along the 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL (N-S alignment). North extreme and west extreme shows recent unconsolidated sediments.

The alteration of these ancient rocks results in the formation of sand-silt or clay-silt and micaceous soils, with the sand and silt content varying as a consequence of the quartz and feldspar content of the rocks. Thus, clayey and silty terms prevail in the most micaceous portions, and sandy-clay and clay-sandy terms, with granules and quartz fragments, in the quartz-feldspathic portions.

The surface soil is clayey and clay-sandy and has thicknesses of 1 to 2 m, while the residual soil can reach thicknesses of 10 to 15m in the softer relieves. In the more inclined relieves the surface soil is 0.5m thick, and the residual soil is thinner, with thicknesses of up to 3 m.

The formation of blocks and boulders with diameters of 0.6 to 3 m is common where porphyritic rocks occur, both on the surface of the terrain and emersed in the residual soil.

Continental sediments, particularly fluvial and lacustrine deposits, occur along floodplains and at the foot of mountain slopes and sets of inselbergs. They are unconsolidated, with low bearing capacity and thicknesses of 3 to 6 m.

Table 7.1.1.a presents the main attributes, associated soils, geotechnical characteristics and preventive measures for the occupation of areas constituted by these groupings of rocks.

Table 7.1.1.a
Attributes, associated soils, geotechnical characteristics and preventive measures for the occupation of areas constituted by more frequent types of rock

	TYPE OF ROCK OR SEDIMENT	RESTRICTIONS AND GEOTECHNICAL BEHAVIOR	CARE AND PREVENTIVE MEASURES
Granites, Migmatite and Granitoids	Igneous and metamorphic rocks composed essentially of quartz, feldspar and mica, with fine to thick granulometry, and bands of well-developed schistosity. The residual soil is sandy-clay to clay-sandy, sometimes micaceous and rich in quartz and feldspar granules, the presence of immersed boulders being common. The surface soil is clayey to very clayey.	- Gully erosion in the cuts and fills, more intense in the cuts due to the constitution of the residual soil; - Landslide in road cuts in the soil/rock transition, commonly associated with upwellings of water; - Instability and rock falls by descaling on road cuts and slope surfaces; - Difficulty of excavation, sloping, and earthmoving due to the presence of boulders; - Possibility of differential settlements of structures due to implantation on boulders.	- Evaluate the possibility of occurrence of boulders and the irregularity of the rocky top, for the implantation of civil works; - Deploy public networks and road system together due to the presence of boulders; - Use the surface soil for the finishing of earthworks and road covering; - Protect the cutting slopes and areas of exposed soil, shortly after exposure, as well as implement drainage system and vegetation cover.
Cataclastic rocks and greenstones with BIFs	Metamorphic rocks associated with shear zones with pronounced subvertical to vertical foliation. Superficial and residual soil clayey to very clayey and micaceous, generally deep.	- Problems of instability and sharp erosion due to vertical foliation in conjunction with sub-vertical joint systems.	- Avoid cutting and excavation works parallel to foliation due to risk of collapse.
Metasediments	These are metamorphic rocks made up essentially of quartz (> 80%). The alteration soil is sandy and generally shallow, with rocky outcrops frequently occurring.	- Falling blocks on cutting slopes due to fracturing and shale; - Difficulty in excavation due to the proximity of the rocky top.	
Unconsolidated sediments	Fine sand, clayey sand and silty clay, organic matter and occasionally gravel on floodplains and low terraces.	- Seasonal floods; - Presence of wetlands, elevated water table and soft soils; - Lateral and vertical erosion of the canal and the margins; - Precarious stability of excavation walls; - Settlement of foundations; -Damage of underground networks by repression; - Damage of road surface due to soil saturation; - Risk of contamination of the water table.	- Avoid occupation, protect and recover floodplains, valley floors and riparian forests, and implement projects that avoid occupancy by residences, industries and road system in order to avoid the degradation of water resources; - Promote stability and protection against the erosion of the banks of the watercourses; - Adopt measures that accelerate the stabilization of settlements and improve soil support and resistance conditions in landfill projects; - Take appropriate measures to minimize settlements and avoid damaging piping; - Implement efficient surface and underground drainage systems, in order to avoid saturation of the road surface.

Source: Compiled from Campos (1988), SHDU/CSTDE/EMPLASA/IPT (1990) and Nakazawa (1994).

7.1.2
Geomorphology

According to the Ministry of Agriculture of Tanzania, country's relief exhibit a several types of landforms, including the coastal plain, eastern and central plateau and mountain blocs, highland plains, volcano and rift depressions, western highlands, and actual sedimentary regions.

Successive stages of endogeny and erosional cycles from the Precambrian to the present day have resulted in the present Tanzania's relief configuration, whose topographic compartmentalization indicates the presence of mountainous areas (altitudes above 1,500 m), upland zones and inter-upland zones (altitudes between 200 to 1,000 m), lakes and aggradation zones in the territory's lower areas.

While the genesis of mountainous areas is associated with the Precambrian endogenous events, it was only at the beginning of the Tertiary, during the so-called Congo Cycle, that its residual correlate features took definitive form. In the Middle Tertiary, another erosion cycle (Victoria Falls) ended up modelling the upland surfaces and their contact with both elevated areas and the deposition surfaces. These, in particular, result from Mesozoic events (upper and lower Karoo), as well as recent climate oscillations in the Quaternary.

Section 7.1.2.1 presents the identification and general characterization of intercepted geomorphological units. **Section 7.1.2.2** describes the types of reliefs mapped along the TL.

7.1.2.1
Geomorphological Units

Based on the geomorphological classification proposed by FAO (Landform for Tanzania - Thematic Aggregation Geomorphology – AFRICOVER), **Map 7.1.2.1.a** present the main groups of landforms intercepted by the TLs. The landform classes have been developed using the ITC (International Institute for Geo-Information Science and Earth Observation) and SOTER (Soil and Terrain Database) methods. This thematic aggregation groups the landform codes into broader landform units, that are described below.

<u>Plains</u>

This unit is widespread along the route, from Shinyanga to portions west of Nyakanazi. Plains are level land that are not enclosure between higher lying lands, that do not produce above surrounding areas, or that do not rise gently against land with a considerable steep slope.

These areas are elevated to more than a thousand meters above sea level, and can reach up to 1,300 meters above sea level. They are flat areas with low drainage incision, most likely created by erosion polycycles associated with the evolution of peneplanation after the middle Tertiary, as explained by King (1956). They are interdigitated by alluvial

plains and even mountainous residual blocks, as observed near the border between Shinyanga and Geita.

Alluvial Plains

This unit is represented by depositional landforms, formed by plains of fluvial and eluvial accumulation, terraces and colluvial packages. In general, they are low-sloped lands, subject or not to temporary flooding. These areas are sensitives to the Project's interference as there is risk of flooding and contamination due to the presence of a water table, making them susceptible to silting processes.

In the region north of Kyaka to the border with Rwanda, as well as west of Ibadakuli, there are extensive plains, the former associated with the Kagera River valley and depression areas on the edges of Lake Victoria, and the latter most likely related to ancient lake environments.

Hills and Mountain Footridges

This unit includes medium-gradient escarpments zones, ridges, mountainous highlands and steep lands with slopes above 30%.

Mountain highlands, although forming part of a mountain range, constitute a restricted zone with less steep slopes and subdued relief. Always forms part of a mountain system, and is thus on at least at one side bounded by high-gradient mountains.

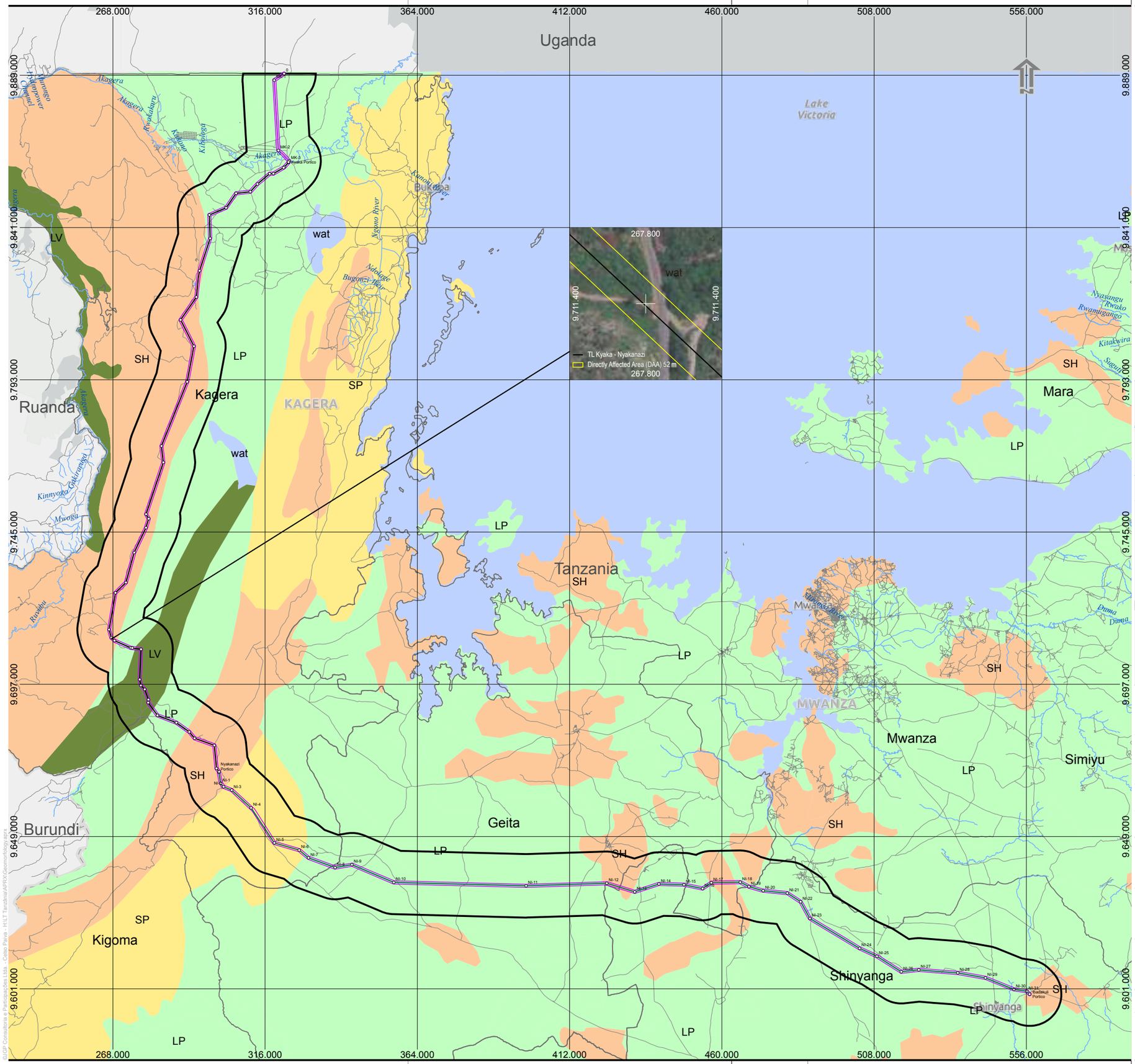
Medium-gradient escarpment is a relatively gently (usually 15-30% gradient) zone that forms a transition between high and low-lying country. A ridge meets all the qualifications of a medium gradient hills, but has an elongated shade with a single crest, which may have a more or less constant elevation, or may contain a number of peaks. A classic ridge is intercepted near the border between Shinyanga and Geita. The other forms are predominant along the stretch north of Nyakanazi and along the N-S segment of the alignment.

Plateau

Plateaus are level lands that are, compared with surrounding landscapes, situated at relatively elevated positions. Plateau can be very extensive, but along the TL they are restricted to a portion near Nyakanazi.

Depressions

A depression is an area of level land that is on all side surrounded by higher level or sloping land. The area occupied by the band of sloping land that forms the transition from the higher ground to the floor of depression is small compared to the area within the depression taken up by level land. Depressions are intercepted near Ibadakuly, at the eastern portion of the alignment.



Legend

T-line Alignment

- Vertices
- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Roads
- Waterways
- Direct area of influence (DAI) - 1 km
- Indirect Area of Influence of Physical Environment - 20 km

Geomorfology

- LP — Plain
- LV — Valley floor
- SH — Medium-gradient hill
- SP — Dissected plain
- wat — Water

Source:
ISRIC, FAO and UNEP
Soil and Terrain Database for Southern Africa (SOTERSAF), August 2024
Available at: https://data.isric.org/geonetwork/srv/eng/catalog.search#/metadata/3571c1f3-159d-442c-b324-0af53d03f12e

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
05/29/2025	1:1.200.000	Geomorfology.aprx	Ø

Developer:
Tanzania Electric Supply Company Limited (TANESCO)

Project:
PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.2.1.a:
Map of Geomorfology

Regions:
Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:
JGP Consultoria e Participações Ltda.

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7.1.2.2
Types of Relief

The identification of the relief types along the TL was made based on the interpretation of terrain characteristics, satellite images and field works carried out along 2023.

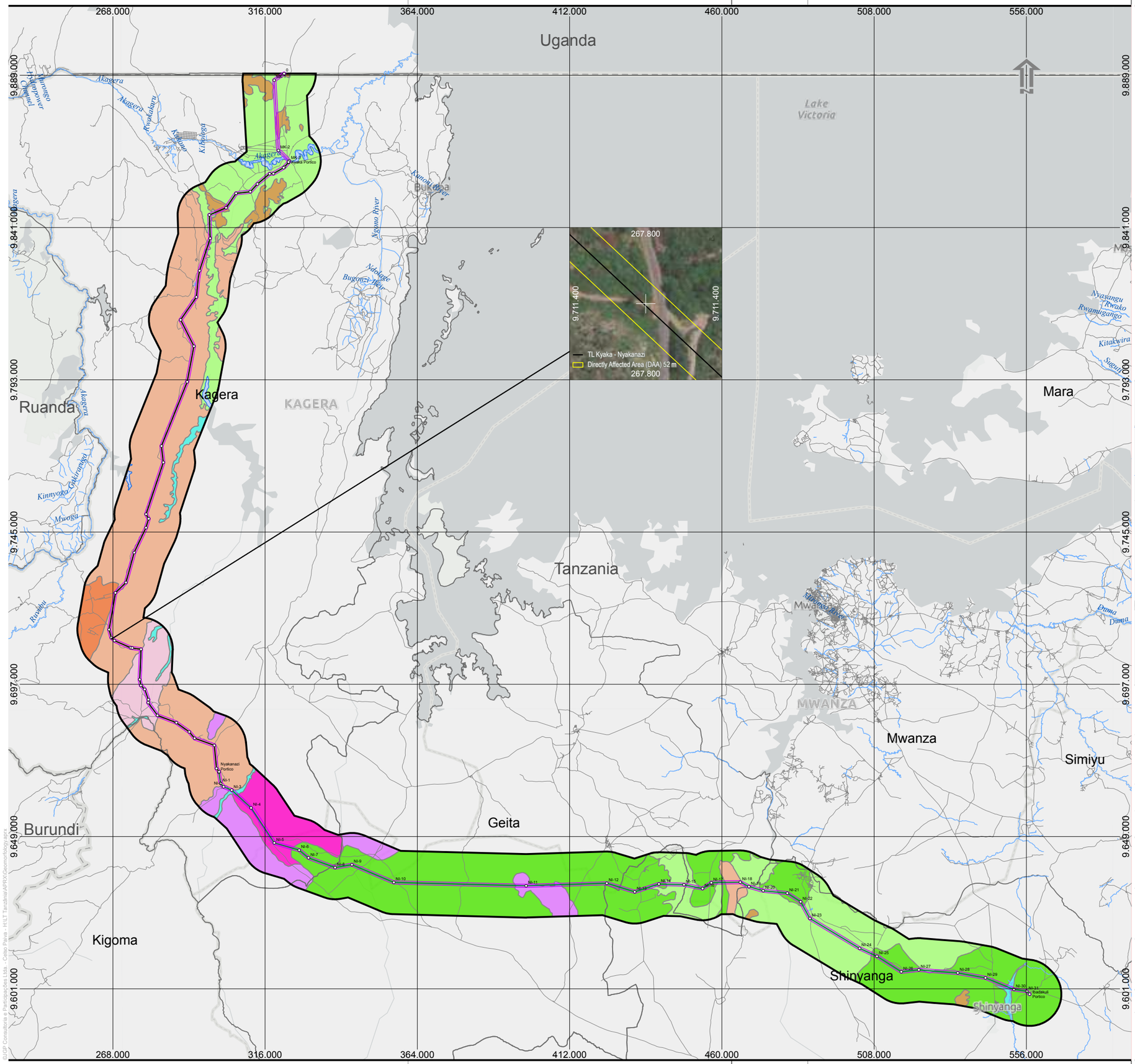
The following methodological procedures were adopted:

- Compilation of geological, geomorphological and pedological maps at different scales;
- Interpretation of satellite images, SRTM (NASA - *Shuttle Radar Topographic Mission*), topographic charts and slope charts obtained from the SRTM for the elaboration of the geomorphological map and land map;
- Fieldwork conducted from July to August, 2023, along roads of the study area, when 55 observation points were recorded and photographic records were made;
- Input of geomorphological and geological information on topographic bases, elaborated in the 1: 250,000 and 1: 100,000 scales, to characterize the study area;
- Analysis of the relationship of the relief with the lithostructural substrate and the detrital cover;
- Integration and analysis of the data obtained, which allowed the preparation of the Land Map and the evaluation of the interference in the area directly affected.

Relief types were differentiated based on the procedures described above. This differentiation was based on the identification of morphometric indices of relief, especially altitude, shape amplitude, ramp length and slope (PIRES NETO, 1992; DEMECK, 1972; IBGE, 2009).

The relief types, therefore, constitute a complex of forms with relatively homogeneous distribution and that constitute territorial unit, which are related to the positioning and characteristics of the water dividers, valley floors, lithostratigraphic and genetic aspects. This design is associated to the conceptualization of morphogenetic types (MORARIU *et al*., 1967), genetic units of relief (VERSTAPPEN & VAN ZUIDAN, 1975), shape complexes (SPIRIDONOV, 1980) and similar morphological units (ROSS, 1992).

The development of these methodological procedures allowed the identification of the relief types presented in **Table 7.1.2.2.a** and spatialized in **Map 7.1.2.2.a - Relief Types in the AII**. **Map 7.1.2.2.b** presents de slopes along the alignment.



Legend

T-line Alignment

- Vertices
- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Roads
- Waterways
- Direct area of influence (DAI) - 1 km
- Indirect Area of Influence of Physical Environment - 20 km

Types of Relief

- Alluvial Plain
- Plain
- Medium Hills
- Plains With Wide Hills
- Mountains
- Plateau
- Mountains With Flat Tops
- Soft Hills
- Mounts
- Water

Source:
ISRIC, FAO and UNEP
Soil and Terrain Database for Southern Africa (SOTERSAF), August 2024
Available at: https://data.isric.org/geonetwork/srv/eng/catalog.search#/metadata/3571c1f3-159d-442c-b324-0af53d03f12e

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
05/29/2025	1:1.200.000	Relief.aprx	Ø

Developer:
Tanzania Electric Supply Company Limited (TANESCO)

Project:
PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.2.2.a:
Map Types of Relief

Regions:
Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:
JGP Consultoria e Participações Ltda.

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Table 7.1.2.2.a
Characteristics of the types of relief that occur along the TLs

Type of Relief Morphometrics	Morphography	Morphodynamics
Alluvial plains (Fp) Slope: 0-3% Variable Altitudes	Flattened plains formed by floodplains and alluvial plains, which are seasonally flooded, with low terraces no longer affected by floods, and also marshes, swamps and lakes. Meanders and alluvial channels in rock.	• Periodic flooding in the plains and permanent flooding in the wetlands. Deposit of fines and organic matter by decantation during floods, and of sands and pebbles by lateral addition; • Lateral and vertical erosion of the channel; • Terrain very sensitive to occupation, with risk of flooding, contamination and silting.
Plains (P) Amplitude: 10 to 30m Slope: 3 to 10% Altitude: 1140 to 1200 m	Extensive level surfaces. Flat to slightly convex tops. Profiles of continuous slopes with straight and long segments. Open erosive valleys. Surface erosive channels, on rock and blocks, sometimes in wetlands (paths). Very low-density drainage.	• Run off and gully erosions, occasional and of low intensity; • Terrain not very sensitive to interference.
Plains and Wide hills (PWh) Amplitude: 20 to 60m Slope: 3 to 10% with sector of 10 to 15% Altitudes: 1120 – 1300m	Association of inclined sub-horizontal top ramps and wide convex top hills. Profiles of straight and long continuous slopes, with detrital pavements of angular quartz. Open and cumulative erosive valleys with floodplains. Low density drainage.	
Soft Hills (Sh) Amplitude: 50 to 150 m Slope: 8 to 30% Altitude: 1250 to 1350m	Hills with broad convex tops, continuous profile slopes, smooth convex and/or straight segments, with occasional rocky outcrops. Open and embedded erosive valleys, channels in rock. Medium drainage density.	• Run off and gully erosions and frequent to widespread crawling, from moderate to high intensity; • River notch is generalized and of high intensity; • Frequent and high-intensity channel silting; • Terrains sensitive to very sensitive to interference, due to slopes, soil erodibility, intensity of erosion and the presence of processes.
Mounts (M) Amplitude: 100 to 280 m Slope: 15 to 30% and sectors of 30 to 45% and >45% Altitude: varied (1200 to 1350m)	Shapes of narrow convex tops. Discontinuous profile slope, steep convex and straight segments, with dentritic pavements and occasional rocky outcrops. Medium drainage density.	

Table 7.1.2.2.a
Characteristics of the types of relief that occur along the TLs

Type of Relief Morphometrics	Morphography	Morphodynamics
Mountains (MM) **Mountains with Flat Tops (MMt)** Amplitude: 100 to 300m Slope: varied, always up to 20% and sectors >45% Altitude: 1300 to 1700 m	Angled, convex and uneven shapes. Some areas present flat tops. Narrow, sharp, convex and rocky tops. Discontinuous slope profile, short, convex, rectilinear, concave and rocky segments. Presence of pediments, talus bodies and foot drop cones. Embedded and erosive valleys. Rock channels, blocks and boulders, with waterfalls and wells, and torrential runoff. Slightly fitted first-order channels, high-density drainage network.	• Run off and gully erosions, gullies and frequent crawling of moderate to high intensity; • Planar landslides and frequent blocks falling at medium intensity; • River notch is generalized and of high intensity; • Deposition of debris at the foot of the slopes is occasional and of low intensity; • Improper terrain and/or very susceptible to interference due to steep slopes and intensity of erosion.
Plateau (Pt) Amplitude: 20 to 100m Slope: 3 to 8% Altitude: 1200 to 1350 and 1450 to 1600 m	Extensive high and flat levelled surfaces. Flat to slightly convex tops. Profiles of continuous slopes with straight and long segments. Open erosive valleys. Surface erosive channels, on rock and blocks, sometimes in wetlands (paths). Very low-density drainage.	• Run off and gully erosions, occasional and of low intensity; • Terrain not very sensitive to interference.

Alluvial Plains

The alluvial and flood plains that occur along the watercourses have their distribution associated with the characteristics of the river channel, with broad and continuous plains stretches marked in the Plain unit and sections with narrower plains in the unit mountains.

In the rest of the area, erosive/depositional channels predominate and narrow and discontinuous plains occur. It should be noted that although plains occur in smaller rivers, they were not mapped due to map scale constraints.

Floodplain terrains usually have seasonal and perennial wetlands, abandoned channels, not always mappable on the scale of the study adopted. The fluvial channels are poorly embedded, with the floodplains elevated from 0.8 to 2.0 m above the level of the channels. In some cases, such as the plains that develop along the Kagera River, they may be elevated above 5.0 m.

These terrains consist of sand, clay, silt and gravel, with or without organic matter, and are associated with the presence of fluvisols.

During the rainy season, erosion, transport and deposition processes are active, with the deposition of fines by decantation in the floodplains, bar deposition, lateral and vertical erosion in the channel, as well as occasional minor slippage of low intensity at the margins of larger channels.

For being terrains subject to seasonal flooding, with flooded areas and high-water table, Floodplains are very sensitive to anthropogenic interference and have a high risk of contamination. These areas are still highly vulnerable to siltation due to erosion on adjacent slopes, commonly caused by agricultural and livestock activities.

These characteristics give the Alluvial Plains a High Geoenvironmental Sensitivity.

Table 7.1.2.2.b
Characteristics and attributes of the Alluvial Plains

Unit of Land	ALUVIAL AND FLOODPLAINS	
Relief	**Alluvial and Floodplains (Ap)** Slope: 0 to 3% Variable Altitudes	Flattened plains formed by floodplains, which are seasonally flooded, with low terraces no longer affected by floods, and also marshes, swamps and lakes. Meanders and alluvial channels in rock.
Rocky Substrate and Detritical Coverage	Medium to thick sand, with intercalations of gravel and angular and subangular blocks of quartz and quartzite, and, subordinately, clay sand, clay and organic matter in flood plains and fluvial channels.	
Soil	Soils of clayey alluvium, relief of valleys and plains, drainage constraints, sometimes salinity and sodicity.	
Surface Dynamics and Fragilities	Periodic flooding in the plains and permanent flooding in the wetlands. Deposition of fines and organic matter by decantation during floods and sands and pebbles by lateral addition. Lateral and vertical erosion of the channel. Seasonal floods. Presence of wetlands, high water table and soft soils. Risk of contamination of the water table. Areas favourable to siltation. Lateral and vertical erosion of the channel and the banks. Settlement of foundations Damage to underground networks by repression	
Geoenvironmental Sensitivity	**HIGH** Due to the risk of flooding, contamination and silting.	

Occurrence of the processes: *Occasional* - occurs in some places, fortuitous and eventual. *Frequent* - occurs in several places, being a process that is repeated in the relief. *Generalized* - occurs in many places being common its presence.
Intensity of processes: *Low:* processes that affect small areas or have shallow depth; *High*: processes that affect large areas or have great depths; and *Average*: processes that affect areas and have moderate depths.

Photo 01: Alluvial Plain – Kagera River.

Photo 02: Alluvial Plain – Proximities of Solwa.

Plains and Plains with Wide Hills

Plains and Plains with Wide Hilla predominates along E-W alignment, as well as the extreme North, near Uganda Border, although they have a discontinuous distribution along the TL in other geomorphological units, including areas of hilly and mountains forms. The main factor defining this complex of shapes is the low slopes, the low degree of drainage deepening and the presence of wide-open valleys.

These terrains are formed by reliefs of flattened surfaces and medium and wide hills. The slopes are extensive with slopes ranging from 3 to 8% and sectors up to 20%.

These terrains consist of crystalline basement rocks and detrital and Cenozoic detrital and tertiary and quaternary covers.

These reliefs are dominated by cambisols with moderate susceptibility to erosion, as well as ferrasols and planosols with low susceptibility. In some areas there are vertisols with low to moderate susceptibility. The predominance of slopes below 8% gives these lands a Low Geoenvironmental Sensitivity, which is characterized by the occurrence of laminar erosion and occasional to frequent, low intensity grooves.

Table 7.1.2.2.c
Characteristics and attributes of Plains and Plains with Wide Hills

Unit of Land	PLAINS and PLAINS WITH WIDE HILLS	
Relief	**Plains (P)** Amplitude: 10 to 30m Slope: 3 to 10%	**Plains and Wide Hills (PWh)** Amplitude: 20 to 60m Slope: 3 to 10% with sectors 10 to 15%
Rocky Substrate and Detritical Coverage	Metasediments, migmatites, granites; Debris-lateritic covers, which vary greatly in composition, consisting of red or whitish sands, and generally unconsolidated clay sands, quaternary deposits, including river runoff and paleo lacustrine environment.	
Soil	Cambisols, Planosols, Vertisols and Ferrasols	
Surface Dynamics and Fragilities	Laminar erosion and occasional to frequent, low intensity grooves. Slight Erosion Susceptibility in ferrasol/planosols and Moderate in vertisols and cambisols. Difficulties in earthmoving, digging, and piling in shallow soil sites. Low adherence of clay surface soils.	
Geoenvironmental Sensitivity	**LOW** Terrain not very sensitive to interference, with localized problems due to the susceptibility to Cambisols erosion.	

Occurrence of the processes: *Occasional* - occurs in some places, fortuitous and eventual. *Frequent* - occurs in several places, being a process that is repeated in the relief. *Generalized* - occurs in many places being common its presence.
Intensity of processes: *Low:* processes that affect small areas or have shallow depth; *High*: processes that affect large areas or have great depths; and *Average*: processes that affect areas and have moderate depths.

Photo 03: Plains near Shinyanga.

Photo 04: Plains near Uganda border.

Soft Hills and Mounts

This unit includes areas with the occurrence of residual forms (inselbergs) and gentle hills. These areas have erosive valleys, embankments and slopes ranging from 15 to 30%, 30 to 45% and 8 to 15%.

Its distribution is wide along the alignment directive, occurring in isolated forms or in close sets, mainly along the E-W alignment. Near the southeast portion of Nyakanazi, a continuous area of soft hills was identified.

They consist of different crystalline basement rocks, including granites, migmatites, ultra-mafic rocks and, in some cases, metasediments.

The soils are shallow, stony, and develop on the slopes where morphogenetic processes predominate.

Residual rock landforms/Hilly relief terrain have *strong/very strong* erosion-susceptible soils, associated with slopes of 15 to 30%, which predominate in most of the area, with frequent sloping sectors with slopes of 30 to 45%. These characteristics give these terrains a High Geoenvironmental Sensitivity, which is characterized by the occurrence of laminar erosion processes, in frequent and medium to high intensity grooves and crawling; occasional low intensity planar landslides; occasional high intensity gullies; besides generalized fluvial notch and silting of frequent channels, both of high intensity.

Table 7.1.2.2.d
Characteristics and attributes of Soft Hills and Mounts

Unit of Land	SOFT HILLS AND MOUNTS RELIEF	
Relief	**Soft Hills (Sh)** Amplitude: 50 to 150 m Slope: 8 to 30%	**Mounts (H)** Amplitude: 100 to 280 m Slope: 15 to 30% and sectors of 30 to 45% and >45%

Unit of Land	SOFT HILLS AND MOUNTS RELIEF
Rocky Substrate and Detritical Coverage	Granites, migmatites, ultra-mafic and localized metasediments
Soil	Lithic soils, sandy loam texture and altered rock. Rock outcrops.
Surface Dynamics and Fragilities	Laminar erosion in grooves and frequent to generalized crawling of medium to high intensity. Occasional low intensity planar landslides. Occasional high intensity gullies. Generalized and high intensity fluvial notch. Frequent and high intensity siltation of channels. Strong/Very strong susceptibility to erosion in soils. Difficulties in earthmoving, plowing and laying of foundations due to the presence of rocky top irregularity, the presence of boulders and rocky outcrops.
Geoenvironmental Sensitivity	**HIGH** Terrain very sensitive to interference due to problems associated with Strong/Very strong susceptibility to erosion of the soil, slopes.

Occurrence of the processes: *Occasional* - occurs in some places, fortuitous and eventual. *Frequent* - occurs in several places, being a process that is repeated in the relief. *Generalized* - occurs in many places being common its presence.
Intensity of processes: *Low:* processes that affect small areas or have shallow depth; *High*: processes that affect large areas or have great depths; and *Average*: processes that affect areas and have moderate depths.

Photo 05: Mounts near Nyugwa ward.

Photo 06: Mounts near Shinyanga.

Mountains and Mountains with Flat Tops

These terrains are formed by mountain reliefs, with closely embedded and eroded valleys and slopes greater than 30%. Sectors with smaller slopes are observed, as well as with greater than 45%.

The altitudes are varied, between 1200 and 1700m, constituting the most prominent features of the regional landscape along N-S alignment. They consist of metasediments basement rocks. Soils are shallow and stony, with outcrops, although in these terrains ferrasols are observed and can predominate along flatten tops areas.

The susceptibility to erosion of these soils is *Strong/Very Strong*, associated with slopes of 30 to 45% and greater than 45% on mountain slopes, giving these terrains a Very High

Geoenvironmental Sensitivity, which is characterized by the occurrence of: laminar and groove erosion; frequent and medium to high intensity creeping, planar sliding and falling blocks; high intensity generalized river notch; and debris deposition at the foot of occasional low-intensity slopes.

Table 7.1.2.2.e
Characteristics and attributes of Mountainous terrains

Unit of Land	MOUNTAINOUS
Relief	**Mountains (MM) and Mountains with Flat Tops (MMt)** Amplitude: 100 to 460m Slope: up to 20% and sectors >45%
Rocky Substrate and Detritical Coverage	Detrital metasediments of Bukoba Group
Soil	Lithic soils, sandy loam texture and altered rock. Rock outcrops. Ferrasols.
Surface Dynamics and Fragilities	Laminar and groove erosion, frequent gullies and crawling of medium to high intensity. Planar landslides and frequent blocks fall of medium intensity. Generalized and high intensity river notch. Debris deposition at the foot of occasional and medium intensity slopes. Strong/Very strong susceptibility to erosion in soils. Difficulties in digging and piling, the possibility of differential repression in structural foundations due to the presence of bumps in the ground and extensive rock outcrops. Risk of landslides and falling blocks due to exposure of soil/rock contact in saturated or watery areas and unsupporting in cutting slopes or hillside surface. More intense risk of erosion in grooves and ravines in cuts than in landfills, which can be compacted. Risk of siltation of the river channels near the intervention areas due to the high erodibility of the soils.
Geoenvironmental Sensitivity	**VERY HIGH** Improper terrain and/or very susceptible to interference due to steep slopes, the intensity of erosion and the extent of rocky outcrops.

Occurrence of the processes: *Occasional* - occurs in some places, fortuitous and eventual. *Frequent* - occurs in several places, being a process that is repeated in the relief. *Generalized* - occurs in many places being common its presence.
Intensity of processes: *Low:* processes that affect small areas or have shallow depth; *High*: processes that affect large areas or have great depths; and *Average*: processes that affect areas and have moderate depths.

Photos 07 and 08: Mountainous areas near Nyakayanja.

Plateau

These forms constitute elevated surfaces at different altitudes, resulting from processes of flattening. In the study area, they were mapped embedded in mountainous reliefs to the southeast and north of Nyakanazi.

In terms of surface dynamics, they have the same characteristics as flat terrain, with the low slopes observed being the conditioning factor for their low susceptibility to erosion processes.

The lithological composition is predominantly related to Bukoba Group metasediments, including metarenites and metaquartizites, beyond ultra-mafic rocks. Deep soils (ferrasols) and nitosols develop there in areas of mafic rock.

The areas of greatest vulnerability, however, occur at the contact with other forms of relief, which can be abrupt, forming discontinuous escarpments.

The predominance of slopes below 8% gives these lands a Low Geoenvironmental Sensitivity, which is characterized by the occurrence of laminar erosion and occasional to frequent, low intensity grooves.

Table 7.1.2.2.f
Characteristics and attributes of Plateau

Unit of Land	PLATEAU
Relief	**Plateau** Amplitude: 100 to 460m Slope: up to 20% and sectors >45%
Rocky Substrate and Detritical Coverage	Detrital metasediments of Bukoba Group and ultra-mafic rocks.
Soil	Ferrasols and Nitosols.
Surface Dynamics and Fragilities	Laminar erosion and occasional to frequent, low intensity grooves. Slight Erosion Susceptibility in ferrasol and nitosols. Difficulties in earthmoving, digging, and piling in shallow soil sites. Low adherence of clay surface soils.
Geoenvironmental Sensitivity	**LOW** Terrain not very sensitive to interference, with localized problems due to the susceptibility to Cambisols erosion.

Occurrence of the processes: *Occasional* - occurs in some places, fortuitous and eventual. *Frequent* - occurs in several places, being a process that is repeated in the relief. *Generalized* - occurs in many places being common its presence.
Intensity of processes: *Low:* processes that affect small areas or have shallow depth; *High*: processes that affect large areas or have great depths; and *Average*: processes that affect areas and have moderate depths.

7.1.3
Soils Characterization

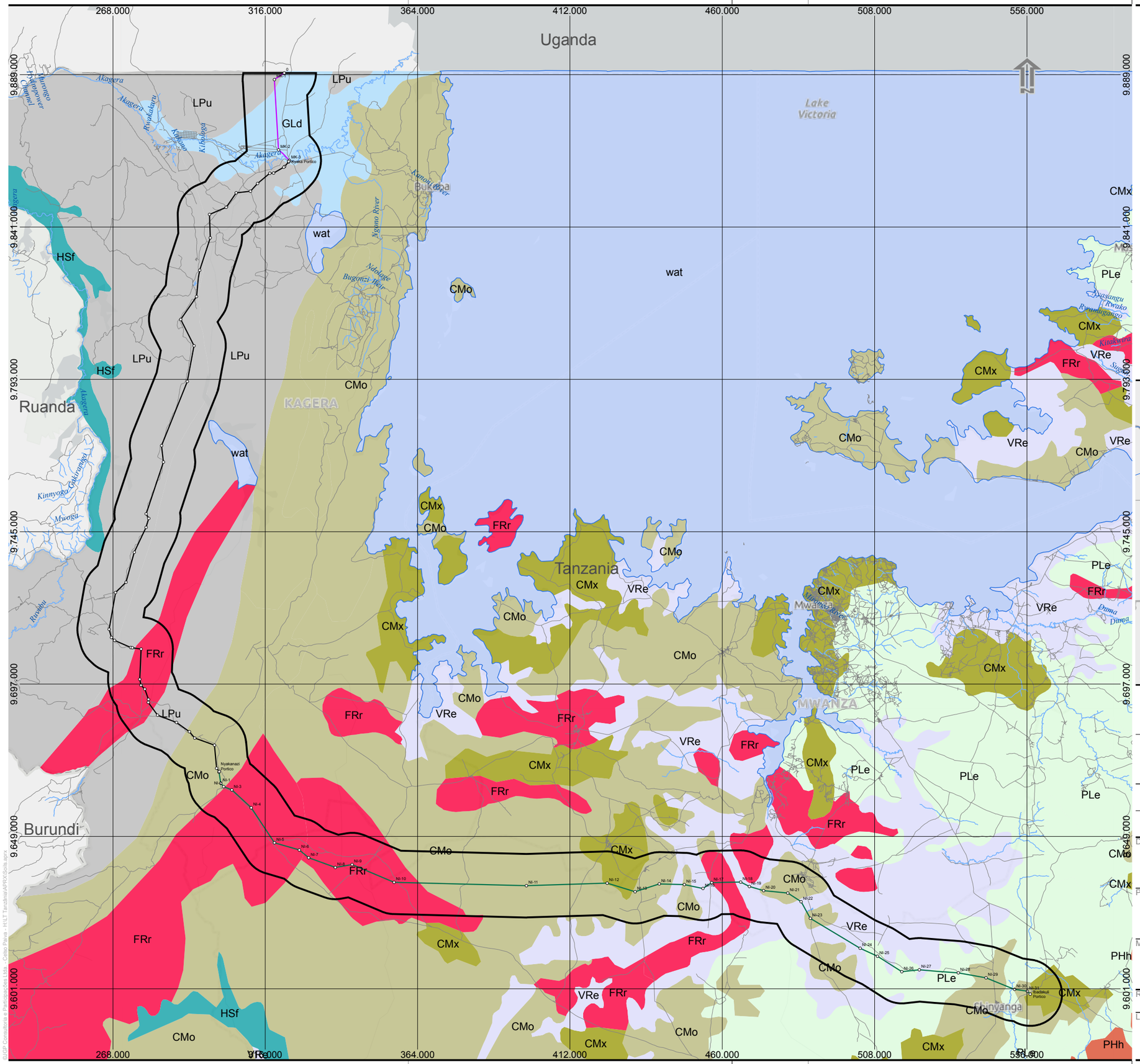
For the identification and characterization of the main soil types that occur along the TLs' alignment, the Provisional Soils Map of Tanzania (BAKER *et al.*, 1977) was consulted.

The compilation of cartographic data available in the FAO/UNESCO soil maps data base, and the information provided by the Soils of Tanzania and their Potential for Agriculture Development Report (Ministry of Agriculture, Food Security and Co-Operatives, 2006), complemented the analyses.

With regards to the soil classification system, the International Soil Classification System updated by the Food and Agriculture Organization (FAO/UN, 2015) was utilized.

In general terms, the soils that occur along the study corridor are directly related to the general subdivision of the relief and to the regional lithostratigraphic distribution. Based on data provided by FAO (SOTERSAF), cambisols are found in the vicinity of Ibadakuli. Planosols and vertisols are used to be found along fluvial plains. As the TLs heads west, there is a widespread occurrence of cambisols and and patches of rhodic ferrasols in areas of residual mountainous relief. To the north of Nyakanazi, it means, along S-N alignment, there is a predominance of leptosols and, north to Kyaka it is predominant the occurrence of gelysols and luvisols.

Map 7.1.3.a shows spatial distribution of soil types and groups along TLs' alignment. The characterization of each soil group is presented below.



Legend

T-line Alignment

- Vertices
- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Roads
- Waterways
- Indirect Area of Influence of Physical Environment

Dominant Soils

- CMo — Ferralic CAMBISOLS
- CMx — Chromic CAMBISOLS
- FRr — Rhodic FERRALSOLS
- GLd — Dystric GLEYSOLS
- HSf — Fibric HISTOSOLS
- LPu — Umbric LEPTOSOLS
- PHh — Haplic PHAEOZEMS
- PLe — Eutric PLANOSOLS
- VRe — Eutric VERTSOLS
- wat — Water

Source:
ISRIC, FAO and UNEP
Soil and Terrain Database for Southern Africa (SOTERSAF), August 2024
Available at: https://data.isric.org/geonetwork/srv/eng/catalog.search#/metadata/3571c1f3-159d-442c-b324-0af53d03f12e

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 21036

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
08/24/2024	1:1.200.000	Soils.aprx	Ø

Developer:
Tanzania Electric Supply Company Limited (TANESCO)

Project:
PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.3.a:
Map of Soils

Regions:
Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:
JGP Consultoria e Participações Ltda.

JGP Consultoria e Participações Ltda. - Celso Paiva - H:\LT Tanzania\APRX\Soils.aprx

Cambisols

They are non-hydromorphic and poorly-developed mineral soils with incipient B horizon, presenting, in their horizons, non-weathered primary minerals. Cromic cambisols are moderately drained and shallow. The silt/clay ratio is high, generally higher than the Oxisols', given their lower degree of weathering. They may have a medium, clay and very clay texture. On the A surface horizon moderate or prominent type, with a granular structure, the B subsurface horizon presents a moderate subangular structure. As they are shallow soils with low porosity, they offer limitations for agricultural production;

Along the Project, cambisols occurs in the 400 kV Nyakanazi – Ibadakuli TL region, generally since Ibadakuli up to the ward of Kaniha, that is located to the east of Nyakanazi SS. Two types of cambisols were identified, as described:

- Chromic cambisols - having a reddish coloured subsurface layer, 30 cm or more thick.
- Ferralic cambisols - horizon within100 cm of the soil surface where the clay fraction is dominated by low-activity clays and the silt and sand fractions by highly resistant minerals, such as (hydr)oxides of Fe, Al, Mn and titanium (Ti)
- Rhodic - having within 150 cm of the soil surface a reddish subsurface layer, 30 cm or more thick, with a Munsell hue that is redder than 5 YR, a value of less than 3.5 when moist and when dry, a value that is no more than one unit higher than when moist.

Photo 01: Cultivated cambisols.

Photo 02: View of a profile portion of cambisols.

Planosols

Planosols are a group of mineral soils with a B horizon, underlying any type of A horizon, and may or may not have an E horizon (albic or not). They show vigorous desiccation of the most superficial part and accumulation or intense concentration of clay in the subsurface horizon.

The classification criterion is linked to the expression of intense desargilization, evidenced by the clear differentiation between the plains B horizon and the preceding A

or E horizons preceding A or E horizons, with an abrupt textural change or abrupt transition combined with a marked difference in texture from the A or E horizon to the B horizon. Another aspect is related to the restriction of permeability in the subsurface, which interferes with infiltration and the water regime, with evidence of reduction processes, with or without segregation of iron, which manifests itself in the colour attributes, with the possibility of mobilization and sorption of the Na+ cation.

Planosols are found in the eastern part of the 400 kV Nyakanazi – Ibadakuli TL alignment, between Shilabela and Iselamagazi, in Shinyanga. The following type of planosol was identified:

- Calcic - having a layer, 15 cm or more thick, with 15% or more secondary carbonate present only in the form of fine particles dispersed in the matrix or as discontinuous concentrations.

Photo 03 and Photo 04: Areas of occurrence of planosols. Near Solwa, in Shinyanga.

Vertisols

These are non-hydromorphic mineral soils or soils with a serious temporary restriction to water percolation, with 30% or more clay along the profile, and which show a pronounced change in volume according to the variation in moisture content. Their characteristic morphological features are the presence of wide, deep shrinkage cracks that open from the top of the profile in dry periods, slickensides in the innermost sections of the profile with large structural units that are inclined in relation to the profile's plumb line.

Due to the high base sum and cation exchange capacity values, associated with the frequent presence of large quantities of easily weathered minerals, they have a high nutritional potential for plants. In large areas, during the period when there is good humidity, the soil is difficult to prepare due to its very clayey texture. On the other hand, the high stickiness when wet and the high hardness when dry require a lot of traction, limiting the use of these soils. Vertisols are not very permeable, which restricts their drainage. These soils occur in flat, gently undulating areas, depressions and former lake sites.

The vertisols occur discontinuously along the 400 kV Nyakanazi – Ibadakuli TL, from Shilabela up to the vicinity of Ilogi, along the induction plains, paleochannels and depression areas. The following types of vertisols were identified:

- Eutric - having a base saturation of 50% or more in the major part between20 and100 cm depth.
- Pellic - having in the upper 30 cm of the soil a dark colour with a Munsell value when moist of 3.5 or less and a chroma of 1.5 or less.

Photo 05 and Photo 06: "Buga" soil (vertisols) near a fluvial plain. Geita region.

Ferrasols

Ferrasols also occur in the 400 kV Nyakanazi – Ibadakuli TL. This type of soil begins to occur in patches from the vicinity of Bulega, and patches have also been identified to the north of Nyakanazi.

These are soils made up of mineral material, with a brassolic B horizon, immediately below any type of A horizon, within 200 cm of the soil surface or within 300 cm if the A horizon is more than 150 cm thick. The soils are devoid of primary or secondary minerals that are less resistant to weathering, and have a low cation exchange capacity of less than 170 cmolc/KgTFSA of clay without correction for carbon, ranging from predominantly kaolinitic soils, with higher Ki values of around 2, with a maximum of 2.2, to oxidic soils with extremely low Ki.

They range from strongly to well drained. They are usually very deep, with the thickness of the soil rarely less than one meter. They have a sequence of A, B and C horizons, with little differentiation between horizons. Transitions between horizons are usually diffuse or gradual.

In contrast to the darker colours of the A horizon, the B horizon has a more vivid appearance, with colours ranging from yellow or even bruno-grey to dark red-grey, in shades from 2.5 YR to 10YR. This depends on the nature, form and quantity of the constituents (usually iron oxides and hydroxides), according to the soil's water regime and drainage conditions, the iron content in the source rock and whether the hematite is

inherited from it or not. In the C horizon, which is comparatively less coloured, the chromatic expression is quite variable, even heterogeneous, given its more saprolitic nature. In general, they are strongly acidic soils with low base saturation and dystrophic.

In the area of occurrence, the ferrasols were classified as Rhodic Ferrasols - having within 150 cm of the soil surface a reddish subsurface layer, 30 cm or more thick, with a Munsell hue that is redder than 5 YR, a value of less than 3.5 when moist and when dry, a value that is no more than one unit higher than when moist.

Photo 07: Road in area of occurrence of typical ferrasols. Nyantakara – Kagera.

Photo 08: Savana vegetation developed on a ferrasols occurrence area. Nyantakara – Kagera.

Leptosols

This is a group of poorly evolved soils with no defined diagnostic B horizon. horizon. They are soils in the process of formation, either due to the reduced action of pedogenetic processes or by inherent characteristics of the parent material. The classification criteria are related to the insufficient expression of the attributes that characterize the various formation processes, such as the differentiation of horizons, with the individualization of the A horizon followed by the C or R horizons, as well as the predominance of characteristics inherited from the original material.

Litholic neosols are found on slopes above 30% and are located on high slopes, interfluves and tops. They comprise poorly developed mineral soils with depths of up to 0.50m. They have a sequence of A - R or A - C - R horizons, a moderate type A surface horizon, a medium to clayey texture and a granular structure. The subsurface C horizon has a medium or clayey texture, with a structure reflecting the source material.

Soils with an A or hystic horizon, laid directly on the rock or on a C or Cr horizon or on material with 90% (by volume) or more of its mass made up of rock fragments with a diameter greater than 2 mm (gravel, pebbles and boulders), which have a typical lithic contact or fragment within 50 cm of the soil surface. They have a B horizon at the beginning of its formation, the thickness of which does not satisfy any type of diagnostic B horizon.

The lithosols found generally along the 400 kV Kyaka – Nyakanazi TL (N-S route) may have a dark surface profile (umbric leptsols), due to the concentration and conservation of organic matter, the occurrence of which can be explained by the high altitudes observed up to the vicinity of the Kagera River depression.

Photo 09: Leptsols with boulders outcrops. Nyakahanga – Kagera.

Photo 10: Leptsols with boulders outcrops on a steep slope. Nyaishozi – Kagera.

Fluvisols with gleysols

These are the soils found in the 400 kV Mutukula – Kyaka TL, from north of Kyaka up to the border with Rwanda, where they can occur in association with gleysols. These are soils derived from alluvial sediments with an A horizon over a layer or C horizon, which has a fluvial character within 150 cm of the soil surface. They may have a glei horizon, horizons with a pale, variegated colour or with abundant or common reduction mottling, which occur below the A horizon. These soils develop on the broad alluvial plains of the main drainage network.

Depending on the granulometric composition of the deposited sediment, these soils have a variable texture, from clayey to sandy, as well as varying morphology in terms of dry, moist and wet consistency, and varying colours from pastel to black. It also shows great variation in organic matter content and its distribution in the profile, which is evidence of several cycles of fluvial deposition.

Photo 11: Cultivated fluvisols. Nsunga – Kagera.

Photo 12: Fluvisols profile near a river channel. Busonzo – Geita.

7.1.4
Erodibility

The classification of susceptibility to erosion in the area of influence was determined by analyzing the interaction between soil erodibility and relief characteristics, and was based on the mapping units shown on the **Map 7.1.4.a**.

To characterize the susceptibility to erosion, information on the characteristics of the soils as opposed to the characteristics of the relief was basically used to establish the categories of natural susceptibility to surface erosion of the land.

The slope and ramp length factors were taken into account when describing the soils, as an integral part of each mapping unit, and the following relief classes were differentiated: flat (slopes of 0 to 3%); gently undulating (slopes of 3 to 8%); undulating (slopes of 8 to 20%), strongly undulating (slopes of 20 to 45%) and steep and very steep (slopes greater than 45%).

The soils were grouped into four different erodibility classes based on quantitative experimental results from specialized literature and an analysis of their intrinsic characteristics, and the following soil erodibility classes were defined:

- Low - This class includes homogeneous, deep soils, with a loamy B horizon and free of gravel or concretions. In general, they have low calculated erodibility values, such as ferrasols and nitosols, both of which have a clayey texture.

- Moderate - This class includes homogeneous, deep soils with a B horizon of medium texture tending towards sandy, or sandy texture throughout the profile. They generally have low calculated erodibility values. Its main representatives are sandy/medium or medium-textured argisols and gleissols.

- Strong - This class includes relatively deep soils, but with some kind of physical impediment to internal permeability, such as a clay-textured B textural horizon,

lithological discontinuity, abrupt textural change or a high textural gradient. They generally have intermediate calculated erodibility values. Its main representatives are argisols, plinthosols and fluvic neosols.

- Very Strong - This class includes soils with a shallow depth, associated with high silt content and the occurrence of other elements restricting drainage. They generally have high calculated erodibility values. Its main representatives are lithic neosols and cambisols.

To define the classes of susceptibility to surface erosion, an analysis was made of the interaction between soil erodibility and relief characteristics, as shown in **Table 7.1.4.a**.

Table 7.1.4.a
Erosion susceptibility classes, obtained from the relationship between soil erodibility and slope

Erodibility	SLOPE				
	Flat (0 a 3%)	**Gently Undulating (3 a 8%)**	**Undulating (8 a 20%)**	**Steep (20 a 45%)**	**Very Steep (>45%)**
Low	Low	Low	Low / Moderate	Moderate / High	High
Moderate	Low / Moderate	Moderate	Moderate/ High	High	High / Very High
High	Moderate	Moderate/ High	High	High / Very High	Very High
Very High	Moderate	Moderate/ High	High	Very High	Very High

Applying the methodology used and the pedological and geomorphological conditions identified for the study area, we have the following indications of soil erodibility, as shown in **Table 7.1.4.b**.

Table 7.1.4.b
Soil susceptibility classes

Soil	SLOPE				
	Flat (0 a 3%)	**Gently Undulating (3 a 8%)**	**Undulating (8 a 20%)**	**Steep (20 a 45%)**	**Very Steep (>45%)**
Cambisol	Moderate	Moderate / High	High	Very High	Very High
Planosol	Low	Low	Low/Moderate	Moderate / High	High
Vertisol	Low / Moderate	Moderate	Moderate	Moderate / High	High / Very High
Ferrasol	Low	Low	Low/Moderate	Moderate / High	High
Leptosol	Moderate	Moderate / High	High	Very High	Very High
Fluvisol Gleysol	Moderate	Moderate / High	High	High/ Very High	Very High

Map 7.1.4.a shows the spatialization of the results obtained. As can be seen, the areas most susceptible to erosion are located in the mountainous terrain along the N-S route. This condition is defined both by the greater slopes observed there and by the presence of incipient soils. The presence of isolated hills or bands of folds that form ridges along the E-W route also imply high soil erodibility. In the rest of the alignment, however, it is possible to infer that a condition of low risk to erosion prevails, given the occurrence of extensive flat surfaces, where the amplitudes condition the low energy of rainfall runoff.

268,000 316,000 364,000 412,000 460,000 508,000 556,000

9,889,000 9,841,000 9,793,000 9,745,000 9,697,000 9,649,000 9,601,000

Uganda

Ruanda

Burundi

Legend

Optimized Alignment

- TL Mutukula - Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A) - Optimized
- TL Nyakanazi - Ibadakuli (Option 1) - Optimized
- Physical environment indirect interference

Soil erosin risk

- Low
- Low / Moderate
- Moderate
- Moderate / High
- High
- High / Very High

Source:
Tanzania Data base
http/.....sss

UTM- Zona 36S
Datum: WGS 84 - EPSG 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
8/26/2024	1:1,200,000	Erosin risk.mxd	Ø

Tanzania Electric Supply Company Limited (TANESCO)

Project:

PROPOSED 400kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.4.a:

Soil erosion risk

Regions:

Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:

JGP Consultoria e Participações Ltda.

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7.1.5
Climate

In order to characterize the climate of the project region, was adopted a systemic approach starting from the synoptic scale, considering the phenomena that define the climate of the African continent, and then addressing the local characteristics of the study area. Cook (2000), Peel *et al*. (2007), Tique (2015), Nobre & Molion (1986), Uvo & Nobre (1989), among others, were consulted.

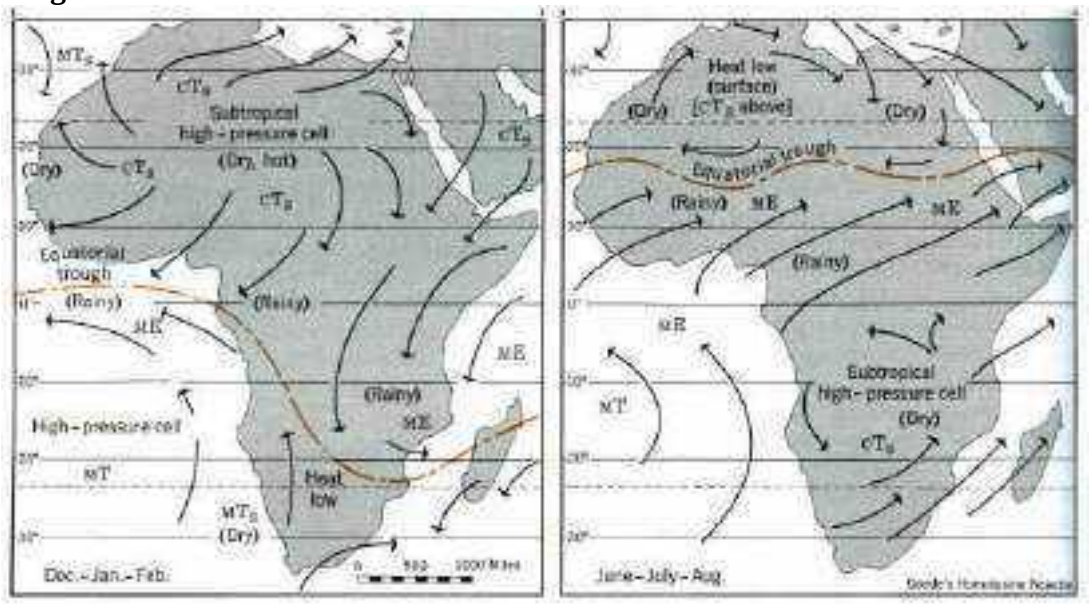
In addition, information from reports produced by the Tanzanian Meteorological Authority (TMA) was used, as well as data from reports by international organizations that promote regional development. Specifically in relation to the historical series of meteorological parameters, data from the Prediction of Worldwide Energy Resource (POWER) Project of the American Space Agency (NASA) was used as a complement.

According to National Climate Change Strategy (GOVERNMENT OF TANZANIA, 2012), the climate in the country is diverse as a result of proximity of the ocean and inland lakes; wide altitudinal range, which governs temperature; and latitude. It is characterized by two main rain seasons namely the long rains and the short rains which are associated with the southward and northwards movement of the Inter-Tropical Convergence Zone. The long rains (Masika) begin in the mid of March and end at the end May, while the short rains (Vuli) begin in the middle of October and continues to early December. The northern part of the country including areas around Lake Victoria Basin, North-Eastern Highlands and the Northern Coast experience a bimodal rainfall regime. Central, South and Western areas have a prolonged unimodal rainfall regime starting from November, continuing to the end of April. In general, annual rainfall varies from 550 mm in the central part of the country up to 3690 mm in some parts of south-western highlands.

Atmospheric Circulation

The climate and weather variation in the study area is influenced by global atmospheric circulation patterns. The majority of Tanzania's land lies in the tropic zone, between the low-pressure area near the equator and the high-pressure belt in the southern hemisphere. This causes air masses to move in a southeast-northwest direction due to the Coriolis Force, which is not a real force but rather a mathematical device used in meteorology to account for the Earth's rotation. This "force" is perpendicular to the movement's path, pointing toward areas of high pressure. It is strongest near the poles and weakest at the equator. **Figure 7.1.5.a** shows the main air masses affecting the African continent.

Figure 7.1.5.a
Diagram of the main air masses on the African continent



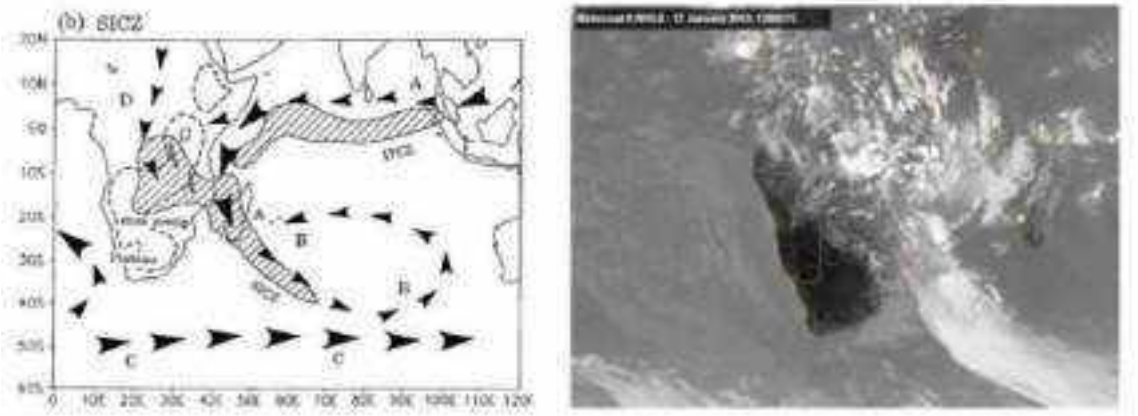
Source: Adapted from Milhano (2008).

The region's climate is largely influenced by several atmospheric systems, including the Intertropical Convergence Zone (ITCZ), the South Indian Convergence Zone (SICZ), the South Atlantic Subtropical Anticyclone (ASAS), and the South Indian Anticyclone (SIA). Additionally, the El Niño Southern Oscillation (ENSO) and the Tropical Indian Dipole Pattern (TIDP) play significant roles in shaping the climate. The ITCZ, influenced by the Alisian Convergence Zone (ACZ) and sea surface temperature (SST), is considered the most important system for generating precipitation over the equatorial region of the Atlantic and Pacific Oceans and the adjacent continents. Notably, variations in SST act as forcing factors and significantly influence atmospheric circulation patterns, leading to changes in precipitation

The South Indian Convergence Zone (**Figure 7.1.5.b**) is formed by the convergence of the southeast and northeast trade winds, leading to the rise of humid air masses. This typically results in the formation of low-pressure bands, favouring cloud formation and precipitation. These systems work together to transport humidity and enhance precipitation over the continent.

The South Atlantic Subtropical Anticyclone (ASAS) is a semi-stationary system that persists throughout the year, with variations in its position and spatial scope. It has a high level of humidity due to ocean evaporation, making it humid and warm because of the high incidence of solar radiation.

Figure 7.1.5.b
Representation of the South Indian Convergence Zone

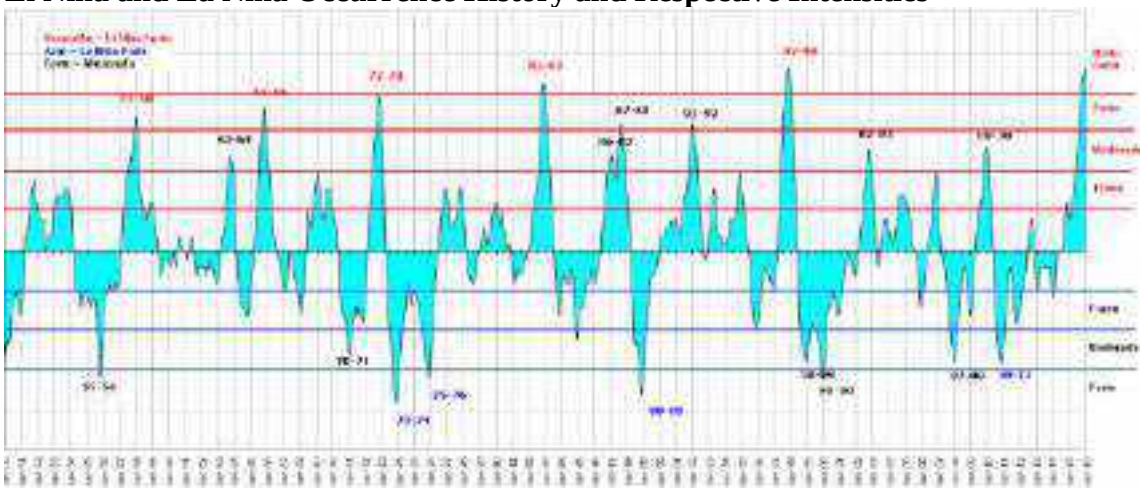


Source: Adapted from Tique (2015). Schematic representation of the South Indian Convergence Zone (SICZ) (NINOMIYA, 2008), left. METEOSAT 2013 image of the SACZ, on the right.

The El Niño and La Niña phenomena refer to the weakening of the trade winds, the eastward displacement of the Walker cell, and the intensification of the subtropical jet, which alter the rainfall regime in the region. These phenomena are associated with the positive and negative phases of the Southern Oscillation, respectively. El Niño represents a positive thermal anomaly in the Sea Surface Temperature (SST) of the Pacific Ocean during the southern hemisphere's summer, while La Niña represents a negative anomaly. Its average duration, from warming to cooling, is 12 to 18 months, typically beginning at the start of the year and reaching its maximum around December.

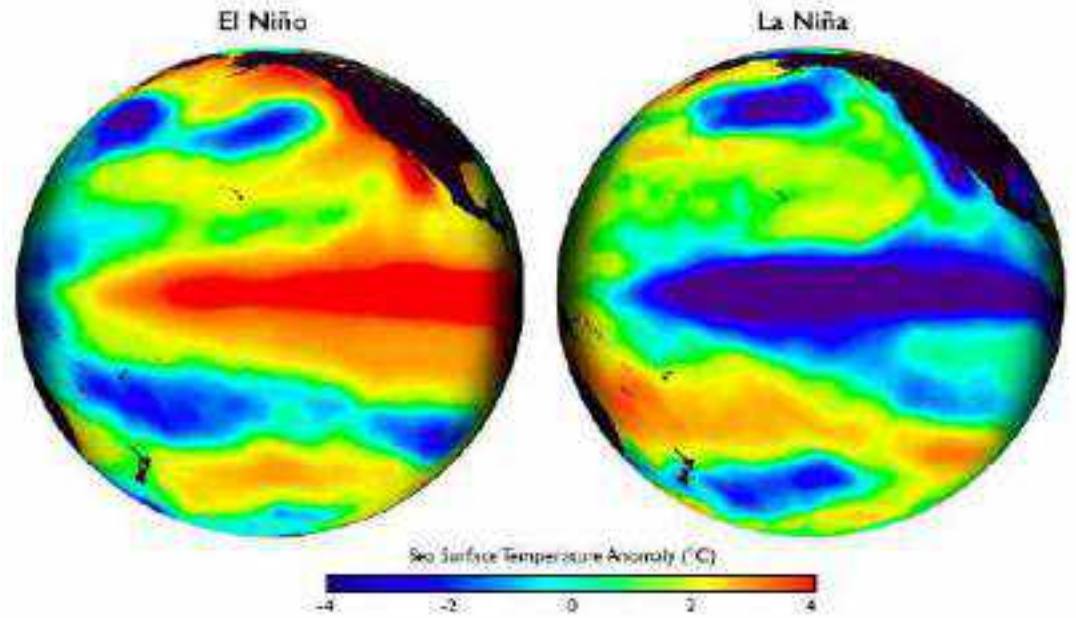
Figures 7.1.5.c and **7.1.5.d** show an annual retrospective of the occurrence of the phenomena and the warming/cooling scheme of ocean waters.

Figure 7.1.5.c
El Niña and La Niña Occurrence History and Respective Intensities



Source: INMET. Period from 1950 to 2016.

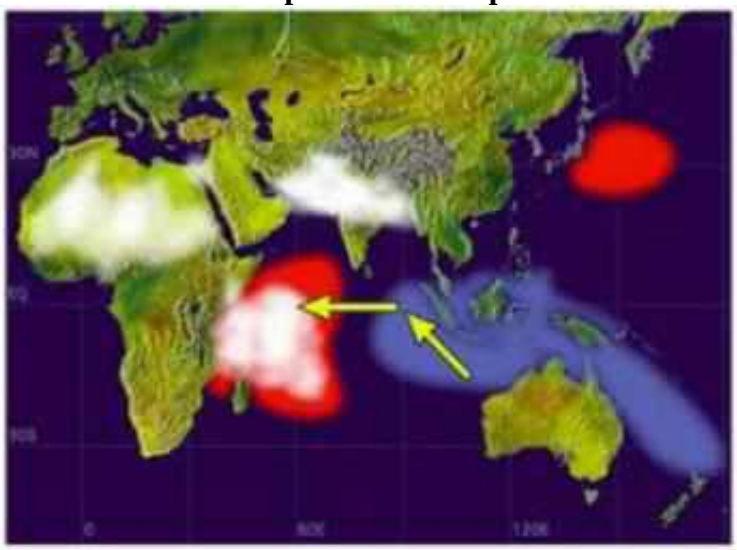
Figure 7.1.5.d
Representation of Sea Temperature During El Niño and La Niña



Source: Adapted from NOAA Education Resources.

The Tropical Indian Dipole Pattern (TIDP) is characterized by positive sea surface temperature (SST) anomalies in the western Indian Ocean off the coast of Africa and negative anomalies on the west coast of Indonesia. It alternates between two phases: positive and negative. In the positive phase, the positive SST anomalies are found close to the African coast, influencing the climate of the region of interest. **Figure 7.1.5.e** illustrates the action of the DMI.

Figure 7.1.5.e
Schematic of the Tropical Indian Dipole Pattern



Source: Adapted from Tique (2015).

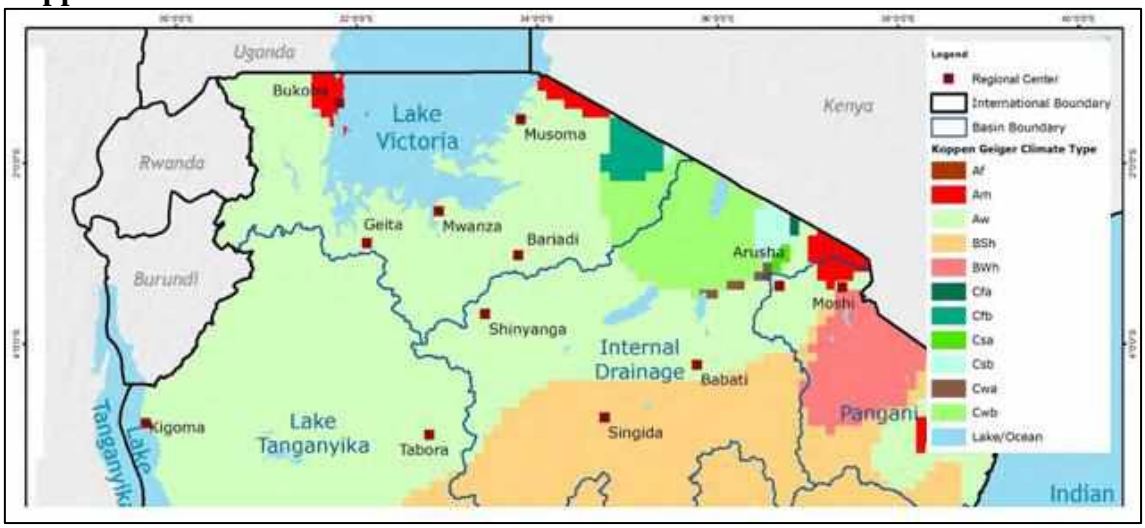
Various mesoscale synoptic systems play a significant role in causing precipitation in southwest Africa by creating bands of cloudiness. These bands are connected to equatorial troughs, such as the semi-permanent low over Angola and the Congo low (COOK, 2000). Anomalies also occur due to the influence of the ENOS phenomenon, impacting sea surface temperatures (SST) and leading to either above-normal rainfall in southwest Africa during El Niño or more severe periods of drought during La Niña. Four atmospheric flows related to the large-scale systems mentioned above further influence these mesoscale systems. The easterly flow originates from the Indian Ocean due to surface divergence caused by the ASI.

The Southeast Flow is associated with the SST in the subtropical Indian Ocean when the ASI shifts further south. The Northeast Flow is linked to the Asian monsoon and occurs only during the rainy season. The convergence of these three flows over the continent creates favourable conditions for the formation of cumuliform clouds. Finally, the westerly flow results from the convergence between the equatorial flow and the southeastern edge of the South Atlantic Subtropical Anticyclone.

Climate Classification

Based on the Koppen climate classification, the region's climate falls under the Aw category, which denotes a megathermic climate with an average annual temperature of over 18ºC. The letter "w" indicates that it is a humid tropical savannah climate where the dry season coincides with winter, and the maximum observed rainfall is less than 60 mm, between May and October. The rainy season, which is in summer, covers the period from November to April, and the annual rainfall exceeds 750 mm. The Bukoka region is dominated by the Am climate, which has a shorter dry season (as shown in **Figure 7.1.5.f**).

Figure 7.1.5.f
Koppen climate classification of north of Tanzania



Source: Tanzania Water Resources Atlas (2019).

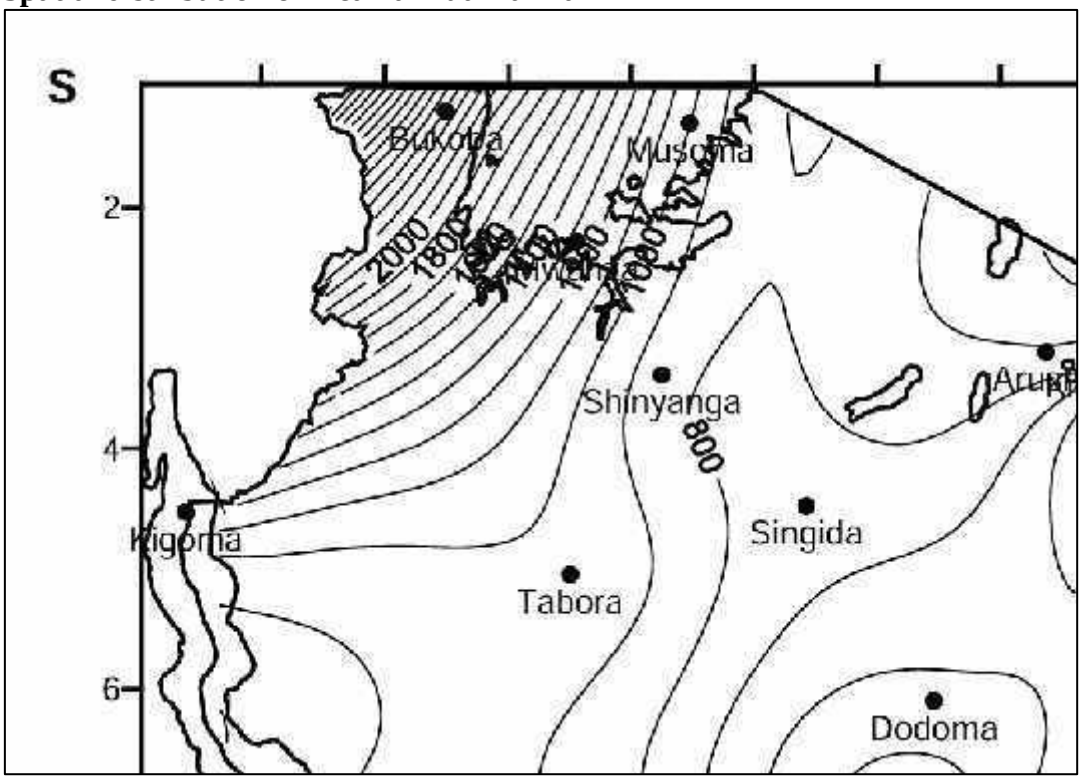
Weather Parameters

Precipitation

The distribution of average annual rainfall in the Project region is shown in **Figure 7.1.5.g**. The isopleths in the Shinyanga region are around 800 mm per year and increase towards the west. On the other hand, in the Bukoba region, the annual averages can easily exceed 2,500 mm. According to the National Climate Change Statistic Report (2019), the data indicates that the average annual rainfall in Bukoba dropped from 2,280 mm in 2012 to 1,706 mm in 2018. Similarly, the Mwanza region also experienced a decrease in average annual rainfall from 1,307 mm in 2012 to 1,153 mm in 2018.

The alignment to the east of the route has a distinct tropical rainfall pattern, with rainy summers and dry winters. Similarly, the Bukoba region in the far northwest of the project experiences a similar pattern, but with higher average monthly rainfall. Dry months occur only in the June-August quarter.

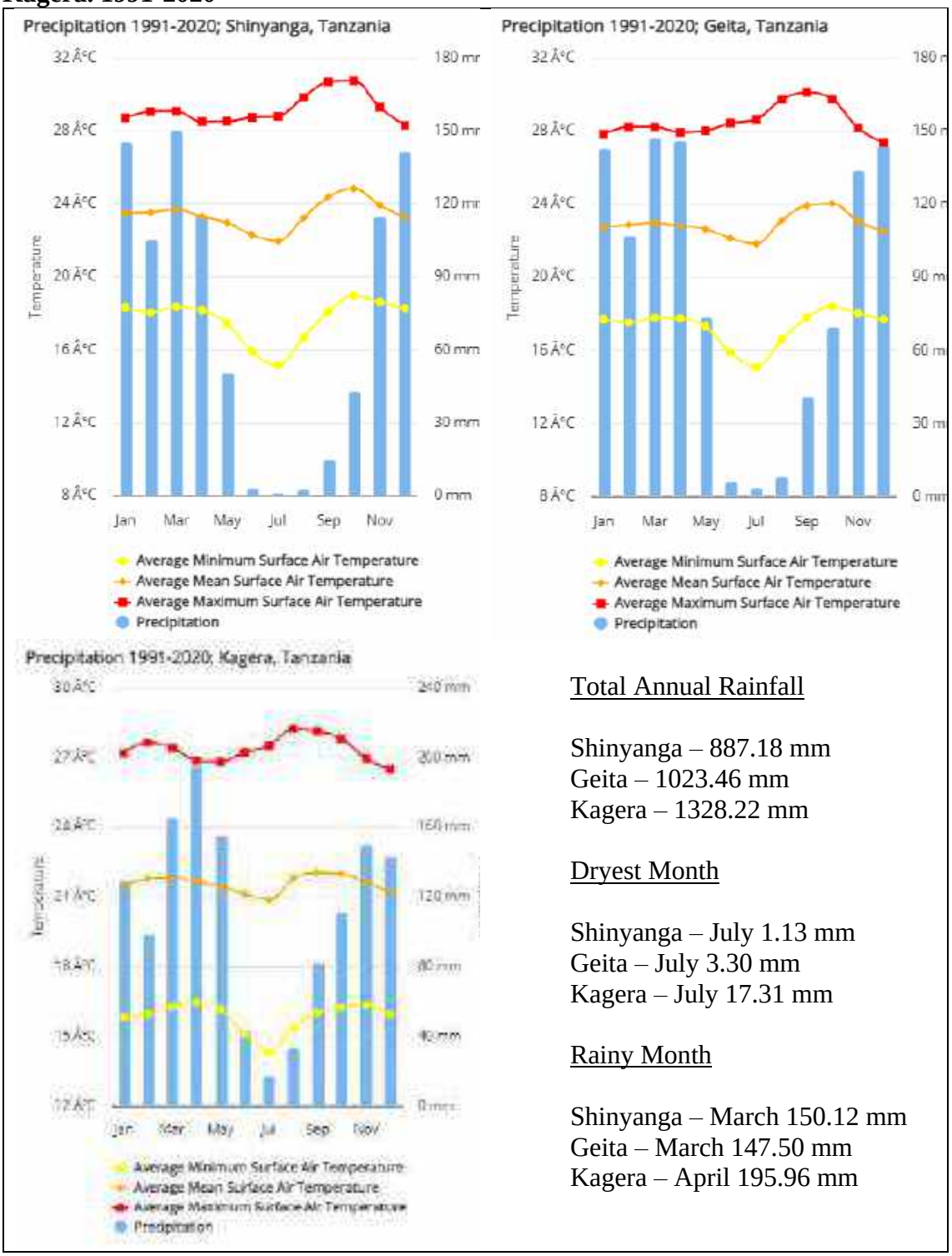
Figure 7.1.5.g
Spatial distribution of mean annual rainfall



Source: Government of Tanzania (2012).

Figure 7.1.5.h shows the climograms with the variation in rainfall throughout the year in the regions affected by the Project. July is the driest month in all locations, when average rainfall remains below 10.00 mm. March is the wettest month in Shinyanga (150.12 mm) and Geita (147.50). In Kagera, the highest rainfall is recorded in April (195.96 mm).

Figure 7.1.5.h
Montlhly climatology of precipitation and temperature. Shinyanga, Geita and Kagera. 1991-2020



Total Annual Rainfall

Shinyanga – 887.18 mm
Geita – 1023.46 mm
Kagera – 1328.22 mm

Dryest Month

Shinyanga – July 1.13 mm
Geita – July 3.30 mm
Kagera – July 17.31 mm

Rainy Month

Shinyanga – March 150.12 mm
Geita – March 147.50 mm
Kagera – April 195.96 mm

Source: World Bank (2024).

Temperatures

Regarding the thermal regime, the homogeneity of its distribution stands out, which is only disturbed by orographic factors, particularly in the section within Kagera region. The temperature profile in general is characteristic of regions with tropical climate, with minimum temperatures in July and maximums in October/November. **Table 7.1.5.a** below prove the distribution of the averages presented in **Figure 7.1.5.h**. There is a downward trend in temperature from Shinyanga do Kagera.

Table 7.1.5.a
Average monthly temperatures (ºC) variation. Shinyanga, Geita and Kagera. 1991-2020

	Shinyanga			Geita			Kagera		
	Avg Temp	Max Temp	Min Temp	Avg Temp	Max Temp	Min Temp	Avg Temp	Max Temp	Min Temp
Jan	23,50	28,73	18,31	22,75	27,85	17,70	21,48	27,2	15,82
Feb	23,54	29,08	18,05	22,88	28,25	17,55	21,79	27,66	15,96
Mar	23,70	29,10	18,35	22,99	28,25	17,79	21,83	27,9	16,28
Apr	23,32	28,52	18,18	22,82	27,94	17,76	21,65	26,9	16,46
May	22,97	28,54	17,44	22,65	28,03	17,31	21,48	26,85	16,16
Jun	22,30	28,76	15,89	22,15	28,45	15,90	21,16	27,25	15,11
Jul	21,96	28,81	15,15	21,85	28,66	15,08	20,89	27,52	14,32
Aug	23,24	29,85	16,67	23,13	29,74	16,58	21,8	25,25	15,39
Sep	24,39	30,72	18,11	23,94	30,13	17,80	22,6	28,15	16,2
Oct	24,85	30,77	18,98	24,05	29,75	18,41	22,1	27,83	16,24
Nov	23,94	29,31	18,62	23,09	28,19	18,04	21,65	26,99	16,36
Dec	23,27	28,32	18,26	22,52	27,38	17,70	21,21	26,53	15,94

Source: World Bank (2024).

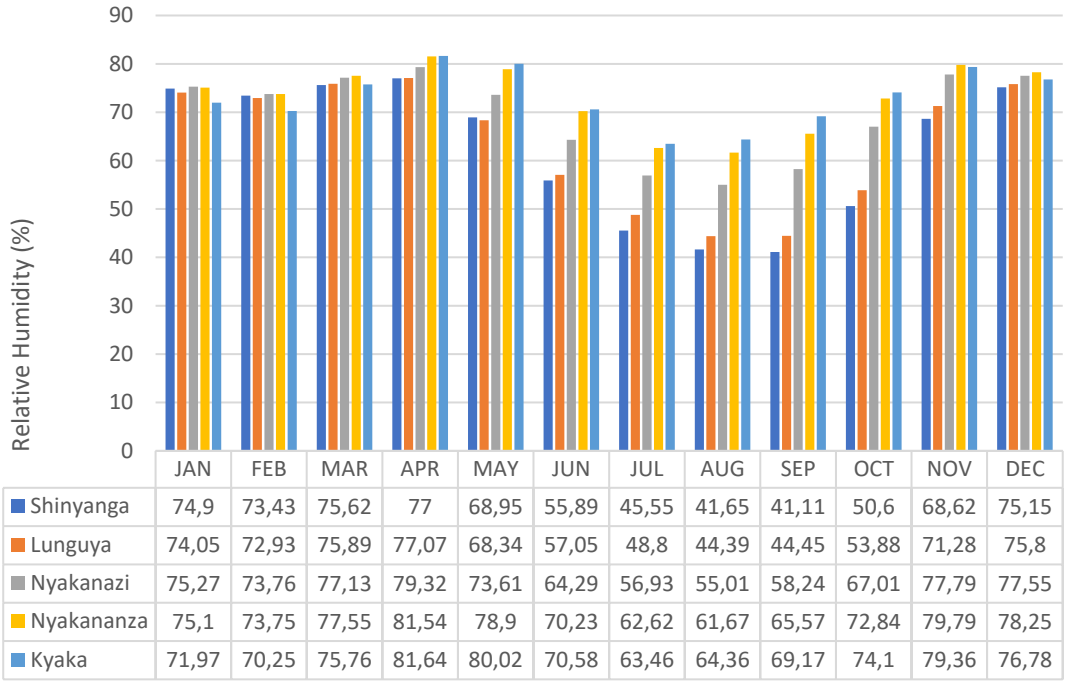
Average annual temperatures reach 23.42 ºC in Shinyanga, 22.90 ºC in Geita and 21.63 ºC in Kagera, where the orographic factor acts as a mitigating factor. Average minimum temperatures can reach values below 16.00 ºC throughout the intercepted region, with the lowest averages being observed in Kagera. Maximum temperatures are around 30.00 ºC in Shinyanga and Geita, and do not exceed 29.00 ºC in the Kagera region.

Relative Humidity

Figure 7.1.5.i shows the mean annual relative humidity along the TL alignment. The lowest annual mean values occur near Shinyanga and Lunguya, where a 62 and 63% average is recorded. The highest humidity indexes (above 70%) are observed along north/south alignment where rainfall ratio increases.

With regards to the seasonal regime, the values are distributed in a similar way to the precipitation variation, that is, with higher averages during the summer and lower percentages during the winter.

Figure 7.1.5.i
Distribution of relative air humidity along TL (%). 2001-2021



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Shinyanga	74,9	73,43	75,62	77	68,95	55,89	45,55	41,65	41,11	50,6	68,62	75,15
Lunguya	74,05	72,93	75,89	77,07	68,34	57,05	48,8	44,39	44,45	53,88	71,28	75,8
Nyakanazi	75,27	73,76	77,13	79,32	73,61	64,29	56,93	55,01	58,24	67,01	77,79	77,55
Nyakananza	75,1	73,75	77,55	81,54	78,9	70,23	62,62	61,67	65,57	72,84	79,79	78,25
Kyaka	71,97	70,25	75,76	81,64	80,02	70,58	63,46	64,36	69,17	74,1	79,36	76,78

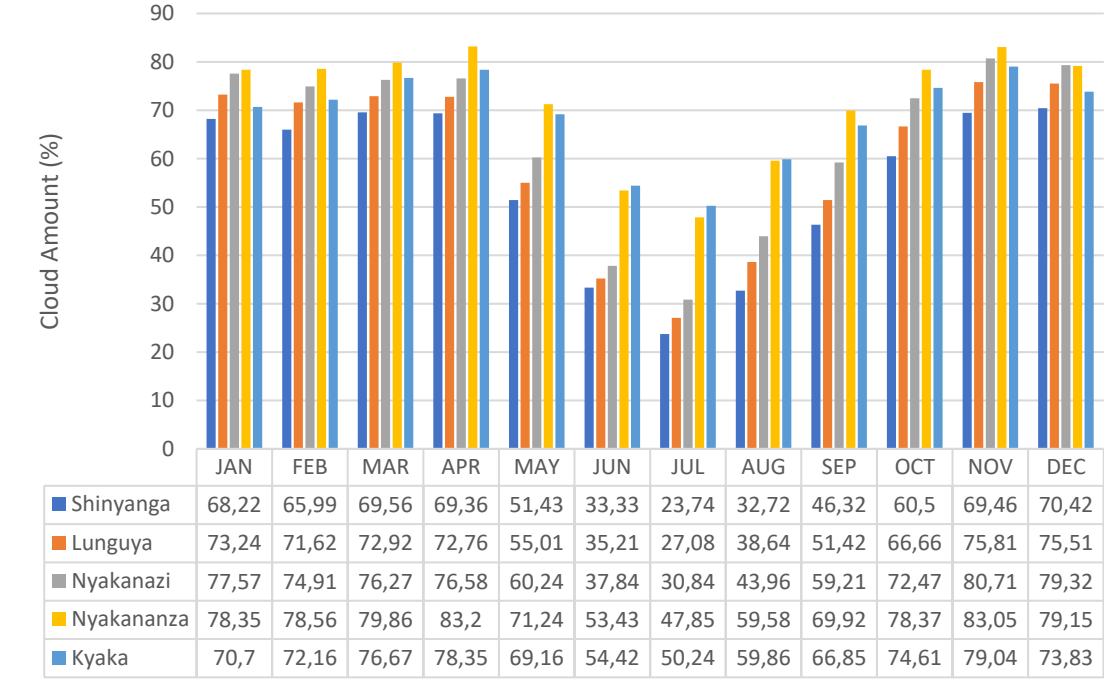
Source: POWER/NASA (2024).

Cloud Amount

Figure 7.1.5.j shows the daily monthly averages of the degree of cloudiness for the study area. It can be seen that the degree of cloudiness behaves throughout the year in accordance with the distribution of rainfall totals, i.e. in the rainiest months there is a tendency for greater cloudiness.

The 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL (north/south alignment), being the rainiest, has the highest average cloud cover, which can exceed 80% during late spring and summer. At the far west of the Nyakanazi – Ibadakuli TL, where rainfall is lowest, cloudiness is also lowest, remaining below 60% in the driest months. In Shinyanga and Lunguya, which are in the region crossed by this TL, between July and August the rainfall is below 30%.

Figure 7.1.5.j
Distribution of cloud amount along TL (%). 2001-2021



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Shinyanga	68,22	65,99	69,56	69,36	51,43	33,33	23,74	32,72	46,32	60,5	69,46	70,42
Lunguya	73,24	71,62	72,92	72,76	55,01	35,21	27,08	38,64	51,42	66,66	75,81	75,51
Nyakanazi	77,57	74,91	76,27	76,58	60,24	37,84	30,84	43,96	59,21	72,47	80,71	79,32
Nyakananza	78,35	78,56	79,86	83,2	71,24	53,43	47,85	59,58	69,92	78,37	83,05	79,15
Kyaka	70,7	72,16	76,67	78,35	69,16	54,42	50,24	59,86	66,85	74,61	79,04	73,83

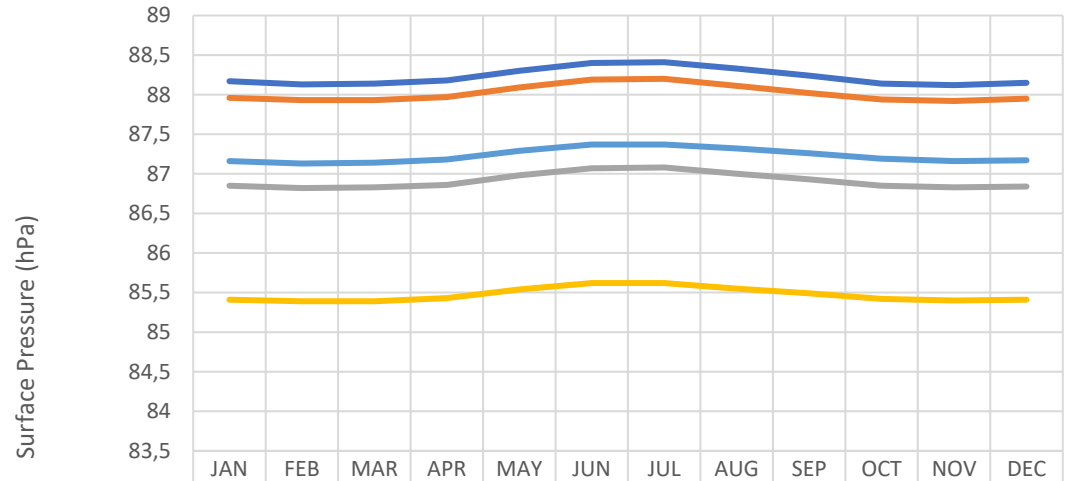
Source: POWER/NASA (2024).

Surface Pressure

The pressure exerted by the atmosphere on a given point is a force that acts in all directions due to its total weight above that point. The weight of the atmosphere above a fixed location varies constantly due to the complex movements of the air, temperature variations and the variability of its water vapour content. Pressure is therefore an important indicator of changes in the weather, due to its relationship with the variability of meteorological conditions. It is worth remembering that atmospheric pressure is a parameter that has a major influence on the synoptic scale and is barely perceptible in small-scale wave movements such as those that occur within the atmospheric boundary layer.

Figure 7.1.5.k shows the average values of atmospheric pressure in the study area. The graph shows relative pressure stability throughout the year, but with a slight difference in the winter months. The highest-pressure values are observed during this period, indicating the action of weather stabilising mechanisms, which explains the low rainfall values observed during this period.

Figure 7.1.5.k
Distribution of surface pressure along TL (hPa). 2001-2021



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Shinyanga	88,17	88,13	88,14	88,18	88,3	88,4	88,41	88,33	88,24	88,14	88,12	88,15
Lunguya	87,96	87,93	87,93	87,97	88,09	88,19	88,2	88,11	88,02	87,94	87,92	87,95
Nyakanazi	86,85	86,82	86,83	86,86	86,98	87,07	87,08	87	86,93	86,85	86,83	86,84
Nyakananza	85,41	85,39	85,39	85,43	85,54	85,62	85,62	85,55	85,49	85,42	85,4	85,41
Kyaka	87,16	87,13	87,14	87,18	87,29	87,37	87,37	87,32	87,26	87,19	87,16	87,17

Source: POWER/NASA (2024).

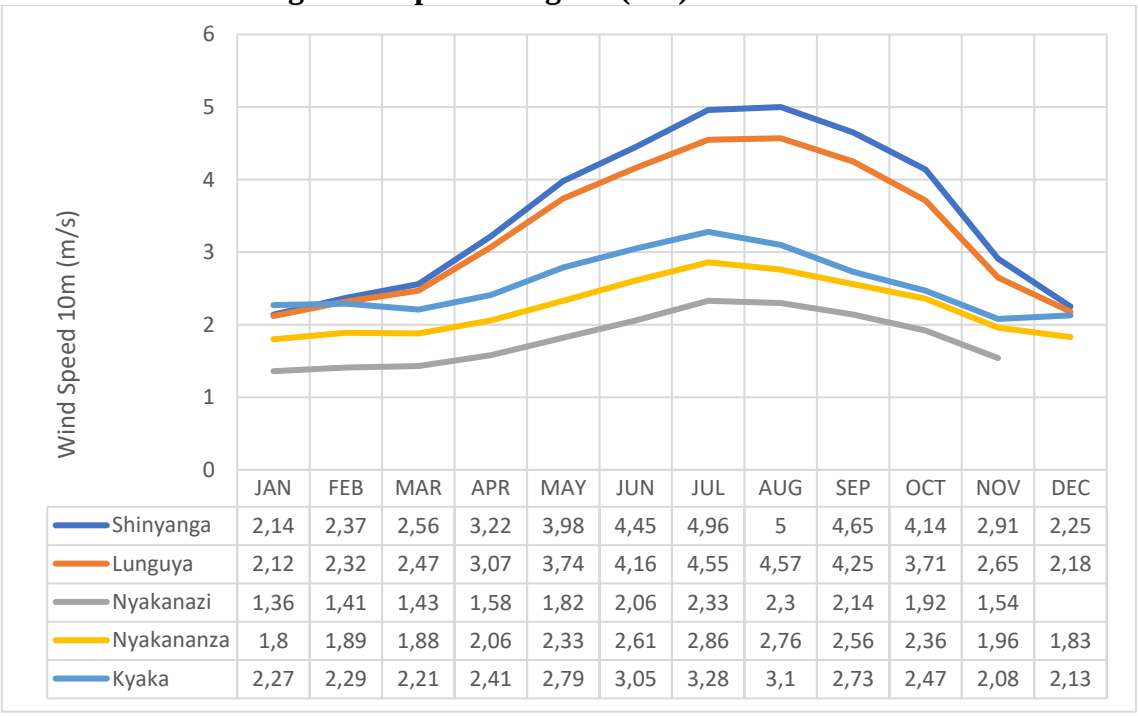
Wind Regime

Figure 7.1.5.l shows the average annual wind speed (10 meters) for the region covered by the TLs' alignment. In general, it can be seen that the highest wind speeds occur during the high-pressure mechanisms, i.e. during the winter months. The highest averages are observed in Shinyanga and Lunguya when, in August, gusts approach 5.0 m/s. In the other locations, the average speed remains between 2.3 m/s (Kyaka) and 3.2 m/s (Nyakanazi). When rain systems are active, particularly during the summer, average speeds are less than 2.5 m/s in all locations.

With regard to the average maximum gusts, shown in **Figure 7.1.5.m**, it can be seen that between May and November the values oscillate between 9.0 and 10.0 m/s approximately in Shinyanga and Lunguya, and between 4.5 and 7.0 m/s in Nyakanazi and Kyaka. The region near Nyakananza has the lowest average gusts recorded.

With regard to wind direction, as shown in **Table 7.1.5.b**, there is a predominance of ESE and SE winds along the entire route. W, WSW and NW winds are the least intense throughout the year.

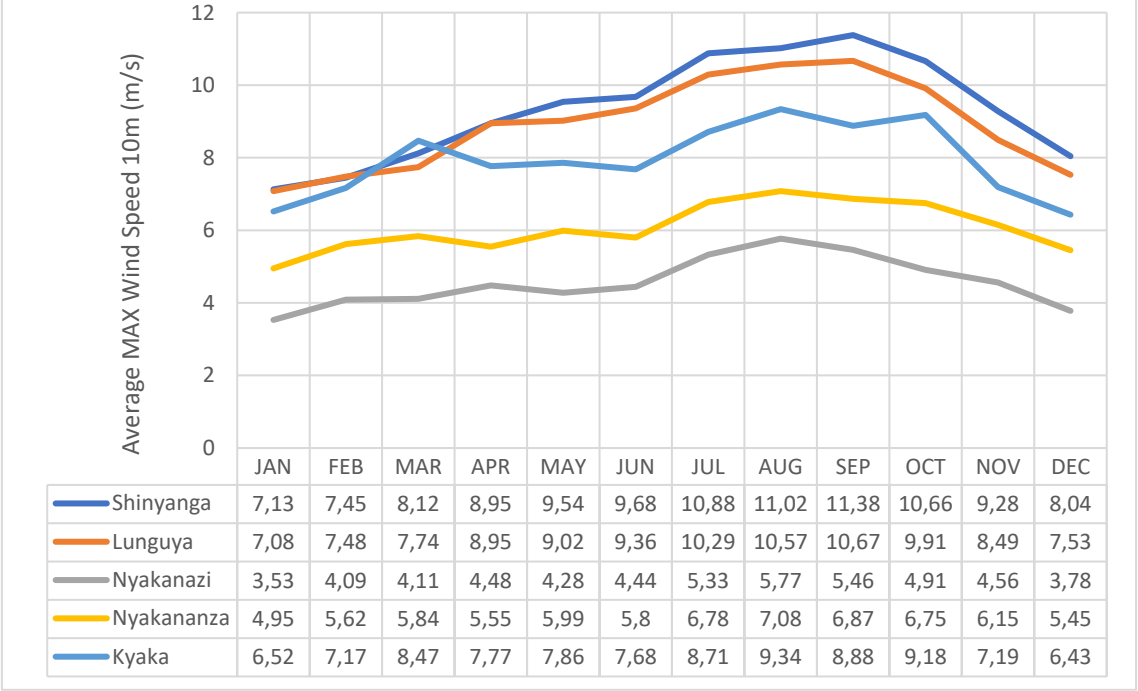
Figure 7.1.5.l
Distribution of average wind speed along TL (m/s). 2001-2021



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Shinyanga	2,14	2,37	2,56	3,22	3,98	4,45	4,96	5	4,65	4,14	2,91	2,25
Lunguya	2,12	2,32	2,47	3,07	3,74	4,16	4,55	4,57	4,25	3,71	2,65	2,18
Nyakanazi	1,36	1,41	1,43	1,58	1,82	2,06	2,33	2,3	2,14	1,92	1,54	
Nyakananza	1,8	1,89	1,88	2,06	2,33	2,61	2,86	2,76	2,56	2,36	1,96	1,83
Kyaka	2,27	2,29	2,21	2,41	2,79	3,05	3,28	3,1	2,73	2,47	2,08	2,13

Source: POWER/NASA (2024).

Figure 7.1.5.m
Distribution of average maximum wind speed along TL (m/s). 2001-2021



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Shinyanga	7,13	7,45	8,12	8,95	9,54	9,68	10,88	11,02	11,38	10,66	9,28	8,04
Lunguya	7,08	7,48	7,74	8,95	9,02	9,36	10,29	10,57	10,67	9,91	8,49	7,53
Nyakanazi	3,53	4,09	4,11	4,48	4,28	4,44	5,33	5,77	5,46	4,91	4,56	3,78
Nyakananza	4,95	5,62	5,84	5,55	5,99	5,8	6,78	7,08	6,87	6,75	6,15	5,45
Kyaka	6,52	7,17	8,47	7,77	7,86	7,68	8,71	9,34	8,88	9,18	7,19	6,43

Source: POWER/NASA (2024).

Table 7.1.5.b
Variation ok wind direction (%) along TL alignment. 2001-2021

Direction	Shinyanga	Lunguya	Nyakanazi	Nyakananza	Kiaka
N	4,06	3,76	3,01	1,87	5,23
NNE	4,28	5,18	9,66	5,28	7,04
NE	4,53	5,62	10,98	9,71	6,82
ENE	4,83	6,60	7,77	9,98	6,45
E	8,79	9,08	7,91	11,40	8,01
ESE	20,58	19,34	11,00	14,46	11,45
SE	28,17	28,52	17,25	17,15	23,59
SSE	9,18	7,12	14,68	15,83	17,72
S	2,22	2,09	7,12	6,55	4,13
SSW	1,49	1,92	2,79	1,69	1,49
SW	1,74	1,94	2,07	0,97	1,02
WSW	2,02	1,87	1,10	0,77	0,75
W	1,54	1,44	0,90	0,87	0,47
WNW	1,64	1,54	1,05	1,05	1,00
NW	2,04	1,69	1,17	1,17	1,64
NNW	2,89	2,29	1,57	1,27	3,19

Source: POWER/NASA (2024).

In summary, what actually characterizes the climate's behaviour in the region of the TLs' alignment is the presence of two well-defined seasons, namely hot and rainy summers and drier winters with cooler temperatures. Rainfall, therefore, is the most important element in the definition of the regional climate, influencing not only the characteristics of the active morphogenetic processes, but also conditioning the cycles of the regional economy, particularly with regard to subsistence agricultural activities.

7.1.5.1
Climate Changes Trends and Effects

According to the update of the national determined contributions (2021), the most recent projections for climate change in Tanzania (Future Climate for Africa, 2017) show a strong agreement on continued future warming in the range of 0.8°C to 1.8°C by the 2040s, evenly distributed across Tanzania. The warming trend leads to a corresponding increase in the number of days above 30°C by 20-50 days in the central and eastern parts and up to 80 additional days in the coastal area of Tanzania. Warming until 2090 is projected in the range of 1.6°C to 5.0°C depending on the level of greenhouse gases in the atmosphere.

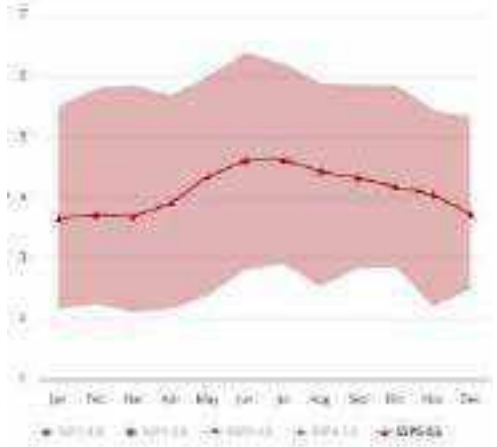
The projected temperature anomalies for the SSP5-4.5 and SSP5-8.5 Multi-model Ensemble scenarios for the study region are shown in **Figure 7.1.5.1.a**.

Figure 7.1.5.1.a
Projected average mean surface air temperature anomaly. SSP5-4.5 and SSP5-8.5 Multi-model Ensemble

Shinyanga SSP5-4.5

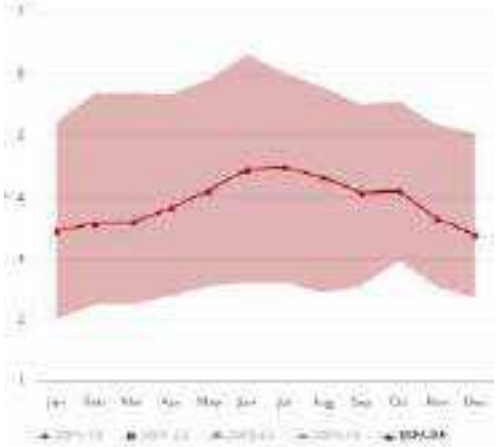
Geita SSP5-4.5

Kagera SSP5.4.5



Shinyanga SSP5-8.5

Geita SSP5-8.5



Kagera SSP5-8.5

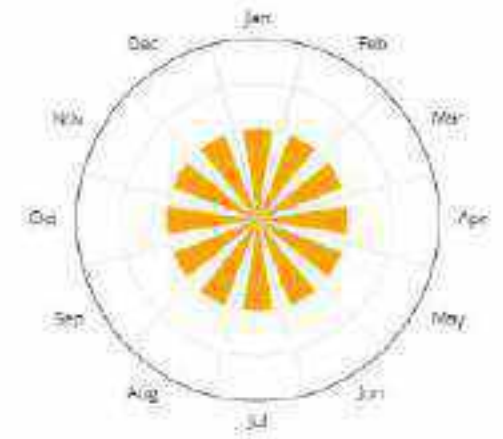
Source: World Bank (2024)

For both scenarios, it can be seen that the greatest anomalies occur for the coldest months of the year, i.e. June and July; a fact that shows a tendency for average temperatures to rise during the winter. Although the projections for the warmer months show an increase in temperatures, the anomalies are smaller.

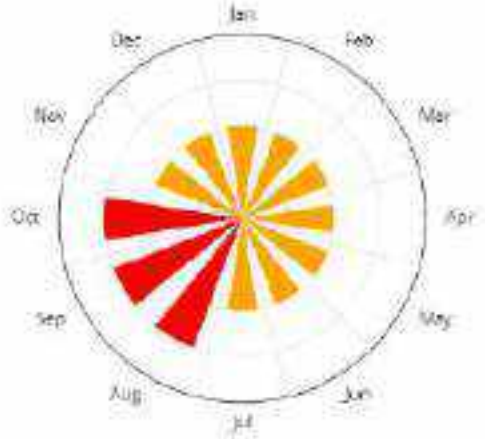
For the short-term scenario (SSP5-4.5) the average anomalies remain in the 2.5 ºC range. The critical long-term projections (scenario SSP5-8.5) are more drastic in terms of the increase in average temperatures, indicating values of around 4.5 ºC for the winter months and 3.5 ºC for the summer months.

With regard to the risk of heatwaves, it can be seen in **Figure 7.1.5.1.b** that for the short-term SSP5-4.5 scenario the risks are moderate throughout the year in Shinyanga and Geita. In Kagera, in some months of the year. In the long-term critical scenario, it can be seen that the Shinyanga region presents the greatest risks, particularly between late winter and early spring, precisely when the highest historical and projected average temperatures are recorded, as already shown.

Figure 7.1.5.1.b
Temperature base heat + population risk categorization

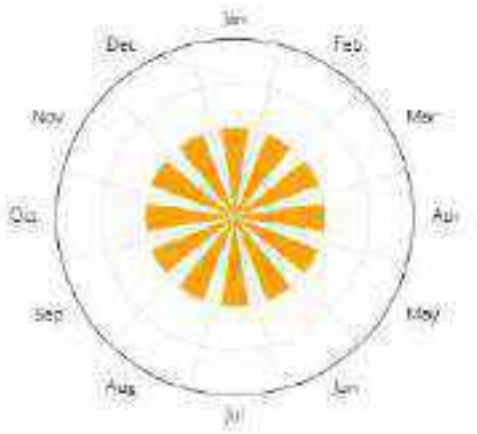


Shinyanga SSP5-4.5



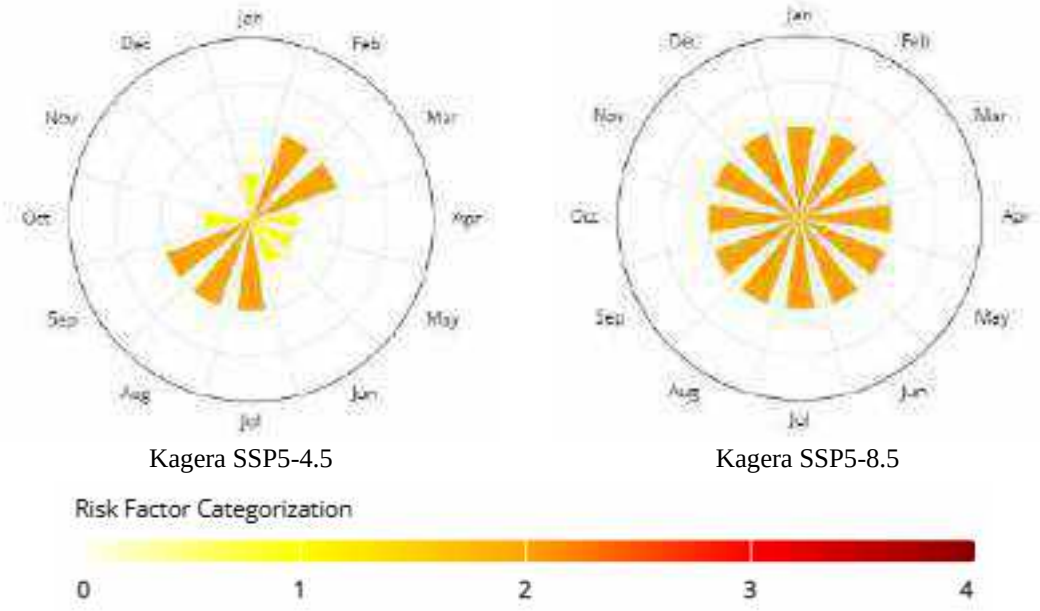
Shinyanga SSP5-8.5

Geita SSP5-4.5



Geita SSP5-8.5

Figure 7.1.5.1.b
Temperature base heat + population risk categorization



Kagera SSP5-4.5 Kagera SSP5-8.5

Source: World Bank (2024).

Rainfall in Tanzania is increasingly variable. Projections indicate that rainfall will decrease during dry seasons and increase during wet seasons which translates to higher risks for drought and flooding. In addition, the southern half of Tanzania is expected to experience a slight decrease in average annual rainfall by 2030, whilst the north western region around Lake Vitoria is projected to observe a slightly higher amount of annual average rainfall. By 2090 these changes can reach up to 10% of current annual rainfall averages (FUTURE CLIMATE FOR AFRICA, 2017).

In any case, these projections are inconclusive, even if there is the prospect of a general trend for the region. As can be seen in **Figure 7.1.5.1.c**, in both the SSP5-4.5 and SSP5-4.5 scenarios, the average anomaly trend for the driest months of the year (winter) remains close to zero. More significant reductions, which imply an increase in dry periods, can be seen in August for the Shinyanga and Geita regions and May for the Kagera region, all projected in the context of the long-term scenario (SSP5.8.5).

As for the rainy season, the average trend is for an increase in rainfall, especially for the month of August, when anomalies of 20.0 mm are observed in the SSP5.4.5 scenario and around 40.0 mm for the critical long-term scenario.

It should be noted that heavy rainfall has been recorded in the region in 2023 and 2024, as indicated by the data presented in the Extreme Weather Reports provided by the Tanzania Meteorological Authority. In 2024, for example, the Lake Victoria region recorded approximately nine events with daily rainfall of over 50.0 mm by June 2024, which led to damage to infrastructure and losses in agricultural production.

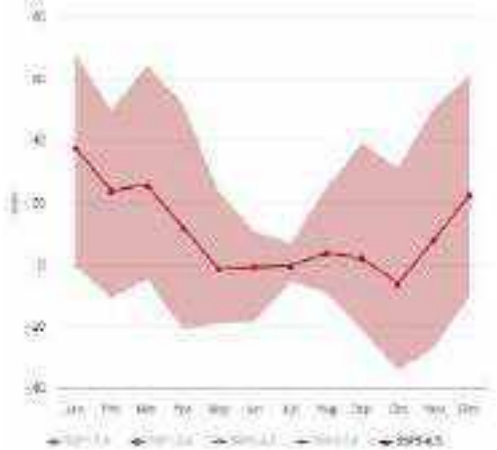
Figure 7.1.5.1.c
Projected precipitation anomaly. SSP5-4.5 and SSP5-8.5 Multi-model Ensemble

Shinyanga SSP5-4.5

Geita SSP5-4.5

Kagera SSP5.4.5

Shinyanga SSP5-8.5



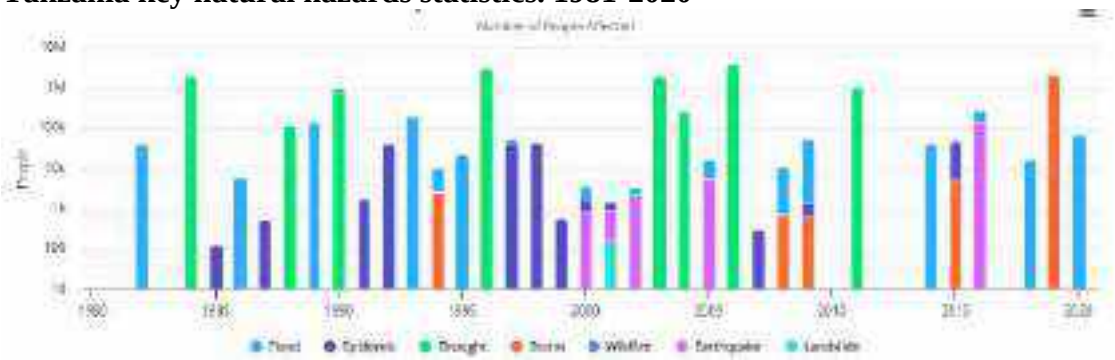
Geita SSP5-8.5

Kagera SSP5-8.5

Source: World Bank (2024).

With regard to historical data on events of this nature, **Figure 7.1.5.1.d** provides a summary of key natural hazards and their associated socioeconomic impacts in Tanzania. It can be seen that floods and storms are the events that have caused the most damage and economic losses, followed by epidemic events, severe droughts and damage from natural earthquakes.

Figure 7.1.5.1.d
Tanzania key natural hazards statistics. 1981-2020



Source: World Bank, 2024.

7.1.6
Hydrology and Hydrography

Referring to Water Resources Management Act of 2009, the Tanzania main land, with an area of about 944,800 km^2, is divided into nine River/Lakebasins, as shown in **Figure 7.1.6.a**. The Project is located at Lake Victoria and Lake Tanganyca Basins, which are transboundary river/lake basins. A small segment of the route near Shinyanga is part of the Internal Drainage unit.

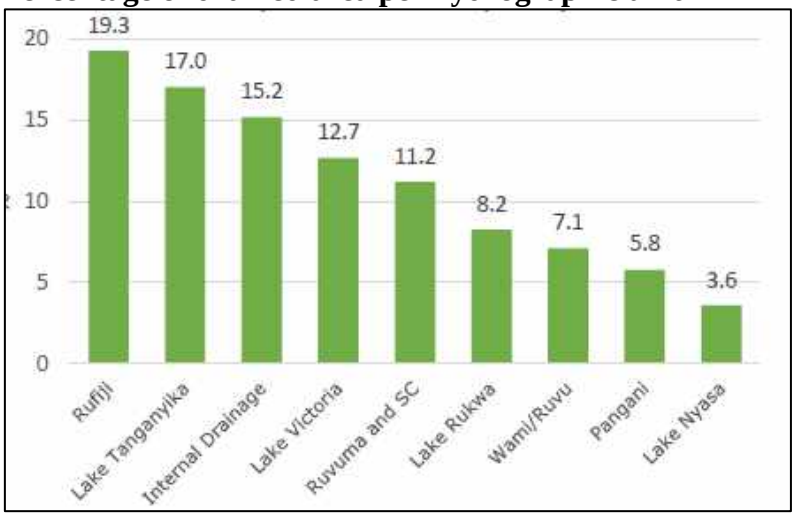
Lake Tanganyika shared by the United Republic of Tanzania, Democratic Republic of Congo, Burundi and Zambia runs along the western border. It is the Africa's deepest and longest fresh water lake, and the world's second deepest lake. Lake Victoria shared by Tanzania, Kenya and Uganda is the world's second largest freshwater lake and drains into the Nile River.

In terms of distribution by area, the region drained by Lake Tanganyka is the second largest, followed by the Internal Drainage Unit and the region drained by Lake Victoria (**Figure 7.1.6.b**).

Figure 7.1.6.a
River/Lake basins of Tanzania

Source: TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

Figure 7.1.6.b
Percentage of drained area per hydrographic unit



Source: TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

Following the Basin Water Boards (BWB) and elaborated in the Integrated Water Resources Management Development Plans (IWRMDPs), each River/Lake basin is divided into several sub-basins. **Table 7.1.6.a** and **Figure 7.1.6.c** shows the sub-basins intercepted by the Project at each region.

Table 7.1.6.a
Basin and Sub-basins intercepted by the project

River Basin	Sub-Basin	Area (km²)
Internal Drainage	Lake Eyasi	64,219
Lake Victoria	Isanga	17,823
	Kagera	22,061
Lake Tanganyka	Malagarasi	66,987

Source: TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

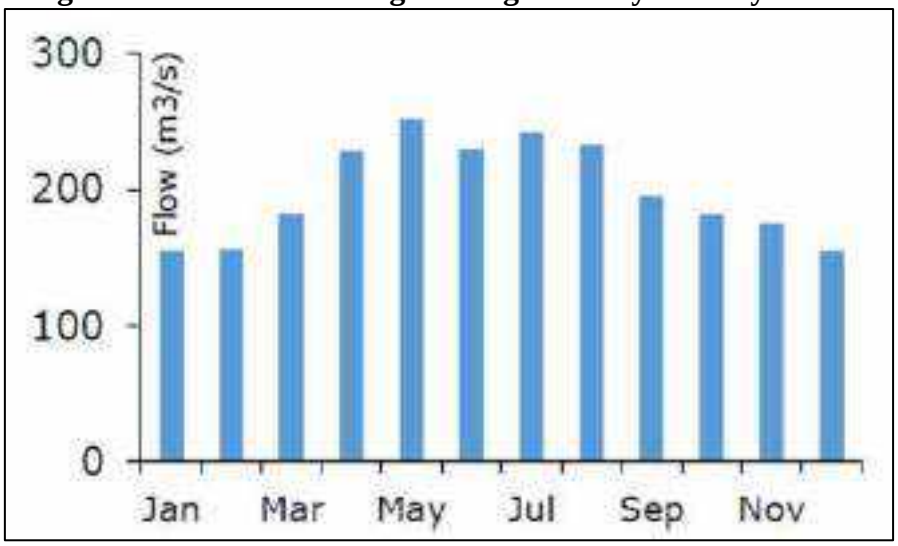
Figure 7.1.6.c
Basin and Sub-basins intercepted by the project

Source: Adapted from TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

In the Internal Drainage, the TL intersects areas drained by the Manoga River, which is one of the contributors to Lake Eyasi. As it enters the areas drained by Lake Victoria, in a westerly direction, the TL intersects the tributaries of the upper course of the Isanga River. Still heading west, in the Lake Tanganyka unit, the TL intersects the basin of two of the main sources of the Malagarasi River: the Nikonga River and the Moyowosi River. Turning N-S towards Kyaka and the border with Uganda, the TL re-enters the Lake Victoria unit, intercepting several tributaries of the right bank of the Kagera River, which it intercepts near Kyaka.

In terms of water regime, most of Tanzania's rivers have a tropical regime, with minimum flows in line with the winter period and maximum flows in summer. However, due to their proximity to the equator, some rivers may behave differently, with a lower annual amplitude and a reversal of maximum flows, which occur between autumn and the end of winter. This is the case with the Kagera River, as can be seen in **Figure 7.1.6.d**.

Figure 7.1.6.d
Long-term observed discharge at Kagera at Kyakaferry Station



Source: TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

However, according to the distribution of rainfall totals shown above, there is a tendency for the channels to be intermittent. This condition is particularly noticeable in the westernmost portions of the route, where the total annual rainfall does not exceed an average of 1,000 mm. As the route moves west and north, the totals increase and intermittency tends to be less significant.

This implies water availability conditions. As can be seen in **Table 7.1.6.b**, the region of the route that intersects the Internal Drainage unit, near Shinyanga, has the second lowest water availability in the country, with only 6,968 MCM/yr. The other two intercepted regions have double the availability, with just over 13,000 MCM/yr.

Table 7.1.6.b
Basin-wise Renewable Water Availability in Tanzania

Basin	Renewable Water Availability (MCM/yr)		Total Water Availability (MCM/yr)
	Runoff	Groundwater Recharge	
Internal Drainage	6,084	884	6,968
Lake Nyasa	12,775	107	12,882
Lake Rukwa	9,288	2,137	11,425
Lake Tanganyika	10,641	2,755	13,396
Lake Victoria	11,700	1,327	13,027
Pangani	7,383	587	7,970
Rufiji	31,000	9,021	40,021
Ruvuma and Southern Coast	11,709	3,238	14,947
Wami/Ruvu	3,988	1,139	5,127
TOTAL	**104,568**	**21,195**	**125,763**

Source: TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

Map 7.1.6.a shows the watercourses intercepted by the project and **Table 7.1.6.c** shows those of most importance. The map was drawn up based on spatial information available in the Food and Agricultural Organization (FAO) database[1], ICPAC Geoportal[2], HydroSheds[3] and the Ministry of Water of the Government of Tanzania (MoW - The United Republic of Tanzania, 2019). The vectors were superimposed on the satellite images to select the main crossings.

Table 7.1.6.c
Main river crossings

Basin	Sub-Basin	Basin Level 7	River	Coordinates		Wetland Crossing
				S	E	
Ibadakuli-Nyakanazi						
Internal Drainage	Lake Eyasi	Manonga	Ibadakuli Dam	3º33'04"	33º30'21"	230 m
	Lake Eyasi	Manonga	Nhumbu	3º36'32"	33º27'44"	85 m
Lake Victoria	Isanga	Isanga	Unamed	3º30'51"	33º04'23"	No
	Isanga	Isanga	Unamed	3º23'25"	32º52'45"	No
	Isanga	Isanga	Isanga	3º19'22"	32º43'53"	250 m
	Isanga	Isanga	Unamed	3º18'52"	32º32'21"	No
	Isanga	Isanga	Nyakaranzi	3º18'44"	32"30'32"	No
Lake Tanganyca	Malaragasi	Nikonga	Unamed	3º18'44"	32º12'01"	No
	Malaragasi	Nikonga	Nikonga	3º18'22"	31º43'32"	115 m
	Malaragasi	Nikonga	Unamed	3º17'16"	31º40'01"	No
	Malaragasi	Nikonga	Muhama	3º15'32"	31º34'08"	No
	Malaragasi	Moyowosi	Moiowosi	3º02'58"	31º15'27"	No
	Malaragasi	Moyowosi	Unamed	3º02'16"	31º14'25"	No
	Malaragasi	Moyowosi	Unamed	3º01'45"	31º13'27"	No

[1]https://data.apps.fao.org/
[2] https://geoportal.icpac.ne
[3] ttps://www.hydrosheds.org/products/hydrorivers

Table 7.1.6.c
Main river crossings

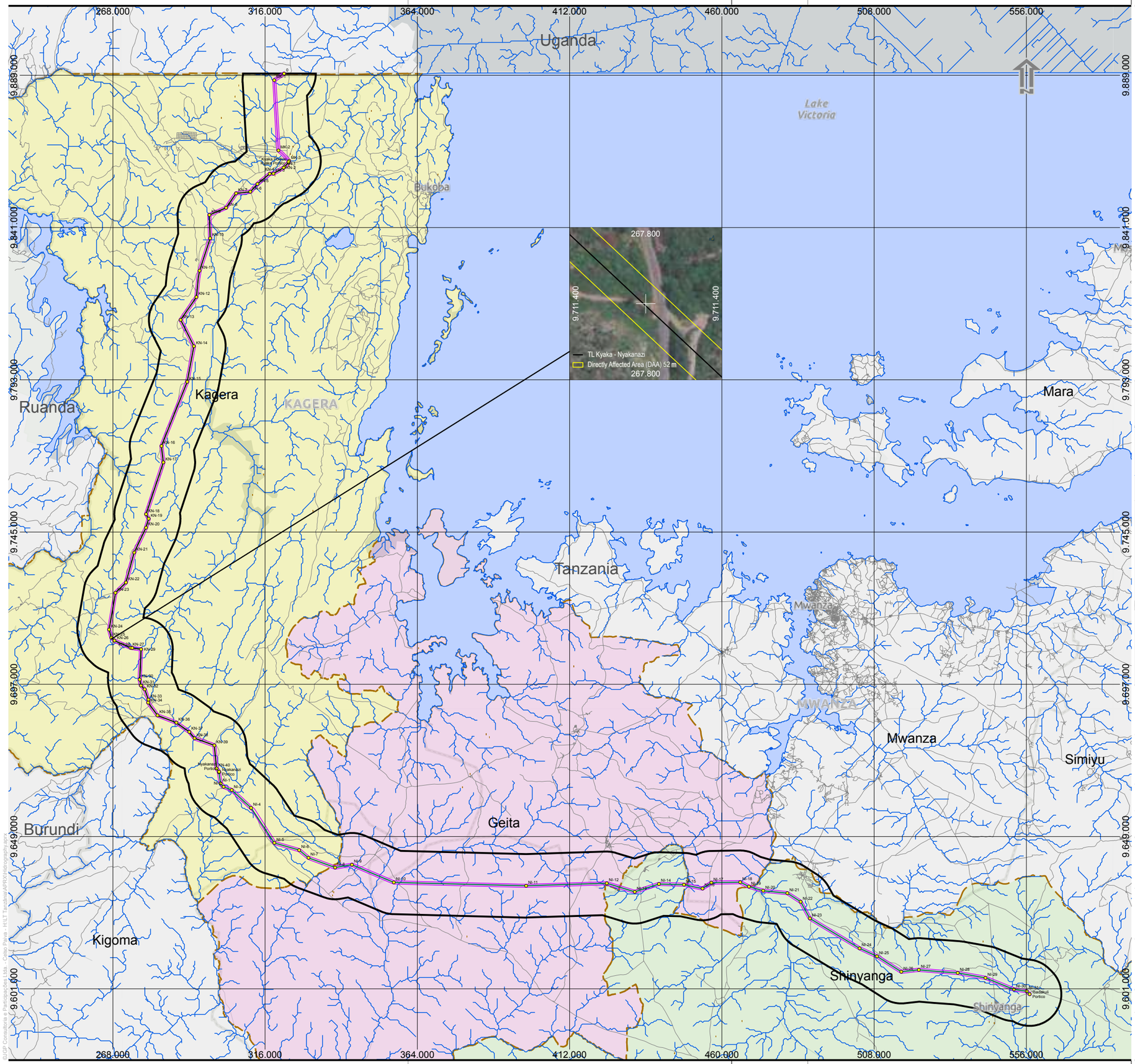
Basin	Sub-Basin	Basin Level 7	River	Coordinates		Wetland Crossing
				S	E	
Nyakanazi - Kyaka						
Lake Tanganyca	Malaragasi	Moyowosi	Unamed	2º56'41"	31º12'12"	No
Lake Victoria	Kagera	Kagera	Unamed	1º19'06"	31º19'11"	300 m
	Kagera	Kagera	Unamed	1º17'03"	31º21'48"	280 m
Mutukula - Kyaka						
Lake Victoria	Kagera	Kagera	Kagera	1º14'58"	31º24'49"	270 m
	Kagera	Kagera	Unamed	1º05'03"	31º22'33"	1000 m

In general, no large rivers were identified along the route of the TLs. Also noteworthy is the intermittency of the channels, especially in the eastern portion of the Ibadakuli-Nyakanazi TL route, where annual rainfall totals do not exceed 1000 mm per year.

In the Internal Drainage unit, from the exit of the Ibadakuli-Nyakanazi TL, in the vicinity of the Ibadakuli SE, the route, after crossing Highway B6, intersects the Ibadakuli Water Dam. Heading west, the main channel intercepted is the Nhumbu River, a tributary of the Manonga River, whose waters feed Lake Kitangiri before reaching Lake Eyasi.

To the west of Shinyanga, the TL Ibadakuli-Nyakanazi enters the areas drained by Lake Victoria, in the Isanga River Sub-basin. The Isanga River empties into Lake Victoria and is fed by several tributaries running from south to north. This sub-basin is bordered by the areas draining into Lake Eyasi to the south, the Simiyu River sub-basin to the east and the Malaragasi River basin to the west. The main collector is intercepted near Isonda, where the channel is conditioned by geomorphological factors that determine its direction. Other small channels are also intercepted in this basin, but there are no large crossings or extensive flooded areas.

After passing through the areas drained by the Isanga River, the TL Ibadakuli-Nyakanazi intercepts the headwaters of the Malaragasi River, which flows into Lake Tanganyka. The main channels intercepted in this part of the route are the formers of the Nikonga River, including the main collector and the Muhama River, and the Moyowosi River and some of its tributaries. The Nyakanazi SE is drained by the Moyowosi River.



Legend

T-line Alignment

- Vertex
- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Waterways
- Roads
- Direct area of influence (DAI) - 1 km
- Indirect Area of Influence of Physical Environment - 20 km
- Water Bodies

Regions

- Kagera
- Geita
- Shinyanga

Source:
IGAD Climate Prediction & Applications Centre (ICPAC), August 2024
Available at: https://geoportal.icpac.net/layers/geonode%3Atza_water_lines_dcw

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
05/29/2025	1:1.200.000	Hidrography.aprx	Ø

Developer:
Tanzania Electric Supply Company Limited (TANESCO)

Project:
PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.6.a:
Map of Hydrography

Regions:
Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:
JGP Consultoria e Participações Ltda.

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From the Nyakanazi SE, the TL Kyaka-Nyakanazi crosses small tributaries that drain into the Malaragasi River basin and then enters the areas drained by the Kagera River, an important contributor to Lake Victoria. In this river basin, the TL Kyaka-Nyakanazi basically runs along interfluves, intercepting valleys embedded in sour reliefs. In fact, the TL intercepts the headwaters of these small tributaries that are contributors to the Kagera River basin, or drain into Lake Edward in Uganda.

The Kyaka substation is located very close to the banks of the Kagera River. Leaving this SE, the TL Mutukula-Kyaka crosses this river plain, intercepting an area subject to flooding. From the Kagera River to the border with Uganda, the TL intersects an area of flat terrain, where it is worth mentioning the crossing of another area subject to flooding to the south of Kabwoba.

Despite being a component susceptible to impacts from the project, especially during the construction phase, effective control measures to reduce the intensity of the impacts are not ruled out, especially those related to moving the towers away from the crossing points. Considering the small size of most of the canals that will be intercepted, it is accepted that this is a feasible measure to implement, which could avoid problems associated with surface water contamination, solids being carried away and altering the natural morphology of the rivers.

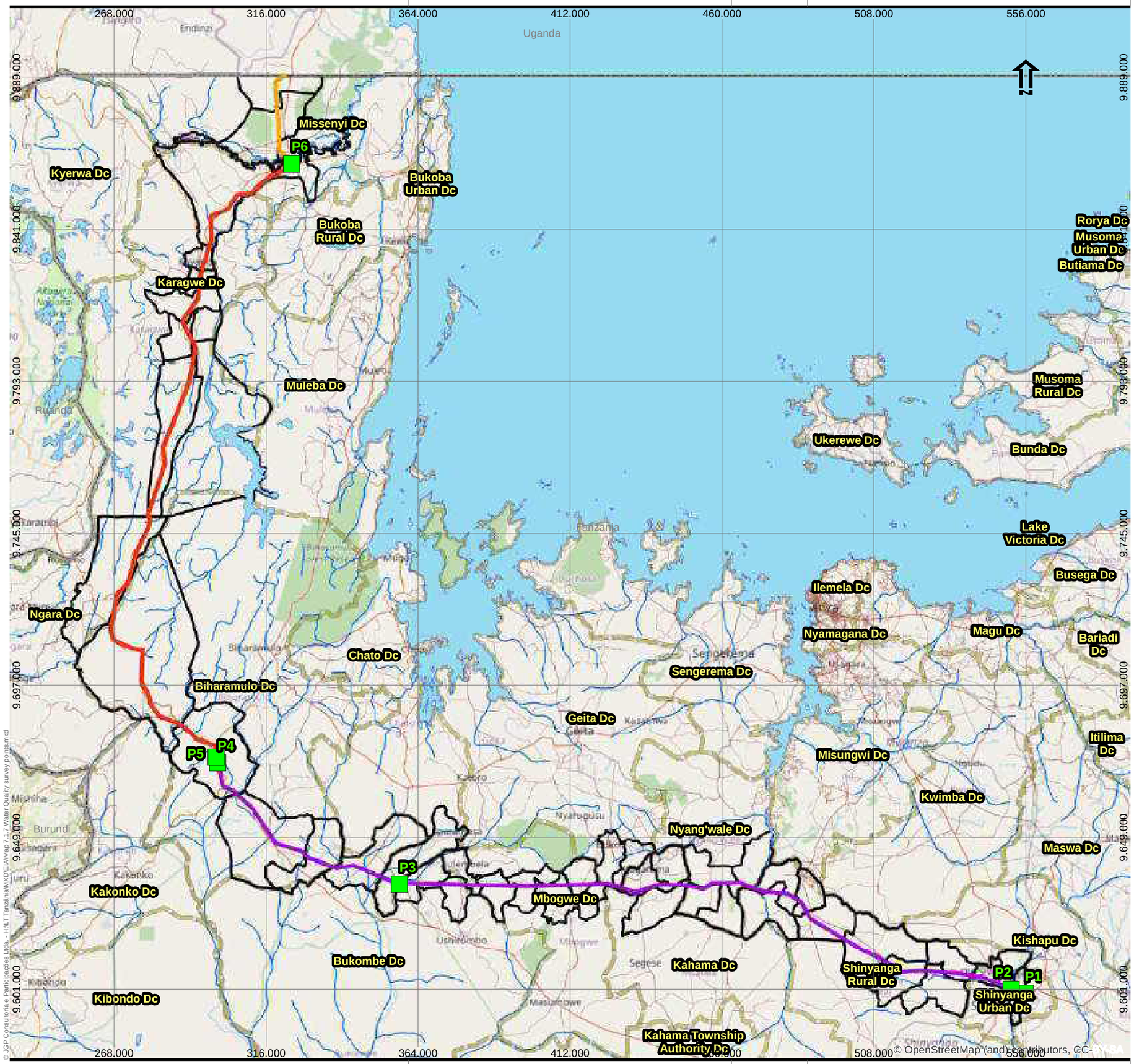
7.1.7
Surface Water Quality

Water quality assessments in the field were carried out at six sampling points, using a multiparameter probe to analyse the parameters water temperature, turbidity, dissolved oxygen and pH. The location of the points along the project route is shown in **Table 7.1.7.a** and **Map 7.1.7.a**.

Table 7.1.7.a
Location of water quality field assessment points

Sampling points	Type of environment	District	Hydrographic Basin	Geographical Coordinate UTM - Zone 36	
				Longitude	Latitude
P1	lentic	Shinyanga	Manonga River	555779.00 m E	9599636.00 m S
P2	lotic	Shinyanga	Manonga River	551341.00 m E	9600960.00 m S
P3	lotic	Bukombe	Nikonga River	358119.00 m E	9634178.00 m S
P4	lotic	Biharamulo	Moyowosi River	300716.00 m E	9672478.00 m S
P5	lotic	Biharamulo	Moyowosi River	300244.00 m E	9674318.00 m S
P6	lotic	Missenyi	Kagera River	324039.00 m E	9861691.00 m S

The sampling points selection took into account the size of the project (more than 500 linear km of project), the characteristics of the water systems intercepted and their susceptibility to receiving the impacts from construction and operation of the project.



Legend

Water quality assessment points

Name

- LT_Kyaka - Nyakanazi (Option A) - Optimized
- LT_Mutukula-Kyaka (Option B)
- LT_Nyakanazi_Ibadakuli (Option 1) - Optimized
- Roads
- Hidrografy
- Lakes
- Districts

Social Expert:

Eliete Francisca da Silva

Source:

This shapefile provides information about Tanzania Wards. It was created in 2012 by the National Bureau of Statistics while preparing data for the National Population and Housing Census.
Tanzania National Bureau of Statistics (NBS), 2019

UTM- Zona 36S
Datum: WGS 84 - EPSG 32736

0 12 24 36 48 km

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Project:

PROPOSED 400kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.7.a:

Water quality survey points

Regions:

Kagera, Geita and Shinyanga - Tanzânia

Lead E&S Consultant:

JGP Consultoria e Participações Ltda.

© JGP Consultoria e Participações Ltda. - H:\LT Tanzânia\MXD\EIA\Map 7.1.7 Water Quality survey points.mxd

Regarding project's dimensions, the high number of canals intercepted is noteworthy, which suggests the indisputable need to proceed with an analysis model based on a sampling network. In other words, it is impractical to sample all the canals intercepted. With regard to the characteristics of the water systems, the intermittency of the canals (especially in the western part of the route) and the small flows observed stand out, with a low number of significant crossings identified. Another factor is related to the positioning of the interception sites: in the N-S portion of the route, in particular, most of the interception sites are located in the upper reaches of the river channels, which hardly reflects the trends and dynamics occurring at river basin level.

For these reasons, the selection of sampling points for water quality assessment prioritized the main intercepted collectors, either because they have a greater tendency to maintain flows throughout the year, or because they better represent the hydrological responses at the catchment level. In the Internal Drainage water unit, the Manonga River was selected, whose drainage area encompasses the entire Shinyanga region in the vicinity of its administrative boundaries with Geita.

Also sampled were the main formers of the Malaragazi River, the Nikonga River and the Moyowosi River, as well as the Kagera River, which drains a large part of the northern southern portion of the Project.

All field procedures during sampling were recorded on standardized technical sheets containing information on collection sites, weather conditions at the time of collection, time, date of sampling and field measurement data. Photos 01 to 06 show a partial view of the sampling points.

In the absence of national legislation establishing quality standards for raw water, the results of the assessments carried out were compared with the reference standards for river water quality contained in the World Bank document "*Water Resources and Environment Technical- Note D.1*" (DAVIS & HIRJI, 2003). In addition, the "*target values*" for lotic and lentic environments defined by the *United Nation Environment Programme* (UNEP) in the document "*SDG Indicator 6.3.2 Technical Guidance Document - No. 2 - Target Values*" (WARNER, 2020) were considered. These "*target values*" are derived from a variety of sources, including legislation from other jurisdictions (e.g. World Health Organization, Canada, Australia/New Zealand, Brazil, United Kingdom, United States, South Africa, etc) and scientific publications.

In order to verify compliance with the dissolved oxygen concentration (mg/L), the water quality guidelines for dissolved oxygen *in fresh*water for the protection of aquatic life, recommended by the *Canadian Council of Ministers of the Environment* (CCME, 1999), were also taken into account.

Photo 01: Partial view of point P01.

Photo 02: Partial view of point P02.

Photo 03: Partial view of point P03.

Photo 04: Partial view of point P04.

Photo 05: Partial view of point P05.

Photo 06: Partial view of point P06.

The results of the measurements of the water quality parameters are described in **Table 7.1.7.b**. The water temperature in the region evaluated ranged from 25.7 °C (P5) to 30.3 °C (P6), and turbidity values ranged from 19.1 (P1) to 287.6 NTU (P2). The pH values ranged from 6.43 (P4) to 8.73 (P2) and were within the range recommended by the

references considered (DAVIS & HIRJI, 2003; WARNER, 2020).

Dissolved Oxygen, with values ranging from 1.90 mg/L (P6) to 4.88 mg/L (P5), was below the CCME (1999) water quality guidelines at all points. Likewise, at all points, DO saturation, which ranged from 26.1% (P6) to 62.5% (P5), was lower than the lowest target value established by UNEP in the document "*SDG Indicator 6.3.2 Technical Guidance Document - No. 2 - Target Values*" (WARNER, 2020).

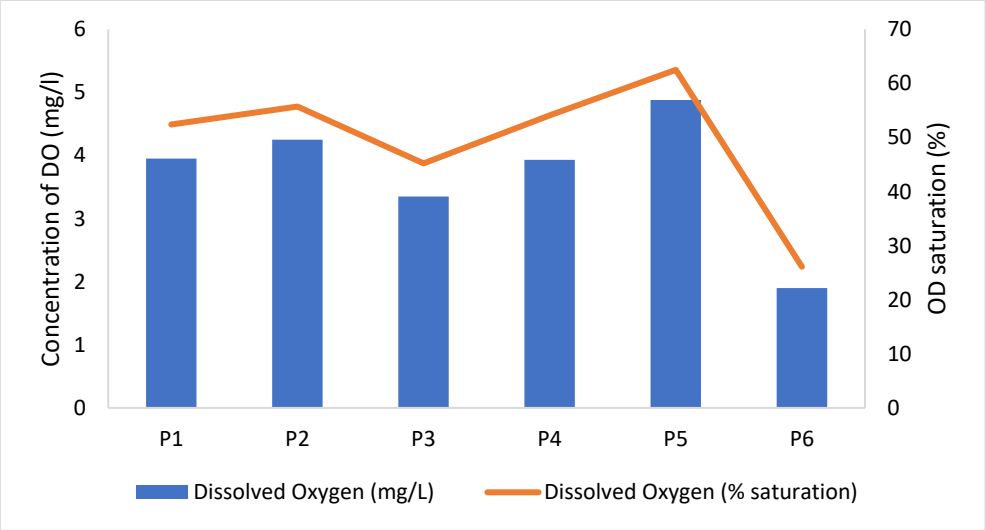
Table 7.1.7.b
Results of on-site measurements of water quality parameters

Water Parameters	P1	P2	P3	P4	P5	P6	Davis & Hirji, (WB), 2003 Guidelines for River Water Quality	Warner (UNEP), 2020 Target Values	CCME, 1999 Warm water
Water Temperature (°C)	29.6	28.0	29.6	29.0	25.7	30.3	-	-	-
pH	7.75	8.73	7.24	6.43	7.19	6.54	6 - 9	6 - 9	-
Dissolved Oxygen (mg/L)	3.95	4.25	3.35	3.93	4.88	1.90	-	-	5.5 - 6
Dissolved Oxygen (% saturation)	52.4	55.7	45.2	54.1	62.5	26.1	-	80 - 120	-
Turbidity (FNU)	19.1	88.8	287.6	91.3	173	8.9	-	-	-

Among the gases dissolved in water, oxygen is one of the most important in the dynamics and characterization of aquatic ecosystems (ESTEVES, 1998) and very low values can be a limiting factor for the maintenance of local aquatic life. The main sources of dissolved oxygen for water are the atmosphere and photosynthesis, and oscillations, on the other hand, are due to consumption by the decomposition of organic matter, losses to the atmosphere, respiration of aquatic organisms and oxidation of metal ions (ESTEVES, 1998). The environments evaluated in this sample are anthropized, with a predominance of agricultural activities in the surroundings, as well as livestock and sewage disposal in urbanized areas, activities that contribute to an increase in the organic load in the water, affecting the concentration of DO.

In this sampling, point P06, located on the Kagera River, had the lowest concentration and saturation of DO (**Figure 7.1.7.a**). This result possibly reflects, in addition to the effects of the use and occupation of the basin, the local characteristics of the area where the sampling took place, which is in the urban region of Kyaka, in a backwater of the river, where there was an accumulation of plant organic matter.

Figure 7.1.7.a
Dissolved oxygen concentration and saturation recorded at the different sampling points



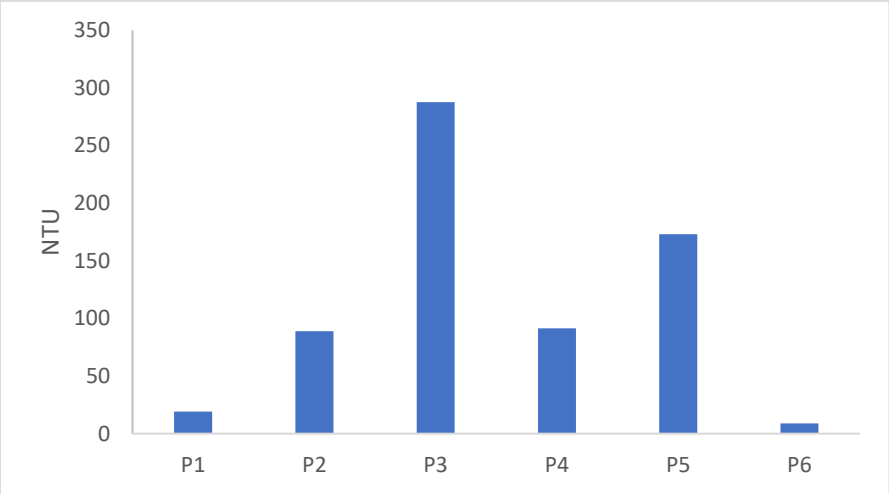
Among the points evaluated, P06 is the one located in an area with the greatest urban agglomeration and the discharge of effluents into the river should be considered as one of the sources of alterations to the DO concentration in water. The study by Nimusiima *et al*. (2023) on the physicochemical and microbial quality of water in a stretch of the Kagera River in Kikagati, Unganda, identified average DO values ranging from 3.85 mg/L to 5.26 mg/L and the lowest values were recorded in the most populated area, within the urban region of Kikagati. It should be noted that, in this study, the authors identified levels of turbidity, color, *Escherichia coli*, lead and cadmium higher than the maximum permitted for drinking water according to the reference standard considered in the study (WHO, 2017), indicating potential risks to public health in the event of direct ingestion or contact with the water from the stretch of the Kagera River evaluated.

At basin level, Hagai (2019) assessed the dynamics of vegetation cover in the Kagera River basin over a 21-year period (from 1990 to 2011), using remote sensing, hydrology and GIS techniques. The investigation found a significant decline in vegetation cover in the basin, with a decline in native forest and shrub areas and an increase in cultivated areas. The changes were attributed to socio-economic factors, including, among others, uncontrolled population growth and deforestation, which can negatively affect water quality.

Water turbidity, although with no maximum values defined in the references considered in this study, is notable for its high values at points P02 to P05, with points P03 and P05 standing out as having the highest levels (**Figure 7.1.7.b**). In these environments, marginal vegetation was found to be altered or absent in the field, with areas of plantations and/or cattle breeding, as well as stretches of exposed soil and points of erosion on the banks, which contributes to soil entering the bodies of water and increasing turbidity, especially during rain events. By definition, water turbidity is a parameter that indicates the degree of attenuation of intensity that a beam of light will suffer when it passes

through a water sample, due to the presence of suspended solids such as sand, silt, clay, debris, planktonic microorganisms, etc. Examples of agents of turbidity changes in aquatic ecosystems are domestic sewage, various industrial effluents, mining activities and erosion of river banks in rainy seasons (CETESB, 2023). High turbidity values can affect water quality by reducing transparency and decreasing the photosynthetic capacity of aquatic plants (BRIGANTE *et al*., 2003).

Figure 7.1.7.b
Turbidity levels recorded at the different sampling points



This sampling identified that the majority of the environments evaluated had warm, turbid waters, a pH close to neutral or basic and low levels of dissolved oxygen. The conditions observed at the points evaluated are mainly the result of anthropogenic activities in the region.

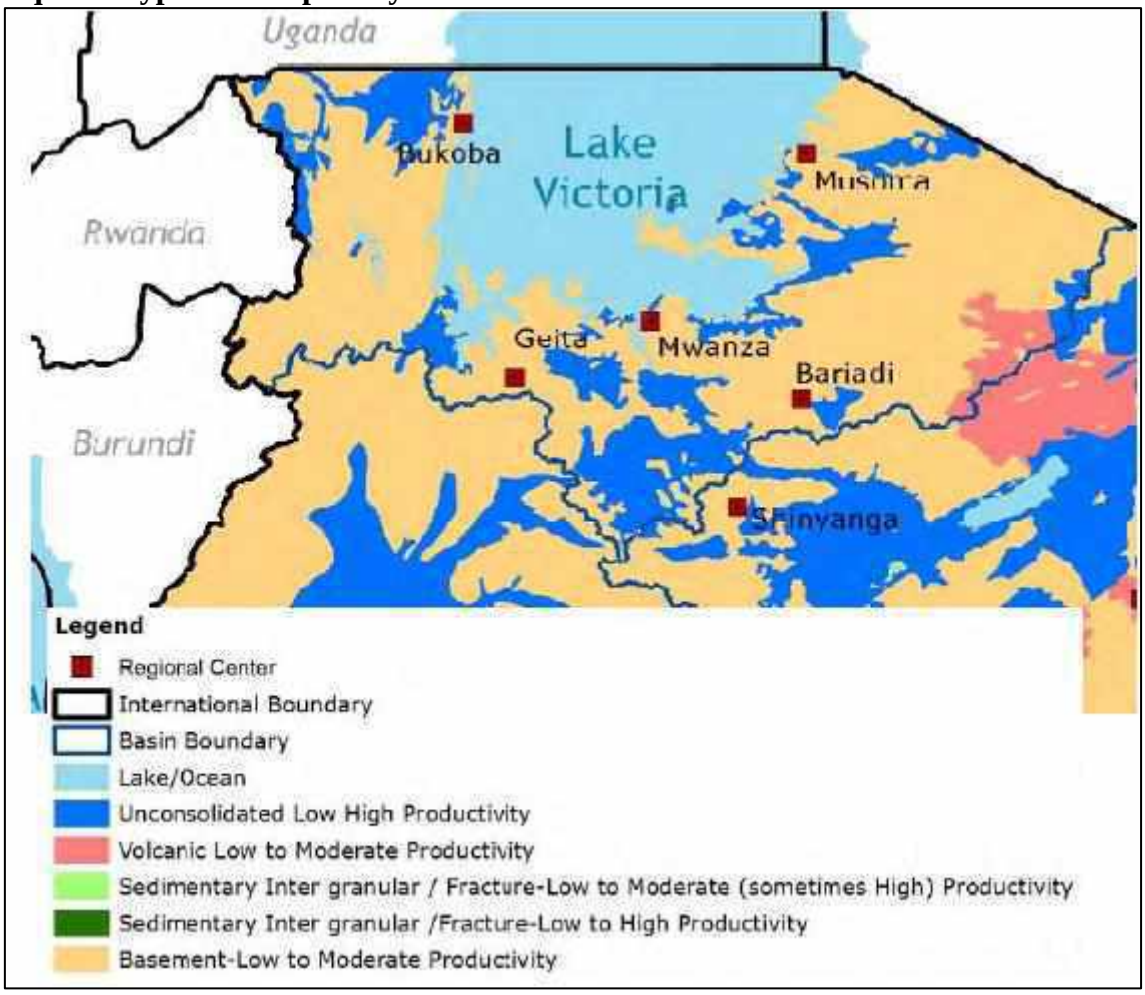
7.1.8
Groundwater

According to the International Groundwater Resources Assessment Centre[4], the TL intercepts two types of aquifers: basement low to moderate productivity aquifer and unconsolidated low high productivity aquifer (**Figure 7.1.8.a**).

Most of the alignment overlaps crystalline lithologies that define low permeability aquifer systems, which correspond to rocks of variable composition and ages, but predominantly Precambrian, which form the basement aquifers. The constituent rocks characterize a fissural aquifer, whose recharge is limited to open and interconnected fractured zones. Due to the low permo-porosity conditions, it is considered a heterogeneous, anisotropic and discontinuous medium, with low storage capacity and circulation of groundwater, being recognized for its low hydrogeological potential.

[4] https://apps.geodan.nl/igrac/ggis-viewer/viewer/sadcgip/public/default)

Figure 7.1.8.a
Aquifers types intercepted by the Transmission Line



Source: Adapted from TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

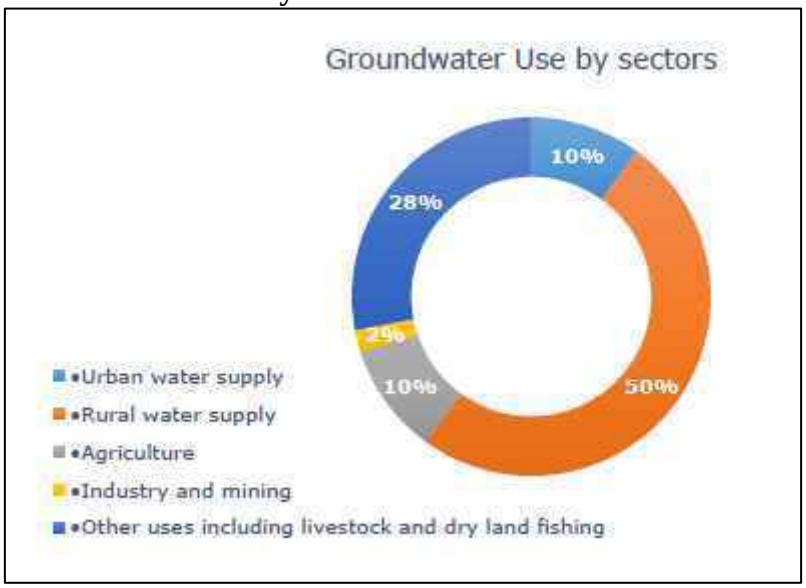
The poorly developed alteration mantles of these aquifers, generally less than 20.0 m deep, limit the water stock, with the average well productivity in these areas being less than 3.0 m³/h. Some exceptions occur in fractured zones and valleys filled with unconsolidated alluviums, where the altered mantle is slightly thicker (between 20.0 and 50.0 m), and wells with productivity greater than 5.0 m³/s can be found.

The unconsolidated low high productivity aquifer consists of alluvial sedimentary sequences, which mostly include interbedded sandy clays and clayey sands with minor lenses of pure sand or clay. The gravel of mostly quartz is scattered throughout in a clay matrix. Since the formation is distributed extensively, large number of wells has been drilled into the Neogene aquifer. Neogene aquifer shows relatively higher yield with an average yield of about 24.5 liters/min.

The recharge rates throughout the intercepted area are always less than 100 mm/year. With regard to water use, **Figure 7.1.8.b** shows that half of the water is used for rural purposes, followed by miscellaneous uses and dry land fishing. Urban uses account for

around 10% of the total, as do agricultural uses. Mining uses around 2% of the country's total groundwater.

Figure 7.1.8.b
Groundwater uses by sector



Source: TANZANIA WATER RESOURCES ATLAS, Ministry of Water, 2019.

7.1.9
Noise

The results achieved in the baseline campaign are presented in this section. The noise measurements are taken place next do the wayleave strip and sensitive receptors between June 10th and 15th 2024

7.1.9.1
Methodology

The noise measurement campaign was carried out by JGP Consultoria, covering eight (8) points that were chosen according to land use, noise sources and the presence of critical receptors in the vicinity of the future wayleave. The location of these points is shown in **Figure 7.1.9.1.a**. It is important to mention that the points pre-selected in the office on the basis of these assumptions underwent some minor adjustments according to the characteristics and reality identified in the field. For example, a point was relocated because the pre-selected building was not being used as a residence.

The **Table 7.1.9.1.a** presents the coordinates of the noise measurement points and the corresponding TL.

Figure 7.1.9.1.a
Noise Measurement Points

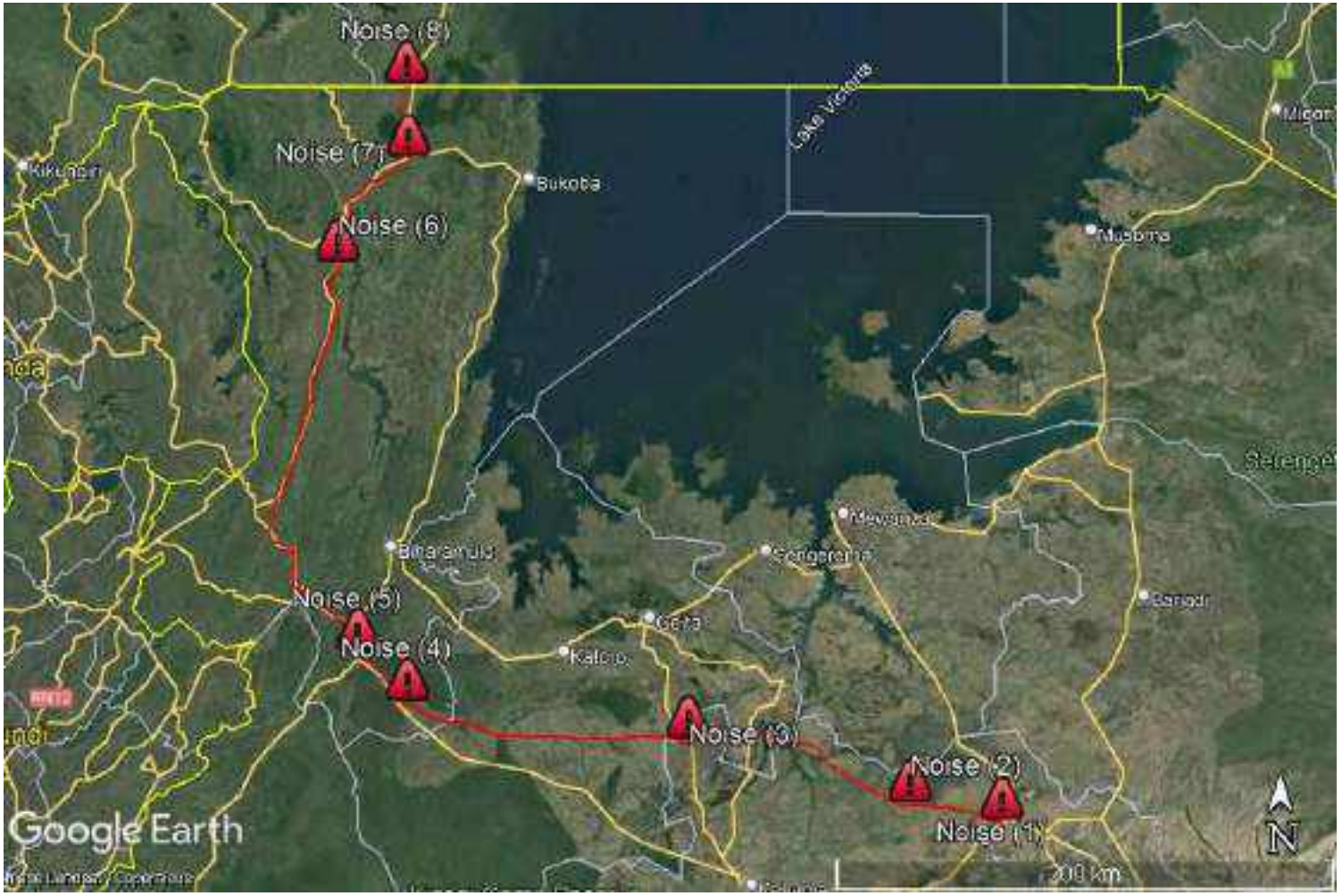


Table 7.1.9.1.a
Noise measurement points

Point nº	Location UTM Longitude/ Latitude	TL	Village	Ward	Region
P1	36 M 556.874 m E / 9.599.312 m S	Nyakanazi - Ibadakuli	Ibadakuli	Ibadakuli	Shinyanga
P2	36 M 520.241 m E / 9.606.627 m S		Mwamakaranga	Iselamagazi	Shinyanga
P3	36 M 432.424 m E / 9.631.807 m S		Ilogi	Bugarama	Shinyanga
P4	36 M 321.560 m E / 9.646.258 m S		Nyantakara/ Iyengamulilo	Nyantakara	Kagera
P5	36 M 302.008 m E / 9.665.736 m S		Nyakanazi	Lusahunga	Kagera
P6	36 M 293.990 m E / 9.818.586 m S	Kyaka - Nyakanazi	Bisheshe	Nyakahanga	Kagera
P7	36 M 321.796 m E / 9.859.790 m S		Kyaka	Kyaka	Kagera
P8	36 M 321.018 m E / 9.888.806 m S	Mutukula - Kyaka	Mutukula	Mutukula	Kagera

The measurements were taken using a Brüel & Kjaer model 2250 sound level meter with statistical data analysis, set to Logging mode, which allows histograms of the measurements to be obtained. All the equipment and programs used are listed below.

- **Sound Level Meter Equipment:**
  Brüel & Kjær Sound Level Meters
  Model: 2250 – Type 1
  Certificate n°: CBR2200342 dated April 2022 (handset and microphone set) (**Annex 3**)

- **Acoustic Calibrator:**
  Brand: Brüel & Kjaer, Model: 4231
  Brüel & Kjaer Calibration Certificate CBR2100807 dated October 2021 (**Annex 3**)

At each selected point, sound level measurements were taken by positioning the meter at a height of 1.20 m above ground level and at least 2.00 m away from nearby walls or other physical barriers. The meter was kept stationary on a tripod during the measurement.

The integration time was 1 second and the minimum measurement time was set at 10 minutes and the maximum at 15 minutes for all the points in this campaign, when it is estimated that the LAeq value will have stabilized. To verify this condition, LAeq values were observed every 5 minutes, and stabilization was only adopted when the variation was less than 1.0 dB. When this was insufficient to stabilize the LAeq, new attempts were made until the stabilized LAeq was obtained. If atypical noises occurred during the measurements, they were restarted.

To sound pressure level measurements and limits, two main noise-related regulations have been considered:

- The Tanzanian Environmental Management (Standards for the Control of Noise and Vibrations Pollution) – The Government Notice – GN No. 32 published on 30/01/2015.

- Environmental, Health and Safety (EHS) Guidelines from Internacional Finance Corporation – IFC, published in April 30, 2007.

The GN No. 32 establishes the period from 06:00 to 22:00 hours as day and from 22:00 to 06:00 as night, and classifies in 5 types of facilities with different noise limits. The **Table 7.1.9.1.b**. below presents the different noise limit established in the GN nº 32.

Table 7.1.9.1.b
Maximum Permissible Noise Levels for General Environment established by GN No. 32

Facility	Noise Limits dBA (Leq)	
	Day 06:00 to 22:00	Night 22:00 to 06:00
A. Any building used as hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, environmental or recreational sites.	45	35
B. Residential Building	50	35
C. Mixed residential (with some commercial and entertainment)	55	45
D. Residential and industry small–scale production and commerce	60	50
E. Industrial area	70	60

Source: The Government Notice – GN No. 32 – The Environmental Management (Standards for the Control of Noise and Vibrations Pollution).

The values obtained in the campaign were also compared with the limits established by the IFC's EHS guidelines, presented in the **Table 7.1.9.1.c**.

Table 7.1.9.1.c
Noise Level Guidelines by IFC

Receptor	L_{Aeq} (dB)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: Environmental, Health, and Safety (EHS) Guidelines - Noise Management (IFC, 2007).

7.1.9.2
Results of Noise Level Measurements

As described in **Section 7.1.9.1**, noise measurements were performed at eight points.

The measured values were compared with the standards established in the regulations on the subject, and the zones were classified as residential building considering the characteristics of the area with people living in all the houses near the chosen points. It should be noted that the Tanzanian regulations and the IFC guidelines consider different periods as daytime and nighttime. The measurements were always taken during the daytime.

Table 7.1.9.2.a shows the baseline results surveyed in the daytime period, compared to the limits established in the legislation.

Table 7.1.9.2.a
Values measured and reference levels established by the standards

Point	L_{Aeq} (Values measured in the campaign) Daytime				GN nº 32 Noise Limits dBA (Leq) Residential Building	IFC - EHS Guidelines Residential; institutional; Educational
	Attempts	LAeq db(A) 5 minutes	LAeq db(A) 10 minutes	LAeq db(A) 15 minutes	Day	Daytime
P1	3	41,01	41,33	-	50	**55**
P2	1	42,08	41,01	40,71	50	55
P3	1	37,79	38,27	37,64	50	55
P4	2	39,95	44,11	43,68	50	55
P5	1	43,53	46,45	45,67	50	55
P6	2	49,14	48,75	48,75	50	55
P7	1	49,67	48,38	48,33	50	55
P8	2	46,31	47,49	46,51	50	55

In all the measurements results in the baseline campaign, were in conformity with the established standards, both for GN standard nº 32 and the IFC standard, as all the results were below 50 db(A) and 55 db(A), respectively.

It should be noted that during the measurements there was little or no interference from mobile sources such as motorcycles, cars and trucks.

In addition, P1 was about 150 meters away from the Tanesco Ibadakuli Shinyanga SS and P2, P4 and P5 are about 150, 50 and 20 meters away from an existing TL, respectively.

In addition to LAeq,1s, the parameters recorded in the measurements were: LAF10, LAF50, LAF90, LAFmin and LAFmax, which are merely for reference purposes and are not relevant for comparison with legal standards in the case of the assessment in question. LAFmax is necessary for assessing impulsive sound, which is not applicable to this study.

Other notes included information on the predominant noises during the measurements, as well as the horizontal and vertical distances between the measurement site and the future possible noise-generating source. All the information was consolidated into Noise Measurement Sheets which form part of this report (**Annex 3**).

7.1.10
Seismicity

The occurrence (geographic distribution, magnitude and intensity) of seismic movements was described based on data available from US Geological Survey (USGS) and Tanzania Geological Survey (TGS) and other studies.

Tanzania is not considered a highly earthquake-prone country, but the region does experience some seismic activity, particularly along the East African Rift Valley fault system, which runs through the country. Although large earthquakes are rare, the presence of the Rift Valley and other tectonic faults means that moderate earthquakes can occur, particularly in the western and northern regions of the country.

The East African Rift Valley system extends through several East African countries, including Tanzania. The Rift Valley region is geologically active, with tectonic plate movements that can cause earthquakes. In Tanzania, the Rift Valley splits into two main branches:

- Western Branch (Western Rift): Passes through the western part of the country, near Lakes Tanganyika and Rukwa. This area is more prone to earthquakes, though most of the tremors are of moderate magnitude.
- Eastern Branch (Eastern Rift): Runs through northern Tanzania, near Mount Kilimanjaro and Lake Natron. This area is also geologically active, but earthquakes are less frequent and generally of lower magnitude.

Lake Tanganyika Region, located in the far west of Tanzania, near the border with the Democratic Republic of Congo and Burundi, is another area of interest related to earthquakes. This area experiences seismic activity due to its location within the Rift Valley. Significant earthquakes have occurred in this region, although they are not common **Figure 7.1.10.a** shows the location of the rifts mentioned above.

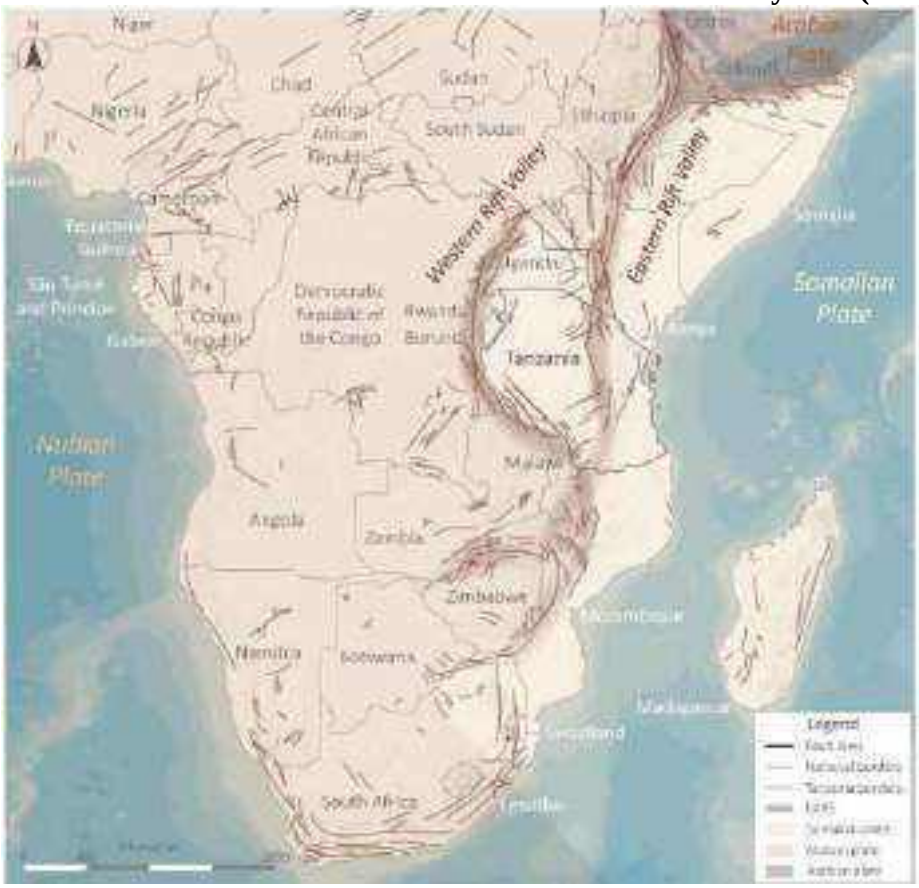
Furthermore, according to the Global Earthquake Model hazard map[5], the district of Iringa falls mostly between the 0.01 g and 0.05 g Peak Ground Acceleration (PGA) area with a 10% probability of being exceeded in 50 years (see **Figure 7.1.10.b**). To provide a reference scale: according to the latest Italian building codes, under the same probabilistic conditions, regions with values between 0.05 g and 0.25 g are classified as medium seismic hazard areas.

Figure 7.1.10.c shows the main events recorded since 1950. It is possible to observe that in the region intercepted by the Project there are records of events with intensities ranging from 2.8 to 6.1 M, both in Shinyanga and Geita and in Kagera, near the border with Uganda.

With regard to historical events of greater magnitude in the Project region, earthquakes measuring 4.4 M in Mwanza and 4.5 to 4.8 M in Geita are recorded, as can be seen in **Figure 7.1.10.d**. Considering the largest events ever recorded in the country, however, we highlight the occurrence of a 7.5 M earthquake 113 years ago in the Mpanda region, Katavi, Tanzania.

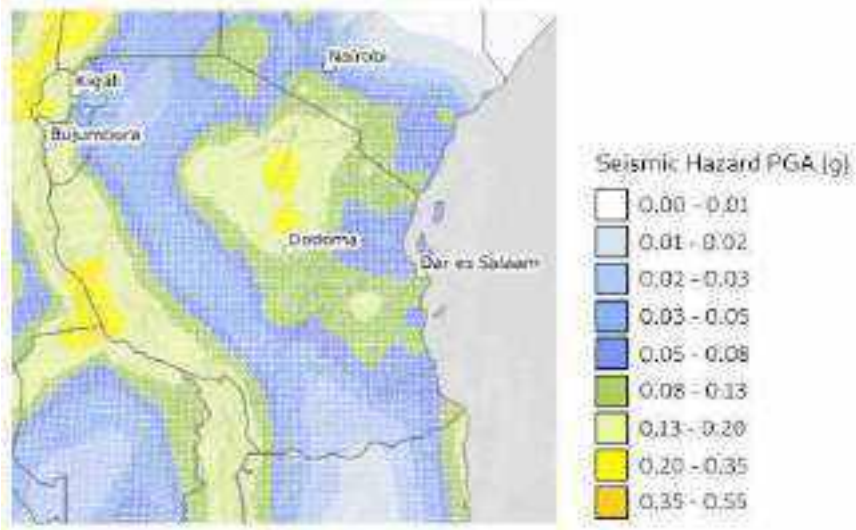
[5] M. Pagani, J. Garcia-Pelaez, R. Gee, K. Johnson, V. Poggi, R. Styron, G. Weatherill, M. Simionato, D. Vigan`o, L. Danciu, D. Monelli, Global Earthquake Model (GEM) Seismic Hazard Map (Version 2018.1 - December 2018), 2018

Figure 7.1.10.a
Western and eastern branches of the East African Rift System (EARS)



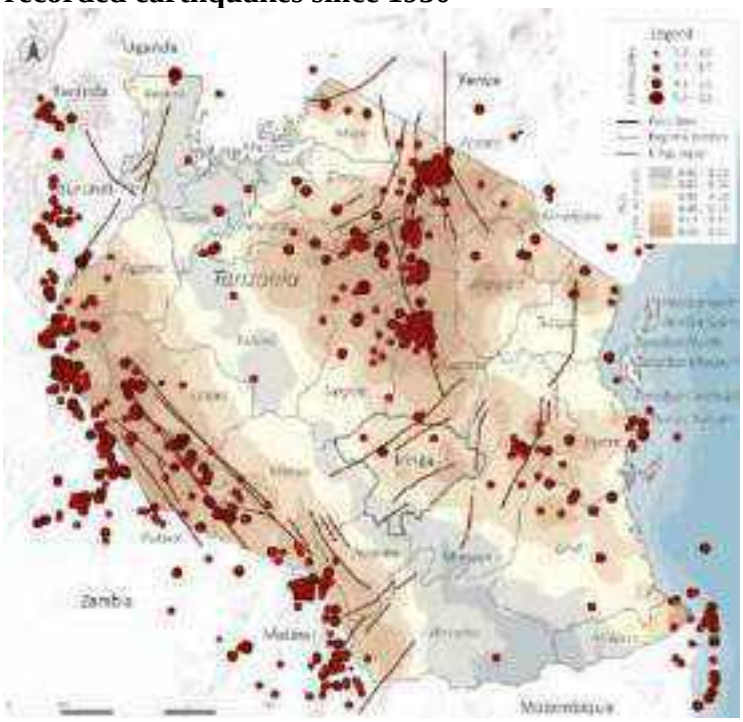
Source: Sechi *et. al*. (2022).

Figure 7.1.10.b
Distribution of the Peak Ground Acceleration (PGA) with a 10% probability of being exceeded in 50 years



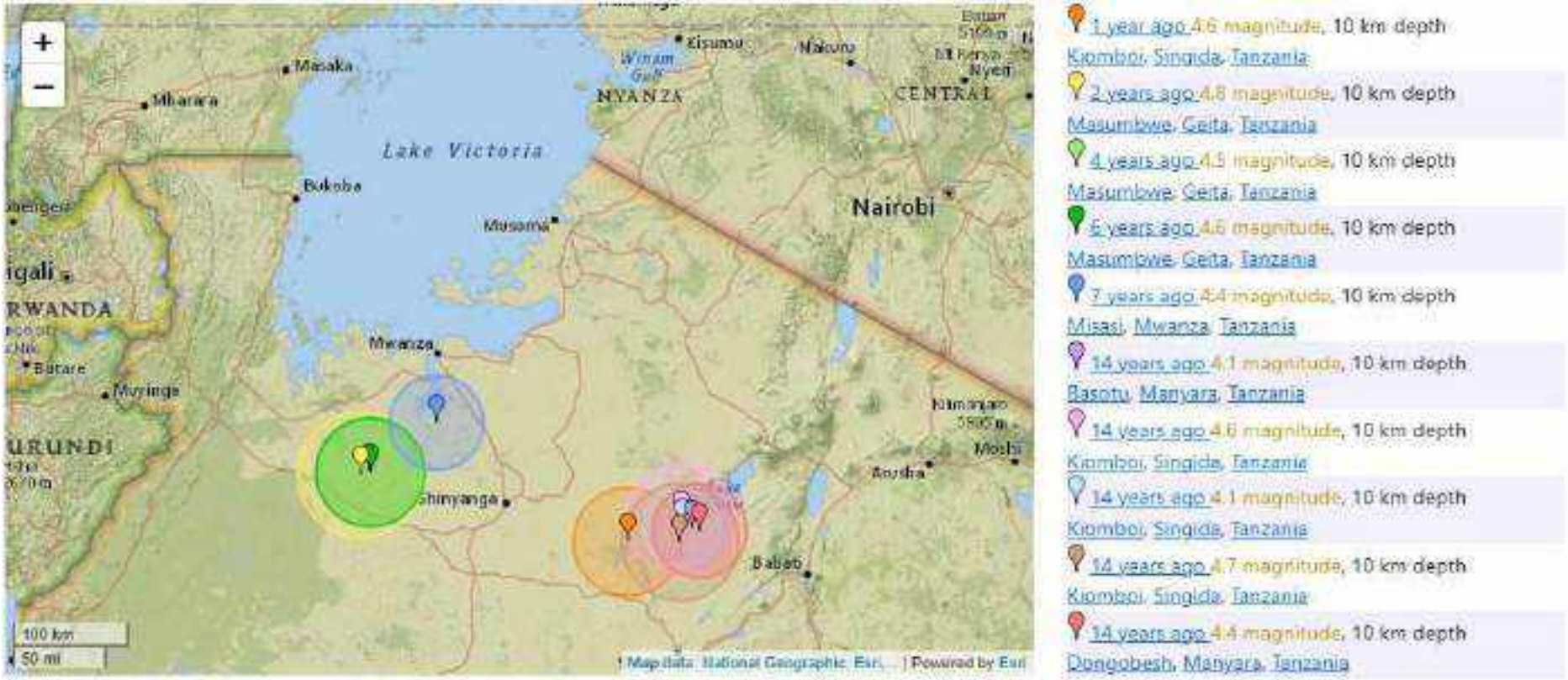
Source: Pagani *et. al*. (2018).

Figure 7.1.10.c
Map of the Peak Ground Acceleration (PGA) in Tanzania, with fault lines and recorded earthquakes since 1950



Source: Sechi *et. al*. (2022).

Figure 7.1.10.d
Greater magnitude events in the Project region



Source: Earthquake Track, 2024.

7.1.11
Paleontology

This section presents the results of the paleontological survey of the TL. The objective of this study was to identify fossil records in the TL influence areas, as well as the potential constraints for their respective occurrence.

The gathering of secondary data, particularly regarding geological and geomorphological constraints, was carried out in conjunction with the geological and geomorphological diagnosis presented in the previous sections.

In addition, expedited field studies (between July and August 2023) were carried out concomitantly with speleological surveys (see **Section 7.1.12**), when secondary information was checked to verify the paleontological potential.

As mentioned above, the major part of TL alignment passes over Precambrian crystalline rocks, including plutonic rocks, granites, and rocks with different metamorphism grades: granulites and migmatites.

Aside from being old lithologies, sometimes from before life on Earth, the formation environments of these rocks, characterized by high pressure and temperature, are unfavorable to the occurrence of fossils.

In any case, there are records of microcosms in the Bukoba Group, already recorded in the 1960 decade during the studies of Stephen A. Simpson. Although most of the Bukoba Group is made up of sedimentary rocks that are not particularly rich in fossils, these studies indicate the presence of microbial fossils or microfossils, which can provide insights into early life on Earth. These microfossils are usually of unicellular organisms, such as stromatolites, which are laminated structures formed by colonies of cyanobacteria.

Stromatolites are important because they are some of the oldest fossils on the planet and indicate the presence of microbial life in the shallow oceans of the time. In addition, the stromatolites found in the Bukoba Group help scientists to better understand the environmental and biological conditions during the Proterozoic period.

Other records have been identified of fossils[6] in Shinyanga and Geita, all associated with lacustrine deposits. All occurrences refer to the Eocene period, and are more than 25 km away from the Transmission Line.

In **Table 7.1.11.a**, information of the lithostatigraphic units with positive results for the occurrence of fossil and the classification of the paleontological potential are consolidated.

[6] https://paleobiodb.org

Table 7.1.11.a
Lithostatigraphic units with paleontological potential in IAI

Symbol	Lithology	Paleontological Potential
aQ	Predominantly alluvial and eluvial sediments	Unlikely
dMP	Meta-sediments	Medium
	Water	Unlikely
s?MP	Peridotite, dunite, lherzolite, gabbro, norite, anorthosite	Low
miNA	Granitoids, migmatite, mafic and ultramafics, meta-sediments	Unlikely
vNP	Volcano-sedimentary formations	Unlikely
gsNA	Mafic volcanics, meta-basalts, phyllite, BIF	Unlikely
IN-Q	Fine clastic sediments	Medium

In any case, field surveys in these areas did not result in the identification of fossil remains. Particularly, little consolidated sediments were observed, currently mobilized by surface dynamics.

It is concluded, therefore, that the potential for the occurrence of fossils along the TL is low, being the possibility of impacts on this component null or slight.

7.1.12
Speleology

The main objective of the speleological studies was to verify the existence of caves along the TL alignment, as well as the stretches that, due to their lithological characteristics, have greater potential for their occurrence.

The work methodology was defined in four distinct stages, namely:

- Definition of Study Areas - The definition of the study areas for speleological research was the same as for the other themes of the physical environment. However, the areas of direct influence (DAI) were prioritized as they are more susceptible to impacts resulting from the implementation of the project.

- Pre-field stage - The pre-field stage consisted of collecting secondary data and consulting the main specific databases. In addition to textual searches, satellite images were also photo-interpreted in order to determine the most prone locations for cave development for later field checking. Information on geology, pedology and geomorphology used to make the diagnosis of the physical environment was compiled, whose sources are cited in their specific sections.

- Field Stage - The data generated in the previous stage, in GIS, were organized and arranged in a Tablet with GPS and the Google Earth and ARCGIS 10.2 software, essential for the application of integrated field analysis, with visualization of the study area in real time, as well as the by-products generated in the Pre-field step.

From the maps generated in the previous step, a walkthrough was done in DAI accessible zones and sample points. The previously selected points in the satellite image were preferentially visited. At each field point the geological and geomorphological characteristics were described, and the existence of caves was verified. Field activities were conducted between July and August, 2023. 55 observation points were inspected.

- Post-field stage - After the fieldwork, the data were processed and analysed, allowing a sketch of the potentiality of cave occurrences.

The results of the surveys are shown below.

Speleological context and regional speleological potential

The corridor of TL alignment presents different levels of karst development potential, including areas with low potential and areas of improbable occurrence. This low potentiality is directly related to regional geological and geomorphological features of the study area.

As mentioned before, the TL intercepts two large crustal blocks of national territory: Lake Nyanza Superterrane and Kalenge–Burigi (Nyakahura–Burigi Terrane), as well as the igneous-sedimentary belt located in the extreme northwest of the country. These terrains are basically made up of volcanic and metasedimentary rocks, including granites, granitoids, rocks associated with the greenstone belt, as well as quartzites, metarenites, conglomerates and Quaternary deposits.

No areas of karst rocks were identified, especially limestones, dolomites or marls, nor sedimentary rocks with significant cabonite cementation.

Although there is great geological diversity in the country, speleological studies in Tanzania require further investigation. Some notable caves in Tanzania include:

- **Amboni Caves**: Located near the city of Tanga in northeastern Tanzania, the Amboni Caves are one of the most extensive cave systems in East Africa. These limestone caves were formed around 150 million years ago and consist of a series of interconnected chambers, with stalactites, stalagmites, and other impressive geological formations. The caves hold cultural and spiritual significance for local communities.
- **Kuumbi Cave**: Situated on the island of Zanzibar, Tanzania, Kuumbi Cave is an important archaeological site. Evidence found here indicates that the cave was inhabited by humans thousands of years ago, and excavations have revealed artifacts that help to understand the prehistory of the region.
- **Pangani Caves**: Also located in the Tanga region, the Pangani Caves are less well-known but are geologically similar to the Amboni Caves. These limestone caves feature various interesting natural formations.

All these known records are far from the area of influence of the Project. A textual search for the region of interest on specialized websites, including the International Speleological Union, did not turn up any cavity records for the region intercepted by the Project.

Concerning the lithological potential for caves occurrence, JANSEN *et al*. (2012) state that:

- Limestone, dolomite, evaporite, banded iron formation, itabirite and jaspilite correspond to the *Very High* Degree of Potentialities;
- Calcrete, carbonatite, marble, metacalcary and marl at *High* Degree of Potentialities;
- Sandstone, conglomerate, phyllite, husk, phosphorite, graywacke, metaconglomerate, metapelite, metasilithite, micaxist, milonite, quartzite, pelite, rhyolite, rhythmite, calci-silicate rock, siltite and schist at *Medium* Degree of Potentialities;
- Other lithotypes (anorthosite, arcose, augengnaisse, basalt, charnockite, diabase, diamictite, enderbito, gabbro, gneiss, granite, granitoids, granodiorite, hornfels, kinzigite, komatiite, laterite, metachert, megmatite, monzogranite, gabbro olivine, orthoamphibolite, syenite, syenogranite, tonalite, trondhjemito, among others), at *Low* Degree of Potentialities;
- Alluvium, sand, clay, gravel, mudstone, lignite, peat, tuff and other sediments, at the *Unlikely* Degree of Potentialities.

Considering the above, the crystalline rocks can be classified as being of low potential for the occurrence of caves, while the areas of quaternary deposits are classified as unlikely occurrence of caves, also for being unconsolidated sediments. The exception is the metasediments, especially the metarenites and metaquartzites found in the N-S portion of the route, in areas of mountainous relief, which indicate a medium potential for the occurrence of cavities.

Table 7.1.12.a presents the classification of the intercepted lithologies according to the potential for the occurrence of caves (JANSEN *et al*., 2012).

Table 7.1.12.a
Classification of the lithologies intercepted by TL as a function of the potential for the occurrence of caves, according to JANSEN *et al*. (2012)

Symbol	Lithology	Spelological Pontetial
aQ	Predominantly alluvial and eluvial sediments	Unlikely
dMP	Meta-sediments	Medium
	Water	Unlikely
s?MP	Peridotite, dunite, lherzolite, gabbro, norite, anorthosite	Low
miNA	Granitoids, migmatite, mafic and ultramafics, meta-sediments	Low
vNP	Volcano-sedimentary formations	Medium
gsNA	Mafic volcanics, meta-basalts, phyllite, BIF	Low
IN-Q	Fine clastic sediments	Unlikely

The only rocks considered to be of moderate potential are those associated with the presence of quartzites, including the undifferentiated metassedimentary of the Bukoba Group. In any case, these rocks occur in associations with other types of rocks considered of low potential.

Speleological Survey

A textual search in Internet sites[7] was carried out, which did not result in the identification of information on caves in the studied area. The only mention of caves found was relative to G**rotte de Nduli** and **Nandembo Cave System**, both located far from the area intercepted by the TLs.

A record of a cavity was found in Geita, located at Lat: -2.5517 - Long: 32.2626, but the information is given as false in the database, and there is no further information about the occurrence. Records of the same nature were found in Arusha, far from the Project.

As shown, during field surveys, 55 observation points were assessed, distributed throughout the whole TLs alignment. These points include areas adjacent to the wayleave, where access was possible, and surrounding areas.

During the activities, the presence of karst rocks or associated features was not evidenced, nor was it recorded, from interviews with local residents, knowledge about the occurrence of caves in the vicinity of the corridor.

Although no cavities were found in the study area, their occurrence cannot be ruled out due to the lithological conditions identified. Based on the potential classification presented above, a map was developed (**Map 7.1.12.a**). As mentioned, the areas with the greatest potential are associated with rocks of the Bukoba Group, distributed in the mountainous reliefs intercepted by the TL's N-S corridor.

[7] https://www-sop.inria.fr/agos/sis/DB/database.html
https://en.wikipedia.org/wiki/List_of_caves
https://www.grottocenter.org/

Symbol	Lithology	Spelological Pontetial
aQ	Predominantly alluvial and eluvial sediments	Unlikely
dMP	Meta-sediments	Medium
	Water	Unlikely
s?MP	Peridotite, dunite, lherzolite, gabbro, norite, anorthosite	Low
miNA	Granitoids, migmatite, mafic and ultramafics, meta-sediments	Low
vNP	Volcano-sedimentary formations	Medium
gsNA	Mafic volcanics, meta-basalts, phyllite, BIF	Low
IN-Q	Fine clastic sediments	Unlikely

Legend

T-line Alignment

- Vertices
- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Waterways
- Roads
- Direct area of influence (DAI) - 1 km
- Indirect Area of Influence of Physical Environment - 20 km

Speleological Potential

- Medium
- Low
- Unlikely

T-lines Alignment

Source:

Geological Survey of Tanzania
https://www.gmis-tanzania.com/ - accessed on 08/07/2024

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale 0 12 24 36 48 km

Date:	Scale:	File:	Revision:
05/29/2025	1:1.200.000	Speleological.aprx	Ø

Developer:

Tanzania Electric Supply Company Limited (TANESCO)

Project:

PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.12.a:

Map of Speleological Potential

Regions:

Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:

JGP Consultoria e Participações Ltda.

JGP Consultoria e Participações Ltda. - Celso Paiva - H:\LT Tanzania\APRX\Speleological.aprx

7.1.13
Mineral Resources

Minerals in Tanzania are public property held by the president in trust for all citizens of Tanzania. To engage in any form of activity in the mining sector, whether it be prospecting or mining, one is required to obtain the appropriate mineral right from several that can be issued by the Mining Commission, the main body regulating mining activities in Tanzania[8].

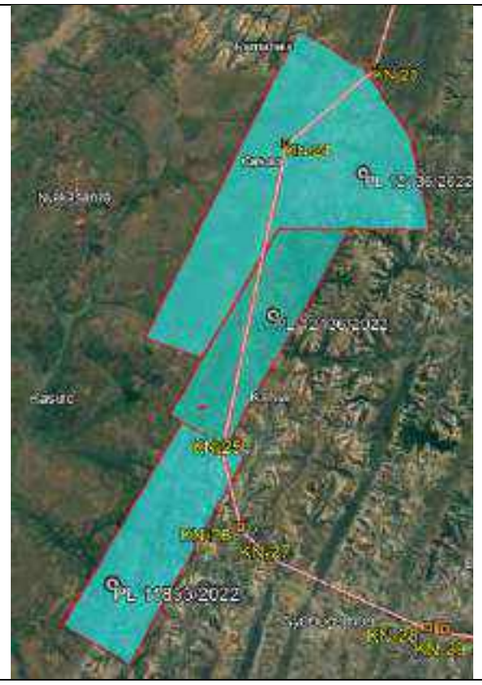
For this ESIA, a survey was carried out of the existing mining rights along the routes of the TLs, the boundaries of which coincide with the Direct Area of (DAI). The survey consisted of consulting the database of the Tanzanian Mining Cadastre Portal[9], prepared by the Ministry of Minerals (MADINI).

This consultation allowed the georeferenced location of the mining licenses identified in the 500 m strip for each side of the line (which includes the 52 m wide wayleave, 26 m for each side of the LT axis) and to obtain information on the area, type of license, parties involved, the commodity, and the villages where the polygons are located.

The result is shown in **Table 7.1.13.a** below and in the **Figure 7.1.13.a**. As the table shows, there are 32 mining rights affected by the Project, of which 20 are directly intercepted by the TLs and 12 are located in their DAI. Of the 20 directly intercepted, 4 are by 400 kV Kyaka - Nyakanazi TL while 16 are by 400 kV Nyakanazi - Ibadakuli TL. There are no mining rights along the 400 kV Mutukula - Kyaka TL.

[8] https://www.dentons.com/en/insights/articles/2020/december/2/mining-in-tanzania
[9] https://portal.madini.go.tz/map/

Figure 7.1.13.a
Mining rights crossed by the Project's TLs



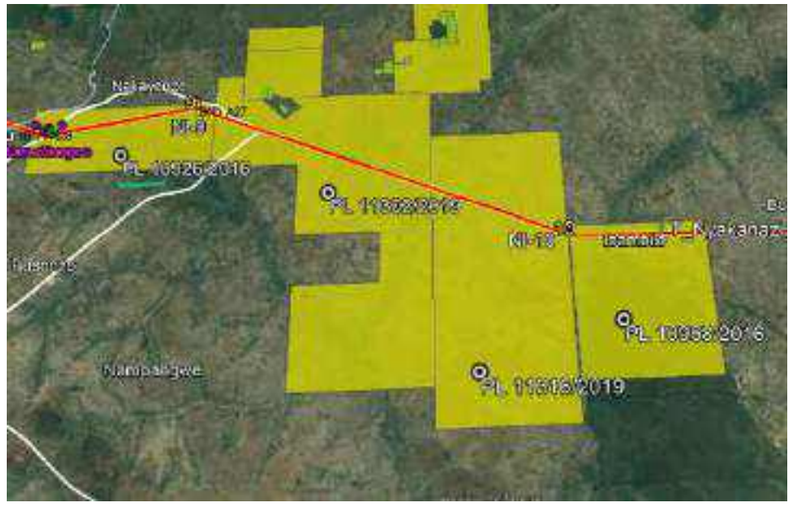


Figure 7.1.13.a
Mining rights crossed by the Project's TLs

Table 7.1.13.a
Mining licences in the Direct Area of Influence (DAI) and in the Direct Affected Area (DAA, wayleave) (in grey) of the Project

Code/	Total area of mining rights		Mining rights area intercepted by the T-Line Wayleave (km2)			Type	Parties	Commodities	Villages	Interception by the project
Year	(km^2)	ha	(km^2)	ha	% of Total Area					
PL 11841/2022	298,26	29.826,00	0,90	89,76	0,30	Prospecting Licence – Metalic Minerals	Innogy Minerals (Tz) Limited (100%)	Gold, Nickel	Katanda, Mulamba, Kihanga, Kishoju and Miti	DAI / DAA (400 kV Kyaka-Nyakanazi TL, between vertices KN-8 and KN-11)
PL 12136/2022	56,41	5.641,00	0,46	45,99	0,82	Prospecting Licence – Metalic Minerals	Mionex International Limited (100%)	Nickel	Rwakalemera, Nyabugombe	DAI / DAA (400 kV Kyaka-Nyakanazi TL, between vertices KN-22 and KN-24)
PL 11855/2022	18,97	1.897,00	0,36	36,26	1,91	Prospecting Licence – Metalic Minerals	Tembo Nickel Corporation Limited (100%)	Nickel	Rwakalemera, Nyabugombe	DAI / DAA (400 kV Kyaka-Nyakanazi TL, between vertices KN-23 and KN-24)
PL 11853/2022	18,40	1.840,00	0,07	6,94	0,38	Prospecting Licence – Metalic Minerals	Tembo Nickel Corporation Limited	Nickel	Nyabugombe	DAI / DAA (400 kV Kyaka-Nyakanazi TL, between vertices KN-24 and KN-26)
PML 002303 LVWZ (2016)	6,52	652,00	-	-	-	Primary Mining Licence - All Minerals other than Building Material	Salum Ibrahimu Lukumla (16%), Tatu S. Mabula (14%), Chubwa J Kalenze (14%), Maltha Kinasa (14%), Osward M. Boyo (14%), Ndaki M Ndaki (14%), Pastory M. Minzangurwa (14%)	Gold	Busiri	DAI (400 kV Kyaka-Nyakanazi TL, next to vertex KN-36)

Table 7.1.13.a
Mining licences in the Direct Area of Influence (DAI) and in the Direct Affected Area (DAA, wayleave) (in grey) of the Project

Code/	Total area of mining rights		Mining rights area intercepted by the T-Line Wayleave (km2)			Type	Parties	Commodities	Villages	Interception by the project
Year	(km^2)	ha	(km^2)	ha	% of Total Area					
PML001712WLZ	5,41	541,00	-	-	-	Primary Mining Licence - All Minerals other than Building Material	Abdallah Salum (25%), Goodluck E. Msaki (25%), Enock Kulindwa (25%), Hamisi Mrisho (25%)	Gold	Busiri	DAI (400 kV Kyaka-Nyakanazi TL, next to vertex KN-36)
PL/15855/2020	20,32	2.032,00	0,19	18,82	0,93	Prospecting Licence - Metallic Minerals	Kalyani Gold Resources Private Limited (100%)	Copper, Gold	Nyakanazi, Nyantakara	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-1 and NI-3)
PL 10926/2016	17,00	1.700,00	0,35	35,36	2,08	Prospecting Licence - Metallic Minerals	Terra Mining Limited (100%)	Gold	Mkunkwa, Kabagole, Busonzo, Nakayenze and Nampalahala	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-8 and NI-9)
PL 11302/2019	54,88	5.488,00	0,44	43,94	0,80	Prospecting Licence - Metallic Minerals	Henan Afro-Asia Geo-Engineering (Tanzania) Company Limited (100%)	Gold	Nakayenze, Nampalahala, Nalusunguti and Songambele	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-9 and NI-10)
PL 11316/2019	48,63	4.863,00	0,26	26,15	0,54	Prospecting Licence - Metallic Minerals	Henan Afro-Asia Geo-Engineering (Tanzania) Company Limited (100%)	Gold	Nampalahala, Songambele, Mwabasabi and Mnekezi	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-9 and NI-10)
PL 10958/2016	25,00	2.500,00	0,24	23,93	0,96	Prospecting Licence - Metallic Minerals	Henan Afro-Asia Geo-Engineering (Tanzania) Company Limited (100%)	Gold	Nampalahala, Songambele, Mwabasabi and Mnekezi	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-9 and NI-10)

Table 7.1.13.a
Mining licences in the Direct Area of Influence (DAI) and in the Direct Affected Area (DAA, wayleave) (in grey) of the Project

Code/	Total area of mining rights		Mining rights area intercepted by the T-Line Wayleave (km2)			Type	Parties	Commodities	Villages	Interception by the project
Year	(km^2)	ha	(km^2)	ha	% of Total Area					
PL 11617/2021	176,12	17.612,00	1,16	116,22	0,66	Prospecting Licence - Metallic Minerals	North Mara Gold Mine Limited (100%)	Gold	Nyitundu, Ntono, Shahende, Buyange, Ilogi and Igwamanoni	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-11 and NI-14)
PML0351KHM	9,82	982,00	-	-	-	Primary Mining Licence - All Minerals other than Building Material	ANSAR ABOUBAKAR KACHWAMBA (40%), Rahim Mzee Kachwamba (20%), Juma Athuman Mgonja (20%), Filbert Eliah Mwafulango (20%)	Gold	Ilogi	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-13 and NI-14)
ML0352KHM	9,95	995,00	-	-	-	Primary Mining Licence - All Minerals other than Building Material	ANSAR ABOUBAKAR KACHWAMBA (40%), Juma Athuman Mgonja (20%), Rahim Mzee Kachwamba (20%), Filbert Eliah Mwafulango (20%)	Gold	Ilogi	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-13 and NI-14)

Table 7.1.13.a
Mining licences in the Direct Area of Influence (DAI) and in the Direct Affected Area (DAA, wayleave) (in grey) of the Project

Code/	Total area of mining rights		Mining rights area intercepted by the T-Line Wayleave (km2)			Type	Parties	Commodities	Villages	Interception by the project
Year	(km^2)	ha	(km^2)	ha	% of Total Area					
PL 11437/2020	17,97	1.797,00	0,29	29,21	1,63	Prospecting Licence - Metallic Minerals	Christina Gabriel Kessy (100%)	Gold	Igwamanoni, Busulwangili and Kalole	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-13 and NI-15)
App no/20749	-	-	-	-	-	Processing Licence	NDEKEJA MPIGACHAI P.O.BOX 2 BUKOMBE	Gold	Kalole	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-14 and NI-15)
PML002236CWZ	10,00	1.000,00	-	-	-	Primary Mining Licence - All Minerals other than Building Material	Anthony John Skell (100%)	Gold	Kalole	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-14 and NI-15)
PL/22246/2022	120,95	12.095,00	0,51	51,32	0,42	Prospecting Licence - Metallic Minerals	Blai Minerals Resources (100%)	Gold	Bukulu, Bukwimba, Kayenze and Igeka	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-15 and NI-18)
PL 11658/2021	23,77	2.377,00	0,09	8,99	0,38	Prospecting Licence - Metallic Minerals	Grapeak Miners (TZ) Limited (100%)	Gold	Kayenze and Igeka	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-17 and NI-18)
PL 11679/2021	3,41	341,00	0,10	9,63	2,82	Prospecting Licence - Metallic Minerals	Mohyadin Mohamed Hussein (100%)	Gold	Isonda	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-17 and NI-18)
PL 11642/2021	6,34	634,00	0,10	10,25	1,62	Prospecting Licence - Metallic Minerals	Henan Yukuang International Mining Investiment (T) Co. Limited (100%)	Gold	Isonda	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-17 and NI-19)

Table 7.1.13.a
Mining licences in the Direct Area of Influence (DAI) and in the Direct Affected Area (DAA, wayleave) (in grey) of the Project

Code/	Total area of mining rights		Mining rights area intercepted by the T-Line Wayleave (km2)			Type	Parties	Commodities	Villages	Interception by the project
Year	(km^2)	ha	(km^2)	ha	% of Total Area					
PL 11769/2021	21,46	2.146,00	0,10	10,12	0,47	Prospecting Licence - Metallic Minerals	Grapeak Miners (TZ) Limited (100%)	Gold	Isonda and Nyang'ombe	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-17 and NI-19)
PCL0038/2014	0,09	9,00	0,00	0,23	2,59	Processing Licence	Vasista Mines Limited (100%)	Gold	Isonda	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-18 and NI-19)
PML0232SHY	0,10	10,00	-	-	-	Primary Mining Licence - All Minerals other than Building Material	LILIAN SOTER BYARUGABA (100%)	Gold	Mwongozo	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-19 and NI-20)
PML0231SHY	0,10	10,00	0,00	0,27	2,75	Primary Mining Licence - All Minerals other than Building Material	LILIAN SOTER BYARUGABA (100%)	Gold	Mwongozo	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-19 and NI-20)
ML 504/2015	7,32	732,00	0,13	12,87	1,76	Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds	Reef Gold Limited (100%)	Gold	Mwongozo and Mwasenge	DAI / DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-19 and NI-21)
PML0182SHY	0,10	9,56	-	-	-	Primary Mining Licence - All Minerals other than	Jumanne Salum Sungura (70%), Faraji Mohamed Ally (20%),	Gold	Mwasenge	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-20 and NI-21)

Table 7.1.13.a
Mining licences in the Direct Area of Influence (DAI) and in the Direct Affected Area (DAA, wayleave) (in grey) of the Project

Code/	Total area of mining rights		Mining rights area intercepted by the T-Line Wayleave (km2)			Type	Parties	Commodities	Villages	Interception by the project
Year	(km^2)	ha	(km^2)	ha	% of Total Area					
						Building Material	Ezekiel John Ndaya (10%)			
PML0179SHY	0,10	9,52	-	-	-	Primary Mining Licence - All Minerals other than Building Material	Jumanne Salum Sungura (70%), Faraji Mohamed Ally (20%), Ezekiel John Ndaya (10%)	Gold	Mwasenge	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-20 and NI-21)
PML0178SHY	0,10	9,59	-	-	-	Primary Mining Licence - All Minerals other than Building Material	Jumanne Salum Sungura (70%), Faraji Mohamed Ally (20%), Ezekiel John Ndaya (10%)	Gold	Mwasenge	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-20 and NI-21)
PML0181SHY	0,09	9,39	-	-	-	Primary Mining Licence - All Minerals other than Building Material	Jumanne Salum Sungura (70%), Faraji Mohamed Ally (20%), Ezekiel John Ndaya (10%)	Gold	Mwasenge	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-20 and NI-21)
ML 535/2014	9,83	983,00	-	-	-	Primary Mining Licence - All Minerals other than Building Material	Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds	Gold	Mwongozo, Mwasenge and Zunzuli	DAI (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-20 and NI-21)
PL 11808/2022	12,05	1.205,00	0,15	15,33	1,27	Prospecting Licence - Energy Minerals	Tanzania Geothermal Development Company Limited (100%)	Geothermal	Ibadakuli	DAA (400 kV Nyakanazi-Ibadakuli TL, between vertices NI-30 and NI-32)

Source: Tanzanian Mining Cadastre Portal, prepared by the Ministry of Minerals (MADINI). Available in: https://portal.madini.go.tz/map/

According to MADINI[10], the types of mining licences in Tanzania are:

Table 7.1.13.b
Types of mining licences

Licence	Description
Prospecting Licences (PLs)	Licences granted under Division A for exploration activities. PLs are issued for initial period of 4 years to individual, company of cooperate at the area where the applicant applied and renewed for first period of 3 years and second period of 2 years then expired and reverted to the Government or proceeded with the application of MLs or SMLs before expiry.
Special Mining Licences (SMLs)	Licences granted under Division B for large scale mining operation, which capital of investment is not less than US$100,000,000 or its equivalent in Tanzanian shillings. SMLs are issued to an individual, company or cooperate and its life depends on estimated life of ore body indicated in feasibility study or requested period by the applicant as per section 43 of the Mining Act, Cap 123.
Mining Licences (MLs)	Licences granted under Division B for medium scale mining operation, which capital investment is between US$100,000 and US$ 100,000,000 or its equivalent in Tanzanian shillings. MLs are issued to an individual or company of cooperate at the area within the prospecting area of minerals for the periods of maximum of 10 years and allowed to be renewed depends on audited substantial development of the area.
Primary Mining Licences (PMLs)	PMLs means a licence for small scale mining characterized by minimal machinery or technology of an initial capital for investment which does not exceed US dollars 5 million or its equivalent in Tanzania Shilling. PMLs are issued under Division C for the period of 7 years to individual or company of cooperate with Tanzanian Citizenship at the area where the applicant is satisfied to conduct prospecting and mining.
Processing Licences (PCLs)	PCLs are issued under Division D for the period of 10 years to an individual, company or cooperate at the area where the applicant applied to conduct processing activities.
Refining Licences (RFLs)	RFLs means licences to refine minerals. RFLs are issued for the period of 25 years to an individual, company or cooperate at the area where the applicant applied to conduct refining activities.
Smelting Licences (SLs)	SLs means licences to smelt minerals. SLs are issued for the period of 25 years to individual, company or cooperate at the area where the applicant applied to conduct smelting activities.
Dealer Licences (DLs)	DLs are the mineral trade licences that enables/allows the owner to buy or otherwise acquire minerals from the Mineral and Gem Houses or to sell or otherwise dispose of minerals as specified in the licence, and for the purpose of carrying on business as a dealer, to have possession thereof. DLs are issued to Tanzanians or Tanzanians and foreigners whereby Tanzanian must have at least 25% share of licence possession. Dealer Licences authorizes the holder to export any mineral or minerals and its life is 12 months from 1st July to 30th June of the following year.
Broker Licences (BLs)	BLs is the mineral trade licence that enables/ Allows to buy minerals from buying stations specified in his licence and sell to a licenced dealer in the Minerals and Gem Houses. It is granted to Tanzanians with at least 18 years or company of cooperate with Tanzanian Citizenship, a broker licence does not authorize the holder to export any mineral or minerals and its life is 12 months from 1st July to 30th June of the following year.

Of these types presented in the **Table 7.1.13.b**, 4 of them (highlighted in the table) cover the processes that are interfered with by the Project.

[10] https://www.tumemadini.go.tz/services/mining-licences-services/

Considering the data in **Table 7.1.13.a**, of the 32 mining rights interfered with by the Project, 17 (all intercepted by the wayleave) are of the "Prospecting Licence – Metalic Minerals" type. Another 12 (1 intercepted by the wayleave and 11 only in the DAI) are of type "Primary Mining Licence - All Minerals other than Building Material". Two are "Processing Licence", 1 of which is intercepted by the wayleave and the last one, also directly intercepted, is of the "Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds" type.

The absolute majority, 27 of the 32 mining licences (84%) are related to gold exploration. There are also other processes involving the exploitation of other minerals, including nickel (3 processes, 1 together with gold) and copper (1 process, together with gold).

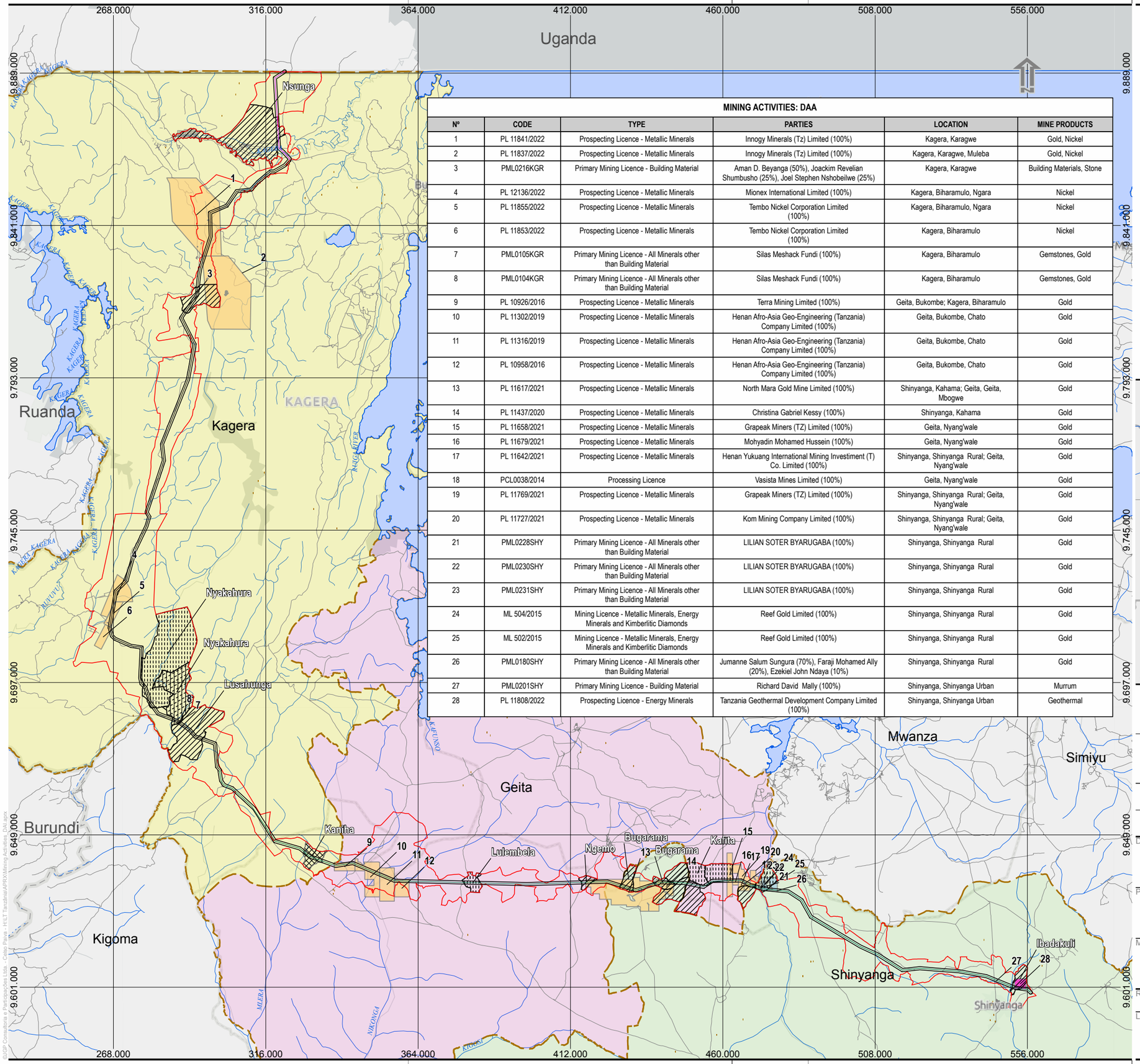
The three largest intercepted areas are of the "Prospecting Licence - Metallic Minerals" type, and cover 120.95, 176.12 and 298.26 km^2. The largest is in the region of the villages Katanda, Mulamba, Kihanga, Kishoju and Miti, in the Karagwe DC district, and is intercepted by 400 kV Kyaka - Nyakanazi TL. The other two are in the region of the villages of Bukulu, Bukwimba, Kayenze and Igeka (Nyang'hwale district) and Nyitundu, Ntono, Shahende, Buyange, Ilogi and Igwamanoni (Kahama, Geita DC and Mbogwe DC districts) and are intercepted by 400 kV Nyakanazi - Ibadakuli TL.

In Tanzania, when holders of mining rights are affected by the wayleave of transmission lines, they are entitled to financial compensation. This compensation is a formalised process and involves several steps and legal considerations, as will be discussed in the impacts assessment (**Section 8.2.3.3**, impact 9.05).

As shown in **Map 7.1.13.a**, the artisanal mining areas that cross the transmission line (TL) route were assessed, showing all polygons intercepted by T-line wayleave. Focus is placed on identifying intersections between artisanal mining activities and official mining polygons, as well as noting villages with declared artisanal mining activities that do not overlap licensed mining polygons intercepted by project wayleave. The analysis identifies villages with artisanal mining activities both intersecting with and independent of licensed mining polygons along the TL route.

Artisanal mining is prevalent across several villages along the UTIP transmission line route, serving as a significant source of livelihood for local communities. This mining type primarily focuses on the extraction of valuable minerals such as gold, which is found in villages like *Ibadakuli*, *Buyange*, and *Ngando*. In addition to gold, artisanal miners in certain areas also extract tin, particularly in *Kalole*, and diamonds, as seen in *Old Shinyanga*. These activities are typically informal and labor-intensive, often lacking formal oversight, which can lead to environmental degradation and social impacts.

Villages with declared artisanal mining activities that do not overlap with licensed polygons, such as Old Shinyanga, Nyang'hwale, and Nsunga, are potentially informal mining zones where official mining boundaries are currently unknown. This suggests the presence of unregulated mining practices, which may require further investigation to understand the extent and impact of these activities. Targeted socio-environmental management and community engagement strategies are essential for these areas to address potential conflicts and dependencies related to informal mining during the TL project's implementation.



MINING ACTIVITIES: DAA

Nº	CODE	TYPE	PARTIES	LOCATION	MINE PRODUCTS
1	PL 11841/2022	Prospecting Licence - Metallic Minerals	Innogy Minerals (Tz) Limited (100%)	Kagera, Karagwe	Gold, Nickel
2	PL 11837/2022	Prospecting Licence - Metallic Minerals	Innogy Minerals (Tz) Limited (100%)	Kagera, Karagwe, Muleba	Gold, Nickel
3	PML0216KGR	Primary Mining Licence - Building Material	Aman D. Beyanga (50%), Joackim Revelian Shumbusho (25%), Joel Stephen Nshobeilwe (25%)	Kagera, Karagwe	Building Materials, Stone
4	PL 12136/2022	Prospecting Licence - Metallic Minerals	Mionex International Limited (100%)	Kagera, Biharamulo, Ngara	Nickel
5	PL 11855/2022	Prospecting Licence - Metallic Minerals	Tembo Nickel Corporation Limited (100%)	Kagera, Biharamulo, Ngara	Nickel
6	PL 11853/2022	Prospecting Licence - Metallic Minerals	Tembo Nickel Corporation Limited (100%)	Kagera, Biharamulo	Nickel
7	PML0105KGR	Primary Mining Licence - All Minerals other than Building Material	Silas Meshack Fundi (100%)	Kagera, Biharamulo	Gemstones, Gold
8	PML0104KGR	Primary Mining Licence - All Minerals other than Building Material	Silas Meshack Fundi (100%)	Kagera, Biharamulo	Gemstones, Gold
9	PL 10926/2016	Prospecting Licence - Metallic Minerals	Terra Mining Limited (100%)	Geita, Bukombe; Kagera, Biharamulo	Gold
10	PL 11302/2019	Prospecting Licence - Metallic Minerals	Henan Afro-Asia Geo-Engineering (Tanzania) Company Limited (100%)	Geita, Bukombe, Chato	Gold
11	PL 11316/2019	Prospecting Licence - Metallic Minerals	Henan Afro-Asia Geo-Engineering (Tanzania) Company Limited (100%)	Geita, Bukombe, Chato	Gold
12	PL 10958/2016	Prospecting Licence - Metallic Minerals	Henan Afro-Asia Geo-Engineering (Tanzania) Company Limited (100%)	Geita, Bukombe, Chato	Gold
13	PL 11617/2021	Prospecting Licence - Metallic Minerals	North Mara Gold Mine Limited (100%)	Shinyanga, Kahama; Geita, Geita, Mbogwe	Gold
14	PL 11437/2020	Prospecting Licence - Metallic Minerals	Christina Gabriel Kessy (100%)	Shinyanga, Kahama	Gold
15	PL 11658/2021	Prospecting Licence - Metallic Minerals	Grapeak Miners (TZ) Limited (100%)	Geita, Nyang'wale	Gold
16	PL 11679/2021	Prospecting Licence - Metallic Minerals	Mohyadin Mohamed Hussein (100%)	Geita, Nyang'wale	Gold
17	PL 11642/2021	Prospecting Licence - Metallic Minerals	Henan Yukuang International Mining Investment (T) Co. Limited (100%)	Shinyanga, Shinyanga Rural; Geita, Nyang'wale	Gold
18	PCL0038/2014	Processing Licence	Vasista Mines Limited (100%)	Geita, Nyang'wale	Gold
19	PL 11769/2021	Prospecting Licence - Metallic Minerals	Grapeak Miners (TZ) Limited (100%)	Shinyanga, Shinyanga Rural; Geita, Nyang'wale	Gold
20	PL 11727/2021	Prospecting Licence - Metallic Minerals	Kom Mining Company Limited (100%)	Shinyanga, Shinyanga Rural; Geita, Nyang'wale	Gold
21	PML0228SHY	Primary Mining Licence - All Minerals other than Building Material	LILIAN SOTER BYARUGABA (100%)	Shinyanga, Shinyanga Rural	Gold
22	PML0230SHY	Primary Mining Licence - All Minerals other than Building Material	LILIAN SOTER BYARUGABA (100%)	Shinyanga, Shinyanga Rural	Gold
23	PML0231SHY	Primary Mining Licence - All Minerals other than Building Material	LILIAN SOTER BYARUGABA (100%)	Shinyanga, Shinyanga Rural	Gold
24	ML 504/2015	Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds	Reef Gold Limited (100%)	Shinyanga, Shinyanga Rural	Gold
25	ML 502/2015	Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds	Reef Gold Limited (100%)	Shinyanga, Shinyanga Rural	Gold
26	PML0180SHY	Primary Mining Licence - All Minerals other than Building Material	Jumanne Salum Sungura (70%), Faraji Mohamed Ally (20%), Ezekiel John Ndaya (10%)	Shinyanga, Shinyanga Rural	Gold
27	PML0201SHY	Primary Mining Licence - Building Material	Richard David Mally (100%)	Shinyanga, Shinyanga Urban	Murrum
28	PL 11808/2022	Prospecting Licence - Energy Minerals	Tanzania Geothermal Development Company Limited (100%)	Shinyanga, Shinyanga Urban	Geothermal

Legend

- TL Mutukula-Kyaka (Option B)
- TL Kyaka - Nyakanazi (Option A)
- TL Nyakanazi - Ibadakuli (Option 1)
- Waterways
- Roads
- Physical and Biological Environment DAI
- Social Environment DAI
- Water Bodies

Regions

- Kagera
- Geita
- Shinyanga

Type of mining in the villages (according to ESIA's social baseline survey

- Village whith Artisanal mining
- Village whith Artisanal / Medium Scale mining
- Village with Artisanal / Medium Scale / Large Scale mining
- Village whith Large Scale mining

Mineral Licenses Active - DAA

Type

- Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds
- Primary Mining Licence - All Minerals other than Building Material
- Primary Mining Licence - Building Material
- Processing Licence
- Prospecting Licence - Energy Minerals
- Prospecting Licence - Metallic Minerals

Source:

Lead E&S Consultant

UTM- Zona 36S
Datum: WGS 1984 - EPSG: 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
11/11/2024	1:1.200.000	Mining Activities	Ø

Developer:

Tanzania Electric Supply Company Limited (TANESCO)

Project:

PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.1.13.a:

Mining Activities: DAA

Regions:

Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:

JGP Consultoria e Participações Ltda.

JGP Consultoria e Participações Ltda. - Celio Paiva - H:\LT Tanzania\APRX\Mining Activities_DAI.aprx

7.2
Biodiversity Baseline

The development of the biodiversity baseline includes the assessment of the diversity of species and ecosystems, the presence of protected areas and internationally recognized areas important for biodiversity, the occurrence of critical habitats, and the availability and prioritization of ecosystem services. Gathering this information is necessary to confirm the environmental feasibility of the project and follow the Project's ToR and the guidelines of the WB's ESS 6, including the corresponding Guidance Notes. Therefore, biodiversity studies developed as part of the ESIA contemplates the following:

1. Development of biodiversity assessment, including species and ecosystem, in the indirect and direct areas of influence.
2. Identification of Legally Protected and Internationally Recognized Areas of High Biodiversity Value.
3. Critical habitat assessment.
4. Analysis of ecosystem services.

Biodiversity in the project's Indirect Area of Influence (IAI) is caractherised using secondary sources of information; primary data on ecossystems, flora and fauna was collected for the project's Direct Area of Influence (DAI) and is presented in **Section 7.2.2**.

7.2.1
Indirect Area of Influence

The assessment carried out for the IAI was based mainly on secondary sources. The secondary sources of information include consultation with international online biodiversity databases, like IUCN[1], GBIF[2], IBAT[3], Plants of the Word Online (POWO[4]), existing land use and land cover maps, studies carried out in Tanzania Protected Areas within the project region, biodiversity databases carried out for other projects in the region, scientific articles, and other reliable and relevant sources of information, which are mentioned throughout the report.

7.2.1.1
Ecosystems and Land Use Cover

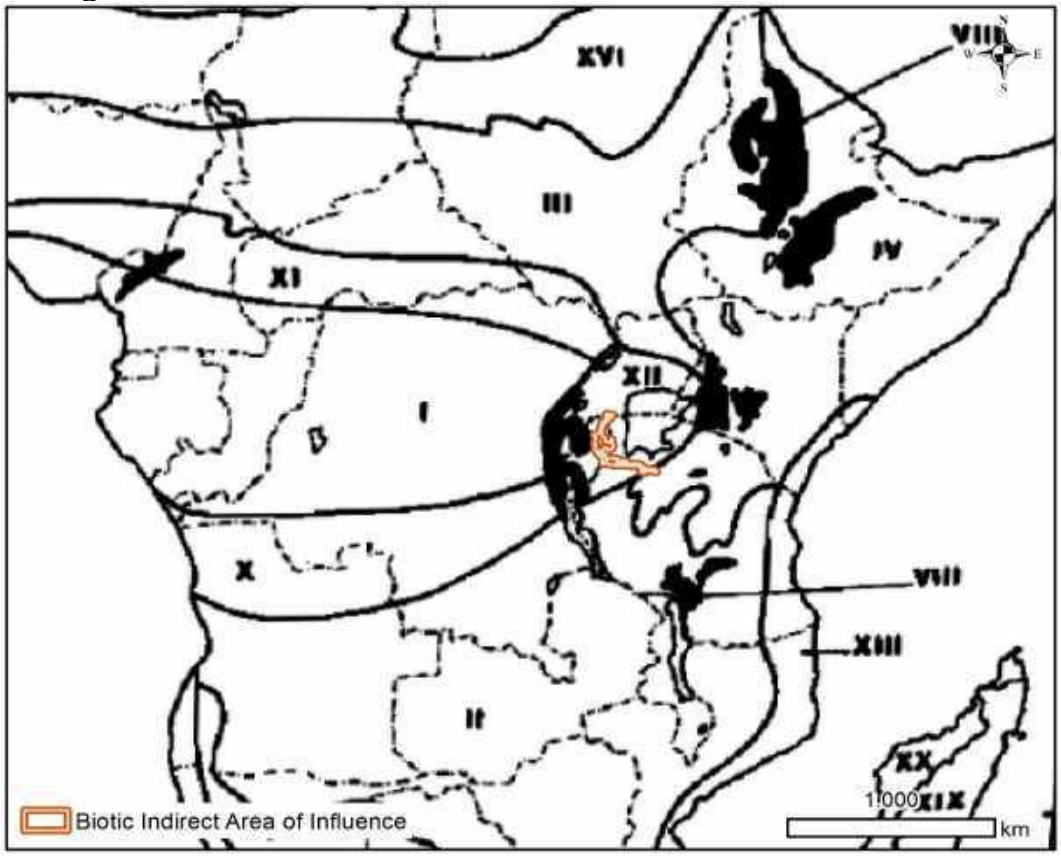
<u>Ecoregions and ecosystems</u>

According to White's vegetation map of Africa (WHITE, 1983), the project is located in three main phytogeographical types (**Figure 7.2.1.1.a**), most part are concentrated in the Guinea-Congolia/ Zambezia regional transition zone and the Lake Victoria regional mosaic. A minor part overlaps with the SomaliaMasai regional centre of endemism. The

[1] IUCN Red List of Threatened Species
[2] GBIF
[3] Integrated Biodiversity Assessment Tool (IBAT) (ibat-alliance.org)
[4] Plants of the World Online | Kew Science

classification proposed by White considers the physiognomic and phytogeographic characteristics as well as edaphic and hydrological requirements (GRONER, 2017).

Figure 7.2.1.1.a
White's vegetation map of Africa (1983) - Main phytochoria of Africa and Madagascar



Source: Adapted from White (1983)
Legend: I. Guineo-Congolian regional centre of endemism. II. Zambezian regional centre of endemism. III. Sudanian regional centre of endemism. IV. Somalia-Masai regional centre of endemism. V. Cape regional centre of endemism. VI. Karoo-Namib regional centre of endemism. VII. Mediterranean regional centre of endemism. VIII. Afromontane archipelago-like regional centre of endemism, including IX, Afroalpine archipelago-like region of extreme floristic impoverishment (not shown separately). X. Guinea Congolia/Zambezia regional transition zone. XI. Guinea-Congolia/Sudania regional transition zone. XII. Lake Victoria regional mosaic. XIII. Zanzibar-Inhambane regional mosaic. XIV. Kalahari-Highveld regional transition zone. XV. Tongaland-Pondoland regional mosaic. XVI. Sahel regional transition zone. XVII. Sahara regional transition zone. XVIII. Mediterranean/Sahara regional transition zone. XIX. East Malagasy regional centre of endemism. XX. West Malagasy regional centre of endemism (WHITE, 1983).

Most of the IAI overlaps with the Lake Victoria regional mosaic. This region includes most of Uganda, the whole of eastern Rwanda and Burundi, and small parts of Zaire, Kenya, and Tanzania. Climatic gradients are accentuated and are related to the complex physiography and to the distance from Lake Victoria, which is an important source of precipitation. In some places, rainfall is sufficiently high (1500-2000 mm per year) and well distributed throughout the year to support the rainforest. In other places, it is too low for rainforest, but not seasonal enough for woodland. Therefore, scrub forest and semi-evergreen bushland and thicket represent the climax. A few miombo species reach their

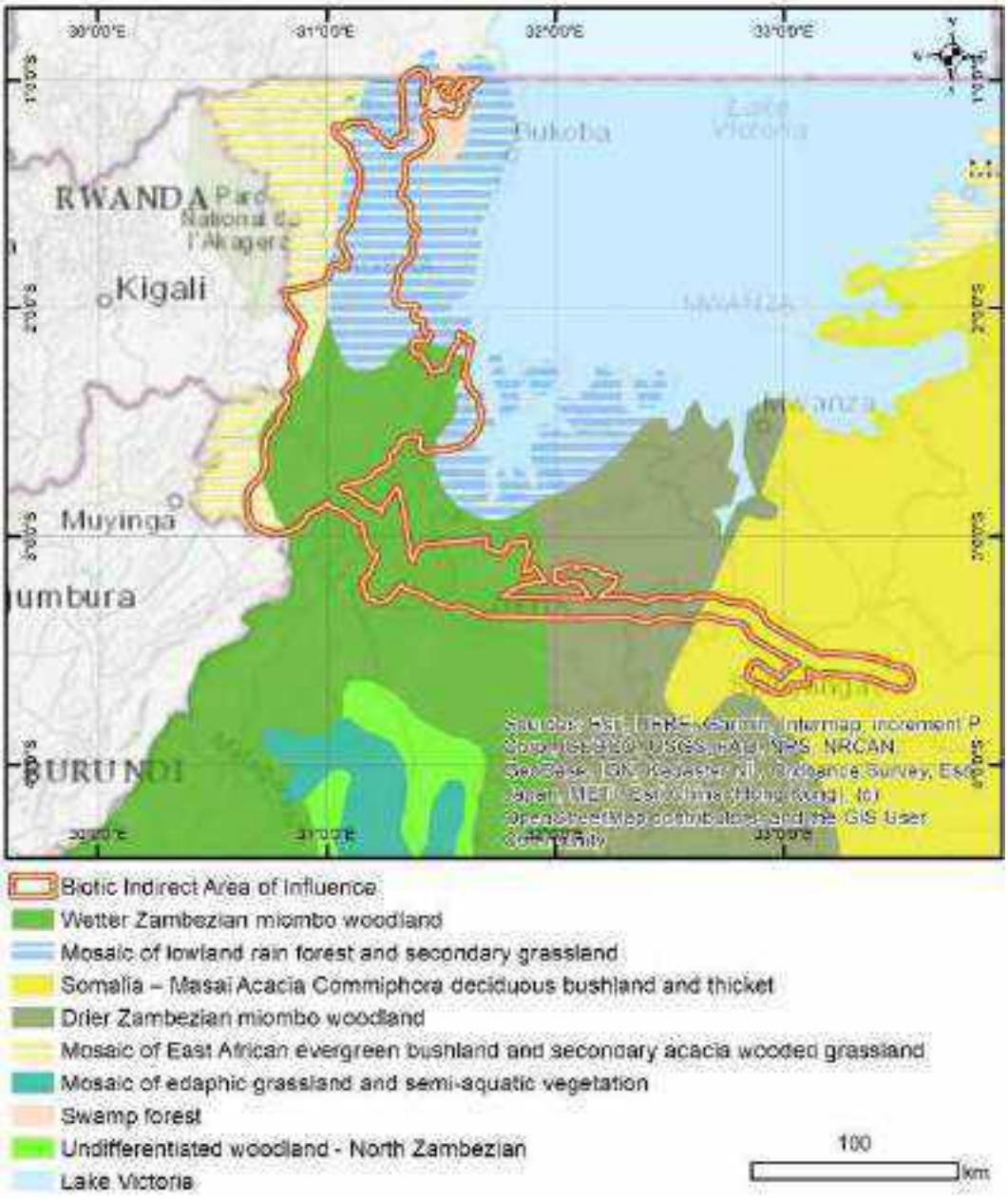
northern limits near the southern shore of Lake Victoria. The dry season is less severe than in most of the Zambezian Region and the communities in which miombo species occur are not typically Zambezian. The Lake Victoria Regional Mosaic is the meeting place of five distinct floras: Guineo-Congolian, Sudanian, Zambezian, Somalia-Masai and Afromontane. Its vegetation consists of a mosaic of floristically impoverished variants of the characteristic vegetation of the first four, in some cases with an admixture of Afromontane species (WHITE, 1983).

The Guinea-Congolia/Zambezia regional transition zone separates the Guinea-Congolese and Zambezi regions stretching from the Atlantic Ocean to the highlands flanking the northern end of Lake Tanganyika. In most places, the climate is intermediate between the Guinea-Congolian and Zambezi regions. The dry season is pronounced, but the relative humidity in the dry season is high. Most of the transition zone is occupied by secondary and wooded grasslands dominated almost exclusively by Zambezian species. The latter, however, have greatly increased in abundance after the destruction of the original vegetation, but their original occurrence was often confined to specialized edaphic sites, such as rocky places and seasonally flooded pastures. In general, in the project region, the edaphic conditions overlap with the climate to produce a mosaic of vegetation (WHITE, 1983).

In the SomaliaMasai centre of endemism, the climate is arid or semi-arid. Rainfall nearly everywhere is less than 500 mm per year and in places as low as 20 mm. Temperatures are high (mean monthly temperature mostly between 25° and 30° C). Most of the Region is covered with deciduous bushland and thicket which grade into and are replaced by semievergreen and evergreen bushland and thicket on the lower slopes of the mountains. There are smaller areas of scrub forest, riparian forest, secondary grassland and wooded grassland, seasonally waterlogged grassland, semi-desert grassland and shrubland, and desert (WHITE, 1983).

According to the Tanzania Vegetation Map, based on the map elaborated by White (1983) (**Figure 7.2.1.1.b**), the ecosystems associated with this phytogeographical types, that occur in the study area, are: Mosaic of lowland rain forest and secondary grassland, Wetter and Drier Zambezian miombo woodland, Somalia – Masai *Acacia Commiphora* deciduous bushland and thicket, Mosaic of East African evergreen bushland and secondary *Acacia* wooded grassland and Swamp Forest.

Figure 7.2.1.1.b
Tanzania vegetation map by F. White (1983)



Source: Adapted from Tanzania Natural Resources Information Centre (TANRIC), University of Dar Es Salaam. Data Source: The Vegetation of Africa by F. White published by UNESCO 1983.

Table 7.2.1.1.a shows the extent of each type of ecosystem within the Project's IAI.

Most of the IAI of the project overlaps with the Wetter and Drier Zambezian miombo woodland ecosystem. The miombo woodland ecosystem accounts for 56% of the project's IAI, including wet and dry formations, the former being significantly dominant (49%). These formations are distributed in the regions of Geita and Kagera, between the districts Nyang'hwale and Biharamulo.

Table 7.2.1.1.a
Ecosystem types in the Project's Indirect Are of Influence, according to White (1983)

Ecosystem type	Area (ha)	Area (%)
Wetter Zambezian miombo woodland	794.101,07	49,6%
Mosaic of lowland rain forest and secondary grassland	425.600,06	26,6%
Somalia – Masai *Acacia Commiphora* deciduous bushland and thicket	137.153,28	8,6%
Drier Zambezian miombo woodland	104.630,07	6,5%
Mosaic of East African evergreen bushland and secondary acacia wooded grassland	95.701,70	6,0%
Swamp forest	36.814,48	2,3%
Lake Victoria	7.493,30	0,5%
	1.601.493,96	100,0%

Source: Quantification by JGP Consultoria, based on the Tanzania Vegetation Map by F. White, produced by the Tanzania Natural Resources Information Centre (TANRIC).

Miombo woodland is the most extensive tropical seasonal woodland and dry forest formation in Africa (perhaps even globally), covering an estimated 2.7 million km^2 (Frost, 1996) and extending from Angola, Kongo, Zambia, Malawi, Mozambique, Tanzania and Zimbabwe. In Tanzania, it covers about two-thirds of the country (FYHRQUIST, 2005).

This vegetation type occurs in regions receiving >700 mm means annual rainfall on nutrient-poor soils (FROST, 1996) and it is primarily woodland (MUNISHI *et al*., 2010). The ecology of the woodlands is driven by climate, soils and disturbances, but given the extent of woodland cover change, the variability in structure and composition across the region is enormous and not always directly related to the determinants (RIBEIRO *et al*., 2020).

The vegetation of this area is dominated by trees in the legume sub-family Ceasalpinoideae with the genera *Brachystegia, Julbernardia* and *Isoberlinia* dominating, and a well-developed underlying layer of grass composed of C4 grasses (Frost, 1996; TIMBERLAKE & CHIDUMAYO, 2011). The dominance of one family of trees provides the unifying feature for this ecosystem (FROST, 1996; MUNISHI *et al*., 2010). Although the miombo ecosystem is relatively homogeneous in terms of plant composition, it has considerable plant diversity, with many species being endemic to the ecoregion (WHITE, 1983; FROST, 1996).

Fires occur regularly and frequently and originate from people preparing land for cultivation, collecting honey or making charcoal. Fire can cause changes in species composition and structure of vegetation, and it is one of the key ecological factors in the Miombo ecosystem, and its management has considerable implications for biodiversity conservation (TIMBERLAKE & CHIDUMAYO, 2011). The Miombo woodlands are undergoing the greatest change in Tanzania due to heavy use for the supply of fuel wood and other sources of energy (MAPAURE & CAMPBELL, 2002).

The miombo ecosystem contains a diverse of major woodland types, the ones that occur in Project IAI include Wet Miombo and Dry Miombo. The wet miombo is a species-rich woodland with a canopy usually greater than 15 m high. Dominant species include

Brachystegia floribunda, B. glaberrima, B. taxifolia, B. wangermeeana and *Marquesia macroura*. The herbaceous layer comprises tall grasses such as *Hyparrhenia*. In the wettest areas, the dominant trees are only briefly deciduous, the canopy is almost closed, and shade-tolerant species are found in the understory. Floodplains and swamp grasslands are found along major rivers (FROST, 1996; TIMBERLAKE & CHIDUMAYO, 2011). The dry miombo type is floristically poorer than wet miombo with *Brachystegia spiciformis, B. boehmii* and *Julbernardia globiflora* dominant. The canopy is generally less than 15 m in height and trees are deciduous for a month or more during the dry season. Species of *Acacia* are found on clay soils in drainage lines. Annual rainfall is less than 1000 mm. The herbaceous layer consists of medium to tall C4 grasses. In drier areas, *Julbernardia* and *Combretum* become dominant. There are no significant areas of floodplain grassland or wetlands, but seasonally waterlogged drainage-line grasslands are common on the central plateau (FROST, 1996; TIMBERLAKE & CHIDUMAYO, 2011).

The Mosaic of lowland rainforest and secondary grassland is the second ecosystem most common in the IAI (26%) and is distributed between the regions of Geita and Biharamulo, around Lake Victoria. This ecoregion lies within the humid tropical savanna zone with mean annual high temperatures ranging between 30-33°C, and lows ranging between 14-21°C. Annual rainfall averages 1,600-2,000 mm with a dry season of 4 to 5 months. The wide variety of habitat types supports a high diversity of animals. Forest patches contain characteristic rainforest species, such as *Afzelia Africana, Aningeria altissima, A. robusta, Aubrevillea kerstingii, Chrysophyllum perpulchrum, Cola gigantea, Hildegardia barteri, Khaya grandifolia, Mansonia altissima, Morus mesozygia, Nesogordonia papaverifera, Pterygota macrocarpa, Annona senegalensis, Borassus aethiopum, Bridelia ferruginea*. Tall grasses up to 4 m high characterize the savanna areas, including fire-tolerant species of the genera *Andropogon* and *Pennisetum* (BURGESS *et al*., 2004; MILLER & GOSLING, 2014).

Hunting and habitat loss for agriculture or logging are the main threats to biodiversity. Agricultural land covers a large part of the ecoregion, with anthropogenic forest types where species of economic interest predominate (BURGESS *et al*., 2004, 2004).

The Somalia – Masai *Acacia Commiphora* deciduous bushland and thicket ecoregion is mainly flat and low-lying (over half lies below 500 m), rising towards the west and north. The mean maximum temperatures are around 30°C, and the mean minimum temperatures are 15° to 18°C. Annual rainfall varies from below 100 mm to around 600 mm (BURGESS *et al*., 2004). Deciduous bushland and thicket are the climax over the greater part of the Somalia-Masai Region. Characteristically it is a dense bushland, 3-5 m tall with scattered emergent trees up to 9 m. The dominant *Acacia* and some of the *Commiphora* are spinous and so impede progress even in the more open types except along game and cattle tracks. In higher-rainfall areas, especially on rocky hills, the emergent trees occur closer together and are a little taller, though scarcely ever more than 10 m. Evergreens, however, occur throughout, but they contribute no more than 2.5 to 10% to the phytomass. In many places, grasses contribute little to the phytomass and are represented by a few annual and short-lived perennial species. Although there is appreciable variation in floristic composition, species of *Acacia, Commiphora,*

Capparidaceae, and *Grewia* are nearly always present (WHITE, 1983).

The highest threat in this ecosystem is from overgrazing by domestic animals, as well as encroachment of human settlement into protected areas, expansion of invasive alien species, weak law enforcement, and lack of capacity in protected areas. Habitats are partially degraded through fuelwood collection, particularly close to villages and towns. Land overuse is more intense in areas where large-scale farming and irrigation schemes have been launched (BURGESS *et al*., 2004).

The ecosystem of East African evergreen bushland and secondary Acacia wooded grassland occurs on the drier slopes of mountains and upland areas in East Africa from central Tanzania to Eritrea and beyond. It often forms an ecotone between montane forest, especially *Juniperus* forest, and deciduous *Acacia-Commiphora* bushland and thicket. It varies greatly in composition and richness, but certain genera and species are nearly always present, such as *Carissa edulis, Dodonaea viscosa, Olea africana, Tarchonanthus camphoratus*, species of *Acokanthera, Euclea, Sansevieria* and *Teclea*, and succulent species of *Aloe* and *Euphorbia*. The height of the canopy varies from 3 to 7 m and consists mostly of the crowns of *Olea africana, Gnidia subcordata, Teclea simplicifolia, Euclea divinorum, Acokanthera schimperi*, and especially in disturbed areas, *Tarchonanthus camphoratus*. Other large bushes include *Canthium keniense, Crotón dichogamus, Dodonaea viscosa, Dombeya burgessiae, Grewia similis, G. tembensis, Maytenus heterophylla* and *Rhus natalensis*. Shrubs are few in species but *Aspilia mossambicensis, Psiadia arabica (punctulata), Tinnaea aethiopica* and *Turraea mombassana* are abundant. The few climbers include *Capparis fascicularis (elaeagnoides), Pterolobium stellatum, Senecio petitianus and Scutia myrtina*. Apart from the succulents, the ground layer is sparse, but includes shade-tolerant grasses such as *Ehrharta erecta*. With increasing altitude scattered stunted individuals of the trees *Schrebera alata, Cassine (Elaeodendron) buchananii, Calodendrum capense, Cussonia holstii, Drypetes gerrardii* and *Juniperus procera* appears and herald the transition to *Juniperus* forest (WHITE, 1983).

Swamp forests are dominated by species which are widespread in tropical Africa and occur extensively on the shores of Lake Victoria and elsewhere. This formation is abundant in the Minziro Forest Reserve (WHITE, 1983; MNRT, 2017). The more important species are *Anthocleista schweinfurthii, Erythrina excelsa, Ficus congensis, Macaranga monandra, M. pynaertii, M. schweinfurthii, Mitragyna stipulosa, Musanga cecropioides, Parkia filicoidea, Pseudospondias microcarpa, Spondianthus preussii, Syzygium cordatum, Uapaca guineensis, Voacanga thouarsii* and the palms *Phoenix reclinata* and *Raphia farinifera*. The forests occurring on aluvial deposits at the mouth of the Kagera River on the western shore of Lake Victoria are unique in tropical Africa in being composed of almost equal proportions of lowland, predominantly Guineo-Congolian, and Afromontane species (WHITE, 1983).

According to the IUCN Red List of Ecosystems[5], none of these phytophysiognomies are threatened with extinction, including Critically Endangered/CR, Endangered/EN and

[5] IUCN Ecosystems (iucnrle.org),

Vulnerable/VU. According to this assessment, in the African continent there are 5 threatened ecosystems, 3 in the Egypt region, one in Madagascar and another one in South Africa (**Figure 7.2.1.1.c**).

However, although these ecosystems are not classified as threatened, many are under threat from the conversion of natural habitats, mainly for the establishment of crops, the use of savannas as grazing land for cattle and the (sometimes indiscriminate) use of fire to renew pastures, and the extraction of timber and other plant products.

Figure 7.2.1.1.c
Threatened ecosystems assessed by the IUCN in the African region

Source: IUCN Red List of Ecosystems.

Land use and cover

According to the World Cover Map produced by the European Spatial Agency (ESA, 2021)[6] almost 60% of the Project's IAI is covered with shrubland and grasslands (**Figure 7.2.1.1.d** and **Table 7.2.1.1.b**). Anthropic areas represent 22,6%. However, some of the areas mapped by the project as grasslands may actually be agricultural areas.

Table 7.2.1.1.b
Land use and cover in the Project's Indirect Are of Influence

Land use and cover	Area (ha)	Area (%)
Tree cover	206,821.08	15.9%
Shrubland	273,779.55	21.0%
Grassland	798,494.20	38.3%
Herbaceous wetland	8,543.46	0.7%
Bare/sparse vegetation	723.15	0.1%
Permanent water body	19,247.63	1.5%
Cropland	290,964.60	22.4%
Built-up	2,920.29	0.2%
Total	1,601,493.96	100.0%

Source: ESA (2021). Available at DATA | WORLDCOVER (esa-worldcover.org)

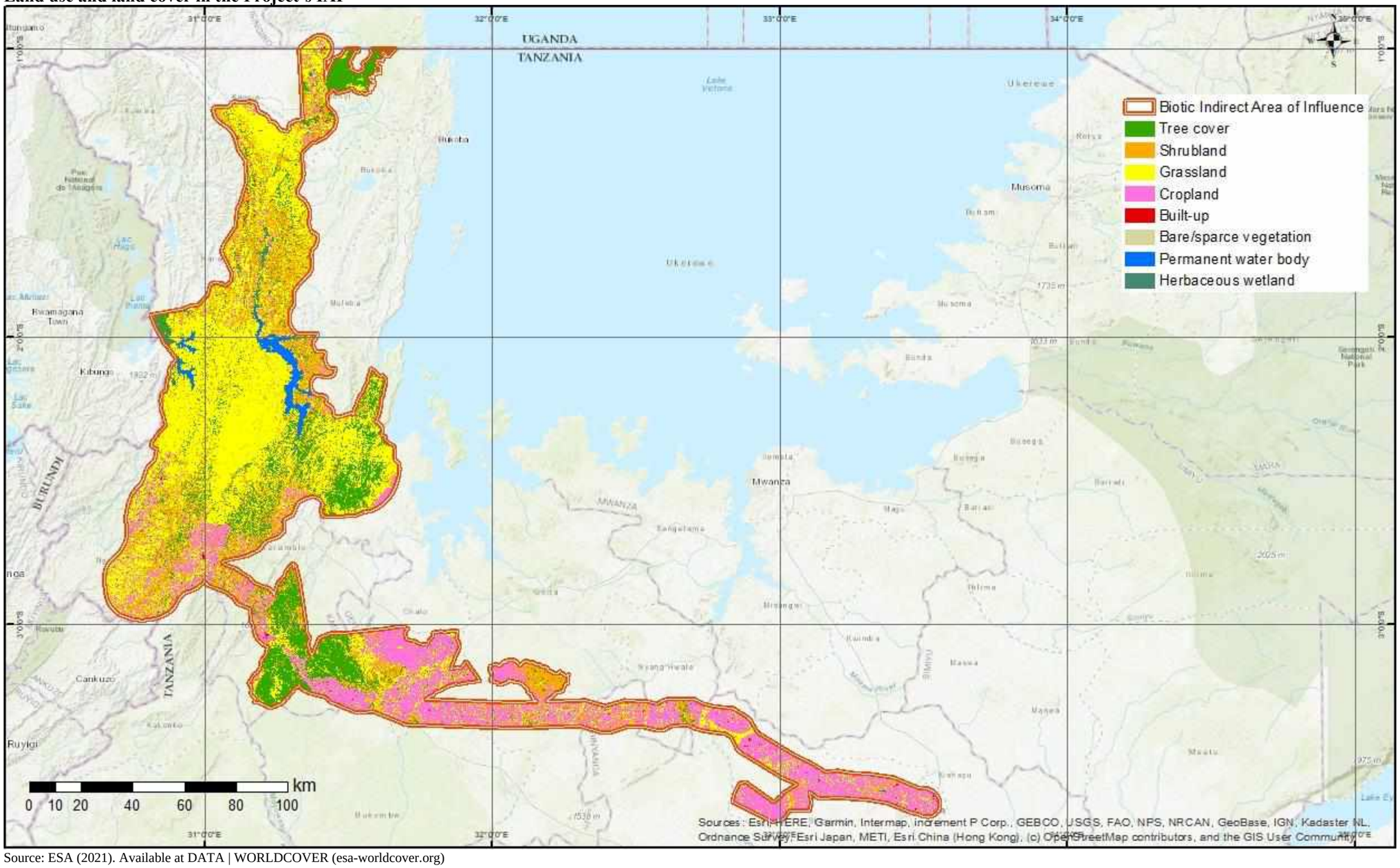
As it refers to global mapping, the classification of land use and land cover has been standardised to represent the different classes around the Earth. **Table 7.2.1.1.c** shows the description of each class, according to the ESA classification, and the correspondence with the regional approach, including some observations on possible discrepancies in interpretation.

As can be seen in **Figure 7.2.1.1.d**, the anthropized areas are mostly located in the Shinyanga and Geita regions, along the east-west alignment of the TL. Areas classified as tree cover are distributed in the Nyantakara, Biharamulo and Ruiga River Forest Reserve, and Minziro Nature Forest Reserve (at the northern end of the TL), and smaller patches near Lake Victoria.

Along the north-south alignment of the TL, areas classified as shrublands and grasslands predominate, they are mostly made up of natural habitats.

[6] The WorldCover project run by the European Spatial Agency/ESA provides global land cover maps from 2020 and 2021 with a spatial resolution of 10 metres, based on Sentinel-1 and Sentinel-2 data. The map is available here: WorldCover Viewer (esa-worldcover.org).

Figure 7.2.1.1.d
Land use and land cover in the Project's IAI



Source: ESA (2021). Available at DATA | WORLDCOVER (esa-worldcover.org)

Table 7.2.1.1.c
Ecosystem types in the Project's Indirect Area of Influence

ESA class	ESA class description[1]	Probably corresponding regional classification	Observations
Natural habitats			
Tree cover	This class includes any geographic area dominated by trees with a cover of 10% or more. Other land cover classes (shrubs and/or herbs in the understorey, built-up, permanent water bodies) can be present below the canopy, even with a density higher than trees. Areas planted with trees for afforestation purposes and plantations (including exotic species) are included in this class. This class also includes tree-covered areas seasonally or permanently flooded with fresh water except for mangroves	Wetter and Drier Zambezian miombo woodland ecosystem Mosaic of lowland rainforest Somalia – Masai Acacia Commiphora deciduous bushland and thicket Swamp forest	As this classification also includes planted trees, this class may include areas of modified habitat. In the project region, small silvicultural plantations and perennial crops have been identified and may be included in this class.
Shrubland	This class includes any geographic area dominated by natural shrubs having a cover of 10% or more. Shrubs are defined as woody perennial plants with persistent and woody stems and without any defined main stem being less than 5 m tall. Trees can be present in scattered form if their cover is less than 10%. Herbaceous plants can also be present at any density. The shrub foliage can be either evergreen or deciduous. 255, 187, 34 30 Grassland A12A2	Mosaic of East African evergreen bushland and secondary acacia wooded grassland	Area used for crops (modified habitats) may be included in this class, due to misinterpretation of the satellite image.
Grassland	This class includes any geographic area dominated by natural herbaceous plants (Plants without persistent stems or shoots above ground and lacking definite firm structure): (grasslands, prairies, steppes, savannahs, pastures) with a cover of 10% or more, irrespective of different human and/or animal activities, such as: grazing, selective fire management etc. Woody plants (trees and/or shrubs) can be present assuming their cover is less than 10%. It may also contain uncultivated cropland areas (without harvest/ bare soil period) in the reference year	Secondary grassland Mosaic of East African evergreen bushland and secondary acacia wooded grassland	Area used for crops (modified habitats) may be included in this class, due to misinterpretation of the satellite image.
Herbaceous wetland	Land dominated by natural herbaceous vegetation (cover of 10% or more) that is permanently or regularly flooded by fresh, brackish or salt water. It excludes unvegetated sediment and swamp forests (classified as trees)	Secondary grassland Mosaic of East African evergreen bushland and secondary acacia wooded grassland	Area used for crops (modified habitats) may be included in this class, due to misinterpretation of the satellite image.
Permanent water bodies	This class includes any geographic area covered for most of the year (more than 9 months) by water bodies: lakes, reservoirs, and rivers.	Water bodies	

Table 7.2.1.1.c
Ecosystem types in the Project's Indirect Area of Influence

ESA class	ESA class description[1]	Probably corresponding regional classification	Observations
Modified habitats			
Cropland	Land covered with annual cropland that is sowed/planted and harvestable at least once within the 12 months after the sowing/planting date. The annual cropland produces an herbaceous cover and is sometimes combined with some tree or woody vegetation. Note that perennial woody crops will be classified as the appropriate tree cover or shrub land cover type.	Cyclical and perennial crops	
Built-up	Land covered by buildings, roads and other man-made structures such as railroads. Buildings include both residential and industrial building. Urban green (parks, sport facilities) is not included in this class. Waste dump deposits and extraction sites are considered as bare.	Urbanized areas, including the centre of the districts intercepted by the project and other infrastructure elements, such as large, paved roads.	

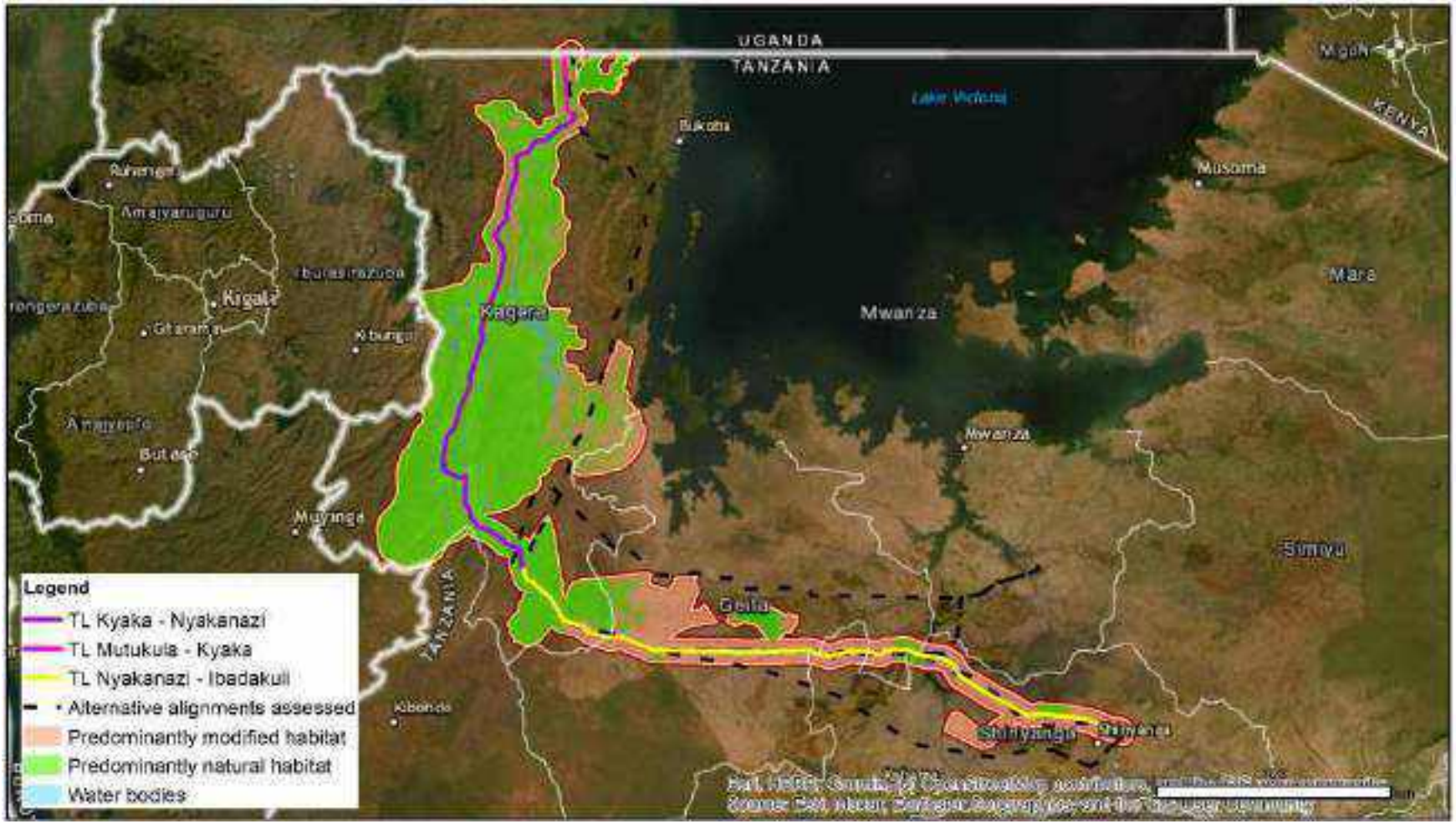
Source: 1 - ESA (2022).

The observations made during the field inspections carried out for this study (see Section 7.2.2) corroborate what is shown in the ESA mapping, the east-west alignment is more intensely anthropized, with the remaining natural habitats basically inside the protected areas and in specific places where the terrain is steeper. Areas with more open vegetation (such as savannah, grasslands, shrublands), located on flat terrain and outside protected areas, are predominantly occupied by anthropogenic land uses, especially the areas close to water bodies, which are intensively used for agricultural activities, mainly rice cultivation. Along the Kyaka- Nyakanazi segment, there is a more significant presence of preserved natural habitats. However, in the region closest to Lake Victoria there are several urban centres and a large population agglomeration, with modified habitats predominating.

Based on this information, the mapping of ecosystem types was detailed including results of fieldwork, to consider past and current habitat threats, including habitat loss or degradation, presence of alien or invasive species, induced human occupation and similar processes. This broader contextual risk understanding was used as input for the development of an Environmental Integrity Map (**Figure 7.2.1.1.e**) that classifies the ecosystem types according to their level of conservation, considering the World Bank Environmental and Social Standard ESS6 habitat definition, as follows:

- Natural habitats are areas composed of viable assemblages of plant and or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
- Modified habitats are areas of land that support a large proportion of flora and or fauna species that are non-native in origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

Figure 7.2.1.1.e
Habitat mapping in the Project's Indirect Area of Influence



Source: Elaborated by JGP Consultoria based on secondary sources and satellite image interpretation.

7.2.1.2
Flora

The assessment of flora in the Project's IAI was made by consulting the following databases:

- IBAT Report, generated in July 2023. To generate this report a buffer zone of 50 km from the outer limit of all the alignment alternatives was considered.
- Global Biodiversity Index Information (GBIF), flora and fauna species records were consulted in a 50 km buffer zone around the alignment alternatives.
- Rapid assessment of biodiversity and key resources in Burigi-Chato National Park (Kisingi *et al*., 2020).
- Minziro Forest Reserve Report (2000).
- Environmental and Social Impact Assessment (ESIA) for the East African Crude Oil Pipeline (EACOP) Project (JSB & COWI/RSK, 2019).

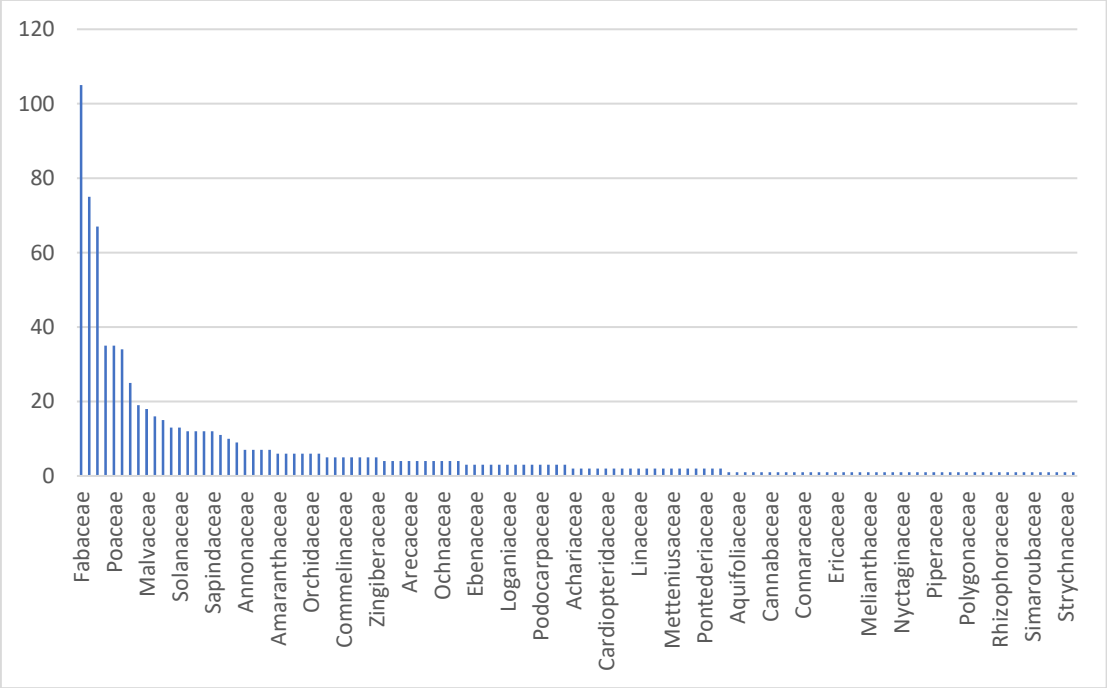
Additional information was consulted on the website of the Plants of the World Online (POWO - Kew Botanical Garden) and the International Union for Conservation of Nature (IUCN).

For the flora, the database consulted indicates a total of 807 species in the Project's IAI, belonging to 410 genera and 122 families. Most of these records came from IBAT and GBIF (683 species, 86% of the total). The families with the largest number of species are Fabaceae (105 species, 13% of the total), Cyperaceae (75 species, 9%), Rubiaceae (67 species, 8%), Euphorbiaceae (35 species, 4%), Poaceae (35 species, 4%), and Asteraceae (34 species, 4%) (**Figure 7.2.1.2.a**). Those six families represent 43% of the total number of species with the potential to occur in the Project's IAI.

With regard to distribution, there was no information on the extent of occurrence for around 24% of the species recorded. For the remaining 76%, none fell below the threshold that characterizes a restricted distribution, according to the Guidance Note (GN) 74 of IFC Performance Standard 6 (PS6). Species endemic to the region, and endemic to Tanzania have been recorded (see some examples in **Table 7.2.1.2.a**).

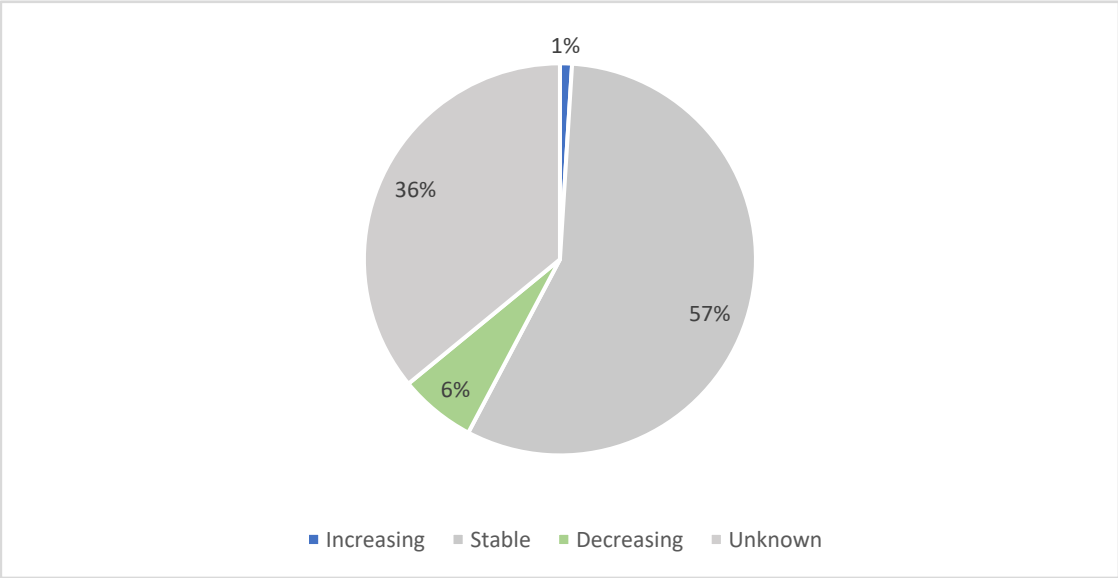
Regarding population trends, according to the information provided by the IUCN, for only 1% of the species registered there are records of a population increase, 57% of the species registered are considered to have stable populations and 6% of the species are in population decline (**Figure 7.2.1.2.b**). For 36% of the species registered there is no information on population trends. Among the species with stable or increasing populations there were no threatened species registered. Among the species with no information on population trends 41 species are classified as threatened with extinction, considering CR, EN and VU (**Figure 7.2.1.2.c**).

Figure 7.2.1.2.a
Number of flora species recorded by botanical family in the Project's Indirect Area of Influence



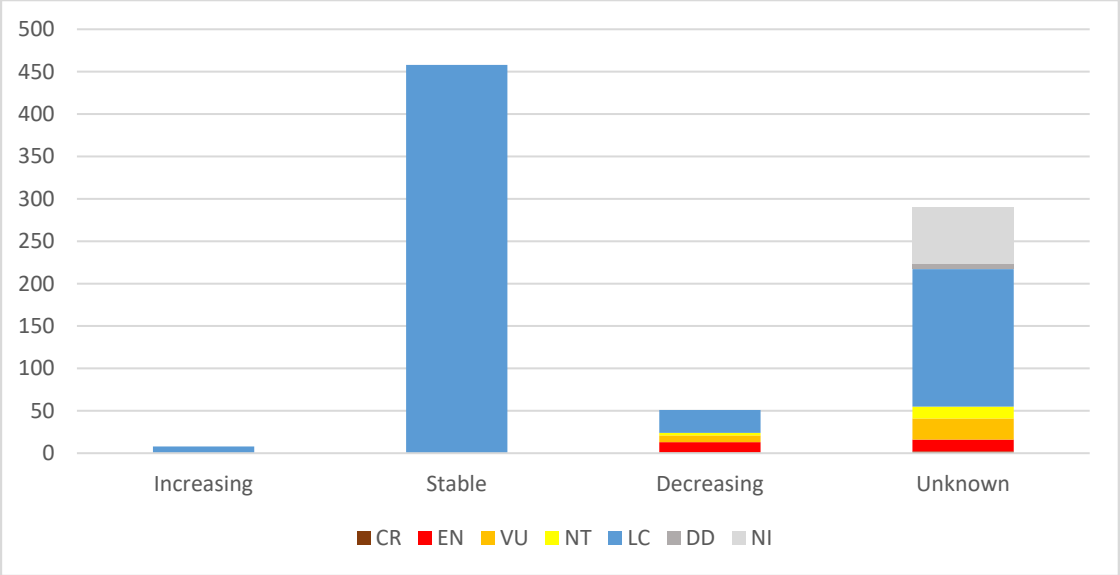
Source: Elaborated by JGP, based on the secondary information gathered.

Figure 7.2.1.2.b
Population trends of flora species recorded in the Project's Indirect Area of Influence



Source: Elaborated by JGP, based on the secondary information gathered.

Figure 7.2.1.2.c
Threat status by population trends of flora species recorded in the Project's Indirect Area of Influence



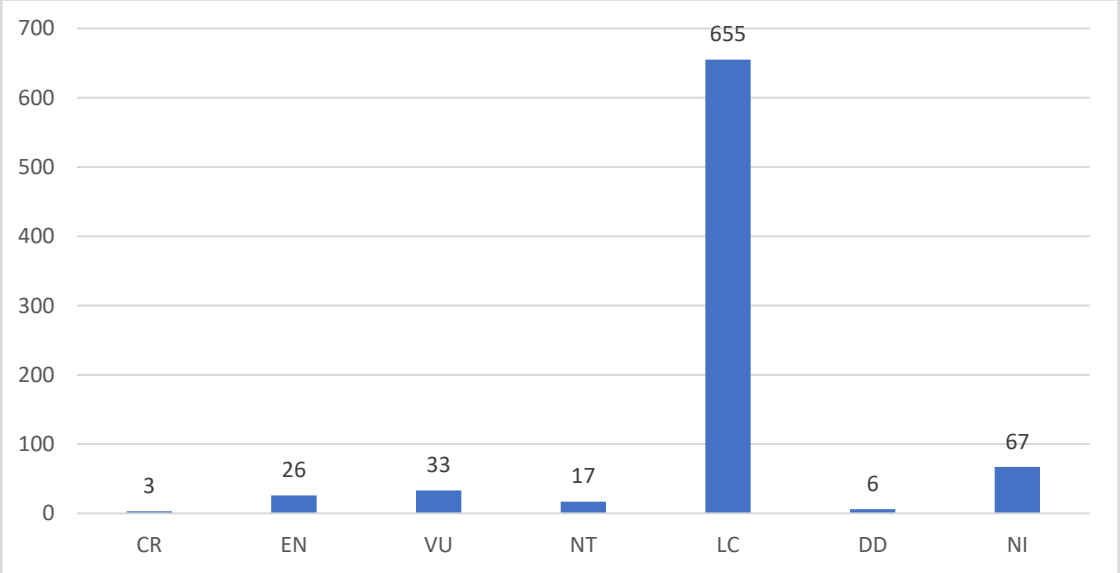
Legend: CR = Critically endangered; EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least concern, DD = Data deficient, NI = No information.
Source: Elaborated by JGP, based on the secondary information gathered.

With regard to threat status, 3 species are classified as CR: the species *Cordia crenata subsp. shinyangensis* is a shrub typical of dry vegetation, it is restricted to Tanzania with an Area of Occupancy (AOO) of approximately 8 km^2 and only 2 individuals have been recorded, one in the Shynianga region and the other in Morogoro region, both were recorded before 1988, and there have been no more recent records[7]. *Rhynchosia holtzii* is a forest species. According to the IUCN the species is restricted to the Dar Es Salaam region[8], however, in the GBIF there is one (1) record close to the Project's IAI, in the Mabira region, as well as other records in Kenya and Malawi[9]. *Vangueria verticillata* is an herb, collected just in one (1) location, at Nyamonge near Geita, Mwanza District, in 1954, at an altitude of 1200 metres[10]. There are no recent records.

Another 26 species are classified as EN, like *Euphorbia hubertii* with a distribution restricted to the northern region of Tanzania, and an extent of occurrence of approximately 16 km^2. Another 33 species are classified as VU (**Figure 7.2.1.2.d**). The species classified as threatened with extinction are presented in **Table 7.2.1.2.a**. As the IBAT and GBIF information was collected considering a buffer zone of 50 km around all the alignment alternatives for the project, some species registered for this area do not occur in the Project's IAI, according to information from IUCN and GBIF.

[7] Cordia crenata subsp. shinyangensis (iucnredlist.org)
[8] Rhynchosia holtzii (iucnredlist.org)
[9] Occurrence search (gbif.org)
[10] Vangueria verticillata (iucnredlist.org)

Figure 7.2.1.2.d
Total threatened flora species recorded in the Project's Indirect Area of Influence



Legend: CR = Critically endangered; EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least concern, DD = Data deficient, NI = No information.
Source: Elaborated by JGP, based on the secondary information collected.

Table 7.2.1.2.a
Threatened species of flora with the potential to occur in the Project's Indirect Area of Influence

Family	Species	Register location	Population trend	IUCN Category	EOO (km²)	Source	Observations
Acanthaceae	*Thunbergia bogoroensis*	Mwanza	Unknown	VU	131,700	GBIF/IBAT	Grassland species, it is found between 900–1,550 m asl.
Acanthaceae	*Thunbergia laborans*	Mwanza	Decreasing	EN	11,574	GBIF/IBAT	Savannah species, it is found between 1,150–1,550 m asl.
Achariaceae	*Dasylepis eggelingii*		Decreasing	VU	88,327	IBAT	-
Amaranthaceae	*Psilotrichum majus*	Kagera	Decreasing	VU	562,087	GBIF/IBAT	-
Asphodelaceae	*Aloe bukobana*	Kagera	Unknown	VU	55,135	GBIF/IBAT	It occurs in north-west Tanzania and into Rwanda, Burundi and Uganda between 1,150–2,000 m asl.
Asphodelaceae	*Aloe macrosiphon*	Kagera	Unknown	VU	269,197	GBIF/IBAT	-
Asteraceae	*Emilia cryptantha*	Kagera	Decreasing	EN	6,394	GBIF	Grassland endemic species from south Uganda and north-west Tanzania
Asteraceae	*Vernonia parapetersii*	Kagera	Unknown	VU	48,013	GBIF	Restricted to southern Uganda, NW Tanzania and southern Rwanda
Asteraceae	*Vernonia tinctosetosa*	Kagera	Unknown	EN	11,093	GBIF	Endemic to northwest Tanzania and southwest Uganda
Canellaceae	*Warburgia stuhlmannii*		Decreasing	VU	1,709,387.80	JSB-COWI & RSK (2019)	-
Chrysobalanaceae	*Magnistipula butayei subsp. montana*		-	VU	61,523	IBAT	-
Commelinaceae	*Murdannia stricta*		Unknown	EN	22,028	IBAT	It occurs in Congo e Rwanda, outside Project's IAI.
Convolvulaceae	*Ipomoea lepidophora*		Unknown	EN	25,655	IBAT	It occurs in congo and Rwanda between 1,400–1,500 m asl, outside Project's IAI.
Convolvulaceae	*Ipomoea macrosepala*	Mwanza	Unknown	VU	92,351	GBIF/IBAT	It occurs in Rwanda and Tanzania between 1,200–1,800 m asl, outside Project's IAI.
Cordiaceae	*Cordia crenata subsp. shinyangensis*		-	CR	-	IBAT	Endemic of Tanzania.
Cyperaceae	*Carpha angustissima*		Unknown	EN	385	IBAT	It occurs um Uganda, Rwanda and the Democratic Republic of Congo and is found between 2,400 and 3,300 m asl, outside Project's IAI.
Dennstaedtiaceae	*Blotiella trichosora*	Kagera	Decreasing	EN	1,384,312.40	GBIF/IBAT	-
Euphorbiaceae	*Euphorbia biharamulensis*		Unknown	VU	-	GBIF	Known from a single specimen from Tanzania: Biharamulo District, 168 km S of Bukoba at Biharamulo road.
Euphorbiaceae	*Euphorbia hubertii*		Unknown	EN	16,243	GBIF/IBAT	-

Table 7.2.1.2.a
Threatened species of flora with the potential to occur in the Project's Indirect Area of Influence

Family	Species	Register location	Population trend	IUCN Category	EOO (km²)	Source	Observations
Fabaceae	*Aeschynomene bullockii*		Unknown	EN	59,136	IBAT/JSB-COWI & RSK (2019)	It occurs in Burundi, the Democratic Republic of the Congo and Tanzania.
Fabaceae	*Aeschynomene burttii*	Mwanza	Decreasing	EN	3,039	GBIF	It occurs in northern Tanzania, in the Rubeho Mountains, Image Forest Reserve and Ruvu, maybe outside Project's IAI.
Fabaceae	*Berlinia orientalis*	Geita	Decreasing	VU	15,249	GBIF	Species restricted to East Africa, occurring in Tanzania and Mozambique, maybe outside Project's IAI.
Fabaceae	*Crotalaria varicosa*	Shinyanga	Decreasing	EN	1,075,655	GBIF/IBAT	-
Fabaceae	*Indigofera dissitiflora var. tenuis*		-	VU	261,219	IBAT	Native to Malawi and Tanzania between 550–1,800 m asl.
Fabaceae	*Millettia schliebenii*	Kagera	Unknown	EN	1.075.655	GBIF	
Fabaceae	*Rhynchosia holtzii*	Kagera	Decreasing	CR	55	GBIF	According to IUCN, it occurs at the coast of Tanzania, outside the Project's IAI.
Gentianaceae	*Faroa graveolens*	Kagera	Unknown	VU	119,337	GBIF/IBAT	It is native to Burundi, Tanzania and Uganda 1,130–2,100 m asl.
Lamiaceae	*Aeollanthus stuhlmannii*		Decreasing	EN	1,075,655	GBIF/IBAT	-
Lamiaceae	*Ocimum urundense*		Decreasing	EN	1,106,216.40	GBIF	-
Lamiaceae	*Rotheca bukobensis*	Kagera	Unknown	VU	7,435,822	GBIF/IBAT	-
Lamiaceae	*Rotheca myricoides subsp. ussukumae*		-	EN	11,540	IBAT	It is known from six collections (1931-1962) from the Mwanza-Shinyanga area of Tanzania.
Lamiaceae	*Tinnea physalis*		Unknown	EN	19,747	GBIF/IBAT	It is endemic to Tanzania (Shinyanga region) where it is found between 1,160–1,350 m asl.
Lauraceae	*Ocotea kenyensis*	Kagera	-	VU	10,871,184	GBIF	-
Linderniaceae	*Craterostigma pusillum*		Unknown	EN	1,011	IBAT	It is known from four collections, one each from Rwanda and Burundi and two in Tanzania (outside Project's IAI).
Loganiaceae	*Strychnos zenkeri*	Kagera	Unknown	VU	656,188	GBIF	-
Loranthaceae	*Englerina schubotziana*	Kagera	Unknown	VU	3,877,115	GBIF/IBAT	-
Malvaceae	*Grewia rugosifolia*	Kagera	Unknown	VU	532,200	GBIF/IBAT	It occurs outside the Project's IAI.
Malvaceae	*Grewia similiopsis*	Shinyanga	Unknown	EN	28,185	GBIF	Species endemic to Tanzania (Shinyanga and Singida region).
Malvaceae	*Microcos conocarpoides*		Unknown	VU	349,933	GBIF	It is native to Tanzania, the Democratic Republic of the Congo and Zambia.

Table 7.2.1.2.a
Threatened species of flora with the potential to occur in the Project's Indirect Area of Influence

Family	Species	Register location	Population trend	IUCN Category	EOO (km²)	Source	Observations
Malvaceae	*Pterygota macrocarpa*	Kagera	-	VU	6,262,294.50	GBIF	-
Menispermaceae	*Albertisia exelliana*		Unknown	EN	281,881	GBIF/IBAT	It is native to Burundi, Rwanda, Tanzania, Uganda between 600–1,250 m asl.
Moraceae	*Ficus tremula subsp. acuta*		-	VU	144,931	IBAT	It occurs in eastern Congo, Burundi, Rwanda, Uganda and Kenya. Outside Project's IAI.
Orchidaceae	*Polystachya nyanzensis*		Unknown	VU	3,553,236	IBAT	-
Orchidaceae	*Polystachya stauroglossa*	Kagera	Decreasing	VU	4,484,479	GBIF/IBAT	-
Orchidaceae	*Tridactyle virgula*		Decreasing	VU	439,609.49	IBAT	-
Peraceae	*Clutia stuhlmannii*	Kagera	Decreasing	VU	68,800	GBIF/IBAT	This species is native to Burundi, the Democratic Republic of the Congo and Tanzania between 1,200–1,900 m asl.
Phyllanthaceae	*Phyllanthus volkensii*	Kagera	Unknown	VU	11,189	GBIF	This species is known from Kenya and Tanzania. It is known from 6 localities, representing a maximum of 6 threat-based locations. Outside Project's IAI.
Podocarpaceae	*Afrocarpus usambarensis*	Kagera	Decreasing	EN	4,278,591.50	GBIF	-
Rosaceae	*Prunus africana*		Decreasing	VU	12.088.329	IBAT	-
Rubiaceae	*Afrocanthium siebenlistii*	Kagera	-	VU	1,075,655	GBIF	-
Rubiaceae	*Coffea arabica*	Kagera	Decreasing	EN	5,401,185	GBIF	-
Rubiaceae	*Oldenlandia duemmeri*		Decreasing	EN	354,497.44	IBAT	-
Rubiaceae	*Oxyanthus ugandensis*	Kagera	Unknown	EN	31,300	GBIF/IBAT	It occurs in Uganda and Tanzania (at Bukoba region).
Rubiaceae	*Pavetta pseudoalbicaulis*	Kagera	Decreasing	EN	12,308	GBIF	This species is known from Mozambique and Tanzania. It is known from five localities. Outside Project's IAI.
Rubiaceae	*Psychotria bagshawei*	Kagera	Unknown	EN	121,736	GBIF/IBAT	This species is native to the Democratic Republic of the Congo, Kenya, Tanzania and Uganda between 1,150–1,700 m asl.
Rubiaceae	*Psychotria petiginosa*	Kagera	Unknown	VU	14,470	GBIF	This species is endemic to Tanzania where it is found in Chome, Kizara and Shengena mountains Forest Reserves and Arusha region, Monduli district. Outside Project's IAI.

Table 7.2.1.2.a
Threatened species of flora with the potential to occur in the Project's Indirect Area of Influence

Family	Species	Register location	Population trend	IUCN Category	EOO (km²)	Source	Observations
Rubiaceae	*Tricalysia bagshawei*	Mwanza	Unknown	VU	1,374,125	GBIF	This species is native to the Democratic Republic of the Congo, Tanzania, Uganda, Zambia between 1,135–1,300 m asl.
Rubiaceae	*Tricalysia pedicellata*	Kagera	-	VU	1,075,655	GBIF	-
Rubiaceae	*Vangueria verticillata*		Unknown	CR	-	GBIF	It is a herb that is only known from the type specimen, collected in 1954 at Nyamonge near Geita, Mwanza District, Tanzania.
Rutaceae	*Zanthoxylum deremense*	Kagera	-	VU	1,255,980.80	GBIF	-
Sapotaceae	*Mimusops bagshawei*	Kagera	Unknown	VU	255,790	GBIF/IBAT	This species is native to Kenya, Rwanda, Tanzania and Uganda between 1,100–2,400 m asl.
Vitaceae	*Cyphostemma shinyangense*		Decreasing	EN	6,642	IBAT	This species is known from Kenya and Tanzania, at Shinyanga region.

Legend: EOO = Extent of Occurrence; CR = Critically endangered; EN = Endangered, VU = Vulnerable.

7.2.1.3
Fauna

This section presents the characterisation of the terrestrial fauna potentially present in the IIA of the Project, based on secondary data collection, indicating the references consulted for each group.

Scientific portals were also consulted, including sites such as Map of Life (MOL, 2024), an online platform that maps the global distribution of species, providing georeferenced data to support conservation and scientific research into biodiversity. The Global Inventory of Biodiversity Frameworks (GIBF, 2024) platform was also used; it is a centralised database that organises information on biodiversity frameworks and global conservation strategies, supporting policy formulation and biodiversity conservation. In addition, the Smithsonian Institution portal (SMITHSONIAN INSTITUTION, 2024) was consulted, which centralises educational resources and information on museums and research, covering topics such as history, science, culture and art, accessible to the general public.

The species mentioned in the references used were checked for nomenclature and current geographical distribution data. As some references are relatively old, the current names may no longer correspond to the taxa cited. In the case of species where it was not possible to clarify doubts due to misidentification or distribution, they were excluded from the list.

Where appropriate, a detailed analysis of the data collected has been carried out, indicating information on migratory habits and other aspects.

7.2.1.3.1
Birds

To characterise the birds in the Project's indirect area of influence (IAI), scientific records available for the study region were taken into account, as well as information from digital platforms and citizen science. Secondary data surveys revealed the existence of at least 16 bibliographical references relating to birds in the region. Of these, eight scientific papers were selected and used:

- Birds of Western Tanzania - Gombe, Mahale, Rubondo, Saanane, Malagarasi, Ntakata and Minziro (JOHN *et al*., 2019);
- East African Rarities Committee Report 2013-2015 (FISHER & HUNTER, 2016);
- A Little Green Sunbird Anthreptes seimundi from Minziro Forest Reserve: the first documented record for Tanzania (BAKER, 2019);
- The Grey-chinned Sunbird Anthreptes rectirostris in Tanzania (BAKER & BAKER, 2019);
- East African Rarities Committee Report for 2018 (FISHER & HUNTER, 2019);
- Notes on some Afrotropical migrants in East Africa with special reference to those recorded at the Ngulia Safari Lodge, Tsavo West National Park, Kenya (TURNER & BACKHURST, 2020);
- Forest bird longevities in NW Tanzania (BAKER & OATLEY);

- Diversity and distribution of Avifauna resource: a case of Lake Burigi wetland, North Western Tanzania (MUTAGWABA, 2010).

Based on the BirdLife International portal, data was consulted on the presence of species in Important Bird Areas (IBAs) and Endemic Bird Areas (EBAs) in Tanzania. IBAs and EBAs are regions identified as essential for bird conservation, with data available on platforms that monitor and promote the preservation of these critical areas (BIRDLIFE INTERNATIONAL, 2024a, 2024b).

Finally, we used digital, collaborative and online citizen science platforms that promote knowledge of Brazilian biodiversity. The first is eBird (EBIRD, 2024), the largest biodiversity-related citizen science project in the world, with an interactive website aimed at the global birdwatching community, with the aim of supporting, publicising and promoting birdwatching and citizen science. The second platform is Xeno-Canto (XENO-CANTO FOUNDATION, 2024), a global community that shares recordings of bird sounds, allowing species to be identified and studied through a collaborative database of bird sounds.

Thus, based on the aforementioned bibliographical references, 568 species of birds are expected to occur in the study region. This richness is distributed among 86 families and 23 orders (**Table 7.2.1.3.1.a** in **Annex 7.2.1.3**).

Among the expected orders, the most representative are: Passeriformes (Old World Flycatchers and Chats, Sunbirds, Weavers and the like), with 295 species, which represents around 52% of the total expected species, followed by Accipitriformes (Hawks, Eagles, Osprey and the like) with 39 species, and Charadriiformes (Sandpipers, Snipes, Phalaropes, Plovers and the like), with 34 species, which represent around 7% and 6% of the expected bird assembly, respectively (**Table 7.2.1.3.1.a**).

As for the families, the most representative were Accipitridae (Hawks, Eagles, Osprey and the like), with 37 species, representing around 6.5% of the bird assemblage. Next were Ploceidae (Weavers) with 33 species and Muscicapidae (Old World Flycatchers and Chats), with 31 species, representing 5.8% and 5.5% of the bird assemblage, respectively (**Table 7.2.1.3.1.a**).

Conservation Status

With regard to the conservation status of the species expected in the project region, searches were made for lists of threatened species at national level (Tanzania). However, in this case, no national list was found. In addition, international lists were considered, such as the Red List of the International Union for Conservation of Nature and Natural Resources (IUCN, 2024) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES, 2024). For these two lists, searches indicated the presence of threatened species, which are presented below.

At a global level, based on the IUCN (2024), seven species are classified as "Near Threatened - NT": Fischer's Lovebird (*Agapornis fischeri*), Great Snipe (*Gallinago*

media), Papyrus Gonolek (*Laniarius mufumbiri*), Red-faced Barbet (*Lybius rubrifacies*), Grey-crested Helmetshrike (*Prionops poliolophus*), Ring-necked Francolin (*Scleroptila streptophora*) and Crowned Eagle (*Stephanoaetus coronatus*) (**Table 7.2.1.3.1.a**). This classification indicates that these birds are close to reaching threatened status, but do not yet face an immediate risk of extinction. Therefore, they do not currently fall into the highest risk categories.

Another five species are in fact threatened with extinction, classified as "Vulnerable - VU" to extinction: Tawny Eagle (*Aquila rapax*), Shoebill (*Balaeniceps rex*), Southern Ground-hornbill (*Bucorvus leadbeateri*), Papyrus Yellow Warbler (*Calamonastides gracilirostris*) and Blue Swallow (*Hirundo atrocaerulea*). In addition to six other species: Steppe Eagle (*Aquila nipalensis*), Grey Crowned Crane (*Balearica regulorum*), Martial Eagle (*Polemaetus bellicosus*), Grey Parrot (*Psittacus erithacus*), Bateleur (*Terathopius ecaudatus*) and Lappet-faced Vulture (*Torgos tracheliotos*), which are classified as "Endangered". Finally, in a more delicate situation, there are five species classified as "Critically Endangered": White-backed Vulture (*Gyps africanus*), Rüppell's Vulture (*Gyps rueppelli*), Hooded Vulture (*Necrosyrtes monachus*) and White-headed Vulture (*Trigonoceps occipitalis*) (**Table 7.2.1.3.1.a**).

The species listed above face significant threats mainly due to human activities. These include habitat loss and degradation, often caused by agricultural expansion and urbanisation, intentional or accidental poisoning, and illegal hunting. In addition, illegal capture for the pet trade is a common threat. These pressures result in population declines and increase the risk of extinction for these species, as identified by the IUCN (2024).

Still based on international criteria, according to the CITES (2024), only two species are listed on Appendix I: Peregrine Falcon (*Falco peregrinus*) and Grey Parrot (*Psittacus erithacus*) (**Table 7.2.1.3.1.a**). The presence of species in CITES Appendix I indicates that they are among the most threatened and therefore subject to the greatest restrictions in terms of international trade.

In addition to these, another 56 species are listed in Appendix II. Although they are not necessarily threatened with extinction at the moment, they could become so if trade is not strictly controlled. Among the species included in this appendix are representatives of the following families: Accipitridae (Hawks, Eagles - 37 species), Anatidae (Ducks, Geese, Swans - 1 species), Balaenicipitidae (Shoebill - 1 species), Falconidae (Falcons, Caracaras - 5 species), Gruidae (Cranes - 1 species), Musophagidae (Turacos - 2 species), Otididae (Bustards - 1 species), Psittacidae (Parrots - 3 species), Strigidae (Typical Owls - 4 species) and Tytonidae (Barn-owls - 1 species) (**Table 7.2.1.3.1.a**).

Endemism

The geographical distribution patterns of endemic species are fundamental in identifying priority areas for conservation globally (KERR, 1997; STATTERSFIELD *et al.*, 1998). The importance of these areas is not only limited to species richness, but also to the critical role they play in maintaining global biodiversity and the stability of local ecosystems (MYERS *et al.*, 2000; BIRDLIFE INTERNATIONAL, 2024). In the East African region,

which covers Kenya, Tanzania, Uganda, Rwanda and Burundi, there are 100 bird species listed as regionally endemic, with Tanzania harbouring 32 of these species (STEVENSON & FANSHAWE, 2020).

Among the species expected to occur in the region, six are endemic to East Africa: Swahili Sparrow (*Passer suahelicus*), Rufous-tailed Weaver (*Histurgops ruficauda*), Grey-crested Helmetshrike (*Prionops poliolophus*), Red-faced Barbet (*Lybius rubrifacies*), Usambiro Barbet (*Trachyphonus usambiro*) and Fischer's Lovebird (*Agapornis fischeri*). Two species are endemic to Tanzania: Grey-breasted Francolin (*Pternistis rufopictus*) and Ashy Starling (*Lamprotornis unicolor*) (**Table 7.2.1.3.1.a**).

Migration

As for the migratory behaviour of the expected birds, it is important to mention that 427 species are classified as "Sedentary - SE", which occupy the same area all year round or have no predictable movement pattern, with no loyalty to a specific breeding site (TOBIAS & PIGOT, 2019; TOBIAS *et al.*, 2022). On the other hand, 134 "Partially Migratory - PM" bird species are expected, i.e. the minority of the population migrates long distances, or the majority of the population undergoes short-distance migration, nomadic movements, distinct altitudinal migration, etc. (TOBIAS & PIGOT, 2019; TOBIAS *et al.*, 2022). These migrations occur on a smaller scale and may be associated with the seasons, which directly interfere with environmental conditions, food supply and shelter (SICK, 1997). The partially migratory species expected for the study region are distributed in 36 families belonging to 14 orders, including: Namaqua Dove (*Oena capensis*), Jameson's Antpecker (*Parmoptila jamesoni*), Great White Pelican (*Pelecanus onocrotalus*), Great Cormorant (*Phalacrocorax carbo*), African Pitta (*Pitta angolensis*), African Spoonbill (*Platalea alba*), Glossy Ibis (*Plegadis falcinellus*), Weyns's Weaver (*Ploceus weynsi*), Black Saw-wing (*Psalidoprocne pristoptera*), Grey-rumped Swallow (*Pseudhirundo griseopyga*), Rock Martin (*Ptyonoprogne fuligula*), Cardinal Quelea (*Quelea cardinalis*), Red-headed Quelea (*Quelea erythrops*), Red-billed Quelea (*Quelea quelea*) and other species (**Table 7.2.1.3.1.a**).

In addition to the species mentioned above, another 74 are classified as "Migratory - MG", indicating that most of their populations make long-distance migrations (TOBIAS & PIGOT, 2019; TOBIAS *et al*., 2022). These species belong to 24 families and 13 orders. They include: Shikra (*Accipiter badius*), Steppe Eagle (*Aquila nipalensis*), Tawny Eagle (*Aquila rapax*), Lesser Spotted Eagle (*Clanga pomarina*), Booted Eagle (*Hieraaetus pennatus*), Yellow-billed Kite (*Milvus aegyptius*), Black Kite (*Milvus migrans*), Osprey (*Pandion haliaetus*), Eurasian Wigeon (*Mareca penelope*), Spur-winged Goose (*Plectropterus gambensis*), Common Hoopoe (*Upupa epops*), Little Swift (*Apus affinis*), Common Swift (*Apus apus*), White-rumped Swift (*Apus caffer*), Alpine Swift (*Tachymarptis melba*), among others (**Table 7.2.1.3.1.a**).

Habitat density

Bird species likely to occur in the area of influence of the development were classified according to habitat density (TOBIAS *et al*., 2016; TOBIAS *et al*., 2022). According to

the classifications adopted by the authors, birds can utilise up to three types of habitat density: i) Dense Habitats (DH); ii) Semi-open Habitats (SH); and iii) Open Habitats (OH).

For the Dense Habitats (DH), 126 bird species are expected to occur, representing approximately 22% of the total species with the potential to occur. These species live mainly in the lower or middle stratum of the forest, in dense thickets and dense shrubs (TOBIAS *et al*., 2016; TOBIAS *et al*., 2022). These include: Red-bellied Paradise-flycatcher (*Terpsiphone rufiventer*), Red-headed Bluebill (*Spermophaga ruficapilla*), Red-headed Malimbe (*Malimbus rubricollis*), Red-tailed Bristlebill (*Bleda syndactylus*), Rufous Flycatcher-thrush (*Stizorhina fraseri*), Sabine's Spinetail (*Rhaphidura sabini*), Scaly Francolin (*Pternistis squamatus*), Scaly-breasted Illadopsis (*Illadopsis albipectus*), Slender-billed Greenbul (*Stelgidillas gracilirostris*), Southern Crested-flycatcher (*Trochocercus cyanomelas*), Splendid Starling (*Lamprotornis splendidus*) and Spotted Flycatcher (*Muscicapa striata*) (**Table 7.2.1.3.1.a**).

For the Semi-open Habitats (SH), 216 species are expected, corresponding to around 38% of the expected total. These species mainly inhabit open shrubs, scattered shrubs, parks, dry or deciduous lowland forests, and thorn forests (TOBIAS *et al*., 2016; TOBIAS *et al*., 2022). Representatives of this category include: Chubb's Cisticola (*Cisticola chubbi*), Collared Sunbird (*Hedydipna collaris*), Common Bulbul (*Pycnonotus barbatus*), Common Cuckoo (*Cuculus canorus*), Common Scimitarbill (*Rhinopomastus cyanomelas*), Compact Weaver (*Ploceus superciliosus*), Crested Barbet (*Trachyphonus vaillantii*), Croaking Cisticola (*Cisticola natalensis*), Dark-backed Weaver (*Ploceus bicolor*), D'Arnaud's Barbet (*Trachyphonus darnaudii*), Diederik Cuckoo (*Chrysococcyx caprius*), Eastern Black-headed Oriole (*Oriolus larvatus*), Emerald-spotted Wood-dove (*Turtur chalcospilos*), European Bee-eater (*Merops apiaster*) and Familiar Chat (*Oenanthe familiaris*) (**Table 7.2.1.3.1.a**).

For Open Habitats (OH), approximately 40% of the expected species live mainly in deserts, grasslands, wetlands, low shrubs, rocky habitats, coastlines and cities. This category also includes species that mainly inhabit the top of the forest canopy (TOBIAS *et al*., 2016; TOBIAS *et al.*, 2022). Among the species in this category are: Cinnamon-chested Bee-eater (*Merops oreobates*), Collared Pratincole (*Glareola pratincola*), Collared Sand Martin (*Riparia riparia*), Common Barn-owl (*Tyto alba*), Common Fiscal (*Lanius collaris*), Common Greenshank (*Tringa nebularia*), Common Hoopoe (*Upupa epops*), Common Kestrel (*Falco tinnunculus*), Common Moorhen (*Gallinula chloropus*), Common Redshank (*Tringa totanus*), Common Reed-warbler (*Acrocephalus scirpaceus*) and Common Ringed Plover (*Charadrius hiaticula*) (**Table 7.2.1.3.1.a**).

Trophic Level

Bird species with the potential to occur in the development area have been classified according to different trophic levels, namely: primary consumers (herbivores), secondary consumers and tertiary consumers (carnivores and scavengers). For omnivorous species, they can be either primary or secondary consumers, depending on the type of food they are consuming (PIGOT *et al*., 2020; TOBIAS *et al*., 2022).

According to the aforementioned classifications, the majority of bird species with the potential to occur in the area are highly specialised in a single trophic level (n = 501 species). The largest proportion is made up of carnivorous birds, totalling 374 species, which represents approximately 66% of the expected total. Carnivorous birds are those that obtain at least 70% of their food resources by consuming live invertebrate or vertebrate animals, including species such as Abdim's Stork (*Ciconia abdimii*), Abyssinian Scimitarbill (*Rhinopomastus minor*), African Blue-flycatcher (*Elminia longicauda*), African Crake (*Crex egregia*), African Cuckoo (*Cuculus gularis*), African Darter (*Anhinga rufa*), African Dusky Flycatcher (*Muscicapa adusta*), African Dwarf-kingfisher (*Ispidina lecontei*), African Emerald Cuckoo (*Chrysococcyx cupreus*), African Fish-eagle (*Haliaeetus vocifer*), African Goshawk (*Accipiter tachiro*), African Grey Flycatcher (*Bradornis microrhynchus*), African Grey Hornbill (*Lophoceros nasutus*), African Harrier-hawk (*Polyboroides typus*), among others (**Table 7.2.1.3.1.a**).

Next are herbivorous birds, with 122 species, representing 21% of the expected total. These species obtain at least 70% of their food resources from plants, including specimens such as Cardinal Quelea (*Quelea cardinalis*), Red-headed Quelea (*Quelea erythrops*), Red-billed Quelea (*Quelea quelea*), Speckle-fronted Weaver (*Sporopipes frontalis*), Yellow-throated Greenbul (*Atimastillas flavicollis*), Joyful Greenbul (*Chlorocichla laetissima*), Plain Greenbul (*Eurillas curvirostris*), Grey Greenbul (*Eurillas gracilis*), Little Greenbul (*Eurillas virens*), Common Bulbul (*Pycnonotus barbatus*), Slender-billed Greenbul (*Stelgidillas gracilirostris*) and Violet-backed Starling (*Cinnyricinclus leucogaster*) (**Table 7.2.1.3.1.a**).

Scavenger birds are fewer in number, represented by only five species, which is equivalent to 1% of the total expected for the study region. These birds obtain at least 70% of their food resources from carrion or waste, and are represented by species such as White-backed Vulture (*Gyps africanus*), Rüppell's Vulture (*Gyps rueppelli*), Hooded Vulture (*Necrosyrtes monachus*), Lappet-faced Vulture (*Torgos tracheliotos*) and White-headed Vulture (*Trigonoceps occipitalis*) (**Table 7.2.1.3.1.a**).

Last but not least are the omnivorous species, which are more generalist and can obtain resources from various trophic levels in approximately equal proportions. These birds account for 12% of the expected total, with 67 species, including Red-faced Barbet (*Lybius rubrifacies*), Black-collared Barbet (*Lybius torquatus*), Yellow-fronted Tinkerbird (*Pogoniulus chrysoconus*), Double-toothed Barbet (*Pogonornis bidentatus*), White-eared Barbet (*Stactolaema leucotis*), Crested Barbet (*Trachyphonus vaillantii*), Hairy-breasted Barbet (*Tricholaema hirsuta*), Red-capped Lark (*Calandrella cinerea*), Rufous-naped Lark (*Mirafra africana*), White-necked Raven (*Corvus albicollis*), Yellow-bellied Waxbill (*Coccopygia quartinia*) and Grey-headed Nigrita (*Nigrita canicapillus*) (**Table 7.2.1.3.1.a**).

7.2.1.3.2
Herpetofauna

To survey the herpetofauna species likely to occur in the Project's IAI, data from scientific articles available for the study region was consulted, as well as information from digital platforms. The secondary data surveys revealed the existence of at least nine bibliographical references relating to amphibians and reptiles in the region. Of these, six scientific papers were selected and used, in addition to the online databases already mentioned:

- The Amphibians of the Tanzanian Forests: A freely downloadable visual guide (MENEGON *et al*., 2020);
- A complete guide to the snakes of southern Africa (MARAIS, 2022, ASI Snakes);
- New range extensions for *Dasypeltis atra* Sternfeld in Tanzania (Serpentes: Colubridae), with a review of the distribution of colour phases (BROADLEY & BATES, 2009);
- Description of a new and critically endangered species of *Atheris* (Serpentes: Viperidae) from the Southern Highlands of Tanzania, with an overview of the country's tree viper fauna (MENEGON *et al*., 2011);
- A can of worms: Identification issues and morphological conservatism in a large sample of African Green and Bush Snakes (Colubridae: *Philothamnus*) from Minziro Forest, Tanzania (NIELSEN *et al*., 2021) e,
- Field guide to East African reptiles (SPAWLS *et al*., 2018).

Therefore, based on the surveyed bibliography, 149 species of reptiles and amphibians are expected on the indirect influence area of the project, distributed in 36 families, inserted in the arura and Reptilia classes, where 35 species belong to the Anura order, 105 species belong to the Squamata order, 8 species belong to the Testudines order and only one species to the Crocodylia order (**Table 7.2.1.3.2.a** in **Annex 7.2.1.3**).

Conservation Status

According to the consulted lists of threatened fauna, three species are listed for the Red List of Threatened Species (IUCN, 2024). These are the venomous snakes *Bitis gabonica* and *Bitis nasicornis*, both classified as VU – Vulnerable and the Pancake Tortoise (*Malacochersus tornieri*) as CR – Critically Endangered. There is also one species classified as NT – Near Threatened, the Central African Rock Python (*Python sebae*), meaning that the species may become threatened if its populations and habitat continue to decrease, also the is one species classified as DD – Data Deficient, the lizard *Heliobolus neumanni*, meaning that there are not enough data to classify it as a threatened species. The remaining species are classified as "LC – Least Concern", or are not present in the listing. As for the CITES (2024), only the Pancake Tortoise (*Malacochersus tornieri*) is classified as threatened, inserted in the Appendix I of the list. Other 13 species are listed in the Appendix II of the list, which does not classify then as threatened, but warn about the pressure they suffer from hunting as a source of protein and trading as pets or for the traditional medicine purpose.

Endemism

None of the species listed in the consulted bibliography and databases is considered to be endemic to Tanzania, according to Frost (2024) and Meng (2016).

7.2.1.3.3
Mammals

To survey the species of mammal likely to occur in the Project's IAI, data from scientific articles available for the study region was consulted, as well as information from digital platforms. The secondary data surveys revealed the existence of at least 12 bibliographical references relating to mammals in the region. Of these, ten scientific papers were selected and used, in addition to the online databases already mentioned:

- A Field Guide to the Mammals of Tanzania (FOLEY *et al*., 2014);
- The Tanzania Small Carnivore Conservation Action Plan (DUARNT *et al.*, 2009);
- A survey of the small mammals of Minziro Forest, Tanzania, with several additions to the known fauna of the country (STANLEY & FOLEY, 2008);
- Minziro Forest reveals new galago and bat records for Tanzania (PERKIN & BEARDER, 2004);
- The African golden cat Caracal aurata in Tanzania: first record and vulnerability assessment (GRECO & ROVERO, 2020);
- Assessment of Effectiveness of Protection Strategies in Tanzania Based on a Decade of Survey Data for Large Herbivores (STONER *et al*., 2007a);
- Changes in large herbivore populations across large areas of Tanzania (STONER *et al*., 2007b);
- The distribution and Conservation Status of *Colobus* Monkeys in Tanzania (RODGERS, 1981);
- The impact of tourist hunting on large mammals in Tanzania: an initial assessment (CARO *et al.*, 1998) e,
- Integrative taxonomic revision of the African thicket rats (Murinae: *Grammomys*): how genomics decreases the number of currently recognized species (BRYJA *et al.*, 2024).

Thus, based on the aforementioned bibliographical references, 253 mammal species are expected to occur in the study region. This richness is distributed among 45 families and 14 orders (**Table 7.2.1.3.3.a** in **Annex 7.2.1.3**).

Among the orders listed, Chiroptera, which includes bats, and Rodentia, which includes rodents, are the most representative, with 66 and 68 species respectively, each representing around 26% of the total obtained. Next, with 33 species each, are the orders Carnivora (carnivores) and Artiodactyla (even-toed ungulates), each representing 13% of the total. Also, with 18 and 16 species are the Primates and Eulipotyphla orders, representing 7% and 6% respectively. The other orders are represented by four or fewer species, namely: Hyracoidea (4 spp.), Macroscelidea (elephant-shrews) (4 spp.), Lagomorpha (3 spp.), Perissodactyla (horses and rhinoceroses) (2 spp.), Proboscidea (elephants) (1 sp.) and Tubulidentata (aardvark) (1 sp.).

In terms of families, Muridae (Old World mice and rats, gerbils, whistling rats, and relatives), with 47 species, is by far the most diverse, accounting for 19% of the total. Next, representing 10% of the total, are the families Bovidae (antelopes, cattle, gazelles, goats, sheep, and relatives) (26 spp.) and Vespertilionidae (evening bats and vesper bats) (25 spp.), followed by Soricidae (shrews) and Cercopithecidae (Old World monkeys), with 15 and 11 species each, representing 4% of the total. The other 40 families are represented by nine or fewer species, such as Molossidae (free-tailed bats), which has nine species or 4% of the total, Nycteridae (slit-faced bats), with seven species or 3%, Mustelidae (badgers, otters, weasels, and relatives), with five species or 2%, Giraffidae (giraffes and okapis), with two species or 1%, and Rhinocerotidae (rhinoceroses), with one species (0.4%), among others (**Table 7.2.1.3.3.a**).

Conservation Status

The conservation status of the species expected in the region of the project was assessed by consulting lists of endangered species at international level only, since there is no list available at national level. Two lists were therefore considered: the International Union for Conservation of Nature and Natural Resources Red List (IUCN, 2024) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2024). For these two lists, the searches indicated the presence of threatened species, which are presented below.

According to the IUCN (2024), ten species are classified as 'Near Threatened - NT': Puku (*Kobus vardonii*), Cape Buffalo (*Syncerus caffer*), Lesser Kudu (*Tragelaphus imberbes*), Striped Hyena (*Hyaena hyaena*), Spotted-necked Otter (*Hydrictis maculicollis*), African Clawless Otter (*Lutra capensis*), Commerson's Leaf-nosed Bat (*Macronycteris commersonii*), Large-eared Giant Mastiff Bat (*Otomops martiensseni*), African Straw-colored Fruit Bat (*Eidolon helvum*), and Plains Zebra (*Equus quagga*) (**Table 7.2.1.3.3.a**). This classification indicates that these species are close to reaching threatened status, but do not yet face an immediate risk of extinction and, for this reason, do not consist of higher risk categories.

Ten species are listed as 'Vulnerable - VU' to extinction, according to IUCN criteria (2024): Northern Giraffe (*Giraffa camelopardalis*), Common Hippopotamus (*Hippopotamus amphibius*), Cheetah (*Acinonyx jubatus*), African Golden Cat (*Caracal auratus*), Lion (*Panthera leo*), Leopard (*Panthera pardus*), Schreibers's Long-fingered Bat (*Miniopterus schreibersii*), Ground Pangolin (*Smutsia temminckii*), Angolan Colobus (*Colobus angolensis*), and Ugandan Crested Mangabey (*Lophocebus ugandae*) (**Table 7.2.1.3.3.a**).

Seven species fall into the 'Endangered' category, such as African Wild Dog (*Lycaon pictus*), Masai Giraffe (*Giraffa tippelskirchi*), Common African Pangolin (*Phataginus tricuspis*), Giant Pangolin (*Smutsia gigantea*), Ashy Red Colobus (*Piliocolobus tephrosceles*), Chimpanzee (*Pan troglodytes*), and African Savanna Elephant (*Loxodonta africana*) (**Table 7.2.1.3.3.a**). Finally, only one species is in a more delicate situation, the Black Rhinoceros (*Diceros bicornis*), which is classified as 'Critically Endangered - CR'.

The species listed above face significant threats mainly due to human activities. These include habitat loss and degradation, often caused by agricultural expansion and urbanisation, intentional or accidental poisoning, and illegal hunting. In addition, illegal capture for the pet trade is a common threat. These pressures result in population declines and increase the risk of extinction for these species, as identified by the IUCN (2024).

Still based on international criteria, according to the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES, 2024), nine species are listed in Appendix I: Sable Antelope (*Hippotragus niger*), Cheetah (*Acinonyx jubatus*), Leopard (*Panthera pardus*), Black Rhinoceros (*Diceros bicornis*), Common African Pangolin (*Phataginus tricuspis*), Giant Pangolin (*Smutsia gigantean*), Ground Pangolin (*Smutsia temminckii*), Chimpanzee (*Pan troglodytes*), African Savanna Elephant (*Loxodonta africana*) (**Table 7.2.1.3.3.a**). The presence of species in CITES Appendix I indicates that they are among the most threatened and therefore subject to the greatest restrictions in terms of international trade.

In addition to these, another 26 species are listed in Appendix II. Although they are not necessarily threatened with extinction at the moment, they could become so if trade is not strictly controlled. These include the Northern Giraffe (*Giraffa camelopardalis*), the serval (*Leptailurus serval*), the African Clawless Otter (*Lutra capensis*), the Vervet Monkey (*Chlorocebus pygerythrus*), the Yellow Baboon (*Papio cynocephalus*), and the Thomas's Dwarf Galago (*Galagoides thomasi*), among others (**Table 7.2.1.3.3.a**).

Finally, four species are included in Appendix III of CITES (2024), which lists ‘species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation’. They are: Striped Hyena (*Hyaena hyaena*), Southern Aardwolf (*Proteles cristatus*), Honey Badger (*Mellivora capensis*), and African Civet (*Civettictis civetta*).

Endemism

The geographical distribution patterns of endemic species are fundamental in identifying priority areas for conservation globally (KERR, 1997). The importance of these areas is not only limited to species richness, but also to the critical role they play in maintaining global biodiversity and the stability of local ecosystems (MYERS *et al*., 2000).

Considering the mammals listed in this survey, three species were detected that occur exclusively in Tanzania, such as the Ugogo Dik-dik (*Madoqua thomasi*) and the murid rodents Muze Spiny Mouse (*Acomys muzei*) and Dark-colored Brush-furred Rat (*Lophuromys aquilus*) (**Table 7.2.1.3.3.a**).

Migration

According to the available information of the Convention on the Conservation of Migratory Species of Wild Animals (CMS, 2020 – Convention Text), a migratory species includes an entire population or a geographically separate part of it when “cyclically and predictably cross one or more national jurisdictional boundaries”.

Among all species listed herein, ten are in agreemnent with this concept, being therefore, considered as migratory species, such as: the African Wild Dog (*Lycaon pictus*), Cheetah (*Acinonyx jubatus*), Lion (*Panthera leo*), Leopard (*Panthera pardus*), Natal Long-fingered Bat (*Miniopterus natalensis*), Schreibers's Long-fingered Bat (*Miniopterus schreibersii*), Large-eared Giant Mastiff Bat (*Otomops martiensseni*), African Straw-colored Fruit Bat (*Eidolon helvum*), Chimpanzee (*Pan troglodytes*), African Savanna Elephant (*Loxodonta Africana*) (**Table 7.2.1.3.3.a**).

Habitat type

The mammal species likely to occur in the area of influence of the project were classified according to habitat type, in accordance with the IUCN (2024), which categorises species into 14 habitat types, such as: i) Forest; ii) Savanna; iii) Shrubland, iv) Grassland, v) Wetlands, vi) Rochy areas, vi) Caves and subterranean habitats, vii) Desert, viii) Marine Neritic, ix) Marine Oceanic, x) Marine Interdial, xi) Marine Coastal/Supratodal, xii) Artificial/Terrestrial, xiii) Artificial/Aquatic & Marine, and xiv) Introduced Vegetation, in addition to the "Unknown" and "Other" categories.

According to the proposed list, it can be seen that most species are capable of occupying more than one type of habitat, although it should be noted that for some there is a preference for a particular habitat, such as terrestrial, aquatic, shrubland, grassland and/or savannah (**Table 7.2.1.3.3.a**). For example, 154 species occupy forested areas, but 30 are exclusive to this type of environment, such as the African Golden Cat (*Caracal auratus*), Abo Butterfly Bat (*Glauconycteris poensis*), Broad-headed Serotine (*Nycticeinops crassulus*), African Black White-toothed Shrew (*Crocidura nigrofusca*), Northern Lesser Galago (*Galago senegalensis*), East African Potto (*Perodicticus ibeanus*), and Forest Giant Pouched Rat (*Cricetomys emini*) (**Table 7.2.1.3.3.a**).

Another 88 species occupy grasslands, among other habitats, but two are exclusive to this type of habitat, such as the Bohor Reedbuck (*Redunca redunca*) and the East African Springhare (*Pedetes surdaster*). In addition, 177 species can occupy Savanna areas, however, 17 are exclusive and dependent on this type of habitat, such as the Angolan Genet (*Genetta angolensis*), o Andersen's Slit-faced Bat (*Nycteris aurita*), o Savanna Dwarf White-toothed Shrew (*Crocidura nanilla*), and the Single-striped Grass Mouse (*Lemniscomys rosalia*), among others. In addition, 103 species occupy shrubland habitat, but only three species are restricted to this habitat, such as Kirk's Dik-dik (*Madoqua kirkii*), Ugogo Dik-dik (*Madoqua thomasi*) and Sundevall's Thallomys (*Thallomys paedulcus*). Finally, 61 species are capable of inhabiting artificial environments, whether terrestrial, in forests, savannas or scrublands, as shown in **Table 7.2.1.3.3.a**.

7.2.1.3.4 Arthropods

The characterisation of arthropods in the project region considered the classes Insecta and Arachnida. The characterisation was based on the information compiled in the IBAT report, which comes from the IUCN database. According to the information available, there are 274 species of insects and 5 species of arachnids (**Table 7.2.1.3.4.a** in **Annex**

7.2.1.3).

Regarding insects, the species recorded belong to 4 orders. The Odonata order, which includes dragonflies, was the order with the highest richness, with 198 species recorded. The order Coleoptera, which includes beetles, had 27 species. The order Lepdoptera, which represents butterflies, had 25 species recorded, and the order Orthoptera, which includes crickets and grasshoppers, had 24 species.

With regard to arachnids, all five species recorded belong to the order Araneae and three genera: the African hermit spider *Nephilingis cruentata*, the constricted golden orb weaver *Nephila constricta*, the hairy golden orb weaver *Trichonephila fenestrata*, the banded golden orb weaver *Trichonephila senegalensis* and the turner's golden orb weaver *Nephila turneri*.

Of the total number of species, 76 are strictly terrestrial, including 5 species of spider, 25 lepidoptera, 23 coleoptera and 23 orthoptera.

Regarding threatened status, only one species is classified as Vulnerable, the dragonfly papyrus wisp *Agriocnemis palaeforma*. *A. palaeforma* has been recorded from various papyrus swamps in Uganda and from papyrus swamps along the Akagera River in Akagera National Park in Rwanda. It might occur in South Sudan. Its Extent of Occurrence includes the northwest of Tanzania, in the border between Tanzania, Rwanda and Uganda, but so far, all records are concentrated in Uganda and Rwanda (IUCN[11]).

Another two dragonflies are classified as Near Threatened, the yellow-sided jewel *Stenocypha jacksoni* and the bow-faced jewel *Stenocypha molindica*. Both species have been recorded in mountainous areas of western Uganda, Rwanda and eastern Democratic Republic of Congo. Despite been included in the 50-killometer buffer zone for the IBAT search, there are no records of these species in Tanzania.

7.2.1.3.5
Fish

The characterisation of fish species in the project region was based on the information compiled in the IBAT report, which comes from the IUCN database. According to the information available, there are 54 species of fish, distributed into 9 Orders and two classes Sarcopterygii and Actinopterygii (**Table 7.2.1.3.5.a** in **Annex 7.2.1.3**).

The main dominant class is the Actinopterygii, with 53 species, and only one species of Sarcopterygii, the lungfish *Protopterus aethiopicus*. Among the Actinopterygii, the most riches Orders are the Cypriniformes (17 species) and the Siluriformes (10 species).

Regarding threatened status, 6 species are classified as Near threatened: the Anguilliformes shortfin eel *Anguilla bicolor*, the african longfin eel *Anguilla mossambica* and the indian mottled eel *Anguilla bengalensis*; the Perfiformes singidia tilapia *Oreochromis esculentus* and victoria tilapia *Oreochromis variabilis*; and the

[11] Agriocnemis palaeforma (Papyrus Wisp)

Cypriniforme *Labeobarbus macrolepis.* The other species are classified as Least Concern, and three species are data deficient.

Eels are serpentine fish with a cylindrical body. They have small scales embedded in their dermis and their skin is covered by abundant mucus. Genus *Anguilla* belongs to the Anguilliformes, these species live in tempered as well as tropical oceans. All eels share a similar reproduction cycle. First larvae are born in the sea and migrate to the continental shelf where they go through morphological changes and colonize freshwater streams (Bell-Cross and Minshull 1988; Okeyo 1998). Anguilla species are susceptible to a number of, primarily anthropogenic, threats. These threats include barriers to migration, climate change, habitat degradation, invasive species, parasitism, pollution, predation and unsustainable exploitation.

The victoria tilapia *Oreochromis variabilis* and singidia tilapia *Oreochromis esculentus* are native to Lake Victoria and Kyoga basins. The subpopulations in the main lakes were depleted in the 1970s by overfishing, new species introductions (through predation and hybridization), and habitat degradation (Ogutu-Ohwayo 1990), although the species is still extant (Genner et al. 2018). The subpopulations in the satellite lakes and affluent rivers of the Victoria and Kyoga basins are still surviving, although the species is not abundant. The singidia tilapia *Oreochromis esculentus* has also been introduced into multiple localities in central, eastern and southern Tanzania (e.g., the Pangani catchment, Zigi River, Malagarazi River, Lake Rukwa, Wami River) (Shechonge et al. 2019) and northern Mozambique.

7.2.2
Direct Area of Influence

The characterization of the DAI was based on primary data collected in the field, and included the diversity of habitat types, ensuring a broad sampling of the ecosystems in the project region.

The selection of sampling points for the biodiversity baseline was made in a stratified random manner, based on information on land use and vegetation cover, location of protected and internationally recognized areas relevant to biodiversity, vegetation conservation status, and accessibility. For land use and vegetation cover the map of the Land cover of United Republic of Tanzania, elaborated by FAO (2005) was initially used[12]. This information was complemented by the features observed in the field during the reconnaissance campaign in July 2023.

Based on these aspects, ten (10) biodiversity sampling points (BS) were selected to carry out flora and fauna sampling. The areas were strategically chosen according to the degree of conservation, connectivity with other environments, and areas with alluvial influence (riparian forest, banks of Lake Victoria). It is important to mention that the coordinates of the points are referential since the sampling also included the area around the point. **Table 7.2.2.a** shows the details of the sampling points, and **Figure 7.2.2.a** show their location in relation to the project and in relation to the protected areas.

[12] Land cover of United Republic of Tanzania - Globcover (22 classes) - Datasets - "FAO catalog"

Table 7.2.2.a
Geographical location and characteristics of the biodiversity sampling points

Point name	Sampling type	Coordinates				Region	District	Location	Distance to the TL (km)	Vegetation cover	Overlapping with Protected Areas and/or KBA
		Geographical (Datum: WGS84)		UTM, 36S, WGS84							
		Longitud (X)	Latitud (Y)	X	Y						
Birds	Only Birds	31°42'37.57"L	1°41'41.32"S	356.554,00	9.812.624,00	Kagera	Muleba	Outside IAI, near one of the evaluated alternatives	65.67	Evergreen dry forest	Close to IBA Lake Victoria: Bumbire Islands (13 km)
BS-1	Flora and Fauna	31°30'48.98"L	1° 6'55.53"S	334.614,00	9.876.670,00	Kagera	Missenyi	IAI	15.12	Wooded grassland	Minziro Forest Reserve (Protected Area and IBA)
BS-2	Flora and Fauna	31°17'1.87"L	1°20'26.10"S	309.059,00	9.851.758,00	Kagera	Karagwe	DAI	0.25	Evergreen dry forest	-
BS-3	Flora and Fauna	31°38'14.49"L	1°49'14.20"S	348.433,63	9.798.709,86	Kagera	Muleba	Outside IAI, near one of the evaluated alternatives	55.78	Swamp forest	Close to IBA Lake Victoria: Bumbire Islands (13 km)
BS-4	Flora and Fauna	31°26'7.85"L	2°28'57.96"S	326.052,42	9.725.474,99	Kagera	Biharamulo	IAI	54.03	Woodland	Burigi-Chato National Park / Ruiga River Forest Reserve / IBA Burigi - Biharamulo

Table 7.2.2.a
Geographical location and characteristics of the biodiversity sampling points

Point name	Sampling type	Coordinates				Region	District	Location	Distance to the TL (km)	Vegetation cover	Overlapping with Protected Areas and/or KBA
		Geographical (Datum: WGS84)		UTM, 36S, WGS84							
		Longitud (X)	Latitud (Y)	X	Y						
											Game Reserves
BS-5	Flora and Fauna	31°12'57.23"L	2°57'38.27"S	301.705,00	9.672.599,00	Kagera	Biharamulo	IAI	1.23	Open miombo woodland	Biharamulo Forest Reserve
BS-6	Flora and Fauna	31° 0'40.61"L	2°14'7.83"S	278.828,00	9.752.758,00	Kagera	Karagwe	DAI	0.43	Savana woodland	Burigi-Chato National Park / IBA Burigi - Biharamulo Game Reserves
BS-7	Flora	31° 5'26.38"L	1°58'20.57"S	287.624,00	9.781.870,00	Kagera	Karagwe	DAI	0.35	Savana woodland	Burigi-Chato National Park / IBA Burigi - Biharamulo Game Reserves
BS-8	Flora and Fauna	31°43'45.05"L	3°19'15.92"S	358.814,00	9.632.825,00	Geita	Bukombe	IAI	1.65	Miombo woodland	Close to Uyovu Forest Reserve (2 km)
BS-9	Flora and Fauna	32°39'12.13"L	3°17'49.87"S	461.492,00	9.635.551,00	Geita	Nyang'wale	IAI	1.13	Shrubland/thickets	-

Table 7.2.2.a
Geographical location and characteristics of the biodiversity sampling points

Point name	Sampling type	Coordinates				Region	District	Location	Distance to the TL (km)	Vegetation cover	Overlapping with Protected Areas and/or KBA
		Geographical (Datum: WGS84)		UTM, 36S, WGS84							
		Longitud (X)	Latitud (Y)	X	Y						
BS-10	Flora	33°17'59.00"L	3°41'14.62"S	533.283,00	9.592.421,00	Shinyanga	Shinyanga	Outside IAI, near one of the evaluated alternatives	13.45	Shrubland/thickets	Mwantini Hill Forest Reserv

Figure 7.2.2.a
Location of the Biodiversity Sampling points

7.2.2.1
Flora Baseline

The flora baseline aims to characterise the existing plant formations and land use in the project area, the phytosociological parameters and the floristic diversity of the region, allowing knowledge of possible endemic, rare, protected and endangered species. This characterisation will help analyse the impact on the flora and discuss the environmental viability of the project and possible adjustments to the project.

The analysis will comprise the following:

- Mapping, description and quantification of native plant formations and anthropogenic areas.
- Phytosociological survey of native tree formations (quantitative assessment).
- Floristic composition of the tree and non-tree strata of the native plant formations.

The diagnosis presented here was based on primary data obtained from the mapping of plant formations and land use; phytosociological and floristic surveys of native plant formations, prioritising the area directly affected by the project, where the likely intervention areas will be; as well as information collected during field inspections and secondary data from specific bibliography on the region in which the project is located.

The field characterization of the flora species and vegetation typologies in the project region were developed in the established sampling plots (**Table 7.2.2.a**) in one (01) field campaign carried out between August 6th and 16th, 2023. The survey of arboreal vegetation was qualitative and quantitative, being only qualitative for shrub, subshrub, herbaceous, epiphyte, and liana species, according to specific methodologies.

There are several different methods for flora sampling, depending on the purpose of the study and the characteristics of vegetation and landscape (KERSTEN & GALVÃO, 2011), in general, larger plots make it possible to better capture variations in the vegetation, and are suitable for heterogeneous sites. In this study, for arboreal vegetation sample plots 20m x 20m (400 m^2) were used. This method was used for other works carried out in vegetation with similar characteristics (DALLMEIER, 1992; AHIMIN & MBOLO, 2010; SCHOLTZ, 2015; Kacholi et al., 2015; MARTINS *et al*., 2019). Ahimin & Mbolo (2010) used this method to assess High Conservation Values (HCV) sites in woodlands in Camerron, with sampling effort ranging from 0.02% and 0.2%. Scholtz (2015) also used this method to evaluate the vegetation structural dynamics in terms of species richness, distribution, composition and woody cover in semi-arid savannah in South Africa. Kacholi et al. (2015) used this method to evaluate abundance, diversity and structure of vegetation in Morogoro region, Tanzania, with sampling effort ranging from 0.07% and 16%. Martins et al., (2019) used the same method to evaluate variations in the distribution and composition of species in Brazilian Cerrado, a vegetation with a similar structure, with sampling effort of 0.5%.

In these plots, all trees with a Diameter at Breast Height (DBH) ≥ 5cm (Circumference at Breast Height (CBH) ≥15.7cm) were measured and identified. The total heights of all

trees within the plots were also obtained through visual observation.

For non-arboreal vegetation, the survey was carried out inside the sampling plots and around the parcel using the walking method proposed by Filgueiras *et al*. (1994) for expeditious floristic surveys. In the physiognomies sampled, the species of vascular plants (Pteridophytes and Phanerogams) belonging to different habits were recorded, such as trees, shrubs, subshrubs, herbs (terrestrial, saprophytic and aquatic), epiphytes, hemiepiphytes, parasites, and lianas.

Plant species were identified direct in the field by an experienced botanist with the aid of books on Flora of Tropical East Africa published series (FTEA). For those plant species which could not be easily identified in the field, herbarium specimens were collected, pressed in the field using a pair of plant press, dried and carried to the herbarium of the University of Dar es Salaam for further identification and documentation through preservation in the herbarium, for future references. The scientific name follows the Angiosperm Phylogeny Group (A.P.G. IV 2016) classification.

The information collected were registered in three field sheets: one for the characterization of the sampling plots, one for the quantitative inventory, and one for the floristic survey of non-arboreal vegetation (qualitative inventory). Vegetation types of each sampled site were classified based on physiognomic characterization (WHITE, 1983)

The phytosociological parameters were calculated according to Mueller-Dombois & Ellenberg (1974), including abundance, dominance, and frequency. Richness was determined according to the recorded floristic composition or number of species within botanical families. Diversity was analysed through the Shannon-Wiener index, which is one of the most widely used to determine the diversity of plant species (BOLFOR, 2000).

7.2.2.1.1
Vegetation Cover and Land use in the Direct Area of Influence

Methodology

The characterization of the vegetation cover and land use was carried out in the project's DAI, which includes a 1,000-metre-wide buffer around the project. The mapping of existing vegetation cover and land use began with a preliminary reconnaissance of the patterns shown in the high-resolution images available in the open-source Google Earth© programme, in order to identify possible existing mapping units (native and/or anthropized vegetation formations, anthropogenic areas, etc.), as well as to help plan the field survey. In a second stage, these previously identified mapping units were checked in the field when carrying out the "ground-truthing" during the flora survey campaign.

The mapping was carried out in the ArcGIS Version 10.8 graphics software through the analogue or manual interpretation of high-resolution satellite images available on Google Earth©. The images were interpreted at a scale of 1:10,000 and the map is presented at a scale of 1:20,000.

The mapping and characterization of the mapping units was supported by the information collected in the field surveys and primary data obtained from the phytosociological and floristic surveys of the native vegetation formations. Mapping and specific publications on the ecosystems and classes of native vegetation in the project region (mentioned in **Section 7.2.1**) helped in this task.

The polygons delimited in the analogue interpretation of the high-resolution satellite images were classified according to the predominant physiognomic pattern distinguishable at the scale adopted, i.e. in the same patch or polygon there may be reduced and indistinguishable portions of other land uses.

Map 7.2.2.1.1.a in **Annex 4** shows the result of this mapping of the Land Cover and Use in the DAI.

Characterization of vegetation cover and land use

In the proposed transmission line corridor six main native vegetation types have been classified: Swamp Forest, Wooded Grassland, Evergreen Dry Forest, Mixed Woodland, Miombo Woodland, and Thicket Bushland. This vegetation type ranges from Geita to Bukoba region.

- **Swamp Forest (riverine forest)**

This vegetation category is characterized by an association of evergreen trees with other life forms growing in water-logged soil or high-water table soils. It is commonly found in Kyabakora area at Muleba with canopy tree height reaching between 5-10m tall. Common plant species found in this category include: Trees: *Pseudospondia macrocarpa* var. *microcarpa, Zyzygium cordatum, Bridelia carthatica, Alchornea cordifolia, Anthocleista grandiflora, Sapium ellipticum, Phoenix reclinata, Elaies guineensis* and *Ficus trichopoda.* Shrubs: *Craterispermum schweinfurthii, Gardenia imperialis, Tarrena pavettoides* ssp.*smithii, Antidesma venosum, Mussaenda arcuta* and *Tricalysia coriacea.* Herbs:*Dissotis speciosa, Microglossa afzelii, Melanthera scandens,Pteridium aquilinum* and *Psorospermum febrifugum.* Sedges and Grasses: *Scleria racemosa, S. boivinii* and *Echnochloa pyramidalis*. This vegetation is of an ecological import as it supports the growth of a tree species with conservation concern *Pseudospondia macrocarpa* var. *microcarpa* IUCN Red Listed (VU) Vulnerable category. Also, this vegetation is a source of water catchments.

Photos 01 and 02: Swamp forest vegetation type at Kyabakora Muleba The dominant tree on the left is *Alchornea cordiformis* and the herb on right side is *Dissotis speciosa.*

➢ Evergreen dry forest

This vegetation category is characterised by an association of evergreen trees in multilayer with other life forms on the understorey. The top canopy height reaches between 10-15m tall. In the project area, it is found in Misenyi area. Common plants found in this category include: Trees: *Anthocleista grandiflora, Sapium ellipticum, Haplocoelum foliolosum, Mystroxylon aethiopicum, Euclea divinorum, Vepris nobilis, Syzygium guinensis, Macaranga capensis, Manilkara obovata.* Shrubs: *Cleistanthus polystachyus, Uvaria angolensis* and *Memecylon myrianthum, Craterispermum schweinfurthii, Harungana madagascariensis, Maesa welwetschii* and *Millettia dura.* Herbs*: Aframomum luteoalbum, Scleria boivinii* and *Acalypha lanceolata.*

Photos 03 and 04: Evergreen dry forest found in Misenyi area. Dominant top canopy trees are *Anthocleista grandiflora*, *Sapium ellipticum* and *Macaranga capensis.*

➢ Mixed woodland

This vegetation type is characterized by being dominated by woody species with patches of grassland patches with canopy height ranges 5-8m tall. Dominant tree species include: *Faurea rochetiana, Terminalia sericea, Hymenocardia acida, Terminalia mollis, Combretum collinum, Psorospermum febrifugum, Combretum collinum, Faurea rochetiana, Pericopsis angolensis* and *Annona senegalensis*

Photos 05 and 06: Mixed woodland vegetation type at Biharamulo area. The trees on the front ground(right) are *Terminalia mollis.*

➢ Miombo woodland

This vegetation type is characterized by being dominated by tree species of the genera *Brachystegia,* and *Julbernardia* in association with *Acacia, Pterocarpus,* and *Pericopsis* and *Combretum*. In the project area this vegetation occupies the second largest cover percentage 20% with canopy height ranges between 7-10m tall occurring at Ibambilo area Bukombe district. Dominant tree species of: *Brachystegia boehmii*, *B. stipulata, B. spicifolmis, B. floribunda* and *B. manga.* Other tree species are *Jurbernardia globiflora, Pterocarpus angolensis, P. tinctorius, Sterculia quinqueloba, Diplorhynchus condylocarpon* and *Annona senegalensis. Combretum molle* and *Albizia versicolor* are common trees found on the lower canopy layer.

Photos 07 and 08: Miombo woodland vegetation growing at Ibambilo area in Bukombe district. The tall tree is *Brachystegia spiciforms* growing on rocky soil.

- **Thicket bushland**

This vegetation type is characterized by an assemblage of woody species thorn bushes. This category is highly disturbed due to human activities grazing and fuel wood collections. Dominant woody species include: *Boscia angustifolium, Dichrostachyus cinerea, Combretum paniculatum, Commiphora **a**fricana, Cordia sinensis, Maerua duchesnei* and *Dalbergia melanoxylon, Combretum.* Common grass species include *Heteropogon contortus, Panicum maximum* and *Hyparrheia rufa*.

Photos 09 and 10: Thicket bushland vegetation type growing at Nyagwale area Shinyanga region.

- **Wooded grassland**

This vegetation category is characterized by being dominated by grass species with few scattered trees and shrubs. In the project area, it is commonly found in vast flat areas. In the project area, in most places, it is subject to human activities especially agricultural and cattle grazing. The small patches are dominated by grass species of *Hyparrhenia rufa, H. filipendula, H. cymbaria, Panicum maximum, Loudetia simplex,* and *Pennistetum polystachyon.* The scattered trees and shrubs include *Faidhebia albida, Acacia polyacanta, Flueggea virosa. Carissa spinarum,* and *Hymenocardia ulmoides* become dominant shrubs on the ground associated with tall grass species. This vegetation is ecologically important as a pasture for wild and domestic animals. It is locally and regionally commonly found in the project and also available in most of the protected areas. Therefore, there are no risks of loss of biodiversity due to project activities.

Photos 11 and 12: A patch of disturbed wooded grassland vegetation found at Uvinza near Lugufu forest reserve. The dominant grass in the foreground is *Loutedia simplex.*

In addition to natural vegetation cover, the Project's DAI includes the following categories of anthropized land use:

- **Cyclical agriculture**

This mapping category includes anthropogenic areas with agricultural crops that require frequent renewal of plantations, usually annually or less.

Cyclical agricultural crops can be found in large areas with commercial monocultures, such as rice, bean, tomatoes, cotton, potatoes, sugar cane and other vegetables, or sporadically on some small properties, generally close to human settlements, with the purpose of self-consumption (subsistence) and/or local commercialisation of the surplus, such as vegetables, for example.

Some small cyclical agricultural crops, generally associated with human occupations, were mapped in the "Rural cluster" category, due to the difficult differentiation in the scale of labour adopted.

- **Perennial agriculture**

This mapping category contains anthropogenic areas with agricultural cultivation that does not require frequent renewal. These areas range from small crops of coffee, banana and other fruit species for personal consumption (subsistence) and/or local commercialisation of the surplus to larger monocultures.

As in the case of cyclical agricultural crops, some small perennial agricultural crops, generally associated with human occupations, were mapped in the "Rural cluster" category, due to the difficulty in differentiating them on the scale adopted.

- **Rural clusters**

In this category, localities and/or groups of rural buildings were mapped, including wards,

villages, and various rural facilities (warehouses, stables, troughs, etc.), as well as groups of trees with various functions.

These areas may have associated anthropogenic vegetation, such as small subsistence crops; groupings of native and/or exotic trees forming groves; residential trees; herbaceous vegetation in areas with no specific use.

- **Anthropic areas**

This category includes anthropized areas with soil devoid of vegetation or with very incipient vegetation, with no specific use or that can be identified using images. Some of these areas can be used as pastures, fallow areas between different crops, areas where earthy or stony material (gravel) is exploited, erosion processes, among others.

The little vegetation that can eventually be found in these areas consists of ruderal shrubs, isolated heliophytic trees and herbaceous vegetation.

- **Unpaved roads**

This category includes all unpaved roads with dirt, sand, gravel, etc., such as local roads, paths and accesses to rural properties.

- **Paved road**

This category includes all roads with a hard asphalt surface, such as highways.

- **Water**

This category includes bodies of water made up of rivers, lakes, small reservoirs and livestock watering ponds.

Quantification of Vegetation Cover and Land Use

Table 7.2.2.1.1.a shows the quantification of vegetation cover and land use in the Project's DAI (**Figure 7.2.2.1.1.a**).

The DAI covers a total of 55,000 hectares, made up of native formations (35%) and anthropized areas (65%).

The native vegetation identified are not exclusive to the Project's DAI, and occur in other locations, including within protected areas. Miombo woodland predominate, accounting for 28.5% of the Project’s DAI. The anthropized areas are mainly made up of cyclical agriculture (34.6%) and anthropic areas (22.9%).

With regard to areas of native vegetation outside protected areas, there is strong anthropogenic pressure to convert areas for agricultural use, especially in the Shinyanga and Geita regions. The Forest Reserves located in these regions show signs of

anthropization, for example, the Nindo, Buyange and Lubaga Forest Reserves in Shinyanga are almost completely devoid of native vegetation.

Considering this scenario, it is understood that the forest reserves in the villages and wards are also quite degraded. This is mainly due to the fact that forestry policy allows for the sustainable utilisation of the natural resources in these reserves, and the use of these resources is a strong cultural factor in the region. The location of the villages and wards forest reserves is presented in **Section 7.2.3**.

The protected areas with the best-preserved native vegetation are Biharamulo Forest Reserve, Burigi-Chato National Park and Minziro Forest Reserve.

Table 7.2.2.1.1.a
Vegetation cover and land use in the Project's Direct Area of Influence

Classes	Outside protected areas		Within Burigi-Chato National Park (ha)		Within Forest Reserves in the Project's DAI		Total	
	hectares	%	hectares	%	hectares	%	hectares	%
Natural habitats	**11.290,02**	**21%**	**6.388,09**	**12%**	**1.564,21**	**3%**	**19.242,32**	**35%**
Miombo woodland	8.022,65	14,6%	6.193,72	11,27%	1.473,41	2,68%	15.689,78	28,5%
Mixed woodland	729,44	1,3%	-	-	-	-	729,44	1,3%
Grass wooded savanna	1.070,46	1,9%	191,68	0,35%	-	-	1.262,14	2,3%
Thicket bushland/shrubland	707,00	1,3%	-	-	-	-	707,00	1,3%
Evergreen dry forest	34,29	0,1%	-	-	-	-	34,29	0,1%
Riverine forest	581,63	1,1%	2,69	0,005%	21,01	0,04%	605,33	1,1%
Riverine grassland vegetation	144,56	0,3%	-	-	69,80	0,13%	214,36	0,4%
Modified habitats	**35.320,23**	**64%**	**181,74**	**0,3%**	**98,47**	**0,2%**	**35.600,44**	**65%**
Cyclical agriculture	16.498,28	30,0%	37,33	0,07%	27,05	0,05%	16.562,66	30,1%
Cyclical agriculture/Rural buildings	2.449,16	4,5%	-	-	-	-	2.449,16	4,5%
Perennial agriculture	403,66	0,7%	1,43	0,00%	-	-	405,09	0,7%
Perennial agriculture/Rural buildings	1.304,68	2,4%	-	-	-	-	1.304,68	2,4%
Anthropic area	12.520,65	22,8%	-	-	46,37	0,08%	12.567,03	22,9%
Silviculture	622,59	1,1%	10,01	0,02%	-	-	632,60	1,2%
Mining	32,53	0,1%	-	-	-	-	32,53	0,1%
Rural buildings	1.166,64	2,1%	-	-	4,70	0,01%	1.171,34	2,1%
Substation	3,17	0,01%	-	-	-	-	3,17	0,01%
Unpaved road	146,18	0,3%	132,98	0,24%	5,00	0,01%	284,17	0,5%
Paved road	166,83	0,3%	-	-	15,35	0,03%	182,17	0,3%
Railway	5,85	0,01%	-	-	-	-	5,85	0,01%
Water bodies								
Water	131,18	0,2%	-	-	-	-	131,18	0,2%
Total	**46.741,43**	**85%**	**6.569,84**	**12%**	**1.662,68**	**3%**	**54.973,94**	**100%**

Source: Mapping carried out by JGP based on field information and satellite image interpretation

7.2.2.1.2
Floristic Survey

The flora surveys contributed to the qualitative characterisation of the plant formations native to the project, establishing a general list of flora species, which made it possible to determine their diversity and known use, as well as to know whether or not there are any species endemic to the region, rare, protected and/or threatened with extinction, of medicinal, economic and food use in the area, according to the bibliography.

The latest version of CITES list (Convention on International Trade on Endangered Species of Wild Fauna and Flora) and the IUCN (International Union for Conservation of Nature) Red List of Threatened Species, were used to identify those species which fall in any of its categories and appendices respectively. A database of the List of East African Plant species (LEAP Master-1996) and an updated list of IUCN Red Listed plant species of Tanzania (Version 2023) were used to identify the threatened, endemic and rare plant species occurring in the project area.

The following bibliographies were also consulted to verify traditional, medicinal, food, economic and ritualistic uses:

- Food Plants and Masticants of the Batemi of Ngorongoro District, Tanzania (JOHNS *et al*., 1996);
- Gender and socio-economic factors influencing domestication of indigenous medicinal plants in the West Usambara Mountains, northern Tanzania (KIDEGHESHO & MSUYA, 2010); and
- The Role of Traditional Management Practices in Enhancing Sustainable Use and Conservation of Medicinal Plants in West Usambara Mountains (MSUYA, KIDEGHESHO JR).

The general list of plant species presented in this report is made up of the species found in the following studies:

- Forest inventory or phytosociological survey of the tree layer of native forest formations
- Floristic survey of the arboreal and non-arboreal stratum of native plant formations

General Floristic Composition Results

The location of the floristic survey points together with the phytosociological survey areas are shown in **Figure 7.2.2.a**.

Summary of the results of the general floristic composition

Table 7.2.2.1.2.a lists the species recorded in the project's DAI and lists their botanical characteristics, providing data on family; scientific name; habit, origin, endemism, threat category and medicinal, economic and food use.

A total of 173 plant morphospecies were recorded, of which 01 were pteridophytes and 172 angiosperms. The morphospecies recorded in this survey were distributed in 133 genera within 52 botanical families. The families with the largest number of species are Fabaceae (26 species, 15% of the total), Rubiaceae (13 species, 7.5%), Malvaceae and Phyllanthaceae with 12 (6.9%) species each, Poaceae and Combretaceae with 8 (4.6%) species each (**Figure 7.2.2.1.2.a**). Those six families represent 45.7% of the total number of species registered in the Project's DAI.

Figure 7.2.2.1.2.a
Number of species per family registered in the Project´s DAI

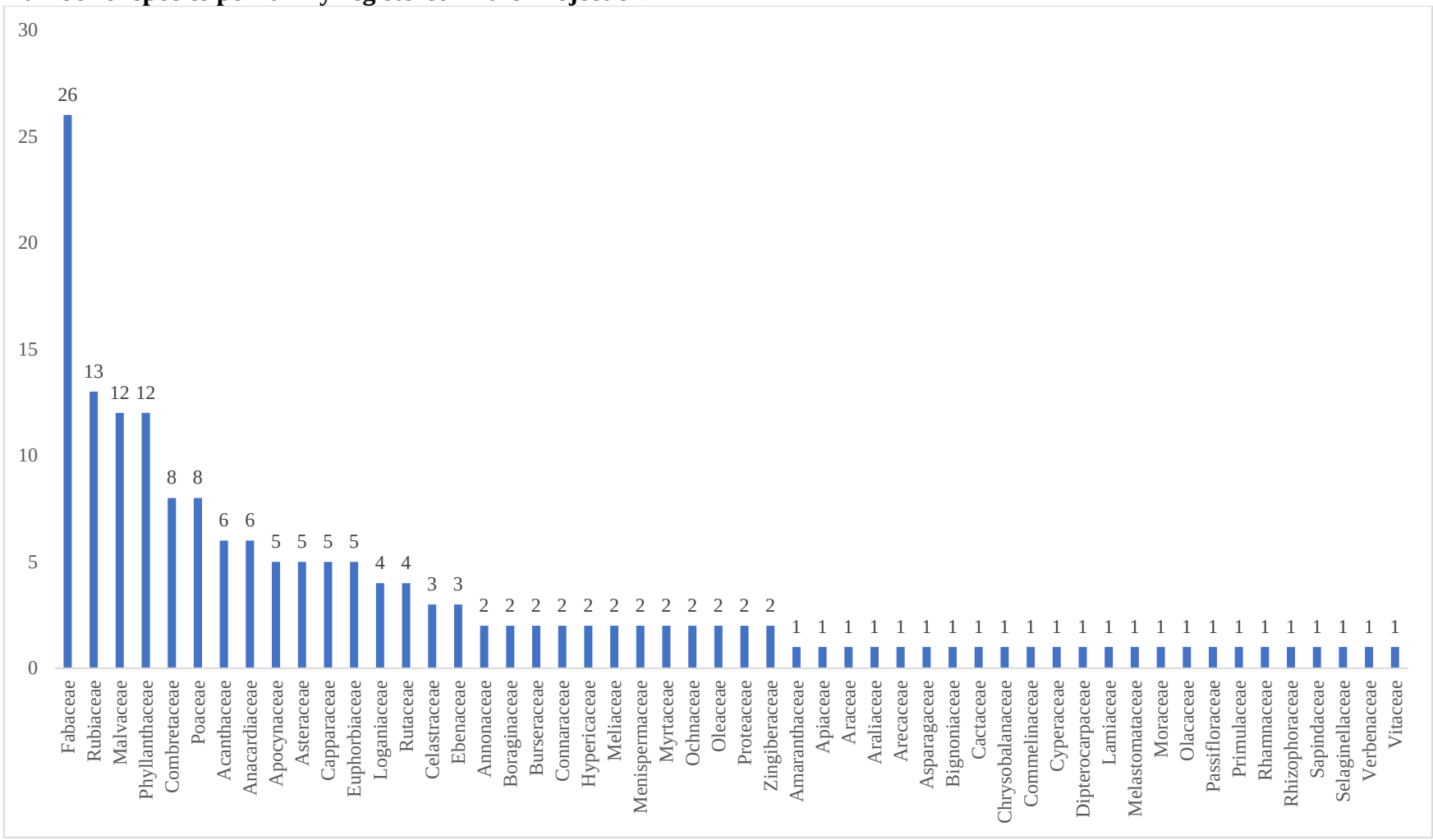


Table 7.2.2.1.2.a
Species registered in the Project´s DAI

Family	Specie name	Author	Life form	Status IUCN	Status Cites	Usage	Occurrency
Acanthaceae	*Acanthus montanus*	(Nees) T.Anderson	Tree	'-	-	-	Native
Acanthaceae	*Barleria crassa*	C.B.Clarke	Tree	'-	-	-	Native
Acanthaceae	*Barleria sp.*	-	Shrub	'-	-	-	-
Acanthaceae	*Justicia sp. 1*	-	Shrub	'-	-	-	-
Acanthaceae	*Justicia sp. 2*	-	Shrub	'-	-	-	-
Acanthaceae	*Thunbergia sp.*	-	-	'-	-	-	-
Amaranthaceae	*Achyranthes aspera*	L.	Herb	'-	-	-	Invasive
Anacardiaceae	*Lannea humilis*	Engl.	Tree	'-	-	-	Native
Anacardiaceae	*Lannea schimperi*	Engl.	Tree	'-	-	food and masticants (fruit, bark)	Native
Anacardiaceae	*Ozoroa insignis*	Delile	Tree	LC OR LR/LC	-	Sacred/medicinal	Native
Anacardiaceae	*Pseudospondias microcarpa*	Engl.	Tree	LC OR LR/LC	-	-	Native
Anacardiaceae	*Searsia natalensis*	(Bernh. ex Krauss) F.A.Barkley	Tree	'-	-	-	Native
Anacardiaceae	*Searsia pyroides var. pyroides*	-	Tree	'-	-	-	Native
Annonaceae	*Annona senegalensis*	Pers.	Tree	LC OR LR/LC	-	-	Native
Annonaceae	*Hexalobus monopetalus*	(A.Rich.) Engl. & Diels	Tree	LC OR LR/LC	-	-	Native
Apiaceae	*Steganotaenia araliacea*	Hochst.	Tree	LC OR LR/LC	-	-	Native
Apocynaceae	*Carissa spinarum*	L.	Tree	'-	-	-	Native
Apocynaceae	*Dictyophleba sp.*	-	Liana	'-	-	-	-
Apocynaceae	*Diplorhynchus condylocarpon*	(Müll.Arg.) Pichon	Shrub	'-	-	-	Native
Apocynaceae	*Strophanthus emini*	Asch. ex Pax	Liana	-	-	-	Native
Apocynaceae	*Voacanga thouarsii*	Roem. & Schult.	Tree	LC OR LR/LC	-	-	Native
Araceae	*Culcasia orientalis*	Mayo	Liana	'-	-	-	Native - Endemic
Araliaceae	*Cussonia arborea*	Hochst. ex A.Rich.	Tree	LC OR LR/LC	-	Snakebite, malaria, constipation	Native
Arecaceae	*Phoenix reclinata*	Jacq.	Tree	LC OR LR/LC	-	-	Native
Asparagaceae	*Asparagus setaceus*	(Kunth) Jessop	Shrub	'-	-	Sacred/medicinal	Native
Asteraceae	*Gymnanthemum exsertiflorum*	(Baker) H.Rob.	Tree	'-	-	-	Native
Asteraceae	*Helichrysum sp.*	-	Shrub	'-	-	-	-
Asteraceae	*Sphaeranthus sp.*	-	Herb	'-	-	-	-
Asteraceae	*Vernonia galamensis subsp. galamensis*	-	herb	'-	-	oilseed	Native - Endemic
Asteraceae	*Vernonia sp.*	-	Shrub	'-	-	-	-
Bignoniaceae	*Markhamia obtusifolia*	(Baker) Sprague	Shrub	LC OR LR/LC	-	-	Native
Boraginaceae	*Cordia sinensis*	Lam.	Shrub	-	-	-	Native
Boraginaceae	*Cordia sp.*	-	Shrub	'-	-	-	-
Burseraceae	*Commiphora africana var. africana*	(A.Rich.) Engl.	Tree	'-	-	food and masticants (gums and resins)	Native
Burseraceae	*Commiphora schimperi*	(O.Berg) Engl.	Tree	LC OR LR/LC	-	food and masticants (gums and resins)	Native
Cactaceae	*Pericopsis angolensis*	(Baker) Meeuwen	Tree	'-	-	-	Native
Capparaceae	*Boscia integrifolia*	Brunn.	Shrub	'-	-	-	Native
Capparaceae	*Cadaba farinosa*	Forssk.	Shrub	'-	-	-	Native
Capparaceae	*Capparis fascicularis*	DC.	Liana	'-	-	-	Native
Capparaceae	*Capparis tomentosa*	Lam.	Shrub	'-	-	-	Native
Capparaceae	*Maerua triphylla*	A.Rich.	Shrub	'-	-	-	Native
Celastraceae	*Maytenus sp.*	-	Tree	'-	-	-	-
Celastraceae	*Maytenus undata*	(Thunb.) Blakelock	Tree	'-	-	-	Native
Celastraceae	*Mystroxylon aethiopicum*	(Thunb.) Loes.	Tree	'-	-	Economic or medicinal usage	Native
Chrysobalanaceae	*Parinari curatellifolia*	Planch. ex Benth.	Tree	'-	-	-	Native
Combretaceae	*Combretum aculeatum*	Vent.	Shrub	'-	-	-	Native
Combretaceae	*Combretum apiculatum*	Sond.	Shrub	LC OR LR/LC	-	-	Native
Combretaceae	*Combretum collinum*	Fresen.	Tree	'-	-	-	Native
Combretaceae	*Combretum paniculatum*	Vent.	Shrub	'-	-	-	Native
Combretaceae	*Combretum pisoniiflorum*	(Klotzsch) Engl.	Tree	'-	-	-	Native – Endemic
Combretaceae	*Combretum zeyheri*	Sond.	Tree	'-	-	-	Native
Combretaceae	*Terminalia sericea*	Burch. ex DC.	Tree	'-	-	-	Native
Combretaceae	*Terminalia zollingeri*	Exell	Tree	'-	-	-	Exotic
Commelinaceae	*Aneilema aequinoctiale*	(P.Beauv.) Loudon	Herb	'-	-	-	Native
Connaraceae	*Agelaea pentagyna*	(Lam.) Baill.	Liana	'-	-	-	Native

Table 7.2.2.1.2.a
Species registered in the Project´s DAI

Family	Specie name	Author	Life form	Status IUCN	Status Cites	Usage	Occurrency
Connaraceae	*Rourea sp.*	-	Tree	'-	-	-	-
Cyperaceae	*Cyperus papyrus*	L.	Sedge	LC OR LR/LC	-	-	Native
Dipterocarpaceae	*Monotes sp.*	-	Tree	'-	-	-	-
Ebenaceae	*Diospyros sp.*	-	-	'-	-	-	-
Ebenaceae	*Euclea divinorum*	Hiern	Tree	LC OR LR/LC	-	Tooth ache, stomach ulcers	Native
Ebenaceae	*Euclea racemosa*	L.	Tree	LC OR LR/LC	-	-	Native
Euphorbiaceae	*Acalypha sp.*	-	Shrub	'-	-	-	-
Euphorbiaceae	*Acalypha volkensii*	Pax	Shrub	'-	-	-	Native
Euphorbiaceae	*Euphorbia hubertii*	Pax	Tree	EN	II	-	Native
Euphorbiaceae	*Macaranga spinosa*	Müll.Arg.	Tree	'-	-	-	Native
Euphorbiaceae	*Neoboutonia macrocalyx*	Pax	Tree	'-	-	-	Native
Fabaceae	*Acacia sp.*	-	Tree	'-	-	-	-
Fabaceae	*Aganope stuhlmannii*	(Taub.) Adema	Shrub	'-	-	-	Native
Fabaceae	*Albizia antunesiana*	Harms	Tree	'-	-	-	Native
Fabaceae	*Albizia versicolor*	Welw. ex Oliv.	Tree	'-	-	-	Native
Fabaceae	*Brachystegia spiciformis*	Benth	Tree	LC OR LR/LC	-	-	Native
Fabaceae	*Burkea africana*	Hook.	Tree	'-	-	-	Native
Fabaceae	*Cassia abbreviata subsp. abbreviata*	Oliv.	Shrub	'-	-	-	Native
Fabaceae	*Dalbergia melanoxylon*	Guill. & Perr.	Tree	NT	II	Economical or medicinal usage	Native
Fabaceae	*Dichrostachys cinerea*	(L.) Wight & Arn.	Tree	'-	-	-	Native
Fabaceae	*Entada abyssinica*	Steud. ex A.Rich.	Tree	LC OR LR/LC	-	-	Native
Fabaceae	*Erythrina abyssinica*	DC.	Tree	'-	-	Malaria, convulsions in children, anthrax, snakebite, sacred	Native
Fabaceae	*Faidherbia albida*	(Delile) A.Chev.	Tree	LC OR LR/LC	-	-	Native
Fabaceae	*Indigofera sp.*	-	Shrub	'-	-	-	-
Fabaceae	*Julbernardia globiflora*	(Benth.) Troupin	Tree	LC OR LR/LC	-	-	Native
Fabaceae	*Mimosa pigra var. pigra*	-	Shrub	'-	-	-	Exotic
Fabaceae	*Mucuna gigantea*	(Willd.) DC.	Liana	'-	-	-	Native
Fabaceae	*Philenoptera bussei*	(Harms) Schrire	Shrub	'-	-	-	Native
Fabaceae	*Polhillides velutina*	(Willd.) H.Ohashi & K.Ohashi	shrub	'-	-	-	Native
Fabaceae	*Pterocarpus angolensis*	DC.	Tree	'-	II	-	Native
Fabaceae	*Pterocarpus tinctorius*	Welw.	Tree	'-	-	-	Native
Fabaceae	*Rhynchosia hirta*	(Andrews) Meikle & Verdc.	Liana	'-	-	-	Native
Fabaceae	*Senegalia brevispica*	(Harms) Seigler & Ebinger	Liana	LC OR LR/LC	-	-	Native
Fabaceae	*Senegalia polyacantha*	(Willd.) Seigler & Ebinger	Tree	'-	-	-	Native
Fabaceae	*Tamarindus indica*	L.	Shrub	'-	-	food (seed), animal food (seed, leaves), poison, fuel, medicinal	Cultivated
Fabaceae	*Vachellia nilotica*	(L.) P.J.H.Hurter & Mabb.	Shrub	'-	-	-	Native
Fabaceae	*Vachellia xanthophloea*	(Benth.) P.J.H.Hurter	Tree	'-	-	-	Native
Hypericaceae	*Harungana madagascariensis*	Lam. ex Poir.	Tree	LC OR LR/LC	-	-	Native
Hypericaceae	*Psorospermum febrifugum*	Spach	Tree	LC OR LR/LC	-	-	Native
Lamiaceae	*Vitex doniana*	Sweet	Tree	LC OR LR/LC	-	-	Native
Loganiaceae	*Strychnos innocua*	Delile	Tree	LC OR LR/LC	-	-	Native
Loganiaceae	*Strychnos panganensis*	Gilg	Tree	'-	-	-	Native
Loganiaceae	*Strychnos potatorum*	L.f.	Shrub	'-	-	-	Native
Loganiaceae	*Strychnos spinosa*	Lam.	Tree	'-	-	-	Native
Malvaceae	*Abutilon mauritianum*	(Jacq.) Medik.	Grass	'-	-	-	Native
Malvaceae	*Dombeya rotundifolia*	(Hochst.) Planch.	Tree	'-	-	Economical or medicinal usage	Native
Malvaceae	*Grewia forbesii*	Harv. ex Mast.	Shrub	'-	-	Food (seeds), sacred	Native
Malvaceae	*Grewia rothii*	DC.	Tree	'-	-	Food (seeds)	Exotic
Malvaceae	*Grewia sp.*	-	Tree	'-	-	Food (seeds)	-
Malvaceae	*Hibiscus cannabinus*	L.	herb	'-	-	Industrial usage - fiber	Invasive
Malvaceae	*Melhania velutina*	Forssk.	Shrub	'-	-	-	Native
Malvaceae	*Pavonia sp.*	-	Shrub	'-	-	-	-
Malvaceae	*Pavonia urens*	Cav.	shrub	'-	-	-	Native
Malvaceae	*Sida cordifolia*	L.	shrub	'-	-	-	Native
Malvaceae	*Sterculia sp.*	-	Tree	'-	-	-	-
Malvaceae	*Triumfetta rhomboidea*	Jacq.	herb	'-	-	-	Native

Table 7.2.2.1.2.a
Species registered in the Project´s DAI

Family	Specie name	Author	Life form	Status IUCN	Status Cites	Usage	Occurrency
Melastomataceae	*Feliciotis speciosa*	(Taub.) Ver.-Lib. & G.Kadereit	Shrub	'-	-	-	Native
Meliaceae	*Trichilia emetica*	Vahl	Tree	'-	-	-	Native
Meliaceae	*Tristemma mauritianum var. mauritianum*	-	Shrub	'-	-	-	Native
Menispermaceae	*Cissampelos pareira*	L.	Liana	'-	-	cultural forests	Native
Menispermaceae	*Stephania abyssinica*	(Quart.-Dill. & A.Rich.) Walp.	Liana	'-	-	-	Native
Moraceae	*Ficus lutea*	Vahl	Tree	'-	-	-	Native
Myrtaceae	*Syzygium cordatum*	Hochst. ex Krauss	Tree	'-	-	Sacred/medicinal	Native
Myrtaceae	*Syzygium guineense*	(Willd.) DC.	Tree	LC OR LR/LC	-	-	Native
Ochnaceae	*Ochna afzelii*	R.Br. ex Oliv.	Tree	LC OR LR/LC	-	-	Native
Ochnaceae	*Ochna holstii*	Engl.	Tree	'-	-	-	Native
Olacaceae	*Ximenia caffra*	Sond.	Shrub	LC OR LR/LC	-	food (fruit)	Native
Oleaceae	*Jasminum sp.*	-	Liana	'-	-	-	-
Oleaceae	*Schrebera trichoclada*	Welw.	Shrub	'-	-	-	Native
Passifloraceae	*Adenia gummifera var. gummifera*	-	Liana	'-	-	-	Native
Phyllanthaceae	*Antidesma venosum*	E.Mey. ex Tul.	Tree	'-	-	-	Native
Phyllanthaceae	*Bridelia atroviridis*	Müll.Arg.	Tree	'-	-	-	Native
Phyllanthaceae	*Bridelia cathartica*	Bertol.	Tree	'-	-	-	Native
Phyllanthaceae	*Bridelia micrantha*	(Hochst.) Baill.	Tree	'-	-	Worms, diarrhoea, headache, sacred	Native
Phyllanthaceae	*Flueggea virosa*	(Roxb. ex Willd.) Royle	Tree	LC OR LR/LC	-	Bilharzia, malaria, stomach ache, itching	Native
Phyllanthaceae	*Hymenocardia acida*	Tul.	Tree	'-	-	-	Native
Phyllanthaceae	*Margaritaria discoidea*	(Baill.) G.L.Webster	Tree	LC OR LR/LC	-	-	Native
Phyllanthaceae	*Phyllanthus muellerianus*	(Kuntze) Exell	Tree	'-	-	-	Native
Phyllanthaceae	*Phyllanthus nummulariifolius subsp. nummulariifolius*	-	Tree	'-	-	-	Native
Phyllanthaceae	*Phyllanthus sp.*	-	Grass	'-	-	-	-
Phyllanthaceae	*Pseudolachnostylis maprouneifolia*	Pax	Tree	LC OR LR/LC	-	-	Native
Phyllanthaceae	*Uapaca nitida var. nitida*	-	Tree	'-	-	-	Native
Poaceae	*Cynodon sp.*	-	herb	'-	-	-	-
Poaceae	*Eragrostis sp.*	-	Grass	'-	-	-	-
Poaceae	*Hyparrhenia cymbaria*	(L.) Stapf	Grass	'-	-	-	Native
Poaceae	*Imperata cylindrica*	(L.) Raeusch.	Tree	'-	-	-	Native
Poaceae	*Loudetia arundinacea*	(Hochst. ex A.Rich.) Hochst. ex Steud.	Grass	'-	-	-	Native
Poaceae	*Loudetia simplex*	(Nees) C.E.Hubb.	Grass	'-	-	-	Native
Poaceae	*Oplismenus compositus*	(L.) P.Beauv.	Grass	'-	-	-	Native
Poaceae	*Phragmites mauritianus*	Kunth	Grass	'-	-	-	Native
Primulaceae	*Maesa lanceolata*	Forssk.	Tree	LC OR LR/LC	-	Diarrhoea, tooth ache, rashes	Native
Proteaceae	*Faurea rochetiana*	Chiov. ex Pic.Serm.	Tree	'-	-	-	Native
Proteaceae	*Protea gaguedi*	J.F.Gmel.	Tree	LC OR LR/LC	-	-	Native
Rhamnaceae	*Scutia myrtina*	Kurz	Tree	'-	-	-	Native
Rhizophoraceae	*Cassipourea sp.*	-	Liana	'-	-	-	-
Rubiaceae	*Afrocanthium sp.*	-	Tree	'-	-	-	Native
Rubiaceae	*Catunaregam spinosa*	(Thunb.) Tirveng.	Tree	'-	-	-	Exotic
Rubiaceae	*Coffea eugenioides*	S.Moore	Tree	'-	-	food (seeds and fruits)	Native
Rubiaceae	*Crossopteryx febrifuga*	(Afzel. ex G.Don) Benth.	Shrub	LC OR LR/LC	-	-	Native
Rubiaceae	*Gardenia imperialis subsp. imperialis*	-	Tree	'-	-	-	Native
Rubiaceae	*Gardenia ternifolia*	Schumach. & Thonn.	Tree	LC OR LR/LC	-	-	Native
Rubiaceae	*Gardenia transvenulosa*	Verdc.	Shrub	'-	-	-	Native – Endemic
Rubiaceae	*Leptactina sp.*	-	Shrub	'-	-	-	-
Rubiaceae	*Pavetta bagshawei*	S.Moore	Tree	'-	-	-	Native – Endemic
Rubiaceae	*Rothmannia engleriana*	(K.Schum.) Keay	Tree	'-	-	-	Native
Rubiaceae	*Rothmannia sp.*	-	Shrub	'-	-	-	-
Rubiaceae	*Tricalysia pallens*	Hiern	Tree	'-	-	-	Native
Rubiaceae	*Tricalysia sp.*	-	Shrub	'-	-	-	-
Rutaceae	*Clausena anisate*	(Willd.) Hook.f.	Tree	'-	-	Stomach pains, worms, diarrhoea, headache, malaria, influenza, food (seed)	Native
Rutaceae	*Harrisonia abyssinica*	Oliv.	Shrub	LC OR LR/LC	-	Fever, nausea, vomiting, snakebite, tuberculosis, stomach ache, malaria	Native

Table 7.2.2.1.2.a
Species registered in the Project´s DAI

Family	Specie name	Author	Life form	Status IUCN	Status Cites	Usage	Occurrency
Rutaceae	*Vepris nobilis*	(Delile) Mziray	Tree	LC OR LR/LC	-	-	Native
Rutaceae	*Vepris sp.*	-	Shrub	'-	-	-	-
Sapindaceae	*Haplocoelum foliolosum*	(Hiern) Bullock	Tree	LC OR LR/LC	-	-	Native
Selaginellaceae	*Selaginella kraussiana*	(Kunze) A.Braun	Liana	'-	-	-	Native
Verbenaceae	*Lantana camara*	L.	Shrub	'-	-	-	Invasive
Vitaceae	*Cissus oliveri*	(Engl.) Gilg ex Engl.	Liana	'-	-	-	Native
Zingiberaceae	*Aframomum luteoalbum*	(K.Schum.) K.Schum.	Herb	'-	-	-	Native
Zingiberaceae	*Aframomum sp.*	-	Herb	'-	-	-	-

Figure 7.2.2.1.2.b illustrates the composition of the species recorded in relation to their origin, revealing a predominance of native species (78.6% or 136 species), 05 (2.9%) of which are endemic to Tanzania and countries bordering the development (Congo Democratic Republic, Rwanda, Burundi, Rwanda and Kenya) 16.8% are morphotypes identified at genus or family level (29 morphotypes), 08 (4.6%) are exotic species, of which 03 (1.7%) are invasive species and 1 (0.6%) is a cultivated species.

Figure 7.2.2.1.2.c shows the composition of species in relation to life forms, indicating that the survey covered a variety of life forms. Thus, among the species recorded in the flora surveys, 53.8% (93 species) are trees; 26.0% (45 species) are shrubs, 8.7% (15 species) are lianas; 5.2% (9 species) are herbs; 4.6% (8 species) are grasses, 01 species (0.6%) is sedge; and two morphotypes identified at genus level did not have their life form defined due to the size of the specimens in the field.

All the native species recorded in the flora surveys have some ecological function in nature, many of which are important for maintaining the balance of the environments where they are native.

It should be emphasised that, in principle, all native species of flora are directly or indirectly important to fauna, whether as shelter, for food and reproduction, for providing living space, etc. Just as various species of fauna also play key roles in pollinating flowers or dispersing seeds for many species of flora.

In general, all the native tree species recorded in the survey can be used in compensatory planting and ecological restoration actions.

Figure 7.2.2.1.2.b
Origin of the species recorded in the flora survey

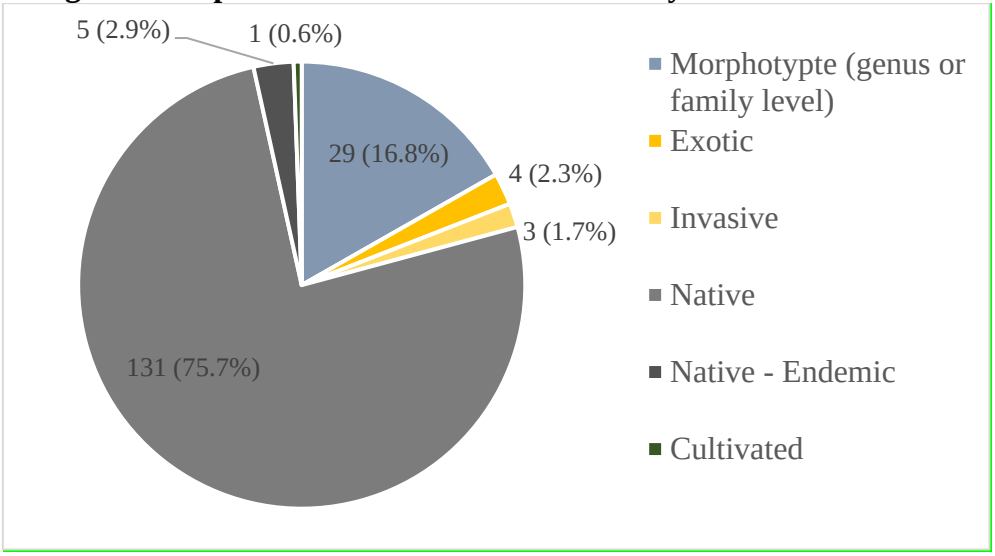
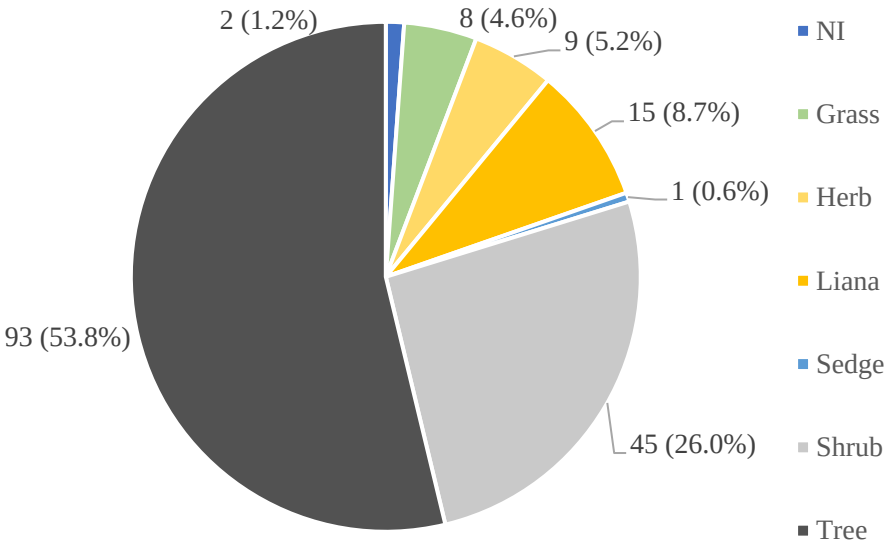


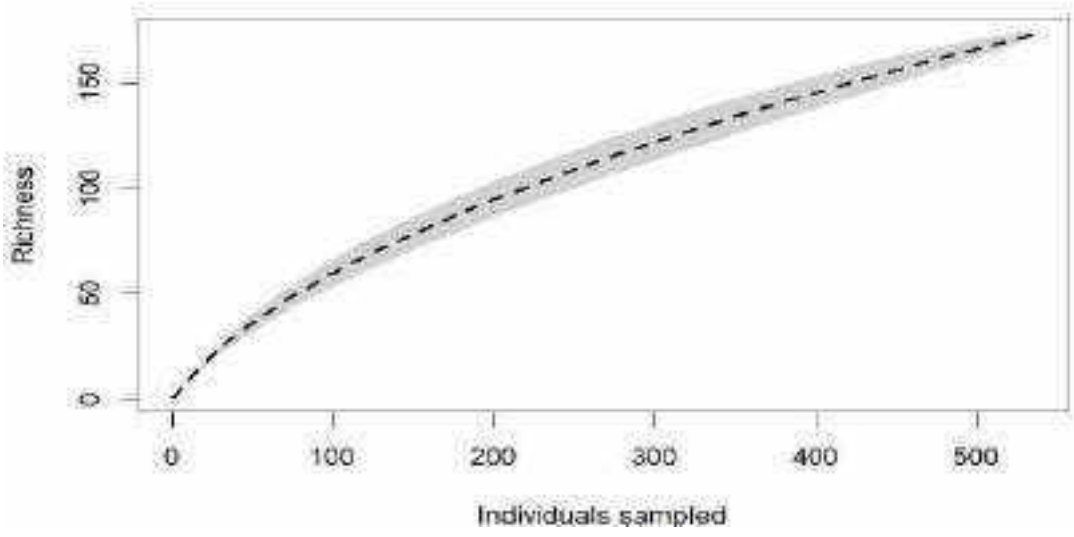
Figure 7.2.2.1.2.c
Life forms of the species recorded in the flora survey



Sampling sufficiency

To demonstrate the effectiveness of the data collected, a rarefaction curve was made using the "Vegan" tool for R software, considering the number of individuals sampled and the number of species recorded (richness). The analysis indicate that the efforts and methods applied to the survey were efficient in detecting species that might occur in the region and that new species are expected with the replication of these efforts (**Figure 7.2.2.1.2.d**).

Figure 7.2.2.1.2.d
Collector curve obtained by rarefaction of the sample



Tropical regions are characterised by high biodiversity, with a wide variety of plant species that are often difficult to identify and catalogue due to their ecological complexity. In this scenario, the use of spot sampling is an efficient strategy, allowing for sampling that can offer a good characterisation of the local flora, providing relevant data for understanding the region's plant composition (MULLER-DOMBOIS & ELLENBERG, 1974, TNC, 2003).

The point sampling approach, based on appropriate statistical methods, has proved effective in identifying the predominant species and detecting the floristic variations that occur in different locations (TNC, 2003). This strategy contributes significantly to subsidising environmental impact analyses.

Endangered and Protected Species

With regard to the risk of extinction of the species recorded in the project's DAI, three species (1.7%) are at some risk of extinction or are listed in CITES Appendix II, which does not necessarily classify a species as endangered, but establishes criteria for international trade in species.

Table 7.2.2.1.2.b below highlights the species mentioned with some degree of threat of extinction and/or protection.

Table 7.2.2.1.2.b
Endangered or protected species recorded in the flora survey

Family	Specie name	Author	Life form	Status IUCN	Status Cites	Occurrence
Euphorbiaceae	*Euphorbia hubertii*	Pax	Tree	EN	II	Native, registered in the BS2 sampling point
Fabaceae	*Dalbergia melanoxylon*	Guill. & Perr.	Tree	NT	II	Native, registered in BS8 and BS10 sampling points
Fabaceae	*Pterocarpus angolensis*	DC.	Tree	'-	II	Native, very abundant in BS5 sampling point

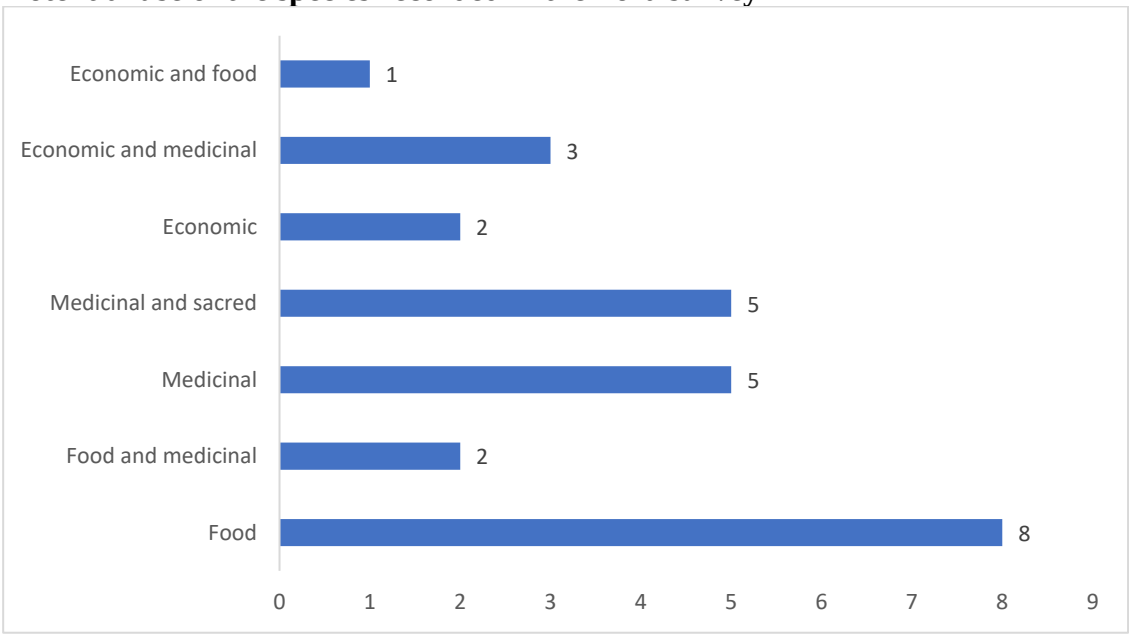
The species with the highest degree of threat according to the IUCN is *Euphorbia hubertii*, which is in endangered status (EN). *Dalbergia melanoxylon*, on the other hand, is in the Near Treated (NT) class, indicating that the species is not under any degree of threat, although it is very likely that it will be assigned a threat category in the near future if measures are not taken to protect it.

Appendix II of CITES lists the two species mentioned by the IUCN, as well as *Pterocarpus angolensis*. It's worth remembering that CITES Appendix II doesn't necessarily classify a species or group of species as endangered, but that they could become so unless the trade in specimens is subject to strict regulations.

Use of Plant Species

The survey of the uses of the species recorded by the floristic survey in the DAI resulted in a list of 26 species with some traditional use, with several species having more than one type of use, 15 species with medicinal use, 11 with food use, 6 with economic use and 5 used in religious activities. **Figure 7.2.2.1.2.e** shows the list of species and their respective uses, while **Table 7.2.2.1.2.c** shows each of the species and their respective uses.

Figure 7.2.2.1.2.e
Potential use of the species recorded in the flora survey



The identification of species with traditional, food and economic uses is important for subsidising restoration activities, ensuring that native species with some uses are prioritised in planting, guaranteeing the continuity of this ecosystem service and thus ensuring traditional activities for the surrounding populations.

Table 7.2.2.1.2.c
Species with traditional, economic and food uses in the DAI

Family	Specie name	Author	Life form	Usage	Occurrence
Anacardiaceae	*Lannea schimperi*	Engl.	Tree	food and masticants (fruit, bark)	Native
Anacardiaceae	*Ozoroa insignis*	Delile	Tree	Sacred/medicinal	Native
Araliaceae	*Cussonia arborea*	Hochst. ex A.Rich.	Tree	Snakebite, malaria, constipation	Native
Asparagaceae	*Asparagus setaceus*	(Kunth) Jessop	Shrub	Sacred/medicinal	Native
Asteraceae	*Vernonia galamensis subsp. galamensis*	-	herb	oilseed	Native - Endemic
Burseraceae	*Commiphora africana var. africana*	(A.Rich.) Engl.	Tree	food and masticants (gums and resins)	Native
Burseraceae	*Commiphora schimperi*	(O.Berg) Engl.	Tree	food and masticants (gums and resins)	Native
Celastraceae	*Mystroxylon aethiopicum*	(Thunb.) Loes.	Tree	Economic or medicinal usage	Native
Ebenaceae	*Euclea divinorum*	Hiern	Tree	Tooth ache, stomach ulcers	Native
Fabaceae	*Dalbergia melanoxylon*	Guill. & Perr.	Tree	Economical or medicinal usage	Native
Fabaceae	*Erythrina abyssinica*	DC.	Tree	Malaria, convulsions in children, anthrax, snakebite, sacred	Native
Fabaceae	*Tamarindus indica*	L.	Shrub	food (seed), animal food (seed, leaves), poison, fuel, medicinal	Cultivated
Malvaceae	*Dombeya rotundifolia*	(Hochst.) Planch.	Tree	Economical or medicinal use	Native
Malvaceae	*Grewia forbesii*	Harv. ex Mast.	Shrub	Food (seeds), sacred	Native
Malvaceae	*Grewia rothii*	DC.	Tree	Food (seeds)	Exotic
Malvaceae	*Grewia sp.*	-	Tree	Food (seeds)	-
Malvaceae	*Hibiscus cannabinus*	L.	herb	Industrial use - fibre	Invasive
Menispermaceae	*Cissampelos pareira*	L.	Liana	cultural forests	Native
Myrtaceae	*Syzygium cordatum*	Hochst. ex Krauss	Tree	Sacred/medicinal	Native
Olacaceae	*Ximenia caffra*	Sond.	Shrub	food (fruit)	Native
Phyllanthaceae	*Bridelia micrantha*	(Hochst.) Baill.	Tree	Worms, diarrhoea, headache, sacred	Native
Phyllanthaceae	*Flueggea virosa*	(Roxb. ex Willd.) Royle	Tree	Bilharzia, malaria, stomach ache, itching	Native

Table 7.2.2.1.2.c
Species with traditional, economic and food uses in the DAI

Family	Specie name	Author	Life form	Usage	Occurrence
Primulaceae	*Maesa lanceolata*	Forssk.	Tree	Diarrhoea, tooth ache, rashes	Native
Rubiaceae	*Coffea eugenioides*	S.Moore	Tree	food (seeds and fruits)	Native
Rutaceae	*Clausena anisata*	(Willd.) Hook.f.	Tree	Stomach pains, worms, diarrhoea, headache, malaria, influenza, food (seed)	Native
Rutaceae	*Harrisonia abyssinica*	Oliv.	Shrub	Fever, nausea, vomiting, snakebite, tuberculosis, stomach ache, malaria	Native

Alien and invasive species

Invasive alien species are organisms that are introduced by humans, either intentionally or accidentally, into places outside of their natural range, negatively impacting native biodiversity, ecosystem services or human economy and well-being (IUCN, 2021). The impact of invasive species is related to one of the most important causes of loss of diversity and a concern to academic and political circles (Secretariat of the Convention on Biological Diversity, 2020).

The identification of alien species is extremely important to subsidise measures and programmes to avoid loss of biodiversity and disturbance in critical habitats. In this primary data study, five (05) alien species were identified and shown in **Table 7.2.2.1.2.d**.

Table 7.2.2.1.2.d
Alien species recorded in Project's DAI

Family	Specie name	Author	Life form	Occurrence
Combretaceae	*Terminalia zollingeri*	Exell	Tree	Exotic
Fabaceae	*Mimosa pigra var. pigra*	-	Shrub	Exotic
Fabaceae	*Tamarindus indica*	L.	Shrub	Cultivated
Malvaceae	*Grewia rothii*	DC.	Tree	Exotic
Rubiaceae	*Catunaregam spinosa*	(Thunb.) Tirveng.	Tree	Exotic
Verbenaceae	*Lantana camara*	L.	Shrub	Exotic

The *Tamarindus indica* is a species highly cultivated in the tropics due to its usage in culinary and is considered by some botanists to be a naturalised species. Two other species have a high potential to invade native habitats. *Mimosa pigra* var. *pigra* and *Lantana camara* are American tropical plants reported as invasive in a long list of countries worldwide, *Grewia rothii* and *Catunaregam spinosa* are species native from India Continet and southeast Asia having some reports in East Africa, showing less concern when comparing to the American invasive species (POWO-Kew; GBIF).

Among the exotic species found, *L. camara* was the most abundant, observed at three sampling points (BS1, BS5 and BS9). An abundance of *L. camara* individuals was found at point BS9.

L.camara, a native plant from tropical America, is considered one of the most harmful invasive species worldwide. In South Africa, *L. camara* has been identified as a problematic invasive shrub, but the understanding of the plant and its invasion impacts on natural ecosystems is limited and biased in favour of a few biomes, notably in the savanna and grassland (VARDIEN *et al*., 2012; RUWANZA, 2020). A study in Zimbabwe reported that sites heavily invaded by *L. camara* had significantly lower native species composition and diversity as compared to sites with low L. camara invasion (CHATANGA, 2007).

7.2.2.1.3
Phytosociological Survey

This section presents the results of the phytosociological survey of the tree stratum carried out for the diagnosis of native forest cover DAI.

Location and characterization of the tree stratum sampling units

Table 7.2.2.1.3.a below shows the main location data and the environmental characterization of the sampling units for the phytosociological survey of the tree stratum.

Table 7.2.2.1.3.a
Environmental characterization of the phytosociological survey plots of the tree stratum

Parcel code	Date	Main phytophysiognomy	Location	Declivity	Situation	Environment	Conservation status of the vegetation	Forest understory	Predominant species	Soil	Description of the surrounding area	Exotic species
BS1	07/08/2023	Wooded Grassland	Misenyi District	0 to 5 º	Plain	Dry	Little disturbed	Medium	*Acnathus* sp, *Flueggea virosa*	Sandy	Area dominated by grasses and shrub, wetland area	*Lantana camara* observed in the area.
BS2	06/08/2023	Evergreen Dry Forest	Kyaka near Magereza farm	0 to 5 º	Slope	Dry	Very disturbed	non-existent	*Euclea racemosa*	Sandy	Access road with gravel materials, cattle pasture areas, shrubs	-
BS4	09/08/2023	Woodland	Biharamulo	6 to 15º	Hilltop	Dry	Preserved	Little	*Protea gagnedi, Combretum molle, Hymenocardia acida, Annona senegalensis.*	Loam	Woodland area with protected area	-
BS5	10/08/2023	Open Miombo Woodland	Biharamulo	16 to 30º	Slope/Hilltop	Dry	Preserved	Dense	*Julbernardia globiflora, Combretum Molle, Dalbergia boehmii*	Rocky	Rocky, slope & valley	*Lantana camara* observed in the site
BS6	11/08/2023	Savannah Woodland	Kamuli Ngara	6 to 15º	Slope	Dry	Preserved	Medium		Rocky	Hills with savanna woodland, rocks, termite mound	-
BS7	12/08/2023	Savannah Woodland	Mashasha Mpakani - Karagwe	6 to 15º	Slope	Dry	Little disturbed	Medium	*Faurea rocheliana, Ozoroa insignis, Lannea schimpora* and *Combretum zeyheri*	Rocky	Valley, Hill with rocks, settlement and cultivation, grazing	-

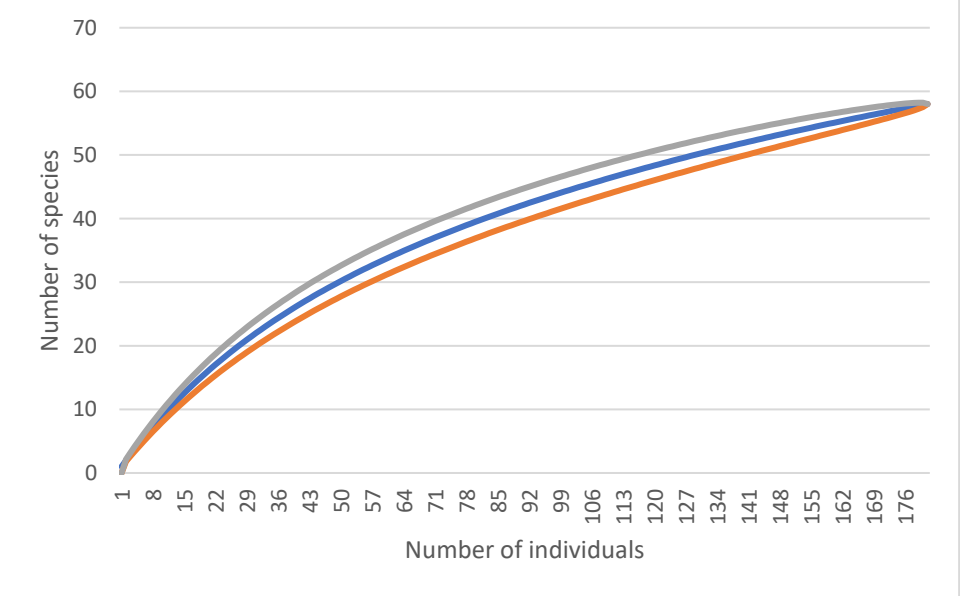
Table 7.2.2.1.3.b shows the sampling intensity of the phytosociological survey of the tree stratum, relating the area sampled to the total area of native forest formations in the DAI. A total of 06 plots (0.24 ha) were considered, representing a sampling effort of 0.02% of the DAA's native forest formations.

Table 7.2.2.1.3.b
Sampling intensity of the phytosociological survey of the tree layer

Number of parcels measured	Total area Sampled (ha)	Total area of arboreal vegetation in the DAI (ha)	Total area of arboreal vegetation in the DAA (ha)	Intensity sample in the DAI (%)	Intensity sample in the DAA (%)
6	0.24	16,453.50	947.12	0.002	0.02

To demonstrate the effectiveness of the data collected, a rarefaction curve was made using the "Vegan" tool for R software, considering the number of individuals sampled and the number of species recorded (richness) (**Figure 7.2.2.1.3.a**).

Figure 7.2.2.1.3.a
Collector curve obtained by rarefaction of the sample



In order to sort out the results obtained in the phytosociological survey of the tree layer, **Table 7.2.2.1.3.c** presents a summary of the parameters calculated for the sampling carried out in the forest and tree formations of the DAI (phytosociological, volumetric, diversity and statistical estimators).

During the phytosociological survey, 181 individuals were recorded in the 6 plots. Of all the plots surveyed, 2 were allocated to Savannah Woodland, in addition to 1 plot in each of the following phytophysiognomies: Wooded Grassland, Evergreen Dry Forest, Woodland and Open Miombo Woodland.

Table 7.2.2.1.3.c
Summary of the parameters of the native forest formations sampled in the phytosociological survey of the tree layer

Parameters	Values
Instalments	6
N (individuals)	182
N/ha (Individuals/ha)	758.33
Families identified	22
Genres identified	46
Morphospecies (not including dead)	59
Average DBH (cm)	8.03
Maximum DBH (cm)	64.30
Average total height (m)	6,85
Maximum overall height (m)	25
Basal area (m²/ha)	13.35
Barked log volume (m3/ha)	123.26
Shannon's diversity index (H')	3.70
Simpsons Diversity Index (C)	0.97
Pielou index (J')	0.91
Jackknife T (95%) = 2.06	4.10 a 4.75
Jentsch Coefficient of Mixture	1:3.12

Legend: N/ha: number of individuals per hectare; ADo: basal area per hectare (m2/ha); Vt/ha: Barked log volume per hectare (m3/ha);

The density found was 758.33 individuals per hectare. A total of 58 morphospecies were recorded, distributed in 46 genera from 22 botanical families.

The Shannon-Weaver diversity index (H') expresses the richness and uniformity of the population, and the higher its value, the greater the diversity of the population (MAGURRAN, 1988). The Shannon-Weaver index found was 3.70 nats/individual. In a 95% confidence interval estimated by Jackknife richness (T), a value of 4.10 to 4.75 was found.

Simpson's index (C) estimates the probability of two randomly selected individuals in the sample being of the same species at 0.97 (BROWER & ZARR, 1984).

The Pielou Equability Index (J') represents the maximum diversity and indicates the degree of homogeneity of the community. The index varies between 0 and 1, with "0" being total homogeneity and "1" being total heterogeneity; the value for the sample was 0.91.

The Jentsch Mixture Quotient (QM) indicates the intensity of the mixture of species in the sampled area, since this index relates the number of species to the number of trees sampled. Thus, the closer the QM value is to 1, the more diverse the population is. The QM value obtained was 1:3.12, which means that a new species is recorded for every 3 individuals measured.

Absolute dominance is a measure of the area occupied by trees in a hectare (basal area) and is an indicator of the biomass of a forest community (MARTINS, 1991). The average

basal area per hectare obtained from the allocated plots was 13.35 m²/ha. The average volume of the trunk with bark totalled 123.26 m²/ha.

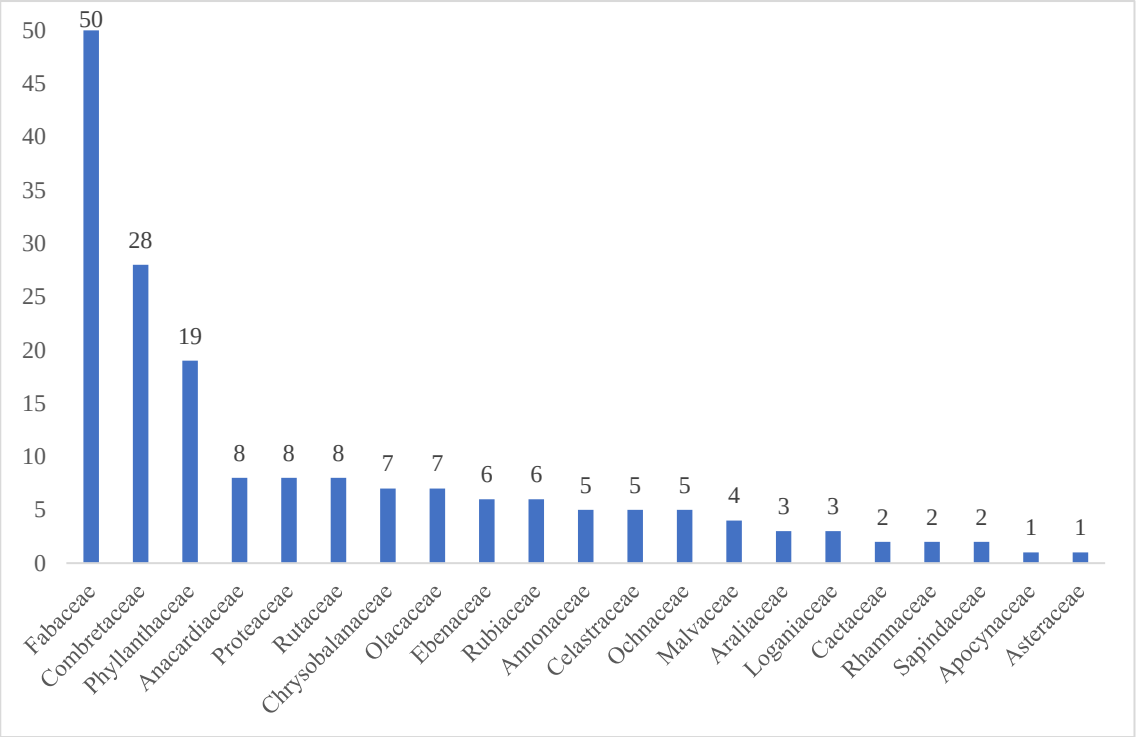
As shown in **Table 7.2.2.1.3.d** and **Figure 7.2.2.1.3.b**, the families with the highest number of individuals recorded were Fabaceae (50 individuals or 27% of the total), Combretaceae (28 individuals or 15%) and Phyllanthaceae (19 individuals or 10%). Thus, the three families mentioned above accounted for 52 % of all the sampling in the plots.

In terms of species richness, Fabaceae was the family with the highest morphospecies richness (12 spp.). This was followed by Combretaceae (6 spp), Phyllanthaceae and Rubiaceae (5 spp each), Euphorbiaceae, Myrtaceae and Sapindaceae (4 spp each), Anacardiaceae, Celastraceae and Malvaceae (3 spp each). The above families account for 69.0% of all the species richness recorded.

Table 7.2.2.1.3.d
Distribution of individuals and species among the botanical families recorded in the phytosociological survey of the tree **layer**

Family	N. of Species	Total ind.	Total (%)
Fabaceae	12	50	27%
Combretaceae	6	28	15%
Phyllanthaceae	5	19	10%
Anacardiaceae	3	8	4%
Proteaceae	2	8	4%
Rutaceae	1	8	4%
Chrysobalanaceae	1	7	4%
Olacaceae	1	7	4%
Ebenaceae	2	6	3%
Rubiaceae	5	6	3%
Annonaceae	1	5	3%
Celastraceae	3	5	3%
Ochnaceae	2	5	3%
Malvaceae	3	4	2%
Araliaceae	1	3	2%
Loganiaceae	3	3	2%
Cactaceae	1	2	1%
Rhamnaceae	1	2	1%
Sapindaceae	1	2	1%
Apocynaceae	1	1	1%
Asteraceae	1	1	1%
Euphorbiaceae	1	1	1%
Hypericaceae	1	1	1%
Sum	**58**	**182**	**100%**

Figure 7.2.2.1.3.b
Distribution of species among the families recorded in the phytosociological survey of the tree stratum of the formations



Horizontal structure

Table 7.2.2.1.3.e shows the phytosociological parameters calculated for each of the species recorded in the tree stratum survey, sorted in descending order of IVI: Importance Value Index (%).

In the phytosociological survey carried out, the species with the highest IVI were: *Julbernardia globiflora* (10.47%), *Combretum collinum* (4.86%), *Faurea rochetiana* (4.69%), *Senegalia polyacantha* (4.03%), *Vepris nobilis* (3.79%), *Euclea divinorum* (3.45%) and *Combretum pisoniiflorum* (3.27%), together accounting for 34.5% of the IVI, while the other 52 species account for 65.5% of the IVI, with values ranging from 2.99% to .065%.

These values show that there was no hyper-dominance of a few species, but rather a population with a more homogeneous distribution in terms of horizontal structure.

Table 7.2.2.1.3.e
Phytosociological parameters of the species recorded in the phytosociological survey of the tree layer

Cientific name	N	U	BC	AD	RD	AF	RF	ADo	RDo	IVI	IVI (%)
Julbernardia globiflora	17	1	0.6619	70.833	9.34	16.67	1.41	2.758	20.65	31.402	10.47
Combretum collinum	9	3	0.1709	37.5	4.95	50	4.23	0.712	5.33	14.504	4.83
Faurea rochetiana	6	2	0.2546	25	3.3	33.33	2.82	1.061	7.94	14.056	4.69
Senegalia polyacantha	1	1	0.3247	4.167	0.55	16.67	1.41	1.353	10.13	12.089	4.03
Vepris nobilis	8	2	0.1331	33.333	4.4	33.33	2.82	0.554	4.15	11.365	3.79
Euclea divinorum	5	1	0.1982	20.833	2.75	16.67	1.41	0.826	6.18	10.34	3.45
Combretum pisoniiflorum	9	2	0.0657	37.5	4.95	33.33	2.82	0.274	2.05	9.811	3.27
Faidherbia albida	6	1	0.1367	25	3.3	16.67	1.41	0.57	4.27	8.971	2.99
Parinari curatellifolia	7	2	0.0692	29.167	3.85	33.33	2.82	0.288	2.16	8.823	2.94
Vachellia xanthophloea	2	1	0.1685	8.333	1.1	16.67	1.41	0.702	5.26	7.766	2.59
Brachystegia spiciformis	7	1	0.0768	29.167	3.85	16.67	1.41	0.32	2.4	7.652	2.55
Hymenocardia acida	8	1	0.0534	33.333	4.4	16.67	1.41	0.222	1.67	7.47	2.49
Ximenia caffra	7	1	0.0564	29.167	3.85	16.67	1.41	0.235	1.76	7.015	2.34
Annona senegalensis	5	2	0.0235	20.833	2.75	33.33	2.82	0.098	0.73	6.296	2.1
Pterocarpus tinctorius	7	1	0.0257	29.167	3.85	16.67	1.41	0.107	0.8	6.057	2.02
Pericopsis angolensis	2	2	0.0676	8.333	1.1	33.33	2.82	0.282	2.11	6.026	2.01
Lannea schimperi	4	2	0.0158	16.667	2.2	33.33	2.82	0.066	0.49	5.508	1.84
Protea gaguedi	2	1	0.0952	8.333	1.1	16.67	1.41	0.397	2.97	5.478	1.83
Maytenus undata	3	1	0.0774	12.5	1.65	16.67	1.41	0.323	2.42	5.472	1.82
Cussonia arborea	3	2	0.0259	12.5	1.65	33.33	2.82	0.108	0.81	5.274	1.76
Ozoroa insignis	2	2	0.0421	8.333	1.1	33.33	2.82	0.175	1.31	5.229	1.74
Ochna afzelii	4	1	0.0436	16.667	2.2	16.67	1.41	0.182	1.36	4.968	1.66
Combretum zeyheri	4	1	0.0425	16.667	2.2	16.67	1.41	0.177	1.33	4.932	1.64
Bridelia cathartica	3	1	0.0513	12.5	1.65	16.67	1.41	0.214	1.6	4.657	1.55
Dombeya rotundifolia	2	1	0.0535	8.333	1.1	16.67	1.41	0.223	1.67	4.178	1.39
Searsia natalensis	2	2	0.0059	8.333	1.1	33.33	2.82	0.025	0.18	4.099	1.37
Pterocarpus angolensis	4	1	0.01	16.667	2.2	16.67	1.41	0.042	0.31	3.918	1.31
Flueggea virosa	4	1	0.0046	16.667	2.2	16.67	1.41	0.019	0.14	3.751	1.25

Table 7.2.2.1.3.e
Phytosociological parameters of the species recorded in the phytosociological survey of the tree layer

Cientific name	N	U	BC	AD	RD	AF	RF	ADo	RDo	IVI	IVI (%)
Terminalia zollingeri	3	1	0.0144	12.5	1.65	16.67	1.41	0.06	0.45	3.506	1.17
Terminalia sericea	2	1	0.025	8.333	1.1	16.67	1.41	0.104	0.78	3.287	1.1
Tricalysia pallens	1	1	0.0406	4.167	0.55	16.67	1.41	0.169	1.27	3.225	1.08
Haplocoelum foliolosum	2	1	0.0194	8.333	1.1	16.67	1.41	0.081	0.61	3.114	1.04
Pseudolachnostylis maprouneifolia	2	1	0.0196	8.333	1.1	16.67	1.41	0.082	0.61	3.119	1.04
Scutia myrtina	2	1	0.0046	8.333	1.1	16.67	1.41	0.019	0.14	2.651	0.88
Euphorbia hubertii	1	1	0.0199	4.167	0.55	16.67	1.41	0.083	0.62	2.579	0.86
Margaritaria discoidea	2	1	0.0014	8.333	1.1	16.67	1.41	0.006	0.04	2.551	0.85
Pavetta bagshawei	2	1	0.0006	8.333	1.1	16.67	1.41	0.002	0.02	2.525	0.84
Coffea eugenioides	1	1	0.0171	4.167	0.55	16.67	1.41	0.071	0.53	2.49	0.83
Combretum apiculatum	1	1	0.0153	4.167	0.55	16.67	1.41	0.064	0.48	2.435	0.81
Grewia sp.	1	1	0.0135	4.167	0.55	16.67	1.41	0.056	0.42	2.38	0.79
Entada abyssinica	1	1	0.0111	4.167	0.55	16.67	1.41	0.046	0.35	2.303	0.77
Acacia sp.	1	1	0.0092	4.167	0.55	16.67	1.41	0.038	0.29	2.245	0.75
Strychnos innocua	1	1	0.0077	4.167	0.55	16.67	1.41	0.032	0.24	2.197	0.73
Fabaceae sp.	1	1	0.0062	4.167	0.55	16.67	1.41	0.026	0.19	2.152	0.72
Maytenus sp.	1	1	0.0045	4.167	0.55	16.67	1.41	0.019	0.14	2.098	0.7
Strychnos potatorum	1	1	0.0037	4.167	0.55	16.67	1.41	0.015	0.11	2.073	0.69
Strychnos spinosa	1	1	0.0031	4.167	0.55	16.67	1.41	0.013	0.1	2.055	0.69
Mystroxylon aethiopicum	1	1	0.0026	4.167	0.55	16.67	1.41	0.011	0.08	2.038	0.68
Grewia bicolor	1	1	0.0026	4.167	0.55	16.67	1.41	0.011	0.08	2.038	0.68
Naltideritia crassa	1	1	0.0013	4.167	0.55	16.67	1.41	0.005	0.04	1.999	0.67
Euclea racemosa	1	1	0.0018	4.167	0.55	16.67	1.41	0.008	0.06	2.015	0.67
Gymnanthemum exsertiflorum	1	1	0.0003	4.167	0.55	16.67	1.41	0.001	0.01	1.967	0.66
Ochna holstii	1	1	0.0008	4.167	0.55	16.67	1.41	0.003	0.02	1.983	0.66
Vachellia nilotica	1	1	0.0008	4.167	0.55	16.67	1.41	0.003	0.02	1.983	0.66
Burkea africana	1	1	0.0008	4.167	0.55	16.67	1.41	0.003	0.02	1.983	0.66
Afrocanthium sp.	1	1	0.0008	4.167	0.55	16.67	1.41	0.003	0.02	1.983	0.66

Table 7.2.2.1.3.e
Phytosociological parameters of the species recorded in the phytosociological survey of the tree layer

Cientific name	N	U	BC	AD	RD	AF	RF	ADo	RDo	IVI	IVI (%)
Senegalia brevispica	1	1	0.0008	4.167	0.55	16.67	1.41	0.003	0.02	1.983	0.66
Carissa spinarum	1	1	0.0008	4.167	0.55	16.67	1.41	0.003	0.02	1.983	0.66
Psorospermum febrifugum	1	1	0	4.167	0.55	16.67	1.41	0	0	1.958	0.65
Total	182	6	3.205	758.333	100	1183.33	100	13.354	100	300	100

Legend: N: Number of individuals; U: plot occurrence; BC: Basal cover (m²); AD: absolute density; RD: Relative density; AF: Absolute frequency; RF: Relative frequency; ADo: absolute dominance; RDo: Relative Dominance; IVI: Importance Value Index.

Diametric distribution

Table 7.2.2.1.3.f and **Figure 7.2.2.1.3.c** show the distribution by diameter class of the absolute density parameters, basal area per hectare and trunk volume with bark per hectare obtained in the survey.

Figure 7.2.2.1.3.c (A) and **Table 7.2.2.1.3.f** show that there is a clear predominance of small individuals, giving an inverted "J" shaped distribution of diameters, shifted towards the smaller diameters, with 54.1% of the individuals being in the first two diameter classes (0 to 5 cm and 5 to 10 cm). This result is explained by the natural dynamics of mortality and recruitment of new individuals in the community (OLIVEIRA & AMARAL, 2004). The first three diameter classes, which include trees with a DBH between 5 and 15 cm, concentrate the largest number of individuals in the community (76.2%).

According to **Figure 7.2.2.1.3.c (B)** and **Table 7.2.2.1.3.f**, the basal area per hectare is best distributed among the first six diameter classes. The two DBH classes with the highest basal area values per hectare are the 4th (15 to 20 cm) and 5th (20 to 25 cm), with 1.71 m²/ha and 2.18 m²/ha, respectively.

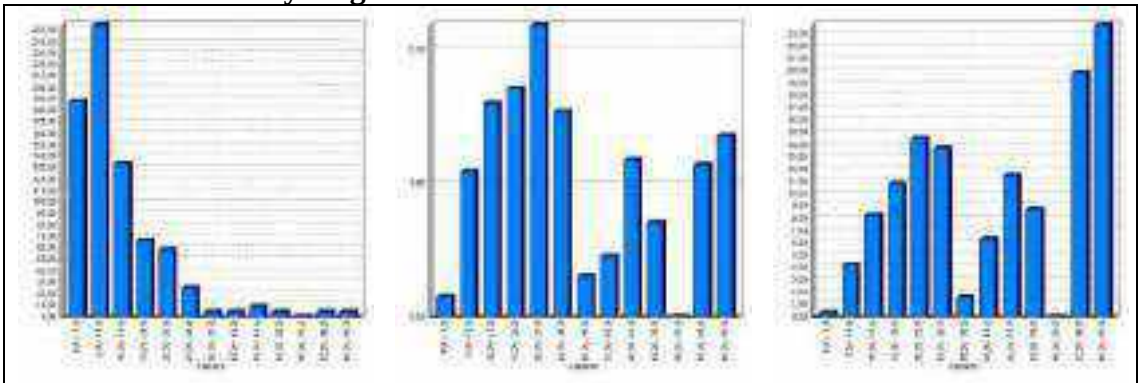
According to **Figure 7.2.2.1.3.c (C)** and **Table 7.2.2.1.3.f**, it can be seen that although the first two DBH classes (0 to 5 cm and 5 to 10 cm) have a high density, the average volumes per hectare of these categories were not the highest, showing that the diameter of the trees has a greater influence than the number of individuals. In this study, the highest volume values per hectare were found in the two classes with the highest DBH, 55 to 60 cm (19.87 m³/ha) and 60 to 65 cm (23.68 m³/ha).

Table 7.2.2.1.3.f
Distribution of parameters by diameter class obtained in the phytosociological survey of the tree stratum of early-stage forest formations

DBH	N	DA	DoA	VT/ha
0.0 |- 5.0	45	187.5	0.14	0.3265
5.0 |- 10.0	61	254.17	1.08	4.2135
10.0 |- 15.0	32	133.33	1.59	8.2111
15.0 |- 20.0	16	66.67	1.71	10.7891
20.0 |- 25.0	14	58.33	2.18	14.4784
25.0 |- 30.0	6	25	1.53	13.6782
30.0 |- 35.0	1	4.17	0.31	1.4987
35.0 |- 40.0	1	4.17	0.45	6.2872
40.0 |- 45.0	2	8.33	1.17	11.4984
45.0 |- 50.0	1	4.17	0.70	8.7439
50.0 |- 55.0	0	0	0	0
55.0 |- 60.0	1	4.17	1.14	19.8609
60.0 |- 65.0	1	4.17	1.35	23.6777
Total	181	754.17	13.35	123.2636
Mean	13.92	58.01	1.027	9.4818
Std. Dev.	19.89	82.87	0.66	7.2754

Legend: N: Number of individuals; AD: Absolut density (N/ha); ADo: Absolut dominance (m2/ha); VT/ha: barked log volume (m3/ha).

Figure 7.2.2.1.3.c
Absolute density (A), basal area per hectare (B) and trunk volume with bark per hectare (C) in the diameter classes obtained in the phytosociological survey of the tree stratum of early-stage forest formations



A B C

Legend: (A) - Absolut density (N/ha);
(B)- ADo: Absolut dominance (m2/ha);
(C) -VT/ha: barked log volume (m3/ha).

Vertical structure

This section will present the distribution of absolute density parameters, basal area per hectare and trunk volume with bark per hectare in the survey according to the height classes defined in **Table 7.2.2.1.3.g**, with Class 1 being dominated individuals; Class 2 being intermediate individuals; and Class 3 being dominant individuals.

Table 7.2.2.1.3.g
Parameters related to the vertical structure of the native forest formations sampled

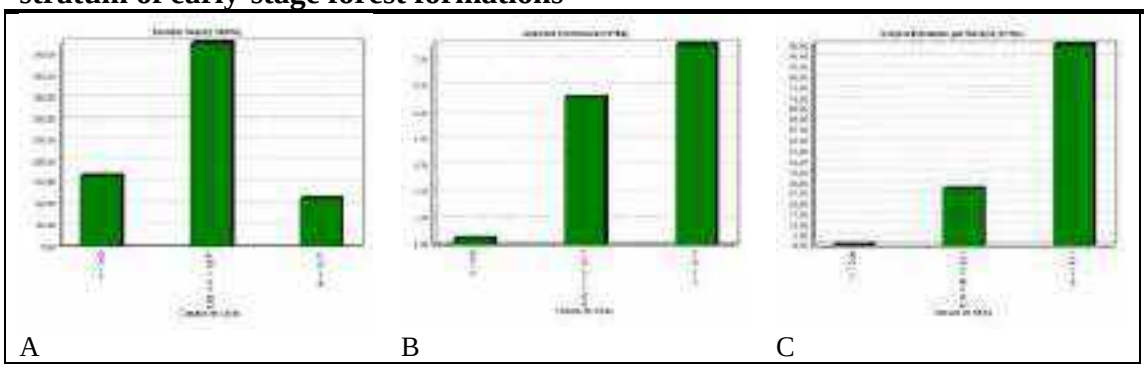
Height classes	AD (N/ha)		ADo (m²)		V/ha (m³)	
H < 3.00	166.67	22.0%	0.22	1.6%	0.44	0.4%
3.00 ≤ H ≤ 10.71	479.17	63.2%	5.57	41.7%	27.29	22.1%
H > 10.71	112.50	14.8%	7.56	56.6%	95.54	77.5%
Sum	758.33	100.0%	13.35	100.0%	123.26	100.0%

Legend: N: Number of individuals; AD: Absolut density (N/ha); ADo: Absolut dominance (m2/ha); VT/ha: barked log volume (m3/ha).

As can be seen in **Table 7.2.2.1.3.g** and **Figure 7.2.2.1.3.d**, Class 3 (trees taller than 10.71 meters) concentrates the greatest volume of woody material (95.54 m3/ha or 77.5%) and basal area (7.56 m²/ha and 56.6%). Class 2 (trees between 3.0 and 10.71 meters tall) had the highest absolute density (479.17 individuals per hectare or 63.2%).

According to the results presented, we can see a clear stratification of the formations studied, with a lower stratum dominated by a few individuals and a low volume of woody material, an intermediate stratum with many individuals and an emerging stratum with a high volume of wood, showing that this is where the woody biomass of the formations inventoried is concentrated.

Figure 7.2.2.1.3.d
Absolute density (A), basal area per hectare (B) and trunk volume with bark per hectare (C), by height class, obtained in the phytosociological survey of the tree stratum of early-stage forest formations



A B C

Legend: Absolute density or DA (number of individuals/ha); Basal area per hectare or absolute dominance DoA (m2²/ha); Volume of trunk with bark per hectare VT/ha (m3/ha).

The sampling carried out covered 0.24 ha, which corresponds to approximately 0.002% and 0.026% of the native wooded formations of the project's DAI and DAA, respectively.

The forest and wooded formations had a Shannon-Wiener diversity index (H') of 3.34. The Pielou Equability index (J') recorded in these formations was 0.87 and Simpson's index (C) was 0.96. The basal area and volume per hectare were 23.06 m²/ha and 135.39 m³/ha, respectively.

Few phytosociological studies were carried out in the region, and in many cases, these were in restricted formations, making it difficult to compare the values obtained in these studies with the present survey.

7.2.2.1.4
Vegetation cover and land use in the Directly Affected Area

The characterization of vegetation cover and land use in the area directly affected by the project included the 52-metre-wide of the wayleave. It is important to highlight that it will not be necessary to clear the entire length of the wayleave, in order to minimize impacts on native vegetation, clearing will be carried out in a 14-metre-wide service strip (7 metres on each side of the line). It is also important to highlight that other support infrastructures (such as new accesses and construction sites), should they be necessary, are not included in this quantification as these structures have not yet been detailed.

As this is a smaller area, the mapping of this strip was carried out on a more detailed scale, making it possible to properly differentiate the existing features in this area. The mapping was carried out using the same methodologies, images and programs, based on visual interpretation of the images and ground-truthing. The images were interpreted at a scale of 1:2,000 and the map is presented at a scale of 1:5,000.

The delimited polygons were classified according to the predominant feature distinguishable at the adopted scale, i.e. in the same patch or polygon there may be reduced portions indistinguishable from other land uses.

As shown in **Table 7.2.2.1.4.a**, in the wayleave (52 metre-wide), native formations occupy 39% of the total, mainly Miombo woodland (32%). Anthropogenic formations occupy 61%, with cyclical crops occupying most of this area (40%). Thus, in the service strip, 85.25% is occupied by modified habitats, mainly cyclical agriculture (50.08%). Natural habitats occupy 14.75% of the service strip, mainly charactrerised by Miombo woodland (12.12%).

Map 7.2.2.1.4.a in **Annex 5** shows the result of the mapping of the Land Cover and Use in the DAA.

Table 7.2.2.1.4.a
Land use and cover in the wayleave (Project's directly affected area, 52 metre-wide) and in the service strip (vegetation clearing strip, 14 metre-wide)

Classes	Wayleave (52 metre-wide)		Service strip (14 metre-wide for for native formations and 52 metre-wide for arable areas)	
	hectares	%	hectares	%
Natural habitats	**1,110.97**	**39%**	**300.37**	14.75%
Miombo woodland	915.20	32%	246.86	12.12%
Mixed woodland	54.35	2%	15.13	0.74%
Grass wooded savanna	67.32	2%	18.11	0.89%
Thicket bushland/shrubland	40.83	1%	11.24	0.55%
Evergreen dry forest	4.57	0.2%	1.23	0.06%
Riverine forest	12.60	0.4%	3.46	0.17%
Riverine grassland vegetation	16.10	0.6%	4.34	0.21%
Modified habitats	**1,736.38**	**61%**	**1,736.37**	85.20%
Cyclical agriculture	1,142.19	40%	1,142.19	56.08%
Perennial agriculture	80.67	3%	80.67	3.96%
Anthropic area	426.73	15%	426.73	20.95%
Silviculture	47.81	2%	47.81	2.35%
Rural buildings	16.70	1%	16.7	0.82%
Substation	3.17	0.1%	3.17	0.16%
Unpaved road	16.83	0.6%	16.83	0.83%
Paved road	2.27	0.1%	2.27	0.11%
Water bodies	**4.17**	**0.2%**	**1.22**	0.06%
Water	4.17	0.2%	1.22	0.06%
Total	**2,851.52**	**100%**	**2,036.74**	**100.00%**

Source: JGP mapping and quantification

7.2.2.2
Fauna Baseline

The fauna baseline considered the groups of wild vertebrates represented by mammals, birds, reptiles and amphibians. Mammals include small, medium and large mammals and bats.

To characterise the fauna, 3 (three) fauna survey campaigns were carried out in the following periods (see **Table 7.2.2.2.a**):

Table 7.2.2.2.a
Periods for terrestrial fauna surveys

Fauna Campaign	Schedule	*Biodiversity Sample (BS)* Points	Season
1st	3 - 15 August 2023	Birds, BS2, BS3, BS4 and BS5	Dry
2nd	21 April - 5 May 2024	BS1, BS5, BS6, BS8 and BS9	Wet
3rd	22 June - 4 July 2024	BS1, BS6, BS8 and BS9	Dry

The fauna campaigns were carried out during the dry and rainy seasons and took into account the regional seasonality. This is corroborated by the report Statement on the Status of Tanzania Climate in 2023. According to this report, Tanzania has a savannah climate (Aw) with a dry season from May to October and a rainy season from November to April. Within the rainy season, there are long rains known as Masika, which can occur from March to May, and shorter rains known as Vuli, which occur between October and December.

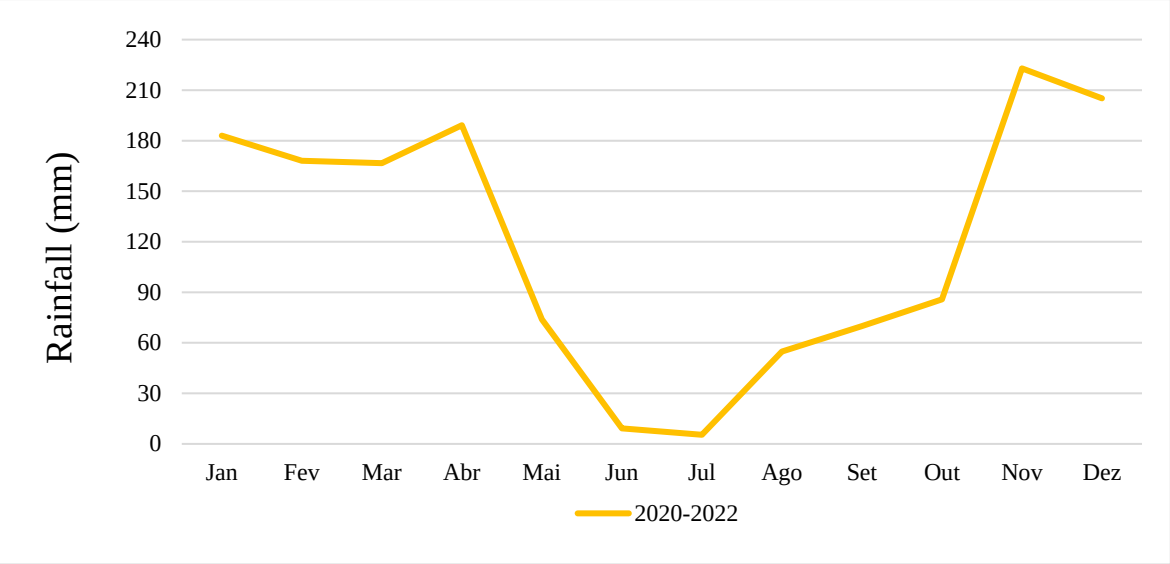
Figure 7.2.2.2.a shows the average monthly rainfall from 2020 to 2022 for the study region. The figure shows that the Vuli period (October to December) had the longest rainfall period, followed by the Masika period with rainfall between March and April. The oscillation in maximum rainfall over the years is between 222.92 mm in December and 189.14 mm in April. As for the dry season, it is notable that from June to August there is around 5.4 mm.

Thus, it can be said that the first and third campaigns were carried out during the dry season and the second campaign was carried out during the Masika rainy season, making it possible to sample the two well-defined seasons in the study region.

Fauna survey thus considered local seasonality, and to assess faunal biodiversity, 10 (ten) sampling areas were initially chosen, entitled as ***Biodiversity Sample (BS)***. These areas BS1 to BS10 were chosen according to their degree of forest preservation, close to the Lake Victoria area, small forest remnants, Protected Areas, altered environments, etc.

However, among the ten areas sampled for fauna, it was detected in the field that two of them, BS7 and BS10, were close to and had the same vegetation characteristics as the other surrounding areas such BS6 and BS9.

Figure 7.2.2.2.a
Average monthly rainfall in the study area from 2020 to 2022



Source: POWER/NASA, 2024.

The **Photos 01 to 04** show the characteristics of these two areas that were inspected by the fauna team in the field, prior to the fauna survey activities.

Photo 01: Detail of the surroundings of area BS7 with domestic animals. The area is located just 30 kilometres from area BS6

Photo 02: Area BS7 more anthropized than area BS6.

Photo 03: Detail of the surroundings of area BS10 with very altered environments

Photo 04: BS10 bushlands area

Area BS6 is located at coordinates 36 M 278,828 and 9,752,758 inside Burigi-Chato Park, just 30 kilometres away from area BS7. However, area BS7 is outside the Protected Area, and so it was found in the field to have greater anthropogenic influence characterised by the presence of small human dwellings in the surrounding area and domestic animal farms. Therefore, as the area was only 30 kilometres away from the point chosen for area BS6, and the physiognomies and relief were similar and with a higher degree of forest preservation and protection, it was decided to sample the BS6 area.

As for area BS10, it is located at the end of the TL route and is also relatively close to area BS9 (about 80 kilometres away). According to the flora survey carried out at the same time as the first fauna survey campaign, the region had a high level of anthropogenic influence and was therefore discarded as a fauna sampling area. As a result, eight (8) areas were effectively sampled, which catered for regional seasonality. The characteristics of the areas are shown in **Table 7.2.2.2.b** below.

Table 7.2.2.2.b
Locations of the sampling areas

Area	UTM coordinates	Physiognomies	1st C	2nd C	3rd C
BS1	36 M 334614 9876670	Wooded grassland		X	X
BS2	36 M 309059 9851758	Evergreen dry forest	X	X	
BS3	36 M 348433 9798709	Swamp forest	X		
BS4	36 M 326052 9725474	Woodland	X		
BS5	36 M 301705 9672599	Open Miombo Woodland	X	X	
BS6	36 M 278828 9752758	Savannah Woodland		X	X
BS8	36 M 358814 9632825	Miombo Woodland		X	X
BS9	36 M 461492 9635551	Shrubland Thickets		X	X

As the table shows, although three fauna campaigns were carried out, the areas BS1, BS2, BS5, BS6, BS8 and BS9 were sampled in two campaigns, one dry and one rainy.

However, the fauna campaigns were carried out during the period of the study of route alternatives. The study was concluded after the first fauna campaign and resulted in the

discarding of the alternative route in which the sample areas BS3 and BS4 were located (see Analysis of Alternatives in **Chapter 5.0**). Therefore, BS3 and BS4 were excluded from the subsequent campaigns and did not have seasonal sampling completed. Despite this, the richness and abundance of these sampling areas were assessed in this document. Therefore, the sampling areas BS1, BS2, BS5, BS6, BS8 and BS9 were analysed and compared, as they were sampled in two fauna survey campaigns, taking into account the local seasonality.

In addition to the BS points for birds, a point called ***Birds Point*** was defined, located next to the Lake Vitoria. The aim of this point was to identify birds with congregatory habits, larger birds, nests, etc. This required the use of binoculars and a telezoom camera. This point is located at coordinate 36N 356594.59 E 187371.60 N UTM at a height of 1321 m and is around 1400 metres from Lake Vitoria in the Buhama district.

7.2.2.2.1
Methodological Procedures

Mammals

Mammals were systematically sampled in the BS using both non-invasive methods (recording only through observation and camera traps) and invasive methods (capture, handling and subsequent release).

Three groups were assessed for the diagnosis of mammals: small non-flying species (rodents and marsupials), bats (chiroptera) and medium and large mammal species. The specific methodological procedures for surveying each of these three groups are described below and, at the end of the sub-item, **Tables 7.2.2.*2*.1.a** to **7.2.2.2.1.e** show the sampling effort of the methods.

Small non-flying mammals

Two sampling methods were used to sample small non-flying mammals, including rodents and marsupials: visual active search and camera traps.

- Visual active search - active searches were carried out during the day (7.30 am to 11.30 am) and in the late afternoon, from 5.30 pm to 7.30 pm on the main trails and access trails, looking for direct (visual) and indirect (burrows, faeces) records of small terrestrial mammals. For this methodology, around 6 hours per day were spent in each sampling area,
- Camera traps - 4 (four) camera traps were installed and remained active (24 hours) in each sampling area. The cameras are activated by movements of small, medium and large animals. Video mode was activated on all the cameras, making it possible to record them photographically.

Table 7.2.2.2.1.a below shows the sampling effort for small terrestrial mammals.

Table 7.2.2.2.1.a
Sampling efforts using camera traps and visual active searches (VAS) in the areas where the mammals were surveyed

Area	Traps cameras (CT)	Visual active search (VAS)	Total
BS1	24 hours x 1 night x 2 campaigns x 4 CT	6 hours x 2 campaigns	192 hours CT and 12 hours BAV
BS2	24 hours x 1 night x 2 campaigns x 4 CT	6 hours x 2 campaigns	192 hours CT and 12 hours BAV
BS3	24 hours x 1 night x 1 campaign x 4 CT	6 hours x 1 campaign	96 hours CT and 6 hours BAV
BS4	24 hours x 1 night x 1 campaign x 4 CT	6 hours x 1 campaign	96 hours CT and 6 hours BAV
BS5	24 hours x 1 night x 2 campaigns x 4 CT	6 hours x 2 campaigns	192 hours CT and 12 hours BAV
BS6	24 hours x 1 night x 2 campaigns x 4 CT	6 hours x 2 campaigns	192 hours CT and 12 hours BAV
BS8	24 hours x 1 night x 2 campaigns x 4 CT	6 hours x 2 campaigns	192 hours CT and 12 hours BAV
BS9	24 hours x 1 night x 2 campaigns x 4 CT	6 hours x 2 campaigns	192 hours CT and 12 hours BAV
Total			**1344 hours and 84 hours BAV**

Chiroptera

The bats were sampled using both mist nets (at night), considered to be an efficient method for capturing chiropterans (KUNZ *et al*., 1996) and bioacoustic recordings using the Songmeter device. No crevices, shelters or caves were found that could harbour a density of bats. Below is the sampling effort of the methodologies employed:

- Mist nets - For this methodology, three (3) mist nets measuring 12 metres x 2.5 metres were installed and kept open from 6pm until 8pm. The nets were checked every 50 minutes. This required equipment such as head and hand torches, leather and surgical gloves. It should be noted that in some areas, due to the high risk of night-time attacks by animals or even local hunters, the nets were closed before 8pm, as in the case of area BS5 (Second Campaign) and area BS6 (Second Campaign) and,
- Song Meter - bioacoustics sampling. More and more researchers in different countries are using echolocation to acoustically identify bat species. With the method, richness and activity patterns (bat passes) are obtained and for some groups it is already possible to reach identifications at specific levels with some ease (ARIAS-AGUILAR *et al*., 2018). The great advantage of this method is that it is non-invasive, efficiently sampling the bat families under sampled by the mist net method and with the possibility of obtaining a number of records (bat passes) that allow more robust detailed analyses in a shorter study time compared to mist net sampling. The sampling method is considered passive, with the equipment installed during the night in strategic locations within the sampling area. During the analysis, the number of bat passes are recorded, which are defined as a sequence of three or more echolocation calls per unit of time (e.g. passes/15 seconds) (BARROS *et al*., 2017). The equipment used is the Song Meter SM4 BAT FS, with the following

configuration: sampling frequency of 400 kHz, pre-triggering of 3s and 15s after triggering. The identifications are performed automatically and manually, the former serving to separate files with noise from files with bat calls using the Kaleidoscope software version 3.1.1 (www.wildlifeacoustics.com) and after this evaluation all files with bat calls are evaluated manually using the CallViewer18 program (SKOWRONSKI & FETON, 2008), using the automatic Hamming window detection function, FFT=1024, window length of 1 m and background threshold of 10 dB. The parameters are extracted from the best calls of each vocalisation sequence. The equipment is intended to be programmed to record for 12 hours at night and the records of the first 10 minutes of each hour of recording are analysed. The planned sampling effort is 720 minutes per night for 24 consecutive hours per sampling area of recordings.

Table 7.2.2.2.1.b shows the sampling effort for bats.

Table 7.2.2.2.1.b
Sampling efforts using mist nets and Song Meter in chiropterofauna survey areas

Area	Mist nets	Song Meter	Total
BS1	3 mist nets (6pm to 8pm) x 1 night x 2 campaigns	24 hours x 1 night x 2 campaigns	2 hours x 2 campaigns = 4 hours and 3 active networks = 12 hours/network and 48 hours of Songmeter
BS2	3 mist nets (6pm to 8pm) x 1 night x 2 campaigns	24 hours x 1 night x 2 campaigns	2 hours x 2 campaigns = 4 hours and 3 active networks = 12 hours/network and 48 hours of Songmeter
BS3	Not sampled with a mist net	24 hours x 1 night x 1 campaign	24 hours of Songmeter
BS4	Not sampled with a mist net	24 hours x 1 night x 1 campaign	24 hours of Songmeter
BS5	3 mist nets (6pm to 8pm) x 1 night x 1 campaign and 6pm to 7pm (1 hour) x 2 campaigns*	24 hours x 1 night x 2 campaigns	3 hours and 3 active networks = 9 hours/network and 48 hours of Songmeter
BS6	3 mist nets (6pm to 8pm) x 1 night x 1 campaign and 6pm to 7pm (1 hour) x 2 campaigns*	24 hours x 1 night x 2 campaigns	3 hours and 3 active networks = 9 hours/network and 48 hours of Songmeter
BS8	3 mist nets (6pm to 8pm) x 1 night x 2 campaigns	24 hours x 1 night x 2 campaigns	2 hours x 2 campaigns = 4 hours and 3 active networks = 12 hours/network and 48 hours of Songmeter
BS9	3 mist nets (6pm to 8pm) x 1 night x 2 campaigns	24 hours x 1 night x 2 campaigns	2 hours x 2 campaigns = 4 hours and 3 active networks = 12 hours/network and 48 hours of Songmeter
Total			**66 hours of fog nets + 336 hours of Songmeter**

* Due to the high risk of night-time attacks by animals or even local hunters, the nets were closed before 8pm, as in the case of area BS5 (Second Campaign) and area BS6 (Second Campaign).

Medium and Large Mammals

As most species of medium and large mammals can be identified in the field, invasive methods were not used to survey this group. In this case, the survey was carried out using

only direct and indirect observation methods (Visual Census by Transect), camera traps, interviews and information collected by third parties.

Below is the description and sampling effort for all the campaigns.

- Transect census - for this methodology, the existing trails in each sampling area were considered. Censuses were carried out from 7.30am until 11.30am and at the end of the day, from 5.30pm until 7.30pm, totalling approximately 6 hours of searching per day. This methodology took into account indirect records such as faeces, carcasses, signs of marking, fur and footprints, as well as visual records using binoculars and a telezoom camera. It is worth noting that the records obtained on car journeys on the trails and main roads were also considered in this methodology.
- Camera traps - Camera traps are an efficient technique for detecting medium and large mammals, as they allow species to be photographed in the natural environment without them realising the presence of the equipment. The camera trap works by means of a motion sensor and even allows species to be recorded (video mode) (CHEIDA & RODRIGUES, 2010). For the sampling, 4 camera traps were installed in a location chosen by the researcher in each sampling area. The locations where the camera traps were installed were selected considering the environments and traces of medium and large mammals. To this end, priority was given to natural trails and paths used by the target species, in order to maximise the result of photographic captures.
- Interviews - This method was only used in a complementary way, since characterisation through species reports is less reliable, especially when considering residents who are less familiar with wildlife. Therefore, the reports of residents who are more familiar with wildlife were selected, favouring those who use forests and natural environments in their daily activities. The characteristics of the specimens indicated by the interviewees, in terms of fur, size and habits, were noted down during the interviews. Afterwards, the interviewees were shown images of the wild mammals in order to confirm the identity of the species. Photographic records sent in by rangers in areas BS4, BS5, BS6 and area BS2 were also considered. This method made it possible to record species that are observed in the region, but which are often not recorded during the campaigns due to the limited sampling time.
- Third Party Collections - This method consisted of records brought in by members of other teams and residents. Although third-party data is not included in statistical analyses, this method allowed species to be added to the local list.

Table 7.2.2.2.1.c shows the sampling effort for medium and large mammals

Table 7.2.2.2.1.c
Sampling effort for the transect census in mammal survey areas

Area	Census by transect	Total
BS1	07:30 until 11:30 17:30 until 19:30 = 6 hours x 2 campaigns	12 hours
BS2	07:30 until 11:30 17:30 until 19:30 = 6 hours x 2 campaigns	12 hours
BS3	07:30 until 11:30 17:30 until 19:30 = 6 hours x 1 campaign	6 hours
BS4	07:30 until 11:30 17:30 until 19:30 = 6 hours x 1 campaign	6 hours
BS5	07:30 until 11:30 17:30 until 19:30 = 6 hours x 2 campaigns	12 hours
BS6	07:30 until 11:30 17:30 until 19:30 = 6 hours x 2 campaigns	12 hours

Table 7.2.2.2.1.c
Sampling effort for the transect census in mammal survey areas

Area	Census by transect	Total
BS8	07:30 until 11:30 17:30 until 19:30 = 6 hours x 2 campaigns	12 hours
BS9	07:30 until 11:30 17:30 until 19:30 = 6 hours x 2 campaigns	12 hours
Total		**84 hours**

Birds

Three methods were used to diagnose terrestrial birds: transect census, Song Meter Micro and an invasive method, mist nets. Below are descriptions of the methods:

- Transect Census - This consists of recording all the birds seen or heard while the observer walked along the transect of each sampling area. This method made it possible to record birds in places where the visual and auditory field of the static observer would not reach (BLONDEL *et al*., 1970; BIBBY *et al*., 1992). For this method, the observer travelled along the main trail of each sampling area and consisted of identifying the acoustic and visual ones. In the event of doubtful identification, the *play-back* method was used to attract territorial birds. The census by transect was carried out at a speed of approximately 1 km/h in the early hours of the morning, from 7.30am until 11.30am, and then at the end of the day, from 5.30pm until 7.30pm, totalling 6 hours per day.
- Song Meter Micro - The bird community was sampled using bioacoustics recordings, which required the installation of specific equipment called the Song Meter Micro (*Wildlife Acoustics, Inc*.). The Song Meter Micro has an inbuilt omnidirectional microphone, making it possible to record the sounds emitted by bird species that use various forest strata for foraging. The device was installed at fixed points, defined in the field, and remained in the same position for the duration of its operation. The recordings were made using a sampling rate of 22,050 kHz, gain of +18 dB and a 16-bit ".wav" format. Sampling began at dawn and ended after sunset, with the Song Meter Micro programmed to record 60-minute recordings every hour. The Songmeter equipment was started at 6pm and remained active for 12 hours in each sampling zone. In this way, it was possible to record birds of both nocturnal and diurnal habits. To identify the acoustic recordings, the free Audacity software was used to separate files containing only noise. Manual identification was then carried out using RAVEN Pro, the Cornell Lab of Ornithology's (Cornell University) software for visualising, measuring and analysing sounds, and in the event of doubtful identification, bird sound collection databases were consulted, such as Xeno-Canto (https://xeno-canto.org/) and Merlin® (https://merlin.allaboutbirds.org/).
- Mist nets - Mist nets are widely used in bird survey studies (KARR, 1990; KEYES & GRUE, 1982; GOSLER, 2004). For this methodology, three (3) mist nets measuring 12 m x 2.5 m were installed and kept open from 07:00 until 11:00 and at the end of the day from 17:00 until 18:00, totalling around 5 hours of mist netting per day. The nets were checked every 50 minutes.

Table 7.2.2.2.1.d shows the sampling effort for birds.

Table 7.2.2.2.1.d
Sampling efforts by mist *nets*, transect census and Song Meter Micro

Area	Mist nets	Census by transect	Song Meter Micro	Total
BS1	3 mist nets (07:00 to 11:00 and 17:00 to 18:00) x 1 night x 2 campaigns	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	5 hours x 2 campaigns = 10 hours and 3 active networks = 30 hours/network and 10 hours of census per transect and 24 hours of Song Meter Micro
BS2	3 mist nets (07:00 to 11:00 and 17:00 to 18:00) x 1 night x 2 campaigns	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 2 campaigns	6pm to 6am = 12 hours x 1 campaign	5 hours x 2 campaigns = 10 hours and 3 active networks = 30 hours/network and 10 hours of census per transect and 24 hours of Song Meter Micro
BS3	Not installed	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 1 campaign	6pm to 6am = 12 hours x 1 campaign	5 hours of census per transect and 12 hours of Song Meter Micro
BS4	Not installed	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 1 campaign	6pm to 6am = 12 hours x 2 campaigns	5 hours of census per transect and 12 hours of Song Meter Micro
BS5	3 mist nets (07:00 to 11:00 and 17:00 to 18:00) x 1 night x 2 campaigns	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	5 hours x 2 campaigns = 10 hours and 3 active networks = 30 hours/network and 10 hours of census per transect and 24 hours of Song Meter Micro
BS6	3 mist nets (07:00 to 11:00 and 17:00 to 18:00) x 1 night x 2 campaigns	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	5 hours x 2 campaigns = 10 hours and 3 active networks = 30 hours/network and 10 hours of census per transect and 24 hours of Song Meter Micro
BS8	3 mist nets (07:00 to 11:00 and 17:00 to 18:00) x 1 night x 2 campaigns	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	5 hours x 2 campaigns = 10 hours and 3 active networks = 30 hours/network and 10 hours of census per transect and 24 hours of Song Meter Micro
BS9	3 mist nets (07:00 to 11:00 and 17:00 to 18:00) x 1 night x 2 campaigns	07:30 until 11:30 and 17:30 until 18:30 = 5 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	5 hours x 2 campaigns = 10 hours and 3 active networks = 30 hours/network and 10 hours of census per transect and 24 hours of Song Meter Micro
Total				**180 hours/network and 70 hours of census per transect and 168 hours of Song Meter Micro**

In addition to the BS (*Biodiversity Sample*) points for birds, a ***Birds Point*** was defined, located next to the Vitória Lagoon. This required the use of binoculars and a telephoto camera. Sampling was carried out during the day, from 8am until 10am, in a bird campaign.

Herpetofauna

The herpetofauna group was sampled in the sampling areas using auditory and visual census methods and songmeter for amphibians. The methods and sampling efforts are described below.

- Auditory and visual census - this method consists of careful searches on the trails (BLOMBERG & SHINE, 2006), noting down all the animals of the herpetofauna group observed, with a special focus on species in the tree layer and leaf litter. The time-limited search made it possible to assess the richness and abundance of records. The team began the survey by taking notes and/or capturing the species of herpetofauna observed among tree roots, leaf litter and in the upper vegetation, such as bromeliads and tree branches present in the area, in order to record all the individuals in the sample plot. Acoustic recordings were also included in this sampling (NELSON & GRAVES, 2004). The visual and auditory census was carried out from 6pm until 8pm, totalling 2 hours of searching for amphibians and other species of herpetofauna per sampling area. Hand-held and head torches were used to help in the twilight period.
- Song Meter Micro - The amphibian community was sampled by means of bioacoustics recordings, requiring the installation of specific equipment called Song Meter Micro (Wildlife Acoustics, Inc.). The Song Meter Micro has an inbuilt omnidirectional microphone, making it possible to record sounds emitted by amphibian species. This device was installed at fixed points, defined in the field, and remained in the same position throughout its operation. The recordings were made using a sampling rate of 22,050 kHz, +18 dB gain and a 16-bit ".wav" format. Sampling began at dawn and ended after sunset, with the Song Meter Micro programmed to record 60-minute recordings every hour. The Song Meter Micro was started at 6pm and remained active for 12 hours in each sampling zone.
- Third Party Collaboration (TC) - Specimens found by other members of the fauna survey team were considered Third Party Collaboration. As with the other groups, the sighting of herpetofauna specimens by researchers from other faunal groups allowed for a better sampling of the area, making it possible to observe specimens that by chance had not been recorded by the group's specialist, regardless of whether they were dead or not. In addition, specimens found dead (e.g. run over) by local people were recorded using this method.

Table 7.2.2.2.1.e shows the sampling effort for the herpetofauna.

Table 7.2.2.2.1.e
Auditory and visual census sampling efforts for herpetofauna and Song Meter Micro

Area	Auditory and visual census	Song Meter Micro	Total
BS1	6pm to 8pm = 2 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	4 hours of auditory and visual census and 24 hours of Song Meter Micro
BS2	6pm to 8pm = 2 hours x 1 campaign	6pm to 6am = 12 hours x 1 campaign	4 hours of auditory and visual census and 24 hours of Song Meter Micro
BS3	6pm to 8pm = 2 hours x 1 campaign	6pm to 6am = 12 hours x 1 campaign	2 hours of auditory and visual census and 12 hours of Song Meter Micro
BS4	6pm until 8pm = 2 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	2 hours of auditory and visual census and 12 hours of Song Meter Micro
BS5	6pm until 8pm = 2 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	4 hours of auditory and visual census and 24 hours of Song Meter Micro
BS6	6pm until 8pm = 2 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	4 hours of auditory and visual census and 24 hours of Song Meter Micro
BS8	6pm until 8pm = 2 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	4 hours of auditory and visual census and 24 hours of Song Meter Micro
BS9	6pm until 8pm = 2 hours x 2 campaigns	6pm to 6am = 12 hours x 2 campaigns	4 hours of auditory and visual census and 24 hours of Song Meter Micro
Total			**28 hours of auditory and visual census and 168 hours of Song Meter Micro**

The following sections present the results by sample group. The photographic record is presented in **Annex 6**.

7.2.2.2.2
Terrestrial Mammals

The assessment of the terrestrial mammals detected 55 species from 10 orders and 23 families, as shown in **Table 7.2.2.2.2.a** in **Annex 7** of this ESIA. The orders Artiodactyla (even-toed ungulates) and Carnivora (carnivores) presented the highest richness of species, counting 17 species each, while the orders Eulipotyphla (insectivores and true shrews), Macroscelidea (elephant-shrews), Perissodactyla (horses and rhinoceroses), Proboscidea (elephants) presented only one species each (**Figure 7.2.2.2.2.a**). The family Bovidae (antelopes, cattle, gazelles, goats, sheep, and relatives) presented 13 species, followed by Cercopithecidae (Old World monkeys), with six species, while 13 families presented one species each (**Figure 7.2.2.2.2.b**).

The interviews, one of the methods used to survey the mammalian fauna, detected 43 species of terrestrial mammals, of which 20 were exclusive. A total of 33 species were detected by standardised methods, being six exclusives from camera trapping and six from direct and indirect observations. There were very few occasional encounters, which detected four species, none of them exclusive of this method (**Figure 7.2.2.2.2.c**).

Figure 7.2.2.2.2.a
Number of species (richness) of the terrestrial mammals detected in each mammalian Order

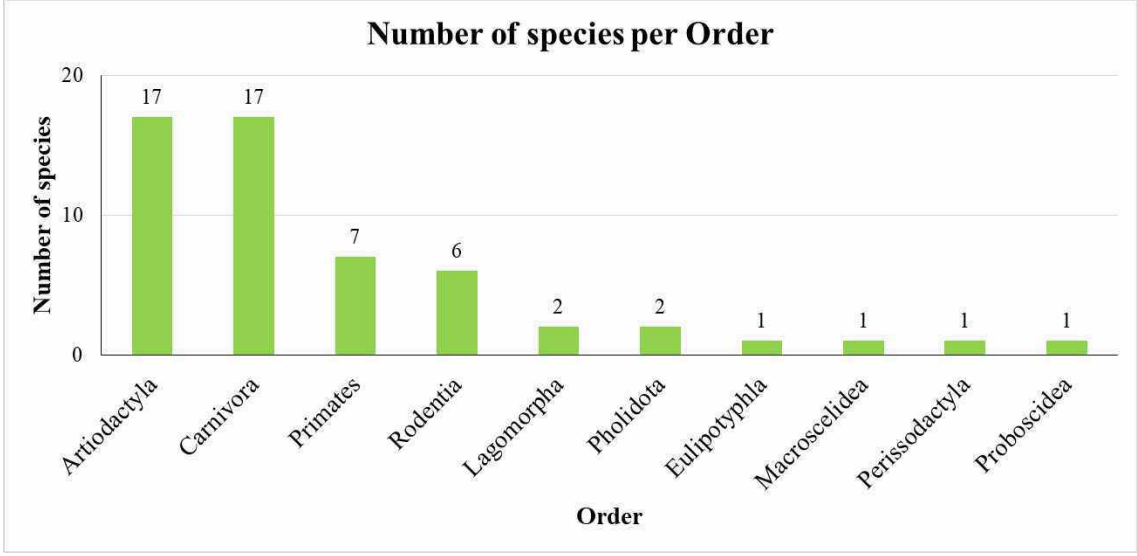


Figure 7.2.2.2.2.b
Number of species (richness) of the terrestrial mammals detected in each mammalian Family

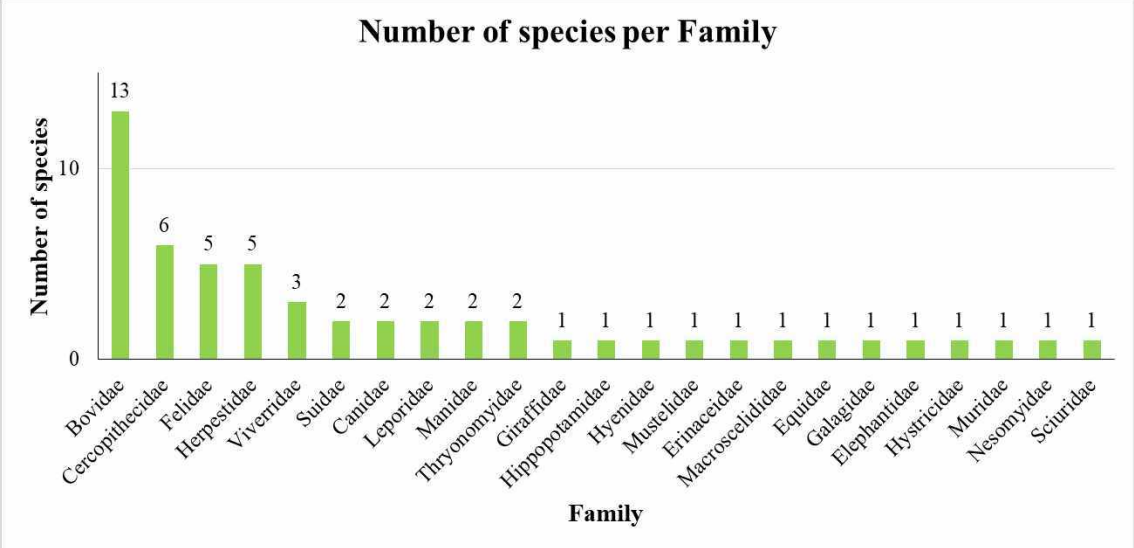


Figure 7.2.2.2.2.c
Number of species (richness) of terrestrial mammals detected by each sampling method, showing the shared and exclusive richness of each one

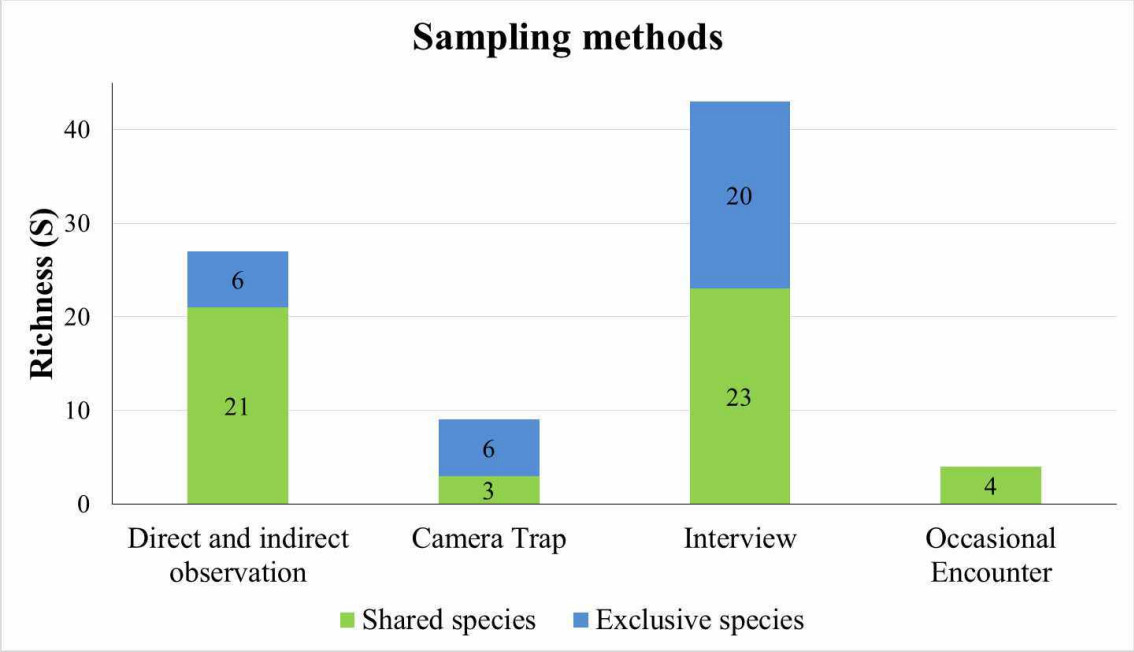


Table 7.2.2.2.2.a in **Annex 7** shows the species list detected by all the methods applied during the survey of terrestrial mammals. For further analyses, the records obtained through non-standardised methods, such as the interviews and occasional encounters, were not included. Besides, the records obtained in sampling sites BS3 and BS4 were not included in any analysis considering richness, abundance and seasonality. The exclusion of these records obtained at these sites and those from non-standardised methods is needed because the statistical methods need data collected in both seasons (dry/wet) and using standardised sampling (direct and indirect observation/camera traps).

Threatened Species, Migration, Cinegetics, and Endemism

The presence of species included in some risk category of IUCN Red List was confirmed through the active survey and camera trapping during the assessment. Among the Near Threatened, the species detected were the Cape Buffalo (*S. caffer*) and the Plains Zebra (*Eqqus quagga*). The species considered Vulnerable were the Lion (*Panthera leo*), the Leopard (*Panthera pardus*), the Masai Giraffe (*Giraffa tippelskirchi*), the Ugandan Crested Mangabay (*Lophocebus ugandae*) and the Angolan Colobus (*Colobus angolensis*). There were also species included in the Endangered category, as the African Savanna Elephant (*L. africana*) and the Ashy Red Colobus (*Piliocolobus tephrosceles*).

Concerning the taxa listed in the CITES Appendices, the species included in the Appendix I (lists species that are the most endangered and CITES prohibits their international commercial trade) were the Leopard (*P. pardus*) and the African Savanna Elephant (*L. africana*). In the Appendix II (species that are not necessarily now threatened with

extinction but that may become so if trade is not regulated) were included the Lion (*P. leo*), the Caracal (*C. caracal*), the Masai Giraffe (*G. tippelskirchi*), the Olive Baboon (*P. anubis*), the Ashy Red Colobus (*P. tephrosceles*), the Angolan Colobus (*C. angolensis*), the Vervet Monkey (*Chlorocebus pygerythrus*), the Blue Monkey (*Cercopithecus mitis*), and the Ugandan Crested Monkey (*L. ugandae*); in the Appendix III (species included under request of countries that regulate their trades but need cooperation of other countries to prevent unsustainable or illegal exploitation), it was included only the African Civet (*C. civetta*).

The Lion (*Panthera leo*), one of the most iconic carnivores of the African savanna, occupies a wide range of habitats, absent only from the rainforests and the interior of Sahara Desert (NICHOLSON *et al*., 2024) and present a wide distribution across Tanzania (KINGDON *et al*., 2013; FOLEY *et al*., 2014). Lions are found in almost all mainland Tanzanian National Parks (except Gombe NP) and have been seldom spotted nearby areas with high human habitation (FOLEY *et al*., 2014). The species is included in Appendix II of the Convention for Migratory Species (CMS), because some of its populations cyclically cross international borders. It is documented their movement seem to follow the migration movements of prey during the wet season and respond to prey abundance on an annual scale (HOPCRAFT *et al*., 2005; SUNQUIST & SUNQUIST, 2009; LOVERIDGE *et al*., 2009). The species is threatened mainly by habitat loss, which has led to the prey depletion and reduction and isolation of its subpopulations, which may experience loss of genetic diversity. Besides, the conversion of suitable habitats into farming and urban areas promotes the conflicts with human populations, increasing the retaliatory killing (NICHOLSON *et al*., 2024). The trophy hunting of lions is regulated in several sub-Saharan countries, but some areas present offtakes in higher levels than those stablished by regulation, suggesting that the trophy hunting may become locally unsustainable (NICHOLSON *et al*., 2024).

The Leopard (*Panthera pardus*) occupies a very wide range of habitats, from arid deserts to rainforests, from plains to mountain habitats, as well as coastal regions (KINGDON *et al*., 2013; STEIN *et al*., 2024). They are also tolerant to habitat conversion and human occupation, once cover and prey are available (KINGDON *et al*., 2013). Leopards are present in all mainlands Tanzanian Game and Nature Reserves, and almost all the National Parks (except Gombe NP and Rubondo NP) (FOLEY *et al*., 2014). The species is considered as Vulnerable by IUCN (2024) and are included in the Appendix I of CITES (2024). Although the species' tolerance to human occupations, it is also one of the main threats to the leopards. The loss of suitable habitats promotes the fragmentation of population, reduction of prey availability, and increases the conflicts with humans, leading to retaliatory killing and pouching (STEIN *et al*., 2024). It is reported the species preys on domestic dogs around cities such as Dar es Salaam and Arusha in Tanzania (FOLEY *et al*., 2024). The bushmeat hunting by humans can also negatively affect the leopard populations in rainforest areas by drastically reducing the prey stock (KINGDON *et al*., 2013).

The primate Ugandan Crested Mangabey (*Lophocebus ugandae*), formerly a subspecies of the Grey-cheeked Mangabey (*L. albigena*) is included in the Vulnerable category by IUCN (2024), as *L. albigena ugandae* (OLUPOT, 2020). The species has no proper

assessment in CITES, being considered as part of *L. albigena*, which is included in Appendix II. The species' known distribution is restricted to northern Tanzania in the Minziro Reserve, where it forms a contiguous population with individuals from Uganda (FOLEY *et al*., 2014). The Ugandan Crested Mangabey (*L. ugandae*) is found in lowland forests, living in sex-mixed groups with 6-30 individuals, and commonly associates with other primates, such as the Red-tailed Monkeys (*Cercopithecus ascanius*) and Mitis Monkeys (*Cercopithecus mitis*) (FOLEY *et al*., 2014). The Ugandan Crested Mangabey is almost-strictly arboreal and, in mosaic or altered landscapes, it is more commonly found where the tree densities are higher (KINGDON *et al*., 2013). As a forest-dweller, the species is mostly threatened by the loss of suitable habitats due to logging and conversion to exotic tree plantations (KINGDON *et al*., 2013; OLUPOT, 2020).

The Angolan Colobus (*Colobus angolensis*) is an arboreal monkey, occurring mainly in lowland evergreen and semi-deciduous forests, including swamps and seasonally flooded areas (KINGDON *et al*., 2013). The species forms small groups (2-20 individuals), but different groups may temporarily aggregate into large groups of hundreds of individuals (FOLEY *et al*., 2014). It is listed as Vulnerable by IUCN (2024) and included in the Appendix II of CITES (2024), indicating that the species may be threatened with extinction if trade is not regulated. The species is threatened by the loss of forested habitats due to deforestation, degradation, and fragmentation, and it is considered the major menace in Tanzania (KINGDON *et al.*, 2013). Hunting for meat is also a threat for the Angolan Colobus, and some populations seem to be extinct in suitable habitats due to this activity (DE JONG *et al*., 2020).

The Ashy Red Colobus (*Piliocolobus tephrosceles*) occurs in a wide variety of forest types, including degraded secondary forests, being more abundant in old-growth, evergreen forests (KINGDON *et al*., 2013; STRUHSAKER & TING, 2020). It presents a very disrupted distribution, with records in southern Ugandan and northwestern Tanzania (KINGDON *et al*., 2013; STRUHSAKER & TING, 2020). During the field sampling of the first campaign, it was observed a large group of the species in the site BS4, with ca. 280 individuals, in a forest fragment near the road. Foley *et al*. (2014) mentions that this primate might be distributed in relict forests in western Tanzania. The species is considered Endangered by IUCN (2024), and included in the Appendix II from CITES (2024). As the other forest-dweller monkeys mentioned above, the Ashy Red Colobus is highly threatened by habitat loss due to logging or conversion to agricultural land (STRUHSAKER & TING, 2020). In places where there are communities of Chimpanzees (*Pan troglodytes*), the colobus is heavily predated, causing great losses annually (KINGDON *et al*., 2013; STRUHSAKER & TING, 2020).

The Masai Giraffe (*Giraffa tippelskirchi*), formerly considered a subspecies of the Northern Giraffe (*Giraffa camelopardalis*), is widely distributed in Tanzania and parts of Kenya, through open *Acacia* and miombo woodlands, bushlands, and grasslands (FOLEY *et al*., 2014; BOLGER *et al*., 2019). The populations in Kenya and Tanzania currently represent a vestige of their former range (KINGDON et al., 2013). The species is considered Endangered by IUCN (2024; as *G. camelopardalis tippelskirchi*), but has not been assessed by CITES yet. The illegal pouching and land use change are listed as the main threats to the Masai Giraffe, and it is common to find its body parts being traded as

traditional medicine items or used as ornaments and souvenirs (BOLGER et al., 2019). Among the conservation efforts, there are the prohibition of its hunting and killing in Kenya and Tanzania, and reintroduction projects (KINGDON *et al*., 2013; BOLGER *et al*., 2019).

The African Savanna Elephant (*Loxodonta africana*) is the largest living terrestrial mammal. The species occurs in virtually every habitat type (KINGDON *et al*., 2013; GOBUSH *et al*., 2022). Despite its wide range of occurrence, the species has been experiencing a process of retraction and fragmentation of its distribution (KINGDON *et al*., 2013; GOBUSH *et al*., 2022). KINGDON *et al*. (2013) mentions that the Tanzanian populations, together with those from Kenya, stand as "strongholds" for the elephants from Eastern Africa, because of their greater numbers. Recent official reports show that the species had experienced a drastic reduction from mid-2000s to mid-2010s, with some stabilisation in numbers in late 2010s (MNRT, 2023). The Savanna Elephant is capable of moving long distances in search for resources, such as water, presenting different degrees of migration patterns that may vary with seasonality and local water availability (KINGDON *et al*., 2013). The protection and conservation of wildlife corridors connecting protected areas is one of the instruments to promote the viability of elephant populations in Tanzania (MNRT, 2022, 2023). Lohay *et al*. (2020) has shown that the degradation and fragmentation of these connections may isolate the Tanzanian Savanna Elephant populations, thus affecting their genetic diversity.

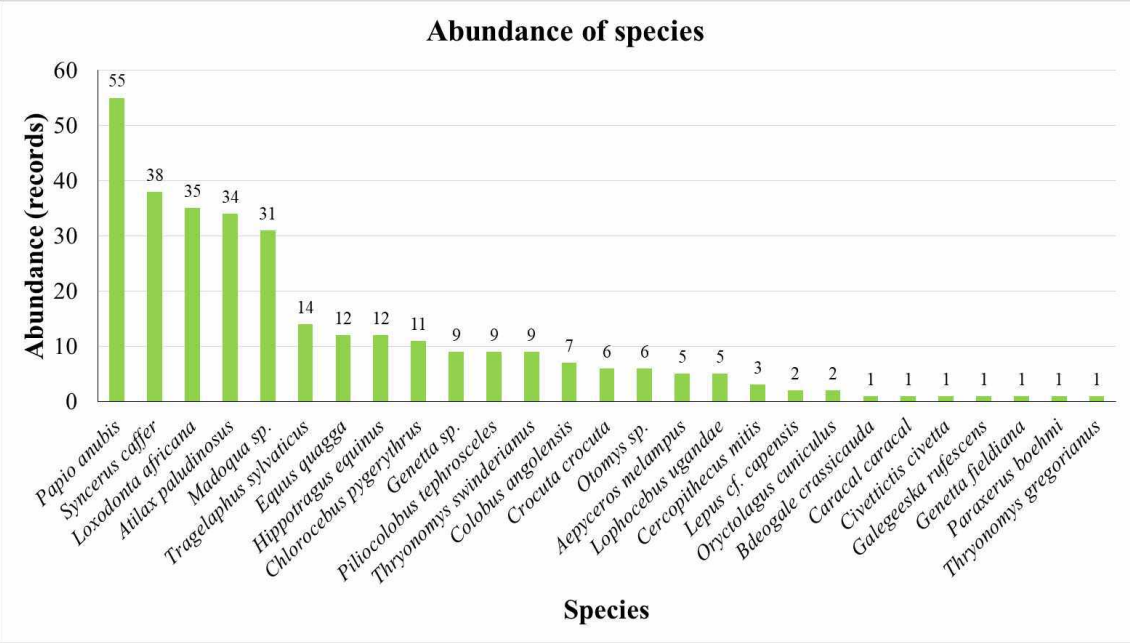
As observed in the literature, the use as food source is one of the most common impacts caused by the human-wildlife coexistence in the region, affecting 36 of the 55 taxa detected (**Table 7.2.2.2.2.a**). The bushmeat harvesting and consumption is very complex subject, that involves several factors related to the biology of the targeted species, historical and cultural aspects, economic and political issues, as well as the interaction among them (MBOTIJI, 2002). The consumption of bushmeat is one of the major problems in western Tanzania and seems to vary in each region, depending on the studied community, availability and prices of food items (such as eggs and pork), and landscape particularities (vegetation type, seasonality, local fauna) (MARTIN *et al*., 2012). During this study, it was found some carcasses with signs of hunting activity, such as the absence of predation marks (for example, in BS4 and BS6).

Concerning the endemism, most of the species detected in field and through interviews present large distribution ranges and are not habitat specialists. As observed in the secondary data, none of the endemic species from Tanzania were detected. It deserves attention that the presence of the Dik-dik, (*Madoqua* sp.), which could not be identified at the species level, was detected in sites (BS8 and BS9) near the distribution ranges of the Ugogo Dik-dik (*Madoqua thomasi*), which is an endemic species of Tanzania. The Ugandan Crested Mangabey (*Lophocebus ugandae*) is not an endemic species from Tanzania but presents a very restricted distribution range in the forests that encompass the southern Uganda and northwestern Tanzania, and may deserve attention.

Richness and Abundance

Considering only the sampling with standardised methods in the areas visited in both wet and dry season, there were 312 records of 27 species of terrestrial mammals. According to the **Figure 7.2.2.2.2.d** below, the Olive Baboon (*Papio anubis*) was the most abundant species, with 55 records (17.6%), followed by the Cape Buffalo (*Syncerus caffer*; N= 38, 12.2%), the African Savanna Elephant (*Loxodonta africana*; N= 35, 11.2%) and the Marsh Mongoose (*Atilax paludinosus*; N= 34, 10.9%). Several species presented only one record (N= 1, 0.3%), namely the Bushy-tailed Mongoose (*Bdeogale crassicauda*), the Caracal (*Caracal caracal*), the African Civet (*Civettictis civetta*), the Rusty-spotted Genet (*Genetta fieldiana*), the Rufous Elephant-shrew (*Galegeeska rufescens*), the Bush Squirrel (*Paraxerus boehmi*), and the Lesser Cane Rat (*Thryonomys gregorianus*).

Figure 7.2.2.2.2.d
Ranking of abundance (number of records) of the terrestrial mammals detected through the standardised methods

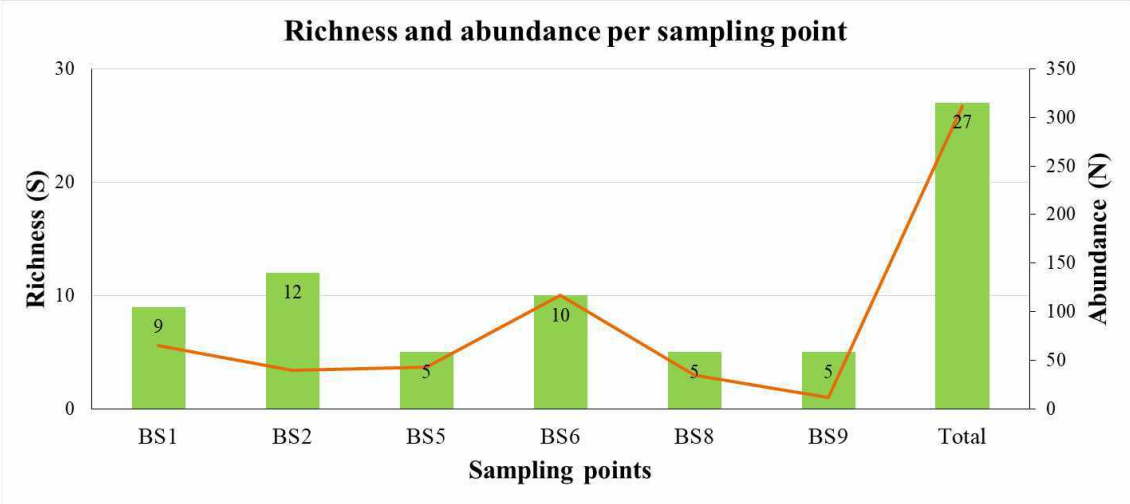


Concerning the sampling sites, BS2 was the richest, with 12 species, followed by BS6 (S= 10), while BS5, BS8 and BS9 presented five species each. Although the higher richness, the BS2 site presented an intermediate abundance of records (N= 40, 12.8%), similar to BS5 (N= 43, 13.8%). The BS6 site presented the highest abundance (N= 117, 37.5%), while BS9 showed the lowest number of records (N= 12, 3.8%) (**Figure 7.2.2.2.2.e**). The majority of the species detected (S= 17) occurred in only one sampling site. The areas BS1 and BS2 showed five exclusive species each, while BS8 and BS9 only one each.

Most of the primates occurred exclusively in one sampling point (BS1: *C. angolensis*, *C. mitis*, *L. ugandae*; BS5: *P. tephrosceles*), as well as the carnivores (BS2: *B. crassicauda*, *G. fieldiana*; BS5: *C. caracal*; BS6: *C. civetta*). The Roan Antelope (*H. equinus*) was the

only exclusive species at BS8, and the Rufous Elephant-shrew (*G. rufescens*) at BS9 site. Some shared species were detected in most sampling points, as the Marsh Mongoose (*A. paludinosus*; BS1, BS2, BS5, BS8, BS9), the Dik-dik (*Madoqua* sp.; BS2, BS5, BS6, BS8, BS9), and the Olive Baboon (*P. anubis*; BS1, BS5, BS6, BS8). Others occured in two sites, as the Impala (*A. melampus*; BS2, BS6), the Vervet Monkey (*C. pygerythrus*; BS1, BS2), the Spotted Hyena (*C. crocuta*; BS6, BS9), the Genet (*Genetta* sp.; BS2, BS6), the Vilei Rat (*Otomys* sp.; BS8, BS9), and the Cape Bushbuck (*T. sylvaticus*; BS2, BS6).

Figure 7.2.2.2.2.e
Richness and abundance for each sampling point. The bars represent the richness (number of species) and the lines the abundance (number of records)



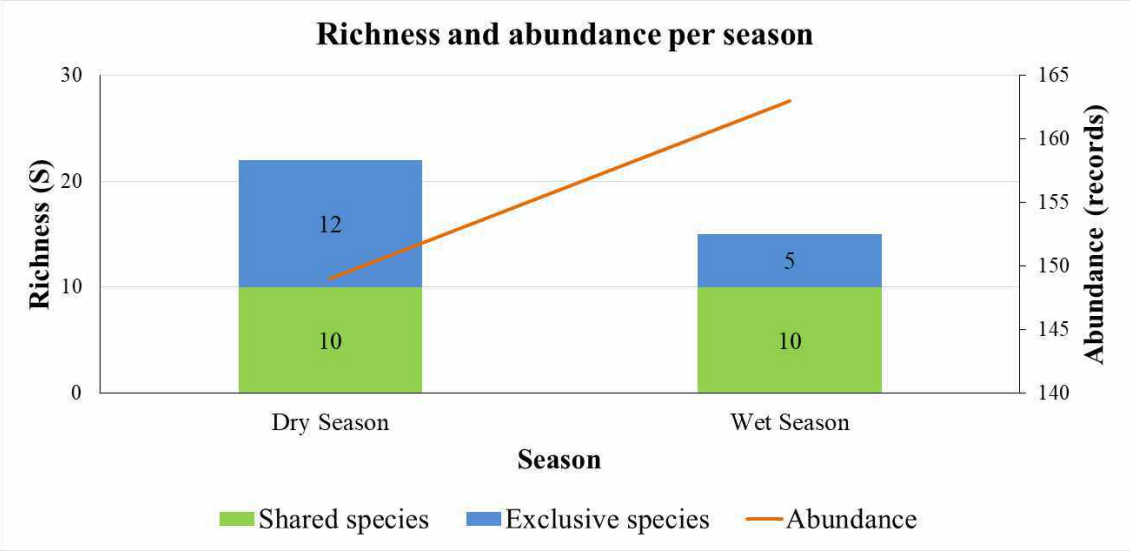
The Olive Baboon (*P. anubis*) was the most abundant species at BS1 (N= 26) and BS5 (N= 19) but presented only one record in BS6 (**Table 7.2.2.2.2.a**). The Dik-dik (*Madoqua* sp.) presented the highest abundance in BS2 (N= 18), and presented intermediate number of records in BS6 (N= 6) and BS8 (N= 4). The Cape Buffalo (*S. caffer*) and the African Savanna Elephant (*L. africana*) presented the highest abundances in BS6 (N= 38 and N= 29, respectively). In BS8, the Roan Antelope (*H. equinus*) was the most abundant. As expected, the species with highest abundances in each area were those that usually form herds or have gregarious habits.

Seasonality

Concerning the seasonality, richness and abundance presented different patterns. The sampling in the dry season presented the highest richness (S= 22) and lowest abundance (N= 149) when compared to the wet season (S= 15; N= 163) (**Figure 7.2.2.2.2.f**). Most of the species of terrestrial mammals were detected in a single season. The dry season presented 12 exclusive species (*A. melampus*, *B. crassicauda*, *C. mitis*, *C. angolensis*, *Genetta* sp., *G. fieldiana*, *Lepus* cf. *capensis*, *L. ugandae*, *Otomys* sp., *P. boehmi*, *T. gregorianus*, *T. swinderianus*) and the wet season presented only five (*C. caracal*, *C. civetta*, *G. rufescens*, *O. cuniculus*, *P. tephrosceles*). Some species presented noticeably

higher abundances in wet season, as the Spotted Hyena (*C. crocuta*), the Olive Baboon (*P. anubis*), the African Savanna Elephant (*L. africana*), and the Cape Buffalo (*S. caffer*); while others did so in dry season, as the Plains Zebra (*E. quagga*) and the Cape Bushbuck (*T. sylvaticus*).

Figure 7.2.2.2.2.f
Richness and abundance by season for total sampling. The bars represent the richness (number of species) and the lines the abundance (number of records)



When observing the distribution of richness and abundances by season in each area, it is not possible to establish a common pattern. Some sampling points presented highest richness and abundance during dry season (BS1, BS8, BS9), while only BS5 did so in wet season; other sites presented reverse patterns of richness and abundance between seasons, like BS2 and BS6 (**Figure 7.2.2.2.2.g**).

Figure 7.2.2.2.2.g
Richness and abundance of terrestrial mammals by season for each sampling point. The bars represent the richness (number of species) and the lines the abundance (number of records)

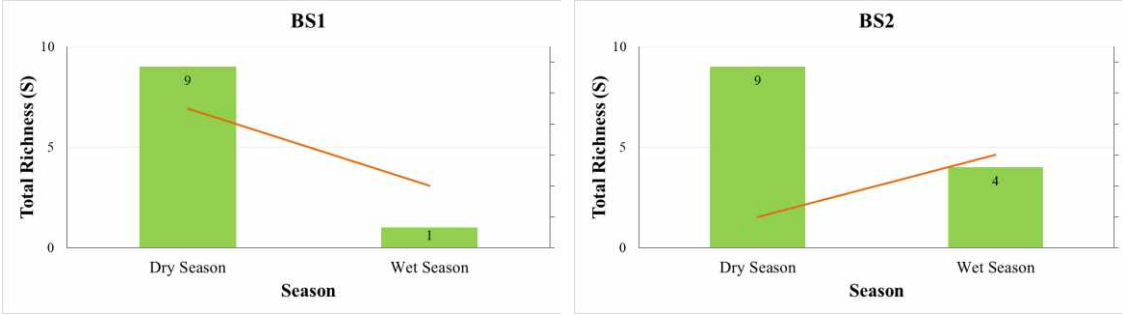
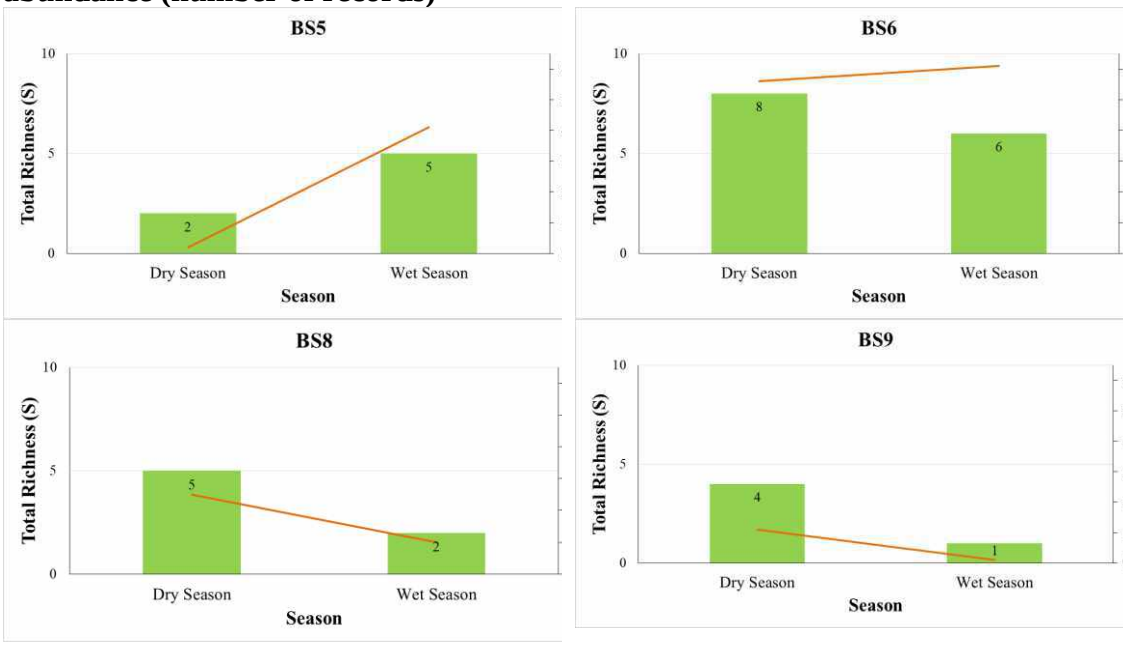


Figure 7.2.2.2.2.g
Richness and abundance of terrestrial mammals by season for each sampling point. The bars represent the richness (number of species) and the lines the abundance (number of records)



Sampling sufficiency

The rarefaction and the accumulation curves showed an ascending pattern, indicating the total richness of terrestrial mammals is yet to be achieved (**Figure 7.2.2.2.2.h**).

The rarefaction and the accumulation curves of individual sampling points showed the general ascending patterns, with noticeable variation among them. The site BS2 showed the most ascending patterns, suggesting its high potential of recording new taxa (**Figure 7.2.2.2.2.i**), while BS8 presented a very flattened curve, indicating its low probability of finding new species. It is important to stress that these curves are based on two sampling events (dry season/wet season) and could change their patterns if data from new campaigns are added in the future.

Figure 7.2.2.2.2.h
Rarefaction curve (blue line) and accumulation curve (red line) for terrestrial mammals sampled in the dry and wet seasons

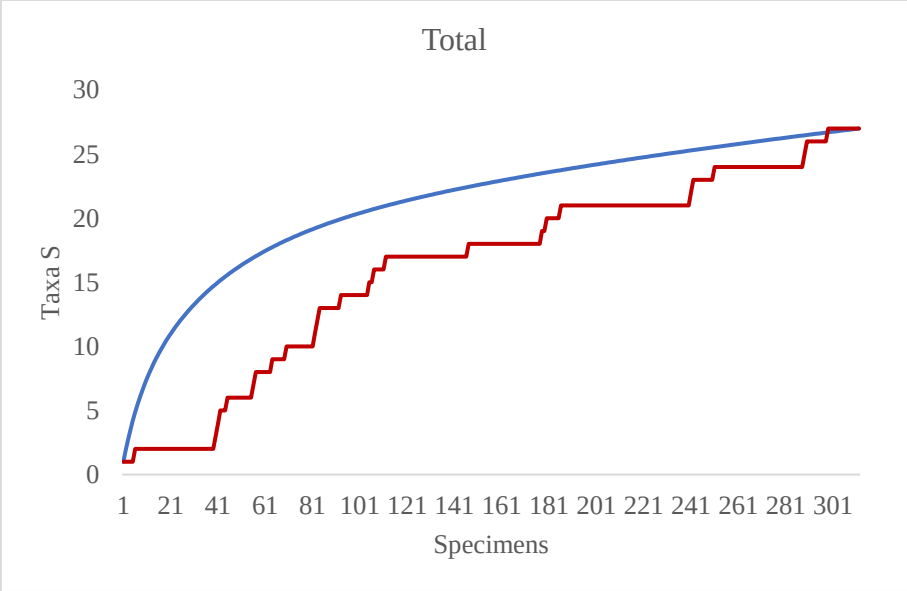


Figure 7.2.2.2.2.i
Rarefaction curve (blue line) and accumulation curve (red line) of each sampling point for the terrestrial mammals sampled in dry and wet seasons

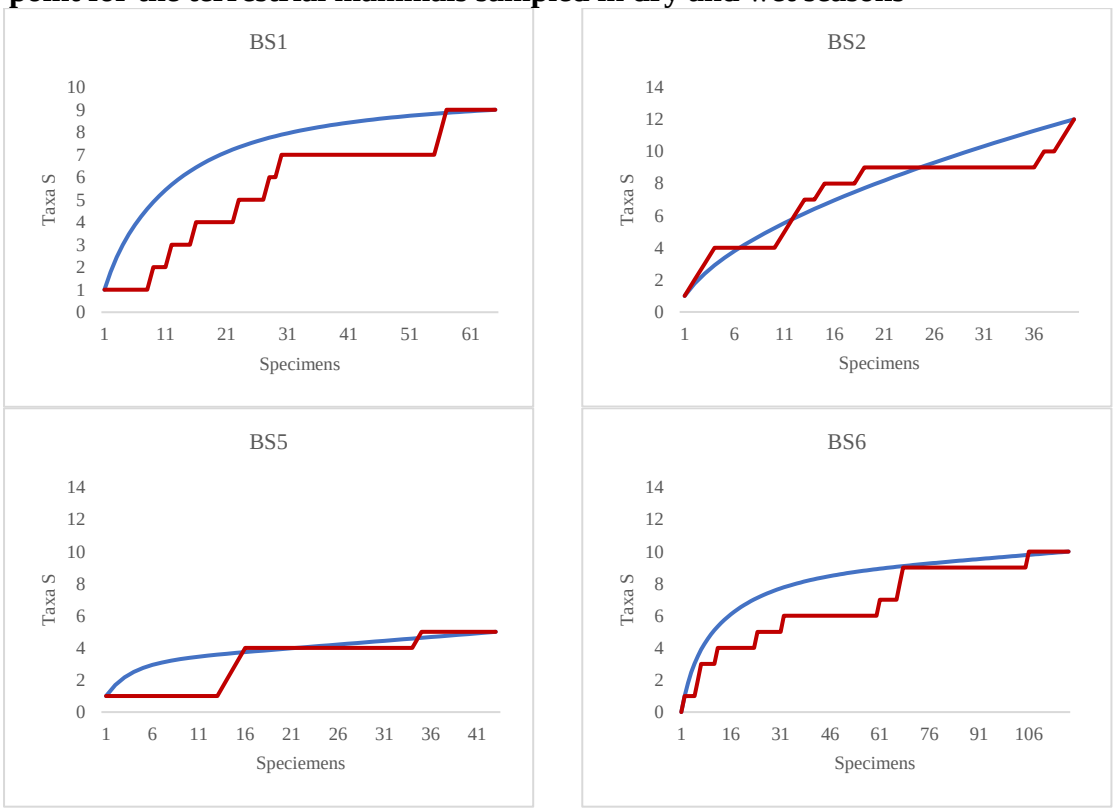
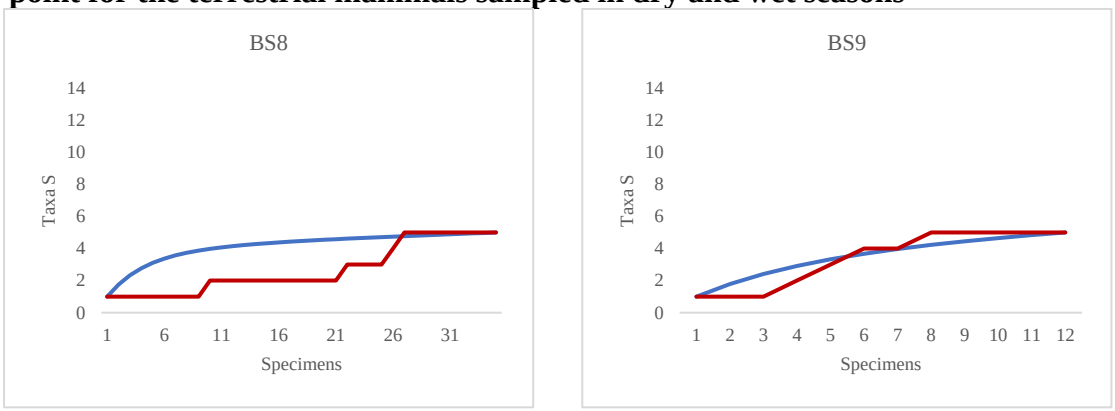


Figure 7.2.2.2.2.i
Rarefaction curve (blue line) and accumulation curve (red line) of each sampling point for the terrestrial mammals sampled in dry and wet seasons



Diversity indexes

The richness estimators showed different patterns among the sampling sites. As expected, the area BS2 showed the highest difference between the observed (S= 12) and estimated richness (Chao 2= 25.75), followed by BS1 and BS9 (**Table 7.2.2.2.2.b**). The richness estimators obtained for the areas BS5, BS6 and BS8 were closer to the number of species observed (S). The site BS2 also presented the highest diversity indexes (Fisher's alpha= 5.812; H'= 2.173), a result of both the number of unique records (seven species with a single record) and the distribution of abundances among species. The areas BS5, BS8 and BS9 presented the same richness (S= 5), but BS9 showed higher Fisher's alpha value (3.218), possibly a result of the much lower abundance (N= 12), which could increase the bias of the single records (MAGURRAN, 2013). Although less influenced by the single records, the Shannon indexes showed a similar pattern among the areas, indicating that BS2 was the site where the highest diversity is observed. In general, the equitability calculated for each area shows a tendency for even distribution of abundance among species, where the highest value was observed in BS9 (>1), as a result of the low number of records (N= 12).

Concerning the total sampling, both richness estimators indicate that the observed richness (S= 27) is lower than the expected, which were higher than 30 species (**Table 7.2.2.2.2.b**. The Shannon index observed (H'= 2.753) fits into the expected results for sampling in the wild for terrestrial vertebrates (MAGURRAN, 2013). The Fisher's alpha obtained for total sampling is very close to the number of species with single records, which was seven. The equitability (0.835) showed similar level of that observed for most areas (BS1-BS6: 0.820-0.875).

Table 7.2.2.2.2.b
Observed richness, abundance, richness estimators, diversity indexes and equitability of the sampling sites and total sampling obtained for the terrestrial mammals

	Sampling sites						Total
	BS1	BS2	BS5	BS6	BS8	BS9	
Observed richness (S)	9	12	5	10	5	5	27
Abundance (records)	65	40	43	117	35	12	312
Estimated S (Chao 2)	16	25,75	5,50	11,50	5,50	10,00	33,18
Estimated S (Jackknife 1)	13	17,50	6,50	13,00	6,50	7,50	35,50
Diversity (Fisher's alpha)	2,834	5,812	1,465	2,616	1,596	3,218	7,093
Diversity (Shannon's H')	1,885	2,173	1,319	1,899	1,479	1,660	2,753
Equitability (Pielou's J')	0,858	0,875	0,820	0,825	0,919	1,031	0,835

Similarity

The similarity analyses showed similar patterns with both Bray-Curtis and Jaccard indexes (**Figures 7.2.2.2.2.j** and **7.2.2.2.2.k**). Both dendrograms presented a cluster containing the areas BS2 and BS6, and another cluster grouping the areas BS5, BS8 and BS9. The position of BS1 varied between the two approaches. The cophenetic correlation coefficients were high for both indexes (Bray-Curtis: 0.8137; Jaccard: 0.9251), showing the results of similarity analyses are well supported.

The areas BS2 and BS6 presented three exclusively shared species, the Impala (*A. melampus*), the Genet (*Genetta* sp.), and the Cape Bushbuck (*T. sylvaticus*), being the areas that most share exclusive taxa. Regarding the area BS1, it presented more than half of its species (five out of nine) as exclusive taxa, while the remaining species were shared with areas from different clusters (**Table 7.2.2.2.2.a**), explaining the changes in its position in each dendrogram. The remaining areas (BS5, BS8, BS9) showed different combinations of shared species and their abundances, and their grouping in one cluster could be interpreted as a segregation from the BS2+BS6 cluster, both in terms of richness (Jaccard) and abundance (Bray-Curtis).

The area BS1 presented most of the records of arboreal primates, some of them exclusive of the site (*C. mitis*, *C. angolensis*, *L. ugandae*). The presence of these primates in this sampling point could be related to its proximity to the Minziro Forest Nature Reserve (Minziro FNR), at northwestern Tanzania. The BS1 has some forested areas with little disturbance, which may be positive for these primates. These species depend on the higher arboreal strata (KINDGON *et al*., 2013; FOLEY *et al*., 2014). Their presence was also detected in Minziro FNR (ROVERO *et al*., 2018).

Figure 7.2.2.2.2.j
Dendrogram showing the similarity among sampling points based on the Bray-Curtis similarity index based on abundances

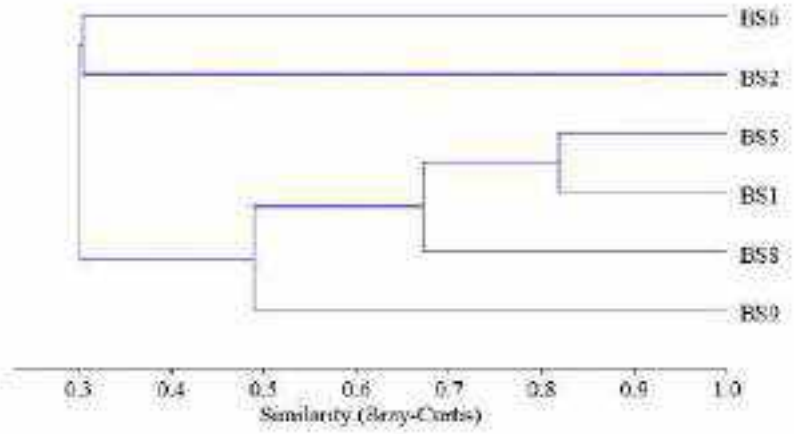
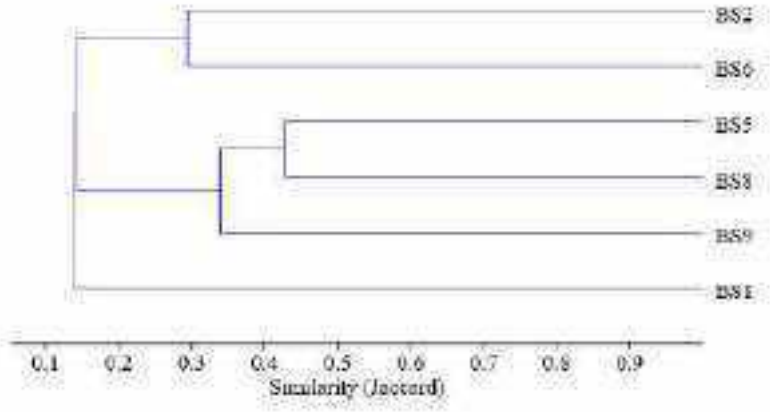


Figure 7.2.2.2.2.k
Dendrogram showing the similarity among sampling points based on the Jaccard similarity index based on species' occurrences



It is well known that some mammalian species carry out long-distance migrations in search of areas with more resources, such as water, commonly crossing international borders. Some of them were detected in this study and are listed in the Convention on the Conservation of Migratory Species of Wild Animals (CMS) appendices. The Lion (*P. leo*), the Leopard (*P. pardus*), the Savanna Elephant (*L. africana*), and the Masai Giraffe (*G. tippelskirchi*). Most of the migration routes in Tanzania are reported for central and northern regions (HARRIS *et al*., 2009; MNTR, 2022). Although the region studied is not inserted in a properly documented migration route, there is an important wildlife corridor to the west, connecting the Akagera River and Akagera NP (Rwanda) to the Burigi-Chato NP (MNRT, 2022). Another important conservation area nearby is the Minziro FNR, which stands as an important biodiversity spot for Tanzania, because of its connection to Guinea-Congo biome (ROVERO *et al*., 2018). The sampling points where the migratory species occurred (BS2 and BS4) are all inserted in this region.

It is important to stress that the areas BS1 and BS2 were two of the most species enriched sampling points and registered 10 exclusive species. These areas are close to the Minziro FNR, in northwestern Tanzania. The Minziro reserve registered 33 species of mammals in recent surveys (ROVERO *et al*., 2018). Together, the BS1 and BS2 recorded 18 species of terrestrial mammals (Table 4.2.1a), of which 10 (*T. sylvaticus, A. paludinosus, C. fieldiana, C. mitis, L. ugandae, C. angolensis, P. anubis, L. africana, T. swinderianus, P. boehmi*) were also detected in Minziro reserve by Rovero *et al*. (2018).

The site BS6 shared some species exclusively with BS2. Both BS2 and BS6 are inserted in landscapes of open savanna with elevated rocky outcrops, and the Lake Burigi stands as a humid connection between them, surrounded by gallery forests and floodable lands. Thus, as reported for the Akagera region (MNRT, 2022), the Lake Burigi and its surroundings could stand as corridor for wildlife, as indicated by the exclusive species shared.

The sampling site BS8 and BS9 were the most disturbed areas, located near villages and anthropogenic structures. These areas presented lower richness and species that are not habitat specialists and seem to be widely distributed in the region, because they were detected in the field in multiple sampling sites (*Madoqua* sp., *A. paludinosus, P. anubis*). Corridors for wildlife are essential for the maintenance of migration routes and connection between fragments and protected lands. The maintenance, conservation, and protection of wildlife corridors enhances the gene flow, avoids isolation process of populations and helps species to keep their biological interactions (BEIER & GREGORY, 2012; BERGER & CAIN, 2014). This seems to be the case of the northwestern areas (BS1, BS2, BS3, BS4, BS5, BS6), which reunite most of the mammalian species detected through standardised sampling, including those that are migrant.

Linear infrastructure (such as energy transmission lines) has the potential to cause habitat loss and disruption of corridors and connections (RICHARDSON *et al*. 2017). Benítez-López *et al*. (2010) detected that mammal population densities tend to decline with their proximity to human infrastructure, especially in open landscapes. This pattern is more evident for the medium and large-sized mammals, which are more dependent on landscape connectivity and present larger homeranges than small mammals (BENÍTEZ-LÓPEZ *et al*., 2010).

Primary and secondary data

Regarding the surveyed data from literature, a total of 187 taxa of terrestrial mammals were listed for secondary data, from 13 orders and 36 families. The primary data collected in the field detected 55 taxa, from 10 orders and 23 families.

Concerning the shared taxa between primary and secondary data, all the families and orders detected during the sampling efforts are previously reported in literature (Figure 4.2.1l). The small difference between the shared species from the primary (S= 53) and secondary data (S= 51) is due to some taxa that could not be identified to species level: in the primary data, *Madoqua* sp., *Genetta* sp., *Hystrix* sp., *Otomys* sp., *Cricetomys* sp.

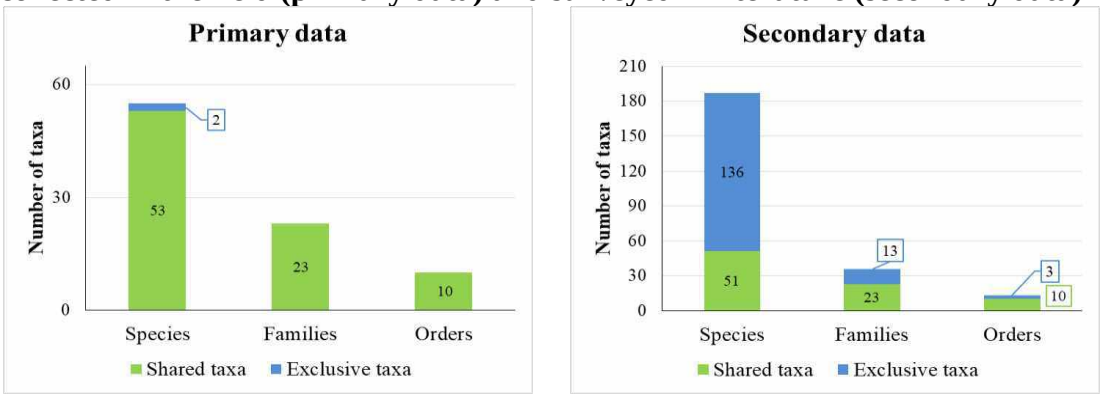
were identified only to genus level, while in the secondary data it is reported the Reedbuck (*Redunca* sp.), the Jackal (*Lupulella* sp.), and the Baboon (*Papio* sp.) to genus level. Thus, these genus-level taxa were also considered as shared between the data sources, because these genera were found in both. The primary data also detected two exclusive taxa for the primary data, the Duiker (*Cephalophus* sp.) and the European Rabbit (*Oryctolagus cuniculus*).

The Duiker (*Cephalophus* sp.) was reported only through interviews. There are several species of Duikers reported for Tanzania, and its taxonomy is still in need of revision (KINGDON *et al*., 2013; FOLEY *et al*., 2014). Their presence in the area studied must be taken with some caution, because the genus was not detected in the field and its distribution is reported for the eastern and southern regions of Tanzania (KINGDON *et al*., 2013; FOLEY *et al*., 2014).

The exotic European Rabbit (*O. cuniculus*) was detected during regular sampling in BS2 site. The species is native in Europe and was introduced in many countries for hunting, farming, and as pet. In Tanzania, it is currently used in trade, pet and food source (MOTO, 2024), and its presence in the sampling site can be a result of the process of domestication or farming of an exotic species, because it is common that individuals escape or are released in the wild by humans.

In this study, 51 of the 195 (26.1%) taxa of terrestrial mammals listed in the secondary data were recorded in the field by the surveying methods (direct and indirect observation, camera trap, interviews, occasional encounters). Regarding the higher taxonomic ranks, 23 of the 36 families (63.9%) and 10 of the 13 orders (76.9%) were detected during sampling efforts. In this sense, it is possible to affirm that this study presented a good representation of the great groups of terrestrial mammals expected for the area. In the case of the species rank, the greatest number of absences are related to the rodents (Order Rodentia), true shrews (Order Eulipotyphla) and hyraxes (Order Hyracoidea), which are not the main focus of the sampling methods applied in the field.

Figure 7.2.2.2.2.l
Comparison of shared and exclusive taxa of terrestrial mammals between data collected in the field (primary data) and surveyed in literature (secondary data)



7.2.2.2.3
Chiroptera

The bat inventory along the sampling points used two methodologies: mist nets and acoustic recordings. As shown in **Table 7.2.2.2.3.a** in **Annex 7**, using mist nets, five records of two species were obtained, while using the acoustic recording method, 1087 records were obtained, represented by 13 taxa. In addition, one species was recorded by direct observation during the study, with four individuals observed resting in a tree (**Table 7.2.2.2.3.a**, **Figure 7.2.2.2.3.a**). In total, 15 taxa were recorded, belonging to seven families out of a total of 1096 records.

In terms of families, Vespertilionidae was the most diverse with five species, followed by Molossidae with four species, Rhinolophidae with two species and the families Emballonuridae, Miniopteridae, Pteropodidade and Megadermatidae with one species each.

Of these species, only the Mauritian Tomb Bat (*Taphozous mauritianus*) was recorded by both the mist net method and the acoustic recorders.

In relation to the analyses of community structure, the results obtained for sampling zones BS3 and BS4 were excluded, since these areas do not include the area of direct influence of the preferred route of the TL, but all the species recorded were analysed for richness, conservation status, endemism and migration.

Five individuals were captured using mist nets, four of which were attributed to the genus *Epomophorus* sp., popularly known as Fruit Bat, and one identified as Mauritian Tomb Bat (*Taphozous mauritianus*), belonging to the Pteropodidae and Emballonuridae families respectively.

At least five species of the genus *Epomophorus* are expected in the area of influence of the project and due to the similarity between these species in their external morphological characteristics, these individuals were kept at genus level.

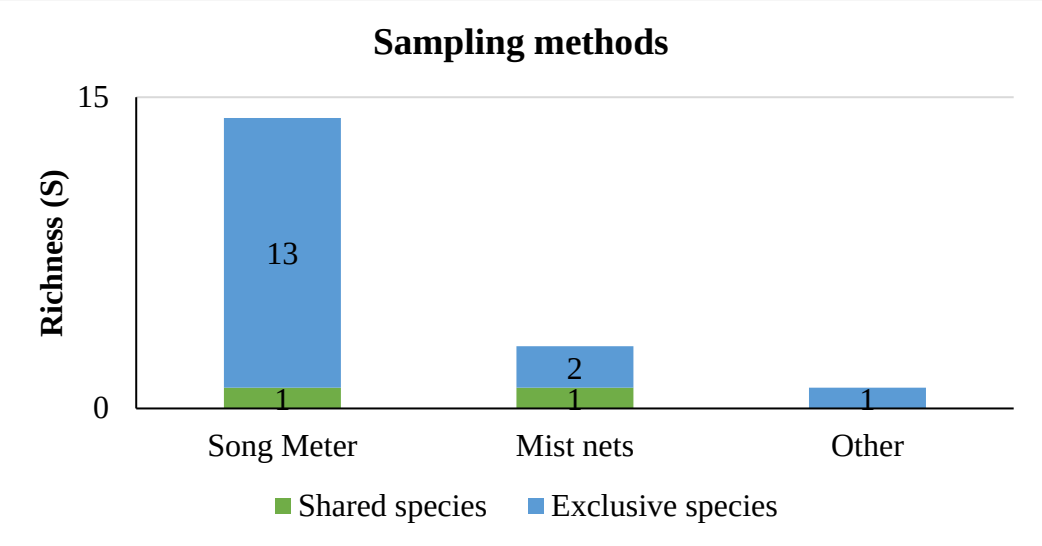
During the sampling of the other vertebrate groups, four individuals of the False Vampire (*Lavia frons*) were spotted and photographed at BS9. This species belongs to the Megadermatidae family, and its specific morphological characteristics made it possible to identify it with certainty, especially as it is the only representative of the *Lavia* genus (KINGDON *et al*., 2013).

Using the method of acoustic recordings, more than 99% of all recordings were obtained (**Table 7.2.2.2.3.a** in **Annex 7**, **Figure 7.2.2.2.3.a**). This method is very efficient for detecting aerial insectivorous bats, as our results show and corroborate information in the literature (MONADJEM *et al*., 2017; ADAMS & KWIECINSKI, 2018).

The identification of bat species through vocalisations obtained by ultrasonic recorders for the African continent is still far from being an exact science, but progress has been made (MONADJEM *et al*., 2017; ADAMS & KWIECINSKI, 2018). There are no

specific studies for Tanzania at the community level in terms of bioacoustics, but the parameters provided by the most recent literature (MONADJEM et al., 2017; ADAMS & KWIECINSKI, 2018) on the calls of aerial insectivorous bats and more classic studies (FENTON & BEEL, 1981; ALDRIGE & RAUTENB, 1987; TAYLOR, 1999; KINGDON *et al*, 2013; TAYLOR *et al*, 2013; LINDEM *et al*., 2014), especially in central, southern and eastern Africa, made it possible to identify the records obtained. Files with few pulses, attenuated and/or with a lot of associated noise were discarded as they substantially increased the possibility of identification errors.

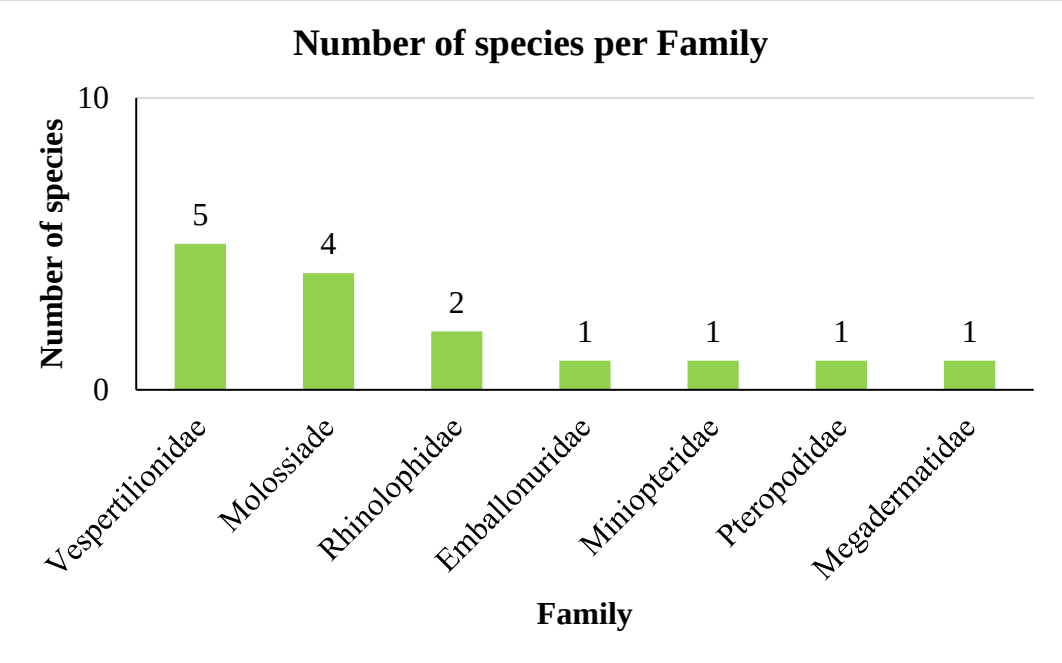
Figure 7.2.2.2.3.a
Number of species (richness) of bats detected by each sampling method, showing the shared and exclusive richness of each one



Of the 13 taxa recorded by biocoustics, only one remained at genus level, the Free Tailed Bat (*Tadarida* sp.), this taxon belongs to the Molossidae family and of the acoustic calls recorded, this genus still needs to be assessed for possible geographical variations in its vocalisations (KINGDON *et al*., 2013). The parameters obtained in their vocalisations did not fit within the known variations for species with sonotypes already described for the study area. In this case, they may be species with sonotypes that have not yet been described, undocumented regional variations or even species with cryptic vocalisations (LÓPEZ-BAUCELLS *et al*., 2016, ARIAS-AGUILAR *et al*., 2018).

Based on these assumptions, 15 specific and/or generic taxa were recorded during the diagnosis, distributed among seven families. Although two taxa were at genus level, it is safe to say that the richness sampled was at least 15 taxa, and from these identifications it was possible to characterise this fauna, as well as generate data to monitor its patterns of richness and activity throughout the construction and operation of the project (**Figure 7.2.2.2.3.b**).

Figure 7.2.2.2.3.b
Number of species (richness) of the terrestrial mammals detected in each mammalian Family



Threatened Species

None of the species that could be identified down to the specific level are considered endangered by the lists consulted (IUCN, 2024; CITES, 2024).

The Large Eared Mastiff Bat (*Otomops martiensseni*) is classified as Near Threatened (NT) by the IUCN (2024). This species was once considered vulnerable, however, with new records extending its range, its conservation status has changed to a less worrying situation (IUCN, 2024). The greatest threats reported for this species is the use of toxic products in anthropogenic shelters to eliminate its populations, as it is a species commonly found in urban environments (FETTON *et al*., 2002).

Even for the genera that could not have species identified, *Tadarida* sp. and *Epomophorus* sp. it is possible to state that they do not have species already classified as threatened according to the lists consulted. For these genera, the species that could potentially occur in the area of influence of the project are not under any degree of threat (IUCN, 2024).

Endemism

None of the species that could be identified are considered endemic. All the species recorded have wide geographical distributions, occurring in the central, southern and eastern regions of Africa, a common characteristic of this order of mammals due to their great power of locomotion.

Cinegetics

Of the species recorded, two have been identified as targets for persecution by local populations, the Mauritian Tomb Bat (*Taphozous mauritianus*) and the Large Eared Mastiff Bat (*Otomops martiensseni*), by the IUCN (2024). However, it is believed that more species are being targeted by local populations, either for fun and/or in retaliation for being potential disease transmitters, especially those species that use human dwellings as shelter and in relation to fruit consumption in orchards.

In a recent publication reviewing the knowledge of bat species that transmit viruses in Africa, at least four genera recorded in the present diagnosis are potentially carriers and transmitters of viruses from the Coronaviridae, Filoviridae and Paramyxoviridae families (Markother et al, 2020). These genera are *Rhinolophus. Mops, Laephotis and Epomophorus* (MARKOTHER *et al*., 2020).

Migration

Two species recorded are considered migratory or potentially migratory in Appendix II of the Convention on Migratory Species (CMS, 2024). These are *Miniopterus natalensis* and *Otomops martiensseni* (**Table 7.2.2.2.3.a** in **Annex 7**).

For *Miniopterus natalenses*, Pretorius et al. (2020) associate the migration of this species with the climatic cycle. Voigt *et al*. (2013) report the migration of this species on Mount Kilimanjaro to other areas of lower altitude related to the seasonal cycle.

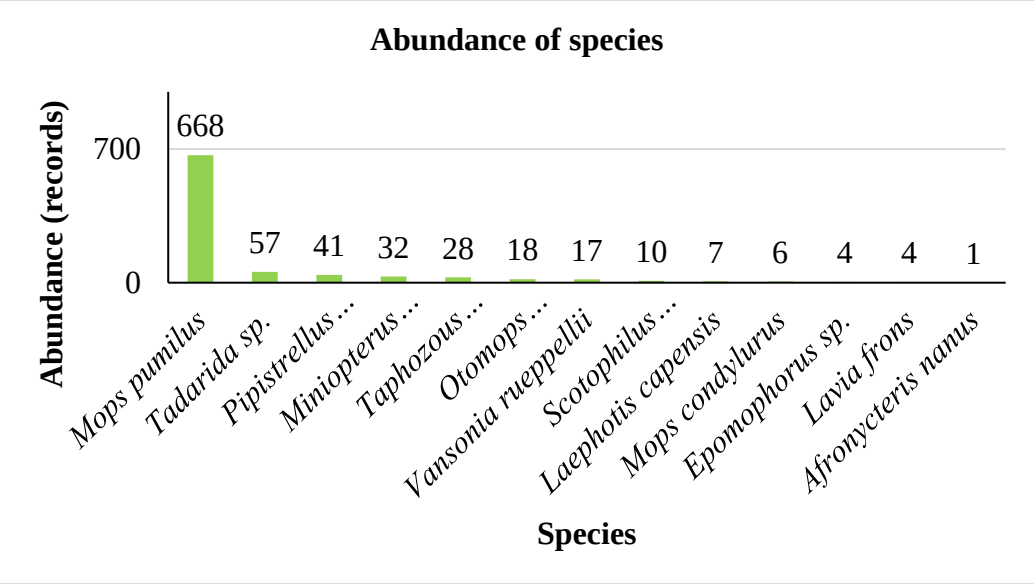
Otomops martiensseni is listed as a potentially migratory species by the Convention on Migratory Species (CMS, 2024), but this information is based on data from the 1970s and there are currently no reports proving this behaviour (IUCN, 2024).

In any case, all the species recorded have a wide distribution, occurring at least in central, southern and eastern Africa (KINGDON et al., 2013; IUCN, 2024).

Richness and Abundance

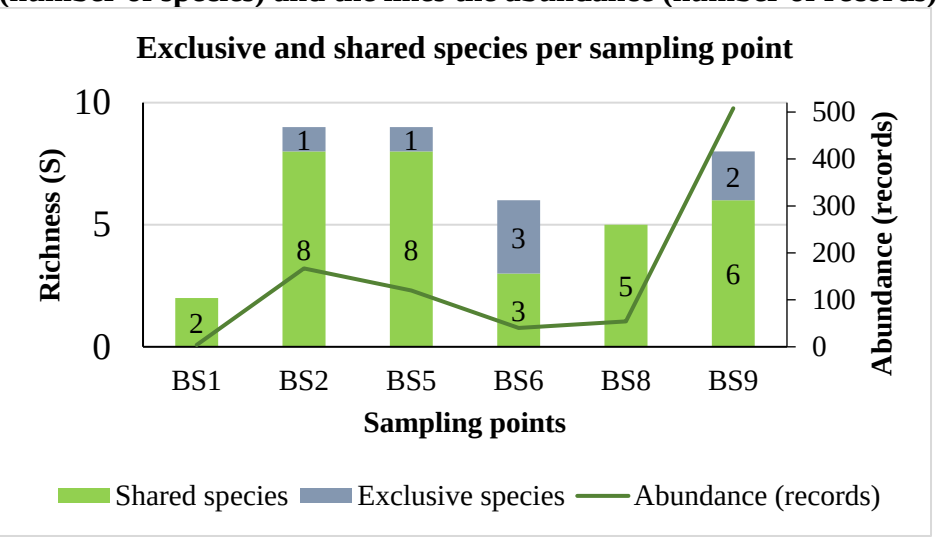
In terms of the number of records for the total area, the most representative species was *Mops pumilius* with 74.8% of the records, followed by *Tadarida* sp. These were the species with the most activity during the sampling (**Figure 7.2.2.2.3.c**). On the other hand, *Afronycteris nanus* had only 0.1%, making it the species with the least activity in the sampling areas during this diagnosis. We can therefore observe a pattern very similar to the abundance data of species in a community, a pattern that is most commonly observed in nature, with some species being more abundant, others moderately common and the majority of species being rarer (MAGURRAN, 2013), which in this case is reported here as activity and not abundance.

Figure 7.2.2.2.3.c
Ranking of abundance (number of records) of the bats detected through the standardised methods



Comparing the number of species and records obtained in each of the six sampling zones analysed, it can be seen that BS2 and BS5 recorded richness values and each with an exclusive species. The BS9 sampling zone had eight species with two exclusive species and BS6 recorded six species with three exclusive species. The lowest richness was observed in BS1 and BS8 with one and five species recorded respectively, all of which had already been recorded in other sampling zones (**Figure 7.2.2.2.3.d**).

Figure 7.2.2.2.3.d
Richness and abundance for each sampling point. The bars represent the richness (number of species) and the lines the abundance (number of records)

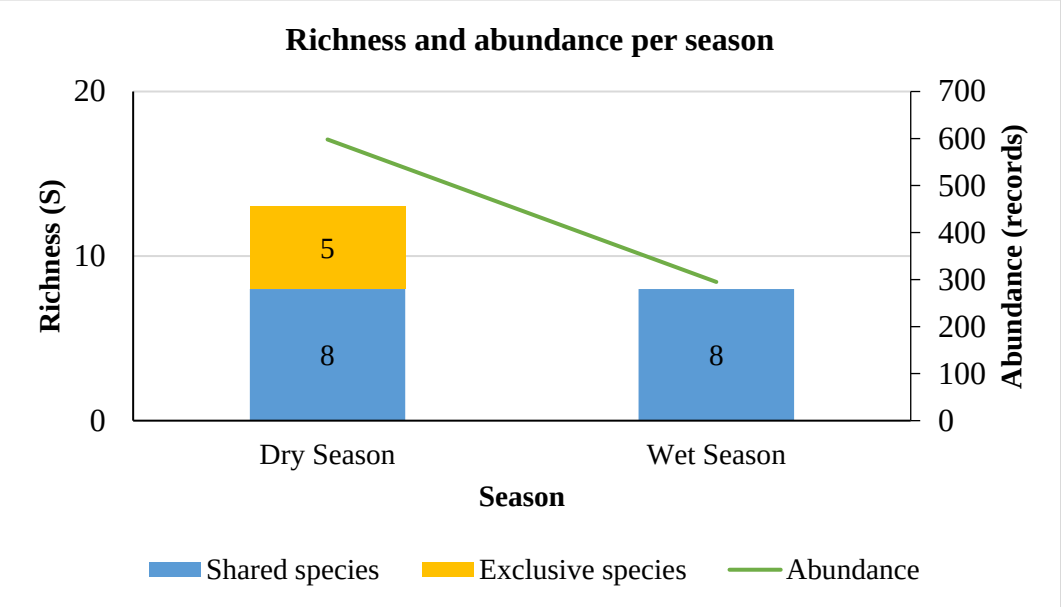


These differences are probably more related to climatic and/or biological factors, such as the incidence of rain at the time of sampling or the low activity of their prey, which greatly reduces bat activity and consequently their detection. Due to their great plasticity in the use of habitats and great power of locomotion, it is not expected that there will be very different communities between the sampling points.

Seasonality

Considering the total records in relation to seasonality, it can be seen that both the richness and the number of records were higher in the dry season, including five species exclusive to the dry period (**Figure 7.2.2.2.3.e**).

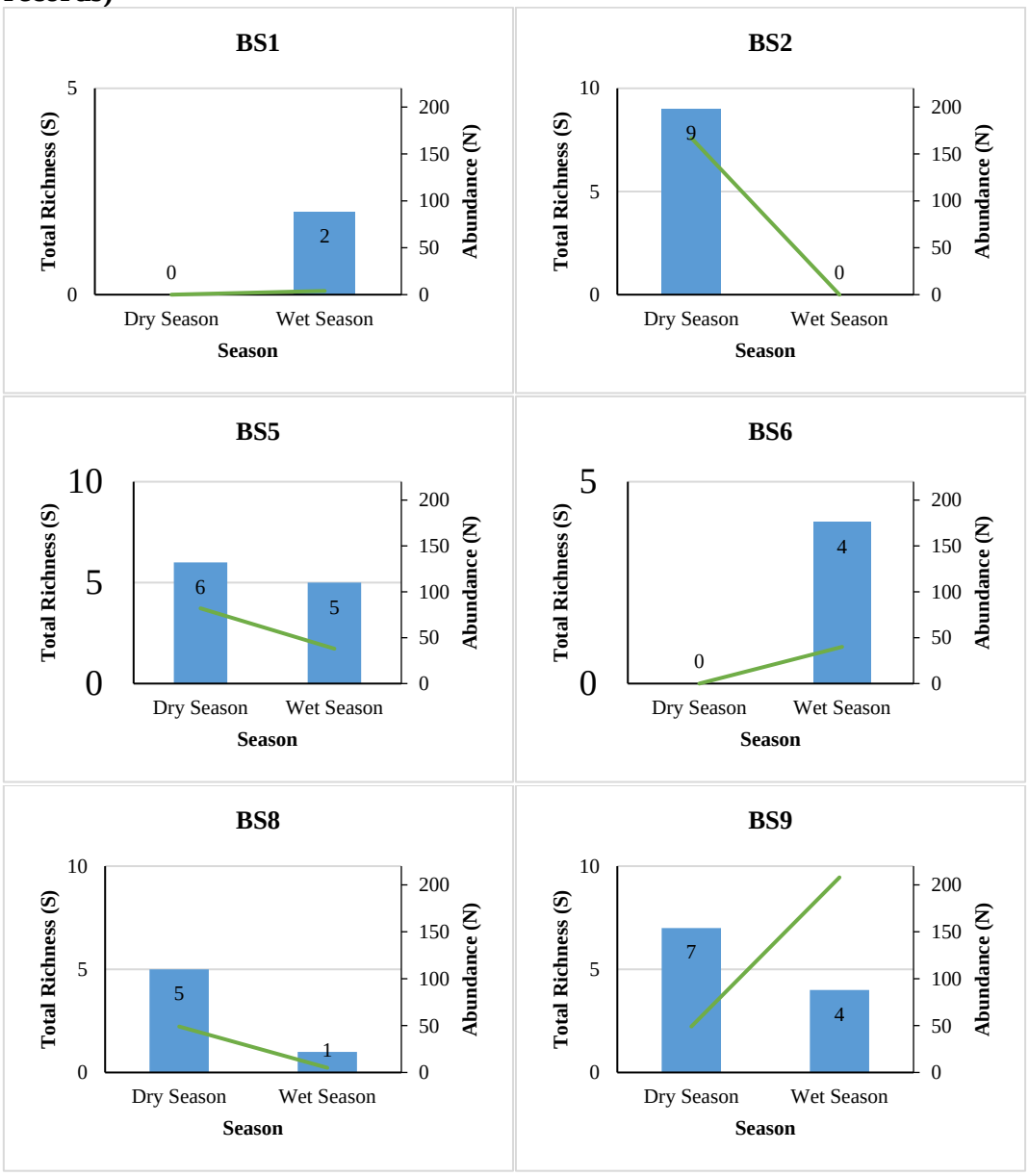
Figure 7.2.2.2.3.e
Richness and abundance by season for total sampling. The bars represent the richness (number of species) and the lines the abundance (number of records)



Analysing seasonality by sampling area, this scenario changes in some cases, such as in sampling areas BS1 and BS6, where there were no records during the dry season. In BS2, there were no records during the rainy season (**Figure 7.2.2.2.3.f**). In the BS5, BS8 and BS9 sampling areas, the same pattern is observed for the total area (**Figure 7.2.2.2.3.e**).

These results should be analysed with caution and probably represent a sampling bias, since the activity of bats, especially aerial insectivores, is related to the activity of their prey and climatic conditions. Environmental conditions such as heavy rainfall or temperature variations that may inhibit prey activity directly influence bat activity. In general, there were more records and species in the dry season, which is probably related to the incidence of rainfall during the sampling period.

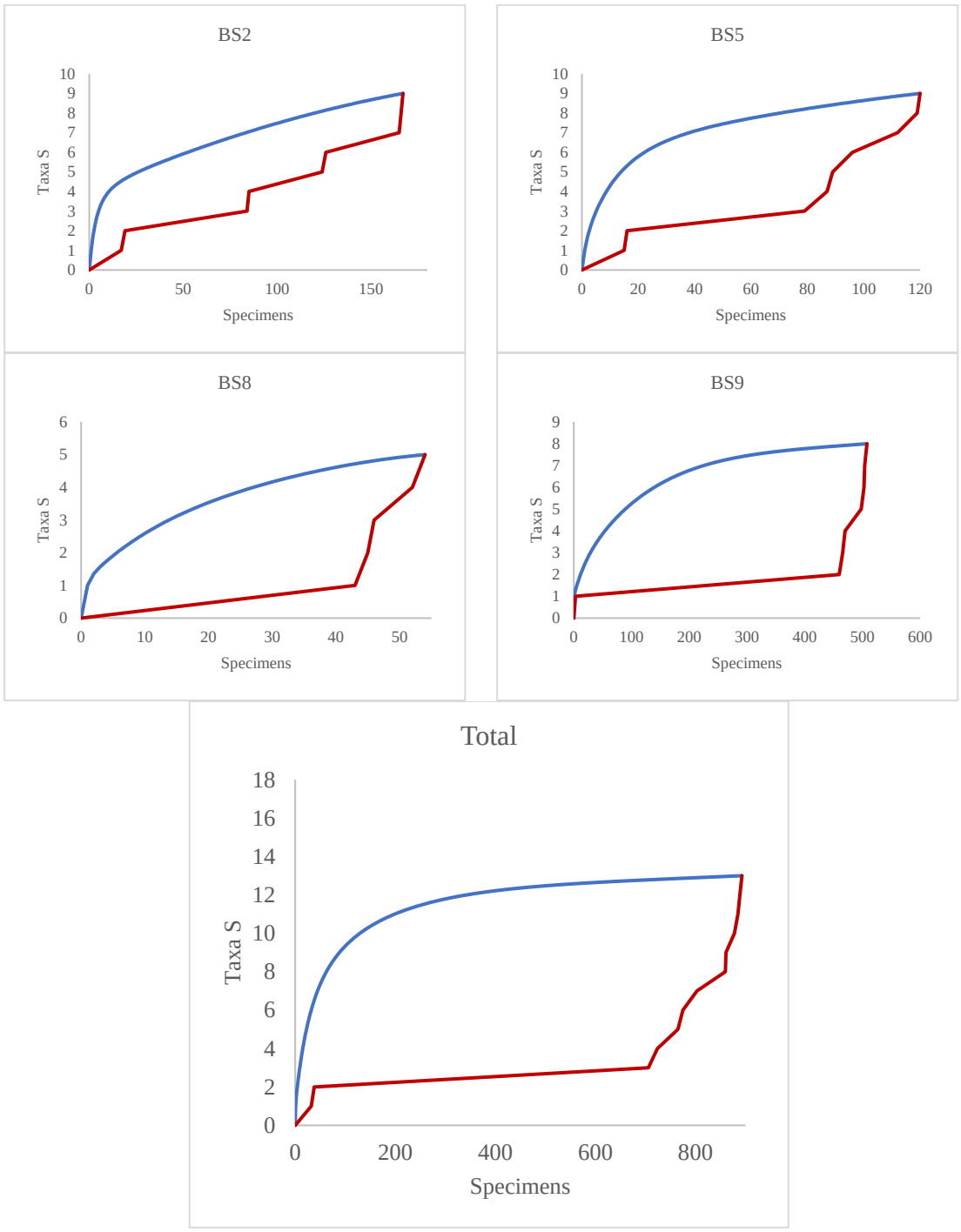
Figure 7.2.2.2.3.f
Richness and abundance of bats by season for each sampling point. The bars represent the richness (number of species) and the lines the abundance (number of records)



Sampling sufficiency

As a way of evaluating the sampling effort employed during sampling, rarefaction and accumulation curves were generated based on the records obtained for each sampling zone and for the campaign as a whole. The Krebs algorithm (1989) was used in the PAST programme (Version 3.22, HAMMER *et al*, 2001). It should be noted that rarefaction and accumulation curves were not carried out for sampling zones BS1 and BS6 due to the small number of species and records (**Figure 7.2.2.2.3.g**).

Figure 7.2.2.2.3.g
Rarefaction (blue line) and the accumulation (red line) curves of each and total sampling point for the bats sampled in dry and wet seasons



The results per sampling point show that more species are expected for these areas, except for BS9, which is already tending to stabilise in terms of the number of species. For the total sample, the curve stabilises, showing that sampling was very efficient in listing the

bat species present in the study area during the sampling periods of this diagnosis (**Figure 7.2.2.2.3.g**).

It is interesting to note that the accumulation curves are almost opposite to the rarefaction curves for the areas sampled and for the total. Different factors can be attributed to the observed difference between the curves, such as the fact that the species accumulation curve continues to rise until all species are recorded and that the rarefaction curve carries out random simulations with the number of individuals recorded and can obtain a good representation of diversity with fewer individuals. The low number of species observed and the fact that some species had few records, while others had a large number of records, also influence the fact that the rarefaction curves do not show results similar to the accumulation curves. Finally, the slower stabilisation of the accumulation curve reflects the presence of these rare species. In contrast, the rarefaction curve reflects a more balanced distribution of diversity within the fixed sample of individuals (**Figure 7.2.2.2.3.g**).

Diversity indexes

The following are statistics of richness (incidence-based indices using 1,000 randomisations), diversity and evenness for each Sampling Zone and the total of the campaigns. These statistics were obtained using the PAST software (Version 3.22, HAMMER *et al*., 2001).

From the data in the **Table 7.2.2.2.3.b**, the comparison of the richness observed in the field to the richness estimated by Chao 2, results in a value very close to that observed, with the lowest difference being 0.5 for BS1 and the highest being 3.5 for BS5. Jacknife 1 obtained the lowest estimated richness with one more species estimated and the highest was 3.5 for BS5. These data corroborate the species rarefaction and accumulation curves, especially for the total sample, where only 0.5 more species were estimated than observed. In terms of diversity, both the Shannon index and Fisher's Alpha indicate that diversity is medium to low, with BS5 being the sampling area with the highest diversity, reflecting a more balanced relationship between the number of species and records. In terms of equitability, the index for all areas can be considered low, reflecting the predominance of the activity of three taxa, *Mops pumilius*, which alone accounted for 74.8% of all records. The exception was sampling area BS1, which scored a 1 for equitability, as two species were recorded in two records.

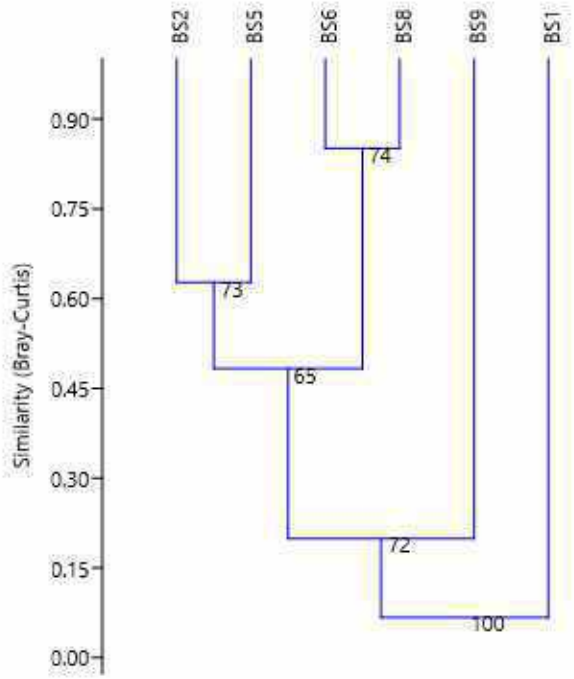
Table 7.2.2.2.3.b
Observed richness, abundance, richness estimators, diversity indexes and equitability of the sampling sites and total sampling obtained for the bats

Indexes	BS1	BS2	BS5	BS6	BS8	BS9	Total
Rate_S	2	9	9	3	5	8	13
Individuals	4	167	120	40	54	508	893
Chao 2	2.5	11	12.5	4.5	6.5	8.6	13.5
Jacknife 1	3	13.5	12.5	4.5	7	10	15.5
Shannon_H	0.69	1.47	1.52	0.23	0.74	0.47	1.09
Fisher_alpha	1.59	2.03	2.25	0.75	1.34	1.34	2.15
Equitability_J	1	0.67	0.69	0.21	0.46	0.22	0.42

Similarity

Considering the similarity between the sampling points, through the analysis based on abundance (Bray-Curtis) (**Figure 7.2.2.2.3.h**, **Table 7.2.2.2.3.b**), it can be seen that the areas with the most similar numbers of records are clearly grouped together, with BS6 and BS8 being the most similar, forming a group more similar to BS2 and BS5 and the areas with the fewest and most records being the furthest apart. This result reflects the variation in the pattern of records across the sampling zones.

Figure 7.2.2.2.3.h
Dendrogram showing the similarity among sampling points based on the Bray-Curtis similarity index based on abundances

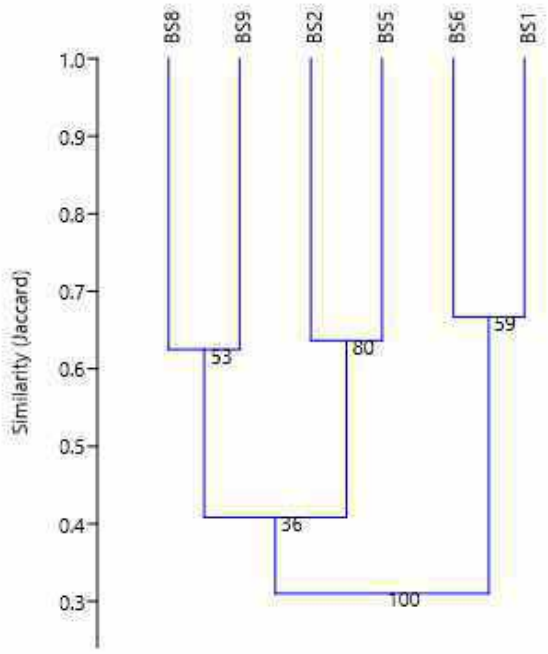


As the **Figure 7.2.2.2.3.i** and **Table 7.2.2.2.3.b**, analysing the similarity between the sampling points using the richness analysis (Jaccard), the same pattern can be seen for sampling zones BS2 and BS5, again the most similar, with nine species each and sharing seven species. The next group is BS8 and BS9, with five and eight species respectively, sharing five species. Finally, the group furthest from the others was formed by sampling zones BS1 and BS6, with the lowest number of species, two and three respectively, but sharing two of them.

These results directly reflect the detectability of species in the field rather than the structure of the community throughout the study area. As bats are highly mobile and utilise a wide variety of habitat types, a strong relationship between environments and species richness is not expected, reflecting their great ability to explore a wide range of

environments. There is no evidence to justify the absence or clustering of species in ecological terms throughout the area of influence of the project.

Figure 7.2.2.2.3.i
Dendrogram showing the similarity among sampling points based on the Jaccard similarity index based on species' occurrences



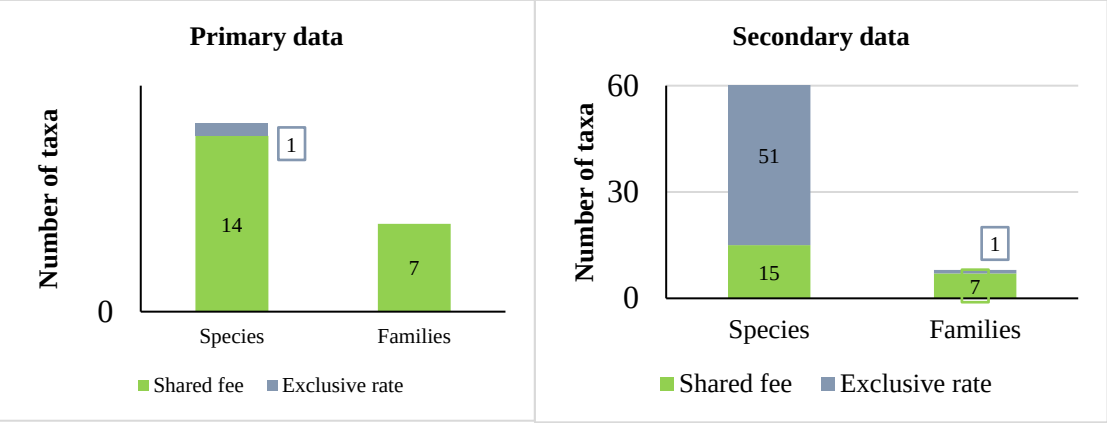
Comparison between primary and secondary data

The total list of bats obtained from the secondary data survey totalled 66 species with potential occurrence in the region, distributed in eight families. Through the primary data, 15 taxa from seven families were obtained, which corresponds to almost 23% of the potential richness of the area (**Figure 7.2.2.2.3.j**).

Of the species that potentially occur in the region, 14 were detected in this diagnosis (**Figure 7.2.2.2.3.j**). This study detected the presence of a species that is not included in the secondary data, the Swinny's Horseshoe Bat (*Rhinolophus swinnyi)*. By consolidating the secondary data with the data obtained in the field, it is possible to infer that at least 67 species from eight different families occur in the area of influence of the project.

This result demonstrates the efficiency of the bat sampling in this study, reaching almost a quarter of the potentially occurring species for the region and also recording a taxon that was not recorded in the literature used for the project's area of influence.

Figure 7.2.2.2.3.j
Comparison of shared and exclusive taxa of terrestrial mammals between data collected in the field (primary data) and surveyed in literature (secondary data)



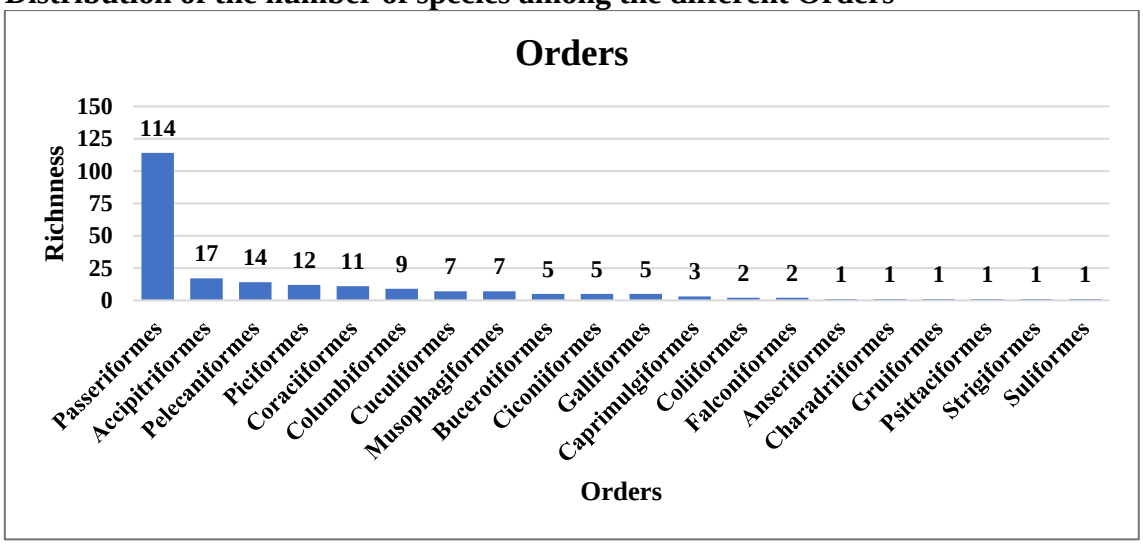
7.2.2.2.4
Birds

As shown in **Table 7.2.2.2.4.a** in **Annex 7**, the bird surveys yielded 3,756 records belonging to 219 species, distributed among 20 orders and 55 families. These results were achieved using standardised and non-standardised methodologies. Considering the standardised methodologies (Transect Sampling, Mist Nets and Bioacoustics), which generate consistent and comparable data, 3,721 records were made, belonging to 211 bird species, distributed among 20 orders and 55 families. On the other hand, the non-standardised methodologies (Interview and Opportunistic Observation), which are flexible and adaptable but less comparable, resulted in 35 records of 30 species, distributed in eight orders and 16 families.

Among the orders recorded, **Passeriformes** (Old World Flycatchers and Chats, Sunbirds, Weavers and similar) was the most representative, with 114 species, corresponding to approximately 52% of the total species identified. Next, **Accipitriformes** (Hawks, Eagles and Osprey) stood out with 17 species (8%), followed by **Pelecaniformes** (Ibises, Spoonbills, Herons and Pelicans) with 14 species (6%). The orders **Piciformes** (African Barbets, Honeyguides and Woodpeckers) and **Coraciiformes** (Bee-eaters, Rollers and Kingfishers) recorded 12 and 11 species, respectively, each representing around 5% of the birds observed (**Figure 7.2.2.2.4.a** and **Table 7.2.2.2.4.a**).

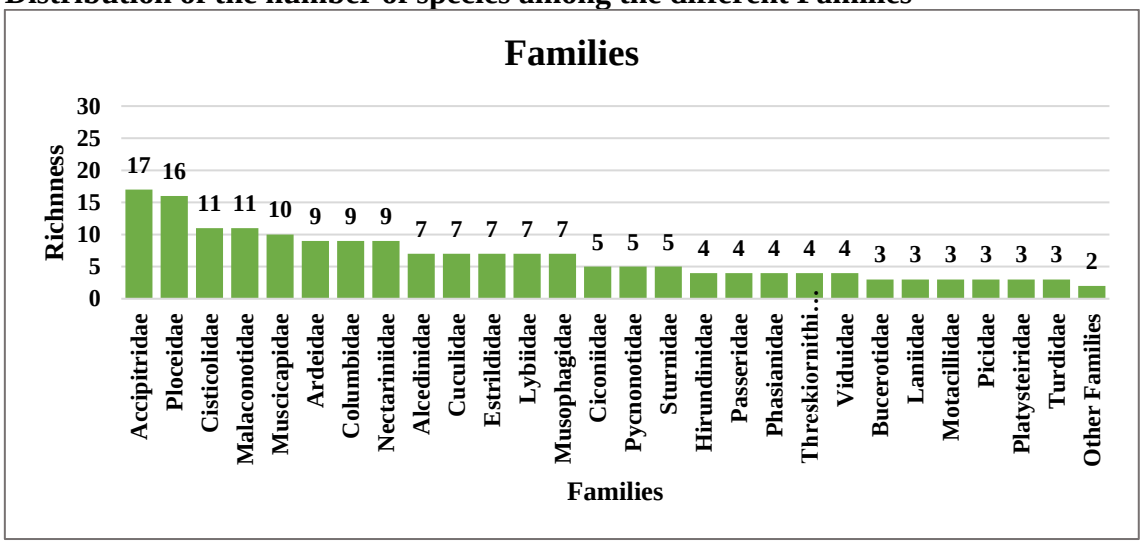
The high representation of Passeriformes in the study can be explained by their enormous diversity and adaptability, which allows these species to occupy a wide range of habitats, from dense forests to open areas. This ecological versatility increases the likelihood of their detection during surveys, justifying the large number of species observed. In addition, Passeriformes is the most diverse order globally, accounting for more than half of all bird species (CLEMENTS, 2023). In Tanzania, this order accounts for 54% of all birds catalogued (BIRDLIFE INTERNATIONAL, 2024) (**Figure 7.2.2.2.4.a**).

Figure 7.2.2.2.4.a
Distribution of the number of species among the different Orders



Among the most representative families, **Accipitridae** (Hawks, Eagles and Osprey) stood out with 17 species, representing approximately 8% of the total recorded. This was followed by the **Ploceidae** family (Weavers) with 16 species, corresponding to around 7% of the total. The families **Cisticolidae** (Cisticolas and allies) and **Malaconotidae** (Bush-shrikes) were recorded with 11 species each, equivalent to 5% of the total observed. The **Muscicapidae** (Old World Flycatchers and Chats) also contributed significantly with 10 species, representing approximately 5% of the total (**Figure 7.2.2.2.4.b** and **Table 7.2.2.2.4.a**).

Figure 7.2.2.2.4.b
Distribution of the number of species among the different Families



The predominance of Accipitridae (Hawks, Eagles and Osprey) can be explained by the presence of large hunting areas and open or semi-open habitats, which are ideal for these birds of prey. Their position at the top of the food chain and the need for large territories for hunting contribute to their high representativeness (AMAR *et al*., 2018).

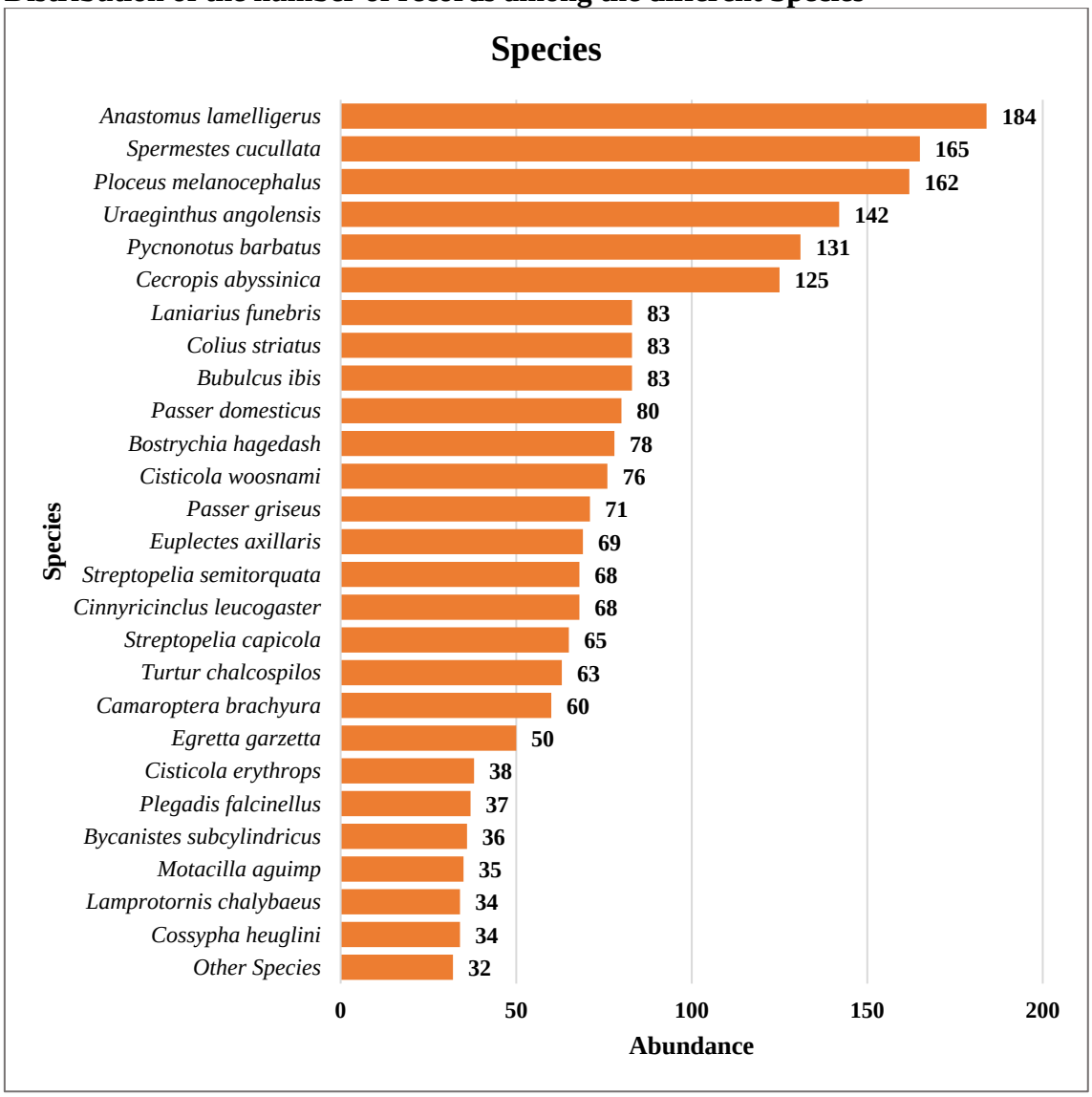
The representativeness of Ploceidae (Weavers) is often attributed to their ability to adapt to a variety of environments, including urban and agricultural areas, as well as their skills in building complex nests, which increase their reproductive success in diverse habitats (WINKLER *et al*., 2020).

Among the most abundant species, the **African Openbill** (*Anastomus lamelligerus*) stands out with 184 records, which represents around 5% of the total observed during the survey campaigns, as shown in **Figure 7.2.2.2.4.c**. Next are the **Bronze Mannikin** (*Spermestes cucullata*) with 165 records (4%), the **Black-headed Weaver** (*Ploceus melanocephalus*) with 162 records (4%) and the **Blue-breasted Cordon-bleu** (*Uraeginthus angolensis*) with 142 records (4%).

The high abundance of African Openbill (*Anastomus lamelligerus*) in the study can be attributed to its adaptation to aquatic habitats, where it finds an abundance of food, such as molluscs and crustaceans. Its ability to form large colonies for nesting and its wide distribution in wetlands in sub-Saharan Africa also contribute to its high number of records (ELLIOTT *et al*., 2020; BIRDLIFE INTERNATIONAL, 2024).

In addition to the species highlighted in the graph, another 193 species were recorded with up to 32 occurrences each, totalling 88% of the bird richness observed (**Figure 7.2.2.2.4.c**). Of these, 133 species had a maximum of 10 records, and 43 of them were recorded only once. Examples of these species include Shikra (*Accipiter badius*), Western Violet-backed Sunbird (*Anthreptes longuemarei*), Squacco Heron (*Ardeola ralloides*), Marsh Tchagra (*Bocagia minuta*), Red-billed Buffalo-weaver (*Bubalornis niger*), Bennett's Woodpecker (*Campethera bennettii*), African Emerald Cuckoo (*Chrysococcyx cupreus*), Spotted Palm-thrush (*Cichladusa guttata*), Woolly-necked Stork (*Ciconia episcopus*), Western Banded Snake-eagle (*Circaetus cinerascens*), Short-winged Cisticola (*Cisticola brachypterus*), Great Spotted Cuckoo (*Clamator glandarius*), Speckled Pigeon (*Columba guinea*), Brown-faced Go-away-bird (*Corythaixoides personatus*) and Brimstone Canary (*Crithagra sulphurata*) (see **Table 7.2.2.2.4.a**).

Figure 7.2.2.2.4.c
Distribution of the number of records among the different Species



Conservation Status

As for the conservation status of the species recorded during the surveys, searches were made for national lists of endangered species in Tanzania, but no official national list was found. In addition, international lists were consulted, such as the Red List of the International Union for Conservation of Nature and Natural Resources (IUCN, 2024), the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES, 2024) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS, 2024). Searches of these lists revealed the presence of endangered species, information on which is presented below.

At a global level, based on the IUCN (2024), three species are classified as "Near Threatened - NT": **Papyrus Gonolek** (*Laniarius mufumbiri*), **Woolly-necked Stork** (*Ciconia episcopus*) and **Crowned Eagle** (*Stephanoaetus coronatus*) (**Table 7.2.2.2.4.a**). This classification indicates that these birds are close to being considered threatened, but do not yet face an imminent risk of extinction and do not currently fall into the highest risk categories.

Four other species are effectively threatened with extinction. The **Tawny Eagle** (*Aquila rapax*) is classified as "Vulnerable - VU", while the **Bateleur** (*Terathopius ecaudatus*) and the **Grey Crowned Crane** (*Balearica regulorum*) are "Endangered - EN". The **Hooded Vulture** (*Necrosyrtes monachus*) is the species most at risk, classified as "Critically Endangered - CR" (**Table 7.2.2.2.4.a**).

These species face significant threats, mainly due to human activities, such as habitat loss and degradation caused by agricultural expansion and urbanisation, poisoning, and illegal hunting. In addition, illegal capture for the pet trade is a common threat. These pressures result in population declines, increasing the risk of extinction as identified by the IUCN (2024).

Still based on international criteria, according to the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES, 2024), none of the species recorded in the field are listed in Appendix I (**Table 7.2.2.2.4.a**). The presence of species on CITES Appendix I indicates that they are among the most threatened and therefore subject to the greatest restrictions in terms of international trade, which is not the case in this study.

In addition to these, another 24 species are listed in Appendix II. Although they are not necessarily threatened with extinction at the moment, they could become so if trade is not strictly controlled. Among the species included in this appendix are representatives of the following families: Accipitridae (Hawks, Eagles - 17 species), Falconidae (Falcons, Caracaras - 2 species), Gruidae (Cranes - 1 species), Musophagidae (Turacos - 2 species), Psittacidae (Parrots - 1 species), Strigidae (Typical Owls - 1 species) (**Table 7.2.2.2.4.a**).

Finally, based on the Convention on the Conservation of Migratory Species of Wild Animals (CMS, 2024), the species recorded were analysed in relation to the convention's two appendices. Appendix I includes endangered migratory species for which strict conservation measures are required. Appendix II lists species that need or would benefit from international co-operation for their conservation. None of the species recorded were included in Appendix I; however, 65 species are present in Appendix II. These include the families Accipitridae (Hawks, Eagles) with 17 species, Cisticolidae (Cisticolas and allies) with 11 species, Muscicapidae (Old World Flycatchers and Chats) with 10 species, as well as representatives of the families Ciconiidae (Storks), Falconidae (Falcons, Caracaras), Leiotrichidae (Laughingthrushes and allies), Macrosphenidae (Crombecs and allies) with two species each, and Anatidae (Ducks, Geese, Swans) with one species (**Table 7.2.2.2.4.a**).

Cinegetic Species

The intensive exploitation of wild animals for consumption, particularly poaching, is a serious problem in regions of Africa, Asia and Latin America, resulting in the sharp decline of several species, especially large birds such as the guinea fowl (*Numida meleagris*) and bustards (*Ardeotis* spp.). This pattern of overhunting is evident in northern and western Africa, where the ostrich (*Struthio camelus*), once widely distributed, is now facing extinction in several regions. The combination of hunting and forest fragmentation exacerbates the situation, drastically reducing the populations of species with already low densities and putting many at risk of extinction (FA *et al*., 2002; NIELSEN, 2006; PARRY *et al*., 2009; MAGIGE *et al*., 2009; BIRDLIFE INTERNATIONAL, 2018).

Although there is no consolidated study on the species of birds hunted on the African continent, including Tanzania, it is possible to make inferences based on data available in the literature from other regions of the world, considering related or morphologically similar species. Thus, among the groups of birds recorded in the field, representatives of the families Anatidae (ducks, geese, swans), Ciconiidae (storks), Columbidae (pigeons, doves), Numididae (guineafowl), Phasianidae (pheasants, partridges, turkeys, grouse), Ardeidae (herons) and Threskiornithidae (ibises, spoonbills) stand out (**Table 7.2.2.2.4.a**). Species from these families may be under hunting pressure, mainly for food consumption (FERNANDES-FERREIRA, 2014).

On the other hand, birds belonging to the families Bucerotidae (hornbills), Ploceidae (weavers), Accipitridae (hawks, eagles), Falconidae (falcons, caracaras), Strigidae (owls) and Psittacidae (parrots) tend to be hunted by local communities for the pet trade or for use in traditional and/or ritual practices (FERNANDES-FERREIRA, 2014) (**Table 7.2.2.2.4.a**).

These hunting practices vary from region to region and are influenced by cultural, economic and environmental factors. In some cases, hunting can have a negative impact on the populations of these species, especially in areas where hunting pressure is high or where bird populations are already in decline. In this context, we highlight the recorded species which, as well as being threatened with extinction, are also the target of hunting, which further exacerbates their conservation status. Examples include the Tawny Eagle (*Aquila rapax*), Hooded Vulture (*Necrosyrtes monachus*), Bateleur (*Terathopius ecaudatus*) and Grey Crowned Crane (*Balearica regulorum*) (IUCN, 2024) (**Table 7.2.2.2.4.a**). In addition to the various threats that already impact their populations, such as agriculture, livestock, mining, transport, services, pollution, among others, hunting is an additional factor that could jeopardise the long-term viability of these species.

Exotic species

Only one of the species recorded during the bird survey in the project region is classified as an introduced exotic, the House Sparrow (*Passer domesticus*) (**Table 7.2.2.2.4.a**). The House Sparrow (*Passer domesticus*), originally from the Middle East, is a synanthropic species that expanded its distribution as agriculture expanded, occupying parts of Eurasia and North Africa. Through natural dispersal and ship transport, this species began to

occur in a large part of the world from the 19th century onwards, and continues to expand its distribution in some regions, making it one of the most widely distributed birds on the planet today. Sparrows are closely linked to cultivated areas and human environments, adapting well to life in urban areas and even breeding indoors, although they can also thrive in natural environments (SUMMERS-SMITH, 1988; ANDERSON, 2006).

Endemism

The geographical distribution patterns of endemic species are fundamental in identifying priority areas for conservation globally (KERR, 1997; STATTERSFIELD *et al*., 1998). The importance of these areas is not only limited to species richness, but also to the critical role they play in maintaining global biodiversity and the stability of local ecosystems (MYERS *et al*., 2000; BIRDLIFE INTERNATIONAL, 2024). In the East African region, which covers Kenya, Tanzania, Uganda, Rwanda and Burundi, there are 100 species listed as regionally endemic, with Tanzania harbouring 32 of these species (STEVENSON & FANSHAWE, 2020).

Among the species expected to occur in the region, two are endemic to East Africa: Swahili Sparrow (*Passer suahelicus*), Rufous-tailed Weaver (*Histurgops ruficauda*). While one is endemic to Tanzania: Ashy Starling (*Lamprotornis unicolor*) (**Table 7.2.2.2.4.a**).

Swahili Sparrow (*Passer suahelicus*) is found mainly in northern Tanzania and southern Kenya, preferring dry savannah areas and semi-arid regions. This species is often seen in agricultural areas and around human settlements, where it benefits from proximity to human activities. Its distribution in Tanzania is limited, but within this range, the species is relatively common and well adapted (BIRDLIFE INTERNATIONAL, 2024; SUMMERS-SMITH, 2020; STEVENSON & FANSHAWE, 2020; BIRDLIFE INTERNATIONAL, 2024).

Rufous-tailed Weaver (*Histurgops ruficauda*) has an almost restricted distribution in Tanzania and also occurs in southern Kenya. This species is associated with savannas with widely spaced trees, such as those found in the Serengeti ecosystem. Although its range is limited, the Rufous-tailed Weaver is a common species in the habitats in which it occurs, where it can be seen in small groups (BIRDLIFE INTERNATIONAL, 2016; CRAIG, 2020; STEVENSON & FANSHAWE, 2020; BIRDLIFE INTERNATIONAL, 2024).

Ashy Starling (*Lamprotornis unicolor*) has a distribution that mainly covers north-central Tanzania, and is a typical species of the savannah plains. Preferring open areas, this species is easily spotted in groups, especially in habitats shared with large mammals. According to the IUCN, it is classified as locally common (BIRDLIFE INTERNATIONAL, 2016; CRAIG & FEARE, 2020; BIRDLIFE INTERNATIONAL, 2024).

Although these species are endemic to Tanzania and East Africa, they have a wide distribution within their areas of occurrence. These species are locally common in the

habitats in which they live, adapting well to local conditions such as dry savannas, semi-arid regions and agricultural areas. In addition, none of them are currently threatened with extinction, with no clear evidence of population declines (IUCN, 2024).

Migration

In the big picture, the concept of "migration" is commonly used to describe the mass movement of a large number of individuals of the same species from one place to another (BEGON *et al*., 1990). When considered more specifically, migration refers to the repetitive, annual displacement of an animal population that moves from its breeding area to places where it finds food and rest during a given season, returning later to its initial breeding area (ALERSTAM & HENDENSTRÖM, 1998; CHERNETSOV, 2016).

This migratory pattern, which is repeated every year, is mainly driven by the seasonal variation in food availability (SICK, 1983). In regions far from the equator or in colder areas, the length of daylight has been identified as a key factor that stimulates the development of reproductive organs and the increase in fat reserves, which serve as a source of energy for long journeys (ROWAN, 1930). In tropical regions, where variations in photoperiod are less marked than in temperate zones, other factors such as rainfall and flowering and fruiting patterns may be the main drivers of migrations (SICK, 1983).

Africa is crossed by three main migratory routes that are fundamental to the survival of various bird species:

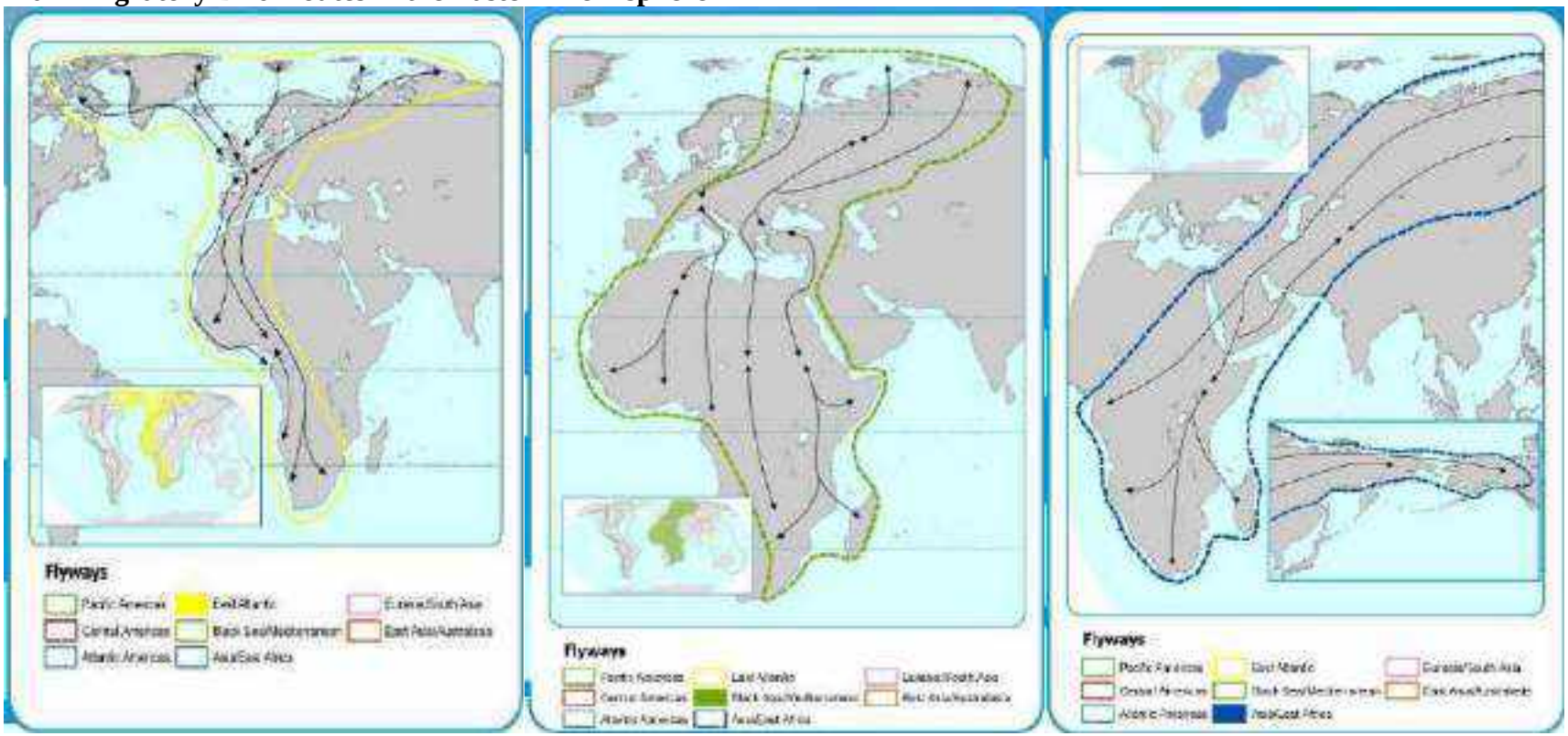
The **East Atlantic Flyway** connects breeding areas in the Arctic, from Canada to Central Siberia, to wintering areas in Western Europe and West Africa. Although Tanzania is off the main route, some birds divert eastwards, which contributes to local biodiversity (BIRDLIFE INTERNATIONAL, 2010a, 2010b).

The **Mediterranean/Black Sea Flyway** is crucial, linking Europe and Central Asia to tropical Africa. Migratory birds such as the white stork and various raptors use this route, crossing the Mediterranean and the Nile Valley to the Red Sea, passing through Tanzania on their journeys (BIRDLIFE INTERNATIONAL, 2010a, 2010b).

The **East Asia/East Africa Flyway** connects East Asia to East Africa, passing directly through Tanzania. Birds such as the black flycatcher and the chimney swallow choose this route to avoid obstacles such as the Himalayas. This route is characterised by rapid migrations, with the birds arriving in north-east Africa, including Tanzania, in August and September (BIRDLIFE INTERNATIONAL, 2010a, 2010b).

These routes are essential for maintaining biodiversity, as they connect distant habitats and support large populations of migratory birds, which play critical ecological roles in the region.

Figure 7.2.2.2.4.d
Main Migratory Bird Routes in the Eastern Hemisphere



Legend: Migratory routes are shown in the following colours: **East Atlantic Flyway** (yellow), **Mediterranean/Black Sea Flyway** (green) and **East Asia/East Africa Flyway** (blue). Adapted from BirdLife International (2010a), "Spotlight on Flyways". Available at: https://datazone.birdlife.org/sowb/spotflyway/

Considering the presence of migratory routes in the study area, it is crucial to assess the migratory behaviour of the birds recorded. Of the 219 species identified during the surveys, 11 (5%) are classified as "Migratory - MG". These species have the majority of their populations making long-distance migrations (TOBIAS & PIGOT, 2019; TOBIAS *et al*., 2022). They belong to seven families and six orders, including: Accipitriformes, with Shikra (*Accipiter badius*), Tawny Eagle (*Aquila rapax*), Yellow-billed Kite (*Milvus aegyptius*) and Black Kite (*Milvus migrans*); Anseriformes, with Spur-winged Goose (*Plectropterus gambensis*); Caprimulgiformes, with Little Swift (*Apus affinis*); Cuculiformes, with Great Spotted Cuckoo (*Clamator glandarius*); Pelecaniformes, with Squacco Heron (*Ardeola ralloides*) and Black-crowned Night-heron (*Nycticorax nycticorax*); and Passeriformes, with White-headed Saw-wing (*Psalidoprocne albiceps*) and Violet-backed Starling (*Cinnyricinclus leucogaster*) (**Table 7.2.2.2.4.a**).

In addition, 23 bird species, representing 10% of the total recorded, are classified as "Partially Migratory - PM". This means that the minority of the population carries out long-distance migrations, or the majority of the population carries out short-distance migrations, nomadic movements or distinct altitudinal migration (TOBIAS & PIGOT, 2019; TOBIAS *et al*., 2022). These migrations occur on a smaller scale and may be associated with the seasons, which directly affect environmental conditions and the supply of food and shelter (SICK, 1997). The partially migratory species recorded in the study region are distributed in 17 families belonging to eight orders, including: Fiery-necked Nightjar (*Caprimulgus pectoralis*), African Openbill (*Anastomus lamelligerus*), Yellow-billed Stork (*Mycteria ibis*), Namaqua Dove (*Oena capensis*), African Green-pigeon (*Treron calvus*), Grey-headed Kingfisher (*Halcyon leucocephala*), Lilac-breasted Roller (*Coracias caudatus*), Olive Bee-eater (*Merops superciliosus*), Red-chested Cuckoo (*Cuculus solitarius*), Lanner *Falcon* (*Falco biarmicus*), Pied Crow (*Corvus albus*), and Black Saw-wing (*Psalidoprocne pristoptera*), among other species (**Table 7.2.2.2.4.a**).

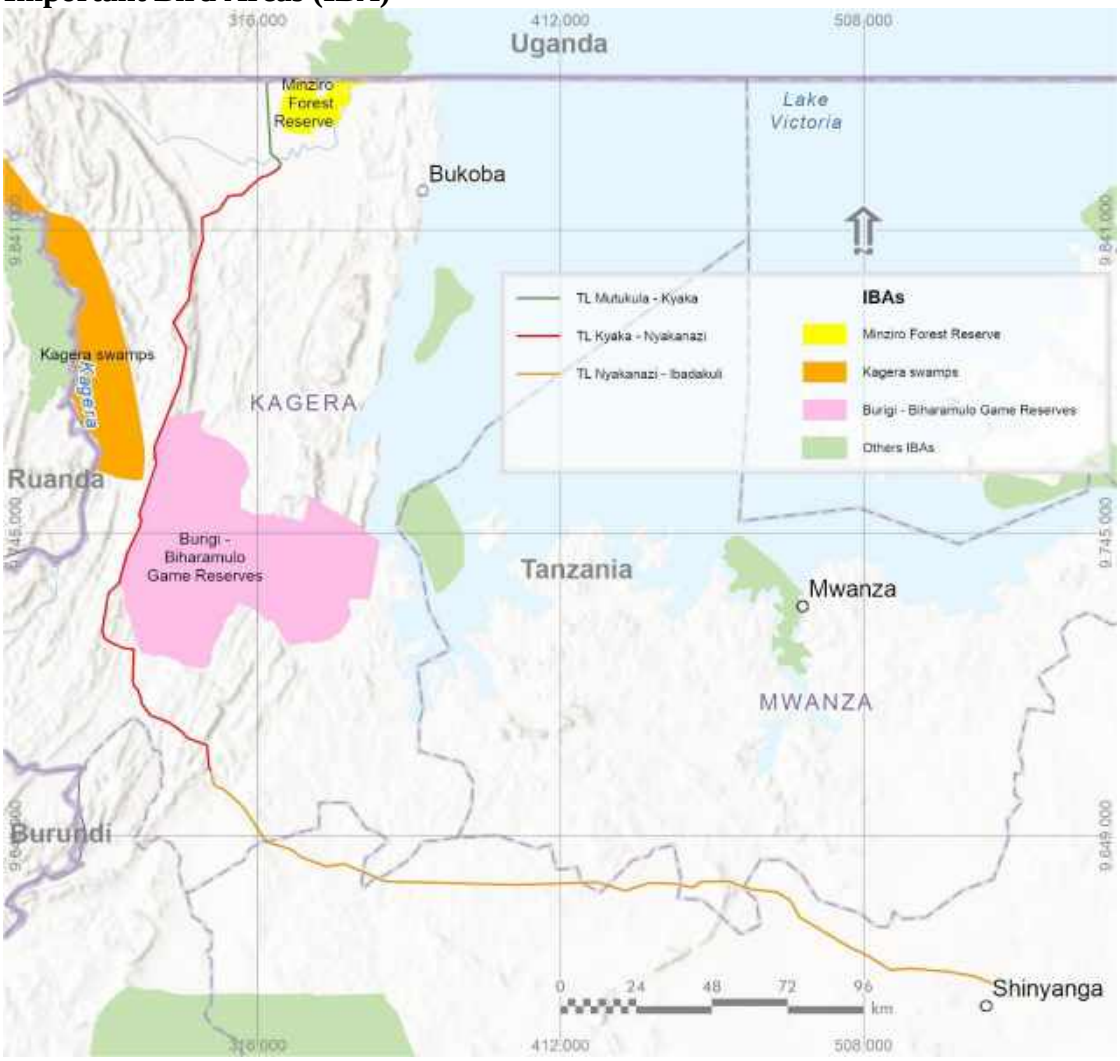
On the other hand, 185 of the 219 species recorded (84%) are classified as "Sedentary - SE" (**Table 7.2.2.2.4.a**). These species occupy the same area all year round or do not have a predictable movement pattern and do not show fidelity to a specific reproductive site (TOBIAS & PIGOT, 2019; TOBIAS *et al*., 2022).

Important Bird Areas (IBA)

Important Bird Areas (IBAs) are sites selected on the basis of quantitative ornithological criteria, which assess bird population sizes and trends to ensure that these areas play a crucial role in the international conservation of bird populations. These areas are essential for breeding, feeding and migrating birds, guiding conservation efforts, creating protected areas and monitoring populations, and play a vital role in preserving global biodiversity (BIRDLIFE INTERNATIONAL, 2021a).

Considering the current route of the development, it can be seen that the project will intercept two IBAs, to the north of which is the **Minziro Forest Reserve** IBA (TZ075) and further down, the **Burigi - Biharamulo Game Reserves** IBA (TZ014) (**Figure 7.2.2.2.4.e**).

Figure 7.2.2.2.4.e
Important Bird Areas (IBA)



Source: Adapted from BirdLife International (2024a, 2024b, 2024c).

The Minziro Forest Reserve, situated in north-west Tanzania near the border with Uganda, is an essential area of groundwater forest and extensive grasslands. As the largest forest area in the region, it represents an extension of Guinea-Congo's lowland forests, harbouring rich vegetation including Podocarpus trees and areas of papyrus along the Kagera River. However, the reserve faces significant threats, such as logging, forest degradation, grazing and uncontrolled burning, which jeopardise its biodiversity and ecological integrity. The reserve is home to 238 species of birds, including key species such as the Grey Parrot (*Psittacus erithacus*) and the Papyrus Gonolek (*Laniarius mufumbiri*), as well as other resident species of importance such as the Forest Francolin (*Peliperdix lathami*), Afep Pigeon (*Columba unicincta*) and Grey-cheeked Hornbill (*Bycanistes subcylindricus*), which enrich the biological diversity of the area (BIRDLIFE INTERNATIONAL, 2024a).

During the campaigns, six species of birds were recorded that are considered key species in this IBA: Black-lored Babbler (*Turdoides sharpei*), Carruthers's Cisticola (*Cisticola carruthersi*), Grey-cheeked Hornbill (*Bycanistes subcylindricus*), Papyrus Gonolek (*Laniarius mufumbiri*), Rufous Flycatcher-thrush (*Stizorhina fraseri*) and Vieillot's Black Weaver (*Ploceus nigerrimus*). These include the Papyrus Gonolek (*Laniarius mufumbiri*), classified as "Near Threatened - NT" by the IUCN (2024). The other species have the status of "Least Concern - LC" (IUCN, 2024) (**Table 7.2.2.2.4.a**).

The Burigi - Biharamulo Game Reserves IBA, located between Bunkwe Bay on Lake Victoria and the Kagera swamps, is made up of two reserves joined together for management purposes. This area is marked by a series of ridges stretching from north to south, separated by drainage lines and rivers flowing northwards, where Lake Burigi stands out, 30 kilometres long and 4 kilometres wide. Ornithologically, the site is little explored, but it is estimated that its diversity of habitats could harbour up to 400 species of birds, although only around 60 have been recorded to date. The presence of species such as *Balaeniceps rex* and *Lybius rubrifacies* suggests that the area is an important refuge for passing (migratory) and resident birds (BIRDLIFE INTERNATIONAL, 2024b).

Among the key species of this IBA are the Ring-necked Francolin (*Scleroptila streptophora*), the Shoebill (*Balaeniceps rex*), the Red-faced Barbet (*Lybius rubrifacies*) and the Black-lored Babbler (*Turdoides sharpei*), with the latter being recorded during the field surveys (**Table 7.2.2.2.4.a**).

Finally, although it is not included, the route of the development is close to the boundaries of the **Kagera swamps** IBA (TZ024). This IBA is situated along the Kagera River, which forms the border between Tanzania and Rwanda, and covers a vast area of swamps and lakes, with extensive fields of *papyrus (Cyperus papyrus*) in particular. This site, which includes the Ibanda Arena game reserve, is important for biodiversity, although the birdlife is still little explored. Species such as Chloropeta gracilirostris and *Balaeniceps rex* are possible inhabitants, with sporadic records of other species such as *Gallinago media* and *Laniarius mufumbiri* (BIRDLIFE INTERNATIONAL, 2024c).

Although the fauna survey sampling areas are not within the boundaries of this IBA, their proximity made it possible to identify three of the nine key species in the field: Carruthers' Cisticola (*Cisticola carruthersi*), Black-lored Babbler (*Turdoides sharpei*) and Papyrus Gonolek (*Laniarius mufumbiri*) (**Table 7.2.2.2.4.a**). The other key species expected to be found in this IBA include Ring-necked Francolin (*Scleroptila streptophora*), Red-faced Barbet (*Lybius rubrifacies*), Papyrus Yellow Warbler (*Calamonastides gracilirostris*), White-winged Swamp-warbler (*Bradypterus carpalis*), Northern Brown-throated Weaver (*Ploceus castanops*) and Papyrus Canary (*Crithagra koliensis*) (BIRDLIFE INTERNATIONAL, 2024c).

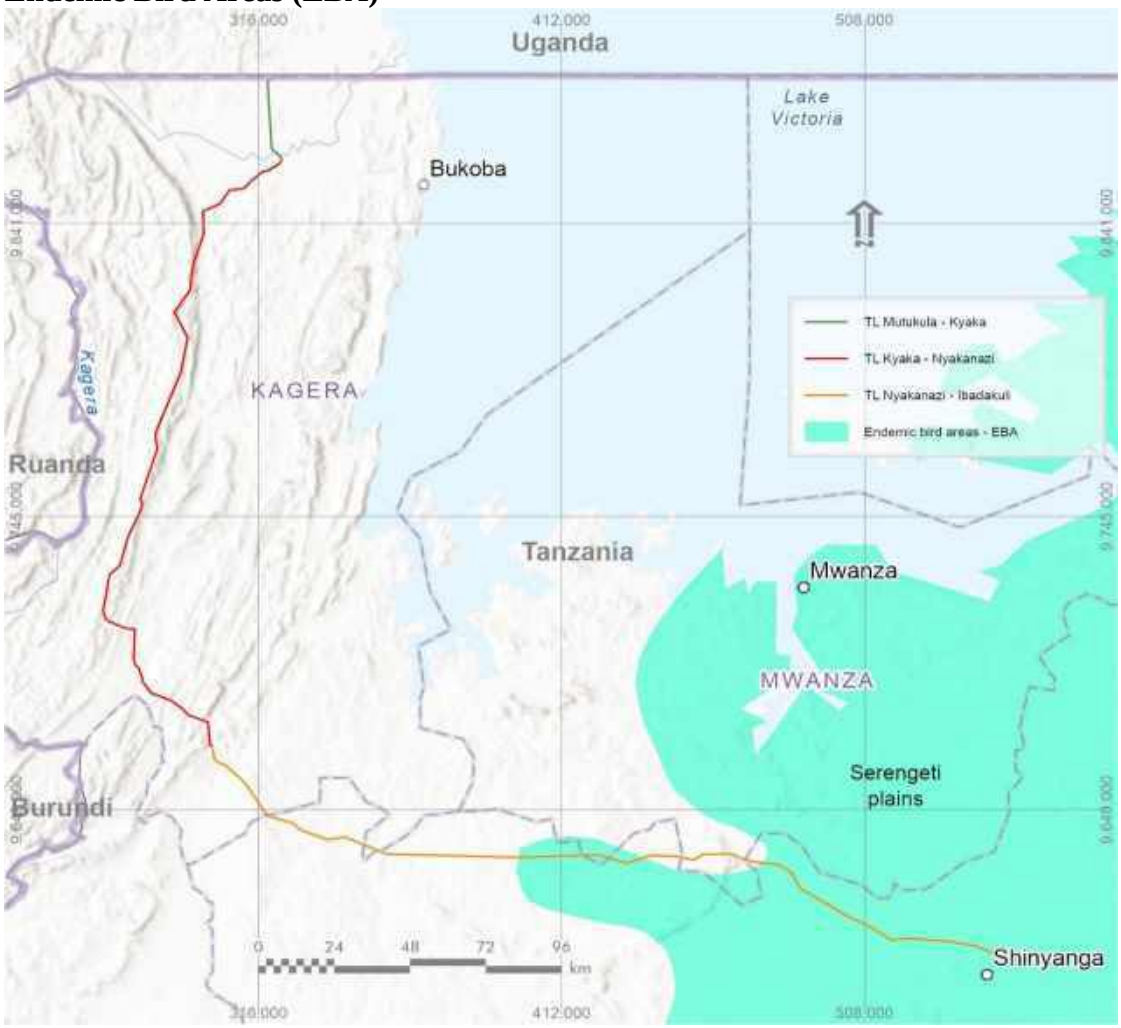
Endemic Bird Areas (EBA)

An *Endemic Bird Area* (EBA) is an important region for the conservation of endemic birds, which are species restricted to specific areas. These regions are defined as

containing terrestrial birds whose global distribution area is less than 50,000 km². Species whose historical range has been reduced below this threshold due to habitat loss or other threats are not included. The aim of EBAs is to protect natural zones that support the unique biodiversity restricted to these areas (BIRDLIFE INTERNATIONAL, 2021b).

It is therefore important to mention that, in addition to the presence of the **Minziro Forest Reserve** (TZ075) and **Burigi - Biharamulo Game Reserves** (TZ014) IBAs, the development will cross the boundaries of the **Serengeti Plains** EBA (108) (see **Figure 7.2.2.2.4.f**). This EBA (Serengeti Plains) covers the semi-arid plains to the south and east of Lake Victoria in Tanzania and Kenya. This territory includes the region of bushland and Acacia-Commiphora shrubs, stretching from the Serengeti National Park to the Lake Eyasi basin and the Wembere steppe. In Kenya, it stretches from south of the border with Tanzania to the areas around Lakes Naivasha and Nakuru. Restricted species of occurrence, such as *Trachyphonus usambiro* and *Prionops poliolophus*, are mainly located in Acacia and scrub grass habitats, which are increasingly threatened.

Figure 7.2.2.2.4.f
Endemic Bird Areas (EBA)



Source: Adapted from BirdLife International (2021b).

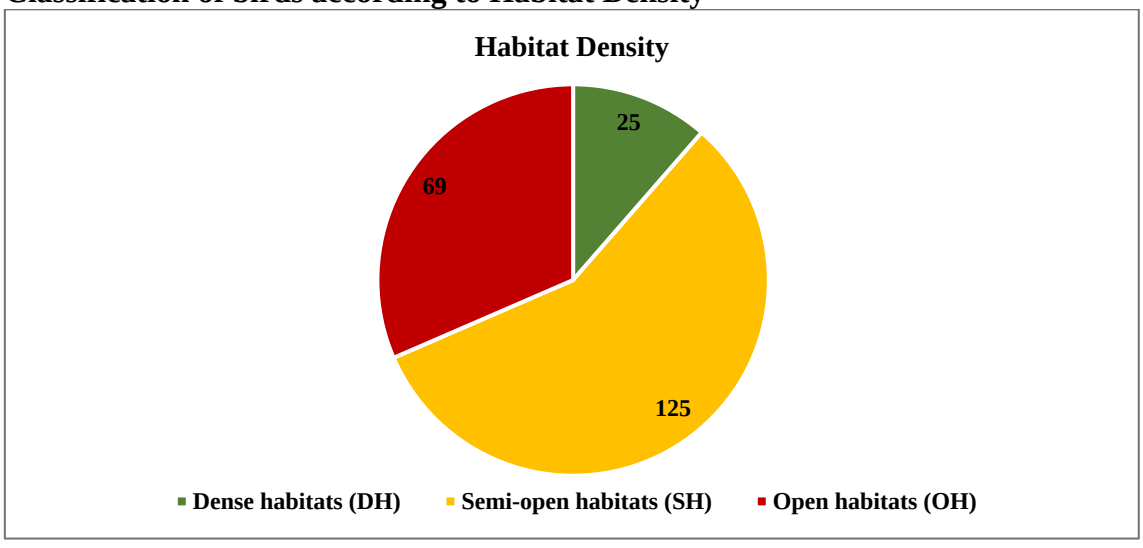
Based on the results of the bird surveys carried out, only one key species of this EBA was recorded in the areas under the influence of the development, being the Rufous-tailed Weaver (*Histurgops ruficauda*), which, although endemic to East Africa, is not threatened with extinction and is classified as "Least Concern - LC" by the IUCN (2024) (according to **Table 7.2.2.2.4.a**).

Habitat density

The bird species recorded in the field in the area of influence of the development were classified according to habitat density (TOBIAS *et al*., 2016; TOBIAS *et al*., 2022). According to the classifications adopted by the authors, birds can utilise up to three types of habitat density: i) Dense Habitats (DH); ii) Semi-open Habitats (SH); and iii) Open Habitats (OH).

For **Dense Habitats** (DH), 25 bird species were recorded, representing approximately 11% of the total bird assemblage recorded in the study (**Figure 7.2.2.2.4.g**). These species live mainly in the lower or middle stratum of the forest, in dense thickets and dense shrubs (TOBIAS *et al*., 2016; TOBIAS *et al*., 2022). These include: Bleating Camaroptera (*Camaroptera brachyura*), Blue-headed Coucal (*Centropus monachus*), White-browed Coucal (*Centropus superciliosus*), Yellow-bellied Greenbul (*Chlorocichla flaviventris*), Western Banded Snake-eagle (*Circaetus cinerascens*), Great Blue Turaco (*Corythaeola cristata*), Olive Sunbird (*Cyanomitra olivacea*), African Palm-swift (*Cypsiurus parvus*), Grey-capped Warbler (*Eminia lepida*), Yellow-whiskered Greenbul (*Eurillas latirostris*) (**Table 7.2.2.2.4.a**).

Figure 7.2.2.2.4.g
Classification of birds according to Habitat Density



For **Semi-open Habitats** (SH), 125 species that use this type of habitat were recorded, corresponding to around 57% of the total (**Figure 7.2.2.2.4.g**). These species mainly inhabit open shrubs, scattered shrubs, parks, low dry or deciduous forests, and thorn forests (TOBIAS *et al*., 2016; TOBIAS *et al*., 2022). Representatives of this category

include: Shikra (*Accipiter badius*), Northern Red-headed Weaver (*Anaplectes leuconotos*), Southern Red-headed Weaver (*Anaplectes rubriceps*), Western Violet-backed Sunbird (*Anthreptes longuemarei*), Plain-backed Pipit (*Anthus leucophrys*), Yellow-breasted Apalis (*Apalis flavida*), Tawny Eagle (*Aquila rapax*), Pale-throated Greenbul (*Atimastillas flavigula*), Chinspot Batis (*Batis molitor*), Hadada Ibis (*Bostrychia hagedash*), African Grey Flycatcher (*Bradornis microrhynchus*), Red-billed Buffalo-weaver (*Bubalornis niger*) (**Table 7.2.2.2.4.a**).

And for **Open Habitats** (OH), approximately 32% (N=69) of the species recorded live mainly in deserts, pastures, wetlands, low shrubs, rocky habitats, coastlines and cities (**Figure 7.2.2.2.4.g**). This category also includes species that mainly inhabit the top of the forest canopy (TOBIAS *et al.*, 2016; TOBIAS *et al.*, 2022). Among the species in this category are: African Openbill (*Anastomus lamelligerus*), Great White Egret (*Ardea alba*), Grey Heron (*Ardea cinerea*), Black-headed Heron (*Ardea melanocephala*), Squacco Heron (*Ardeola ralloides*), Rufous-bellied Heron (*Ardeola rufiventris*), Grey Crowned Crane (*Balearica regulorum*), Marsh Tchagra (*Bocagia minuta*), Little Rush-warbler (*Bradypterus baboecala*), Cattle Egret (*Bubulcus ibis*), Green-backed Heron (*Butorides striata*), Bennett's Woodpecker (*Campethera bennettii*) (**Table 7.2.2.2.4.a**).

Overall, the results show a significant predominance of species associated with semi-open habitats (SH), which account for 57% of the total. This is followed by species that inhabit open environments (OH), accounting for 32%, and lastly, species from dense habitats (DH), with only 11%. These proportions reflect the characteristics of the environments in the areas studied, which are predominantly made up of ecosystems such as savannas, grasslands and sparse forests. The low representation of species associated with dense habitats may also suggest that some of these areas are fragmented or reduced due to human activity, such as agriculture, deforestation or urbanisation.

Habitat type

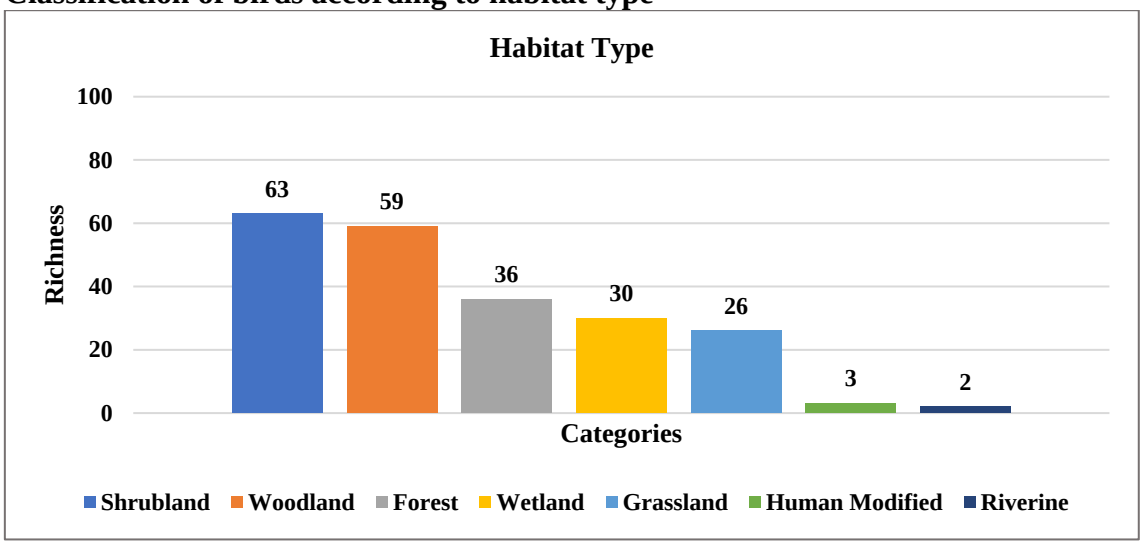
The birds were also categorised in relation to the types of habitats they can occupy in the wild. According to the authors, this data was taken from primary and secondary literature, especially the Handbook of the Birds of the World (including Birds of the World) (TOBIAS *et al*., 2022). According to these classifications, birds can utilise various types of habitat density, and seven types were identified for the study area: Shrubland, Woodland, Forest, Wetland, Grassland, Human Modified and Riverine.

Based on these classifications, the distribution of bird species in different types of habitats shows greater richness in environments with denser and more complex vegetation. **Shrubland** birds are those that utilise low **shrub** habitats, including thorny shrubs, thorny or arid savannas, caatinga, xerophytic shrubs and coastal shrubs. While **woodland** birds occupy habitats dominated by trees of medium height, including acacia woodlands, riverine woodlands, mangrove forests, forest edges and also more open parks with scattered taller trees. **Forest** birds, on the other hand, are those that utilise vegetation dominated by tall trees with a more or less closed canopy. These categories concentrated most of the diversity, with 63 (29%), 59 (27%) and 36 species (16%), respectively (**Figure 7.2.2.2.4.h**). These results suggest that habitats with a more varied vegetation

structure offer a wider range of resources for birds, such as food, shelter and nesting sites.

In contrast, habitats highly modified by human action, such as **human modified** and **riverine**, showed the lowest richness, with only 3 (1%) and 2 species (1%), respectively (**Figure 7.2.2.2.4.h**). Human-modified environments include urban landscapes, intensive agriculture and even landscaped areas, while riverine environments are those associated with rivers and streams at all elevations. The lower representation of these habitats can be attributed to the lower availability of resources and the fragmentation of these types of environments.

Figure 7.2.2.2.4.h
Classification of birds according to habitat type



Finally, **wetlands** and **grasslands** showed intermediate richness, with 30 (14%) and 26 species (12%) respectively, indicating the importance of these environments for birdlife (**Figure 7.2.2.2.4.h**). The first type of habitat is represented by a wide variety of freshwater aquatic environments, including lakes, swamps and marshes. The second is characterised by the presence of open, dry to wet landscapes dominated by grasses.

These data demonstrate the heterogeneity of bird distribution among the different habitat types and the influence of vegetation structure and human activities on the composition of bird communities. This highlights the importance of environments such as shrublands, woodlands and forests, which offer a greater variety of microhabitats that can be utilised by different bird species.

Among the species present in these two types of environments, the following can be mentioned: Northern Red-headed Weaver (*Anaplectes leuconotos*), Southern Red-headed Weaver (*Anaplectes rubriceps*), Western Violet-backed Sunbird (*Anthreptes longuemarei*),Yellow-breasted Apalis (*Apalis flavida*), Tawny Eagle (*Aquila rapax*), Pale-throated Greenbul (*Atimastillas flavigula*), Chinspot Batis (*Batis molitor*), African Grey Flycatcher (*Bradornis microrhynchus*), Red-billed Buffalo-weaver (*Bubalornis niger*), Augur Buzzard (*Buteo augur*), Grey-cheeked Hornbill (*Bycanistes*

subcylindricus), Bleating Camaroptera (*Camaroptera brachyura*), Black Cuckooshrike (*Campephaga flava*), Bennett's Woodpecker (*Campethera bennettii*), Nubian Woodpecker (*Campethera nubica*) (**Table 7.2.2.2.4.a**).

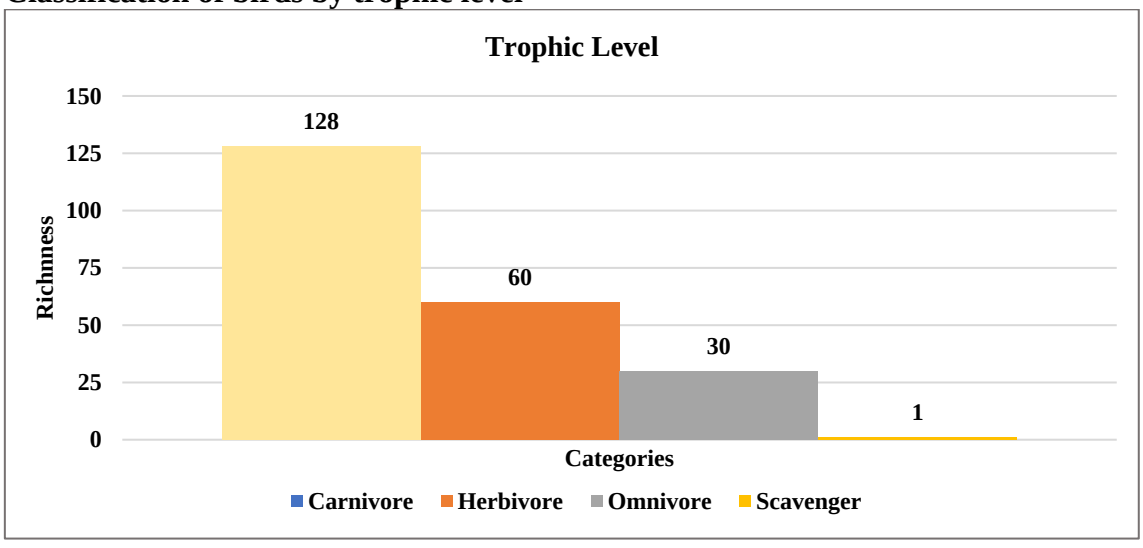
Trophic Level

Trophic levels correspond to groups of species that exploit the same class of resources in a similar way (ROOT, 1967). According to TERBORGH & ROBINSON (1986), the concept of trophic levels makes it possible to compare the functional organisation of different communities, even if they have different specific compositions. The structure and composition of a bird community changes when any alteration occurs in the vegetation, whether natural or caused by human activities, and this can influence the trophic structure of the bird community studied (ALEIXO, 1999).

The bird species recorded in the development area have been classified according to different trophic levels, namely: primary consumers (herbivores), secondary consumers and tertiary consumers (carnivores and scavengers). For omnivorous species, they can be either primary or secondary consumers, depending on the type of food they are consuming (PIGOT *et al*., 2020; TOBIAS *et al*., 2022).

Analysing **Figure 7.2.2.2.4.i** reveals a clear dominance of **carnivores** in the community studied, representing 128 individuals (58.4% of the total). **Herbivores** are next with 60 individuals (27.4%), followed by **omnivores** with 30 individuals (13.7%). **Scavengers** represent a very small portion of the community, with only 1 individual (0.5%).

Figure 7.2.2.2.4.i
Classification of birds by trophic level



The high proportion of carnivorous birds may be related to the strong presence of potential prey biomass in the area studied, which may favour the growth of predator populations and consequently increase the chance of observing these species in the field. Birds classified as carnivores include distinct subcategories, such as aquatic predators,

birds that feed on invertebrates, and those that consume small vertebrates (SICK, 1997). This diversity within the subcategories significantly expands the number of carnivorous species recorded.

Similarly, herbivores benefit from the wide availability of natural resources such as fruit and seeds. The presence of nutrient-rich vegetation, including seeds, fruits and shoots, can support considerable populations of herbivorous birds. Frugivorous species, for example, represent around 10% of bird families globally and play a crucial role in seed dispersal, not only because of the abundance and frequency with which they consume fruit, but also because of their ability to travel great distances, which makes dispersal more effective (PIZO & GALETTI, 2010).

As for omnivores, they are birds that often demonstrate impressive environmental adaptability, with the ability to thrive in modified environments and without great demands on the available food resources. The abundance of omnivorous birds is directly associated with the diversity of food available, both of animal and plant origin. In resource-rich ecosystems, these birds easily find food, which facilitates the growth of their populations (SICK, 1997).

Finally, scavenger species, such as the Hooded Vulture (*Necrosyrtes monachus*) recorded in this study (**Table 7.2.2.2.4.a**), tend to be abundant, show gregarious behaviour and have a wide distribution. However, the scavenger guild is represented by few species, with only five listed as probable in the region of the development, which explains the lower representativeness of this guild.

Primary Lifestyle

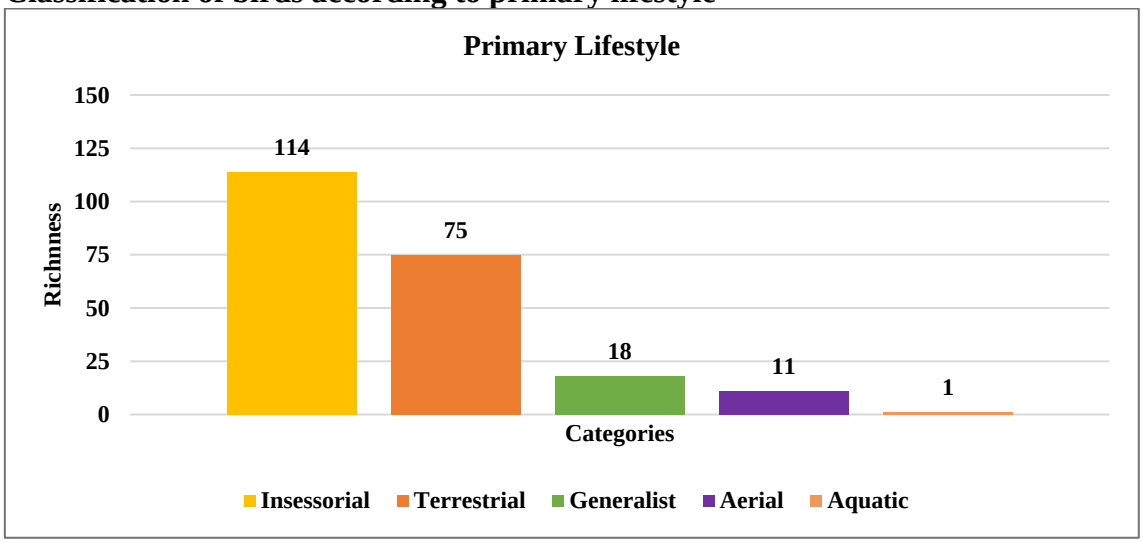
Finally, the bird species recorded were classified according to their primary lifestyle (TOBIAS *et al*., 2022). According to the classifications adopted by the authors, birds can have up to five lifestyles: i) Aerial; ii) Terrestrial; iii) Insessorial; iv) Aquatic and; v) Generalist.

Based on the above classifications, the distribution of bird species according to lifestyle reveals a predominance of insessory species, which totalled 114 individuals, representing 52.1% of the total. Terrestrial species appear in second place, with 75 individuals, corresponding to 34.2% of the total. Generalists, which have a more adaptable lifestyle to different types of habitats, totalled 18 individuals, or 8.2%. Birds with an aerial lifestyle, more associated with continuous flight, are represented by 11 individuals, or 5.0%. Finally, water birds, with only 1 individual recorded, make up 0.5% of the total sample (**Figure 7.2.2.2.4.j**).

The predominance of insessory species can be seen as an indication of the abundance of suitable habitats for these birds in the area studied. Insessory species spend most of their time perched above the ground, either on tree branches, other vegetation (such as shrubs), or on elevated substrates such as rocks, buildings, posts and wires. Considering the characteristics of the environments sampled, insessorial birds generally depend on vegetation, whether dense or sparse, to find shelter and food. Therefore, the high

representativeness of this group suggests that the environments studied are capable of providing the necessary resources to sustain large populations of these species.

Figure 7.2.2.2.4.j
Classification of birds according to primary lifestyle



Land birds, on the other hand, are those that spend most of their time on the ground, where they obtain food while walking or jumping, and also include species that use aquatic environments but keep their bodies above water. This group, which accounted for 34.2% of the birds recorded, is directly related to the presence of large open areas or exposed soil in the fauna sample areas, which offer suitable conditions for foraging. The significant presence of this group may reflect the combination of savannas, grasslands and other open formations in the study sites.

Generalist birds, which don't have a defined primary lifestyle and spend their time in different lifestyle categories, accounted for 8.2% of the birds recorded. This percentage highlights the versatility of certain species in exploring different types of habitats and, consequently, different food resources.

Aerial species, which spend most of their time flying and forage predominantly in flight, accounted for only 5.0% of the total number of birds recorded. This result suggests that, although they are important, the resources available to this group, such as open spaces for flight and specific food (such as insects in flight), are less abundant in the study area.

Finally, the near absence of waterfowl (0.5%) could at first indicate a limitation of aquatic environments or wetlands in the region. However, this analysis should be made with caution. Tobias *et al.*'s (2022) classifications for these categories consider that terrestrial species also include birds that directly use aquatic environments, but which do not have the right morphology for swimming and forage upright. As a result, this categorisation limits the number of birds considered to be aquatic, restricting this category only to birds that spend most of their time floating or diving in the water to obtain food.

Thus, species belonging to the Ardeidae, Ciconiidae and Threskiornithidae families, known for using aquatic environments, were distributed in the insessorial and terrestrial categories, while only the Long-tailed Cormorant (*Microcarbo africanus*) was included in the aquatic category. This is because it is the only species among those recorded that actually spends most of its life in aquatic environments, diving for food.

Qualitative and Quantitative Analyses

The qualitative and quantitative information obtained during the bird surveys is presented and discussed below. Firstly, aspects related to the richness and abundance recorded in the Sampling Areas are discussed. This is followed by comparative analyses between the different Sampling Areas and Stations, considering factors such as sampling sufficiency, estimates of richness, diversity and equitability, as well as other relevant analyses; specifically for the BS1, BS2, BS5, BS6, BS8 and BS9 sampling areas. As mentioned above, areas BS3 and BS4, as well as the point called Birds Point, were sampled in one fauna survey campaign, and the results are presented as a whole, without a comparative analysis.

Finally, a comparison is made between the primary data obtained in the field and the secondary data available in the literature for the project area.

It is worth noting that the topics on Sample Areas, Sample Stations, Sample Sufficiency, Richness Estimators, Diversity and Equitability, as well as Similarity between Sample Areas, were developed based exclusively on field data obtained using standardised methodologies. This approach was chosen to guarantee the consistency and comparability of the results throughout the study. On the other hand, the topic dealing with the comparison between Primary and Secondary Data covers all the results obtained, including those from non-standardised methodologies.

Thus, reiterating the information presented earlier, considering only the standardised data that will be used in subsequent statistical analyses, 3,721 records were obtained for 211 bird species, distributed in 20 orders and 55 families (**Table 7.2.2.2.4.a**).

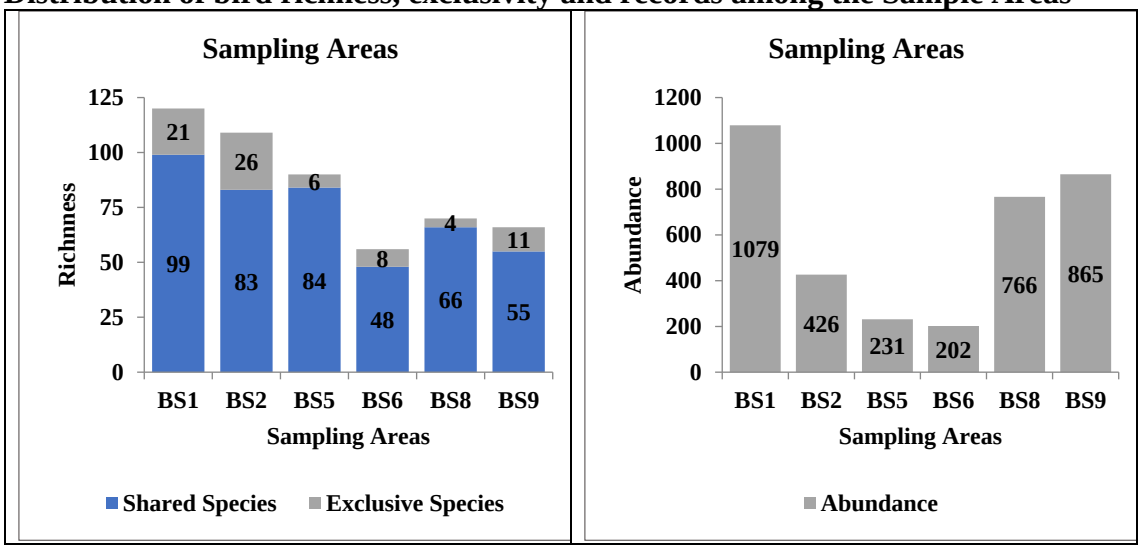
Sample Areas

Analysing the results for the Sampling Areas, BS1 stood out with the highest richness, recording 120 species, followed by BS2 with 109 species and BS5 with 90 species. BS8 showed intermediate richness, with 70 species, while areas BS9 and BS6 showed the lowest diversity, with 66 and 56 species, respectively. The average number of species between the sampling areas was 85, and the difference in richness between the richest area and the one with the lowest richness was 53%, indicating that the diversity in BS1 is more than double that found in BS6 (**Figure 7.2.2.2.4.k**).

In terms of exclusivity, i.e. species only recorded in a single sampling area, the data reflects the distribution of richness observed. Areas BS2 and BS1 had the highest number of exclusive species, with 26 and 21, respectively. On the other hand, areas BS6 and BS8 had the lowest values, with eight and four exclusive species, respectively (**Figure**

7.2.2.2.4.k).

Figure 7.2.2.2.4.k
Distribution of bird richness, exclusivity and records among the Sample Areas



As for abundance, the number of records does not follow the same pattern as richness. Area BS1 leads the way with 1,079 records, while BS9 and BS8 follow with 865 and 766 records, respectively. Despite their low richness, these areas had high numbers of records. BS2, which had the second highest richness, had the third lowest number of records, with 426. On the other hand, BS5 and BS6 were the areas with the lowest abundance, with only 231 and 202 records, respectively. The average number of records between the areas was 595, and the difference between the most abundant area (BS1 - N=1,079) and the least abundant (BS6 - N=202) was 877 records, representing a difference of almost 80% (**Figure 7.2.2.2.4.k**).

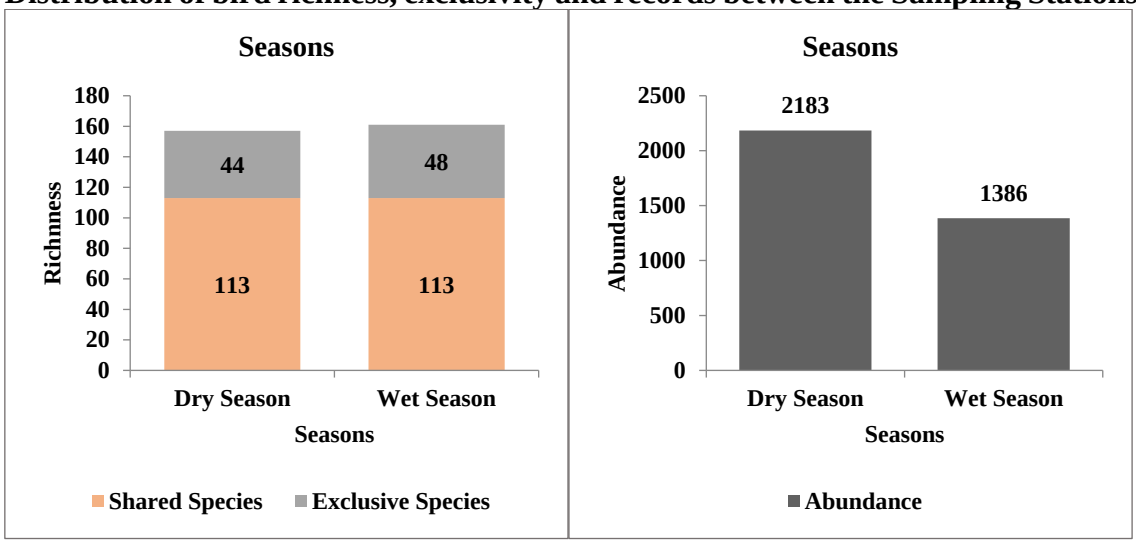
Correlating the values obtained with the environmental characteristics of each sampling area, it can be seen that BS1, with little disturbed Wooded Grassland vegetation, has the highest species richness (120) and abundance (1,079), while BS2, a heavily disturbed Evergreen Dry Forest, has high richness (109) and exclusivity (26), but low abundance (426). BS5, a preserved Open Miombo Woodland, has 90 species and 231 records, with low exclusivity (6). BS6, a preserved Savannah Woodland, has the lowest richness (56) and abundance (202), with 8 unique species. BS8, a heavily disturbed Miombo Woodland, has moderate richness (70) and high abundance (766), but low uniqueness (4). BS9, a highly disturbed Shrubland/Thickets, has 66 species and high abundance (865), with 11 unique species. In summary, the results suggest that areas with preserved and less disturbed vegetation tend to have higher species richness, while more disturbed areas may favour the abundance of adaptable species. Species exclusivity varies according to habitat specificity and the availability of distinct habitats in each area.

Sample plots

During the wet season, which occurs in most tropical and subtropical regions, there is an abundance of water and an explosion in the availability of food, such as fruit, insects and small vertebrates, which favours bird reproduction and the formation of large groups. The vegetation is dense and offers various micro-habitats. In contrast, the dry season is marked by a shortage of water and a significant reduction in the food supply, with the vegetation becoming less productive. During this period, birds may face difficulties in obtaining resources, leading some species to migrate or adapt their foraging and breeding behaviour to survive the adverse conditions. Seasonality therefore plays a crucial role in the ecological dynamics of birds, shaping their migration, breeding and feeding patterns (SINCLAIR, 1978; SICK, 1997; CHAVES-CAMPOS, 2004; COX *et al*., 2013; DINESEN *et al*., 2022).

Analysing the data from the two sampling seasons, dry and wet, reveals subtle differences in species richness. During the wet season, 161 species were recorded, of which 48 were exclusive. In contrast, the dry season showed 157 species, with 44 exclusives. Both seasons shared the majority of species, totalling 113 common ones, which represents around 55% of the total richness (N=205) (**Figure 7.2.2.2.4.l**).

Figure 7.2.2.2.4.l
Distribution of bird richness, exclusivity and records between the Sampling Stations



However, the abundance of records revealed a more marked difference. The dry season accumulated 2,183 records, while the wet season had 1,386 records, reflecting a 37% difference between the two sampling periods (**Figure 7.2.2.2.4.l**).

These results indicate that, as expected, the wet season had higher species richness and exclusivity, since better environmental conditions are present in this season due to the greater supply of food and consequently greater foraging activity by the birds. On the other hand, the same was not true of abundance, which was significantly higher in the dry season.

However, the abundance results should be interpreted with caution. Although the wet season is generally more favourable for birdwatching, the heavy rains observed in the field during this season may have compromised some of the sampling. Rain can affect the impermeability of birds' feathers, leading to rapid heat loss and consequently affecting their biological activity when exposed to these conditions (ROOS, 2010). Thus, during the rain, it is common for birds to reduce their foraging activities and remain in shelters, which can reduce the detection of individuals by observers in the field.

When comparing the records of migratory species, which tend to respond better to the environmental conditions of the sampling stations, subtle differences were observed. For the richness of migratory species between the seasons, 20 species were recorded in the dry season and 22 in the wet season, representing a difference of just 9%. For abundance, there were 290 records of migratory birds in the dry season, compared to 309 in the wet season, indicating a difference of just 6%. These results suggest that the seasonality sampled had little influence on the bird community in the region. However, it is important to emphasise that these conclusions are based exclusively on the data obtained in the field and should not be considered an absolute truth for the reality of the region affected by the project.

Sample Areas and Plots

With regard to richness, only two sampling areas had a higher number of species in the dry season compared to the wet season: area BS1, with 92 species recorded in the dry season compared to 55 in the wet season, representing a 40% difference between the two seasons; and BS6, with 37 species in the dry season and 34 in the wet season, corresponding to a difference of just 8% (**Figure 7.2.2.2.4.m**).

In all the other areas, the wet season was the richest in species, with area BS2 standing out with 80 species in the wet season, while 63 species were recorded in the dry season, resulting in a difference of 21%. Next, area BS9 had 57 species in the wet season and 34 in the dry season, indicating 40% more species in the wet season (**Figure 7.2.2.2.4.m**).

In general, species richness tended to be higher in the wet season than in the dry season. However, this trend was not uniform in all the sampling areas.

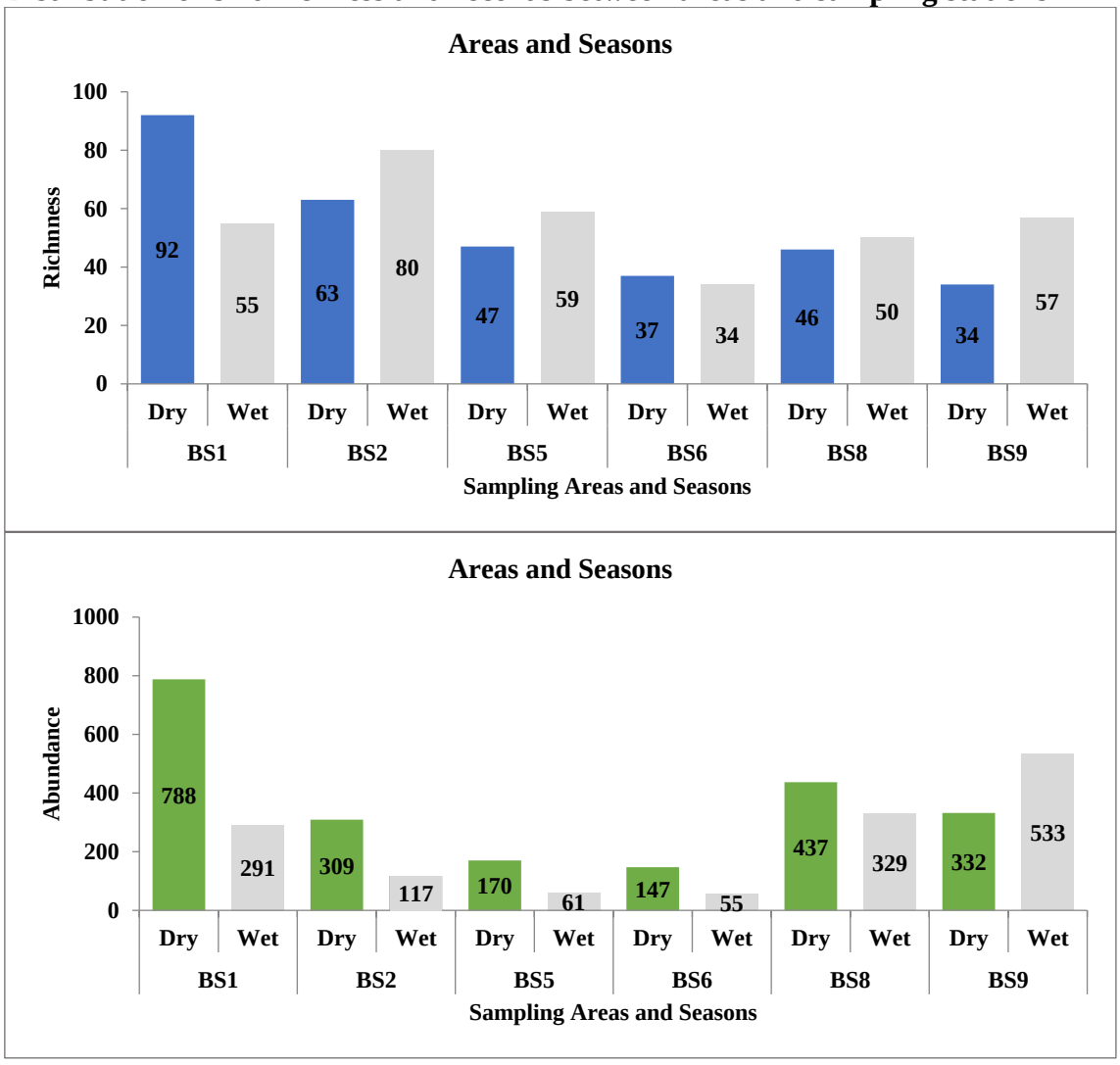
With regard to abundance, with the exception of sampling area BS9, all the other areas had their highest abundance values in the dry season. The BS9 area obtained 533 records in the wet season and 332 in the dry season, resulting in a difference of 38% more records for the wet season (**Figure 7.2.2.2.4.m**).

In contrast, area BS1 had the highest overall abundance, with 788 records in the dry season and 291 in the wet season, equivalent to a significant difference of 63% more records in the dry season. Area BS6, on the other hand, despite having the lowest overall abundance, with only 147 records in the dry season and 55 in the wet season, also showed a difference of 63% between the seasons, with greater abundance in the dry season.

It is therefore possible to see that the abundance of species varied considerably between the seasons and between the different areas. There was no clear upward or downward trend in abundance between the seasons, but it is clear that the dry season was also more abundant when compared between each sampling area.

Thus, the analysis of richness and records in each sampling area reveals that, as discussed above, the composition of the landscape seems to exert a more significant influence on bird species than the seasonal periods in which the data was collected. This indicates that, in this case, spatial factors had a greater impact than temporal factors.

Figure 7.2.2.2.4.m
Distribution of bird richness and records between areas and sampling stations



Sampling Sufficiency

The species rarefaction and accumulation curves generated for both sampling events (dry and wet seasons) and for all the sampling areas together show an upward trend, with no

signs of stabilisation. This indicates that the total number of species present in the sampled areas is probably higher than that recorded in this study. In other words, the real species richness has not yet been completely sampled, suggesting that a greater number of species could be found with a more intensive sampling effort (**Figure 7.2.2.2.4.n**).

These results were already expected, considering that studies with small sampling efforts are not enough to achieve curve stability, which should only occur over the long term, especially when considering endemic and/or endangered species, which are naturally rare and have low population densities, requiring much more time to be recorded in the field (COSTA-BRAGA *et al*., 2014; STRAUBE *et al*., 2010; VASCONCELOS, 2006).

Figure 7.2.2.2.4.n
Sample rarefaction curve (blue line) and accumulation curve (red line) for the Sample Areas and the Total

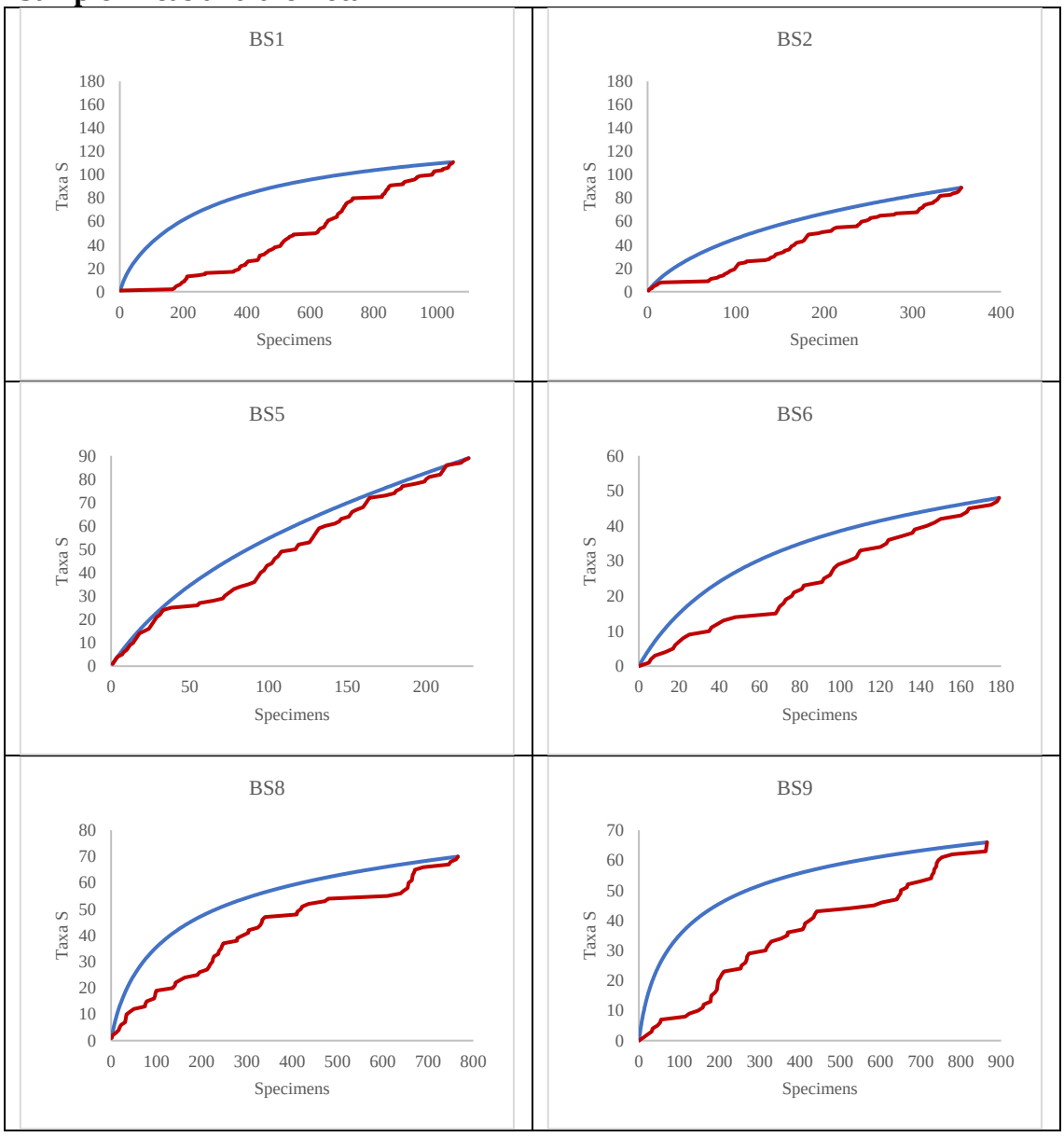
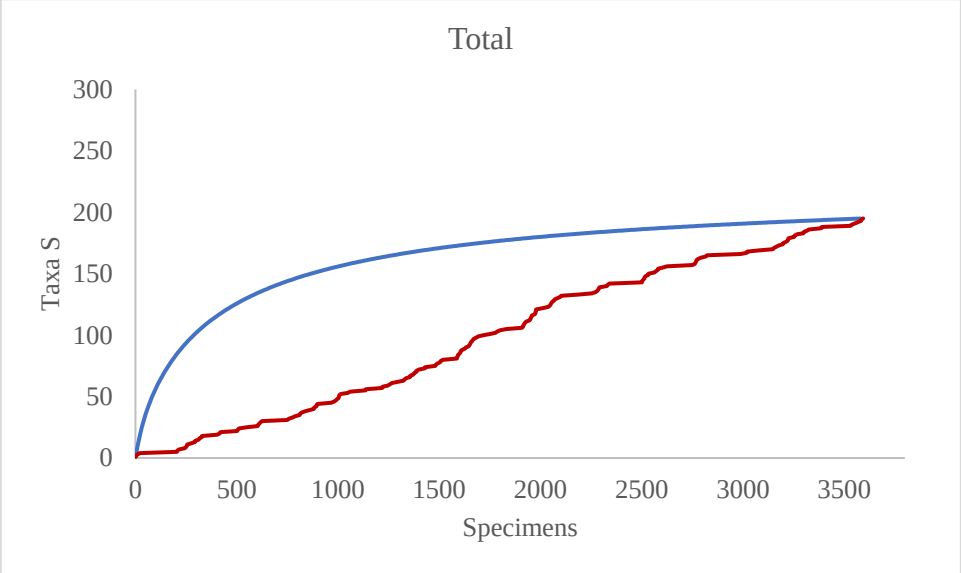


Figure 7.2.2.2.4.n
Sample rarefaction curve (blue line) and accumulation curve (red line) for the Sample Areas and the Total



Estimators of Richness, Diversity and Evenness

The richness estimators, Chao 2 and Jacknife 1, provided higher values than the observed number of species in all zones, indicating that there are probably more species present in the sampling areas that were not detected in the field. For example, in BS1, Chao 2 estimated 196.39 species and Jacknife 1 estimated 166.5 species, both higher than the 120 species observed. For the total, Chao 2 estimated 272.08 species and Jacknife 1 estimated 269.16 species, suggesting that the sampling was fairly comprehensive, but not yet complete (**Table 7.2.2.2.4.b**). Thus, although the Chao 2 and Jacknife 1 indices indicate good sampling coverage (75% and 76%, respectively), it is important to emphasise that there is still potential to find new species with an increase in sampling effort.

Table 7.2.2.2.4.b
Richness, diversity and evenness estimators for the Sample Areas and the Total

Indexes	BS1	BS2	BS5	BS6	BS8	BS9	Total
Rate_S	120	109	90	56	70	66	205
Individuals	1079	426	231	202	766	865	3569
Chao 2	196.39	148.64	169.44	81.62	87.51	81.86	272.08
Jacknife 1	166.5	146.5	127	76.5	92	86.5	269.16
Shannon_H	3,77	4	4,09	3,64	3,43	3,5	4,48
Fisher_alpha	34,55	47,34	54,2	25,65	18,74	16,62	47.26
Equitability_J	0,78	0,85	0,9	0,9	0,8	0,83	0.84

As for the Shannon index, which measures diversity considering both richness and evenness, it varied between 3.43 (BS8) and 4.09 (BS5), while the total value was 4.48. These values can be considered relatively high, indicating a well-diversified community,

since typical Shannon-Wiener index values generally vary between 1.5 and 3.5, and rarely exceed 4.5 (MAGURRAN, 1988) (**Table 7.2.2.2.4.b**).

The Fisher alpha index, another indicator of diversity, was highest in BS5 (54.2), suggesting greater diversity in this area, and lowest in BS9 (16.62). Areas BS1 and BS6 had average values of 34.55 and 25.65, respectively. The total value was 47.26, indicating high diversity when analysing the data set (**Table 7.2.2.2.4.b**).

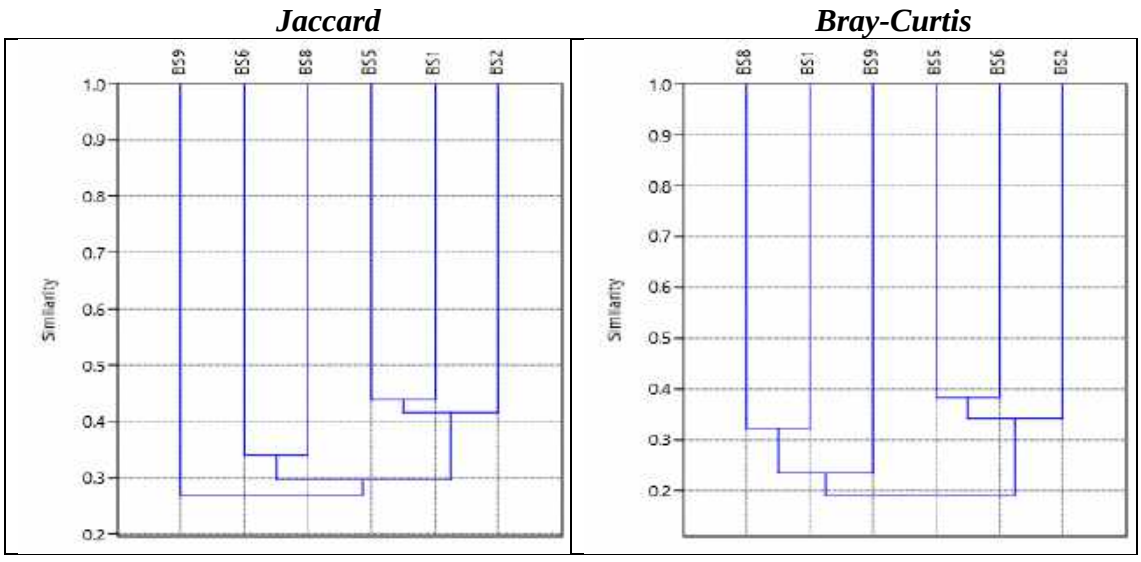
Finally, equitability ranged from 0.78 (BS1) to 0.90 (BS5 and BS6), with a total value of 0.84. This indicates that, in general, the species are relatively evenly distributed in all the areas, although there are some variations (**Table 7.2.2.2.4.b**).

Similarity between the Sample Areas

To assess the faunal composition of the species recorded in the Sampling Areas, communities were grouped based on similarity using the UPGMA (Unweighted Pair Group Method with Arithmetic Mean) method. This grouping method is based on unweighted arithmetic means and was applied in conjunction with two similarity indices: the Jaccard index, which is based on the presence/absence of species in each community, and the Bray-Curtis index, which takes species abundance into account.

Figure 7.2.2.2.4.o below shows a dendrogram, which is a diagram illustrating the hierarchical relationships between different elements, in this case the sample areas BS1, BS2, BS5, BS6, BS8 and BS9. The height of the horizontal lines in the dendrogram reflects the dissimilarity (or distance) between the groups; the lower the junction point, the greater the similarity between the sampling areas.

Figure 7.2.2.2.4.o
Grouping by similarity of the bird communities in the Sample Areas, obtained using the Jaccard and Bray-Curtis similarity indices



The dendrogram based on Jaccard's index, which considers the presence of species in each area, indicates the formation of two distinct groups. The first group, made up of areas BS1, BS2 and BS5, suggests that these areas share more species with each other, with similarity indices varying between 0.4 and 0.5. The second group includes areas BS6, BS8 and BS9, demonstrating greater similarity in species composition between these areas, with indices varying between 0.2 and 0.35 (**Figure 7.2.2.2.4.o**).

In turn, the dendrogram based on the Bray-Curtis index, which takes species abundances into account, also reveals the formation of two groups. The first group includes areas BS2, BS5 and BS6, indicating that these areas have more similar abundances, with indices varying between 0.3 and 0.4. The second group, which includes areas BS1, BS8 and BS9, shows greater similarity in species abundance, with indices between 0.2 and 0.35 (**Figure 7.2.2.2.4.o**).

These results, for both the Jaccard and Bray-Curtis indices, are in line with the previous analysis of birds composition between the sampling areas, which pointed to a greater shared richness between areas BS1, BS2 and BS5, while the most similar abundances were observed in areas BS1, BS8 and BS9 (**Figure 7.2.2.2.4.o**). Although the two groups within each index are well defined, the similarity within these groups is relatively low, with values varying between 0.2 and 0.4. These values suggest that although the sampling areas share some species or abundance patterns, there are still significant differences between them. This can be interpreted as an indication that the areas share certain ecological characteristics, but that they also show important variations, possibly due to differences in habitats or specific environmental conditions. Thus, the similarity between the areas, within the groups, does not reach 50%.

Primary and Secondary Data

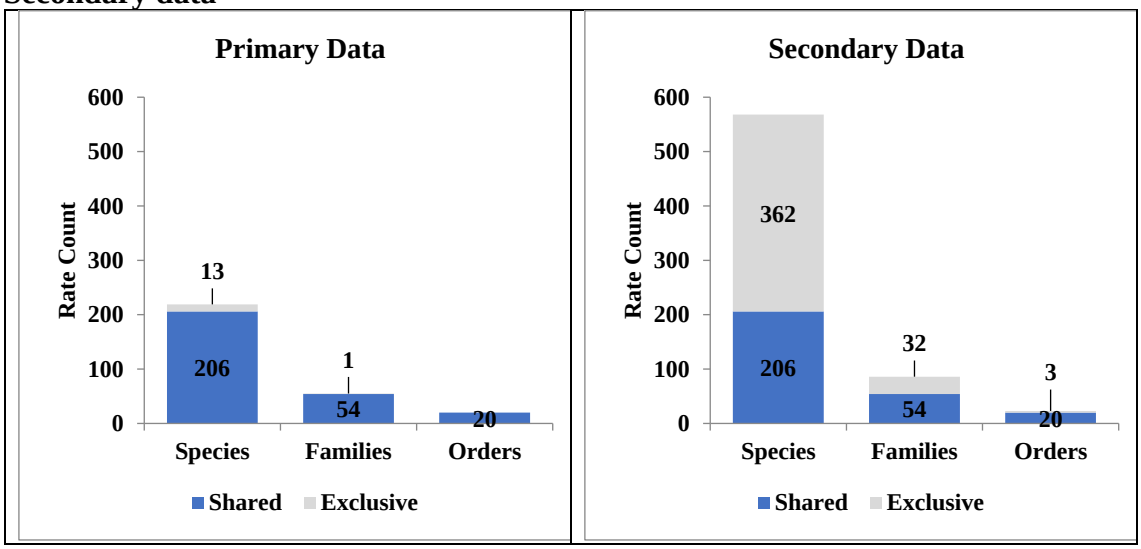
The bibliographic survey (Secondary Data) carried out resulted in a list of 568 species, distributed in 23 orders and 86 families, all with confirmed records for the region through scientific records, as well as information from digital and citizen science platforms (BAKER & OATLEY, 2001; MUTAGWABA, 2010; FISHER & HUNTER, 2016; JOHN *et al*, 2019; BAKER, 2019; BAKER & BAKER, 2019; FISHER & HUNTER, 2019; TURNER & BACKHURST, 2020; GIBF, 2024; SMITHSONIAN INSTITUTION, 2024; BIRDLIFE INTERNATIONAL, 2024a, 2024b; EBIRD, 2024; XENO-CANTO FOUNDATION, 2024) (**Figure 7.2.2.2.4.p**).

For the primary data, 3,756 records were made, belonging to 219 species, distributed in 20 orders and 55 families (**Figure 7.2.2.2.4.p**). These results were obtained considering all the sampling methods defined, both standardised (Transect Sampling, Mist Nets and Bioacoustics) and non-standardised (Interview and Opportunistic Observation).

When comparing the results of the primary and secondary surveys, 362 species expected for the study region were not recorded in the field campaigns (**Figure 7.2.2.2.4.p**). This figure is in line with the rarefaction and accumulation curves by area and the richness estimators, which indicated greater richness than that observed throughout the studies (**Figure 7.2.2.2.4.n** and **Table 7.2.2.2.4.b**).

On the other hand, the primary data expanded the diversity of the project's area of influence, adding 13 species, totalling 581 species for the region, distributed in 23 orders and 87 families (**Figure 7.2.2.2.4.p**). None of these 13 species recorded in the field and absent from the literature are classified in any threat category. Only the Woolly-necked Stork (*Ciconia episcopus*) is considered "Near Threatened - NT" by the IUCN (2024), while the Red-necked Falcon (*Falco chicquera*) and African Scops-owl (*Otus senegalensis*) are listed in Appendix II of CITES (2024).

Figure 7.2.2.2.4.p
Distribution of bird richness, exclusivity and records between Primary and Secondary data



It is important to note that, despite the 2.2% increase in the total number of species expected for the area, all 13 species are expected to occur in the region, according to their distributions (STEVENSON & FANSHAWE, 2020). Thus, although they were not on the secondary data list, their presence in the area of influence of the project was not unexpected, and there was no increase in the distribution of these species.

In total, 219 of the 568 bird taxa (38%) listed in the secondary data were recorded in the field. As for the highest taxonomic classifications, 55 of the 86 families (64%) and 20 of the 23 orders (87%) were detected during the surveys (**Figure 7.2.2.2.4.p**). Among the families recorded exclusively in the field, the Turnicidae (Buttonquails) stands out. Birds in this family face threats such as habitat loss and degradation due to agricultural expansion and urbanisation, as well as illegal hunting and capture, especially in regions where these practices are common (BIRDLIFE INTERNATIONAL, 2016; WINKLER *et al.*, 2020).

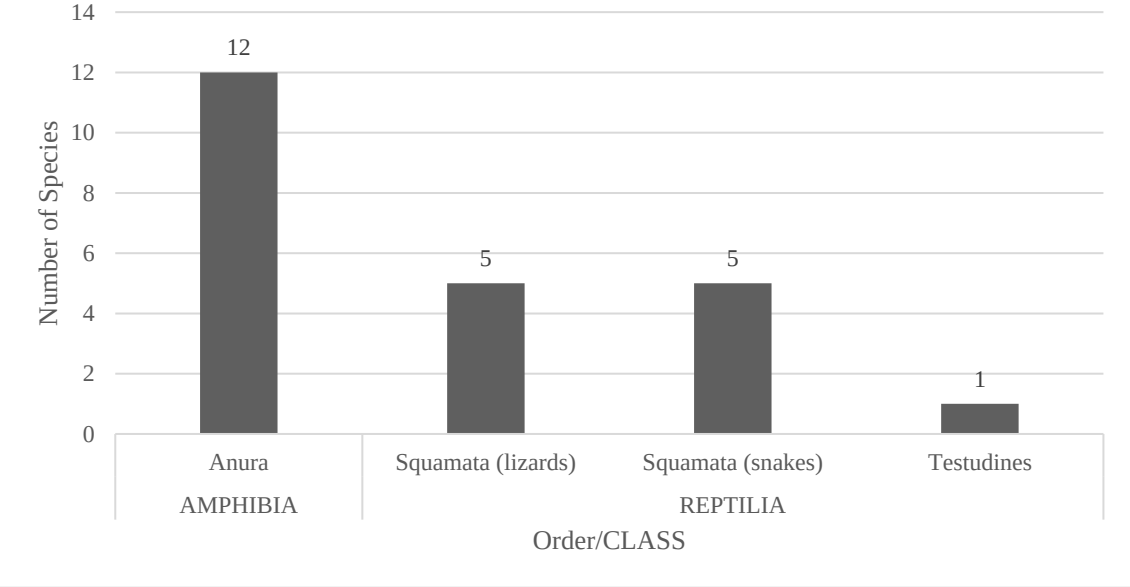
Considering that the field activities covered a year, including dry and wet seasons, and that the secondary data was obtained from various bibliographic sources, covering different periods and inventory methods, it can be said that this study provided a good representation of the birds expected for the study area.

7.2.2.2.5
Herpetofauna

Data collection efforts during the reptile and amphibian survey campaigns at the project's sampling points resulted in a total of 23 taxa and 349 herpetofauna records.

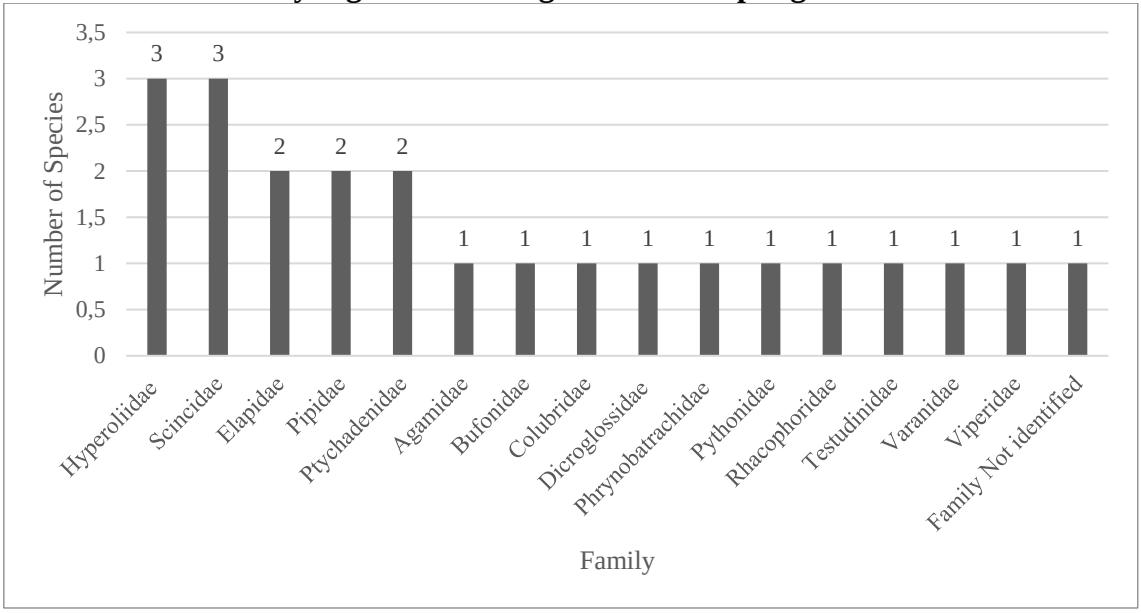
The amphibian group was the most abundant and diverse, accounting for around 75% of all records and 52% of all taxa. The reptile group accounted for around 25% of all records and 48% of all taxa (**Figure 7.2.2.2.5.a**). **Table 7.2.2.2.5.a** in **Annex 7** summarises the results obtained during the study, with the list of species, sampling points, data collection methods, hunting, endemism and threat status.

Figure 7.2.2.2.5.a
Distribution of Orders registered during the field sampling



For amphibians, 12 taxa were identified in 262 records, distributed in seven families: Bufonidae, Dicroglossidae, Hyperoliidae, Phrynobatrachidae, Pipidae, Ptychadenidae and Rhacophoridae, all from the Anura order. For reptiles, 11 species were identified in 87 records, distributed in eight families, including the Testudinidae family of the Testudines order, as well as three families of lizards Agamidae, Scincidae, Varanidae and four families of snakes Colubridae, Elapidae, Pythonidae, Viperidaeda of the Squamata order (**Figure 7.2.2.2.5.b**). Among the taxa recorded, two anurans could not be identified to species level: "Anura Not Identified" and *Hyperolius* sp., both recorded using vocalisations recorded with the aid of SongMeter Micro. Through these vocalisations it was only possible to arrive at the order and genus level, making it necessary to capture the specimens for identification.

Figure 7.2.2.2.5.b
Distribution of Family registered during the field sampling



In all, three different collection methods were applied to obtain field data: Active Search, SongMeter Micro auditory recordings and Interviews. Of the species surveyed, four reptiles were recorded only by interviews: Egyptian Cobra (*Naja haje*), Central African Rock Python (*Python sebae*), Puff Adder (*Bitis arietans*) and Leopard Tortoise (*Stigmochelys pardalis*). These species are easy to identify due to their unique characteristics and were therefore included in the list. The other reptile species were recorded during the Active Search and three amphibian taxa were only recorded using SongMeter recordings: Bubbling Kassina (*Kassina senegalensis*), "Anura Not Identified" and Hyperolius sp. (**Table 7.2.2.2.5.a**).

Conservation Status

In order to check the conservation *status of* the species recorded, lists of internationally endangered species were consulted, according to the Red List of the International Union for Conservation of Nature and Natural Resources (IUCN 2024) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES 2024).

None of the species recorded are classified as endangered, with the only highlight being the Central African Rock Python (*Python sebae*), under the status of "Near Threatened", which was only recorded through interviews with local residents.

Another three species, the Nile Monitor (*Varanus niloticus*), the Central African Rock Python (*Python sebae*) and the Leopard Tortoise (*Stigmochelys pardalis*) are listed in Appendix II of CITES (2024), which draws attention to the pressure they are under from hunting and selling, even though they are not threatened with extinction.

Endemism

None of the species recorded during the study are considered to be endemic to Tanzania, but occur in other East African countries

Potentially Invasive and Epidemiological Risk Species

During the campaign no invasive species of reptiles and amphibians or those with a potential epidemiological risk were recorded.

Species of Significant Economic or Food Value to Local Populations

Among the species recorded, three are recognised for being hunted and consumed by traditional communities spread across the African continent: the Central African Rock Python (*Python sebae*), the Nile Monitor lizard (*Varanus niloticus*) and the Leopard Tortoise (*Stigmochelys pardalis*).

The reptiles *Python sebae* and *Varanus niloticus* are widely hunted for food and are among the species with the highest price/body mass ratio.

The *Stigmochelys pardalis* species is recognised for being hunted for different purposes, such as pet or raw material in the production of household items (hooves) (ASEFA, 2020).

Three species of venomous snakes were recorded: Egyptian Cobra (*Naja haje*), Black Mamba (*Dendroaspis polylepis*) and Puff Adder (*Bitis arietans*). These are species that commonly occur in Tanzania, are considered to be the most venomous snake genera in the world and accidents caused by them, in most cases, lead to the victim's death when the correct treatment is not applied within the necessary time (SPAWLS & BRANCH, 2020).

Ranking of abundance

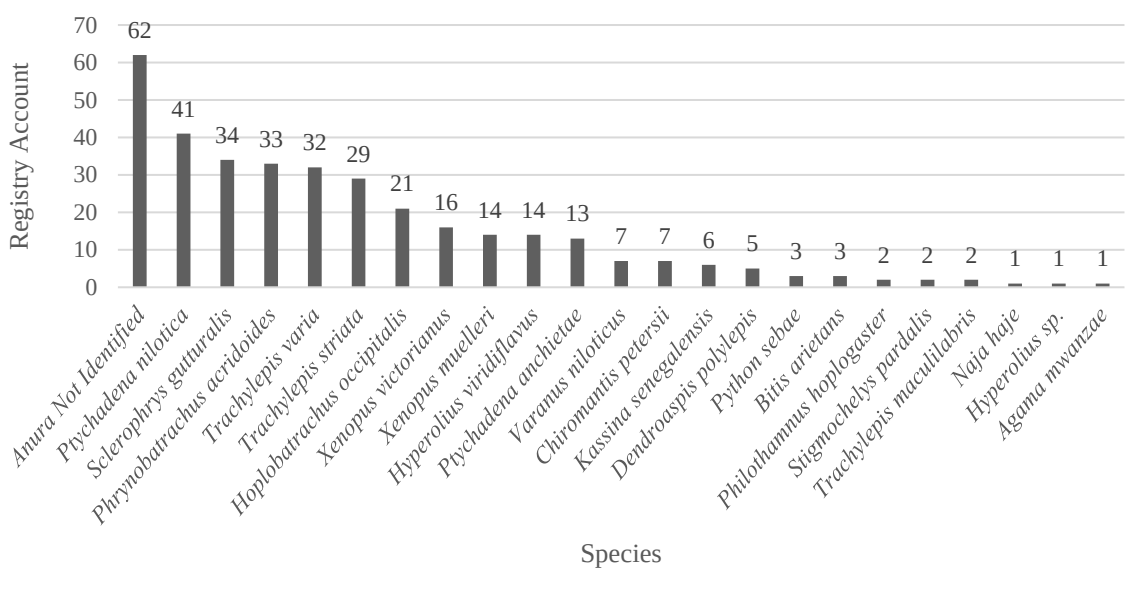
In order to compare the different abundances of the populations that make up the reptile and amphibian community in the development areas, an abundance ranking was drawn up (**Figure 7.2.2.2.5.c**).

Among the taxa recorded, "Anura Not Identified" was the most abundant, accounting for around 18% of all records. All the records of this taxon were made with the aid of the SongMeter Micro recorder, however, it is necessary to capture specimens for identification, which was not possible for safety reasons, since the location where the device was installed posed risks to the professional responsible for capturing these individuals during the night, such as attacks by hunters or predatory animals.

Next, other anurans stand out: *Ptychadena nilotica* with 41 records representing 12% of the total and *Sclerophrys gutturalis* with 34 records representing 10% of the total. The remaining species had records that accounted for 9% or less of the total recorded, especially the taxa *Naja haje*, *Hyperolius* sp. and *Agama mwanzae*, which were recorded only once each.

Within a sampling context, it is expected that a few species will have a high number of records and that several species will have a low number, an exception being communities where richness and abundance are close or similar (MAGURRAN, 2013).

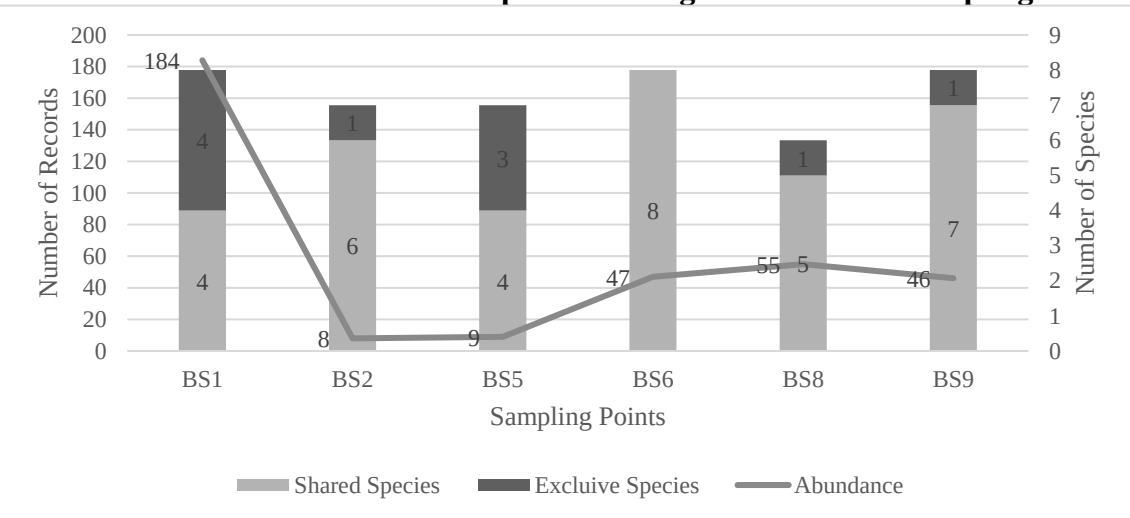
Figure 7.2.2.2.5.c
Abundance ranking for the registered amphibians and reptiles



Comparison between sample points

Based on the data obtained, **Figure 7.2.2.2.5.d** was drawn up, illustrating in a summarised way the distribution of richness and abundance of amphibians and reptiles at the different sampling points.

Figure 7.2.2.2.5.d
Richness and abundance of the herpetofauna registered on the Sampling Points



The number of species varied little between the sampling points, with the highest values being obtained at points BS1, BS6 and BS9 with eight species each. Areas BS2, BS5 had seven records each and point BS8, with six species, had the lowest value.

As for the number of species with a single record for each sampling point, the highest value was obtained at BS1, with four. Next, BS5 had three species, BS2, BS8 and BS9 had one record each and BS6 had no species with unique records.

Looking at the richness data, it is possible to say that the reptile and amphibian community in the area of influence of the development has little variation in its composition along the gradient that makes up the landscape, with the exception of sampling point BS1, where the taxa *Ptychadena anchietae*, *Xenopus muelleri*, *Xenopus victorianus* and *"Anura Not Identified"* were recorded, which were not recorded at the other points. The genus *Xenopus* comprises amphibians with an aquatic habit, strongly associated with environments that have both permanent and temporary lentic water bodies (HARPER *et al*., 2010), indicating the presence of these environments in BS1, in addition to the local vegetation being little impacted by anthropogenic actions, which favours the presence of a greater variety of niches for the species. In contrast, the other species with unique records are associated with open or arid environments, such as the Mwanza Flat-Headed Agama (*Agama mwanzae*) and the Egyptian Cobra (*Naja haje*) (SPAWLS *et al*., 2018).

The abundance data showed a marked difference between the sampling points, with the highest number of records obtained at BS1, with 184, and the lowest numbers at sampling points BS2 and BS3, with 8 and 9 records, respectively. The high abundance at BS1 reflects the abundance of the *"Anura Not Identified"* anuran, which accounted for around 18% of all records (**Figure 7.2.2.2.5.c**), all of which were made using vocalisations recorded with the aid of the SongMeter. The reduced abundance at sampling points BS2 and BS3 is mainly made up of reptile species, which vary between one and two records.

Seasonality comparison

The fauna study campaigns took place in two different stages, one during the region's rainy season and one during the dry season.

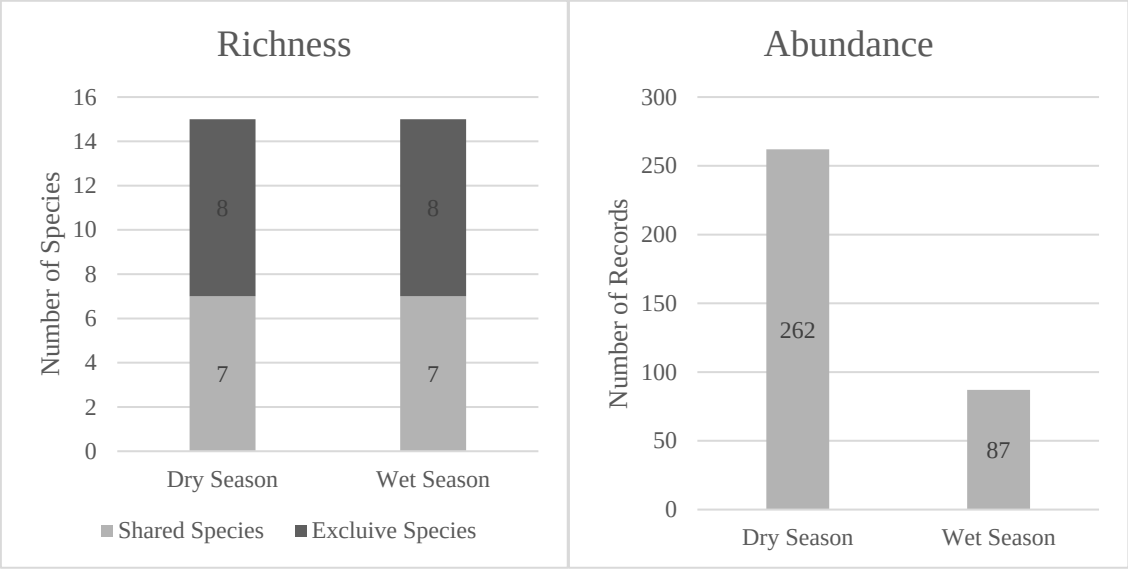
Comparing the results obtained in these two periods (**Figure 7.2.2.2.5.e**), it can be seen that the richness was similar during the two seasons, with 15 species for each, 8 of which were recorded exclusively. During the wet season, the snakes *Naja haje*, *Python sebae*, *Dendroaspis polylepis*, *Bitis arietans*, the amphibians *Hyperolius* sp., *Kassina senegalensis*, *Xenopus victorianus* and the lizard *Agama mwanzae* were recorded. During the dry season, the lizards *Varanus niloticus*, *Trachylepis striata* and the amphibians *Chiromantis petersii*, *Ptychadena anchietae*, *Xenopus muelleri*, *Hoplobatrachus occipitalis*, *Phrynobatrachus acridoides* and *"Anura Not Identified"* were recorded

The high number of amphibian species recorded during the dry season indicates little influence of seasonality on the region's reptile and amphibian community. The same can be observed for the abundance results by season, where 162 records were made during

the rainy season and only 87 during the dry season.

The low influence of seasonality emphasises the importance of landscape composition on the different species present in these habitats, where sites with environments more associated with humidity harbour species that differ from those found in arid environments.

Figure 7.2.2.2.5.e
Richness and abundance of the herpetofauna recorded on each season



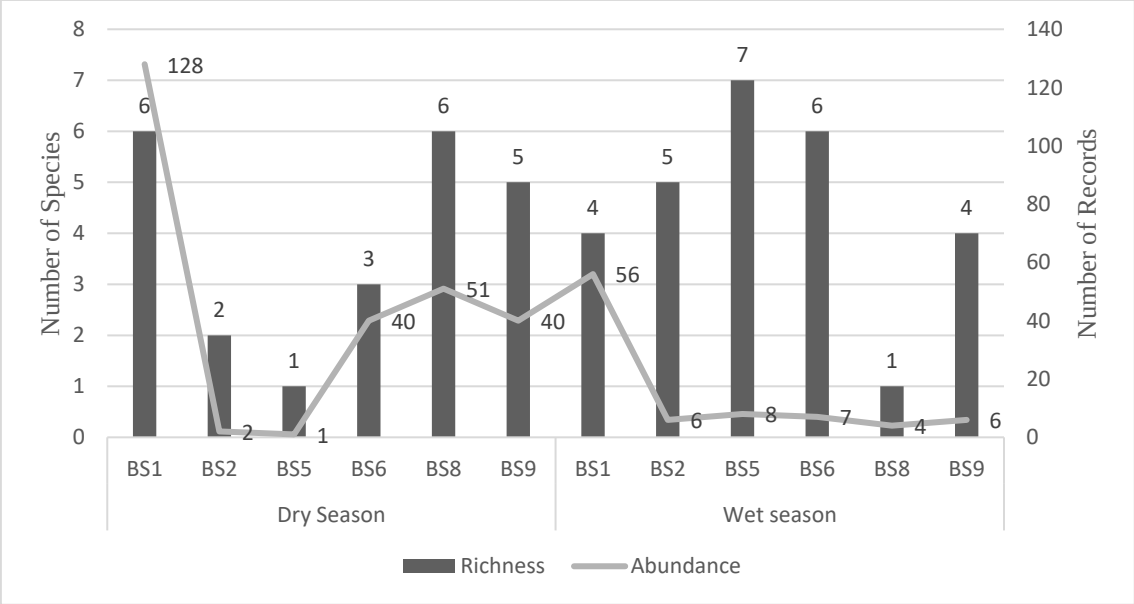
Sample Points and Seasonality

Analysing the records made at each sampling point during each season, it can be seen, as discussed in the previous topic, that the composition of the landscape has a greater influence on the species of herpetofauna in the region sampled compared to the different seasonal periods in which the data was collected, and it is notable that spatial factors are more relevant than temporal ones.

Seasonality patterns vary according to region and year in East Africa (STEVENSON & FANSHAWE, 2020), however, the opposite is expected for other tropical regions, where a greater richness and abundance of reptiles and especially amphibians is expected during the rainy periods of the year (HAYER *et al*., 2014).

The highest richness values were observed at points BS1 and BS8 during the rainy season and at points BS5 and BS6 during the dry season. The lowest values were obtained at points BS2 and BS5 during the dry period and BS8 during the rainy period **(Figure 7.2.2.2.5.f**).

Figure 7.2.2.2.5.f
Richness and abundance of the herpetofauna recorded on each season for each Sampling Point



Point BS5 has the best-preserved vegetation among the other points, with dense vegetation and little anthropogenic influence. However, during the rainy season it had the lowest richness and abundance values and during the rainy season it had the highest richness value, suggesting that seasonality can have a distinct influence on each sampling point.

As for abundance, the highest value was recorded at point BS1 during the dry season. Points BS6, BS8 and BS9 showed high values during the dry season and then the lowest values during the rainy season, again indicating that regional seasonality has a distinct effect on each of the points sampled.

Sampling Sufficiency

Figure 7.2.2.2.5.f shows the rarefaction and accumulation curves for reptiles and amphibians, based on the number of records, for each Sample Point and for the total sampled.

The rarefaction curves at points BS1 and BS8 are stable, which indicates that no new species are expected to be recorded at these points, but this result differs from the richness estimators, which point to the possibility of new species being recorded (**Table 7.2.2.2.5.b**).

The other curves generated, both for the points and for the total, show an ascending pattern, with no signs of reaching the asymptote , both for the main curve (red) and for the error margins (blue), a pattern that indicates that the efforts and methods applied to the survey were efficient in detecting species of possible occurrence in the region and that

new species are expected with the replication of these efforts, which corroborates the Chao2 and Jacknife 1 richness estimators in **Table 7.2.2.2.5.b**.

The accumulation and rarefaction curves show almost opposite behaviour in the areas sampled and in total. Several factors can explain the difference observed between these curves. One is that the species accumulation curve continues to rise until all species are recorded, while the rarefaction curve performs random simulations with the number of individuals already recorded, being able to provide a good representation of diversity with fewer individuals. The small number of species observed and the fact that some have few records, while others are recorded more frequently, also contribute to the rarefaction curves not matching the accumulation curves. Finally, the slower stabilisation of the accumulation curve reflects the presence of rare species, while the rarefaction curve indicates a more balanced distribution of diversity within the fixed sample of individuals (**Table 7.2.2.2.5.b**).

Figure 7.2.2.2.5.f
Rarefaction curve (blue line) and accumulation curve (red line) of amphibians and reptiles per account for each sampling point and total

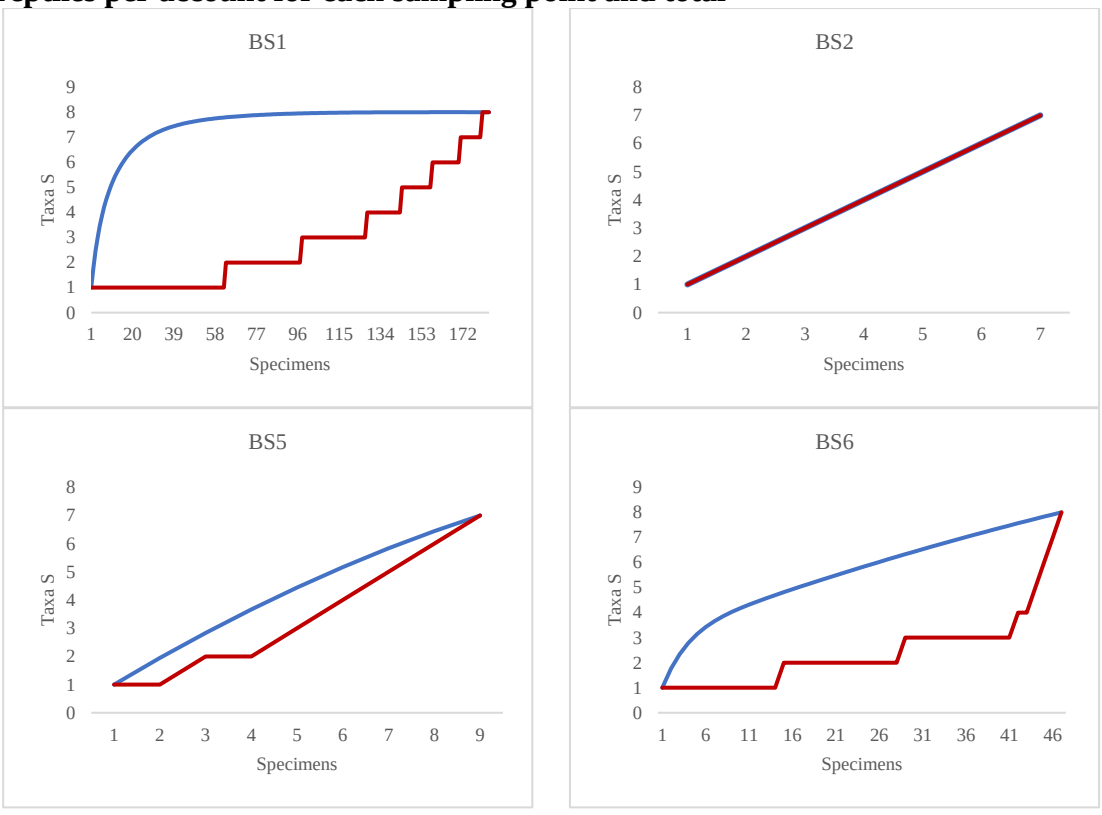


Figure 7.2.2.2.5.f
Rarefaction curve (blue line) and accumulation curve (red line) of amphibians and reptiles per account for each sampling point and total

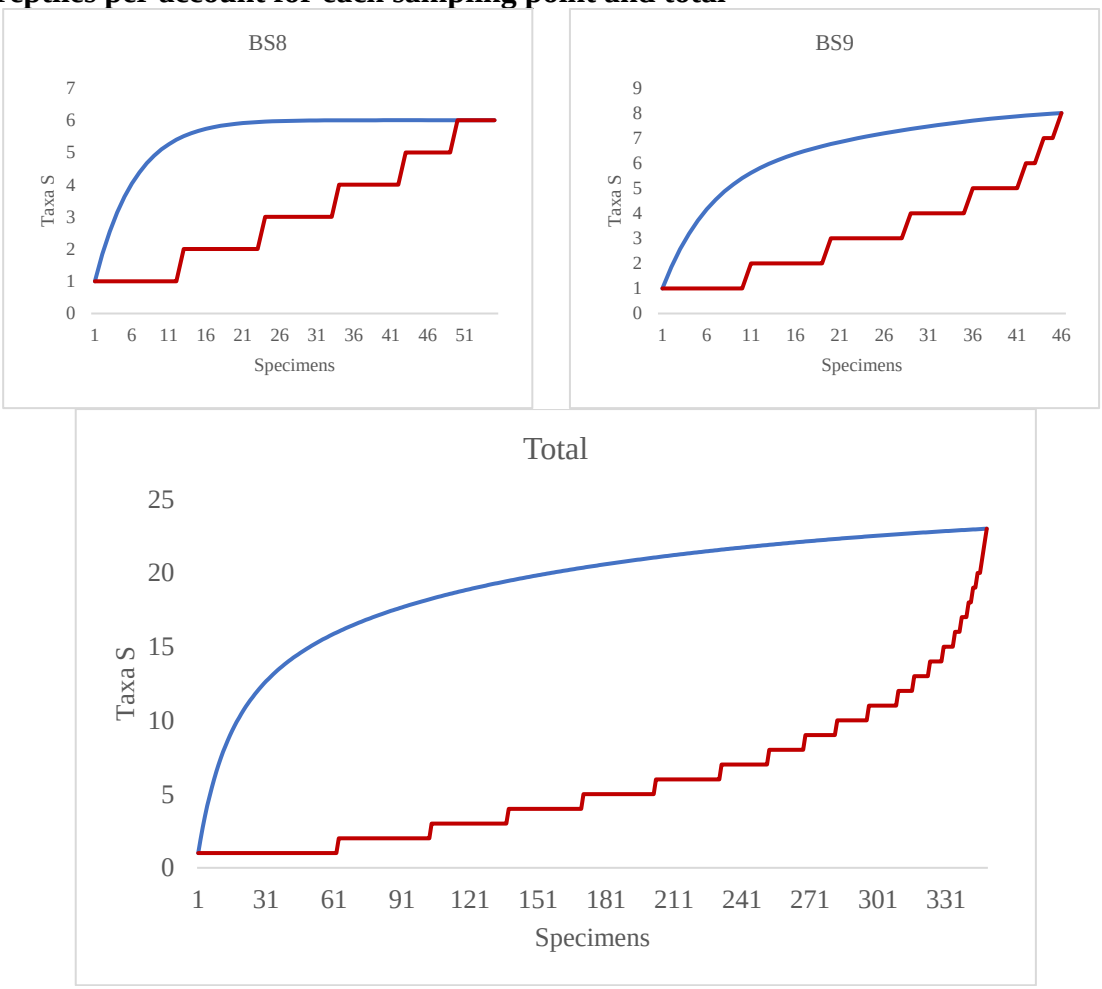


Table 7.2.2.2.5.b
Richness, abundance, estimated S, diversity indices and equitability for each sampling point and total

	BS1	BS2	BS5	BS6	BS8	BS9	Total
Observed richness(S)	8	7	7	8	6	8	23
Abundance (N)	184	8	9	47	55	46	349
Estimated S (Chao 2)	10,50	17,50	10,75	13,25	8,50	13,25	29,16
Estimated S (Jacknife 1)	11,00	10,50	10,00	11,50	8,50	11,50	33,17
Diversity (Fisher's alpha)	1,71	26,78	14,49	2,77	1,72	2,80	5,53
Diversity (Shannon's H')	1,82	1,91	1,89	1,54	1,76	1,88	2,63
Equitability (Pielou's J')	0,87	0,98	0,97	0,74	0,98	0,90	0,84

Richness and Diversity Estimators

In order to analyse the structure of species and their abundance within the amphibian and reptile communities of the Sampling Points, richness, diversity and evenness statistics

were drawn up for each point and for the total data collected during the campaign (**Table 7.2.2.2.5.b**), using the PAST software, version 4.03 (HAMMER *et al*., 2001).

The estimators indicate that the richness surveyed at point BS1 is the closest to the estimated richness when compared to the other areas as, where Chao2 estimates that around 76% (10.50) of the species expected for the point were recorded and Jackife1 estimates 73% (11.00). The lowest estimated values were for point BS2, where Chao2 indicates that 40% (17.50) of what was estimated was recorded and Jacknife1 indicates 67% (10.50). These results partly corroborate the rarefaction and accumulation curves shown in **Figure 7.2.2.2.5.f**, where more than half of the richness estimated for each Sample Point and for the total was recorded during the field collections, with the exception of points BS1 and BS8, where the curves reached the asymptote.

With regard to the diversity indices, both Shannon's H' index (H'=1.91), which considers abundance, and Fisher's Alpha (Alpha=26.78), which considers incidence, showed the highest diversity for point BS2. On the other hand, Fischer's Alpha indicates that the lowest value was obtained for point BS1, while Shannon's H' indicates the lowest value for point BS6. The sum total of the sampling units for Fisher's Alpha H' index is 5.53, which is considered a low value. For Shannon's H' index, the total value observed was 2.69, which is considered average for the diversity of reptiles and amphibians at the points sampled, since the Shannon-Wiener index is between 1.5 and 3.5 and only rarely exceeds 4.5.

The equitability indicates that the community closest to a homogeneous distribution between species and records is present at point BS2, with a value of 0.98, considered to be highly elevated, since this index ranges from 0 to 1. The community closest to a heterogeneous distribution is at point BS6, with a value of 0.74, although this is considered a medium value. For the total, the equitability is 0.84, which is considered a high value for the reptile and amphibian community in the region comprising the project's area of direct influence.

Similarity Analysis

In order to compare the different landscapes and their influence on species composition, the similarity between the points was calculated using the Jaccard index based on species incidence and the Bray-Curtis index based on species abundance (**Figure 7.2.2.2.5.g**, **Figure 7.2.2.2.5.h**). According to the results, distinct groupings were formed for each analysis, with one grouping between BS2 and BS6 for Jaccard and another grouping between BS2 and BS5 for Bray-Curtis, with a third grouping between points BS8 and BS9 for both indices.

The most distal point among the others was BS1, in both indices, emphasising the difference in plant composition and the presence of water bodies at this point when compared to the others, which could be considered the point of greatest biological value for herpetofauna.

The grouping between BS8 and BS9 associates two environments that suffer from various anthropogenic disturbances, such as the felling of tree vegetation and consequent removal of the understory. As a result, the occurrence of generalist reptile and amphibian species that are resilient to anthropogenic changes is expected, such as the anuran *Chiromantis petersii* (HARPER et al., 2010) and the lizard *Trachylepis striata* (SPAWLS *et al*., 2018).

Figure 7.2.2.2.5.g
Jaccard's similarity between the sampling points

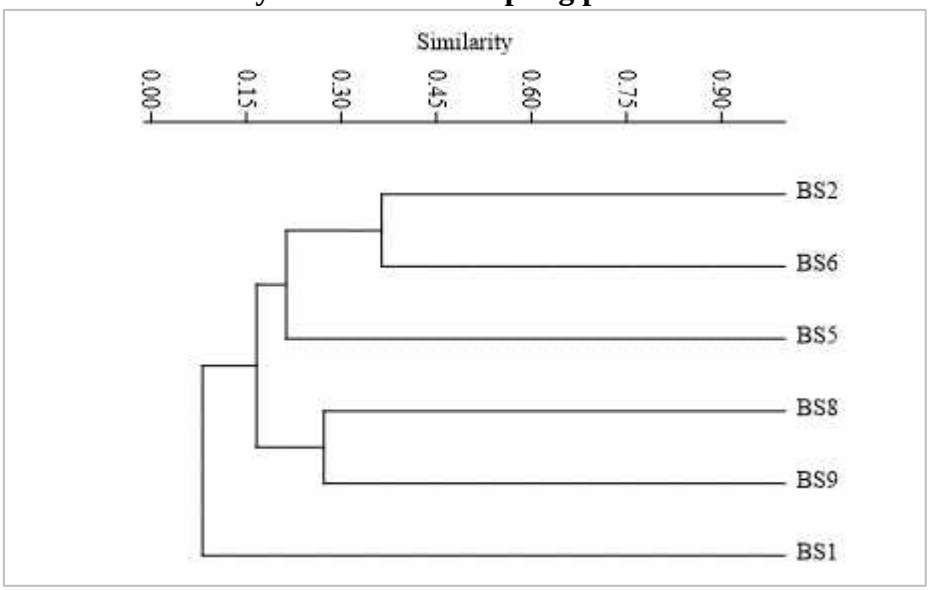
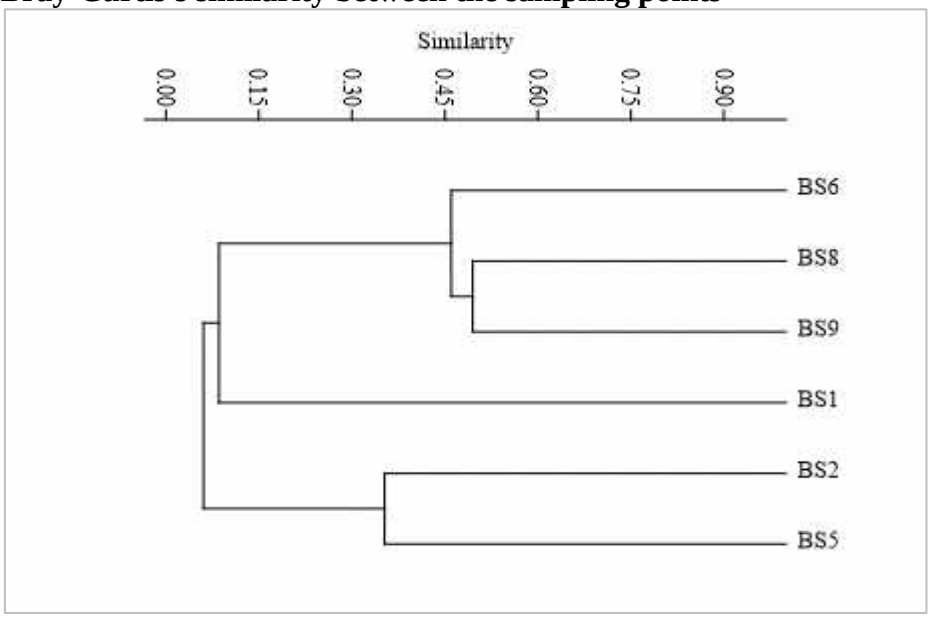


Figure 7.2.2.2.5.h
Bray-Curtis's similarity between the sampling points



Comparing primary and secondary data

The survey carried out using secondary data resulted in a total of 149 reptile and amphibian species for the area of indirect influence of the buffer that comprises the transmission line. These species are divided into 36 families belonging to four orders (**Figure 7.2.2.2.5.i**).

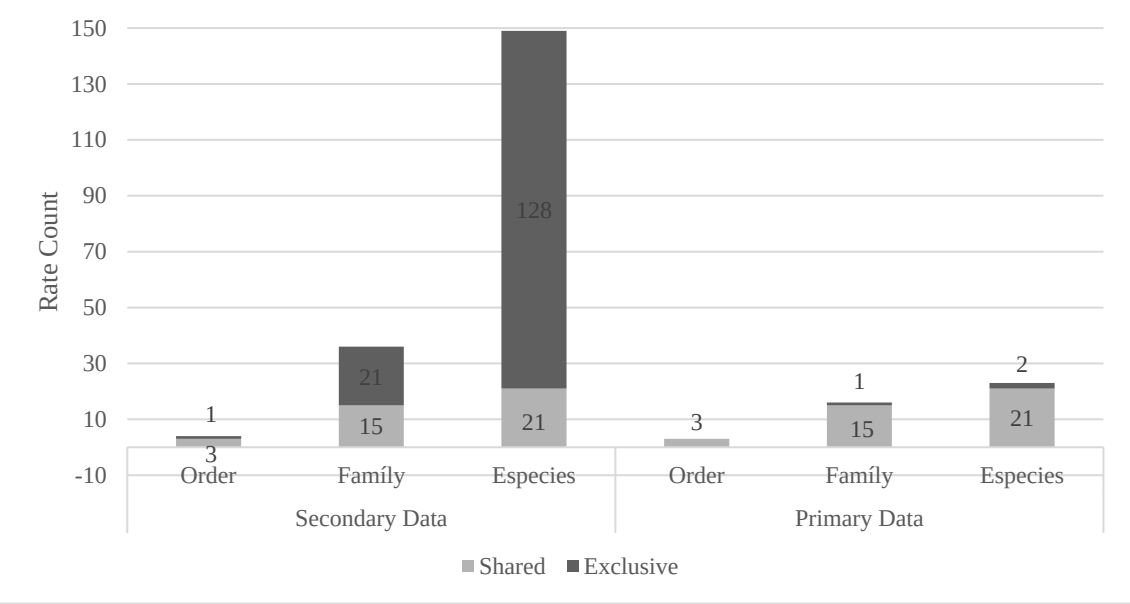
primary data collection in the areas of direct influence of the development resulted in a total of 23 taxa, including records that could not be identified, which were divided into 15 families of two orders (**Figure 7.2.2.2.5.i**).

In the comparison, it is notable that only 15% of the species surveyed by secondary data for the area of indirect influence of the development were recorded, but a higher proportion of the families were recorded in the primary data, with 42% of what was expected, in addition to the order Crocodilia, which was not recorded in the field.

All the species recorded in the field are present in the databases consulted, with the exception of *Hyperolius* sp., which may be a representative of the three species present in the databases: *Hyperolius glandicolor*, *Hyperolius kivuensis* and *Hyperolius lateralis*, as well as *Hyperolius viridiflavus*, which was recorded in the field.

The discrepancy between the number of species between the two data sources (primary and secondary) is to be expected, since the bibliography consulted covers studies carried out over long periods of time and in a great diversity of environments, comprising habitats other than those found at the sampling points and, consequently, harbouring different species of regional herpetofauna, such as SPAWLS *et al*., 2018, which covers all reptile species in East Africa, or HARPER *et al*., 2010.

Figure 7.2.2.2.5.i
Comparison between primary and secondary data gathered



7.2.3
Legally Protected and Internationally Recognized Areas of High Biodiversity Value

Legally Protected Areas

There are 8 Protected Areas in the Project's region: 3 of which are intercepted by the Project, the Burigi-Chato National Park, intercepted by the and the 400 kV Kyaka – Nyakanazi TL; the Biharamulo Forest Reserve and the Uyovu Forest Reserve, both intercepted by the 400 kV Nyakanazi - Ibadakuli TL. The other 5 Protected Areas are within the Project's Indirect Area of Influence (IAI) (**Table 7.2.3.a**).

According to TANAPA[13][14], **Burigi-Chato National Park** with an area of 4,702 km^2 was gazette as a National Park in 2019. This park was established through the upgrading of Biharamulo, Burigi and Kimisi Game Reserves. The Park's eastern boundary is located near Lake Victoria, and its western limit coincides with the Kagera River, in the border with Rwanda. The park is also surrounded by Lake Burigi to the north.

Burigi - Chato National Park has the typical grasslands of the African Savannah. The Park also involves the other ecosystems of Rwanda Akagera National Park and Uganda's Kikati Game Reserve. Its area is interspersed with additional lakes and papyrus swamps and is renowned for its diversity and great wildlife populations. The park supports a rich diversity of wildlife and is home to rare species of birds are also found in the Burigi-Chato, such as fish eagles, papyrus ganolek, and bizarre shoebill stork. The park has a long tradition of cultural importance to the local communities.

The project will intercept the Burigi-Chato National Park over a 65.92 km strech, in paralell with the existing Nyakasanza – Kyaka Road (Road B182) (**Figure 7.2.3.a**).

According to the Nacional Policies for National Parks in Tanzania[15], no new rights-of-way will be issued within park boundaries. Existing rights-of-way will be maintained and managed in accordance with the national policies, the park's General Management Plan and regulations for national parks. However, Section 2.9 of the National Policies for National Parks establishes that: "*To avoid adverse effects on the environment and to ensure that environment quality is maintained, restored, and enhanced, Environmental Impact Assessment will be required on all major actions, developments, and activities within and adjacent to national park boundaries, including but not limited to major actions proposed by TANAPA, other agencies, organizations, and private entities."*

Also, Part VI of the Environmental Management Act (2004) establishes the legal basis for the ESIA process and its main requirements. Requires the NEMC to determine whether a developer is required to prepare an ESIA before a proposed project, establish whether a project is likely to have a significant impact on the environment, and recommend projects to the Minister for approval and issuance of an ESIA certificate.

[13] TANZANIA NATIONAL PARKS. Investment Prospectus, 2020.
[14] https://www.tanzaniaparks.go.tz/national_parks/burigi-chato-national-park
[15] Nacional Policies for National Parks in Tanzania, prepared by Tanzania National Parks National Policy Committee, March 1994.

Table 7.2.3.a
Protected areas in the Project's Indirect Area of Influence

Name	Designation	Governance	IUCN Management	Obs.
Biharamulo	Forest Reserve	National	Not reported	Intercepted by T-line Nyakanazi - Ibadakuli
Burigi-Chato	National Park	National	II	Intercepted by T-line Kyaka - Nyakanazi
Lubaga	Forest Reserve	National	Not reported	Within IAI
Minziro	Nature Forest Reserve	National	Not reported	Within IAI
Nindo	Forest Reserve	National	Not reported	Within IAI
Nyantakara	Forest Reserve	National	Not reported	Within IAI
Ruamagazi	Forest Reserve	National	Not reported	Within IAI
Ruiga River	Forest Reserve	National	Not reported	Within IAI
Uyovu	Forest Reserve	National	Not reported	Intercepted by T-line Nyakanazi - Ibadakuli

Figure 7.2.3.a
Interception of the project with the Burigi-Chato National Park

Source: Elaborated by JGP
Legend: Green polygon = Burigi-Chato National Park

Finally, Part IV Section 35 of the Wildlife Conservation Act (2009) establishes that:

> *"(1) Every significant physical development in a wildlife protected area, the wildlife management area, the buffer zone, migratory route or dispersal area to which this section applies, whether that development is prepared by, or is being implemented by a person or organization in the public or private sector, the prospective developer shall prepare and submit to the satisfaction of the Minister responsible for environment a report on Environmental Impact Assessment of the proposed development.*
>
> *(2) Notwithstanding sub-section (1) or any other law to the contrary, any development to which this section applies shall not commence unless and until an Environmental Impact Assessment certificate has been issued by the Minister responsible for environment.*
>
> *(3) The developments in a wildlife protected area and Wildlife Management Areas to which this section applies shall include*
> *(a) mining development;*
> *(b) road construction or laying of pipe lines;*
> *(c) semi or permanent establishments;*
> ***(d) construction of dams, power stations, electrical and telecommunication installations; and (bold added)***
> *(e) such other similar developments or activities as the Director may, for good cause, prescribe"*

According to the Tanzania Forest Service Agency (TFS), the **Biharamulo Forest Plantation** is established on the Biharamulo-Kahama Forest Reserve (FR) which was gazetted in 1954 through Government Notice (GN) No. 292 and map JB No. 200, which underwent variation to GN No. 311 in 1959. The Forest Reserve has total area of 134,680 ha and a boundary distance of 254 km. It extends to two regions of Geita and Kagera in Chato, Bukombe and Biharamulo districts. The reserve is managed by Tanzania Forest Services (TFS) Agency.

It is the major source of water to Nyambale, Bizi, Nyalwambu, Kagogo, Kayanza, Mtundu, Kahogo, Mlera, Viyonza, Muhama, Kabwibwizi, Munekezi, Nabuyelu, Kabohelele and Kasinge rivers which all drain in Lake Victoria and Tanganyika.

The Forest Reserve is of miombo woodlands with various indigenous tree species. These include *Combretum molle, Tamarindus indica*, *Terminalia sericea*, *Lannea humilis*, *Harrisonia abyssinica*, *Catunarega mspinosa*, *Combretum adenogonium*, *Lanchocarpus capasa*, *Faidherbia spiciformis, albida*, *Brachystegia*, *Brachystegia boehmii*, *Amisophyllea pomifera* and *Pericopsis angolensis*.

Due to unsustainable utilization including encroachment for agricultural, human settlements, tree felling for charcoal, lumbering and firewood, cattle grazing and mining led to degradation of this reserve. In turn, the Government of Tanzania decided to establish a new forest plantation on the degraded parts of Forest Reserve. At the end, this forest plantation will have a mosaic form, whereby out of the total area of the Forest Reserve, 69,757 ha will be potential for plantation establishment. In terms of development, about 446 ha were planted with *Pinus caribaea* in 2017. The plantation is about 51 km from Geita and can be reached through Geita – Chato highway.

The project will intercept the Biharamulo Forest Reserve over a 17.12 km strech, in paralell with the existing Singida – Rusumo Road (Road B3) (**Figure 7.2.3.b**).

As for the third Protected Area intercepted, the **Uyovu Forest Reserve**, the project will intercept it over a strech of just 137 metres, and an adjustment to the route in the project's detailing phase could avoid its interception, leaving the Reserve in the TL's DAI (**Figure 7.2.3.c**).

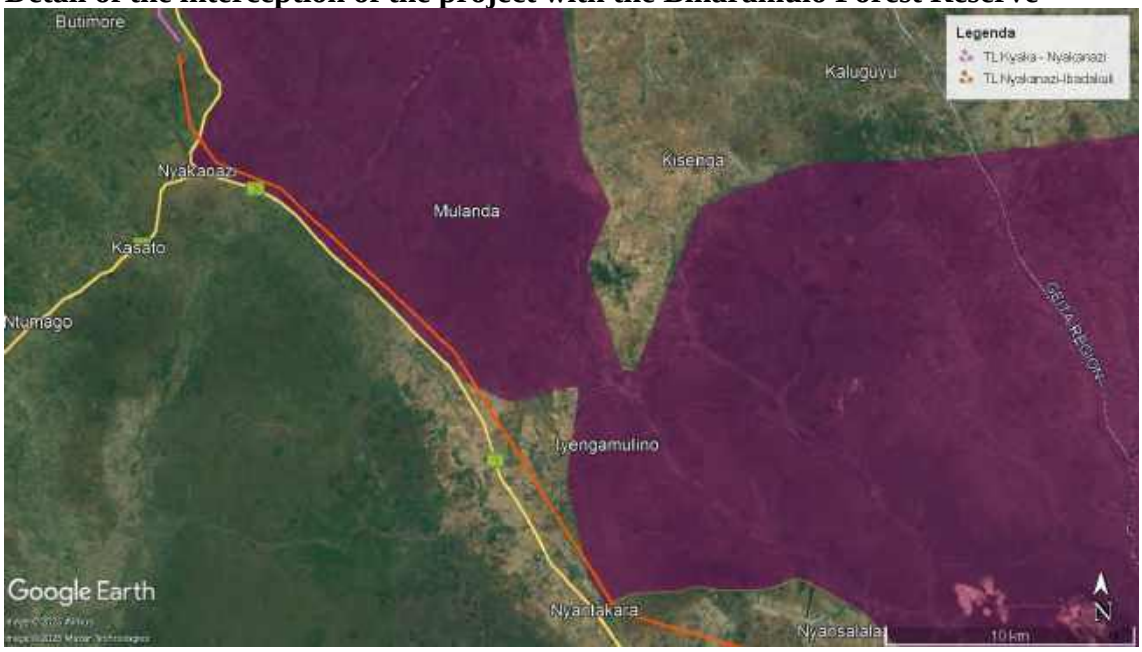
The Uyovu Forest Reserve was gazetted in 1958, with 190.0 km², covering areas of the Chato and Geita districts[16]. It is managed by local authorities under the governance of the Tanzania Forest Services (TFS) Agency. This reserve is part of the extensive network of forest reserves across Tanzania, which play a critical role in preserving biodiversity, protecting water sources, and supporting local communities.

While detailed information about specific management plans for Uyovu Forest Reserve is not readily available, the TFS is responsible for overseeing the conservation and sustainable use of forest resources across the country. They manage a variety of forest types, including natural forests, plantations, and nature reserves, focusing on activities

[16] https://www.protectedplanet.net/303344

such as ecological conservation, research, education, and promoting sustainable tourism[17].

Figure 7.2.3.b
Detail of the interception of the project with the Biharamulo Forest Reserve

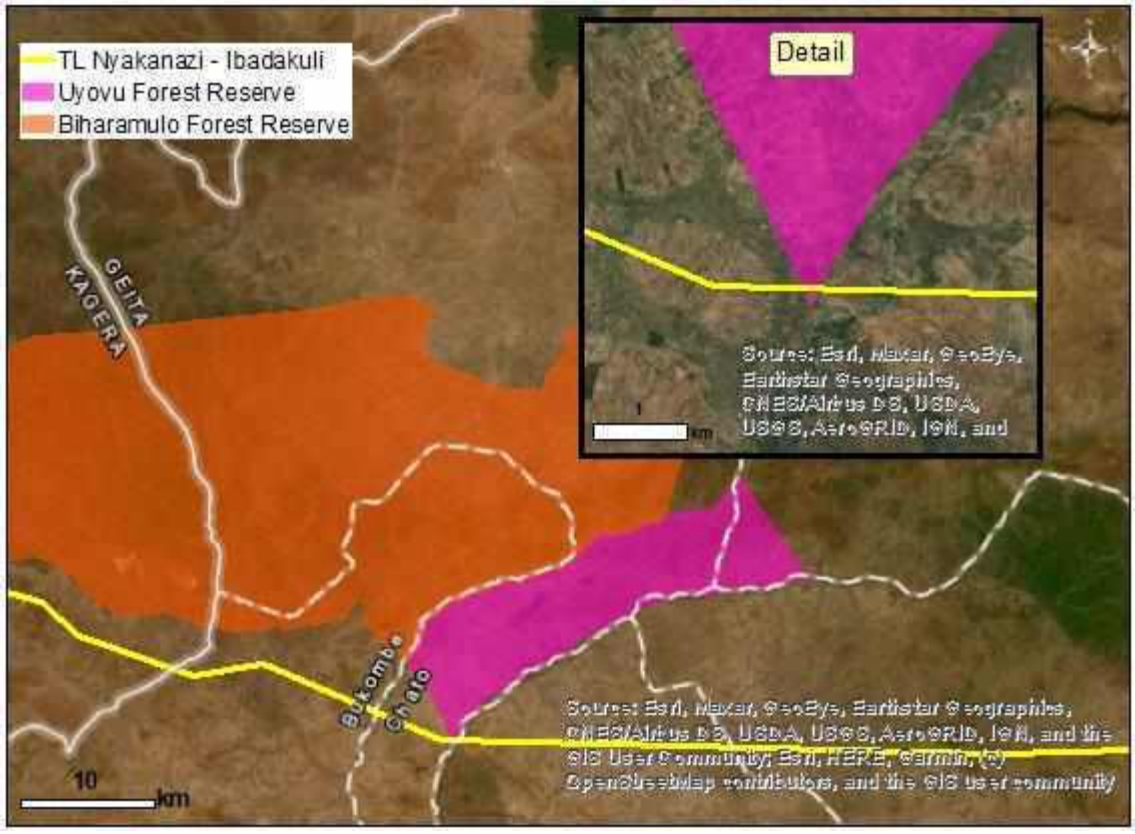


Source: Elaborated by JGP
Legend: Purple polygon = Biharamulo Forest Reserve

Besides the National Park, the Forest Act under Part V provides for the categorization of forests into national forest reserves or a local authority forest reserve (sections 22 -31), village land forest reserves (sections 23-41) and community forest reserves (sections 42-48). National forest reserves and local authority forest reserves are centrally owned and managed by the central government through the Tanzania Forest Service Agency (TFS) in collaboration with the respective district councils. The village land forest reserves are managed by the village council and community forest reserves are managed by the respective community groups who are living in or near forest resources. The private forests are recognized for a person or group of people holding a right of occupancy or a lease in general land or village land in excess of fifty hectares or such area as may be prescribed, and different areas may be prescribed for different types of private forests.

[17] https://tfsdemo.nature-reserves.go.tz/index.php/forests/view/forest_overview

Figure 7.2.3.c
Detail of the interception of the project with the Uyovu Forest Reserve



Source: Elaborated by JGP
Legend: Pink polygon = Uyovu Forest Reserve

The complexities surrounding the governance of forest resources exist mostly in the village land forest reserves and community forest reserves. A village land forest reserve is either a declared village land forest reserve or a gazetted village land forest reserve (section 32 of the Forest Act). The Forest Act (section 33) states further that a village council may declare an area of village land to be a village land forest reserve. In doing so, the village council may apply to the Director of Forest through a local government authority for a declaration of village land forest reserve to be gazetted as a village land forest reserve. The Council may also negotiate a joint management agreement or other arrangement with the Director of Forest, or some other person or body concerning the management of a village land forest reserve. With that effect, the council may establish a committee to manage a village land forest reserve or allocate the duties of managing a village land forest reserve to an existing committee of the village council. A declared village land forest reserve shall be managed by a committee established or allocated the responsibilities to other persons or entities as may be proposed by the village council and agreed to by the village assembly.

On the other hand, the village council may also apply to the Director of Forest to register and declare a village land forest reserve as a gazetted village land forest reserve (section 35). Upon registration, the village council has jurisdiction over the gazetted village land

forest reserve and the Director and such other persons and bodies as may be considered appropriate by the village council may negotiate and agree to a joint management agreement or other arrangement for the management of that gazetted village land forest reserve. Until a joint management agreement or some other arrangement for the management of the gazetted village land forest reserve is made, the gazetted village land forest reserve shall be managed by the village land forest management plan by-laws and other rules, agreements and practices applicable to the gazetted village land forest reserve (section 36). This indicates that to ensure total ownership and management of village land forest reserves the village councils should register and gazette their forest reserves to promote shared benefits and sustainability. The provisions of the Forest Act recognize the need for local communities to access these resources and provide mechanisms for permitting resource use. The idea is to grant the rights to the local authority or village to establish and manage the forest reserves.

The Forest Policy recognizes the importance of trade in non-wood and wood products as sources of income, and the Forest Act provides for the harvest and trade of forest products based on licenses issued to authorized users at the district level. In addition, the subsistence uses of forest products are permitted to the villages inside the village where forest reserves are located, but not to the neighbouring communities adjacent to or near the forest resources. The current policy framework does create administrative hurdles for the local communities in exercising commercial activities on their forest resources. Although the government encourages forest use as a pathway for economic benefit and poverty reduction, it remains under the auspices of a state-managed system. The enactment of Forest (Sustainable Utilization of Logs, Timber, Withies, Poles or Charcoal) Regulations GN. No. 417 of 2019 is vivid in this matter.

The regulations provide for sustainable utilization of logs, timber, withies, poles or charcoal in the forest reserves including the Village Forest Reserves and community-based Forest Reserves. The regulations established a Committee known as the District Forest Produce Harvesting Committee, which is normally referred to as the District Committee. The District Committee is composed of different officials from the district level and the District Commissioner serves as a Chairperson. Only two officials, the Village Chairman and Executive Officer of the village where the forest produce is to be harvested represent the local communities in the committee. However, the regulations have no provisions on how the local communities will socially and economically benefit from sustainable utilization of logs, timber, withies, poles or charcoal.
Regarding implementantion of infrastructure projects within these areas, Section 18 of Forest Act (2002) establishes that:

> *"(1) In any proposed development in a forest reserve, private forest or sensitive orest area including watersheds to which this section applies, whether that development is proposed by, or is to be implemented by, a person or organisation in the public or private sector, the proposer of the development shall prepare and submit to the Director an Environmental Impact Assessment of the proposed development from independent consultants selected from a list approved by the Government of the United Republic and, notwithstanding any other law to the contrary, no development to which this section applies shall be commenced unless and until an Environmental Impact*

Assessment has been completed to the satisfaction of the Director.

(2) The developments in a forest reserve, private forest sensitive forest area to which this section applies include:
…
(d) the construction of dams, power stations, electrical or telecommunication Installations;…"

According to the socio-economic data village forest reserves along the alignment are presented in the following villages and wards:

Villages with forest reserves: Buyange, Byeju, Ihembe, Kadoke, Kagongo, Kihanga, Lusahunga, Mavota, Mutukula, Muungano, Mwajiji, Nyantakara, Rwandaro, Shahende

Wards with forest reserves: Bugarama, Bugene, Bulega, Butobela, Ihembe, Ikobe, Kaniha, Kihanga, Kyaka, Lusahunga, Lyabusalu, Mbogwe, Mtukula, Mutukula, Nundu, Nyakahanga, Nyakasimbi, Nyamalogo, Nyantakara, Salawe, Ushirika.

Internationally Recognized Areas of High Biodiversity Value

As for the internationally recognized area, there are 3 Important Bird Areas (IBA) in the project region (**Table 7.2.3.b**). Two of these areas also coincide with Protected Areas, the IBA Burigi - Biharamulo Game Reserves, which has a similar boundary to the Burigi-Chato National Park, and the IBA Minziro Forest Reserve, whose area coincides with that of the Minziro Nature Forest Reserve. These areas are shown in **Map 7.2.3.a**.

Table 7.2.3.b
Internationally recognized areas in the Project region

Name	Designation	KBA Trigger	Obs.
Burigi - Biharamulo Game Reserves*	KBA - IBA	Vulnerable and endemic species, other	Intercepted by T-line Kyaka - Nyakanazi
Kagera swamps	KBA - IBA	Species classified as CR/EN, endemic species	Within IAI
Minziro Forest Reserve*	KBA - IBA	Vulnerable species, other	Within IAI

* The boundaries of these two IBA partially coincide with the boundary of the Burigi-Chato National Park and the Minziro Forest Reserve, respectively

According to Birdlife International[18], the **IBA Burigi - Biharamulo Game Reserves** comprises two separate protected areas joined to form a single unit for management purposes. Lying between Bunkwe Bay on Lake Victoria in the east and Kagera swamps to the west, this site is characterized by a series of north–south ridges, separated by drainage lines and rivers flowing north. In one of these drainage lines is Lake Burigi, 30 km long and 4 km wide. To the east the land slopes towards Lake Victoria where large stands of *Acacia xanthophloea* dominate on the poorer soils. On the higher ground the

[18] https://datazone.birdlife.org/site/factsheet/burigi--biharamulo-game-reserves-iba-tanzania/text

woodland is largely *Brachystegia speciformis* (rather stunted at its northern limits) and *B. boehmii* in the east, with *Protea-Combretum* on the drier ridges in the west. On the slopes there are considerable areas of open grassland and, in the steeper valleys and gullies, remnants of Guinea–Congo forest. There is relict sclerophyll forest on some hill-slopes suggestive of more extensive forest cover historically.

According to Birdlife International, this area, that reaches 350,000 ha, qualifies as an IBA due to populations of the following trigger species: Shoebill *Balaeniceps rex* (IBA criteria A1), VU – Vulnerable according to the IUCN Red List; Ring-necked Francolin *Scleroptila streptophora* (IBA criteria A3) and Red-faced Barbet *Lybius rubrifacies* (IBA criteria A1, A2 and 3), both NT - Near Threatened according to the IUCN Red List; and Black-lored Babbler *Turdoides sharpei* (IBA criteria A3), LC - Least Concern.

As already mentioned, the **IBA Minziro Forest Reserve**, with 31,142 ha, coincides with the Protected Area Minziro Nature Forest Reserve. According to the TFS, this Reserve is located between 01º06'21"S and 31º30'58"E in Misenyi District, Kagera Region, north western Tanzania. The forest (25,717 ha) extends to Uganda where it is called Sango Bay forests. The forest is essentially an outlier of the Guinea-Congo biome which stretches from Senegal in West Africa across Central Africa covering 26 countries where it forms its eastern end at Minziro Forest Reserve. Consequently, it contains flora and fauna that reach their eastern range limits at Minziro Forest Reserve. The uniqueness of the biological assemblages in Minziro Forest Reserve makes this forest an important Protected Area and a major component of the national biological diversity of Tanzania[19].

Birdlife International points to the IBA Minziro Forest Reserve as a groundwater-forest with extensive areas of grassland. Kere Hill, a small rock outcrop at 1,180 m, lies within the reserve and the village of Minziro at 1,330 m sits on higher ground with the Forest Reserve extending around it. To the south and east is the Kagera river while the northern boundary is formed by the international border with Uganda. North of the border the contiguous forest is known as Malabigambo Forest Reserve, one of the Sango Bay forests. Minziro is the largest forested area in north-west Tanzania and is essentially an outlier of the Guinea–Congo lowland forests. A few kilometres to the south the vegetation changes dramatically on the higher plateau country of Kagera Region. Minziro is therefore a unique habitat-type in Tanzania. The only significant tree of economic value is *Podocarpus*, but this has been heavily exploited and few large trees remain. A stretch of the Kagera river with stands of papyrus *Cyperus papyrus* is included in this site.

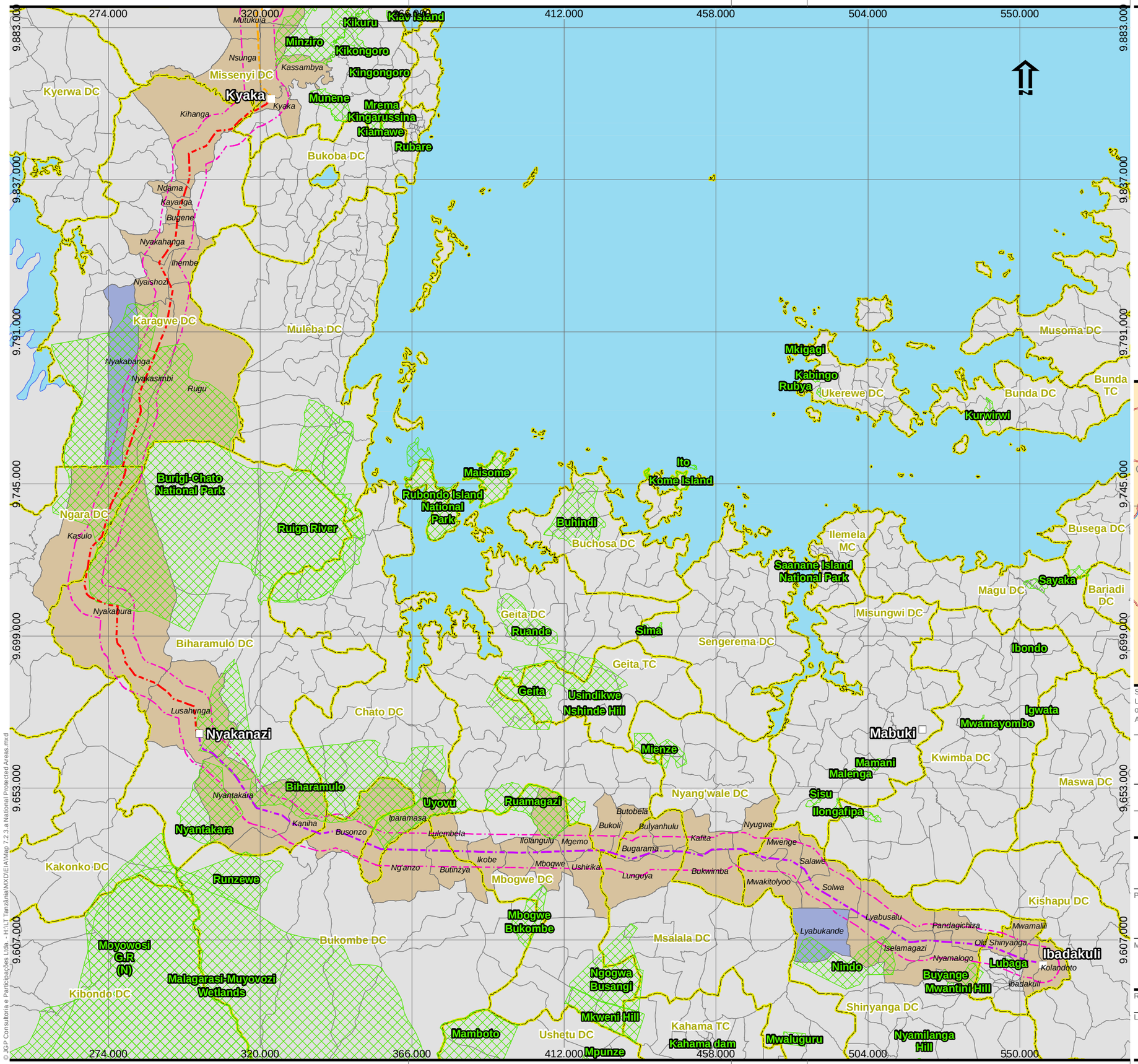
This area qualifies as an IBA due to populations of 62 trigger species, mostly considered as LC - Least Concern according to the IUCN Red List. But among the 62 species, there are some with a more worrying threat classification. This is the case of Grey Parrot *Psittacus erithacus* (IBA criteria A3), EN – Endangered according to the IUCN Red List; Papyrus Yellow Warbler *Calamonastides gracilirostris* (IBA criteria A3) and Blue Swallow *Hirundo atrocaerulea* (IBA criteria A1), both VU – Vulnerable according to the IUCN Red List; and Papyrus Gonolek *Laniarius mufumbiri* (IBA criteria A1 and A3), NT - Near Threatened according to the IUCN.

[19] https://www.tfs.go.tz/en/forests/minziro

The **IBA Kagera Swamps** is an area of 111,600 ha whose lower part overlaps the limits of the Burigi-Chato National Park.

The Kagera river forms the border between Tanzania and Rwanda. As it flows north between the two countries, it passes through a series of lakes and swamps for some 100 km. These are surrounded by a series of low rolling hills which, in Tanzania, are extensively cultivated, but within Rwanda are within the Akagera National Park (other IBA). The swamps and lakes are characterized by extensive stands of papyrus *Cyperus papyrus*. The Ibanda Arena Game Reserve (20,000 ha), in the extreme north-west of Tanzania, is included in the IBA, the boundaries of which remain provisional, but nothing is known about the bird community.

This area qualifies as an IBA due to populations of 9 trigger species, 5 of them of LC - Least Concern according to the IUCN Red List. Of the other 4, Papyrus Yellow Warbler *Calamonastides gracilirostris* (IBA criteria A3) is considered VU – Vulnerable according to the IUCN and Ring-necked Francolin *Scleroptila streptophora* (IBA criteria A3), Red-faced Barbet *Lybius rubrifacies* (IBA criteria A3) and Papyrus Gonolek *Laniarius mufumbiri* (IBA criteria A1 and A3) are considered NT - Near Threatened according to the IUCN.



Source:
UNEP-WCMC (2024). Protected Area Profile for United Republic of Tanzania from the World Database on Protected Areas, August 2024.
Available at: www.protectedplanet.net

UTM- Zona 36S
Datum: WGS 84 - EPSG 32736

Graphic Scale
0 12 24 36 48 km

Date:	Scale:	File:	Revision:
9/4/2024	1:1.150.000	Location map of the preferred route guideline	Ø

Tanzania Electric Supply Company Limited (TANESCO)

Project:

PROPOSED 400 kV UGANDA-TANZANIA INTERCONNECTOR POWER (UTIP)

Map 7.2.3.a:

Map of National Protected Areas

Regions:
Kagera, Geita and Shinyanga - Tanzania

Lead E&S Consultant:
JGP Consultoria e Participações Ltda.

7.2.4
Critical Habitat Assessment

Paragraph 23 of ESF6 states that Critical Habitats (CH) are areas with high biodiversity importance or value, including:

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

The identification and delimitation of CH are independent of the assessment of a project's impacts. In other words, habitat is not critical because it is threatened by the potential impacts of a project, but because it is of great importance for certain biodiversity values and, in many cases, is already under threat due to historical events and processes. Therefore, the delimitation of critical habitat should be based on the distribution of the biodiversity features in question, and not on the footprint of the project.

Critical habitats vary greatly in their spatial scale, and the appropriate scale should be determined based on the biological, ecological and biogeographical aspects of the biodiversity features in question, and should be identified and delineated at scales that are ecologically relevant to the biodiversity values and processes that designate it. Thus, one of the first steps to be taken is to identify the priority biodiversity values present in the project area. Once these values have been identified, criticality is only applied when the habitat is significant for one (or more) of the criteria listed above.

To facilitate this assessment, this Critical Habitat Assessment (CHA) was carried out for the Project's IAI using the IFC's Performance Standard 6 (PS6)[20] thresholds as a reference. IFC PS6 Guidance Notes (GN) present numerical thresholds for the first four criteria (a to d), which act as triggers for categorisation as CH (GN70 to GN80). For criterion 5 (e) there is no defined threshold, however, GN81 and GN82 provide guidance on which areas can be categorised as critical due to key evolutionary processes.

This analysis aims to assess and identify the region's priority biodiversity values, including species and ecosystems, which meet the criteria of importance for qualification under ESF6 and the thresholds defined by PS6, guiding the development of a biodiversity mitigation strategy aligned with ESF6.

[20] Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources | International Finance Corporation (IFC)

7.2.4.1
Methodology

The CHA was carried out considering the IAI of the project as the study area. The biodiversity baseline considered for this analysis was the secondary and primary data presented in **Sections 7.2.1** and **7.2.2**. Verification of the importance of the habitat for the priority biodiversity values was carried out in 4 stages:

1) Determination of priority biodiversity values: the biodiversity values identified in the biodiversity baseline (**Sections 7.2.1** and **7.2.2**) were assessed in relation to their conformity with the CH definitions set out in paragraph 23 of ESF6. This assessment took into account all the biodiversity values surveyed for the project region, which included not only the IAI but a 50-kilometre buffer around all the route alternatives evaluated. This analysis resulted in a list of priority biodiversity values, i.e. those that, due to their degree of threat, distribution and/or ecological significance for natural populations, fall within the definitions of items (a) to (e) of paragraph 23.
2) Determination of potential trigger for critical habitat: the priority biodiversity values were primarily assessed concerning their distribution, ecological characteristics, potential to occur in the project region and evidence of important populations in the Project's IAI. This analysis resulted in a list of potential triggers for CH. This assessment was based on the IFC PS6 Guidance Notes related to critical habitat criteria.
3) Delimitation of Ecologically Appropriate Areas of Analysis (EAAA): the values considered potential triggers for CH were grouped according to their ecological and distribution information and had their EAAA delimited (this delimitation considered similar ecological characteristics). For ecosystems, the extension occupied in the EAAA and the extension directly affected were considered.
4) Trigger activation analysis: the EAAA were compared to the Areas of Occupancy (AOO) of the potential trigger values and evaluated in relation to the activation thresholds established in paragraphs GN70 to GN 80 from IFC PS6.

Criterion 5 (v) was assessed based on bibliographical research and the biodiversity data collected in this study.

Delimitation of the Ecologically Appropriate Area of Analysis (EAAA)

GN59 from IFC PS6 states that the delimitation of CH should be based on the distribution of the biodiversity features in question, not on the footprint of the project. Thus, for the present study, the concept of EAAA was applied to determine the presence of critical habitat for each regularly occurring species in the project region. The delimitation of this EAAA must take into account the distribution of the species and the connectivity of the landscape that supports the ecological processes necessary for the survival of the species. The EAAA represent a regional cross-section of the species distribution and subsidises the analysis of their classification as critical habitat. As such, the EAAA should be delimited for the area where the project under analysis is located but not limited to its area of influence.

The delimitation of the EAAA considered the phytophysiognomies in which each priority species occurs, using the ecological information collected, visual analysis of satellite images and the Enhanced Ecosystem Type and Land Use Map. The EAAA were delimited by species groups (GN59 from IFC PS6). The species were grouped based on their ecological characteristics and habitat preferences. The delimitation of the EAAA for each group followed the concept of habitat continuity, i.e. the delimitation of the polygon was based on continuous and connected remnants of native vegetation with the necessary characteristics for the occurrence of the species that make up the group.

Delimitation of the Area of Occupancy (AOO)

The AOO of a taxon is defined as the area within the Extent of Occurrence (EOO) that it can effectively occupy, excluding occasional cases. This measure reflects the fact that a taxon does not usually occupy the entire scope of its EOO, which may contain habitats unsuitable for the needs of a particular species (IUCN, 2001). Thus, the AOO must be adapted to the biological and ecological characteristics of the taxon, i.e. the characteristics of the phytophysiognomy of occurrence, altitude, etc. necessary to meet the demands for food, shelter and reproduction and support the population of each species. In this context, the AOO provides an idea of the geographical extent required for the global population of each species, making it possible to infer how important the EAAA is in the global context of supporting the population of a given species.

The size of the AOO is a function of the scale at which it is measured and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data (IUCN, 2021). The size of the AOO was obtained from bibliographic data. When there is no information available in the bibliography, the AOO was estimated using the GeoCAT tool developed by the Kew Royal Botanical Garden[21].

Delimitation of critical habitats

The analysis of the activation of the critical habitat was based on the premise that the individuals in a population are distributed equally within their AOO. Therefore, the verification is made by comparing the importance of a species' EAAA with its AOO.

7.2.4.2
Results

Criteria (a) and (b)

Criteria a and b were assessed together, as many species fit both criteria. Criterion (a) defines CH as “Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches”. Tanzania's red list of species is based on IUCN classification. GN72 of IFC’s PS6 states that significant importance is “areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population

[21] GeoCAT

and ≥ 5 reproductive units).

Criterion (b) defines CH as a "habitat of significant importance to endemic or restricted-range species." GN74 of PS6 defines endemic as a restricted-range species, i.e. one that has a limited extent of occurrence (EOO). For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO of less than 50,000 km². GN75 of IFC's PS6 states a threshold for this criterion as areas that regularly hold ≥ 10% of the global population size and ≥ 10 reproductive units.

There are 28 species of flora (**Table 7.2.4.2.a**) and 18 species of fauna (**Table 7.2.4.2.b**) classified as EN or CR and/or with a restricted range that is, therefore, a priority biodiversity value according to criterion (a) and/or (b). For fauna, the priority species includes 10 birds, 7 mammals and 1 reptile (the Pancake tortoise *Malacochersus tornieri*).

Regarding flora, 25 species are classified as EN and 3 as CR. Of the 28 species, 20 have a restricted range, i.e., with an EOO of less than 50,000 km². Regarding fauna, 12 species are classified as EN and 6 as CR, and only one has a restricted range, the primate Ashy Red Colobus. Those 46 species were considered priority biodiversity values, and assessed against their potential to trigger critical habitat (detailed in **Tables 7.2.4.2.a** and **7.2.4.2.b**). This initial assessment was based on an analysis of the species' distribution and occurrence patterns, evidence of significant populations in the IAI and the ecological characteristics of the species. Some of these species were included in the biodiversity baseline through secondary sources, which considered a wider area (50 km buffer surrounding all the alternatives alignment), so there may be populations of these species within this buffer, but their presence/occurrence in the Project's IAI in some cases is uncertain or not significant, based on the available information.

The species considered as a potential trigger for CH had their EAAA delimited, and assessed against the thresholds established in GN72 and GN75 of IFC PS6. This assessment is presented in **Tables 7.2.4.2.c** and **7.2.4.2.d**.

For flora, 13 species were not considered potential triggers (**Table 7.2.4.2.a**). Some, despite their EOO overlapping the project area, among the databases consulted (sources mentioned in Section 7.2.1 and 7.2.2), there were no significant numbers of records in the Project's IAI, an indication that the project area may not be important for the species' population. For four species (*Crotalaria varicosa, Aeollanthus stuhlmannii, Rotheca myricoides subsp. ussukumae and Cyphostemma shinyangense*) records were found in the Shinyanga and Mwanza regions, close to Lake Victoria, and a viable EAAA for these species would be outside the Project's IAI. For 7 species, there was not enough information to conclude on the presence or not of the species in the Project's IAI. There are few records available, some are quite old (for example, for the species *Cordia crenata subsp. Shinyangensis* (before 1988) and *Vangueria verticillate* (before 1955)), and there is also divergent information on the distribution of these species when comparing the data available on the different platforms consulted (IUCN, GBIF and KEW BOTANICAL GARDEN).

Seven species were considered potential CH triggers, and all triggered the critical habitat thresholds (**Table 7.2.4.2.c**), 3 by criterion a (*Tinnea physalis, Albertisia exelliana* and *Oxyanthus ugandensis*) and 4 by criteria a and b (*Thunbergia laborans, Emilia cryptantha, Vernonia tinctosetosa* and *Blotiella trichosora*). These species have a very restricted distribution, with few known records and/or most of the available records are in the project region, mainly in the western part of Lake Victoria, in the Minziro and Burigi-Chato Protected Areas, which were considered critical habitat for these species. Only the shrub Tinnea physalis which has most of its records in the Shynianga region, near the Mwantini Hill Forest Reserve, which was considered a critical habitat for this species.

Regarding flora, all trigger species were registered through secondary sources and were not evidenced during the field surveys in the Projects DAI.

T. physalis is a species of flowering plant in the family Lamiaceae. This species is a shrub which is found in *Commiphora* scrub, rocky outcrops and inselbergs in only 3 locations of Tanzania: Shynianga, Mwanza and Babati. The proper EAAA for this species was designated as being the Protected Area Mwantini Hill, a relatively preserved area where four individuals were registered.

A. exelliana is a liana which grows in riverine forest along small stream and closed forest. It is native to Burundi, Rwanda, Tanzania, Uganda between 600–1,250 m asl. The known records for the project region are near the Biharamulo Forest Reserve and Minziro Forest Reserve.

O. ugandensis is an undershrub, it grows in lowland forest and there are only three know record, one in Bukoba, close to Lake Victoria, and the other two in Uganda. *T. laborans* is a perennial herb which occurs in woodland, bushland and roadsides. There are four known locations for this species: in Rwanda, near the border with Tanzania; in Burigi-Chato NP, near road B8; in Mwanza, near Lake Victoria; and in Butiam, east side of Lake Victoria.

E. cryptantha, *V. tinctosetosa* and *B. trichosora* have very similar distributions, occurring in northern Tanzania and southern Uganda. In Tanzania, all three species were recorded in the Bukoba region, near Lake Victoria, therefore, the suitable EAAA for these species was delimited as the Minziro Forest Reserve. *E. cryptantha* is an annual herb found growing in swamp grassland at 1,000-1,250 m. *V. tinctosetosa* is a perennial herb that grows in wetland areas on sandy lake shores at 1,100-1,200 m. *B. trichosora* is a terrestrial fern, usually near streams in undergrowth of semideciduous moist forest, occasionally at forest edge in a swamp, rarely in gallery forest; at 800-1,750 m elevation.

Regarding fauna, 13 species were not considered potential triggers (**Table 7.2.4.2.b**), mainly because, although the EOO of these species overlaps the Project region, most of the records are outside the Project's IAI. For birds, although some of them were registered in the Project's DAI, for example, the Grey Crowned Crane *Balearica regulorum*, the Hooded Vulture *Necrosyrtes monachus*, and the Bateleur *Terathopius ecaudatus*, the largest concentration of records available on the studies consulted are in the Akagera

National Park (which is also an IBA), in Rwanda, and the Serengeti/Ngorongoro region. A similar situation happens to the mammals, which most of the records available are outside the Project's IAI.

The black rhino *Diceros bicornis* was included in the baseline through secondary data (IBAT Report). Currently, the largest population of this species is found in Ngorongoro Park and Serengeti Park. The most viable location to support a rhino population in the project region would be Burigi-Chato NP (BNCP). The IUCN data does not specify where black rhino occurs in the country for security reasons. However, the Rapid Biodiversity Assessment report of the BCNP states that there are no black rhino populations in the park area (TANAPA, 2020). Therefore, there is no evidence of the presence of this species in the project area, and it was not considered a potential trigger for CH.

The pancake tortoise *Malacochersus tornieri* has a distribution restricted to certain areas and conditions. The species is usually found in fissures and crevices in and between boulders and bedrock. It is associated with isolated rocky hills and outcrops (Mwaya et al. 2018). In the project region, it occurs near Lake Victoria in Mwanza. The project region presents environments favourable to its occurrence, but it was not evidenced during the field surveys, so its occurrence in the Project's IAI is uncertain.

Three species were considered potential CH triggers, and all triggered the critical habitat thresholds by criterion a (**Table 7.2.4.2.d**). The Common African Pangolin *Phataginus tricuspis* was recorded in the Projects DAI through interviews and individuals are registered in the Minziro FR, which seems to be an important habitat for this species. The primate Ashy Red Colobus *Piliocolobus tephrosceles,* also registered in the Project's DAI (BS4 and BS5) occurs in Burigi-Chato NP, considered a CH for this species. The African Savanna Elephant *Loxodonta Africana* also recorded in the project's DAI, which overlaps with an important migratory route, is considered CH for this species.

Table 7.2.4.2.a
Priority flora species for the project region

Family	Species	Data source	Distribution	Ecology and habitat	Population trend	IUCN Category	EOO (km²)	AOO (km²)	Restricted range	Criteria	Analysis	Potential trigger?
Acanthaceae	*Thunbergia laborans*	Secondary source	This species is native to Rwanda and Tanzania where it is found between 1,150–1,550 m asl.	This species is a perennial herb which occurs in woodland, bushland and roadsides.	Decreasing	EN	11.636,68	20,00	Yes	a and b	Species recorded in the IAI, with most of it in the western part of Lake Victoria. Individuals were recorded in the Burigi-Chato NP. Is a potential trigger for CH.	**Yes**
Asteraceae	*Emilia cryptantha*	Secondary source	Emilia cryptantha is endemic to S Uganda and NW Tanzania.	An annual herb found growing in swamp grassland at 1,000-1,250 m.	Decreasing	EN	6.394,34	45,00	Yes	a and b	Species recorded in the IAI, with most of it in the western part of Lake Victoria. It has been recorded in the Bukoba region and Minziro FR. Is a potential trigger for CH.	**Yes**
Asteraceae	*Vernonia tinctosetosa*	Secondary source	Endemic to northwest Tanzania and southwest Uganda.	This perennial herb grows in wetland areas on sandy lake shores at 1,100-1,200 m.	Unknown	EN	11.093,95	45,00	Yes	a and b	Species recorded in the IAI, with most of it in the western part of Lake Victoria. It has been recorded in the Bukoba region and Minziro FR. Is a potential trigger for CH.	**Yes**
Commelinaceae	*Murdannia stricta*	Secondary source	This species is known from the Democratic Republic of the Congo and Rwanda.	This species' growth form is as a small herb, to 30 cm. Its habitat is a temporary marsh on laterite hardpan; 900 m asl.	Unknown	EN	22.028,48	36,00	Yes	a and b	The species has been included in IBAT's 50 km buffer, but there are no records for the Project's IAI. It occurs in DR Congo and Rwanda. There is no evidence of important populations in the project region, so it was not considered a potential trigger for CH.	No
Convolvulaceae	*Ipomoea lepidophora*	Secondary source	This species is native to the Democratic Republic of the Congo and Rwanda between 1,400–1,500 m asl.	This species is a perennial herb which grows in grassland and park savanna which is sometimes burned.	Unknown	EN	38.707,57	32,00	Yes	a and b	The species has been included in IBAT's 50 km buffer, but there are no records for the Project's IAI. It occurs in DR Congo and Rwanda. There is no evidence of important populations in the project region, so it was not considered a potential trigger for CH.	No
Cordiaceae	*Cordia crenata subsp. shinyangensis*	Secondary source	Only known from Tanzania, from two old specimens (1938, 1988).	Presumably woodland or wooded grassland.	Unknown	CR	-	8,00	Yes	a and b	There are only 2 records of the species, one in the Shinyanga region and the other in the Mikumi region. Both records date back to 1988. There is no recent evidence that the species still occurs in the Shinyanga region, considering the high degree of anthropization in the area.	Uncertain
Cyperaceae	*Carpha angustissima*	Secondary source	This species is native to Uganda, Rwanda and the Democratic Republic of Congo and is found between 2,400 and 3,300 m Asl. It extends from southwest Uganda to the eastern Democratic Republic of Congo.	This species is found in montane or afro-alpine bogs.	Unknown	EN	385,00	16,00	Yes	a and b	The species has been included in IBAT's 50 km buffer, but there are no records for the Project's IAI. There is no evidence of important populations in the project region, so it was not considered a potential trigger for CH.	No
Dennstaedtiaceae	*Blotiella trichosora*	Secondary source	The species occurs in Burundi, Tanzania and Uganda.	Terrestrial fern, usually near streams in the undergrowth of the semideciduous moist forest, occasionally at forest edge in a swamp, rarely in gallery forest; at 800-1,750 m elevation.	Decreasing	EN	28.723,52	63,00	Yes	a and b	Species recorded in the IAI, with most of it in the western part of Lake Victoria. It has been recorded in the Bukoba region and Minziro FR. Is a potential trigger for CH.	**Yes**
Euphorbiaceae	*Euphorbia hubertii*	Primary source (DAI)	This species distribution is restricted to Tanzania.	This tree to 6 m, grows in rocky outcrops near the lake shore; at 1,025-1,200 m asl.	Unknown	EN	16.243,00	54,00	Yes	a and b	It was found in the study region, but only in 1 sampling plot (BS2). The records available from secondary sources indicate a higher concentration of individuals in the eastern region of Lake Victoria (GBIF and IUCN). This indicates that the project region may not be significant for the species' population. Therefore, it was not	No

Table 7.2.4.2.a
Priority flora species for the project region

Family	Species	Data source	Distribution	Ecology and habitat	Population trend	IUCN Category	EOO (km²)	AOO (km²)	Restricted range	Criteria	Analysis	Potential trigger?
											considered a potential HC trigger.	
Fabaceae	*Aeschynomene bullockii*	Secondary source	The species is distributed in Burundi, the Democratic Republic of the Congo and Tanzania.	This species' growth form is as a subshrubby herb from a woody rootstock. Its habitat is grassland on stony soil, Brachystegia woodland at 780-1,600 m asl. It is probably a pyrophyte.	Unknown	EN	59.136,00	90,00	No	a	Species included in the baseline through secondary data. It has been recorded in the project area in field surveys carried out for other studies. However, the highest concentration of individuals seems to be in the region bordering Burundi and Tanzania. Therefore, it was not considered a potential trigger for CH.	No
Fabaceae	*Aeschynomene burttii*	Secondary source	Endemic of Tanzania. This species is recorded from northern Tanzania, in the Rubeho Mountains, Image Forest Reserve and Ruvu.	A shrub or small tree found in Brachystegia woodland and in grassland with proteas.	Decreasing	EN	3.039,00	70,00	Yes	a and b	The species was included in the baseline through GBIF, with only 1 record in the Geita region. However, according to the IUCN and Kew Botanical Garden, the species is restricted to the Dodoma region. Its occurrence in the project region is uncertain, so it was not considered as a potential trigger for CH.	Uncertain
Fabaceae	*Crotalaria varicosa*	Secondary source	This species is endemic to northern Tanzania, on the shores of Lake Victoria.	This species' growth form is a perennial herb. Its habitat is grassland on sandy soil, pastures, and cultivated ground, at 1,140-1,250 m asl.	Decreasing	EN	4.189,41	80,00	Yes	a and b	Species recorded in the Shinyanga and Mwanza region, near Lake Vitoria. A suitable EAAA for the species would be outside the project's IAI, since its region of occurrence overlaps with the project and is heavily converted. It was therefore not considered a potential CH trigger.	No
Fabaceae	*Millettia schliebenii*	Secondary source	A species endemic to southeastern coastal Tanzania.	A small tree is found in riverine forests, semi-deciduous thickets and scattered tree grassland.	Unknown	EN	4.410,00	70,00	Yes	a and b	The species was included in the baseline through GBIF, with only 1 record in the Geita region. However, according to the IUCN and Kew Botanical Garden, the species is restricted to the coastal region of Tanzania. Its occurrence in the project region is uncertain, so it was not considered as a potential trigger for CH.	Uncertain
Fabaceae	*Rhynchosia holtzii*	Secondary source	This species is recorded from near the coast in central Tanzania (Pugu and Mpande).	A climber found in lowland forest.	Decreasing	CR	55,00	30,00	No	a	The species was included in the baseline through GBIF, with only 1 record in the Geita region. However, according to the IUCN and Kew Botanical Garden, the species is restricted to the coastal region of Tanzania. Its occurrence in the project region is uncertain, so it was not considered as a potential trigger for CH.	Uncertain
Lamiaceae	*Aeollanthus stuhlmannii*	Secondary source	Aeollanthus stuhlmannii Gürke is endemic to northern Tanzania.	This species' growth form is as a herb, which is often woody at the base. Its habitat is rocks or shallow soil on rocks at 1,100-1,220 m asl.	Decreasing	EN	26.542,36	50,00	Yes	a and b	A species recorded in the Serengeti, Shinyanga and Mwanza regions, close to Lake Victoria, a suitable EAAA for the species would be outside the project's IAI, since its region of occurrence overlaps with the project and is heavily converted. It was therefore not considered a potential CH trigger.	No

Table 7.2.4.2.a
Priority flora species for the project region

Family	Species	Data source	Distribution	Ecology and habitat	Population trend	IUCN Category	EOO (km²)	AOO (km²)	Restricted range	Criteria	Analysis	Potential trigger?
Lamiaceae	*Ocimum urundense*	Secondary source	This species is known from southwestern, central and northeastern Burundi and western Tanzania.	*Ocimum urundense* is an erect plant, with shoots sprouting from burnt stumps. It occurs in areas quite or almost denuded of trees, on stony grey soil, in burnt-over grassland, and loosely wooded savannas, between 1,600 and 1,900 m. Seed dispersal is limited, it is presumably ballistic – -shooting.	Decreasing	EN	1.106.216,40	-	No	a	The species has been included in IBAT's 50 km buffer, but there are no records for the Project's IAI. Most of the records for the species are located on the border between Tanzania and Rwanda, and in Burundi. There is no evidence of its occurrence in the project region.	Uncertain
Lamiaceae	*Rotheca myricoides subsp. ussukumae*	Secondary source	The species is known from six collections (1931-1962) from the Mwanza-Shinyanga area of Tanzania.	This shrub grows on thickets and in abandoned cultivation at 1,120-1,260 m asl.	-	EN	11.540,00	60,00	Yes	a	A species recorded in the Shinyanga and Mwanza regions, close to Lake Victoria, a suitable EAAA for the species would be outside the project's IAI. It was therefore not considered a potential CH trigger.	No
Lamiaceae	*Tinnea physalis*	Secondary source	This species is endemic to Tanzania where it is found between 1,160–1,350 m asl.	This species is a shrub which is found in Commiphora scrub, rocky outcrops and inselbergs.	Unknown	EN	21.112,13	24,00	Yes	a and b	Individuals are recorded in the Shinyanga and Mwanza regions, with the majority of records in Shinyanga. It is a potential HC trigger.	**Yes**
Linderniaceae	*Craterostigma pusillum*	Secondary source	This species is known from four collections, one each from Rwanda and Burundi and two in Tanzania.	This species occurs on the edges of quartzitic rock pools.	Unknown	EN	25.000,00	25,00	Yes	a and b	The species has been included in IBAT's 50 km buffer, but there are no records for the Project's IAI. It occurs on the border between Tanzania and Burundi. There is no evidence of important populations in the project region, so it was not considered a potential trigger for CH.	No
Malvaceae	*Grewia similiopsis*	Secondary source	This species is endemic to Tanzania between 1,060–1,700 m asl.	This species is a shrub or small tree up to 4.5 m tall which is found in open bushland or woodland.	Unknown	EN	28.185,00	36,00	Yes	a and b	The species occurs in the Serengeti region and Singida, and there is no other evidence of records in the Project's IAI. Therefore, it was not considered a potential trigger for CH.	No
Menispermaceae	*Albertisia exelliana*	Secondary source	This species is native to Burundi, Rwanda, Tanzania, and Uganda between 600–1,250 m asl.	This species is a liana which grows in riverine forests along small streams and closed forests.	Unknown	EN	1.023.615,15	40,00	No	a	There are only 29 known records for this species (GBIF), and most of it is in the western part of Lake Victoria. This indicates that the region may be important for the species. Therefore, it was considered a potential trigger for CH.	**Yes**
Podocarpaceae	*Afrocarpus usambarensis*	Secondary source	Recorded from Tanzania and Kenya (Kyulu Hills, Taita Taveta District).	Occurs in montane evergreen rainforest and dry evergreen forest, mixed with co-dominant angiosperms. Elevation ranges from ca. 1,500 m to ca. 3,000 m. a.s.l.	Decreasing	EN	4.278.591,50	425,00	No	a	Widely distributed species, occurring on other continents. Abundant in the region between Burundi, Rwanda Congo, and eastern Tanzania. In Tanzania, most records are in the eastern part of the country. There are no indications that the project region is important for the species' population. Therefore, it was not considered a potential trigger for CH.	No
Rubiaceae	*Oldenlandia duemmeri*	Secondary source	*Oldenlandia dummeri* occurs in Uganda and Rwanda. It has been collected 13 times between 1915-1972.	This annual or short-lived perennial herb grows on grassland at 1,050-1,820 m asl.	Decreasing	EN	18.635,88	130,00	Yes	a and b	The species has been included in IBAT's 50 km buffer, but there are no records for the Project's IAI. There is no evidence of important populations in the project region, so it was not considered a potential trigger for CH.	No

Table 7.2.4.2.a
Priority flora species for the project region

Family	Species	Data source	Distribution	Ecology and habitat	Population trend	IUCN Category	EOO (km²)	AOO (km²)	Restricted range	Criteria	Analysis	Potential trigger?
Rubiaceae	*Oxyanthus ugandensis*	Secondary source	The native range of this species is E. Central DR Congo to SW. Uganda and North Tanzania.	It is a shrub and grows primarily in the wet tropical biome.	Unknown	EN	159.777,00	-	No	a	There are records in only 3 locations, one of which is the Bukoba region, close to the project. Its occurrence in the project region is probable and has been considered a potential trigger for CH.	**Yes**
Rubiaceae	*Pavetta pseudoalbicaulis*	Secondary source	This species is known from Mozambique and South Tanzania. It is known from five localities, representing a maximum of five threat-based locations.	This species is a shrub and is found growing in forests at elevations of 140-790 m above sea level.	Decreasing	EN	263.612,62	50,00	No	a	The species was included in the baseline through GBIF, with only 1 record in the Burigi-Chato region. However, according to the IUCN and Kew Botanical Garden, the species is restricted to the south of Tanzania. Its occurrence in the project region is uncertain, so it was not considered as a potential trigger for CH.	Uncertain
Rubiaceae	*Psychotria bagshawei*	Secondary source	This species is native to the Democratic Republic of the Congo, Kenya, Tanzania and Uganda between 1,150–1,700 m asl.	This species is a shrub or small tree which grows in evergreen and gallery forests.	Unknown	EN	231.249,78	44,00	No	a	In the project area, it has been found in the Minziro FR region. However, most of the records seem to be concentrated on the border between Uganda and DR Congo, and in Kenya. There are no indications that the project region is important for the species' population. Therefore, it was not considered a potential trigger for CH.	No
Rubiaceae	*Vangueria verticillata*	Secondary source	*Vangueria verticillata* is a herb that is only known from the type specimen, collected in 1954 at Nyamonge near Geita, Mwanza District, Tanzania.	The habitat where this species was collected is not known but was presumably woodland at 1,200 m.	Unknown	CR	8,00	8,00	Yes	a and b	There is not enough information. The only record was in 1954.	Uncertain
Vitaceae	*Cyphostemma shinyangense*	Secondary source	This species is known from Kenya and Tanzania.	This species' growth form is as a slender climber to 1.8 m; it can be found in “hard pan thicket”, rocky hill; 1,170-1,830 m asl.	Decreasing	EN	45.000,00	27,00	Yes	a and b	A species recorded in the Shinyanga and Serengeti regions. A suitable EAAA for the species would be outside the project's IAI. It was therefore not considered a potential CH trigger.	No

1 – CR = Critically endangered; EN = Endangered
2 – EOO = Extent of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool[22], and occurrence records available from GBIF.
3 – AOO = Area of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool, and occurrence records available from GBIF.

[22] GeoCAT (iucnredlist.org)

Table 7.2.4.2.b
Priority fauna species for the project region

Class	Species	Common name	Data source	Distribution	Ecology and habitat	IUCN category	EOO (km²)	AOO (km²)	Migration	Restricted range	Criteria	Analysis	Potential trigger?
Birds	*Aquila nipalensis*	Steppe Eagle	Secondary data	This species breeds east of 43°E in European Russia from the Republic of Kalmykia (I. Karyakin in litt. 2016), across Kazakhstan into Kyrgyzstan, China and Mongolia (MEYBURG & BOESMAN 2013).	It inhabits areas of steppe and semi-desert and is recorded breeding up to 2,300 m in mountainous regions (DEL HOYO *et al*., 1994). It feeds mainly on small mammals on its breeding grounds, with susliks forming the vast majority of its diet in some areas; when wintering it appears to feed mainly on mole rats in East Africa. The latest estimates indicate that the global population is not more than 37,000 breeding pairs (KARYAKIN *et al*. 2016).	EN	12.600.000	1.948	MG	No	a	Although the species' range overlaps with the Project region, there are no records of individuals in the IAI. Most records of the species are concentrated in the eastern region of Lake Victoria (Serengeti) in Kenya and Uganda. The project region does not appear to be an important location for these populations. It was not considered to be a potential trigger for CH	No
Birds	*Balearica regulorum*	Grey Crowned Crane	Primary data (DAI)	*B. regulorum* occurs in eastern and southern Africa.	The species inhabits wetlands such as marshes, pans and dams with tall emergent vegetation (HOCKEY *et al*., 2005), riverbanks (MEINE & ARCHIBALD, 1996), open riverine woodland, shallowly flooded plains (URBAN *et al*., 1986) and temporary pools (del Hoyo et al. 1996) with adjacent grasslands, open savannas, croplands (DEL HOYO *et al*., 1996) (DEL HOYO *et al*., 1996, MEINE & ARCHIBALD, 1996), pastures, fallow fields and irrigated areas (DEL HOYO *et al*., 1996).	EN	6.070.000	1.972	SE	No	a	There are few records of the species in the project region, just one north of Bukoba, in Uganda. It was also evidenced in the Project region during the biodiversity sampling (BS1 and 3). The largest concentrations of records are in the Kagera swamps IBA region, the north-western region of Lake Victoria (in Uganda), the Serengeti region and the Ngorongoro Crater. There is no evidence of an important population in the project region. It was not considered a potential CH trigger.	No
Birds	*Gyps africanus*	White-backed Vulture	Secondary data	This species is the most widespread and common vulture in Africa, although it is now undergoing rapid decline. It occurs from Senegal, Gambia and Mali in the west, throughout the Sahel region to Ethiopia and Somalia in the east, through East Africa into Mozambique, Zimbabwe, Botswana, Namibia and South Africa in the south	*G. africanus* is primarily a lowland species of open wooded savanna, particularly areas of Acacia. It requires tall trees for nesting but has also been recorded nesting on electricity pylons in South Africa (DE SWARDT, 2013). It is a gregarious species congregating at carcasses, in thermals and at roost sites.	CR	23.400.000	2.154	SE	No	a	There are some records in the Kyaka region, but the highest concentration is in the Akagera Park region in Rwanda, in the Serengeti region and in southern Kenya. There is potential for it to occur in the project area, however, there is no evidence of relevant populations occupying the project area. Therefore, it was not considered a potential trigger for CH.	No
Birds	*Gyps rueppelli*	Rüppell's Vulture	Secondary data	This species occurs throughout the Sahel region of Africa from Senegal, Gambia and Mali in the west to Sudan, South Sudan and Ethiopia in the east. Also, south through the savanna regions of East Africa in Kenya, Tanzania and Mozambique	It frequents open areas of Acacia woodland, grassland and montane regions, and it is gregarious, congregating at carrion, soaring together in flocks and breeding mainly in colonies on cliff faces and escarpments at a broad range of elevations.	CR	14.200.000	1.557	SE	No	a	Similar distribution to *G. africanus*, with some records in Burigi Chato NP, in the Burigi Lake. However, there is no evidence of relevant populations occupying the project area. Therefore, it was not considered a potential trigger for CH.	No
Birds	*Necrosyrtes monachus*	Hooded Vulture	Primary data (DAI)	This species is widespread in Africa south of the Sahara; from Senegal and southern Mauritania east through southern Niger and Chad, to southern Sudan, South Sudan, Ethiopia and western Somalia, southwards to northern Namibia and Botswana, and through Zimbabwe to southern Mozambique and north-eastern South Africa and Eswatini (FERGUSON-LEES & CHRISTIE, 2001, eBird 2021).	The species is often associated with human settlements north of the Equator, but is also found in open grassland, forest edge, wooded savanna, desert and along coasts; and tends to occur at higher densities in areas where populations of larger *Gyps* vultures are low or nonexistent (FERGUSON-LEES & CHRISTIE, 2001. K. BILSTEIN in litt. 2016).	CR	22.500.000	960	SE	No	a	Similar distribution to *G. africanus and G. ruepelli*, with some records in the Bukoba region. It was evidenced in the Project region during the biodiversity sampling (BS2). There is no evidence of an important population in the project region. It was not considered a potential CH trigger.	No

Table 7.2.4.2.b
Priority fauna species for the project region

Class	Species	Common name	Data source	Distribution	Ecology and habitat	IUCN category	EOO (km²)	AOO (km²)	Migration	Restricted range	Criteria	Analysis	Potential trigger?
Birds	*Polemaetus bellicosus*	Martial Eagle	Secondary data	*P. bellicosus* has an extensive range across much of sub-Saharan Africa, from Senegal and the Gambia east to Ethiopia and north-west Somalia, and south to Namibia, Botswana and South Africa.	It inhabits open woodland, wooded savanna, bushy grassland, thornbush and, in southern Africa, more open country and even sub desert, from sea level to 3,000 m but mainly below 1,500 m (FERGUSON-LEES & CHRISTIE, 2001). The main prey is sizeable mammals, birds and reptiles (FERGUSON-LEES & CHRISTIE, 2001)	EN	26.000.000	2.156	SE	no	a	In the project region, all the records are concentrated in the Akagera Park area in Rwanda. Another important concentration of records is on the border between Tanzania and Kenya. As there are no significant records of the species in the project region, it was not considered a potential CH trigger.	No
Birds	*Psittacus erithacus*	Grey Parrot	Secondary data	Psittacus erithacus has a distribution extending from southeastern Côte d'Ivoire east through the moist lowland forests of West Africa to Cameroon, and thence in the Congo forests to just east of the Albertine Rift (up to the shores of Lake Victoria) in Uganda, Kenya and Tanzania, and south to northern Angola (JUNIPER & PARR, 1998), as well as on the islands Sao Tomé and Principe (JONES & TYE, 2006) and Bioko (Equatorial Guinea).	Although typically inhabiting dense forests, they are commonly observed at forest edges, clearings, gallery forests, mangroves, wooded savannahs, cultivated areas, and even gardens (Juniper and Parr 1998), but it is not clear whether these are self-sustaining populations.	EN	4.460.000	932	SE	no	a	A species with a wide distribution and many records throughout Central Africa. In the project region, most of the records are concentrated in the north of Lake Victoria and in lake Edward and George in Uganda. As there are no significant records of the species in the project region, it was not considered a potential CH trigger.	No
Birds	*Terathopius ecaudatus*	Bateleur	Primary data (DAI)	*T. ecaudatus* has an extensive range across much of sub-Saharan Africa (from southern Mauritania, Senegal, southern Mali and Guinea east to southern Sudan, northern South Sudan, Ethiopia, west Somalia and south to Namibia, Botswana and northern and north-eastern South Africa). It also occurs in south-west Arabia (south-west Saudi Arabia and Yemen). Although there have been significant population declines or range contractions suspected in many regions, evidence suggests that it remains widespread and common in Tanzania (N. BAKER in litt. 2020; C. KENDALL in litt. 2020), and in Malawi (S. CHIHANA in litt. 2020).	It inhabits open country, including grasslands, savanna and sub desert thornbush from sea level to 4,500 m but generally below 3,000 m (FERGUSON-LEES & CHRISTIE, 2001).	EN	23.500.000	2.044	SE	No	a	In the project region, all records are concentrated in the Akagera Park region in Rwanda and the Serengeti region. It was evidenced in the Project region during the biodiversity sampling (BS2, 6 and 8). There is no evidence of an important population in the project region. Baker and Kendal (2020) state that the species is common in Tanzania. Therefore, it was not considered a potential CH trigger.	No
Birds	*Torgos tracheliotos*	Lappet-faced Vulture	Secondary data	Occurs throughout Africa and the Middle East	The species inhabits dry savanna, arid plains, deserts and open mountain slopes (SHIMELIS *et al.*, 2005), up to 3,500 m (A. Shimelis in litt. 2007).	EN	34.200.000	150	PM	no	a	Similar to the other vultures, there are some records in the Kyaka region, but the highest concentration is in the Akagera Park region in Rwanda, in the Serengeti region and in southern Kenya. There is potential for it to occur in the project area, and it is considered a potential trigger for CH.	No

Table 7.2.4.2.b
Priority fauna species for the project region

Class	Species	Common name	Data source	Distribution	Ecology and habitat	IUCN category	EOO (km²)	AOO (km²)	Migration	Restricted range	Criteria	Analysis	Potential trigger?
Birds	*Trigonoceps occipitalis*	White-headed Vulture	Secondary data	This species has an extremely large range in sub-Saharan Africa (from Senegal, Gambia and Guinea-Bissau disjunctly east to Eritrea, Ethiopia and Somalia, and south to easternmost South Africa and Eswatini), where it is uncommon, but generally widespread outside forested regions (Harrison et al. 1997). It has declined rapidly in parts of West Africa since the early 1940s (P. HALL in litt. 1999, J. M. THIOLLAY in litt. 2006, 2012), is declining in East Africa (VIRANI *et al*., 2011) and in southern Africa is now largely confined to protected areas.	It prefers mixed, dry woodland at low altitudes, avoiding semi-arid thornbelt areas (MUNDY *et al*., 1992). It also occurs up to 4,000 m in Ethiopia, and perhaps 3,000 m in Kenya, and ranges across the thorny Acacia-dominated landscape of Botswana (MUNDY *et al*., 1992). It generally avoids human habitation (MUNDY *et al*., 1992). The species is thought to be a long-lived resident that maintains a territory (DEL HOYO *et al*., 1994, Murn and Holloway 2014). It may generally fly lower than other vultures and is often the first vulture species to arrive at carcasses (MUNDY *et al*., 1992).	CR	21.100.000	1.876	SE	no	a	Similar to the other vultures, there are some records in the Kyaka region, but the highest concentration is in the Akagera Park region in Rwanda, in the Serengeti region and in southern Kenya. There is potential for it to occur in the project area, and it is considered a potential trigger for CH.	No
Mammalia/ Carnivora	*Lycaon pictus*		Secondary data	Historical data indicate that African Wild Dogs were formerly distributed throughout sub-Saharan Africa, from desert (LHOTSE, 1946) to mountain summits (THESIGER, 1970), and probably were absent only from lowland rainforest and the driest desert (SCHALLER, 1972). They have disappeared from much of their former range. The species is virtually eradicated from North and West Africa, and greatly reduced in Central Africa and North-east Africa. The largest populations remain in southern Africa (especially northern Botswana, western Zimbabwe, eastern Namibia, and western Zambia) and the southern part of East Africa (especially Tanzania and northern Mozambique).	African Wild Dogs are generalist predators, occupying a range of habitats including short-grass plains, semi-desert, bushy savannas and upland forests. While early studies in the Serengeti National Park, Tanzania, led to a belief that African Wild Dogs were primarily an open plains species, more recent data indicate that they reach their highest densities in the thicker bush (e.g., Selous Game Reserve, Tanzania; Mana Pools National Park, Zimbabwe; and northern Botswana).	EN	7.529.483	1.303.469	II	No	a	The species occurs in a disjunct manner and, according to information from the IUCN, one of the most significant populations can currently be found in southern Africa, and in the eastern part of the continent, mainly Tanzania and Mozambique. Assessing the species' occurrence records (GBIF), the highest concentration of individuals in Tanzania is in the northeastern region of the country (on the border with Kenya). In the project region, there is only 1 record near Lake Victoria, in the Mwanza region. Therefore, considering that there is no evidence of important populations in the project region, it was not considered a potential CH trigger.	No
Mammalia/ Perissodactyla	*Diceros bicornis*		Secondary data	There are now three remaining recognised subspecies/genetic management clusters of Black Rhino occupying different areas of África. Diceros b. michaeli was distributed from South Sudan, Ethiopia, and Somalia, through Kenya into northern-central Tanzania and Rwanda. Its current stronghold is Kenya. Smaller but growing numbers occur in northern Tanzania. Diceros b. minor is believed to have occurred from southern Tanzania through Zambia, Zimbabwe, and Mozambique, and parts of South Africa.	Black Rhino occurs in a wide variety of habitats from desert areas in Namibia to wetter wooded areas. The highest densities of rhinos are found in savannas on nutrient-rich soils and in succulent Valley Bushveld areas. Black rhinos are browsers and favour small acacias and other palatable woody species (Grewia's, Euphorbiaceae species, etc.) as well as palatable herbs and succulents. Apart from plant species composition and size structure, Black Rhino carrying capacity is related to rainfall, soil nutrient status, fire histories, levels of grass interference, extent of frost and densities of other large browsers.	CR	5.851.703	179.136	-	No	a	The black rhino was included in the baseline through secondary data (IBAT Report). Currently, the largest population of this species is found in Ngorongoro Park and Serengeti Park. The IUCN data does not specify where black rhino occurs in the country for security reasons. The most viable location to support a rhino population in the project region would be Burigi-Chato NP. However, the Rapid Biodiversity Assessment carried out by the BCNP states that there are no black rhino populations in the park area (TANAPA, 2020). Therefore, there is no evidence of the presence of this species in the project area.	No

Table 7.2.4.2.b
Priority fauna species for the project region

Class	Species	Common name	Data source	Distribution	Ecology and habitat	IUCN category	EOO (km²)	AOO (km²)	Migration	Restricted range	Criteria	Analysis	Potential trigger?
Mammalia/ Pholidota	*Phataginus tricuspis*	Common African Pangolin	Primary data (DAI)	This species ranges from Guinea-Bissau in West Africa through Guinea, Sierra Leone and much of West Africa, to Uganda and through south to north of Zambia and Angola. In Tanzania, the species is known from the Minziro Forest Reserve on the northwest border with Uganda, and close to Bukoba (FOLEY *et al*., 2014).	This species occurs predominantly in moist tropical lowland forests and secondary growth, but also occurs in dense woodlands, especially along water courses (KINGDON, 1971; GAUBERT, 2014).	EN	6.415.869	512	-	No	a	The species was recorded in the Projects DAI through interviews. There are also records in the Minziro FR, which seems to be an important habitat for this species. Therefore, it was considered a potential trigger for CH.	Yes
Mammalia/ Pholidota	*Smutsia gigantea*	Giant Ground Pangolin	Secondary data	The species is widely but discontinuously distributed throughout West and Central Africa in a broad range of habitats including primary and secondary rainforest formations, swamp forests, forest savannah mosaics and savannah woodlands. There is an authenticated record from the Mahale Mountains in western Tanzania, where their presence has been confirmed by camera traps and they may also occur in Gombe National Park (FOLEY *et al*., 2014). From the eastern bank of the Sanaga River in Cameroon, the species is continuously distributed throughout the Congo Basin into Central Uganda (KINGDON *et al*., 2013). Giant Pangolins have been observed on the lakeshore in western Kenya, close to the Uganda border, although there are no recent records (KINGDON, 1971).	The Giant Pangolin occurs in primary and secondary rainforest forest formations, gallery forests, swamp forests, forest-savannah mosaic habitats and wooded savannah (HOFFMANN *et al*., 2019). The species also persists discontinuously in savannah woodland /agricultural mosaics in central and southwestern Uganda (N. MATTHEWS & S. NIXON unpubl. data). In Tanzania, it has been recorded in bamboo stands in miombo woodland (Foley et al. 2014). It is thought that the species may be dependent on access to permanent water sources (KINGDON *et al*., 2013), although this requires confirmation. The species is found across a wide altitudinal gradient, from sea level on the Gabon coast to at least 2200 a.s.l. in the Albertine rift escarpment forests of eastern DRC (S. NIXON, unpubl. data).	EN	4.093.442	360	-	No	a	Although the EOO of the species overlaps with the Project IAI, the records for Tanzania are only known for Mahale Mountains National Park, in the Kalambo region. The Uganda records are not close to the Tanzanian border. There is no evidence for the presence of the species in the Project region. Therefore, it was not considered a potential trigger for CH.	No
Mammalia/ Primates	*Pan troglodytes*	Chimpanzee	Secondary data	Chimpanzees have the widest geographic distribution of any great ape, with a range of over 2.6 million km² (IUCN shapefiles). They have a discontinuous distribution from southern Senegal across the forested belt north of the Congo River to western Tanzania and western Uganda, between 13°N and 7°S. The subspecies *Pan t. schweinfurthii* (GIGLIOLI, 1872) ranges from the Ubangi River/Congo River in southeast Central African Republic and DR Congo, to Burundi, Rwanda, western Uganda and western Tanzania, with a small, relict population in South Sudan. The Albertine Rift escarpment is a stronghold for this subspecies (PLUMPTRE *et al*., 2010a).	Chimpanzees are found discontinuously across the forest belt of Africa, occupying primary and secondary moist lowland forests, swamp forests, submontane and montane forests, dry forests, forest galleries in savanna woodland, and farmland (OATES, 2011).	EN	6.522.026	2.196	I, II	No	a	The records for this species in western Tanzania are concentrated in the Kigoma region, near Lake Tanganyika, and in Rubondo Island National Park, in Lake Victoria. There are no records for the Project's IAI. Therefore, this species was not considered a potential trigger for CH.	No

Table 7.2.4.2.b
Priority fauna species for the project region

Class	Species	Common name	Data source	Distribution	Ecology and habitat	IUCN category	EOO (km²)	AOO (km²)	Migration	Restricted range	Criteria	Analysis	Potential trigger?
Mammalia/ Primates	*Piliocolobus tephrosceles*	Ashy Red Colobus	Primary data (DAI)	It is present on the eastern border of the Rift Valley in western Uganda and western Tanzania (Struhsaker and Grubb 2013). Five distinct subpopulations are known in western Uganda in Kibale National Park, in western Tanzania in Biharamulo on the southwestern shores of Lake Victoria, in Gombe Stream and Mahale Mountains national parks on the eastern shores of Lake Tanganyika, and on the Ufipa Plateau (Mbizi and Misheta) (Rodgers et al. 1984). However, recent sampling has failed to reveal the species in some parts of Tanzania, concluding that it is probably extinct in the Misheta, Nsangu, Mbuzi and Chala forests. This species may be present in Burundi, Rwanda and eastern parts of the Democratic Republic of Congo, but its presence has not been confirmed.	This species occurs in a wide variety of forest types, including riverine and gallery forest, forest-miombo savanna mosaic, old-growth lowland, mid-altitude, and montane moist rain forest, degraded secondary forests, and raphia palm swamps (STRUHSAKER, 2010, STRUHSAKER & GRUBB, 2013). In Kibale, *P. tephrosceles* is most abundant in moist, old-growth, evergreen forests with emergent trees reaching 50 m in height (STRUHSAKER, 2010, STRUHSAKER & GRUBB, 2013, and references therein). It can persist in lightly logged forests as long as important food trees remain (LEE *et al.*, 1988).	EN	21.100	3.847	-	Yes	a and b	Species with restricted distribution. According to IUCN, the species is known for only three sites, one of them the Burigi-Chato NP, near Lake Victoria. It was recorded in the Project region (BS4 and BS5), which may indicate that the region is an important habitat for the population. Therefore, this species was considered a potential trigger for CH.	Yes
Mammalia/ Proboscidea	*Loxodonta africana*	African Savanna Elephant	Primary data (DAI)	Currently, *L. africana* is found in 24 countries. Although knowledge of African Savanna Elephant distribution varies spatially and temporally, it is evident that the species distribution is retracting and becoming increasingly fragmented across their range in the continent. African Savanna Elephants occupy an estimated 15% of their historic pre-agricultural range (CHASE *et al.*, 2016).	African Savanna Elephants are found over a wide latitudinal range between the northern tropics in Mali (16° North) to the southern temperate zone (34° South) in South Africa. They occupy a variety of habitats ranging from montane forest, miombo and mopane woodland, thicket, savanna and grasslands to arid deserts and a wide altitudinal range from mountain slopes to oceanic beaches. This species is capable of moving long distances and naturally does so in arid ecosystems and in response to climatic conditions (e.g., seasonality and drought). Depending on productivity, and water availability they demonstrate a range of residence, migratory, semi-migratory and near-nomadic movement patterns in different regions of the continent.	EN	15.625.712	3.428	II	No	a	The species was found in the study area through primary data (BS1, 2, 4 and 6), and the region is also home to an elephant migratory corridor, classified as one of the 10 most important in the country according to the MNRT. Therefore, the species was considered a potential trigger for CH	Yes

Table 7.2.4.2.b
Priority fauna species for the project region

Class	Species	Common name	Data source	Distribution	Ecology and habitat	IUCN category	EOO (km²)	AOO (km²)	Migration	Restricted range	Criteria	Analysis	Potential trigger?
Reptiles	*Malacochersus tornieri*	Pancake Tortoise	Secondary data	*M. tornieri* occurs in Kenya, Tanzania, and marginally in Zambia (IVERSON, 1992; SPAWLS *et al*., 2002; MALONZA, 2003; CHANSA & WAGNER, 2006; TTWG, 2017; MWAYA *et al*., 2018). In Tanzania, it occurs disjunctly from the southern shores of Lake Victoria into the Maasai Steppe and further south on the Precambrian Basement in the Somalia-Maasai and the Zambesian Floristic Regions.	*M. tornieri* has a flat and pliable shell resulting from limited bony shell development with a covering of thin keratinous scutes. It is an inhabitant of arid thorn-bush and savanna landscapes, where it lives on hills with rocky outcrops (kopjes) (LOVERIDGE & WILLIAMS, 1957; BROADLEY, 1989; MWAYA *et al*., 2018). The species inhabit predominantly dry savanna regions with 250 to 500 mm annual rainfall, with populations ranging into adjacent areas of semi-desert as well as moist savanna. Individual Pancake Tortoises are usually found in fissures and crevices in and between boulders and bedrock. It is associated with isolated rocky hills and outcrops (kopjes) within its range (MWAYA *et al*., 2018).	CR	385.000	72.000		No	a	The pancake tortoise has a distribution restricted to certain areas and conditions. In the project region, it occurs near Lake Victoria in Mwanza. It was not identified during the field surveys, so its occurrence in the Project's IAI is uncertain.	Uncertain

1 – CR = Critically endangered; EN = Endangered
2 – EOO = Extent of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool[23], and occurrence records available from GBIF.
3 – AOO = Area of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool, and occurrence records available from GBIF.
4 – Migration: For birds, the classification of the migratory pattern followed Tobias & Pigot (2019): SE = Sedentary; PM = Partially migratory, i.e. minority of the population migrates long distances, or most of the population undergoes short-distance migration, nomadic movements, distinct altitudinal migration, etc; MG = Migratory, i.e. majority of population undertakes long-distance migration. For other groups, the classification of migratory behaviour followed the list of migratory species of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) – I = Appendix I, migratory species that have been assessed as being in danger of extinction throughout all or a significant portion of their range.; II = Appendix II, migratory species that have an unfavourable conservation status and that require international agreements for their conservation and management, as well as those that have a conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement.

[23] GeoCAT (iucnredlist.org)

Table 7.2.4.2.c
Evaluation of the activation of CH thresholds by flora species classified as potential triggers

Family	Species	Data source	Distribution	Ecology and habitat	Population trend	IUCN Category	EOO (km²)	AOO (km²)	Restricted range	Analysis	EAAA	EAAA/ AOO	CH?
Acanthaceae	*Thunbergia laborans*	Secondary data	This species is native to Rwanda and Tanzania where it is found between 1,150–1,550 m asl.	This species is a perennial herb which occurs in woodland, bushland and roadsides.	Decreasing	EN	11.636,68	20,00	Yes	Species recorded in the IAI, with most of it in the western part of Lake Victoria. Individuals were recorded in the Burigi-Chato NP. Is a potential trigger for CH.	An EAAA includes the environments favourable to the occurrence of the species within the Burigi Chato NP, with an area that certainly exceeds its AOO	>10%	Yes, criteria a and b
Asteraceae	*Emilia cryptantha*	Secondary data	Emilia cryptantha is endemic to S Uganda and NW Tanzania.	An annual herb found growing in swamp grassland at 1,000-1,250 m.	Decreasing	EN	6.394,34	45,00	Yes	Species recorded in the IAI, with most of it in the western part of Lake Victoria. It has been recorded in the Bukoba region and Minziro FR. Is a potential trigger for CH.	An EAAA includes the environments favourable to the occurrence of the species within the Minziro FR, with an area that certainly exceeds its AOO	>10%	Yes, criteria a and b
Asteraceae	*Vernonia tinctosetosa*	Secondary data	Endemic to northwest Tanzania and southwest Uganda.	This perennial herb grows in wetland areas on sandy lake shores at 1,100-1,200 m.	Unknown	EN	11.093,95	45,00	Yes	Species recorded in the IAI, with most of it in the western part of Lake Victoria. It has been recorded in the Bukoba region and Minziro FR. Is a potential trigger for CH.	An EAAA includes the environments favourable to the occurrence of the species within the Minziro FR, with an area that certainly exceeds its AOO	>10%	Yes, criteria a and b
Dennstaedtiaceae	*Blotiella trichosora*	Secondary data	The species occurs in Burundi, Tanzania and Uganda.	Terrestrial fern, usually near streams in the undergrowth of the semideciduous moist forest, occasionally at the forest edge in a swamp, rarely in gallery forest; at 800-1,750 m elevation.	Decreasing	EN	28.723,52	63,00	Yes	Species recorded in the IAI, with most of it in the western part of Lake Victoria. It has been recorded in the Bukoba region and Minziro FR. Is a potential trigger for CH.	An EAAA includes the environments favourable to the occurrence of the species within the Minziro FR, with an area that certainly exceeds its AOO	>10%	Yes, criteria a and b
Lamiaceae	*Tinnea physalis*	Secondary data	This species is endemic to Tanzania where it is found between 1,160–1,350 m asl.	This species is a shrub which is found in Commiphora scrub, rocky outcrops and inselbergs.	Unknown	EN	21.112,13	24,00	Yes	The species were recorded in the Shinyanga and Mwanza regions, with the majority of records in Shinyanga. It is a potential HC trigger.	Most of GBIF's records were in the Shinyanga region, so a suitable EAAA for the species would be the Mwantini Hill protected area, with 23 km²	1%	Yes, for criteria a and no for criteria b
Menispermaceae	*Albertisia exelliana*	Secondary data	This species is native to Burundi, Rwanda, Tanzania, and Uganda between 600–1,250 m asl.	This species is a liana which grows in riverine forests along small streams and closed forests.	Unknown	EN	1.023.615,15	40,00	No	There are only 29 known records for this species (GBIF), and most of it is in the western part of Lake Victoria. This indicates that the region may be important for the species. Therefore, it was considered a potential trigger for CH.	An EAAA includes the environments favourable to the occurrence of the species within the Minziro FR, with an area that certainly exceeds its AOO	>0,5%	Yes, criteria a
Rubiaceae	*Oxyanthus ugandensis*	Secondary source	The native range of this species is E. Central DR Congo to SW. Uganda and North Tanzania.	It is a shrub and grows primarily in the wet tropical biome.	Unknown	EN	159.777,00	-	No	There are records in only 3 locations, one of which is the Bukoba region, close to the project. Its occurrence in the project region is probable and has been considered a potential trigger for CH.	An EAAA includes the environments favourable to the occurrence of the species within the Minziro FR, with an area that certainly exceeds its AOO	>0,5%	Yes, criteria a

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2 – EOO = Extent of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool[24], and occurrence records available from GBIF.
3 – AOO = Area of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool, and occurrence records available from GBIF.
4 – EAAA = Ecologically Appropriate Area of Analysis

[24] GeoCAT (iucnredlist.org)

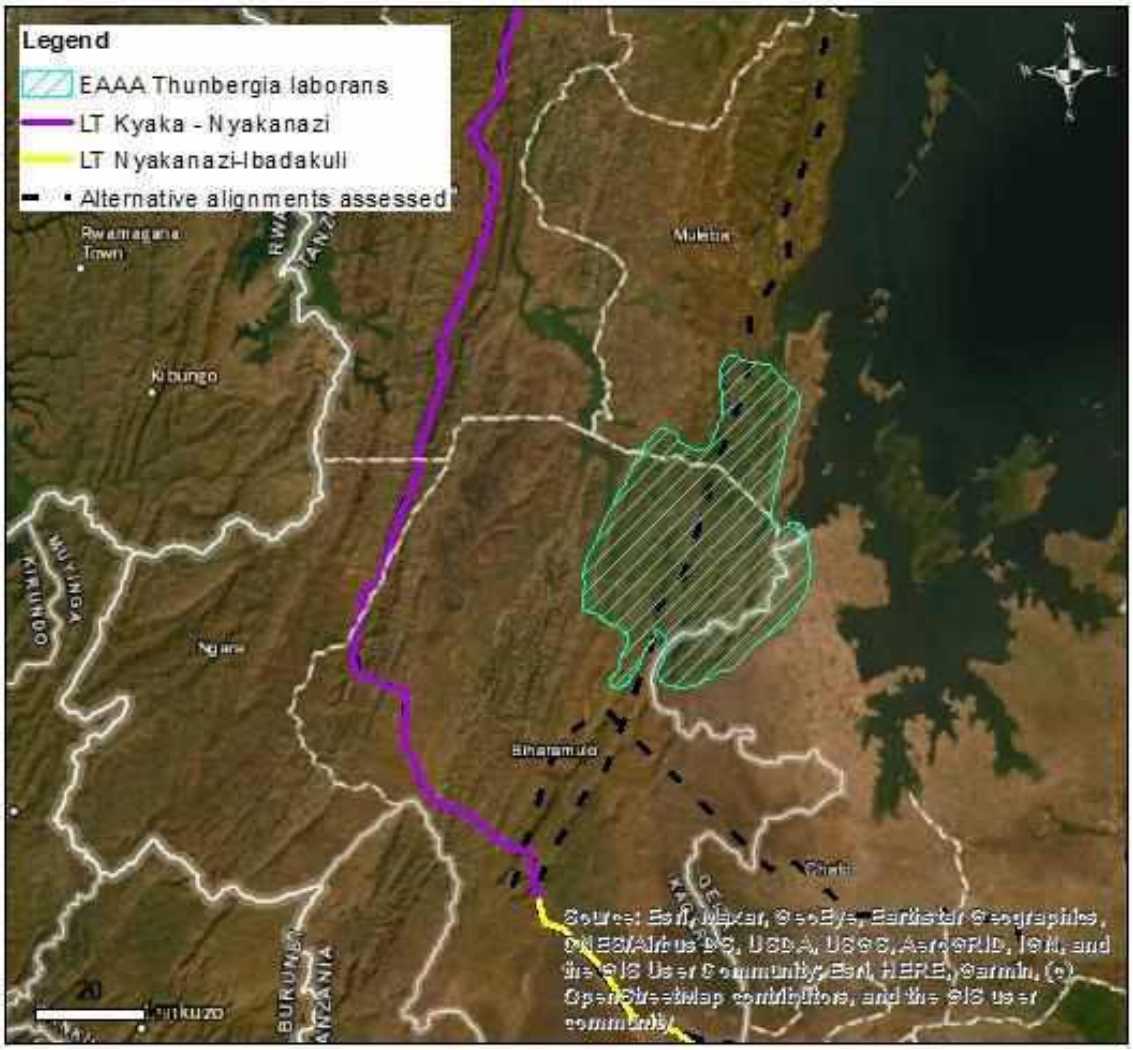
Table 7.2.4.2.d
Evaluation of the activation of CH thresholds by fauna species classified as potential triggers

Class	Species	Common name	Data source	Distribution	Ecology and habitat	IUCN	Endemism	EOO (km²)	AOO (km²)	Migration	Restricted range	Analysis	EAAA	EAAA/ AOO	CH?
Mammalia/ Pholidota	*Phataginus tricuspis*	Common African Pangolin	Primary data (DAI)	This species ranges from Guinea-Bissau in West Africa through Guinea, Sierra Leone and much of West Africa, to Uganda and through south to north of Zambia and Angola. In Tanzania, the species is known from the Minziro Forest Reserve on the northwest border with Uganda, and close to Bukoba (Foley et al. 2014).	This species occurs predominantly in moist tropical lowland forests and secondary growth, but also occurs in dense woodlands, especially along water courses (Kingdon 1971; Gaubert 2014).	EN	-	6.415.869	512	-	No	The species was recorded in the Projects DAI through interviews. There are also records in the Minziro FR, which seems to be an important habitat for this species. Therefore, it was considered a potential trigger for CH.	An EAAA includes the environments favourable to the occurrence of the species within the Minziro FR, in an area of 459 km²	>0,5%	Yes, criteria a
Mammalia/ Primates	*Piliocolobus tephrosceles*	Ashy Red Colobus	Primary data (DAI)	It is present on the eastern border of the Rift Valley in western Uganda and western Tanzania (Struhsaker and Grubb 2013). Five distinct subpopulations are known in Kibale National Park (Uganda), in Biharamulo (Tanzania) on the southwestern shores of Lake Victoria, in Gombe Stream and Mahale Mountains NP on Lake Tanganyika, and on the Ufipa Plateau (Mbizi and Misheta) (Rodgers et al. 1984). However, recent sampling has failed to reveal the species in some parts of Tanzania, concluding that it is probably extinct in the Misheta, Nsangu, Mbuzi and Chala forests.	This species occurs in a wide variety of forest types, including riverine and gallery forest, forest-miombo savanna mosaic, old-growth lowland, mid-altitude, and montane moist rain forest, degraded secondary forests, and raphia palm swamps (Struhsaker 2010, Struhsaker and Grubb 2013). In Kibale, *P. tephrosceles* is most abundant in moist, old-growth, evergreen forests with emergent trees reaching 50 m in height (Struhsaker 2010, Struhsaker and Grubb 2013, and references therein). It can persist in lightly logged forests as long as important food trees remain (Lee et al. 1988).	EN	East Africa	21.100	3.847	-	Yes	Species with restricted distribution. According to IUCN, the species is known for only three sites, one of them the Burigi-Chato NP, near Lake Victoria. It was recorded in the Project region (BS4 and BS5, outside the preferred alignment), which may indicate that the region is an important habitat for the population. Therefore, this species was considered a potential trigger for CH.	The delimitation of the species' EAAA included the region where it was sighted in the primary survey, delimited by the boundaries of the protected area and lakes Burigi and Vitoria to the west and east. The area is 1495 km²	>0,5%	Yes, criteria a
Mammalia/ Proboscidea	*Loxodonta africana*	African Savanna Elephant	Primary data (DAI)	Currently, *L. africana* is found in 24 countries. Although knowledge of African Savanna Elephant distribution varies spatially and temporally, it is evident that the species distribution is retracting and becoming increasingly fragmented across their range in the continent. African Savanna Elephants occupy an estimated 15% of their historic pre-agricultural range (Chase et al. 2016).	The species is found over a wide latitudinal range between Mali and South Africa. They occupy a variety of habitats ranging from montane forest, miombo and mopane woodland, thicket, savanna and grasslands to arid deserts and a wide altitudinal range from mountain slopes to oceanic beaches. They are capable of moving long distances and naturally do so in arid ecosystems and response to climatic conditions (e.g., seasonality and drought). Depending on productivity, and water availability they demonstrate a range of residence, migratory, semi-migratory and near-nomadic movement patterns in different regions of the continent.	EN	-	15.625.712	3.428	II	No	The species was found in the study area through primary data (BS1, 2, 4 and 6), and the region is also home to an elephant migratory corridor, classified as one of the 10 most important in the country according to the MNRT. Therefore, the species was considered a potential trigger for CH	The EAAA for this species included the wildlife corridor identified in the region by the MNRT (2022), with an area of 2,700 km².	>0,5%	Yes, criteria a

1 – CR = Critically endangered; EN = Endangered
2 – EOO = Extent of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool[25], and occurrence records available from GBIF; 3 – AOO = Area of occurrence. Information obtained from the IUCN website or, where not available, estimated using the GeoCAT tool, and occurrence records available from GBIF; 4 – EAAA = Ecologically Appropriate Area of Analysis

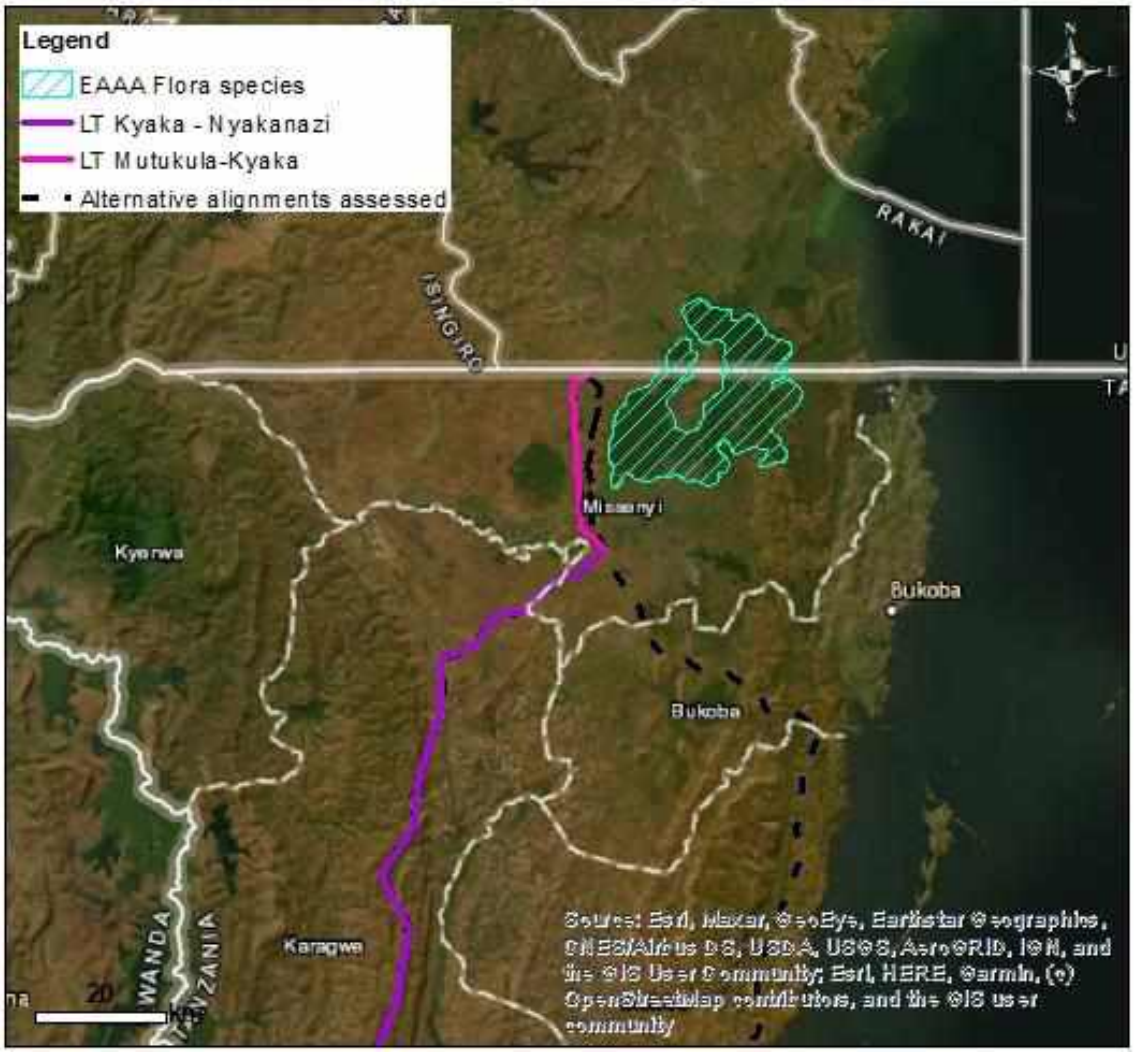
[25] GeoCAT (iucnredlist.org)

Figure 7.2.4.2.a
Ecologically appropriate area of analysis of *Thunbergia laborans*



Source: Own analysis.

Figure 7.2.4.2.b
Ecologically appropriate area of analysis of *Albertisia exelliana, Blotiella trichosora, Emilia cryptantha, Oxyanthus ugandensis and Vernonia tinctosetosa*

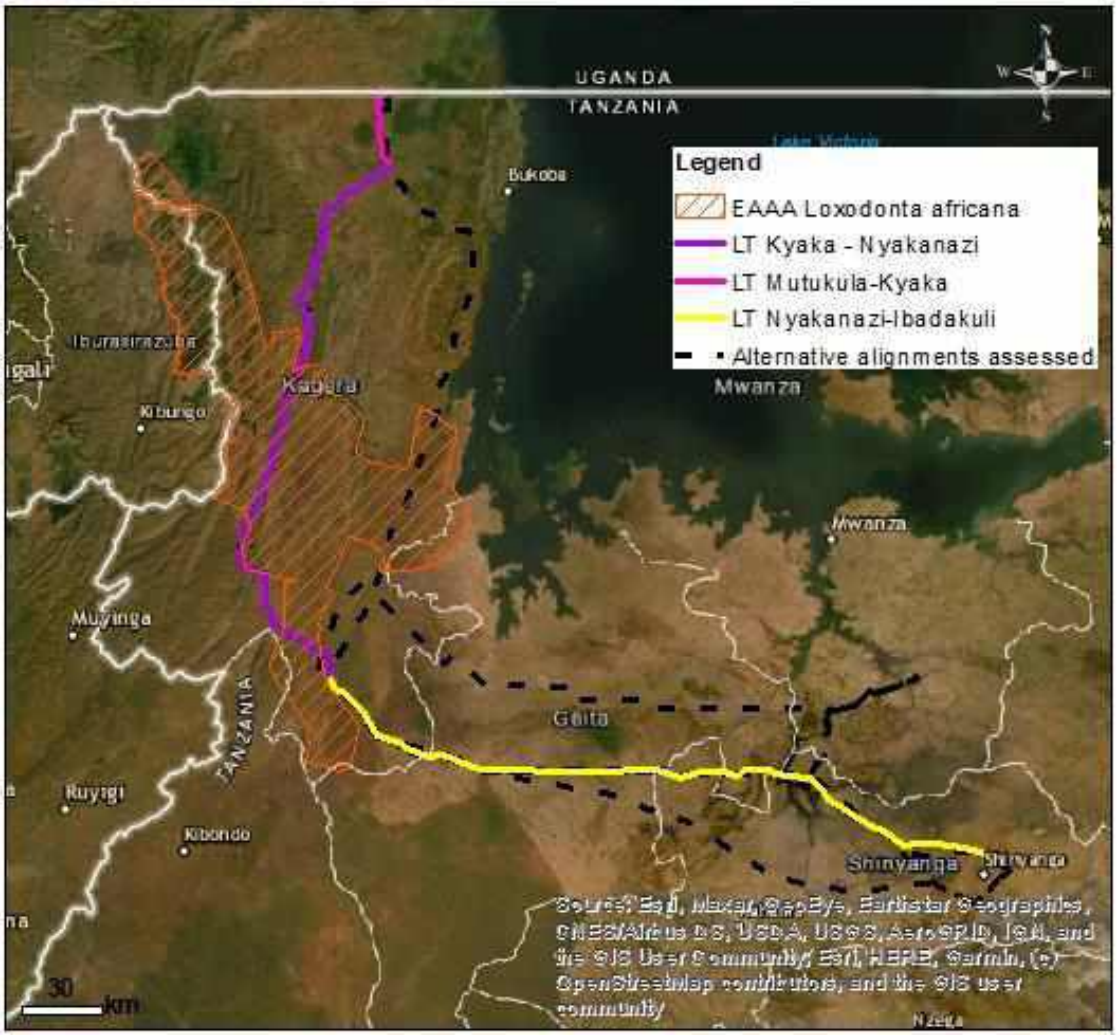


Source: Own analysis.

Figure 7.2.4.2.c
Ecologically appropriate area of analysis of *Tinnea physalis*

Source: Own analysis.

Figure 7.2.4.2.f
Ecologically appropriate area of analysis of *Loxodonta africana*



Source: Own analysis.

Criterion (c)

Criterion 3 determines that CH are those that host globally or nationally significant concentrations of migratory and/or congregated species. According to GN77, migratory species are defined as any species with a significant proportion of its members moving cyclically and predictably from one geographical area to another. Congregating species are those whose individuals gather in large groups in a cyclical, regular and/or predictable manner.

GN78 from IFS PS6 establishes thresholds for this criterion which include:

(a) Areas are known to sustain, on a cyclical or otherwise regular basis, ≥ 1% of the global population of a migratory or congregatory species at any point of the species' lifecycle.

(b) Areas that predictably support ≥10% of the global population of a species during periods of environmental stress.

According to the data collected, there are 85 species with migratory behaviour in the Projects region, 74 birds and 11 mammals (**Table 7.2.4.2.e**).

Table 7.2.4.2.e
Species with migratory behaviour in the Project region

Class	Species	Common name	Register location	IUCN category	Migration
Birds	*Accipiter badius*	Shikra	Primary data (DAI)	LC	MG
Birds	*Acrocephalus arundinaceus*	Great Reed-warbler	Secondary data	LC	MG
Birds	*Acrocephalus schoenobaenus*	Sedge Warbler	Secondary data	LC	MG
Birds	*Acrocephalus scirpaceus*	Common Reed-warbler	Secondary data	LC	MG
Birds	*Actitis hypoleucos*	Common Sandpiper	Secondary data	LC	MG
Birds	*Anthus cinnamomeus*	African Pipit	Secondary data	LC	MG
Birds	*Anthus trivialis*	Tree Pipit	Secondary data	LC	MG
Birds	*Apus affinis*	Little Swift	Primary data (DAI)	LC	MG
Birds	*Apus apus*	Common Swift	Secondary data	LC	MG
Birds	*Apus caffer*	White-rumped Swift	Secondary data	LC	MG
Birds	*Aquila nipalensis*	Steppe Eagle	Secondary data	EN	MG
Birds	*Aquila rapax*	Tawny Eagle	Primary data (DAI)	VU	MG
Birds	*Ardea purpurea*	Purple Heron	Secondary data	LC	MG
Birds	*Ardeola ralloides*	Squacco Heron	Primary data (DAI)	LC	MG
Birds	*Calidris minuta*	Little Stint	Secondary data	LC	MG
Birds	*Calidris pugnax*	Ruff	Secondary data	LC	MG
Birds	*Calidris temminckii*	Temminck's Stint	Secondary data	LC	MG
Birds	*Cecropis daurica*	Red-rumped Swallow	Secondary data	LC	MG
Birds	*Chlidonias leucopterus*	White-winged Tern	Secondary data	LC	MG
Birds	*Ciconia ciconia*	White Stork	Secondary data	LC	MG
Birds	*Cinnyricinclus leucogaster*	Violet-backed Starling	Primary data (DAI)	LC	MG
Birds	*Cisticola juncidis*	Zitting Cisticola	Secondary data	LC	MG
Birds	*Clamator glandarius*	Great Spotted Cuckoo	Primary data (DAI)	LC	MG
Birds	*Clamator jacobinus*	Jacobin Cuckoo	Secondary data	LC	MG

Table 7.2.4.2.e
Species with migratory behaviour in the Project region

Class	Species	Common name	Register location	IUCN category	Migration
Birds	*Clamator levaillantii*	Levaillant's Cuckoo	Secondary data	LC	MG
Birds	*Clanga pomarina*	Lesser Spotted Eagle	Secondary data	LC	MG
Birds	*Coturnix delegorguei*	Harlequin Quail	Secondary data	LC	MG
Birds	*Crex egregia*	African Crake	Secondary data	LC	MG
Birds	*Cuculus canorus*	Common Cuckoo	Secondary data	LC	MG
Birds	*Cuculus clamosus*	Black Cuckoo	Secondary data	LC	MG
Birds	*Delichon urbicum*	Northern House Martin	Secondary data	LC	MG
Birds	*Falco amurensis*	Amur Falcon	Secondary data	LC	MG
Birds	*Falco subbuteo*	Eurasian Hobby	Secondary data	LC	MG
Birds	*Falco tinnunculus*	Common Kestrel	Secondary data	LC	MG
Birds	*Ficedula semitorquata*	Semi-collared Flycatcher	Secondary data	LC	MG
Birds	*Gallinago gallinago*	Common Snipe	Secondary data	LC	MG
Birds	*Gallinago media*	Great Snipe	Secondary data	NT	MG
Birds	*Glareola pratincola*	Collared Pratincole	Secondary data	LC	MG
Birds	*Hieraaetus pennatus*	Booted Eagle	Secondary data	LC	MG
Birds	*Hippolais icterina*	Icterine Warbler	Secondary data	LC	MG
Birds	*Hirundo atrocaerulea*	Blue Swallow	Secondary data	VU	MG
Birds	*Hirundo rustica*	Barn Swallow	Secondary data	LC	MG
Birds	*Iduna pallida*	Olivaceous Warbler	Secondary data	LC	MG
Birds	*Ixobrychus minutus*	Common Little Bittern	Secondary data	LC	MG
Birds	*Lanius collurio*	Red-backed Shrike	Secondary data	LC	MG
Birds	*Lanius minor*	Lesser Grey Shrike	Secondary data	LC	MG
Birds	*Lanius phoenicuroides*	Red-tailed Shrike	Secondary data	LC	MG
Birds	*Mareca penelope*	Eurasian Wigeon	Secondary data	LC	MG
Birds	*Merops apiaster*	European Bee-eater	Secondary data	LC	MG
Birds	*Merops persicus*	Blue-cheeked Bee-eater	Secondary data	LC	MG
Birds	*Milvus aegyptius*	Yellow-billed Kite	Primary data (DAI)	LC	MG
Birds	*Milvus migrans*	Black Kite	Primary data (DAI)	LC	MG

Table 7.2.4.2.e
Species with migratory behaviour in the Project region

Class	Species	Common name	Register location	IUCN category	Migration
Birds	*Motacilla flava*	Western Yellow Wagtail	Secondary data	LC	MG
Birds	*Muscicapa striata*	Spotted Flycatcher	Secondary data	LC	MG
Birds	*Nycticorax nycticorax*	Black-crowned Night-heron	Primary data (DAI)	LC	MG
Birds	*Oenanthe isabellina*	Isabelline Wheatear	Secondary data	LC	MG
Birds	*Oenanthe oenanthe*	Northern Wheatear	Secondary data	LC	MG
Birds	*Pandion haliaetus*	Osprey	Secondary data	LC	MG
Birds	*Phylloscopus trochilus*	Willow Warbler	Secondary data	LC	MG
Birds	*Plectropterus gambensis*	Spur-winged Goose	Primary data (DAI)	LC	MG
Birds	*Porphyrio alleni*	Allen's Gallinule	Secondary data	LC	MG
Birds	*Psalidoprocne albiceps*	White-headed Saw-wing	Primary data (DAI)	LC	MG
Birds	*Riparia riparia*	Collared Sand Martin	Secondary data	LC	MG
Birds	*Saxicola rubetra*	Whinchat	Secondary data	LC	MG
Birds	*Sylvia atricapilla*	Eurasian Blackcap	Secondary data	LC	MG
Birds	*Sylvia borin*	Garden Warbler	Secondary data	LC	MG
Birds	*Tachymarptis melba*	Alpine Swift	Secondary data	LC	MG
Birds	*Tringa glareola*	Wood Sandpiper	Secondary data	LC	MG
Birds	*Tringa nebularia*	Common Greenshank	Secondary data	LC	MG
Birds	*Tringa ochropus*	Green Sandpiper	Secondary data	LC	MG
Birds	*Tringa stagnatilis*	Marsh Sandpiper	Secondary data	LC	MG
Birds	*Tringa totanus*	Common Redshank	Secondary data	LC	MG
Birds	*Upupa epops*	Common Hoopoe	Secondary data	LC	MG
Birds	*Xenus cinereus*	Terek Sandpiper	Secondary data	LC	MG
Mammalia/ Artiodactyla	*Giraffa tippelskirchi*	Giraffe, Maasai Giraffe	Primary data (DAI)	NA	II
Mammalia/ Carnivora	*Acinonyx jubatus*	Cheetah	Secondary data	VU	I
Mammalia/ Carnivora	*Lycaon pictus*	African wild dog	Secondary data	EN	II
Mammalia/ Carnivora	*Panthera leo*	Lion	Primary data (DAI)	VU	II
Mammalia/ Carnivora	*Panthera pardus*	Leopard	Primary data (DAI)	VU	II
Mammalia/ Chiroptera	*Eidolon helvum*	African Straw-coloured Fruit-bat	Secondary data	NT	II
Mammalia/	*Miniopterus natalensis*	Natal long-fingered bat	Secondary	LC	II

Table 7.2.4.2.e
Species with migratory behaviour in the Project region

Class	Species	Common name	Register location	IUCN category	Migration
Chiroptera			data		
Mammalia/ Chiroptera	*Miniopterus schreibersii*	Schreiber's Bent-winged Bat	Secondary data	VU	II
Mammalia/ Chiroptera	*Otomops martiensseni*	Otomops harrisoni	Secondary data	NT	II
Mammalia/ Primates	*Pan troglodytes*	Chimpanzee	Secondary data	EN	I, II
Mammalia/ Proboscidea	*Loxodonta africana*	African Savanna Elephant	Primary data (DAI)	EN	II

1 – CR = Critically endangered; EN = Endangered
2 – Migration: For birds, the classification of the migratory pattern followed Tobias & Pigot (2019): SE = Sedentary; PM = Partially migratory, i.e. minority of the population migrates long distances, or most of the population undergoes short-distance migration, nomadic movements, distinct altitudinal migration, etc; MG = Migratory, i.e. majority of population undertakes long-distance migration. For other groups, the classification of migratory behaviour followed the list of migratory species of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) – I = Appendix I, migratory species that have been assessed as being in danger of extinction throughout all or a significant portion of their range.; II = Appendix II, migratory species that have an unfavourable conservation status and that require international agreements for their conservation and management, as well as those that have a conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement.

The assessment of the region's importance in the congregation of bird species was based on the evaluation of Important Bird Areas (IBA) carried out by BirdLife International. The Global IBA criteria A4 characterises sites known or thought to hold congregations of ≥1% of the global population of one or more species on a regular or predictable basis. On a regional basis, criteria B3 includes sites of regionally important congregations (the site is known or thought to hold, on a regular basis, ≥ 1% of a biogeographic or other distinct population of a congregatory waterbird, breeding seabird or other species).

As shown in Section 7.2.3, there are three IBA in the Project's IAI, the Burigi-Biharamulo Game Reserves and the Minziro Forest Reserves. None of these areas has been designated according to the criteria of globally or regionally important congregations of bird species (criteria A4 and B3).

The IBA Burigi–Biharamulo Game Reserves was designated based on criteria A1 - globally threatened species, A2 - restricted-range species, and A3 - biome-restricted species. Four bird species trigger this IBA, the Ring-necked Francolin *Scleroptila streptophora* (A3), the Shoebill Balaeniceps rex (A1), the Red-faced Barbet *Lybius rubrifacies* (A1, A2 e A3), and the Black-lored Babbler *Turdoides sharpie* (A3) (BIRDLIFE INTERNATIONAL, 2024a)[26].

The IBA Minziro Forest Reserve was designated based on criteria A1 and A3. This area is home to a large number of bird species with a restricted distribution, some of which are threatened with extinction. However, there were no records of significant concentrations of individuals (BirdLife International, 2024b)[27].

[26] BirdLife Data Zone
[27] BirdLife Data Zone

The IBA Kagera Swamps is near the Project's IAI. It was designated due to the presence of globally threatened and biome-restricted bird species. Important concentrations of individuals are not mentioned for this area (BIRDLIFE INTERNATIONAL, 2024c)[28]. However, during the process of this CHA, several records of the occurrence of threatened and/or restricted range species in the Akagera National Park were noted, according to the information bases consulted (GBIF, MAP OF LIFE and IUCN).

Regarding other areas outside IBA, it is important to notice that wetlands have irreplaceable significance in biodiversity maintenance, especially for waterbirds, favouring elevated waterbird diversity and abundance, and supporting more numerous and diverse waterbird populations (ZHOU *et al*., 2020; QIU *et al*., 2024; AGIDIE *et al*., 2024). Currently, most of the wetlands in the Project's region are used for rice plantations, and their natural characteristics have been significantly altered.

Studies carried out in the West African region show that rice fields are important habitats for bird species. Most of the bird species recorded in irrigated rice fields in these studies belong to common species and, apart from the type of vegetation, water level was the most important variable in explaining the variation in bird densities. However, both rice and natural vegetation have value as bird habitats and harbour overlapping bird communities (BOS *et al*., 2006; WYMENGA, 2011).

During the field campaigns carried out in the project area, there were no significant concentrations of birds in these rice fields. Therefore, although they are an important habitat for birds, it is understood that they do not constitute a critical habitat according to criterion 3.

In terms of other terrestrial fauna, Lake Burigi, located in Burigi-Chato National Park, is Tanzania's third-largest lake and an important gathering point for migratory species, including birds and mammals. Burigi-Chato National Park is part of two important wildlife corridors called Burigi-Chato - Akagera (Rwanda) and Kigosi Moyowosi - Burigi Chato (MNRT, 2022). Several studies have already identified the importance of Africa's lakes as a biodiversity hotspot, both for aquatic and terrestrial fauna (HUGHES & HUGHES, 1992; LOWE-MCCONNELL, 2003; SALZBURGER *et al*., 2014).

However, there is no scientific data on the population of species that congregate in Lake Burigi, so it is not possible to assess whether CH triggers are activated. Thus, adopting a conservative premise, it is assumed that the Lake Burigi area is a potential critical habitat in relation to criterion (c).

[28] BirdLife Data Zone

Figure 7.2.4.2.g
Ecologically appropriate area of analysis of *Lake Burigi*

Source: Own analysis.

Criterion (d)

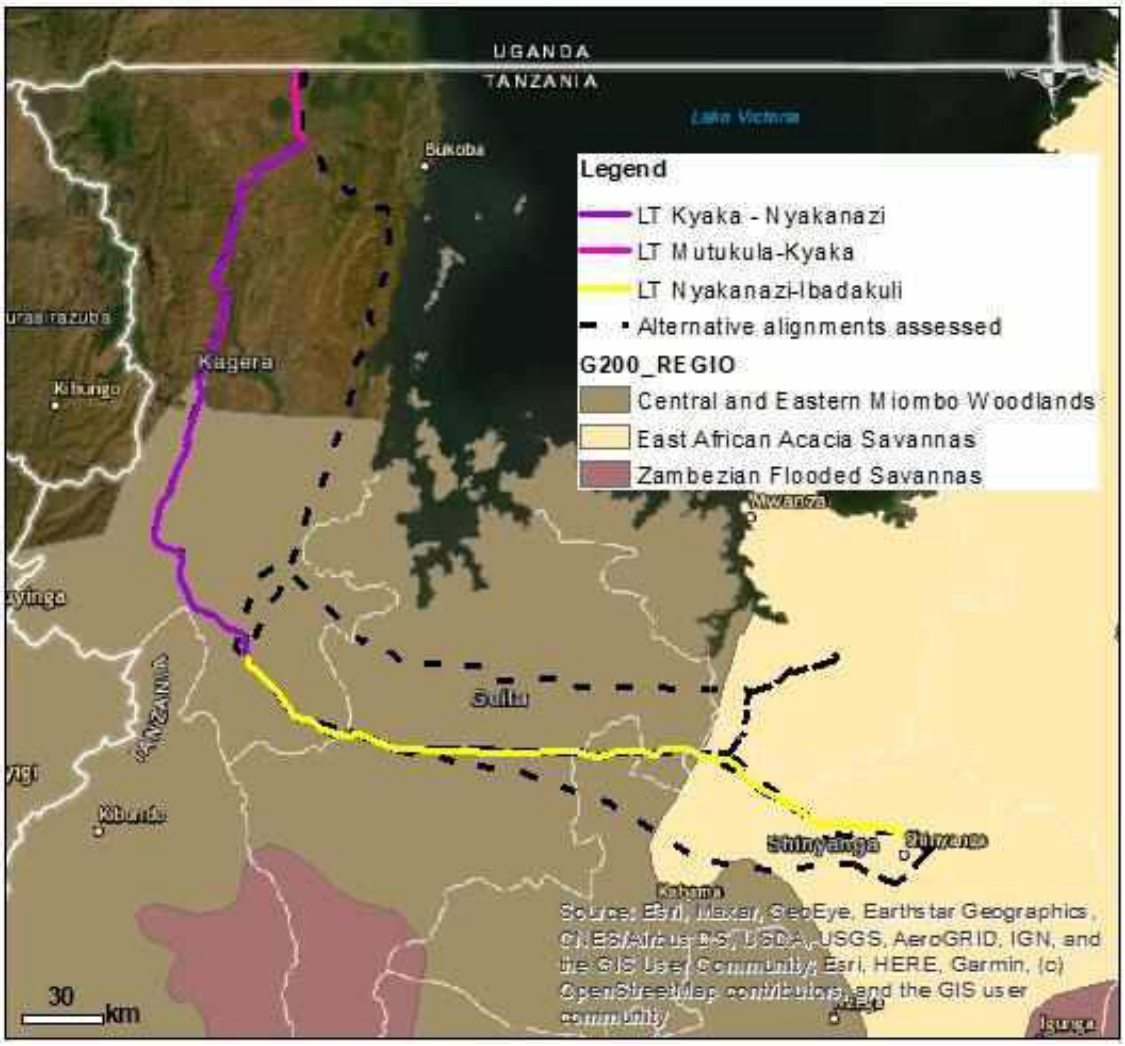
Regarding criterion (d), ESF 6 recognizes highly threatened and/or unique ecosystems as critical habitats. GN84 from IFC PS6 recommends to use of the Red List of Ecosystems where formal IUCN assessments have been made. Tanzania is in the process of assessment and, so far, no threatened ecosystem has been classified (see **Figure 7.2.1.1.c** in **Section 7.2.2.1**).

GN80 of IFC PS 6 establishes as thresholds for this criterion the following:

a) Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.
b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

Regarding other international mappings, WWF's Global 200 project analysed global patterns of biodiversity to identify a set of the Earth's terrestrial, freshwater, and marine ecoregions that harbour exceptional biodiversity and are representative of its ecosystems. According to this assessment part of the Project's IAI overlaps with the ecoregion Central and Eastern Miombo Woodlands.

Figure 7.2.4.2.h
Miombo ecorregion



Source: Own analysis.

The Miombo Ecoregion, covering over 3.6 million square kilometres across 11 countries of southern Africa (Figure 1), comprises dry and moist woodlands that support some of the most important thriving large mammal populations left in Africa and endemic plant species. The primary and direct impacts on the ecoregion come from the large and rapidly growing human population and its demand for agricultural land. Large areas of dry woodland, unlike moist forests, can be more easily converted to agricultural land owing to the lower above-ground woody plant biomass, though the social and environmental consequences are probably as profound as with moist forests. Most of the Miombo

savanna woodlands are inhabited, and few areas can be considered at all pristine. Many rural people depend heavily on natural resources for their livelihoods (TIMBERLAKE & CHIDUMAYO, 2011).

Timberlake *et al*. (2018) identified areas of particular biodiversity interest in the Miombo Ecoregion, whether for high species diversity, the presence of endemic (range-restricted) or threatened species, significant populations, areas of migration, or areas of particular importance. A total of 36 maps were elaborated by taxonomic group (plants, large mammals, small mammals, birds, amphibians, reptiles, freshwater fish, butterflies and Odonata) and presented in thematical maps and presented in thematic maps, highlighting important areas in terms of species richness, endemism, migratory and/or congregation areas, key evolutionary processes and ecosystem services.

The project region was not identified as an important area in terms of biodiversity representativeness or unique characteristics of the ecoregion. It was classified as an important area for the provision of ecosystem services, as a region of important water contribution to Lake Tanganyika (the discussion about ecosystem services is presented in **Section 7.2.5**).

Ryan *et al*. (2016) estimate that the total area of the African Miombo is 2.7 million km^2. The Project's IAI, according to the mapping carried out for this assessment, contains a total extent of the natural vegetation of 12,876.38 km^2. These amounts represent 0.47% of the total extent of this ecoregion.

Therefore, the CH trigger for criterion (d) is not activated.

Criterion (e)

Criterion (e) refers to the presence of ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described in the other criterion. According to GN81 and GN82 from IFC PS6, the structural attributes of a region (topography, geology, soil, temperature, vegetation and their combinations) can influence the evolutionary processes that generate the regional configurations of species and ecological properties and functions.

In some cases, spatial features have been associated with genetically unique populations or subpopulations of plant and animal species. These physical or spatial characteristics have been described as surrogates or spatial catalysts for ecological and evolutionary processes and are commonly associated with species diversification. Maintaining these key evolutionary processes inherent in a terrestrial landscape, as well as the resulting species (or subpopulations of species), has become an important focus of biodiversity conservation in recent decades, particularly the conservation of genetic diversity. By conserving species diversity in a terrestrial landscape, the processes that drive speciation, as well as the genetic diversity of species, ensure the evolutionary flexibility of a system, which is especially important in rapid climate change scenarios (IFC, 2019).

It is observed that the determination of the occurrence of a key evolutionary process is complex and involves a detailed bibliographic and field study, including an integrated analysis of the physical and biotic environments of the region. The relevance of structural attributes in a terrestrial landscape that could influence evolutionary processes is usually determined on a case-by-case basis, and the determination of the habitat that triggers this criterion depends very much on scientific knowledge. In most cases, this criterion is activated in areas that have been previously investigated and that are already known or suspected to be associated with unique evolutionary processes.

GN 82 from IFC PS6 presents some examples of spatial features that can be associated with evolutionary processes. One of the examples is connectivity between habitats (for example, biological corridors), which ensures species migration and gene flow and is especially important in degraded landscapes and for the conservation of metapopulations

Ecological connectivity is the unimpeded movement of species and the flow of natural processes that sustain life on Earth (CMS, 2020). There are various sub-definitions of ecological connectivity, one of them is the "Ecological connectivity for species", which is the movement of populations, individuals, genes, gametes and propagules between populations, communities and ecosystems, as well as that of non-living material from one location to another (CMS, 2020; HILTY *et al*., 2020).

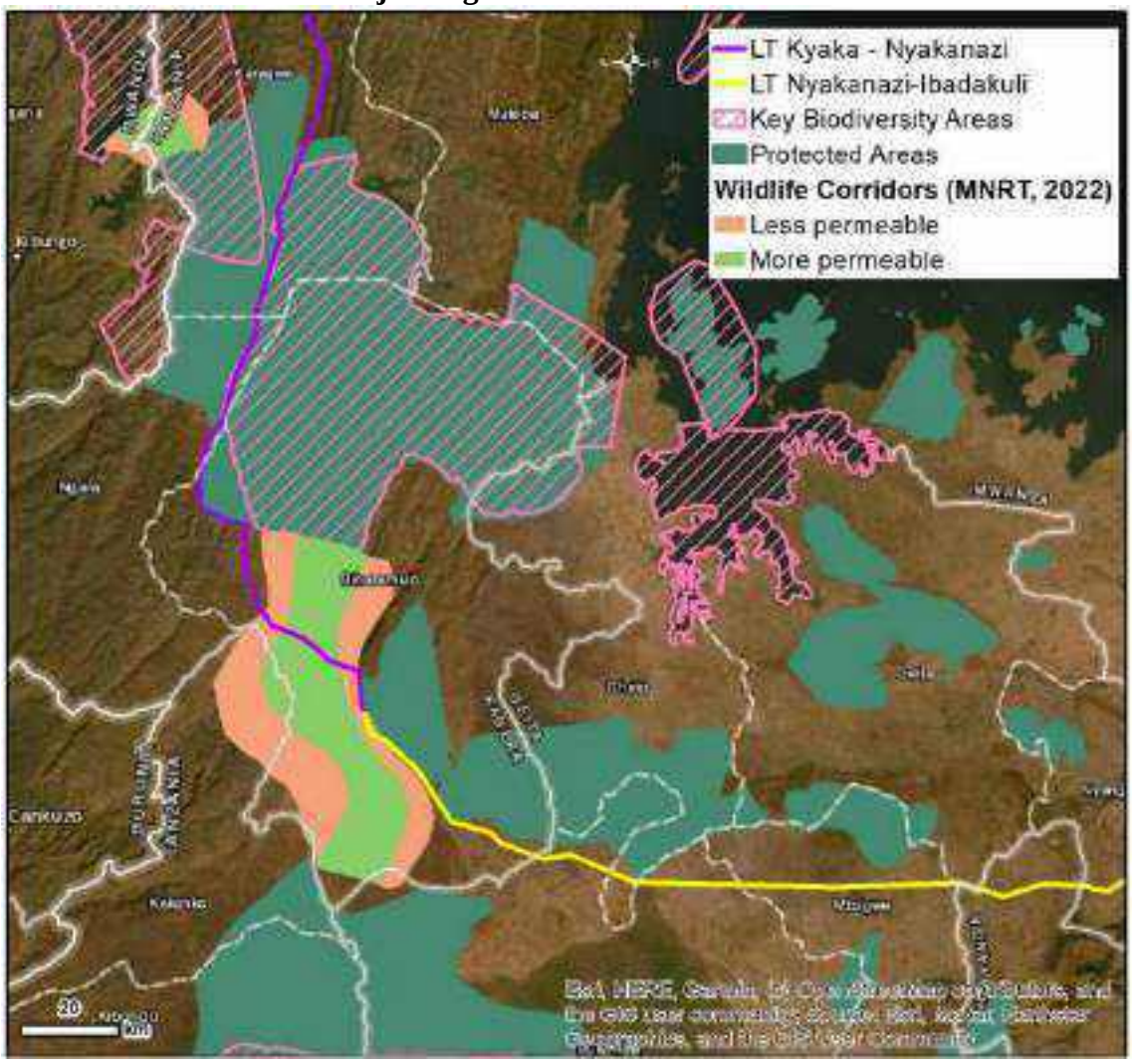
The need to both maintains and restore ecological connectivity is critical to the conservation of biological diversity (HILTY *et al*., 2020). According to the IUCN Guidelines for conserving connectivity through ecological networks and corridors (Hilty et al., 2020), improving or maintaining connectivity between protected areas and other effective area-based conservation measure (OECM) is fundamental for effective conservation and management of biodiversity. Managing connectivity, even in degraded environments, can aid conservation by increasing the total area within the landscape that is effectively connected, thus reducing the risk of species extinction (Newmark et al., 2017). Studies show that the conservation of species, ecosystems and habitats can only be achieved if protected areas are functionally linked (TROMBULAK & BALDWIN, 2010; RESASCO, 2019).

In this sense, the Tanzania Wildlife Research Institute (TAWIRI, 2009), Riggio & Caro (2017) and the Ministry of Natural Resources and Tourism of Tanzania (MNRT, 2022 and 2023) identified and mapped the terrestrial wildlife corridors in Tanzania. Terrestrial wildlife corridors are defined as areas used by animals to pass from one habitat patch to another and/or an area that connects two patches of suitable habitat by passing through a matrix of unsuitable habitat. Besides those wildlife corridors being often identified through their use by large mammals (called landscape species, such as elephants *Loxodonta africana* and wild dogs *Lycaon pictus*) those corridors are also used by smaller animals (small carnivores, antelopes, bats, bids, and amphibians) (TAWIRI, 2009).

Two corridors were identified in the project region (MNRT, 2022): Burigi-Chato - Akagera (Rwanda) and Kigosi Moyowosi - Burigi Chato (**Figure 7.2.4.2.i**). The corridor Kigosi Moyowosi - Burigi Chato is considered one of the ten highest-priority corridors in the country, out of a total of 61 corridors. Kigosi Moyowosi - Burigi Chato is a large-

medium corridor with 81.4% natural habitat cover. This corridor is important for the movement of elephants and vultures, among other species (MNRT, 2022). The Burigi-Chato - Akagera corridor is a critical transboundary connection to Rwanda, only 1% of this relatively small corridor currently has land governing instruments that can help conserve it, however, about 89% of the corridor is covered by natural habitats. The Burigi Chato-Akagera corridor was elevated as a priority due to its importance as the only transboundary corridor to the west of Tanzania, which is important for facilitating cross-border tourism with Rwanda, conservation of iconic species of eland and facilitating gene flow (MNRT, 2022).

Figure 7.2.4.2.i
Wildlife corridor in the Project region



Source: Adaptaded from MNRT (2022)

The authors of the study state that the top 20 priority corridors (which include the two mentioned above) conserve significant landscape connections. The conservation of these corridors would maintain a landscape network that connects most of the major protected areas in Tanzania, forming the backbone of a countrywide conservation strategy to

maintain Tanzania's iconic wildlife and the ecological integrity of the network of protected areas. These corridors can provide essential north-south and east-west connectivity across the country, and also conserve critical transboundary connections (MNRT, 2022).

Therefore, considering the above information, these corridors can be classified as critical habitat according to criterion (e).

7.2.4.3
Conclusions

130 priority biodiversity values (PBV) have been identified, including the following priority triggers (detailed in **Table 7.2.4.3.c**):

- 21 Threatened species (EN or CR)
- 21 Threatened (EN or CR) and restricted-range species
- 4 Threatened (EN or CR) and migratory species
- 6 Vulnerable migratory species
- 75 Migratory species
- Ecological functions needed to maintain the viability of the biodiversity values (1)
- Important habitat for species congregation (1)
- Natural habitats (1)

For 8 PBV (7 flora and 1 reptile, the pancake tortoise) there is no certainty regarding the activation of CH due to the lack of information on the distribution and population of these species. For these species, additional information on their occurrence in the region of the project, especially in the area of the project footprint, should be obtained during the execution of the Biodiversity Management Plan (BMP) programmes, specifically the fauna and flora rescue and relocation plan, that will be carried out before the construction of the TL. The fauna and flora monitoring programmes to be carried out during the operation of the TL (Operation Biodiversity Management) will also provide input for reviewing these analyses. The information collected during these activities should be used to revise this CHA (details of the revision process are presented in the Biodiversity Offset Plan).

Twelve (12) PBVs triggered the thresholds for activating CH, listed below.

For the biodiversity trigger values, the critical habitat was delimited based on an ecologically appropriate analysis area (EAAA), which considered the ecological characteristics of the CH triggers, and its delimitation was based on the continuity of phytophysiognomies and geomorphological formations in the region with the potential to sustain a viable population of these biodiversity values, including both natural and modified habitats. The final CH delimitation includes three main areas:

- Minziro Forest Reserve (in Tanzania) and part of the IBA Sango Bay (in Uganda).
- Burigi-Chato National Park, part of the Ruiga River Forest Reserve, the Akagera National Park and the IBA Kagera Swamps (in Rwanda), and the two ecological

corridors which connects these Protected Areas to the Moyowosi - Kigosi Game Reserve.

- Part of the Mwantini Hill Forest Resere, in Shinyanga region.

Although there are CH triggers, the Project only directly intercepts the EAAA of the African Elephant *L. africana* (criterion a) and the wildlife corridor delimited for this species (criterion e), as detailed below:

1. Criteria (a) and (b): 10 species (7 of flora and 3 of fauna) triggered the CH for criteria (a) and (b).
   - For the flora species, none of the trigger species were found in the DAI field surveys, the species were included through secondary data, and the project does not directly intercept the delineated EAAA.
   - For four of these species, *B. trichosora*, *E. cryptantha*, *O. ugandensis*, and *V. tinctosetosa*, the known records for the Project region are in the Bukoba region, close to Lake Victoria, and the preferred ecosystem is associated with humid environments. Other records are located in south Uganda, Rwanda and Burundi (**Figure 7.2.4.3.a**). *A. exelliana* is a shrub that grows in riverine forests. Humid environments and riverine forests represent only 1.2% of the Project's DAI (see **Table 7.2.2.1.4.a**). In addition, there will be no clearing of vegetation in the riverine forests for project implementation. For *B. trichosora* and *A. exelliana*, a recent study published for Luke et al. (2024), states that both are species with potential to trigger an Important Plant Area (IPA) for Minziro region (which includes the Minziro Forest Reserve and the Sango Bay KBA, in Uganda). The assessment was carried out considering the IPA criteria established by Darbyshire et al. (2017). It is therefore unlikely that significant population of these species will occur in the areas directly affected by the project.

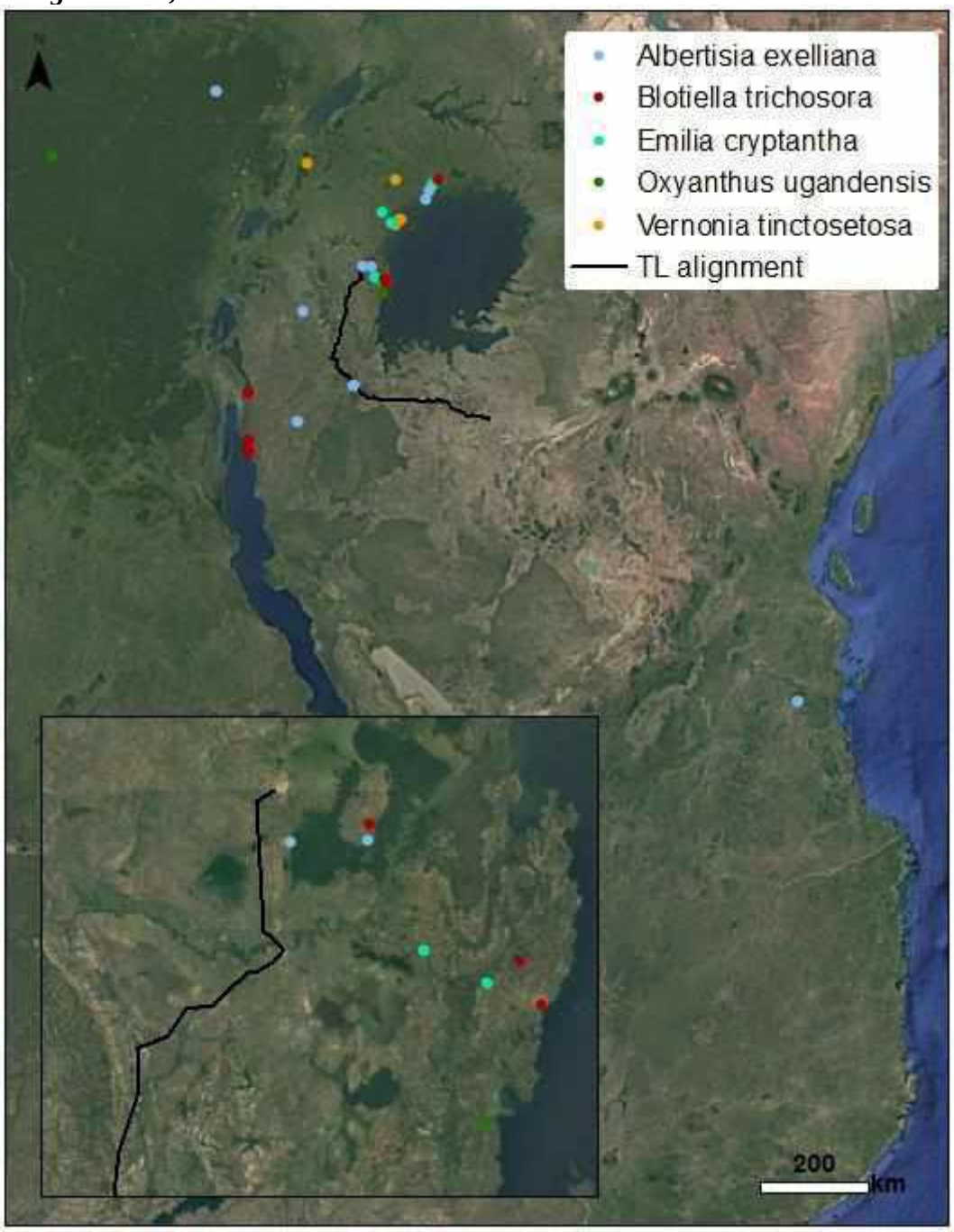
   - *T. physalis* is a shrub that grows on rocky outcrops in the Shinyanga region. The region is heavily anthropised and the land use and cover are dominated by human occupation, crops and pastures. The known records for this species are also very old, the most recent dating from 1958, so the presence of the species in the region is uncertain. However, at the western end of the TL Nyakanazi-Ibadakuli, there are some stretches with rocky outcrops, an environment where the species occurs (**Figure 7.2.4.3.b**). On this stretch, the line will be built parallel to an existing transmission line, minimising the impacts of fragmentation in a landscape that is already extremely altered and fragmented. Therefore, is unlikely that significant population of these species still occur in the region.

   - *T. laborans* is an herb found in woodlands and bushlands of the BCNP and three other regions. The known record for the BCNP was on the east side of Lake Burigi (near Lake Victoria), far from the Project alignment (**Figure 7.2.4.3.c**). Although this species was not found in the DAI, there are favoured phytophysiognomies in the project region where *T. laborans* may occur. Considering this distribution, the section with the highest probability of this species occurring in the areas directly affected by the TL is where the Project intercepts the BCNP.

Therefore, although it is not possible to confirm that these species are not present in the area directly affected by the Project, they were not evidenced in the Project's DAI during the field surveys (**Section 7.2.2.1.2**), so, the existence of significant population of these species in the directly affected area is unlikely. In addition, the preferred environment (the EAAA) will not be directly affected, so the likelihood of a significant reduction in the population of these species in the region is low.

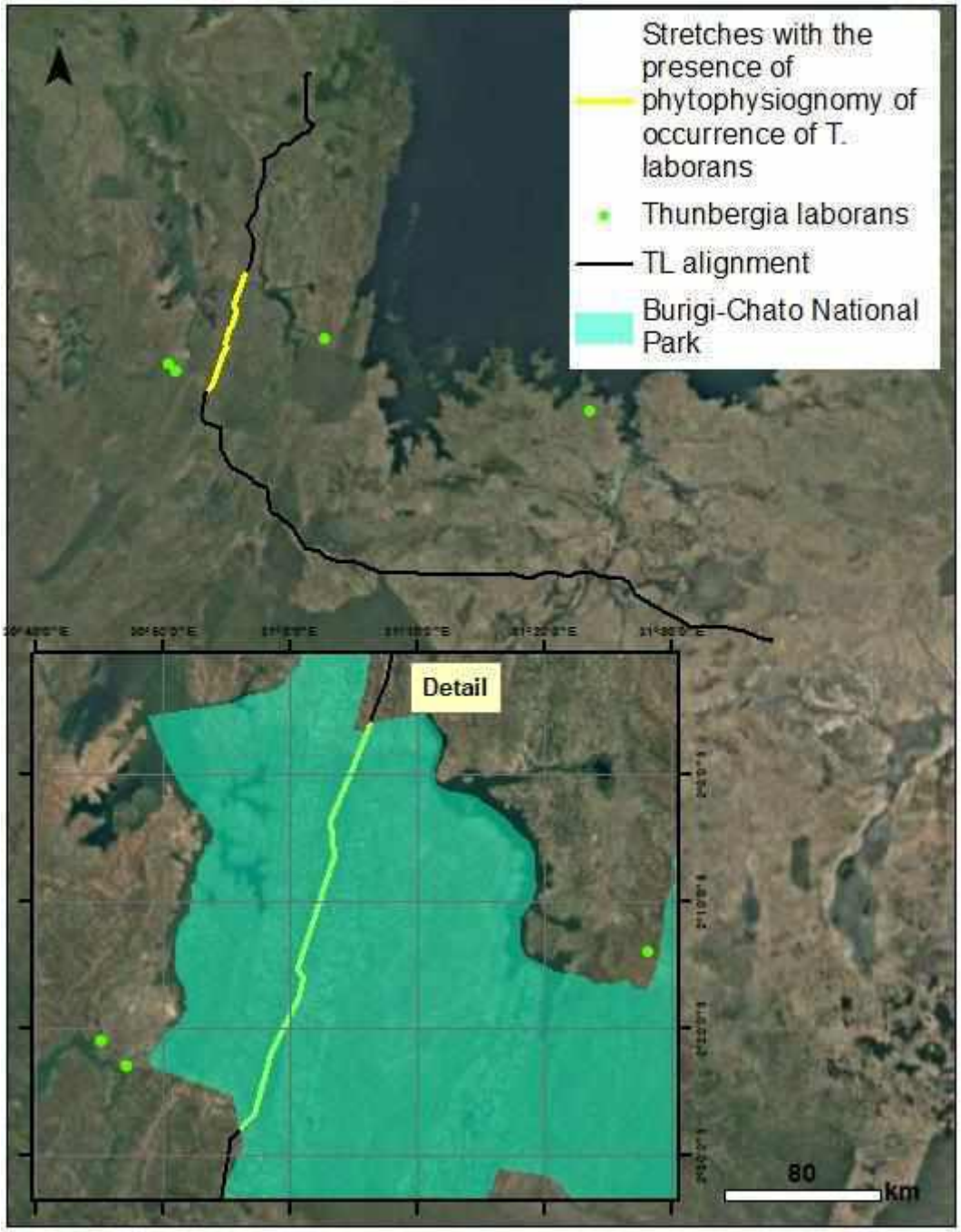
- For the fauna, the three species that triggered CH were registered during field surveys. For two of these species the project will not directly intercept the EAAA delineated: the common african pangolin *P. tricuspis* were registered only through interviews and, according to available information, Minziro Forest Reserve is an important habitat for this species population; and the primate ashy red colobus *P. tephrosceles* were in the sampling points BS4 and BS5, outside the area directly affected by the project. For the African elephant *L. africana* the project is intercepting the EAAA delineated for the species. Although CH threshold was triggered for all three species, according to the available records of individuals (IUCN and GBIF), the most expressive population of the three species is not in the project region (**Figure 7.2.4.3.d**). Therefore, the likelihood of a significant reduction in the population of these species is low.

Figure 7.2.4.3.a
Known records of CH trigger flora species *A. exelliana, B. trichosora, E. cryptantha, O. ugandensis,* and *V. tinctosetosa.*



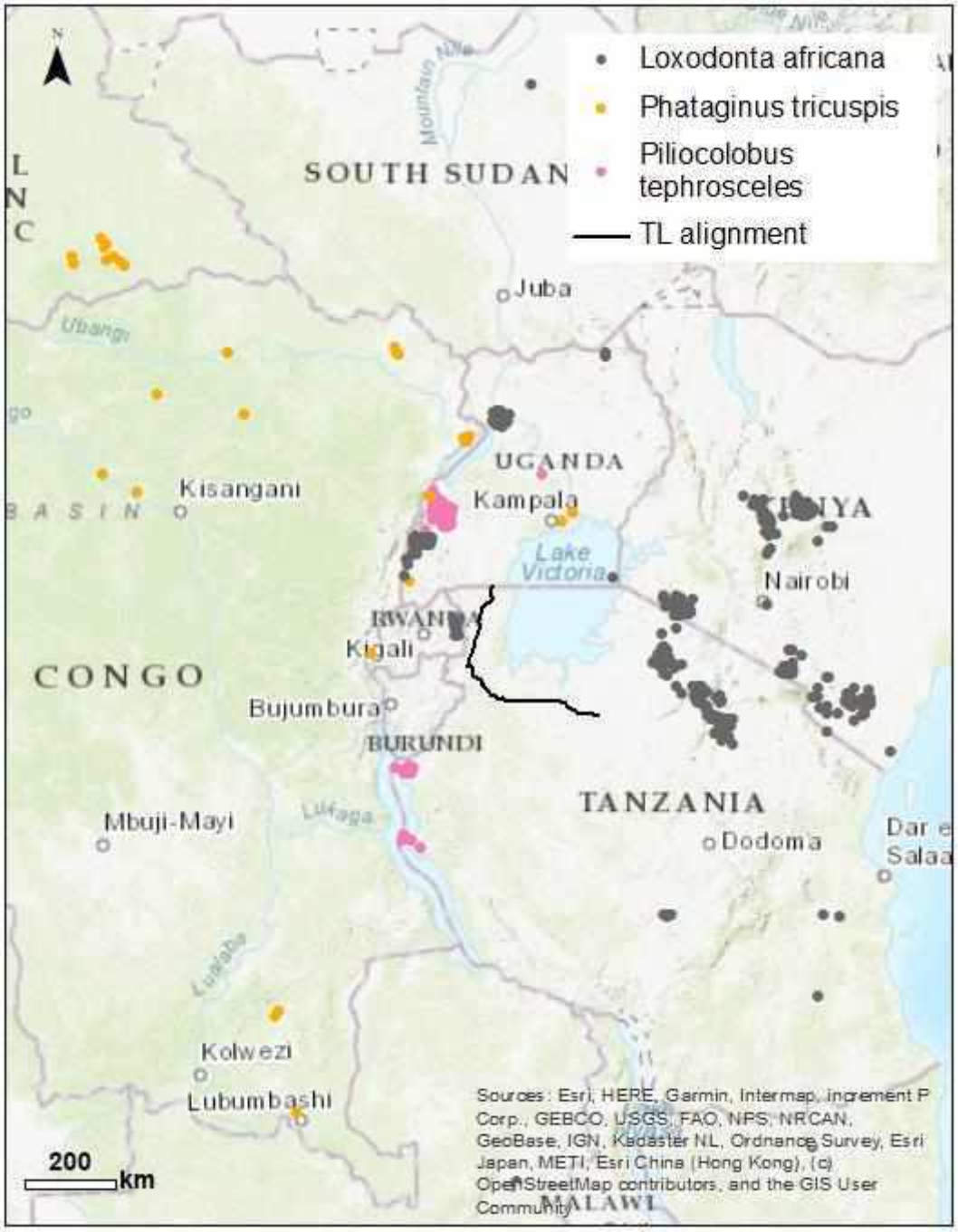
Source: Google Earth

Figure 7.2.4.3.c
Known records of the CH trigger flora species *T. laborans*



Source: Google Earth

Figure 7.2.4.3.d
Known records of CH trigger fauna species *L. africana, P. tricuspis,* and *P. tephrosceles*.



Source: Google Earth

2. Criterion (c), although refers to species congregations, it is well known that large lakes and wetlands act as aggregating environments for species, especially in arid zones. As there was no specific information on species and their populations, the entire Lake Burigi region was considered to be a critical habitat according to the criterion. However, this CH trigger will not be directly affected by the project (**Figure 7.2.4.3.e**).

Figure 7.2.4.3.e
Lake Burigi, CH trigger for criterion c

Source: Google Earth

3. Criterion (e): The two wildlife corridors near the Projects region have an important function in terms of maintenance of gene flow and long-distance range for migratory species, and conservation of transboundary and internal connections between protected areas. The project intersects the wildlife corridor that connects the BCNP with the protected areas located to the south, mainly Moyowosi and Kigosi Forest Reserves. The section of the corridor intercepted by the project is a densely anthropised region, with urban occupations, crops and pastures (**Figure**

7.2.4.3.f). In this stretch, the TL will pass close to the B3 road and in parallel with the existing TL Nyakanazi-Benaco. As such, the implementation of the project will not cause a significant change in the landscape or land cover along this stretch. The rest of the delimited EAAA refers to the BCNP boundary, which is part of the connection network between the corridors and with the Akagera National Park in Rwanda.

Figure 7.2.4.3.f
Wildlife corridor, CH trigger for criterion e.

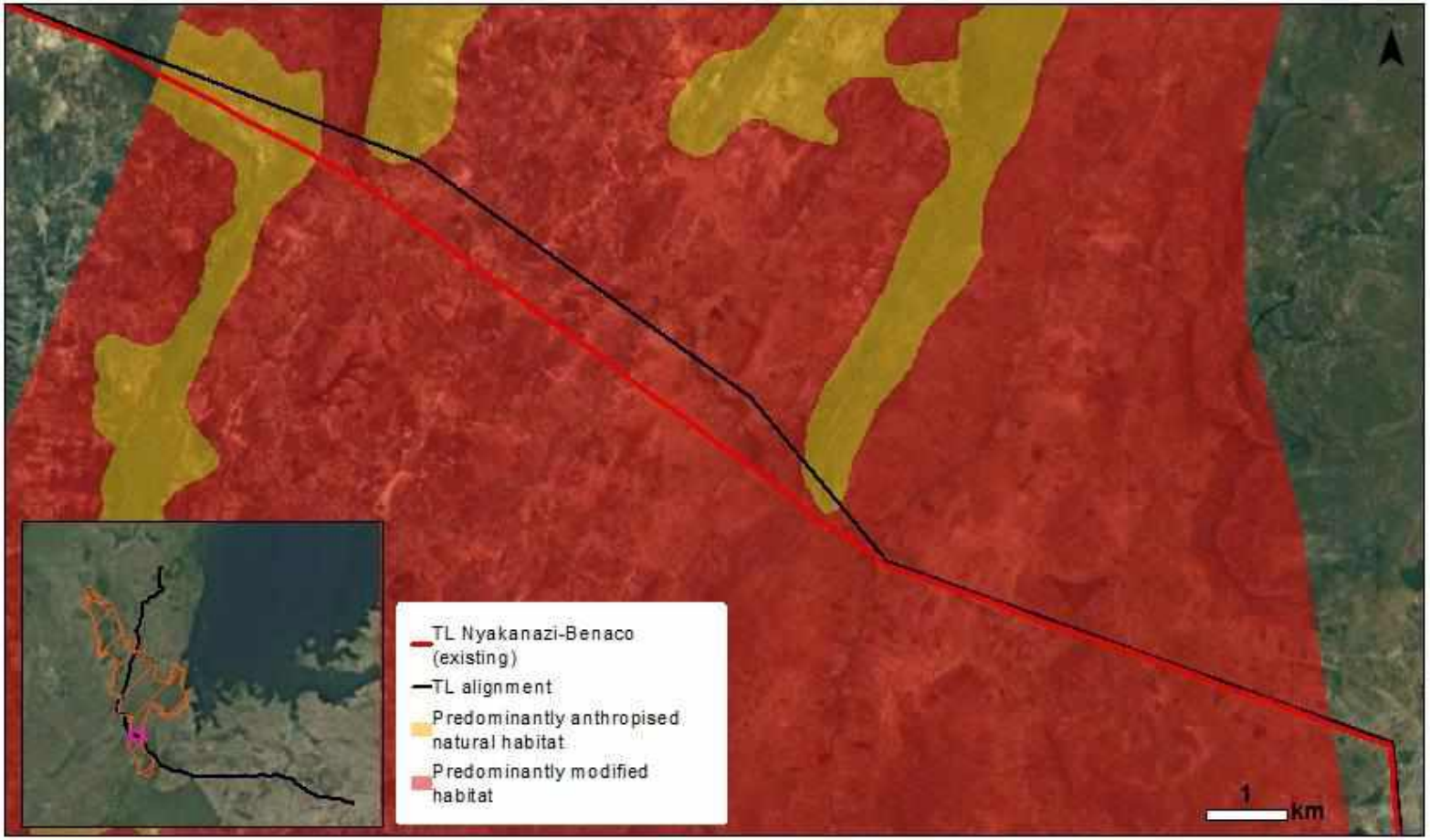


Table 7.2.4.3.a summarizes the critical habitat triggers and position according to the project. The delimitation of the critical habitat is presented in **Figure 7.2.4.3.g** to **Figure 7.2.4.3.n**. As shown in **Table 7.2.4.3.a** and **Figures 7.2.4.3.g** to **n**, the project directly intercepts only the Critical Habitat triggered by the African Elephant *L. africana* (criterion a) and the wildlife corridor (criterion e).

Table 7.2.4.3.a
Critical habitat triggers in the project region

Group	Species	Common name	Data source	Critical habitat trigger	Position regarding the project
Flora species	*Albertisia exelliana*	-	Secondary source	(a)	Indirect Area of Influence
Flora species	*Blotiella trichosora*	-	Secondary source	(a) and (b)	Indirect Area of Influence
Flora species	*Emilia cryptantha*	-	Secondary source	(a) and (b)	Indirect Area of Influence
Flora species	*Oxyanthus ugandensis*	-	Secondary source	(a)	Indirect Area of Influence
Flora species	*Thunbergia laborans*	-	Secondary source	(a) and (b)	Indirect Area of Influence
Flora species	*Tinnea physalis*	-	Secondary source	(a)	Indirect Area of Influence
Flora species	*Vernonia tinctosetosa*	-	Secondary source	(a) and (b)	Indirect Area of Influence
Mammal species	*Phataginus tricuspis*	Common African Pangolin	Primary data	(a)	Indirect Area of Influence
Mammal species	*Piliocolobus tephrosceles*	Ashy Red Colobus	Primary data	(a)	Indirect Area of Influence
Mammal species	*Loxodonta africana*	African Savanna Elephant	Primary data	(a)	Directly Affected Area
Important habitat	Lake Burigi	-	-	(c)	Indirect Area of Influence
Important habitat	Ecological corridor	-	-	(e)	Directly Affected Area

Around 84% of this area is predominantly occupied by natural habitats in a good state of conservation. Small portions of modified habitats within this area may occur, but to a lesser extent. 15% is occupied predominantly by modified habitats, with some areas of natural habitat. And 1% is occupied by natural habitats, but with more intense signs of anthropisation (**Table 7.2.4.3.b** and **Figure 7.2.4.3.o**).

Table 7.2.4.3.b
Types of habitats in the critical habitat in the project region

Habitat type	Area (hectares)	Area (%)
Predominantly natural habitat	831.940,54	84%
Predominantly anthropised natural habitat	13.742,94	1%
Predominantly modified habitat	146.802,93	15%
Total	**992.486,42**	**100%**

The delimitation proposed by this CHA is close to the Global Critical Habitat Screening Layer drawn up by the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC[29]), **Figure 7.2.4.3.p**.

According to paragraph 24 of ESF6, in areas of critical habitat, no project activity that has potential adverse impacts can be implemented unless a few conditions are met, including, among others, that there are no viable alternatives outside of CH, that the project will not cause a reduction in the population of threatened and/or restricted species, and that a robust monitoring and management programme is implemented.

The analysis of the impacts of the project in relation to the CH triggers and the conditions of paragraph 24 is presented in **Section 8.2.3.2**, **Chapter 8**.

[29] Available here Ocean Data Viewer (unep-wcmc.org)

Figure 7.2.4.3.g
Critical habitat delimitation for *Albertisia exelliana* (criterion 'a'), *Blotiella trichosora* (criteria 'a' and 'b'), *Emilia cryptantha* (criteria 'a' and 'b'), *Oxyanthus ugandensis* (criterion 'a') and *Vernonia tinctosetosa (*criteria 'a' and 'b').

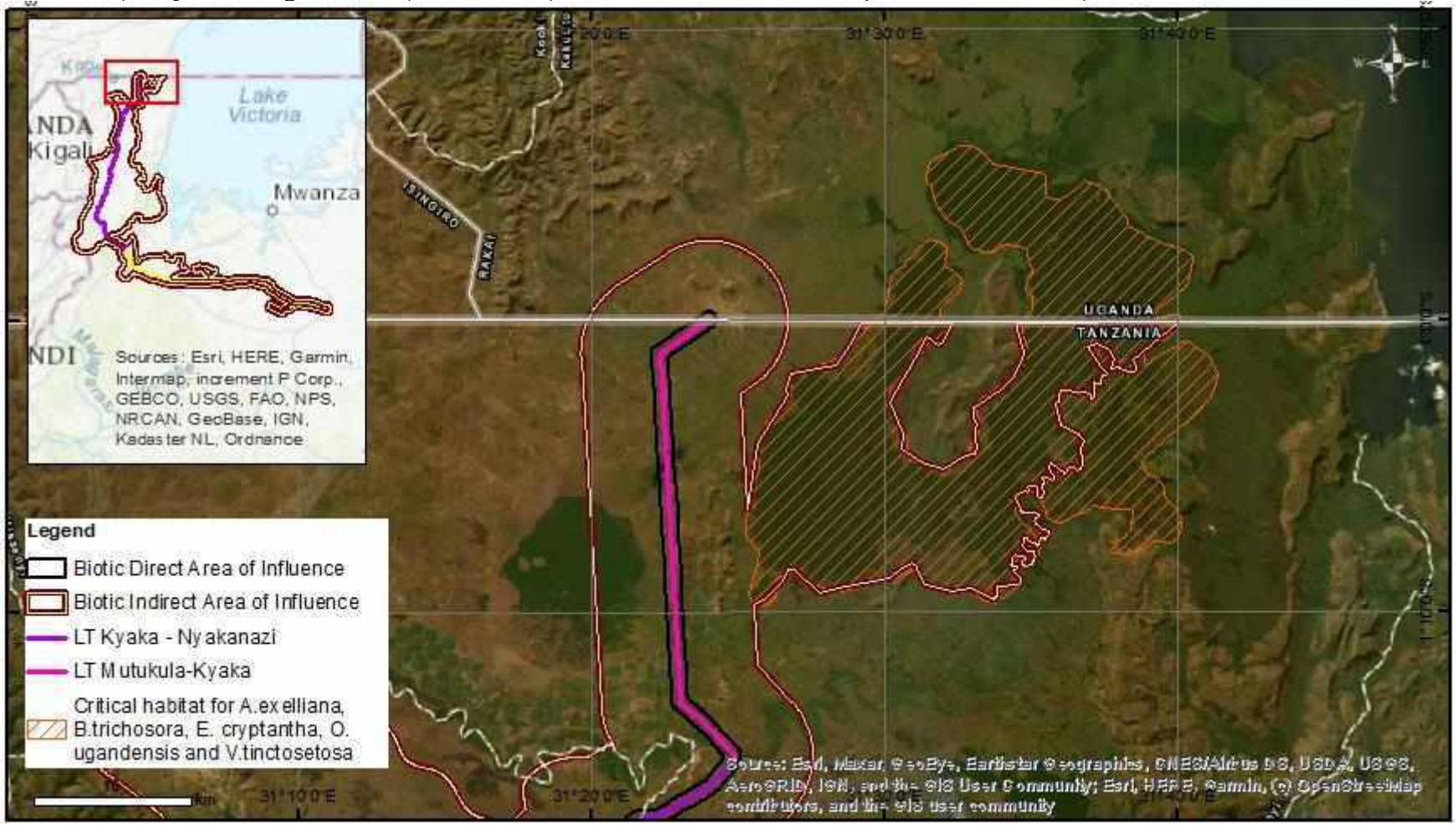


Figure 7.2.4.3.i
Critical habitat delimitation for *Tinnea physalis* (criterion 'a')

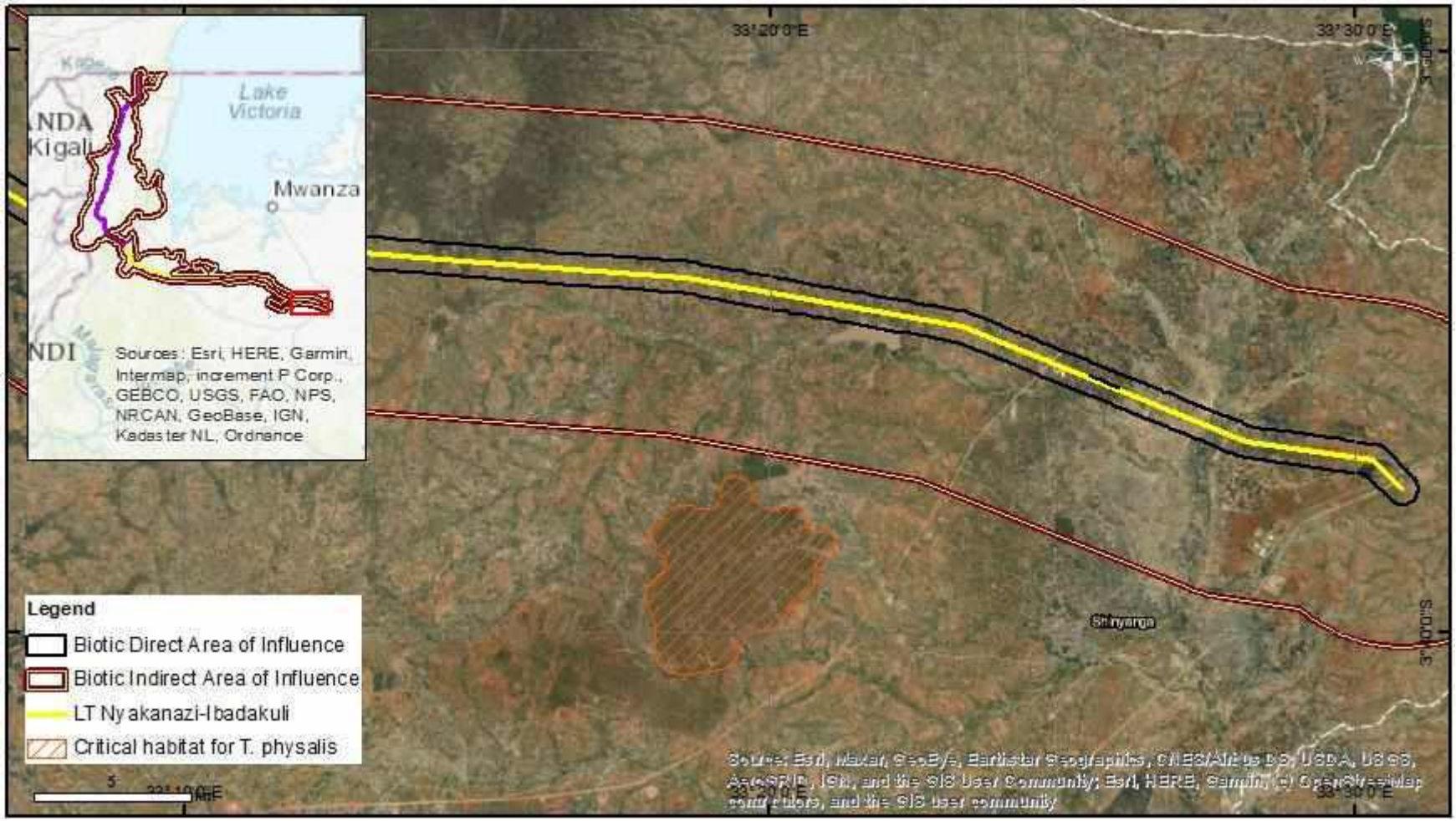


Figure 7.2.4.3.o
Critical habitat mapping

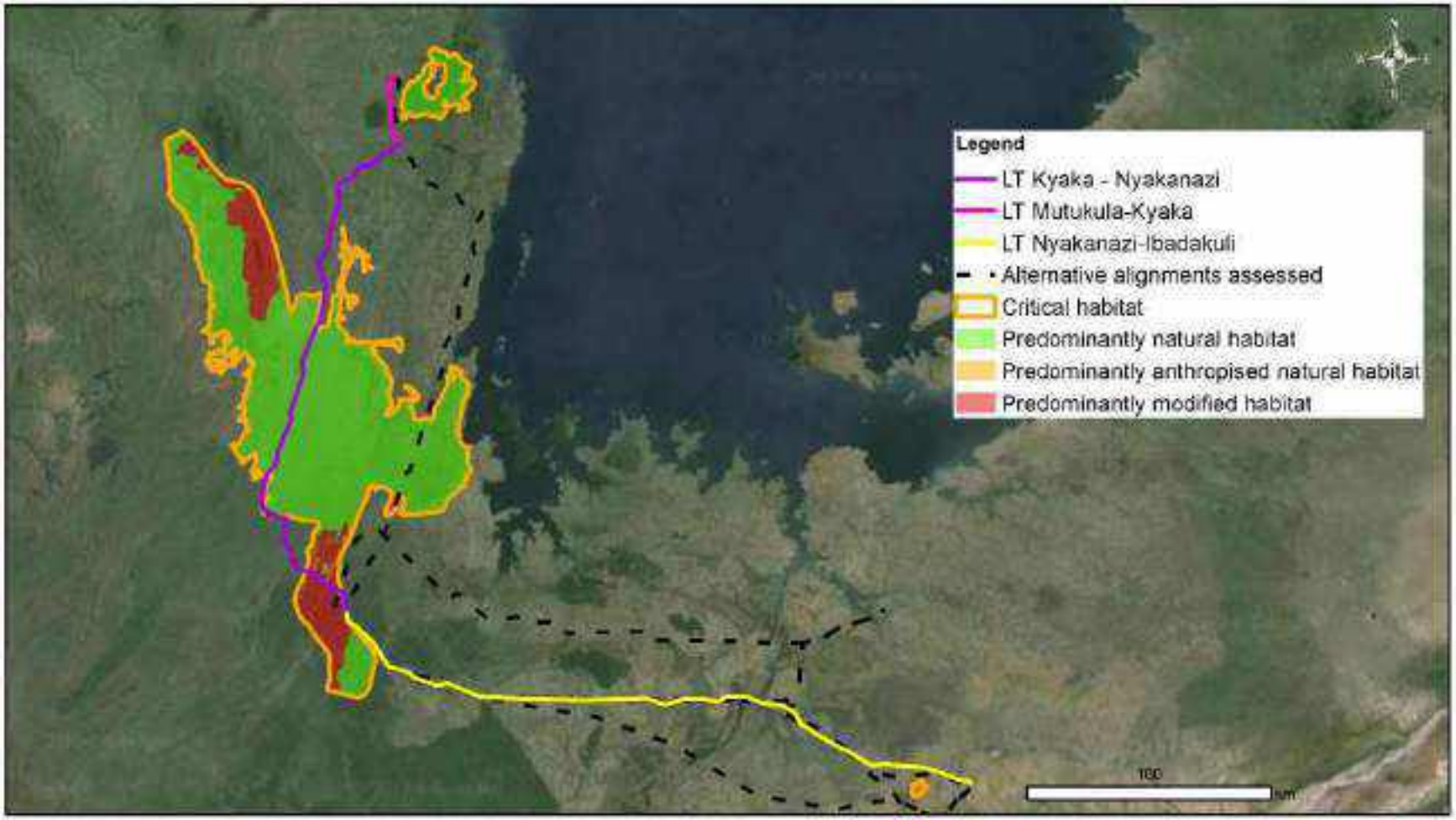
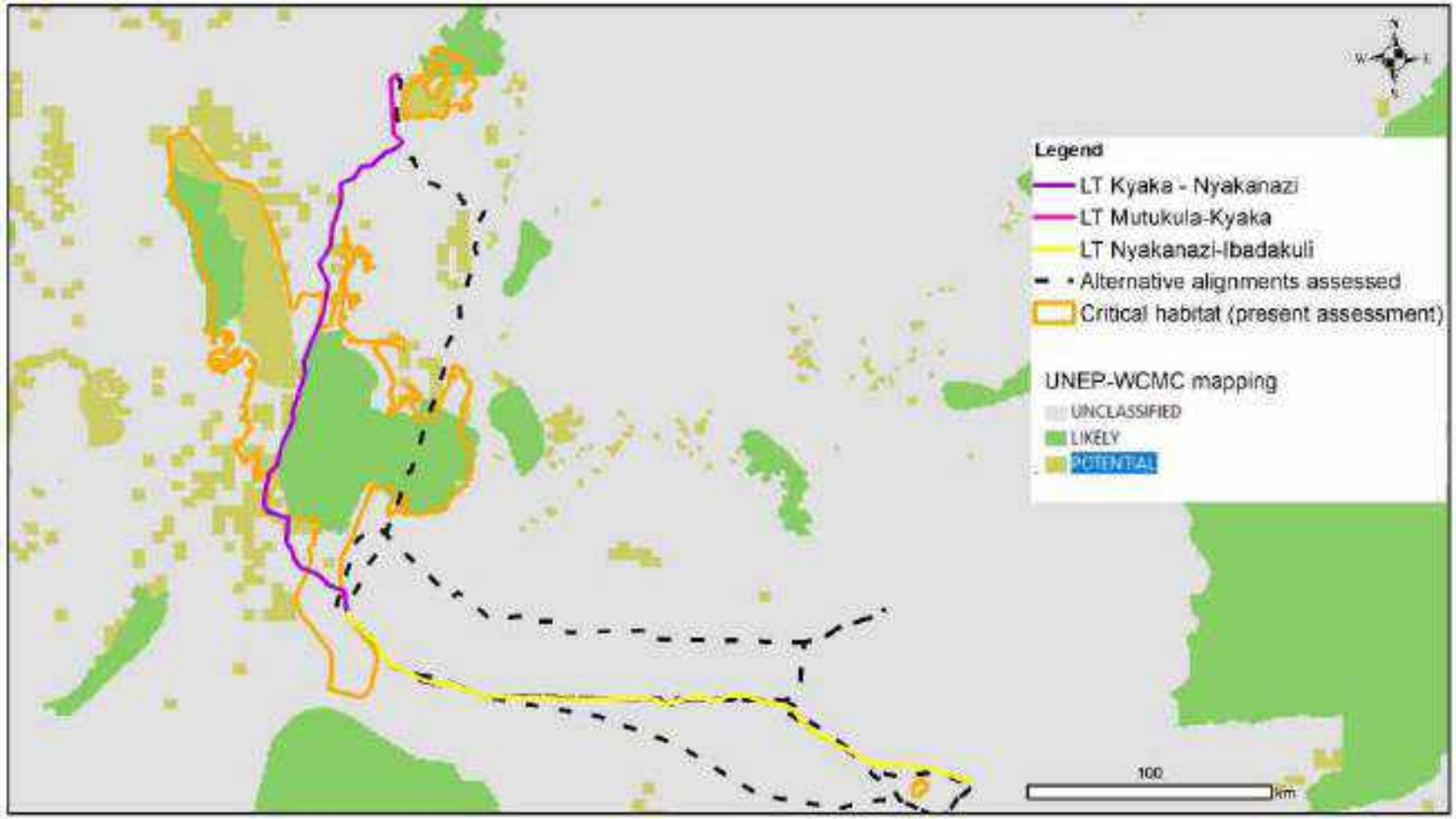


Figure 7.2.4.3.p
Global critical habitat screening layer



Source: UNEP-WCMC (Ocean Data Viewer (unep-wcmc.org))

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Flora species	*Aeollanthus stuhlmannii*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Aeschynomene bullockii*	-	Secondary source	Threatened species (EN or CR)	No
Flora species	*Aeschynomene burttii*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Uncertain
Flora species	*Afrocarpus usambarensis*	-	Secondary source	Threatened species (EN or CR)	No
Flora species	*Albertisia exelliana*	-	Secondary source	Threatened species (EN or CR)	Yes
Flora species	*Blotiella trichosora*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Yes
Flora species	*Carpha angustissima*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Cordia crenata subsp. shinyangensis*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Uncertain
Flora species	*Craterostigma pusillum*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Crotalaria varicosa*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Cyphostemma shinyangense*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Emilia cryptantha*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Yes
Flora species	*Euphorbia hubertii*	-	Primary source (DAI)	Threatened (EN or CR) and restricted-range species	No
Flora species	*Grewia similiopsis*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Ipomoea lepidophora*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Millettia schliebenii*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Uncertain
Flora species	*Murdannia stricta*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Ocimum urundense*	-	Secondary source	Threatened species (EN or CR)	Uncertain
Flora species	*Oldenlandia duemmeri*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Oxyanthus ugandensis*	-	Secondary source	Threatened species (EN or CR)	Yes
Flora species	*Pavetta pseudoalbicaulis*	-	Secondary source	Threatened species (EN or CR)	Uncertain
Flora species	*Psychotria bagshawei*	-	Secondary source	Threatened species (EN or CR)	No
Flora species	*Rhynchosia holtzii*	-	Secondary source	Threatened species (EN or CR)	Uncertain
Flora species	*Rotheca myricoides subsp. ussukumae*	-	Secondary source	Threatened (EN or CR) and restricted-range species	No
Flora species	*Thunbergia laborans*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Yes
Flora species	*Tinnea physalis*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Yes

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Flora species	*Vangueria verticillata*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Uncertain
Flora species	*Vernonia tinctosetosa*	-	Secondary source	Threatened (EN or CR) and restricted-range species	Yes
Bird species	*Accipiter badius*	Shikra	Primary data (DAI)	Migratory species	No
Bird species	*Acrocephalus arundinaceus*	Great Reed-warbler	Secondary data	Migratory species	No
Bird species	*Acrocephalus schoenobaenus*	Sedge Warbler	Secondary data	Migratory species	No
Bird species	*Acrocephalus scirpaceus*	Common Reed-warbler	Secondary data	Migratory species	No
Bird species	*Actitis hypoleucos*	Common Sandpiper	Secondary data	Migratory species	No
Bird species	*Anthus cinnamomeus*	African Pipit	Secondary data	Migratory species	No
Bird species	*Anthus trivialis*	Tree Pipit	Secondary data	Migratory species	No
Bird species	*Apus affinis*	Little Swift	Primary data (DAI)	Migratory species	No
Bird species	*Apus apus*	Common Swift	Secondary data	Migratory species	No
Bird species	*Apus caffer*	White-rumped Swift	Secondary data	Migratory species	No
Bird species	*Aquila nipalensis*	Steppe Eagle	Secondary data	Threatened (EN or CR) and migratory species	No
Bird species	*Aquila rapax*	Tawny Eagle	Primary data (DAI)	Vulnerable migratory species	No
Bird species	*Ardea purpurea*	Purple Heron	Secondary data	Migratory species	No
Bird species	*Ardeola ralloides*	Squacco Heron	Primary data (DAI)	Migratory species	No
Bird species	*Balearica regulorum*	Grey Crowned Crane	Primary data (DAI)	Threatened species (EN or CR)	No
Bird species	*Calidris minuta*	Little Stint	Secondary data	Migratory species	No
Bird species	*Calidris pugnax*	Ruff	Secondary data	Migratory species	No
Bird species	*Calidris temminckii*	Temminck's Stint	Secondary data	Migratory species	No
Bird species	*Cecropis daurica*	Red-rumped Swallow	Secondary data	Migratory species	No
Bird species	*Chlidonias leucopterus*	White-winged Tern	Secondary data	Migratory species	No

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Bird species	*Ciconia ciconia*	White Stork	Secondary data	Migratory species	No
Bird species	*Cinnyricinclus leucogaster*	Violet-backed Starling	Primary data (DAI)	Migratory species	No
Bird species	*Cisticola juncidis*	Zitting Cisticola	Secondary data	Migratory species	No
Bird species	*Clamator glandarius*	Great Spotted Cuckoo	Primary data (DAI)	Migratory species	No
Bird species	*Clamator jacobinus*	Jacobin Cuckoo	Secondary data	Migratory species	No
Bird species	*Clamator levaillantii*	Levaillant's Cuckoo	Secondary data	Migratory species	No
Bird species	*Clanga pomarina*	Lesser Spotted Eagle	Secondary data	Migratory species	No
Bird species	*Coturnix delegorguei*	Harlequin Quail	Secondary data	Migratory species	No
Bird species	*Crex egregia*	African Crake	Secondary data	Migratory species	No
Bird species	*Cuculus canorus*	Common Cuckoo	Secondary data	Migratory species	No
Bird species	*Cuculus clamosus*	Black Cuckoo	Secondary data	Migratory species	No
Bird species	*Delichon urbicum*	Northern House Martin	Secondary data	Migratory species	No
Bird species	*Falco amurensis*	Amur Falcon	Secondary data	Migratory species	No
Bird species	*Falco subbuteo*	Eurasian Hobby	Secondary data	Migratory species	No
Bird species	*Falco tinnunculus*	Common Kestrel	Secondary data	Migratory species	No
Bird species	*Ficedula semitorquata*	Semi-collared Flycatcher	Secondary data	Migratory species	No
Bird species	*Gallinago gallinago*	Common Snipe	Secondary data	Migratory species	No
Bird species	*Gallinago media*	Great Snipe	Secondary data	Migratory species	No

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Bird species	*Glareola pratincola*	Collared Pratincole	Secondary data	Migratory species	No
Bird species	*Gyps africanus*	White-backed Vulture	Secondary data	Threatened species (EN or CR)	No
Bird species	*Gyps rueppelli*	Rüppell's Vulture	Secondary data	Threatened species (EN or CR)	No
Bird species	*Hieraaetus pennatus*	Booted Eagle	Secondary data	Migratory species	No
Bird species	*Hippolais icterina*	Icterine Warbler	Secondary data	Migratory species	No
Bird species	*Hirundo atrocaerulea*	Blue Swallow	Secondary data	Vulnerable migratory species	No
Bird species	*Hirundo rustica*	Barn Swallow	Secondary data	Migratory species	No
Bird species	*Iduna pallida*	Olivaceous Warbler	Secondary data	Migratory species	No
Bird species	*Ixobrychus minutus*	Common Little Bittern	Secondary data	Migratory species	No
Bird species	*Lanius collurio*	Red-backed Shrike	Secondary data	Migratory species	No
Bird species	*Lanius minor*	Lesser Grey Shrike	Secondary data	Migratory species	No
Bird species	*Lanius phoenicuroides*	Red-tailed Shrike	Secondary data	Migratory species	No
Bird species	*Mareca penelope*	Eurasian Wigeon	Secondary data	Migratory species	No
Bird species	*Merops apiaster*	European Bee-eater	Secondary data	Migratory species	No
Bird species	*Merops persicus*	Blue-cheeked Bee-eater	Secondary data	Migratory species	No
Bird species	*Milvus aegyptius*	Yellow-billed Kite	Primary data (DAI)	Migratory species	No
Bird species	*Milvus migrans*	Black Kite	Primary data (DAI)	Migratory species	No

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Bird species	*Motacilla flava*	Western Yellow Wagtail	Secondary data	Migratory species	No
Bird species	*Muscicapa striata*	Spotted Flycatcher	Secondary data	Migratory species	No
Bird species	*Necrosyrtes monachus*	Hooded Vulture	Primary data (DAI)	Threatened species (EN or CR)	No
Bird species	*Nycticorax nycticorax*	Black-crowned Night-heron	Primary data (DAI)	Migratory species	No
Bird species	*Oenanthe isabellina*	Isabelline Wheatear	Secondary data	Migratory species	No
Bird species	*Oenanthe oenanthe*	Northern Wheatear	Secondary data	Migratory species	No
Bird species	*Pandion haliaetus*	Osprey	Secondary data	Migratory species	No
Bird species	*Phylloscopus trochilus*	Willow Warbler	Secondary data	Migratory species	No
Bird species	*Plectropterus gambensis*	Spur-winged Goose	Primary data (DAI)	Migratory species	No
Bird species	*Polemaetus bellicosus*	Martial Eagle	Secondary data	Threatened species (EN or CR)	No
Bird species	*Porphyrio alleni*	Allen's Gallinule	Secondary data	Migratory species	No
Bird species	*Psalidoprocne albiceps*	White-headed Saw-wing	Primary data (DAI)	Migratory species	No
Bird species	*Psittacus erithacus*	Grey Parrot	Secondary data	Threatened species (EN or CR)	No
Bird species	*Riparia riparia*	Collared Sand Martin	Secondary data	Migratory species	No
Bird species	*Saxicola rubetra*	Whinchat	Secondary data	Migratory species	No
Bird species	*Sylvia atricapilla*	Eurasian Blackcap	Secondary data	Migratory species	No

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Bird species	*Sylvia borin*	Garden Warbler	Secondary data	Migratory species	No
Bird species	*Tachymarptis melba*	Alpine Swift	Secondary data	Migratory species	No
Bird species	*Terathopius ecaudatus*	Bateleur	Primary data (DAI)	Threatened species (EN or CR)	No
Bird species	*Torgos tracheliotos*	Lappet-faced Vulture	Secondary data	Threatened species (EN or CR)	No
Bird species	*Trigonoceps occipitalis*	White-headed Vulture	Secondary data	Threatened species (EN or CR)	No
Bird species	*Tringa glareola*	Wood Sandpiper	Secondary data	Migratory species	No
Bird species	*Tringa nebularia*	Common Greenshank	Secondary data	Migratory species	No
Bird species	*Tringa ochropus*	Green Sandpiper	Secondary data	Migratory species	No
Bird species	*Tringa stagnatilis*	Marsh Sandpiper	Secondary data	Migratory species	No
Bird species	*Tringa totanus*	Common Redshank	Secondary data	Migratory species	No
Bird species	*Upupa epops*	Common Hoopoe	Secondary data	Migratory species	No
Bird species	*Xenus cinereus*	Terek Sandpiper	Secondary data	Migratory species	No
Mammal species	*Giraffa tippelskirchi*	Giraffe, Maasai Giraffe	Primary data (DAI)	Migratory species	No
Mammal species	*Acinonyx jubatus*	Cheetah	Secondary data	Vulnerable migratory species	No
Mammal species	*Lycaon pictus*	African wild dog	Secondary data	Threatened (EN or CR) and migratory species	No
Mammal species	*Panthera leo*	Lion	Primary data (DAI)	Vulnerable migratory species	No

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Mammal species	*Panthera pardus*	Leopard	Primary data (DAI)	Vulnerable migratory species	No
Mammal species	*Eidolon helvum*	African Straw-coloured Fruit-bat	Secondary data	Migratory species	No
Mammal species	*Miniopterus natalensis*	Natal long-fingered bat	Secondary data	Migratory species	No
Mammal species	*Miniopterus schreibersii*	Schreiber's Bent-winged Bat	Secondary data	Vulnerable migratory species	No
Mammal species	*Otomops martiensseni*	Otomops harrisoni	Secondary data	Migratory species	No
Mammal species	*Diceros bicornis*	Black rhino	Secondary data	Threatened species (EN or CR)	No
Mammal species	*Phataginus tricuspis*	Common African Pangolin	Primary data (DAI)	Threatened species (EN or CR)	Yes
Mammal species	*Smutsia gigantea*	Giant Ground Pangolin	Secondary data	Threatened species (EN or CR)	No
Mammal species	*Pan troglodytes*	Chimpanzee	Secondary data	Threatened (EN or CR) and migratory species	No
Mammal species	*Piliocolobus tephrosceles*	Ashy Red Colobus	Primary data (DAI)	Threatened (EN or CR) and restricted range species	Yes
Mammal species	*Loxodonta africana*	African Savanna Elephant	Primary data (DAI)	Threatened (EN or CR) and migratory species	Yes
Reptiles	*Malacochersus tornieri*	Pancake Tortoise	Secondary data	Threatened species (EN or CR)	Uncertain
Important habitat	Ecological corridor	-	-	Ecological functions needed to maintain the viability of the biodiversity values	Yes

Table 7.2.4.3.c
Priority biodiversity values in the Project region

Group	Species	Common name	Data source	Priority trigger	Critical habitat trigger
Important habitat	Natural habitats	-	-	Natural habitats	No
Important habitat	Lake Burigi	-	-	Important habitat for species congregation	Yes

7.2.5
Analysis of Ecosystem Services

Ecosystem services are defined as the benefits that people, groups of people or companies obtain from ecosystems (IFC, 2012; MEA, 2005). An ecosystem is defined as a dynamic complex of plant communities, animals, microorganisms and their respective environments, which interact as a functional unit (MEA, 2005).

Terrestrial and aquatic ecosystems, as well as the variability between living organisms of all origins and the ecological complexes of which they are part, are defined by the Convention on Biological Diversity as biodiversity. The ecosystem services (ES) valued by humans are generally supported by biodiversity, and are organized into four types (MEA, 2005; LANDSBERG *et al*., 2013; IFC, 2019):

- Provisioning services: products sourced directly from ecosystems. This ES includes food (agricultural products, seafood, game animals, wild extractive products), water (for drinking, irrigation and industrial purposes), wood and fibres (building materials, biomass for renewable energy) and medicinal products (elements of fauna and flora that serve as the basis for many biopharmaceuticals);
- Regulatory services: benefits obtained from the regulation of ecosystem processes. This ES includes climate regulation, carbon storage and sequestration, air and water purification, pest and disease control, pollination, natural disaster mitigation;
- Cultural services: non-material benefits that people derive from ecosystems, such as sacred and spiritual retreat sites, areas used for recreational purposes (sport, ecotourism, etc.) and scientific and educational exploration; and
- Support services: natural processes that maintain the other services, such as the capture and recycling of nutrients, primary production and pathways for the exchange of genetic material.

Thus, ES are the direct and indirect contributions of the natural ecosystem converted into benefits for human well-being and/or for the performance of projects derived from the use of these services (MEA, 2005; TEEB, 2010; LANDSBERG *et al*., 2013).

Ecosystem services are defined as priorities when the impacts of a given project affect the general well-being (e.g., livelihoods, health, safety, culture) of the beneficiaries of that service, or those services that can provide the planned operational performance for certain projects (HANSON, 2008; LANDSBERG *et al*., 2013). In the same vein, paragraph 24 of PS6 (IFC, 2012) classifies priority ecosystem services in relation to potential risks to the project and beneficiaries: '(i) those services on which project operations are likely to have an impact and therefore result in adverse impacts on affected communities; and/or (ii) those services on which the project is directly dependent for its operations (e.g. water).' Based on this classification, it separates ecosystem services into two types:

- **Type I**: Provisioning, regulating, cultural and supporting ecosystem services, over which the entrepreneur has direct management control or significant influence, and where impacts on such services may adversely affect communities.

- **Type II**: Provisioning, regulating, cultural and supporting ecosystem services, over which the entrepreneur has direct management control or significant influence, and on which the project directly depends for its operations**.**

A common understanding (MEA, 2005; HANSON, 2008; TEEB, 2010; LANDSBERG *et al*., 2013; IFC, 2012 and 2019; IDB, 2020) is that the identification of priority ecosystem services should be based on bibliographic consultations and consultations with the local population directly affected by the project.

7.2.5.1 Methodology

The evaluation of the ES followed the guidelines and recommendations contained in the international socio-environmental standards (mainly the standards of biodiversity conservation and ecosystem services of the IFC[30] and IDB[31]). The methodological approach for this assessment followed the steps described by Landsberg *et al*. (2013[32]). The ES analysis methodology consisted of two stages:

1. Identification of the ES available in the area of analysis, based on the availability of natural resources in the region: this identification was made through the mapping of land use classes, since it is possible to correlate these classes with the potential provision of services (BURKHARD *et al*., 2009, 2012; LANDSBERG *et al*., 2011).
2. Identification of ES relevant to the local population: based on the local assessment carried out during the field visit, interviews with the local community and data from the literature. The interviews were carried out as part of the socio-economic diagnostic. For more details related to the methodology of the interviews with the local population see **Section 7.3**.

7.2.5.2 Results

7.2.5.2.1 Step 1 - Identification of ecosystem services available to the region

The identification of the available ES was based on the association with the different land uses and occupations in the landscape. This approach has been carried out in several publications on the subject (HAINES-YOUNG & POTSCHIN, 2010; LONGO & RODRIGUES, 2017; CICES, 2018). Many ES are provided at the habitat level and are directly associated with a particular class of land use and occupation (PEH *et al*., 2013). In this sense, different types of land cover and their conditions characterize a region, its ecological functions, and its capacity to provide a set of ecosystem goods and services

[30] Mainly IFC PS6 (Paragraphs 24 and 25, and related guidance notes), and also references to ecosystem services in other PSS. Available here: International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (ifc.org)

[31] IDB Environmental and Social Performance Standard 6 (Paragraphs 24 and 25, and related guidance notes), and also references to ecosystem services in other ESPS. Available here: IDB | Environmental and Social Policy Framework (iadb.org)

[32] Available here: weaving_ecosystem_services_into_impact_assessment.pdf (wri.org)

(FOLKE *et al*., 2004 *apud* LONGO & RODRIGUES, 2017).

The list of land use and land cover types for the analysis area was obtained from the land use and land cover map (**Section 7.2.2.1.1**). **Table 7.2.5.2.1.a** presents the list of land use and land cover classes in the analysis area.

Table 7.2.5.2.1.a
Land use and land cover classes in the Project's DAI

Class	Description
Native formations	
Forest formations in dry areas (evergreen dry forest)	Forest formation in non-flooded areas and predominantly dry soils. Species diversity is medium/high, and the canopy is predominantly closed, with the presence of some emergent trees and an abundance of woody lianas. They are home to rich fauna and flora. The vegetation may show signs of anthropisation, such as logging and fire.
Forest formations in humid areas (Riverine and swamp forests)	Forest formation is characterized by an association of evergreen trees with other life forms growing in water-logged soil or high-water table soils. In the case of riverine forests, they occur on the banks of the river, acting as riparian forests. It can also be in different states of conservation.
Savannah and herbaceous shrub formations (Miombo woodland; Mixed woodland Thicket bushland/shrubland and Grass wooded savanna	Areas with predominantly savannah and/or herbaceous-shrub formation, with a high density of grasses and shrubs and trees in lower density than in forest formations and a predominance of species such as the genera *Brachystegia*, and *Julbernardia* in association with *Acacia, Pterocarpus, Pericopsis* and *Combretum*. They are home to rich fauna and flora and are used by the population mainly for cattle grazing and charcoal extraction.
Shrubby herbaceous vegetation in humid areas (Riverine grassland vegetation)	An herbaceous shrub formation, which can change between native and exotic species, is located on the banks of rivers.
Water	Rivers and lakes
Anthropic formations	
Agriculture (cyclical and perennial agriculture)	The main crops are rice, beans, tomatoes, potatoes, maize, cotton, sugar cane, coffee and bananas. There are both small-scale medium and large-scale crops.
Silviculture	Planting of tree species, mainly Eucalyptus, for wood and pulp.
Anthropic areas	Areas used by cattle grazing and other areas of bare soil with no specific use
Other urbanized anthropic areas	Represented by roads and railway, rural buildings, substations, and mining activities

Source: Land use and land cover map drawn up by this ESIA assessment (see **Section 7.2.2.1.1**).

After defining the land use and land cover classes and based on a list of ES available in the literature (MEA, 2005; HANSON *et al*., 2008 and LANDSBERG *et al*., 2011 and 2013), a list of the ES available for the Project's DAI was obtained (**Table 7.2.5.2.1.b**), in the categories of provisioning, regulation and culture. The services in the support category, as they are intrinsically related to the components of biodiversity, were not part of the analysis (CICES, 2018).

Table 7.2.5.2.1.b
Ecosystem services available in the study area

Land use and occupation	Ecosystem Service Delivery Potential		
	Service	**Subcategory**	**Definition/Application**
Forest and savannah vegetation	Provisioning	Feeding	Native animals and plants for food.
		Natural Medicines & Pharmaceuticals	Animals and plants for medicinal use.
		Biomass	Wood and fibres for various uses, such as construction, energy, handicrafts, etc.
		Genetic resources	Genetic resources for research into agricultural crop improvements, for example.
	Regulation	Air quality regulation	The influence that native formations have on regulating air quality by emitting pollutants into the atmosphere (serving as a "source" when they are deforested and burned) or extracting pollutants from the atmosphere (serving as a "sink" during growth).
		Climate regulation	Forests capture and store carbon dioxide and can influence local and regional rainfall patterns.
		Water regulation	The permeable soils of native vegetation areas facilitate the infiltration of water into the soil and the recharge of aquifers.
		Erosion regulation	Forest cover in hillside areas stabilizes the soil, preventing landslides and silting up of rivers.
		Water purification and waste treatment	Native plant formations, with healthy soils, have microorganisms that degrade organic waste, acting in the filtration and decomposition of polluting agents.
		Disease regulation	Forests and other native formations act as biological control of disease vectors, through the regulation of plants and animals by natural enemies, for example, control of disease-transmitting mosquitoes.
		Pest regulation	Similar to the regulation of diseases, native plant formations promote biological control in the extermination of possible agricultural pests, such as, for example, wild animals inhabiting these formations that feed on insects that act as pests of crops.
		Pollination	Native formations can harbour bee species that act as natural pollinators for crops.
		Lifecycle maintenance, habitat and gene pool protection	The presence of ecological conditions (usually habitats) provides habitats for wild plants and animals necessary for sustaining populations of species. In savannas, African Savanna Elephants are manipulators of woody vegetation structure which in turn influences the tree-to-grass ratio with knock-on consequences for the fire regime and potential species composition in the area (DUBLIN *et al.*, 1990; AUGUSTINE & MCNAUGHTON; 2004, PALMER *et al.*, 2008; HOLDO *et al.*, 2009; GOHEEN *et al.*, 2010; PRINGLE *et al.*, 2016).
	Cultural	Recreation and education	Native formations can be attractive for activities related to ecotourism (forest trails, wildlife watching) or activities aimed at environmental education and awareness programs/activities. Particularly in the African region, native formations harbour large mammals which are one of

Table 7.2.5.2.1.b
Ecosystem services available in the study area

Land use and occupation	Ecosystem Service Delivery Potential		
	Service	**Subcategory**	**Definition/Application**
			the main drivers of tourism in the region.
Herbaceous-shrubby vegetation	Provisioning	Feeding	Availability of land that can be used for growing plants and raising animals for food.
		Natural Medicines & Pharmaceuticals	Plants for medicinal use.
		Genetic resources	Genetic resources for research into agricultural crop improvements, for example.
	Regulation	Water regulation	The permeable soils of native vegetation areas facilitate the infiltration of water into the soil and the recharge of aquifers.
		Water purification and waste treatment	Native plant formations, with healthy soils, have microorganisms that degrade organic waste, acting in the filtration and decomposition of polluting agents.
		Disease regulation	Native formations act as biological control of disease vectors, through the regulation of plants and animals by natural enemies, for example, control of disease-carrying mosquitoes.
		Pest regulation	Similar to the regulation of diseases, native plant formations promote biological control in the extermination of possible agricultural pests, such as, for example, wild animals inhabiting these formations that feed on insects that act as pests of crops.
		Pollination	Native formations can harbour bee species that act as natural pollinators for crops.
		Lifecycle maintenance, habitat and gene pool protection	The presence of ecological conditions (usually habitats) provides habitats for wild plants and animals necessary for sustaining populations of species.
	Cultural	Recreation and education	Native plant formations can be attractive for activities related to ecotourism (forest trails, wildlife watching) or activities aimed at environmental education and awareness programs/activities. Particularly in the African region, native formations harbour large mammals which are one of the main drivers of tourism in the region.
Riverbed, lakes	Provisioning	Feeding	Breeding of animals for human consumption.
		Water	Fresh water supply for domestic, agricultural, industrial, energy, etc.
	Regulation	Disease regulation	They can act as biological control of disease vectors, for example, harbouring natural predators of disease-carrying insects and invertebrates.
		Pest regulation	They can act as biological control, for example, harbouring natural predators of pests of crops.
	Cultural	Recreation	Attractions for activities related to ecotourism.
Anthropized areas	It has no potential to provide ecosystem services		

Source: JGP analysis, based on the list of ecosystem services provided by HANSON *et al*. (2008) and LANDSBERG *et al*. (2013)

7.2.5.2.2
Step 2 - Identification of Relevant Ecosystem Services

Once the ES available in the project area has been identified, the second step in the process is the identification of the relevant ES for the local population, considering their dependence on it (LANDSBERG *et al*., 2013).

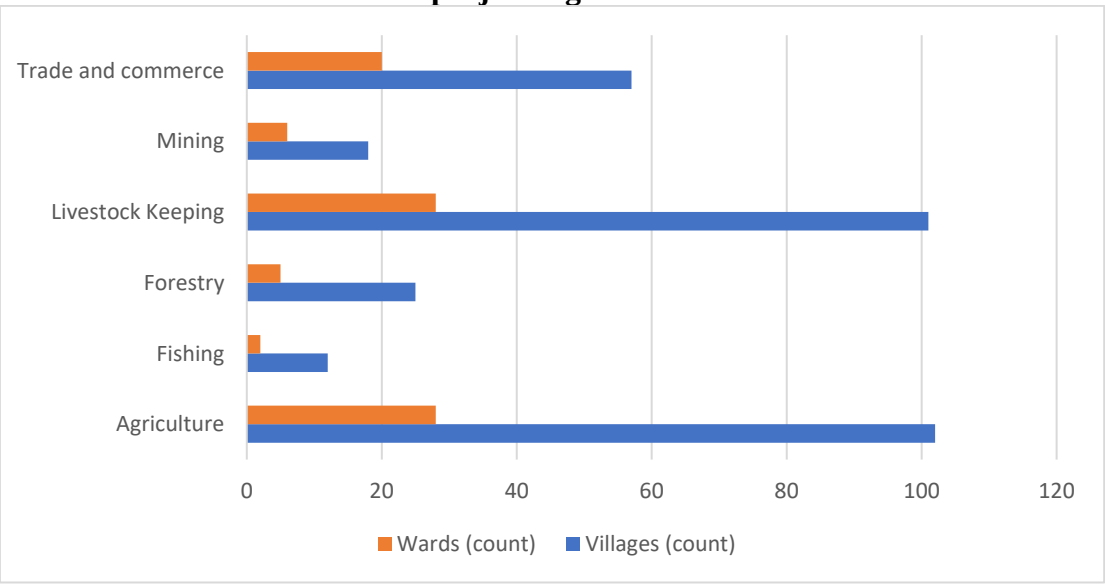
Unlike Stage 1, which is based on information available in the literature, Stage 2 requires stakeholder involvement to identify the most relevant ES to beneficiaries (LANDSBERG *et al*., 2013).

Information collected during the field visit

Information on the use of ecosystem services by the population was obtained throught interviews carried out between June 1st and August 6th in the villages and wards intercepted by the TL alignment for the socio-economic diagnosis. People were interviewed in 96 villages in 35 different wards. More details about this assessment are presented in **Section 7.3**.

Regarding economic activities, the main activities mentioned are agriculture and livestock keeping (**Figure 7.2.5.2.2.a**). As already mentioned, livestock dominates mainly the areas of savannah and herbaceous-shrub vegetation. The main crops cultivated are maize, rice, beans, cassava and banana, among others mentioned, such as vegetables (in general) and cotton. Cyclical and perennial agriculture are carried out near the water courses, to facilitate crop irrigation. However, most of the interviewees mentioned that the main source of water for farming activities is from rainfall. The livestock is mainly for milk and meat production, and also self-consumption.

Figure 7.2.5.2.2.a
Main economic activities in the project region



Some interviewees reported fishing in Lake Victoria and the Kagera River, but it seems to be a smaller-scale activity, with only 12% of interviewees reporting that they fish for tilapia and sardines, mainly for their own consumption.

About the community's relationship with fauna, only 1 interviewee reported that he hunts in Burigi-Chato, without specifying what type of animal he usually hunts. It is understood that, considering the strong ecotourism vocation of the region's fauna, and the legal restrictions against this activity, animal hunting is probably a minority. Around 36% of those interviewed reported keeping bees, all from the Biharamulo district.

Regarding the community's relationship with native vegetation, almost 50% of those interviewed reported using medicinal herbs that they extract from the forest. Concerning other uses mentioned, a large part of the population also extracts wood for use as fuel (firewood, charcoal).

Villagers expressed concern for the loss of trees and other vegetation due to the construction of the transmission line. Villagers demanded to know if the trees will be compensated and what will happen with them once they are cut.

Regarding access to water for own consumption, 31% of the interviewed collect water from wells and 27% have tap water, the remaining 42% have to collect water in a pond or a river.

The natural environment does not seem to be recognized by the population as an important ecosystem service. Only two interviewees mentioned natural environments as tourist attractions in the region, one of which was Burigi-Chato NP.

Information obtained from secondary sources

Biodiversity is not regarded as an ecosystem service itself, but rather as a prerequisite underpinning each of them. Equating biodiversity with ecosystem services implies that managing one will automatically enhance the other.

A regional assessment of biodiversity and ecosystem services carried out in Africa by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2018) provided a critical analysis of the state of knowledge regarding the importance, status, and trends of biodiversity and nature's contributions to people.

The assessment classified the EC into three categories, as follows:

Nature's material contributions

Woodfuel plays an important role in energy provision in Africa and serves as a critical resource for physical and socio-economic development in both rural and urban communities. Most of the population relies on firewood and charcoal for energy, especially for cooking. The demand for charcoal is growing, with likely negative effects on health, socio-economic activities and environmental health under business-as-usual

scenarios. Despite high demand, the topic tends to be under-represented in public policy. There is a need to gain access to 'modern' energy sources such as electricity and kerosene, promoting the security and availability of renewable energies for human comfort (IPBES, 2018).

Non-Timber Forest Products (NTFPs) contribute significantly to maintaining the livelihoods of rural communities in Africa. There is growing evidence that NTFPs are an essential income source in the total household economy in African rural communities. Due to the growing demand for the conversion of land for cultivation purposes, and growing populations in certain areas, the availability of NTFPs is threatened (IPBES, 2018).

Nature's non-material contributions:

Both land and water provide important areas for recreation, relaxation, healing, nature-based tourism and aesthetic enjoyment, religious and spiritual fulfilment, cognitive development, as well as the promotion of social cohesion and a sense of identity. Tourism is well-developed and an important source of income in several parts of Africa (IPBES, 2018).

Regulating contributions:

Regulating contributions services are mainly linked to agricultural production, including climate, air and water regulation, disease and pest control, and pollination. Africa has important genetic diversity that reflects its unique and varied biological and cultural heritages and is the product of interactions with, and adaptation to, an ever-changing environment, and of exchanges with other cultures. This diversity strengthens the resilience of African food systems and communities. It can be seen in the livestock breeds and crop varieties, which were essentially bred from their wild relatives. Africa is home to many subsistence farmers, small-scale livestock herders and pastoralists who maintain a range of plant and animal genetic resources for food and agriculture, which tends to mitigate the consequences of drought, pests and changing environmental conditions (IPBES, 2018).

Other services include nesting, feeding and mating sites for birds and mammals, such as the Protected Areas and the Key Biodiversity Areas.

The African Savanna Elephants also play an important ecological role as bulk processors of plant material (OWEN-SMITH, 1989). In savannas, African Savanna Elephants are manipulators of woody vegetation structure which in turn influences the tree-to-grass ratio with knock-on consequences for the fire regime and potential species composition in the area (DUBLIN *et al*. 1990; Augustine & McNaughton, 2004; PALMER *et al*., 2008; HOLDO *et al*., 2009; GOHEEN *et al*., 2010; PRINGLE *et al*., 2016). Where they are associated with wetlands African Savanna Elephants can be important in maintaining channels and open waterways. Soil fertility can be maintained by the transport of nutrients by large herbivores from nutrient-rich sources (e.g., eutrophic soils in flood plains and termite mounds) to dystrophic soils (e.g., upland miombo woodlands) (CUMMING *et al*.

1997; DOUGHTY *et al*., 2016; MALHI *et al*., 2016).[33]

The charismatic nature of African Savanna Elephants, and other large mammals, plays an important role in attracting tourism into national parks. They also hold important symbolic significance within the cultures of many African communities. African Savanna Elephants are one of the few iconic species that occur in the majority of African countries, and innumerable stories, songs, and cultural traditions revolve around them.

Regarding the potential for climate regulation, although there are uncertainties about the carbon reserves of African savannas (BOUVET *et al*., 2018; MITCHARD *et al*., 2014), some studies demonstrate the potential for carbon storage in savannah areas, both above and below ground. An inventory carried out in the Southeastern Tanzânia found that larger trees contribute to AGC. The researchers found that total tree abundance and biomass lean towards a few locally dominant species, with eight to nine species accounting for more than half of the total trees and carbon measured. This finding implies that carbon production in these areas is channelled through a small number of relatively abundant species. Tree species diversity and carbon stocks were also positively related, implying a potential functional relationship between the two (MCNICOL *et al*., 2017). Another study showed that frequently burned savannas had substantial belowground carbon, especially in biomass and deep soils (ZHOU *et al*., 2022).

Relevant ecosystem services

Relevant ecosystem services are those that are available in the region and that are important to the local population. Through the sources consulted, mentioned above, the following ES were considered relevant (**Table 7.2.5.2.2.a**).

Table 7.2.5.2.2.a
Relevant ecosystem services

Service	Subcategory	Use
Provisioning	Feeding	Livestock keeping and agriculture are the main economic activities in the region.
	Natural medicine	The population extracts herbs and other plants from the forest for medicinal use.
	Biomass	The extraction of wood, mainly for energy and charcoal, is significant in the region.
	Water	The availability of drinking water is vital for any population. Specifically in the region where the project is located, a large part of the population draws water directly from rivers and lakes for their own consumption. Agricultural activity in the

[33] Source: IUCN (Loxodonta africana (African Savanna Elephant) (iucnredlist.org))

Table 7.2.5.2.2.a
Relevant ecosystem services

Service	Subcategory	Use
		region is also quite significant, including crops with a high demand for water, such as rice, which is one of the region's main crops.
Regulation	Climate regulation	The ES service of climate regulation of climate is essential. Although there are uncertainties regarding carbon stocks in African savannas, studies show the potential for carbon accumulation in these native habitats, both above and below ground.
	Water regulation	The availability of drinking water is a major issue in the region, which is highly dependent on agriculture and water catchment from rivers and lakes for consumption.
	Disease regulation	The region has a high incidence of malaria and diseases of the intestinal tract. In this sense, a healthy ecosystem can act as vector control.
	Pest regulation	Due to the high dependence of crop populations on cyclical and perennial crops, similar to disease control, a healthy ecosystem can provide natural controls for crop pests
	Pollination	Due to the high population dependency of cyclical and perennial crops, pollination plays a key role in the success of these crops.
	Lifecycle maintenance, habitat and gene pool protection	Provide and maintain favourable ecological conditions for pollination, seed dispersal and habitats for wild plants and animals that can be useful to the population.
Cultural	Ecotourism	Although the population didn't mention it, Burigi-Chato is one of the largest national parks in the country and attracts a large number of tourists, contributing directly and indirectly to the region's economy.

Ecosystem services are defined as a priority when the impacts of a given project affect the general well-being (e.g., way of life, health, safety, culture) of the beneficiaries of that service, or those services that can provide the planned operational performance for certain projects (HANSON, 2008; LANDSBERG *et al*., 2013).

The analysis of the impacts of the projects on the ES, as well as their prioritization, is presented in **Section 8.2.3.2**.

7.3
Social Environment Baseline

7.3.1
Methodology

The study of the socioeconomic environment was done in three phases. During the first phase, secondary data were obtained and analysed to do a first characterization of the IAI. It also included the information provided by the stakeholders interviewed during the first field trip. The second and third phase consisted of a second field trip where consultation with the villagers took place and primary information was collected through a set of individual and group interviews.

Secondary data used in this report to characterize the IAI was collected during the field trip that took place between July 19th and 27th 2023, where meetings with regional and local governments took place. This is detailed in **Section 7.5 - Stakeholder Consultation and Involvement**. The secondary data collected consisted of the Socioeconomic Profiles and Strategic Plans of the districts of the area of influence when they were available.

Regarding the primary sources of information, the second field trip was carried out between May 27th to July 13th, 2024, during which all the wards and villages were contacted. The information gathering consisted of interviews to Ward Executive Officers (WEOs), Village Executive Officers (VEOs) and members of the communities. These interviews were recorded in a format of a digital questionnaire and uploaded to the Coletum system. The third phase was implemented between October and November 2024.

All the information presented in this document regarding the DAI is based on primary data. Secondary data has only been used for the aspects of the IAI mentioned.

Guidelines

These were the guidelines that orientated the methodology, and the relationship established with the communities:

- Information regarding the exact alignment was not presented to the population as it may vary in the future. Reasons to do so included avoiding concerns among the population as well as opportunistic settlers. This implied that it was not possible to interview the potential project affected people (PAPs). Instead of that, characterization of the area has been based on observation and interviews with members of the affected villages and groups such as miners, or owners of sacred sites.
- Drone surveys and mapping at locations have been carried out where there was a greater density of buildings and economic activities. This covered a strip wider than the right-of-way and has served both the purpose of fine-tuning the alignment at those locations and quantifying the extent of displacement to be provoked.
- The social baseline fieldwork and consultations associated took place only in the alignment chosen. It included the wards and villages that are intercepted by the alignment.

- Primary information gathering was done through a combination of individual and group meetings. The interviews were carried out following a structure that covered the different aspects required.
- Focus Group Discussion or group interviews gathered around 10 people per group. Large number of participants were avoided to allow better participation.
- Interviews with key stakeholders were semi-structured and were not based on the application of a questionnaire. A list of topics to be covered was prepared in advance and their views about the project were collected.
- Focus group meetings were more flexible. A list of topics was prepared, and participants were free to alter the order and to spend more or less time on any given topic as this reflected their interests and main issues of concern. Not all the pre-determined topics were discussed, as new themes emerged during the meetings, according to each group's priorities.
- Digital questionnaires were prepared for application with electronic devices (i.e., tablets or cell phones), with automatic geo-location, link to survey maps and transfer of data to the ESIA team in Brazil and Dar es Salaam.
- When interviewing leaders and members of the communities, the team evaluated if women and men were being sufficiently represented and, if not, they motivated their incorporation and encouraged to participate in the discussions and sometimes grouped based on their gender to seek for freedom of expression.

Information gathering

The aspects covered included:

- Current land use and occupation
- Territorial zoning
- Land tenure status
- Demographic and social indicators
- Economic activities
- Education service
- Health service
- Transportation and communications
- Housing and utilities
- Public safety
- Ecosystem services
- Ethnicity
- Gender roles, gender-based violence and violence against children

7.3.2 Area of Influence

The area of influence of the project is constituted by the administrative units that will be intercepted by the project. The Direct Area of Influence (DAI) is made up of the population who lives or uses the area where the project components will be installed and where the construction and operation will take place. Hence, the DAI is formed by the villages intercepted by the Transmission Line alignment. These villages have been

identified based on the information produced by the National Bureau of Statistics, corresponding to the Census carried out in 2022.

The Indirect Area of Influence (IAI), where indirect impacts will occur, is formed by the wards and districts, together with the regions where the DAI villages are located. As preliminarily defined, the IAI includes three regions (Shinyanga, Geita and Kagera), 12 districts, 47 wards and 105 villages. **Table 7.3.2.a** presents the IAI that is characterized in this social baseline.

Table 7.3.2.a
Direct and Indirect Area of Influence – Social

Indirect Area	District	Ward	Direct Area of Influence
Region			**Villages**
Shinyanga	Shinyanga Municipal Council (former Shinyanga Urban)	Mwamalili	Seseko
		Ibadakuli	Uzogore
			Ibadakuli
		Old Shinyanga	Ihapa
			Old Shinyanga
	Shinyanga District Council (former Shinyanga Rural)	Solwa	Mwasekagi
			Mwiseme
			Solwa
			Mwabuki
		Mwakitolyoo	Mwasenge
			Nyang'ombe
		Salawe	Nzoza
		Iselemagazi	Mwamakaranga
			Ichongo
			Iselamagazi
		Nyamalogo	Mwang'osha
		Pandagichiza	Pandagichiza
			Shilabela
		Mwenge	Mwongozo
			Zunzuli
			Ipango
		Lyabusalu	Mwajiji
			Lyabusalu
			Bukamba
			Mwabagehu
	Msalala	Bugarama	Igwamanoni
			Ilogi
			Buyange
		Lunguya (Runguya)	Kalole
		Bulyan'hulu	Busulwangili
Geita	Geita DC	Bukoli	Ntono
		Butobela	Shahende
	Nyang'hwale	Kafita	Kayenze
			Bukulu
		Nyugwa	Isonda
		Nundu	Igeka
		Bukwimba	Kasubuya
			Bukwimba
	Mbogwe DC	Ikobe	Kagongo

Table 7.3.2.a
Direct and Indirect Area of Influence – Social

Indirect Area	District	Ward	Direct Area of Influence
Region			Villages
			Bugalagala
			Busabaga
		Lulembela	Kashelo
		Ilolangulu	Ilolangulu
		Mbogwe	Nambubi
			Bwendanseko
			Mwanza
		Ngemo	Nyitundu
			Bwendamwizo
			Bulongo
		Ushirika	Kadoke
	Bukombe DC	Busonzo	Nampalahala
			Nalusunguti
			Busonzo
			Kabagole
			Nakayenze
		Butinzya	Butinzya
		Bulega	Ibambilo
			Bulega
	Chato DC	Iparamasa	Mnekezi
			Mwabasabi
			Songambele
Kagera	Karagwe DC	Kihanga	Katanda
			Kihanga
			Kishoju
			Mulamba
		Kayanga	Miti
		Bugene	Omurushaka
			Nyakahanga
			Chagati
			Bujuruga
			Kishao
		Ihembe	Ihembe I
		Nyaishozi	Rukale
			Nyakayanja
		Rugu	Kasheshe
		Nyakasimbi	Nyakasimbi
			Bujara
			Kahanga
			Muungano
		Nyakahanga	Rwandaro
			Bisheshe
	Biharamulo DC	Nyakahura	Nyabugombe
			Ngararambe
			Busiri
			Mabare
			Rugese
		Lusahunga	Nyakanazi
			Kabale

Table 7.3.2.a
Direct and Indirect Area of Influence – Social

Indirect Area	District	Ward	Direct Area of Influence
Region			Villages
			Lusahunga
			Kikoma
			Nyakasenga
		Kaniha	Mavota
			Mkunkwa
		Nyantakara	Mgera
			Nyantakara/Iyengamulilo
			Nyakayenze
	Ngara	Kasulo	Rwakalemera
	Missenyi	Mutukula	Byeju
			Mutukula
		Kassambya	Bunazi
			Nyabihanga
			Omudongo
		Nsunga	Byamutemba
			Ngando
		Kyaka	Kyaka

Source: JGP/BENE based on NBS 2022. Regions and Districts Official Public Shapefiles (2019) and Wards Official Public Shapefiles (2022). The United Republic of Tanzania (URT); Ministry of Finance and Planning; Tanzania National Bureau of Statistics and President's Office-Finance Planning; Office of the Chief Government Statistician, Zanzibar. The 2022 Population and Housing Census: Administrative Units Population Distribution Report. Tanzania, December 2022.

Map 4.0.a in Chapter 4.0 shows the TLs alignment in relation to wards and villages.

7.3.3
Geographical and Administrative Location

Shinyanga region

Shinyanga Region comprises two district and one Municipal council that will be impacted by the project. This includes Shinyanga Municipal Council, Shinyanga District and Msalala. district Council,

- Shinyanga MC officially started in July 1980 as Shinyanga Town Council, in July 2000 became a Municipal Council. It has an area of 548 square kilometres and is divided in an urban are that covers 25 square kilometres and in a rural one with 523 square kilometres. Administratively, the Municipal Council is made up of 3 Divisions, 17 Wards, 19 Villages, 55 Mitaa/streets and 84 vitongoji/ hamlets[1].
- Shinyanga DC was established in January 1984 under the terms of the Local Government Act 1982. Covers an area of 4212 km^2. It has 3 divisions, 26 wards, 126 villages and 856 hamlets or sub-villages.
- Msalala District Council was part of Kahama District. It was established under the

[1]Shinyanga Municipal Council (2013). Profile of Shinyanga Municipal Council.

Local Government Act No. 7 of 1982 and was officially announced in the Government Gazette on November 23rd, 2012. It came into operation on July 1st, 2013. It has an area of 2.635.52 km^2, 2 divisions (Msalala and Isagehe), 18 wards, 92 villages and 389 hamlets.

Geita Region

Geita Region is constituted by five districts.

- Geita DC became a district in 1961. In 1975 it was divided into two provinces (Geita and Sengerema). Currently, it is divided in two constituencies, 4 divisions, 37 wards, 145 registered villages and 626 hamlets or sub-villages. The district covers 7,825 km^2 of which 6,775 km^2 is dry land and 1,050 is covered by Lake Victoria.
- Nyang-hwale DC was established in 2012. Is divided in 4 divisions,15 wards, 62 villages and 273 hamlets. It has a total area of 1,450 km^2.
- Mbogwe DC was established on March 2nd, 2012, and started fully functioning in September 2013. Previously, it was part of Bukombe District. It has an area of 10,482 km2 of land. Mbowe has three divisions: Masumbwe, Mbogwe and Ilolangulu. It also has 17 wards, 87 villages and 335 hamlets.
- Bukombe DC was established in July 1995, separating it from Kahama District. It has a territory of 8,055.59 km2 and three divisions: Ushirombo, Siloka and Bukombe, divided into a total of 17 wards, 64 villages and 348 hamlets.
- Chato DC was established under the Local Government Authority Act of 1982 on July the 1st, 2007. Chato has five divisions, 23 wards, 115 villages and a total of 599 hamlets.

Kagera Region

Kagera region is divided into seven districts, among the districts four are going to be affected by the project, these include Karagwe, Biharamulo, Ngara and Missenyi.

- Karagwe DC has an extension of 4,342 km^2 of land and 158 km^2 of water. It is divided in 23 wards, 77 villages and 629 hamlets.
- Biharamulo DC has an extension of 5,617 km^2 and is divided in 17 wards, 74 villages and 373 hamlets.
- Ngara has a territory of 3,744 km^2. It is comprised by 20 wards, 77 villages and 356 hamlets.
- Missenyi was established in July 2007, under the Local Government Act No. 7 of 1982. It previously was part of Bukoba District Council. It has a total area of 2,523 km^2 of which the land area is 2000 km^2 and 523 km^2 is water. On the northern side, it borders with the Republic of Uganda. Missenyi has 2 divisions, 20 wards, 77 villages and 356 hamlets.

7.3.4 Population and Demographics

The area of influence of the project is characterized by being predominantly rural, with relatively sparse population, an average household size of 5.2 persons per household and

a population that grows due to fertility rates and to the economic incentives for migration, especially in the areas with presence of mining activity and industries.

Tanzania population grew from 44,928,923 (Census 2012) to 61,741,120 with an annual intercensal growth of 4.8%. The Census 2022 indicates that, with that population growth rate, population of the country is expected to double in the next 22 years. Growth rate has been higher in urban areas (4.8%) that in rural ones (2.4%), with one of its reasons being the migration from rural areas, such as the ones intercepted by the project. This trend implies that, in the future, the area of influence of the project may present some level of abandonment. However, currently Tanzania is still predominantly a rural country, although this profile is changing.

Table 7.3.4.a presents the information of Census 2022 regarding population density, average household size, number of households and the percentage of rural and urban population in the Indirect Area of Influence. Regarding the definition of urban, NBS indicates that they have included as urban the areas that are legally recognized as such (gazetted) and all the urban areas recognized by Local Government Authorities.

Table 7.3.4.a
Population and demographic data – population density, household

Area	Total Population size	Population density per km^2	Average household size	# of households	Rural	Urban
Shinyanga Region	2,241,299	118.6	5.3	423,373	68.1%	31.9%
Districts	592,958					
Shinyanga Municipal (urban)	214,744	387.2	4.2	51,714	34.9%	65.1%
Shinyanga DC	468,611	111.2	5.9	79,706	96.4%	3.6%
Msalala	378,214	143.8	5.7	66,367	78.7%	21.3%
Geita Region	2,977,608	148.5	5.3	561,942	65.3%	34.7%
Districts	2,645,937					
Geita	1,035,214	282.0	5.2	198,797	68.8%	31.2%
Nyang'wale	255,803	140.6	6.2	36,159	94.3%	5.7%
Mbogwe	362,855	159.1	5.7	63,635	69.7%	30.3%
Bukombe	407,102	50.54	5.5	74,664	68.5%	31.5%
Chato	584,963	190.3	5.3	110,156	76%	24%
Kagera region	2,989,299	118.3	4.3	702,412	88.8%	11.2%
Districts	1,471,344					
Karagwe	385,744	75.14	4.1	93,366	85%	15%
Biharamulo	457,114	61.25	5.2	87,733	98%	2%
Ngara	383,092	115.9	4.3	88,575	89.1%	10.9%
Missenyi	245,394	86.88	3.8	64,352	89.4%	10.6%

Elaboration: JGP/BENE Consult. Sources: Census 2022. For average household size and number of households: Socioeconomic District Profiles (use data of Census 2012).

The districts intercepted by the project are largely rural, except for Shinyanga Municipal, where only 34.9% live in rural areas. During the fieldtrip was confirmed that the DAI is largely rural, which is ratified by the fact that the predominant economic activity is agriculture, followed by livestock keeping.

Population density has increased, in the national level, from 51 to 70 persons per square kilometre in Tanzania between the last two censuses, and from 49 to 68 in Tanzania Mainland. All the districts of the area of influence are above this rate, except for Biharamulo (61.25 persons per square kilometre). The most densely populated area is Shinyanga Municipal, which also is the only one predominantly urban. The higher density may imply an increasing pressure on resources such as land, although this could be counterweighed by migration to urban areas.

Tables 7.3.4.b, c and **d** present the distribution of population in the DAI, according to the Census 2022, for each region.

Table 7.3.4.b
Distribution of population in the DAI

Ward	Villages	Population	Male	Female	N° Households	Hab./ household
Mwamalili	Seseko	2,741	1,357	1,384	487	5.63
Ibadakuli	Uzogore	3,578	1,816	1,762	672	5.32
	Ibadakuli	8,539	4,293	4,246	2,017	4.23
Old Shinyanga	Ihapa	4,577	2,168	2,409	820	5.58
	Old Shinyanga	7,360	3,510	3,850	1,609	4.57
Sub total		26,795	13,144	13,651	5,605	5.066
Solwa	Mwasekagi	4,332	2,142	2,190	608	7.13
	Mwiseme	4,932	2,447	2,485	729	6.77
	Solwa	8,416	4,008	4,408	1,677	5.02
	Mwabuki	2,874	1,410	1,464	405	7.10
Mwakitolyoo	Mwasenge	3,907	1,966	1,941	532	7.34
	Nyang'ombe	2,571	1,293	1,278	401	6.41
Salawe	Nzoza	2,379	1,225	1,154	320	7.43
Iselemagazi	Mwamakaranga	5,500	2,647	2,853	754	7.29
	1Ichongo	2,337	1,111	1,226	338	6.91
	Iselamagazi	9,446	4,434	5,012	1,904	4.96
Nyamalogo	Mwang'osha	3,565	1,718	1,847	567	6.29
Pandagichiza	Pandagichiza	2,767	1,336	1,431	383	7.22
	Shilabela	3,453	1,653	1,800	586	5.89
Mwenge	Mwongozo	8,204	4,619	3,585	1,238	6.63
	Zunzuli	3,969	1,915	2,054	609	6.52
	Ipango	1,908	949	959	283	6.74
Lyabusalu	Mwajiji	8,261	3,981	4,280	1,006	8.21
	Lyabusalu	4,117	1,997	2,120	592	6.95
	Bukamba	3,308	1,664	1,644	472	7.01
	Mwabagehu	1,655	829	826	169	9.79
Sub total		87,901	43,344	44,557	13,573	6.88
Bugarama	Igwamanoni	2,176	1,097	1,079	292	7.45
	Ilogi	5,614	2,687	2,927	1,141	4.92
	Buyange	3,786	1,881	1,905	583	6.49
Lunguya (Runguya)	2Kalole	10,101	5,326	4,775	2,158	4.68
Bulyan'hulu	Busulwangili	4,566	2,463	2,103	767	5.95
Sub total		26,243	13,454	12,789	4,941	5.898
Total		**140,939**	**69,942**	**70,997**	**24,119**	**5.948**

Table 7.3.4.c
Population and demographic data – gender and households DAI Geita Region

Ward	Villages	Population	Male	Female	N° Households	Hab/ household
Bukoli	Ntono	7,172	3,521	3,651	1,122	6.39
Butobela	Shahende	2,285	1,124	1,161	338	6.76
Sub total		9,457	4,645	4,812	1,460	6.58
1Kafita	Kayenze	6,233	3,255	2,978	1,006	6.20
	Bukulu	4,110	2,082	2,028	599	6.86
Nyugwa	Isonda	4,690	2,443	2,247	681	6.89
Nundu	Igeka	1,913	964	949	320	5.98
Bukwimba	Kasubuya	5,861	2,940	2,921	868	6.75
	Bukwimba	3,948	1,974	1,974	757	5.22
Sub total		26,755	13,658	13,097	4,231	6.32
Ikobe	Kagongo	2,396	1,165	1,231	322	7.44
	Bugalagala	5,000	2,450	2,550	781	6.40
	Busabaga	2,185	1,112	1,073	304	7.19
Lulembela	Kashelo	4,040	1,985	2,055	622	6.50
Ilolangulu	Ilolangulu	6,128	3,023	3,105	1,020	6.01
Mbogwe	Nambubi	2,499	1,228	1,271	418	5.98
	Bwendanseko	1,132	551	581	171	6.62
	Mwanza	1,936	953	983	266	7.28
Ngemo	Nyitundu	1,587	785	802	207	7.67
	Bwendamwizo	2,488	1,190	1,298	456	5.46
	Bulongo	1,390	699	691	167	8.32
Ushirika	Kadoke	1,865	956	909	255	7.31
Sub total		32,646	16,097	16,549	4,989	6.85
Busonzo	Nampalahala	18,388	9,807	8,581	4,150	4.43
	Nalusunguti	1,863	952	911	285	6.54
	Busonzo	4,445	2,249	2,196	777	5.72
	Kabagole	1,809	912	897	339	5.34
	Nakayenze	3,439	1,784	1,655	465	7.40
Butinzya	Butinzya	9,830	4,806	5,024	1,402	7.01
Bulega	Ibambilo	3,209	1,602	1,607	412	7.79
	Bulega	11,232	5,437	5,795	1,736	6.47
Sub total		54,215	27,549	26,666	9,566	6.34
Iparamasa	Mnekezi	2,952	1,425	1,527	446	6.62
	Mwabasabi	9,327	4,661	4,666	1,296	7.20
	Songambele	3,536	1,730	1,806	529	6.68
Sub total		15,815	7,816	7,999	2,271	6.83
Total		**138,888**	**69,765**	**69,123**	**22,517**	**6.58**

Table 7.3.4.d
Population and demographic data – gender and households DAI Kagera region

Ward	Villages	Population	Male	Female	N° Households	Hab/ household
Kihanga	Katanda	3,660	1,849	1,811	941	3.89
	Kihanga	3,186	1,558	1,628	899	3.54
	Kishoju	3,853	1,933	1,920	1,036	3.72
	Mulamba	2,146	1,151	995	646	3.32
Kayanga	Miti	3,995	1,984	2,011	1,001	3.99
Bugene	Omurushaka	2,881	1,417	1,464	926	3.11

Table 7.3.4.d
Population and demographic data – gender and households DAI Kagera region

Ward	Villages	Population	Male	Female	N° Households	Hab/ household
	Nyakahanga	2,684	1,240	1,444	747	3.59
	Chagati	1,712	775	937	466	3.67
	Bujuruga	3,298	1,704	1,594	829	3.98
	Kishao	1,649	781	868	442	3.73
Ihembe	Ihembe I	2,542	1,256	1,286	624	4.07
Nyaishozi	Rukale	2,008	975	1,033	485	4.14
	Nyakayanja	5,354	2,569	2,785	1,258	4.26
Rugu	Kasheshe	1,320	639	681	339	3.89
Nyakasimbi	Nyakasimbi	2,907	1,433	1,474	736	3.95
	Bujara	2,123	1,010	1,113	494	4.30
	Kahanga	6,294	3,170	3,124	1,370	4.59
	Muungano	5,040	2,528	2,512	1,071	4.71
Nyakahanga	Rwandaro	3,357	1,689	1,668	805	4.17
	Bisheshe	9,348	4,721	4,627	2,194	4.26
Sub total		69,357	34,382	34,975	17,309	3.94
Nyakahura	Nyabugombe	8,670	4,306	4,364	2,021	4.29
	Ngararambe	18,423	9,211	9,212	3,745	4.92
	Busiri	8,953	4,661	4,292	1,595	5.61
	Mabare	4,736	2,404	2,332	847	5.59
	Rugese	8,887	4,372	4,515	1,860	4.78
Lusahunga	Nyakanazi	34,913	16,454	18,459	7,917	4.41
	Kabale	3,114	1,507	1,607	615	5.06
	Lusahunga	7,885	3,763	4,122	1,615	4.88
	Kikoma	19,438	9,472	9,966	3,735	5.20
	Nyakasenga	4,292	2,080	2,212	821	5.23
Kaniha	Mavota	8,982	4,494	4,488	1,505	5.97
	Mkunkwa	4,896	2,406	2,490	795	6.16
Nyantakara	Mgera	7,407	3,642	3,765	1,225	6.05
	Nyantakara/Iyengamulilo	5,330	2,627	2,703	977	5.46
	Nyakayenze	1,315	655	660	159	8.27
Sub total		147,241	72,054	75,187	29,432	5.46
Kasulo	Rwakalemera	8,229	3,991	4,238	2,107	3.91
Mutukula	Byeju	6,714	3,267	3,447	1,729	3.88
	Mutukula	15,383	7,363	8,020	4,397	3.50
Kassambya	Bunazi	9,980	4,710	5,270	3,010	3.32
	Nyabihanga	4,160	1,995	2,165	1,084	3.84
	Omudongo	5,473	2,662	2,811	1,507	3.63
Nsunga	Byamutemba	6,075	3,024	3,051	1,461	4.16
	Ngando	15,422	8,972	6,450	5,185	2.97
Kyaka	Kyaka	4,201	2,121	2,080	1,057	3.97
Sub total		67,408	34,114	33,294	19,430	3.66
Total		**292,235**	**144,541**	**147,694**	**68,278**	4.24

Elaboration: JGP/BENE. Source: 2022 Census.

According to the 2022 Census, the total population of the Direct Area of Influence is of 572,062 persons, of which 49.7% (284,248) are men and 50.7% (287,814) women. This distribution is consistent with what is observed in the IAI, where females are a slightly larger population than males (the difference increases in elder groups). However, in the

case few villages the proportion of male population is higher than the female one.

Most villages have less than 10,000 inhabitants, mainly due to its rural character. Only one village has more than 20,000 inhabitants (Nyakanazi in Biharamulo) and 6 have more than 10,000 but less than 20,000.

The total number of households in the DAI is of 114,914, and the average of persons per household is 5.6 persons. This is higher than the national average, that is of 4.3, according to the last census, and than the average in the IAI, which is of 5.2 persons. The size of the households varies between 2.97 persons per house (the lowest being in Ngando village, in Missenyi, Kagera) and 9.79 the highest (in Mwabagehu village, located in Labusalu, Shinyanga DC). In Kagera, households tend to be smaller, even when they are also part of rural areas. Places with a higher number of members per household present a higher degree of vulnerability, since it is likely that more people will depend on the sources of income or livelihood in general.

The population of the area of influence is young with more than half of the population under 17 years of age in Msalala (Shinyanga region), all the districts of Geita Region, and the districts of Karagwe, Biharamulo and Ngara in Kagera region. This implies a higher rate of dependency in adults and even in elder population. Although the regions of Shinyanga and Geita have larger sectors of elder population (9.6% and 8% respectively) in all the districts of the area of influence the percentage of elder population varies between 3.4% and 6.2%.

The Socioeconomic Profiles explain the growth of their population due to different reasons, including immigration induced by economic opportunities. These include mining, industries (Kagera Sugar Company, Olam Coffee Processing Industry), and groups that go to the area looking for pastures. Other causes include high fertility rate and low uptake of new family planning methods.

The rural character of the area of influence and the, still, sparse population makes the provision of services, such as health and education, more costly as a higher investment is required to reach a smaller sector of population (compared with urban areas), posing a challenge.

7.3.5 Economy

According to the Human Development Report done by UNDP (2017), that analyses poverty from a multidimensional perspective, the three regions were below the Human Development Index (HDI) of the country. While at a national level, the HDI is of 0.61, in Kagera it was 0.44 (the lowest of the country); in Shinyanga was 0.53 and in Geita 0.55. Life expectancy in Kagera was of 57.8 years, in Shinyanga 59.8 and 63.3 in Geita. Years of education completed were 7.27 in Geita, 8.8 in Kagera and 7.47 in Shinyanga. The incidence of poverty was of 52.9% in Kagera, 62% in Geita and 63.8% in Shinyanga, while population in severe poverty were 25% in Geita, 19.8% in Kagera and 28.4%.in Shinyanga. Hence, the districts that make up the area of influence are among the ones

which face the most difficult economic conditions in the country. Considering that the project intercepts mainly rural areas, and as observed in the fieldtrips, it can be considered that a high proportion of the population of the area of influence lives in poverty.

One of the reasons for this is that the population mainly relies on agriculture and livestock keeping as their livelihoods, which face problems such as the dependency on rainfall, the little use of modern methods and difficulties to access markets in more beneficial conditions. Livestock keeping also faces difficulties, such as the dependency on pastures that depend on rainfall, the lack or difficulties to access veterinary services and lack of production of secondary products (leather, yogurt, cheese), etc.

However, this is not the same situation for all the villages, as there are some where the economic activities are dynamic and even attract immigration. This is the case of the villages with mining activities and those with the presence of large industries.

7.3.5.1
Economic Activities

The main economic activities in the Area of Influence are agriculture, livestock keeping and, in some areas, mining, especially small-scale. Agriculture and livestock keeping are traditional activities and most of the population of the DAI works on this. Other activities related to this include forestry and beekeeping.

In the case of the direct area of influence, the main economic activities are listed in the **Tables 7.3.5.1.a, b** and **c** below, according to each region:

Table 7.3.5.1.a
Economic Activities: DAI – Shinyanga Region

Ward	Villages	Main Economic Activities
Region: Shinyanga		
District: Shinyanga MC		
Mwamalili	Seseko	Agriculture Livestock keeping
Ibadakuli	Zogore	Agriculture Livestock keeping
	Ibadakuli	Agriculture Livestock keeping Mining
Old Shinyanga	Ihapa	Agriculture Livestock keeping
	Old Shinyanga	Agriculture Livestock keeping Mining Forestry Fishing Trade and commerce
District: Shinyanga DC		

Table 7.3.5.1.a
Economic Activities: DAI – Shinyanga Region

Ward	Villages	Main Economic Activities
Solwa	Mwasekagi	Agriculture Livestock keeping
	Mwiseme	Agriculture Livestock keeping
	Mwabuki	Agriculture Livestock keeping
Mwakitolyoo	Mwasenge	Agriculture Livestock keeping
	Nyang'ombe	Agriculture Livestock keeping Mining
Iselemagazi	Mwamakaranga	Agriculture Livestock keeping Forestry Trade and commerce
	Ichongo	Agriculture Livestock keeping Trade and commerce
	Iselamagazi	Agriculture Livestock keeping Forestry Fishing
Nyamalogo	Mwang'osha	Agriculture Livestock keeping
Pandagichiza	Shilabela	Agriculture Livestock keeping Fishing Trade and commerce
Mwenge	Mwongozo	Agriculture Livestock keeping Mining Fishing Trade and commerce
	Zunzuli	Agriculture Livestock keeping Trade and commerce
	Ipango	Agriculture Livestock keeping Trade and commerce
Lyabusalu	Mwajiji	Agriculture Livestock keeping
	Lyabusalu	Agriculture Livestock keeping
	Bukamba	Agriculture Livestock keeping
	Mwabagehu	Agriculture Livestock keeping
District: Msalala		
Bugarama	Igwamanoni	Agriculture Livestock keeping Mining
	Ilogi	Agriculture

Table 7.3.5.1.a
Economic Activities: DAI – Shinyanga Region

Ward	Villages	Main Economic Activities
		Livestock keeping Trade and commerce
	Buyange	Agriculture Livestock keeping Mining
Lunguya (Runguya)	Kalole	Agriculture Mining Livestock keeping Trade and commerce
Bulyan'hulu	Busulwangili	Agriculture Livestock keeping Trade and commerce Mining

Table 7.3.5.1.b
Economic Activities: DAI – Geita Region

Ward	Villages	Main Economic Activities
District: Geita DC		
Butobela	Shahende	Agriculture Livestock keeping
District: Nyang'hwale		
Kafita	Kayenze	Agriculture Livestock keeping Mining
	Bukulu	Agriculture Livestock keeping Mining Fishing Trade and commerce
Nyugwa	Isonda	Agriculture Livestock keeping Mining
Bukwimba	Kasubuya	Agriculture Livestock keeping Mining
	Bukwimba	Agriculture Livestock keeping
District: Mbogwe DC		
Ikobe	Kagongo	Agriculture Livestock keeping
	Bugalagala	Agriculture Livestock keeping
	Busabaga	Agriculture Livestock keeping
Lulembela	Kashelo	Agriculture Mining Livestock keeping Forestry Trade and commerce

Table 7.3.5.1.b
Economic Activities: DAI – Geita Region

Ward	Villages	Main Economic Activities
Ilolangulu	Ilolangulu	Agriculture Livestock keeping Trade and commerce Fishing
Mbogwe	Nambubi	Agriculture Livestock keeping Forestry Trade and commerce
	Bwendanseko	Agriculture Livestock keeping Trade and commerce
	Mwanza	Agriculture Livestock keeping Trade and commerce
Ngemo	Nyitundu	Agriculture Livestock keeping Mining
	Bwendamwizo	Agriculture Livestock keeping
	Bulongo	Agriculture Livestock keeping Forestry Trade and commerce
Ushirika	Kadoke	Agriculture Livestock keeping Forestry Trade and commerce
District: Bukombe DC		
Busonzo	Nampalahala	Agriculture Livestock keeping Mining Forestry Trade and commerce
	Nalusunguti	Agriculture Livestock keeping
	Busonzo	Agriculture Livestock keeping Trade and commerce Mining
	Kabagole	Agriculture Livestock keeping
	Nakayenze	Agriculture Livestock keeping
Butinzya	Butinzya	Livestock keeping Agriculture Forestry Trade and commerce
Bulega	Ibambilo	Agriculture Livestock keeping
District: Chato DC		
Iparamasa	Mnekezi	Agriculture Livestock keeping

Table 7.3.5.1.b
Economic Activities: DAI – Geita Region

Ward	Villages	Main Economic Activities
	Mwabasabi	Agriculture Livestock keeping Trade and commerce
	Songambele	Agriculture Livestock keeping Mining

Table 7.3.5.1.c
Economic Activities: DAI – Kagera Region

Ward	Villages	Main Economic Activities
Karagwe DC District		
Kihanga	Katanda	Agriculture Livestock keeping Forestry Mining
	Kihanga	Agriculture Livestock keeping Trade and commerce
	Kishoju	Agriculture Livestock keeping Trade and commerce
	Mulamba	Agriculture Livestock keeping
Kayanga	Miti	Agriculture Livestock keeping Forestry Trade and commerce Mining
Bugene	Omurushaka	Agriculture Livestock keeping Trade and commerce
	Nyakahanga	Agriculture Livestock keeping Trade and commerce
	Kishao	Agriculture Livestock keeping Trade and commerce
Ihembe	Ihembe I	Agriculture Livestock keeping Forestry Trade and commerce
Nyaishozi	Rukale	Agriculture Livestock keeping
	Nyakayanja	Agriculture Livestock keeping Forestry Trade and commerce
Rugu	Kasheshe	Agriculture Trade and commerce Livestock keeping

Table 7.3.5.1.c
Economic Activities: DAI – Kagera Region

Ward	Villages	Main Economic Activities
Yakasimbi	Nyakasimbi	Agriculture Livestock keeping Trade and commerce Forestry
	Bujara	Agriculture Livestock keeping Trade and commerce
	Kahanga	Agriculture Livestock keeping
	Muungano	Agriculture Livestock keeping Forestry Trade and commerce
Nyakahanga	Rwandaro	Agriculture Livestock keeping Forestry Trade and commerce
	Bisheshe	Agriculture Livestock keeping Fishing Mining
District: Biharamulo DC		
Nyakahura	Nyabugombe	Agriculture Livestock keeping
	Ngararambe	Agriculture Livestock keeping Trade and commerce Mining
	Busiri	Agriculture Mining Livestock keeping Mining
	Mabare	Agriculture Livestock keeping
Lusahunga	Nyakanazi	Agriculture Livestock keeping
	Kabale	Agriculture Livestock keeping Forestry Trade and commerce
	Lusahunga	Agriculture Livestock keeping Forestry Trade and commerce
	Kikoma	Agriculture Livestock keeping Mining Trade and commerce
	Nyakasenga	Agriculture Livestock keeping Trade and commerce

Table 7.3.5.1.c
Economic Activities: DAI – Kagera Region

Ward	Villages	Main Economic Activities
Kaniha	Mavota	Agriculture Livestock keeping Forestry Fishing Trade and commerce Mining
	Mkunkwa	Livestock keeping Agriculture Trade and commerce
Nyantakara	Mgera	Agriculture Livestock keeping
	Nyantakara/Iyengamulilo	Agriculture Livestock keeping
	Nyakayenze	Agriculture Livestock keeping Forestry Trade and commerce Mining
District: Ngara		
Kasulo	Rwakalemera	Agriculture Livestock keeping
District: Missenyi		
Mutukula	Byeju	Agriculture Livestock keeping Forestry Fishing Mining
	Mutukula	Agriculture Livestock keeping Trade and commerce
Kassambya	Bunazi	Agriculture Trade and commerce
	Nyabihanga	Agriculture Livestock keeping Forestry Fishing Mining
	Omudongo	Agriculture Livestock keeping Trade and commerce
Nsunga	Byamutemba	Agriculture Livestock keeping Forestry Trade and commerce Fishing Mining
	Ngando	Agriculture Livestock keeping Trade and commerce

Table 7.3.5.1.c
Economic Activities: DAI – Kagera Region

Ward	Villages	Main Economic Activities
Kyaka	Kyaka	Agriculture Livestock keeping Trade and commerce

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024.

Agriculture is the most important livelihood in all the villages intercepted by the project, followed by livestock keeping. The main differences among villages are determined by the presence of mining activities and of large industries in the area.

Missenyi differentiates from other district councils due to the presence of large economic actors, such as the sugar and coffee industries. This includes Kagera Sugar Company, Olam Coffee Processing Industry and ranches, such as Missenyi Ranch. These industries are linked to agriculture and livestock keeping.

Agriculture

Agriculture is the main economic activity and the main source of employment in the DAI. However, according to the district reports, a decline in this activity is observed. Although it is not significant, it may be showing that it is not attractive for the population as it does not allow them to alleviate poverty.

The DAI is characterized by small agriculture, which is produced in small scale areas that go from 1ha to 10 ha.

Although cash crops are important, not in all the cases these are produced. The table below presents the main crops of each village (**Table 7.3.5.1.d**) and selling places, according to the information provided by the interviewees:

Table 7.3.5.1.d
Agricultural Activities: DAI – Shinyanga Region

Ward	Villages	Main Crops	Cash Crops	Selling places
Mwamalili	Seseko	Maize Millet Cassava Groundnuts Others		Local market (in the village or ward) Buyers come to the village or ward
Ibadakuli	Uzogore	Maize Others	Cotton	Local market (in the village or ward) Buyers come to the village or ward We travel to the city
	Ibadakuli	Maize Cassava Millet Sorghum	Others	Local market (in the village or ward)

Table 7.3.5.1.d
Agricultural Activities: DAI – Shinyanga Region

Ward	Villages	Main Crops	Cash Crops	Selling places
Old Shinyanga	Ihapa	Maize Others Millet Groundnuts	Cotton	Local market (in the village or ward)
	Old Shinyanga	Maize Millet Sorghum Paddy Cassava Cowpeas Groundnuts Others	Cotton Sugar Cane	Local market (in the village or ward)
Solwa	Mwasekagi	Others Maize Millet Cassava	Others	Local market (in the village or ward) Buyers come to the village or ward
	Mwiseme	Maize Millet		Local market (in the village or ward) Buyers come to the village or ward
	Mwabuki	Maize Millet Others	Cotton	Local market (in the village or ward) Buyers come to the village or ward
Mwakitolyoo	Mwasenge	Maize Others Cassava Millet		Local market (in the village or ward) Buyers come to the village or ward Other
	Nyang'ombe	Maize Sorghum Cassava		Local market (in the village or ward) Buyers come to the village or ward We travel to the city
Iselemagazi	Mwamakaranga	Maize Millet Paddy Cassava Groundnuts Cowpeas	Cotton	Buyers come to the village or ward We travel to the city
	Ichongo	Maize Paddy Groundnuts Millet		Buyers come to the village or ward
	Iselamagazi	Maize Millet Sorghum Paddy Groundnuts Cowpeas Cassava	Cotton	Buyers come to the village or ward
Nyamalogo	Mwang'osha	Maize Others	Cotton Others	Local market (in the village or ward)

Table 7.3.5.1.d
Agricultural Activities: DAI – Shinyanga Region

Ward	Villages	Main Crops	Cash Crops	Selling places
				Buyers come to the village or ward
Pandagichiza	Shilabela	Maize Millet Paddy Groundnuts Cowpeas	Cotton	Local market (in the village or ward)
Mwenge	Mwongozo	Paddy Groundnuts Cowpeas Maize Millet Sorghum	Others	Buyers come to the village or ward Local market (in the village or ward)
	Zunzuli	Maize Cassava Paddy		Local market (in the village or ward) Buyers come to the village or ward We travel to the city
	Ipango	Maize Millet Sorghum Paddy Cassava Groundnuts Cowpeas	Cotton Others	Buyers come to the village or ward
Lyabusalu	Mwajiji	Others Maize Millet Groundnuts	Cotton	Buyers come to the village or ward Local market (in the village or ward)
	Lyabusalu	Maize	Cotton	Local market (in the village or ward) Buyers come to the village or ward
	Bukamba	Maize	Cotton	Local market (in the village or ward) Buyers come to the village or ward
	Mwabagehu	Maize Millet Groundnuts Cowpeas	Cotton	Local market (in the village or ward) Buyers come to the village or ward
Bugarama	Igwamanoni	Others Maize Millet Cassava Groundnuts	Cotton	Buyers come to the village or ward
	Ilogi	Maize Others Groundnuts	Cotton	Buyers come to the village or ward Local market (in the village or ward)
	Buyange	Others Maize Cassava	Cotton	Local market (in the village or ward) Buyers come to the village or

Table 7.3.5.1.d
Agricultural Activities: DAI – Shinyanga Region

Ward	Villages	Main Crops	Cash Crops	Selling places
		Groundnuts		ward We travel to the city
Lunguya (Runguya)	Kalole	Maize Millet Paddy Cassava Groundnuts		Local market (in the village or ward)
Bulyan'hulu	Busulwangili	Maize Cassava Groundnuts Paddy	Others	We travel to the city Buyers come to the village or ward

Table 7.3.5.1.e
Agricultural Activities DAI – Geita Region

Ward	Villages	Main Crops	Cash Crops	Selling places
Butobela	Shahende	Maize Others Groundnuts Cassava Millet	Cotton	Buyers come to the village or ward
Kafita	Kayenze	Maize Sorghum Millet Paddy Cassava Groundnuts Others	Cotton	Buyers come to the village or ward
	Bukulu	Maize Millet Sorghum Paddy Cassava Groundnuts Cowpeas	Cotton	Local market (in the village or ward)
Nyugwa	Isonda	Maize Millet Paddy Cassava Groundnuts	Cotton Others	Local market (in the village or ward)
Bukwimba	Kasubuya	Maize Others Cassava	Cotton	Buyers come to the village or ward
	Bukwimba	Maize Others Groundnuts Cassava	Cotton	Buyers come to the village or ward
Ikobe	Kagongo	Others Maize Groundnuts Cassava	Cotton	Buyers come to the village or ward
	Bugalagala	Maize	Cotton	Buyers come to the village or

Table 7.3.5.1.e
Agricultural Activities DAI – Geita Region

Ward	Villages	Main Crops	Cash Crops	Selling places
		Cassava Others		ward
	Busabaga	Maize Others Groundnuts	Cotton	Buyers come to the village or ward
Lulembela	Kashelo	Maize Sorghum Paddy Cassava Groundnuts	Cotton Others	Local market (in the village or ward) Buyers come to the village or ward
Ilolangulu	Ilolangulu	Maize Millet Sorghum Paddy Cassava Groundnuts	Cotton Others	Local market (in the village or ward) Buyers come to the village or ward
Mbogwe	Nambubi	Maize Paddy Cassava Groundnuts Others	Cotton Sugar Cane Others	Buyers come to the village or ward
	Bwendanseko	Maize Cassava Paddy Groundnuts Others	Cotton Sugar Cane	Buyers come to the village or ward
	Mwanza	Maize Paddy Cassava Groundnuts Others	Cotton Others	Buyers come to the village or ward
Ngemo	Nyitundu	Maize Others Cassava Groundnuts	Others	Local market (in the village or ward) Buyers come to the village or ward
	Bwendamwizo	Others Maize	Cotton	Buyers come to the village or ward
	Bulongo	Maize Sorghum Paddy Cassava Groundnuts	Cotton	Local market (in the village or ward)
Ushirika	Kadoke	Maize Millet Sorghum Paddy Cassava Groundnuts	Cotton	Local market (in the village or ward)
District: Bukombe DC				
Busonzo	Nampalahala	Maize Millet Paddy Cassava	Cotton	Local market (in the village or ward) Buyers come to the village or ward

Table 7.3.5.1.e
Agricultural Activities DAI – Geita Region

Ward	Villages	Main Crops	Cash Crops	Selling places
		Groundnuts		
	Nalusunguti	Maize Others Cassava Groundnuts	Cotton	Buyers come to the village or ward
	Busonzo	Maize Millet Paddy Cassava Groundnuts	Cotton	Local market (in the village or ward) Buyers come to the village or ward
	Kabagole	Maize Others Groundnuts Cassava	Cotton	Buyers come to the village or ward
	Nakayenze	Maize Cassava Others Groundnuts	Cotton	Buyers come to the village or ward We travel to the city
Butinzya	Butinzya	Maize Sorghum Paddy Cassava Groundnuts Millet	Cotton	Local market (in the village or ward) Buyers come to the village or ward
Bulega	Ibambilo	Maize Others Groundnuts Millet	Cotton	Buyers come to the village or ward
Iparamasa	Mnekezi	Others Maize Groundnuts	Cotton	Buyers come to the village or ward Local market (in the village or ward)
	Mwabasabi	Maize Paddy Millet Cassava Groundnuts	Cotton Others	Local market (in the village or ward)
	Songambele	Maize Millet Sorghum Paddy Cassava Groundnuts Others	Cotton Others	Local market (in the village or ward) Buyers come to the village or ward

Table 7.3.5.1.f
Agricultural Activities DAI – Kagera Region

Ward	Villages	Main Crops	Cash Crops	Selling places
Kihanga	Katanda	Maize Millet Groundnuts	Others	Local market (in the village or ward) Buyers come to the village or ward
	Kihanga	Maize Cassava Others	Others	Local market (in the village or ward) Buyers come to the village or ward
	Kishoju	Maize Cassava Others	Others	Local market (in the village or ward) Buyers come to the village or ward
	Mulamba	Maize	Others	Local market (in the village or ward) Buyers come to the village or ward
Kayanga	Miti	Maize	Others	Local market (in the village or ward) Buyers come to the village or ward We travel to the city
Bugene	Omurushaka	Maize Others	Others	Local market (in the village or ward) Buyers come to the village or ward
	Nyakahanga	Others Maize	Others	Local market (in the village or ward) Buyers come to the village or ward
	Kishao	Maize Others	Others	Local market (in the village or ward) Buyers come to the village or ward
Ihembe	Ihembe I	Maize	Others	Local market (in the village or ward) Buyers come to the village or ward
Nyaishozi	Rukale	Maize Others	Others	Buyers come to the village or ward/Other
	Nyakayanja	Maize Cassava Cowpeas	Others	Local market (in the village or ward) Buyers come to the village or ward We travel to the city
Rugu	Kasheshe	Maize Groundnuts Others Cassava	Others	Buyers come to the village or ward
Nyakasimbi	Nyakasimbi	Maize Millet Groundnuts	Others	We travel to the city Buyers come to the village or ward
	Bujara	Cassava	Others	Local market (in the village or

Table 7.3.5.1.f
Agricultural Activities DAI – Kagera Region

Ward	Villages	Main Crops	Cash Crops	Selling places
		Others Cowpeas Maize		ward) Buyers come to the village or ward
	Kahanga	Maize Cassava Cowpeas Others	Others	Local market (in the village or ward) Buyers come to the village or ward
	Muungano	Maize Groundnuts Cassava	Others	Buyers come to the village or ward We travel to the city
Nyakahanga	Rwandaro	Maize Cassava Groundnuts Cowpeas	Others	Local market (in the village or ward) Buyers come to the village or ward
	Bisheshe	Maize Others	Others	Local market (in the village or ward) Buyers come to the village or ward Other
Nyakahura	Nyabugombe	Maize Cassava	Others	Buyers come to the village or ward Local market (in the village or ward)
	Ngararambe	Maize Others Cassava Maize Millet Cassava Others Groundnuts	Cotton Tobacco	Local market (in the village or ward) Buyers come to the village or ward
	Busiri	Maize Others Maize Others	Sugar Cane Others Cotton	Local market (in the village or ward) Buyers come to the village or ward
	Mabare	Maize Others Millet	Cotton Others	Local market (in the village or ward) Buyers come to the village or ward
Lusahunga	Nyakanazi	Maize Cassava Others Groundnuts	Cotton Tobacco	Local market (in the village or ward) Buyers come to the village or ward
	Kabale	Maize Millet Cassava Groundnuts	Cotton	Buyers come to the village or ward Local market (in the village or ward)
	Lusahunga	Maize Groundnuts Cassava Paddy Others	Cotton Tobacco Sugar Cane Cotton	Buyers come to the village or ward Local market (in the village or ward) Buyers come to the village or

Table 7.3.5.1.f
Agricultural Activities DAI – Kagera Region

Ward	Villages	Main Crops	Cash Crops	Selling places
		Maize Millet Paddy Cassava		ward
	Kikoma	Maize Others Groundnuts Cassava	Cotton Tobacco	Local market (in the village or ward) Buyers come to the village or ward
	Nyakasenga	Maize Millet Cassava Groundnuts	Others	Local market (in the village or ward) Buyers come to the village or ward
Kaniha	Mavota	Maize Paddy Cassava Groundnuts Others Maize Millet Sorghum Paddy Cassava Groundnuts	Cotton	Buyers come to the village or ward Local market (in the village or ward) Buyers come to the village or ward
	Mkunkwa	Maize Paddy Cassava Groundnuts Maize Millet Sorghum Cassava Groundnuts Paddy	Cotton	Buyers come to the village or ward/We travel to the city Buyers come to the village or ward We travel to the city
Nyantakara	Mgera	Cassava Maize Others	Cotton	Local market (in the village or ward) Buyers come to the village or ward
	Nyantakara/Iyengamulilo	Maize Paddy Cassava Groundnuts	Cotton	Buyers come to the village or ward
	Nyakayenze	Maize Paddy Cassava Groundnuts Others Maize Cassava	Cotton Others	Buyers come to the village or ward We travel to the city We travel to the city Buyers come to the village or ward
Kasulo	Rwakalemera	Maize Others	Others	Local market (in the village or ward) Buyers come to the village or ward

Table 7.3.5.1.f
Agricultural Activities DAI – Kagera Region

Ward	Villages	Main Crops	Cash Crops	Selling places
Mutukula	Byeju	Maize Sorghum Paddy Cassava Groundnuts	Sugar Cane Others	Local market (in the village or ward)
	Mutukula	Others Maize Cassava Groundnuts	Others	Local market (in the village or ward) Buyers come to the village or ward
Kassambya	Bunazi	Maize Paddy Cassava	Sugar Cane	Local market (in the village or ward) Buyers come to the village or ward
	Nyabihanga	Maize Cassava	Others Sugar Cane	Local market (in the village or ward) Buyers come to the village or ward
	Omudongo	Maize Cassava Others	Others	Local market (in the village or ward) Buyers come to the village or ward
Nsunga	Byamutemba	Maize Paddy Cassava Others	Sugar Cane	Local market (in the village or ward) Buyers come to the village or ward We travel to the city
	Ngando	Others Maize	Sugar Cane Others	Buyers come to the village or ward Local market (in the village or ward)
Kyaka	Kyaka	Maize Cassava Others	Others	Local market (in the village or ward) Buyers come to the village or ward

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024.

The crops used for self-consumption are diverse, and are mainly composed of maize, cassava, paddy and groundnuts. The main cash crop is cotton, except for the villages in Missenyi, Ngara and Kassambya, in the region of Kagera where sugar cane is the main one. Coffee and tobacco are also important in some villages, also located in Kagera.

In most cases, their products are sold in the local markets, that belong to their own villages or wards. In second place, the most frequent situation is that buyers come to the village. In few cases farmers travel to the city, which is the option that can give them a better price.

Regarding irrigation, interviewees indicated that most farmers depend on rainfall except for the villages of Shilabela (in Shinyanga DC) and Nyakayenze (Biharamulo DC in

Kagera) that have village irrigation.

In the case of use of pesticides, interviewees pointed out that in the regions of Shinyanga and Geita, all the villages in the DAI use them, while in Kagera the majority does so (the leaders of 10 villages indicated they are not used in their area). In the case of fertilizers, only 15 of the villages indicated that they do not use them.

Table 7.3.5.1.g
Villages that do not access fertilizers and pesticides

Ward	Village	Does not use pesticides	Does not use fertilizers
Old Shinyanga	Ihapa		x
Iselamagazi	Mwamakaranga		x
Solwa	Mwasekagi	x	x
Lyabusalu	Mwajiji	x	x
	Mwabagehu	x	x
Busonzo	Nalusunguti		x
Iparamasa	Mwabasabi		x
Kihanga	Katanda	x	x
Kishoju	Kihanga	x	x
Ihembe 1	Iheme	x	x
Nyakasimbi	Nyakasimbi		x
	Muunguano	x	
Nyabugombe	Nyakahura	x	x
Lusahunga	Kabale	x	x
	Nyakasenga	x	x
Kaniha	Mkunkwa		x

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024.

The lack of access to these tools makes the farmers more vulnerable to the loss of their crops.

Plot sizes are, in most cases, between 2 and 5 ha. The exceptions are presented in the following table (**Table 7.3.5.1.h**).

Table 7.3.5.1.h
Plot sizes (out of average)

Region	District	Ward	Villages	Plot size (Ha)
Shinyanga	Shinyanga MC	Ibadakuli	Ibadakuli	1-2 ha
		Old hinyanga	Ihapa	1-2 ha
			Old Shinyanga	1-2 ha
	Shinyanga DC	Solwa	Mwiseme	6-10 ha
			Mwabuki	6-10 ha
		Mwakitolyoo	Mwasenge	6-10 ha
		Iselemagazi	Mwamakaranga	More than 11 ha
			Iselamagazi	1-2 ha
		Nyamalogo	Mwang'osha	More than 11 ha
		Mwenge	Mwongozo	More than 11 ha
		Lyabusalu	Mwajiji	6-10 ha
			Mwabagehu	6-10 ha

Table 7.3.5.1.h
Plot sizes (out of average)

Region	District	Ward	Villages	Plot size (Ha)
	Msalala	Bugarama	Igwamanoni	6-10 ha
			Ilogi	6-10 ha
			Buyange	6-10 ha
		Lunguya (Runguya)	Kalole	More than 11 ha
		Bulyan'hulu	Busulwangili	6-10 ha
Geita	Nyang'wale	Kafita	Kayenze	6-10 ha
		Nyugwa	Isonda	6-10 ha
		Bukwimba	Kasubuya	6-10 ha
	Mbogwe DC	Ikobe	Bugalagala	More than 11 ha
			Busabaga	More than 11 ha
		Ngemo	Bwendamwizo	More than 11 ha
			Bulongo	More than 11 ha
		Ushirika	Kadoke	6-10 ha
	Bukombe DC	Busonzo	Busonzo	6-10 ha
			Nakayenze	More than 11 ha
	Chato DC	Iparamasa	Mwabasabi	More than 11 ha
			Songambele	6-10 ha
Kagera	Karagwe DC	Kihanga	Kishoju	1-2 ha
		Bugene	Nyakahanga	1-2 ha
			Kishao	1-2 ha
		Nyakasimbi	Muungano	6-10 ha
	Biharamulo DC	Nyakahura	Ngararambe	6-10 ha
			Mabare	6-10 ha
		Lusahunga	Kabale	6-10 ha
			Kikoma	6-10 ha
		Kaniha	Mavota	6-10 ha
	Ngara	Kasulo	Rwakalemera	6-10 ha
	Missenyi	Mutukula	Byeju	6-10 ha
		Nsunga	Ngando	1-2 ha

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024.

There are six villages where the average size of the plots is smaller, within the range of 1-2 ha. They are in the districts of Shinyanga MC (Ibadakuli, Ihapa and Old Shinyanga villages); in Shinyanga DC (Iselemagazi village) and in Missenyi (Ngando village). These present a higher vulnerability, as their production capacity is lower.

On the other hand, there are 10 villages where, in average, the plots are of 11 ha or more. They are in the districts of Shinyanga DC (Mwamakaranga, Mwang'osha and Mwongozo villages); Msalala (Kalole village); Mbogwe (Bugalagala, Busabaga, Bwendamwizo, Bulongo villages); Bukombe DC (Nakayenze) and in Chato (Mwabasabi village).

According to the reports reviewed and the interviews done, agriculture provides jobs but does not help the farmers to overcome poverty as it generates little revenue. Problems in agriculture also negatively impact food security. These are due to a multiplicity of factors that include problems in the access to natural resources; difficulties in accessing agricultural inputs, and market access barriers.

- *Difficulties accessing natural resources*: The main problem is the dependency on rainfall, which is unpredictable and puts the farmers in a vulnerable position, especially during droughts. During the consultation process, different stakeholders indicated the scarcity of water as one of their main problems. As already mentioned, only two villages (Shilabela in Shinyanga DC and Nyakayenze in Biharamulo DC) have village irrigation. The Socioeconomic Reports and Strategic Plans emphasize the need to develop irrigation projects. The small size of the plots constitutes a barrier, as it makes the use of technology difficult due to its cost. The lack of good soils was also mentioned in Biharamulo as a factor that affected negatively the productions.
- *Access to agricultural inputs*. The districts' reports mention that farmers have difficulties accessing pesticides and fertilizers. However, in the field trip was found that in most villages these inputs are used, except for sixteen villages. This may imply a higher degree of vulnerability, as they have less tools to deal with pests. However, the use of these may impact the quality of soil and, if wrongly used, affect the farmers' health.
- *Difficulties in accessing markets*. Most selling activities take place in the same villages, and farmers do not access markets where they can receive higher prices. This is connected to the lack of accessible roads and means of transportation. The lack of market information and of credit facilities also constitute barriers. The district reports also mention as problems that farmers consider agriculture a subsistence activity, instead of a commercial one, and that farmers sell raw products with no added value.

Livestock keeping

Livestock keeping is practiced together with agriculture and is, in general terms, the second most important economic activity in the DAI as it is widely practiced. It is more important in Geita and Shinyanga, while in Kagera is practiced in a smaller scale.

According to the District Profiles, livestock keeping is the main source of income during dry seasons. It plays a crucial role in food security as it improves protein intake through meat, eggs and milk. It is particularly relevant in times of famines.

Livestock keeping is practiced both in rural and urban areas. It mainly involves indigenous cattle, as well as goats, sheep, donkeys, pigs, rabbits and chicken.

Drought is affecting livestock keeping. This activity also presents problems due to the lack of infrastructure and facilities, such as veterinary centres, slaughter slabs, abattoirs, among others.

The problems that livestock keeping faces include:

- Livestock diseases, such as foot and mouth diseases, that affect both bovine cattle and chickens.
- Inadequate supply and high cost of livestock inputs (vaccines, drugs, feed additives).
- Inadequate livestock infrastructure (dips, crashes, slaughterhouses, livestock markets, veterinary health centres, abattoirs), as either there is a lack of them, or they

remain unrepaired.
- Inadequate water supply for livestock.
- Inadequate grazing land and drought.
- Insufficient extension services and workers that can help with the control and prevention of animal diseases.
- Insufficient infrastructure for the production and commercialization of hides and skins.

Another problem is the lack of markets that function properly, understanding them both as spaces where commercial activities take place, as flow of information and processes of negotiation.

The district and regional profiles mention that livestock keeping has negative impacts on the environment such as soil erosion, deforestation, and water pollution due to overgrazing and bushfire. Given this, it is necessary to educate livestock keepers in modern methods of grazing to protect natural forests.

Livestock keeping is also linked to the migration related to the search of water and pasture. Another problem are the conflicts raised between farmers and livestock keepers for the use of land/pastures. This happens in the absence of land use plans.

In the case of the DAI, the **Table 7.3.5.1.i** below shows the livestock purpose and infrastructure accessed by each village.

Table 7.3.5.1.i
Livestock keeping Activities: DAI

Ward	Villages	Livestock Purpose	Livestock Infrastructure
Region: Shinyanga			
District: Shinyanga MC			
Mwamalili	Seseko	Meat production Milk production Self-consumption	Veterinary services Abattoirs
Ibadakuli	Uzogore	Meat production Others	Veterinary services Livestock markets
	Ibadakuli	Meat production Milk production Self-consumption	Veterinary services
Old Shinyanga	Ihapa	Meat production Milk production	Veterinary services
	Old Shinyanga	Self-consumption Milk production Meat production Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs Livestock markets Hides and skin sheds
District: Shinyanga DC			
Solwa	Mwasekagi	Meat production Milk production	Veterinary services
	Mwiseme	Meat production Milk production	Veterinary services
	Mwabuki	Meat production Milk production	Veterinary services

Table 7.3.5.1.i
Livestock keeping Activities: DAI

Ward	Villages	Livestock Purpose	Livestock Infrastructure
Mwakitolyoo	Mwasenge	Meat production Milk production	None
	Nyang'ombe	Meat production Milk production	Veterinary services
Iselemagazi	Mwamakaranga	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	None
	Ichongo	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services
	Iselamagazi	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs Hides and skin sheds Livestock markets
Nyamalogo	Mwang'osha	Meat production Milk production	Veterinary services
Mwenge	Mwongozo	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs Hides and skin sheds Livestock markets
	Zunzuli	Meat production Milk production	Veterinary services
	Ipango	Meat production Milk production Self-consumption	Veterinary services
Lyabusalu	Mwajiji	Meat production Milk production Self-consumption	Veterinary services
	Lyabusalu	Meat production Milk production	Veterinary services
	Bukamba	Meat production Milk production	Veterinary services
	Mwabagehu	Meat production Milk production	Veterinary services
District: Msalala			
Bugarama	Igwamanoni	Meat production Milk production Self-consumption	None
	Ilogi	Meat production Milk production	Livestock markets
	Buyange	Meat production Milk production	Veterinary services Livestock markets
Lunguya (Runguya)	Kalole	Meat production Milk production Self-consumption Produce and sell yogurt	Veterinary Services Abattoirs Hides and skin sheds Livestock markets

Table 7.3.5.1.i
Livestock keeping Activities: DAI

Ward	Villages	Livestock Purpose	Livestock Infrastructure
		Produce and sell leather	
Bulyan'hulu	Busulwangili	Self-consumption Milk production	Veterinary services Abattoirs
Region: Geita			
District: Geita DC			
Butobela	Shahende	Self-consumption Meat production	None
District: Nyang'hwale			
Kafita	Kayenze	Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services
	Bukulu	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs Livestock markets
Nyugwa	Isonda	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Livestock markets
Bukwimba	Kasubuya	Meat production Milk production	Veterinary services
	Bukwimba	Meat production Milk production	Veterinary services
District: Mbogwe DC			
Ikobe	Kagongo	Self-consumption Meat production Milk production	None
	Bugalagala	Self-consumption Meat production Milk production	None
	Busabaga	Self-consumption Meat production Milk production	None
Lulembela	Kashelo	Self-consumption Meat production Milk production	Veterinary services Abattoirs Livestock markets
Ilolangulu	Ilolangulu	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather Others	Veterinary services Abattoirs Hides and skin sheds Livestock markets
Mbogwe	Nambubi	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs
	Bwendanseko	Meat production Milk production	None

Table 7.3.5.1.i
Livestock keeping Activities: DAI

Ward	Villages	Livestock Purpose	Livestock Infrastructure
		Self-consumption Produce and sell yogurt Others	
	Mwanza	Self-consumption	Veterinary services
Ngemo	Nyitundu	Meat production Milk production Self-consumption	Veterinary services
	Bwendamwizo	Self-consumption Meat production Milk production	None
	Bulongo	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather Others	Veterinary services Livestock markets
Ushirika	Kadoke	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services
District: Bukombe DC			
Busonzo	Nampalahala	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services
	Nalusunguti	Meat production Milk production Self-consumption	None
	Busonzo	Meat production Milk production Self-consumption Produce and sell yogurt	Veterinary services Hides and skin sheds Livestock markets
	Kabagole	Self-consumption Meat production Milk production	None
	Nakayenze	Self-consumption Milk production Meat production	None
Butinzya	Butinzya	Meat production Milk production Self-consumption Produce and sell leather Produce and sell yogurt	Veterinary services Livestock markets Hides and skin sheds
Bulega	Ibambilo	Self-consumption Milk production Meat production	None
District: Chato DC			
Iparamasa	Mnekezi	Meat production Milk production Self-consumption	None

Table 7.3.5.1.i
Livestock keeping Activities: DAI

Ward	Villages	Livestock Purpose	Livestock Infrastructure
	Mwabasabi	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Livestock markets
	Songambele	Meat production Milk production Self-consumption Produce and sell yogurt	Veterinary services Abattoirs Livestock markets
Region: Kagera			
District: Karagwe DC			
Kihanga	Katanda	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	None
	Kihanga	Meat production Milk production Self-consumption	Veterinary services
	Kishoju	Milk production Self-consumption Meat production Produce and sell yogurt Produce and sell leather	Veterinary services Livestock Markets
	Mulamba	Meat production Milk production Self-consumption	None
Kayanga	Miti	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs Hides and skin sheds Livestock markets
Bugene	Omurushaka	Meat production Milk production Self-consumption	Veterinary services Abattoirs
	Kishao	Meat production Milk production Self-consumption	None
Ihembe	Ihembe I	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs Livestock markets
Nyaishozi	Rukale	Meat production Milk production Self-consumption	None
	Nyakayanja	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Livestock markets
Rugu	Kasheshe	Meat production	None

Table 7.3.5.1.i
Livestock keeping Activities: DAI

Ward	Villages	Livestock Purpose	Livestock Infrastructure
		Milk production Self-consumption	
Nyakasimbi	Nyakasimbi	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs Livestock markets Hides and skin sheds
	Bujara	Meat production Milk production Self-consumption	None
	Kahanga	Meat production Milk production Self-consumption	None
	Muungano	Meat production Milk production Produce and sell yogurt Self-consumption Produce and sell leather	Veterinary services
Nyakahanga	Rwandaro	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Livestock markets
	Bisheshe	Meat production Milk production Self-consumption	Veterinary services Livestock markets
District: Biharamulo DC			
Nyakahura	Nyabugombe	Meat production Milk production Self-consumption	None
	Ngararambe	Meat production Milk production Self-consumption	Veterinary services
	Busiri	Meat production Milk production Self-consumption	Abattoirs
	Mabare	Meat production Milk production Self-consumption	None
Lusahunga	Nyakanazi	Meat production Milk production Self-consumption	Veterinary services Abattoirs
	Kabale	Milk production Meat production Produce and sell yogurt Self-consumption Produce and sell leather Others	Livestock markets
	Lusahunga	Meat production Milk production Self-consumption	Veterinary services Abattoirs Livestock markets
	Kikoma	Meat production	Veterinary services

Table 7.3.5.1.i
Livestock keeping Activities: DAI

Ward	Villages	Livestock Purpose	Livestock Infrastructure
		Milk production Self-consumption	
	Nyakasenga	Meat production Milk production Self-consumption Produce and sell yogurt	Veterinary services Abattoirs Livestock markets
Kaniha	Mavota	Meat production Milk production Self-consumption	Veterinary services Livestock markets
	Mkunkwa	Self-consumption Milk production Meat production	Veterinary services
Nyantakara	Mgera	Meat production Milk production Self-consumption	None
	Nyantakara/Iyengamulilo	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Abattoirs
	Nyakayenze	Meat production Milk production Self-consumption	Veterinary services Abattoirs Livestock markets
District: Ngara			
Kasulo	Rwakalemera	Meat production Milk production Self-consumption	Veterinary services Abattoirs
District: Missenyi			
Mutukula	Byeju	Meat production Milk production Self-consumption Produce and sell yogurt Produce and sell leather	Veterinary services Livestock markets
	Mutukula	Milk production Self-consumption Meat production	Veterinary services Abattoirs
	Nyabihanga	Meat production Milk production Self-consumption Produce and sell yogurt	Veterinary services Abattoirs Livestock markets
Nsunga	Byamutemba	Meat production Milk production Produce and sell yogurt	Veterinary services Livestock markets
	Ngando	Self-consumption Milk production Meat production	None
Kyaka	Kyaka	Milk production Self-consumption	Veterinary services

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024.

Most villages produce milk and meat and sell them. In many cases it is also used for self-consumption. In a few ones they go further and generate other products, such as yogurt and leather. Other products, like cheese, were not mentioned.

The most common services are veterinary services, that were mentioned by 63 villages. 31 indicated that they have livestock markets; 24 mentioned they have abattoirs, and 9 hide and skin sheds. 25 villages indicated that they do not have any services.

The cattle provide milk, meat, and manure, they are also used for transportation and for farming, which are essential for their livelihood. Livestock keeping offers resilience. When crops fail due to unexpected weather, their animals can still provide sustenance and income. The challenges they are facing are thelack of grazing grounds, animals' diseases and lack of extension facilities.

Seasonality of livelihoods in the project area

Table 7.3.5.1.j shows the seasonal calendar for Shinyanga and Geita regions, according to gender. The calendars for these regions are the same Kagera is different since it has rain throughout the year and two seasons of farming.

Table 7.3.5.1.j
Seasonal calendar for the regions of Shinyanga and Geita according to gender

Month	Main Activities by gender		Other Activities		Remarks	Action
	Male	Female	Male	Female		
October	Farming/ planting	Farming/ planting	Access to grazing areas, market, charcoal-making.	Access to water sources, grazing areas, firewood, market, social amenities such as education and health facilities, charcoal-making.	With active construction activities on site, access to these services is likely to be affected.	Engage impacted communities, define all the potential access paths before construction starts, establish temporal crossings (if necessary) and community safety awareness during construction.
November	Weeding	Weeding	As above	Vegetable harvesting and drying.	As above	As above
December	Farming	Farming	As above	Farming	As above	As above
January	Farming	Vegetable harvesting and drying.	As above	Vegetable harvesting and drying.	As above	As above

Table 7.3.5.1.j
Seasonal calendar for the regions of Shinyanga and Geita according to gender

Month	Main Activities by gender		Other Activities		Remarks	Action
	Male	Female	Male	Female		
February	Weeding paddy	Weeding paddy	farming potatoes.	Vegetable harvesting and drying	As above	As above
March	Watching birds in the paddy	Watching birds in the paddy			As above	As above
April	Watching birds in the paddy	Watching birds in the paddy		Sweet potatoes harvesting and drying.	As above	As above
May	Harvesting	Harvesting	Crops storing	Crops storing	As above	As above
June	Harvesting	Harvesting	Crops Storing	Crops Storing	As above	As above
July			Selling of crops/leisure	Firewood collection/leisure	As above	As above
August			Selling of crops/leisure	Firewood collection/leisure/ Traditional rituals	As above	As above
September	Preparations of farms.	Preparations of farms.	Leisure/Traditional rituals	Leisure/ Traditional rituals	As above	As above

Source: Meeting with different villages in the project areas October and November 2024

The following is the season calendar for Kagera region. Kagera, unlike Shinyanga and Geita, does have enough rain throughout the year and furthermore they do have permanent crops such as coffee, banana, sugarcane and timber. Below is their season calendar.

Table 7.3.5.1.k
Seasonal calendar for the region of Kagera

Month	Main Activities by gender		Other Activities		Remarks	Action
	Male	Female	Male	Female		
July to August	Farming preparations /planting	Farming preparations /plating	Access to grazing areas, business.	Access to water sources, grazing areas, firewood, market, social amenities such as education and health facilities.	With active construction activities on site, access to these services is likely to be affected.	Engage impacted communities, define all the potential access paths before construction starts, establish temporal crossings (if necessary) and community safety awareness during construction.
September	Weeding	Weeding	As above	Picking coffee	As above	As above

Table 7.3.5.1.k
Seasonal calendar for the region of Kagera

Month	Main Activities by gender		Other Activities		Remarks	Action
	Male	Female	Male	Female		
				and business		
October	Farming	Farming	As above	Farming	As above	As above
December	Harvesting	Harvesting	As above	Harvesting	As above	As above
January	Farming preparations /planting	Farming preparations /planting	Farming preparations /planting		As above	As above
February/March	Weeding	Weeding	Weeding	Weeding	As above	As above
April	Farming	Farming	Farming	Farming	As above	As above
May	Harvesting	Harvesting	Crops storing	Crops storing	As above	As above
June	Harvesting	Harvesting	Crops Storing	Crops Storing	As above	As above
July	Picking coffee	Picking coffee	Selling of crops/leisure	Picking coffee	As above	As above
August	Picking coffee	Picking coffee	Selling of crops	Picking coffee	As above	As above
September	Preparations of farms	Preparations of farms	Leisure	Picking coffee	As above	As above

Source: Meeting with different villages in the project areas October and November 2024

Industries

During the fieldwork, these large industries were identified in the villages that are part of the area of influence:

- Shinyanga: Kubani Company (coffee) Matunda Mema (processing fruits) (Shinyanga Municipal),
- Kagera: Kagera Sugar (Missenyi District), Kahama Fresh (oil processing, milk) (Karagwe District).
- Geita: Isonda Gold mining (Geita – Nyang'hwale District), Sojem Investment (refining minerals) (Katoro, Geita).

Kagera region presents a larger number of industries, which may imply that have better economic conditions for their inhabitants. The industries are related to mining and food industries.

Mining

Mining is practiced in the three regions. It mainly consists of small-scale mining. The types of minerals extracted are mainly gold and building materials, such as sand and gravel. It is generally done through underground pits and in some cases the mines use open pits, with few shallow pits. Mining is a relatively recent activity in these regions. In Geita, the officers mentioned that it started between 1970s and 1980s. **Table 7.3.5.1.f** presents the villages where mining activities take place in the DAI, according to the findings of the fieldwork.

Table 7.3.5.1.l
Mining Activities: DAI

Region	District	Ward	Villages	Type of mining	Mine products	Perceived benefits for villages	Perceived problems for villages
Shinyanga	Shinyanga MC	Ibadakuli	Uzogore	Artisanal	Gold	Employment	Increase of prices
		Old Shinyanga	Old Shinyanga		Diamonds	Employment	
	Shinyanga DC	Mwakitolyoo	Nyang'ombe	Artisanal	Gold	Increase of income.	Increase of prices
		Mwenge	Mwongozo	Artisanal Medium Scale	Tin	Employment	
	Msalala	Bugarama	Igwamanoni	Artisanal		Employment	Increase of prices
			Buyange	Artisanal	Gold	Employment	
		Lunguya (Runguya)	Kalole	Artisanal	Tin	Employment	
		Bulyan'hulu	Busulwangili	Artisanal	Gold	Employment	Increase of prices
Geita	Nyang'hwale	Kafita	Kayenze	Artisanal Medium Scale	Tin	Employment	
			Bukulu	Artisanal Medium Scale	Gold		
		Nyugwa	Isonda	Artisanal Medium Scale Large Scale		Employment	
		Bukwimba	Kasubuya	Artisanal	Gold	Employment	Increase of prices
	Mbogwe DC	Lulembela	Kashelo	Artisanal Medium Scale	Tin	Employment	Increase of prices
		Ngemo	Nyitundu	Artisanal	Gold	Employment	Increase of prices
	Bukombe DC		Busonzo		Gold		
	Chato DC	Iparamasa	Songambele		Gold		
Kagera	Karagwe DC	Kihanga	Katanda		Gold		
		Kayanga	Miti		Diamonds		
		Nyakahanga	Bisheshe	Artisanal	Diamonds	Employment	Increase of prices
	Biharamulo DC	Nyakahura	Ngararambe	Artisanal Medium Scale	Gold	Employment	Increase of prices
			Busiri	Artisanal Medium Scale Large Scale	Gold	Employment	Increase of prices
		Lusahunga	Kikoma	Artisanal	Gold	Employment	Increase of prices
		Kaniha	Mavota	Large Scale	Tin		
			Mkunkwa	Large Scale	Tin		

Table 7.3.5.1.l
Mining Activities: DAI

Region	District	Ward	Villages	Type of mining	Mine products	Perceived benefits for villages	Perceived problems for villages
		Nyantakara	Nyantakara/Iyengamulilo		Diamonds		
			Nyakayenze		Diamonds		
	Missenyi	Mutukula	Byeju		Diamonds		
		Kassambya	Nyabihanga		Diamonds		
		Nsunga	Byamutemba		Diamonds		
			Ngando	Artisanal	Gold		Increase of prices

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024

Mining activities take place in 30 villages of the DAI, which belong to 10 districts. 8 are in Shinyanga, 8 in Geita, and 14 in Kagera. Most of them have artisanal mining, with the exception of the two villages located in Kaniha ward (Biharamulo DC), where only large-scale mining takes place. Medium scale mining is only present in seven villages.

The scales of mining are defined in the Mining Act. It states that small-scale mining is characterized by minimal machinery or technology and an initial capital that does not exceed US$ 5 million dollars; medium scale mining does not exceed US$ 100 million, while large scale is not less than US$ 100 million.

In the DAI, most common metal is gold, which is extracted in 14 villages. In second place are diamonds, that are extracted in 8 villages, and in 6 of them they exploit tin.

Villages where the mining activities take place were recently created, after the introduction of mining activities, initiating with the installation of mining camps, which evolved into villages. Therefore, most mining activities are performed within the villages. However, the mining policy requires that the mining operations should be conducted at least 200 meters away from people's residences. Residents of the villages work on the mines; hence, they do not consider that this activity creates impacts that affect them. Usually, these villages are registered under the land laws and local government authorities.

Mining involves different actors, concretely: the landowner, the license owner, the investor (operator of the shaft) and the different workers. When resettlements happen, the one that is paid is the landowner, and the other ones (despite the investments made by them) are not.

The land tenure in most cases is through customary laws of occupancy. The landowner usually makes leases to the miner's operators. In most cases, the mining camps are owned by the small-scale miners themselves. These are the ones who construct the mining camps to facilitate mining activities. However, some small-scale miners rent the camps from those who own them.

Remuneration for the mining workers is done in-kind. What is produced is shared in terms of percentages divided between the license owner, landowner, workers, government levies, and mining inspector. The distribution is as follows in small-scale mining:

- 7% is given to the government as a government levy,
- 1% is given to the mining inspector,
- 34% is given to the license owner,
- 20% is given to the workers, and
- 45% is given to the landowner.

Miners are afraid of committing themselves to pay salaries to their workers to avoid the risk of incurring costs because the mining activities performed are trial and error due to a lack of mining knowledge. Therefore, the investment risk is shared amongst the investor (the one owning a license) and the workers. Hence, payment is made depending on what

is obtained.

Mining is a predominantly male activity, although women also participate in it. Women work in mining activities as owners, investors and service providers. Although they are not allowed to engage directly in mining activities, due to traditional belief systems, women are involved in other activities such as reducing the size of the stones and sending them to the crusher. They are also involved in the amalgamation process of minerals. Mostly, women are involved in surface work and not in underground work. They are paid based on the work they perform. Some women are facing challenges such as a lack of safety gear to protect them from the danger of or risk of mercury.

Mining also generates child work. Mining Officers, in general, emphasized that children do not directly work in mining, as they are strictly prohibited from engaging in mining activities and there are mining inspectors who are responsible for making sure that the prohibition is rigorously enforced. However, one NGO interviewed mentioned that there is a problem of child trafficking to make them work in mines. Most children (specifically boys) engage in providing different services such as selling bites, beverages, and cigarettes. Some are accompanied by their parents and obliged to assist them in small activities such as washing dishes and the sale of beverages to the miners. These are mainly poor, vulnerable women.

Small-scale miners face different challenges:

- Lack of technical know-how about identification of the existence of mining in the specific area.
- Shortage of electricity in their mining operations, instead they are using diesel to operate their very costly mining equipment.
- Accidents, due to non-compliance with safe mining procedures.
- Use of mercury which is dangerous for their health.
- Lack of investment capital.
- Lack of soft loans.
- Lack of modern mining equipment and tools.
- Uses of traditional beliefs (witchcraft) to identify the minerals.
- Poor infrastructure facilities such as roads in the mining areas.

Negatively, the mining activities have the following impact:

- Overpopulation as it attracts immigration.
- Increasing cost of living for the villages.
- Environmental pollution.
- Marriage conflicts caused by mining activities, and
- Abandonment of children.

In general, the benefits perceived by the members of the villages are economic: employment and an increase of their income. The problems perceived by them include overpopulation, as mining attracts immigration; environmental pollution; increasing costs of living, as mining activities increase prices of goods and services, affecting the

population in general and not only those involved in the mining activities. Also, if mining operations do not follow proper procedures such as blasting, they may cause problems.

The influx of people in the villages attracted by mining creates pressure on the available social services (e.g. education, and health services) and cultural distortions, due to high interaction between migrants and local populations.

The presence of this activity will make the land acquisition process more complex, as this activity may be impacted, affecting an important livelihood and increasing the price of land.

Producers' organizations

In the case of the indirect area of influence, producers' organizations were only mentioned in the reports of Shinyanga MC and Mbogwe. These reports emphasize that these organizations can be important as part of a poverty-alleviation strategy, but that they have little participation and resources.

Producers are organized in SACCOS (Savings and Credits Cooperative Societies), that are microfinance cooperatives. There are also specific cooperatives, linked to the specific economic activities: agriculture cooperatives, livestock cooperatives and mining cooperatives.

Kagera Region:

- Kagera Cooperative Union (KCU): KCU is a voluntary association of 125 primary cooperative societies representing over 60,000 small farmers of the namely robusta coffee in Kagera region. Each primary society is owned by about 500 small coffee producers.

Geita Region:

- Geita Cooperative Union LTD (GCU): GCU is a major cooperative operating in Geita region. It is made up of different AMCOS located both in Geita Urban Districts and Geita Rural. It has a total membership of about 13247 members, including 9514 men and 3733 women. Its primary crop is cotton, although there are other mixed crops such as lentils, sunflowers, and paddy.

Shinyanga Region:

- Shinyanga region has several savings and cooperative groups. There are 60 SACCOS, 3 livestock cooperatives, 8 agricultural/crops cooperatives, and one mining cooperative.

7.3.5.2
Economically Active Population

Table 7.3.5.2.a presents information on the economically active population of the IAI. This information is only available for the IAI.

Table 7.3.5.2.a
Economically active population by gender

Area	Total	Female		Male	
		Number	%	Number	%
Shinyanga Region	961,109	495,033	51.5%	466,076	48.5%
Districts	264,293	131,025	49.6%	133,267	50.4%
Shinyanga Municipal	104,991	49,570	47.2%	55,420	52.8%
Msalala	159,302	81,455	51.1%	77,847	48.9%
Geita Region	1,205,145	624,331	51.8%	580,814	48.2%
Districts	1,037,673	539,187	52%	498,486	48%
Geita	415,017	216,111	52%	198,906	48%
Nyang'wale	90,364	44,746	49.6%	45,618	50.4%
Mbogwe	146,463	75,434	51.5%	71,029	48.5%
Bukombe	158,300	83,164	52.5%	75,136	47.5%
Chato	227,529	119,732	52.6%	107,797	47.4%
Kagera region	1,275,459	664,685	52.1%	610,774	47.9%
Districts	605,027	317,783	52.5%	287,244	47.5%
Karagwe	169,866	86,397	50.9%	83,469	49.1%
Biharamulo	170,896	90,163	52.8%	80,733	47.2%
Ngara	152,991	84,727	55.4%	68,264	44.6%
Misenyi	111,274	56,496	50.8%	54,778	49.2%

Elaboration: JGP/BENE Consult. Source: Census Report, 2022.

Men and women have a close participation in the economic realm. That is, they have been working or looking for jobs recently. In most districts, women's participation is higher. These districts are: Msalala, Geita, Mbogwe, Bukombe, Chato, Karagwe, Biharamulo, Ngara and Missenyi. The districts where men's participation is higher are: Shinyanga Municipal and Nyang'wale. This is different from what is usually found, as men tend to be more active in productive roles while women are more focused on the reproductive ones, taking care of the children and homes. The most notorious case is Ngara, where women represent 55.4% of the Economically Active Population and men only 44.6%. In the rest the difference is shorter. This uncommon situation may be due to different reasons, one is that women are slightly larger population; a second reason may be the migration of men to other areas where they can find better jobs, and a third one is that this data could be reflecting the impact of HIV/AIDS that has affected men in productive years.

7.3.6
Natural Resources / Provision of Ecosystem Services

7.3.6.1
Land

Land, together with water, is the most valued natural resource as the livelihood of the population depends on it. It is particularly important to understand how it is used and how property is handled, as one of the main impacts of the project will be the displacement due to land acquisition and the establishment of the wayleave. During the conversations kept with stakeholders in the first field trip, the representatives of the local and regional governments emphasized the importance of properly dealing with land and assets' compensations. During the consultations with the villages, the participants expressed their concern on how land will be affected by the Project and on the necessity of receiving fair and on-time compensation.

Land use

Mainland uses include agriculture, forestry, housing, and mining. The following table presents information on the land used for forestry and agriculture that are within the T-line wayleave (52 mt wide). The other uses include structures and mining.

The T-line will use a total of 2,862.65 ha. Of those, 1,149.27 ha (304.12 ha in Kagera, 423.6 in Geita and 421.55 in Shinyanga) are destined to annual crops; 80.67 to perennial crops (78.21 ha in Kagera and 2.46 ha in Geita) and 48.88 to forestry (46.24 in Kagera, 2.6 in Geita and 0.04 in Shinyanga).

Table 7.3.6.1.a
Agricultural land affected by the T-line Wayleave (52m wide)

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
Outside of Tanzania	TL Mutukula - Kyaka	Outside of Tanzania (i.e., Uganda)	-	0.95	0.00	Outside of Tanzania (i.e., Uganda)	-	0.95	0.00
Kagera	TL Mutukula – Kyaka (31.01 km)	Missenyi DC	70.38	34.00	11.54	Bunazi	3.59	1.85	1.43
						Byamutemba	12.19	2.30	2.80
						Byeju	13.49	9.28	1.85
						Mutukula	8.61	2.41	2.92
						Ngando	15.27	13.09	0.65
						Nyabihanga	3.74	1.03	-
						Omudongo	8.58	4.05	0.82
	Kyaka Substation Existing area: 1.14 ha Expanded: 8.65 ha					Kyaka	3.77	-	1.06
						No Information	1.14	-	-
	TL Kyaka – Nyakanazi (235.65 km)	Biharamulo DC	106.35	2.43	10.08	Kabale	7.89	-	0.45
						Kikoma	21.13	-	3.35
						Lusahunga	12.50	-	0.49
						Mabare	6.16	-	2.32
						Ngararambe	12.98	-	2.27
						Nyabugombe	25.30	2.43	0.94
						Nyakasenga	9.63	-	0.25
						Rugese	10.75	-	-
		Karagwe DC	29.51	37.28	19.88	Bisheshe	0.46	7.94	2.68
						Bujara	1.11	1.53	1.09
						Bujuruga	-	0.85	-
						Chagati	1.50	1.95	2.95
						Ihembe I	-	1.57	-
						Kahanga	2.50	1.46	-
						Kasheshe	3.66	2.43	0.67
						Katanda	-	-	0.69
						Kishao	1.30	0.55	2.23

Table 7.3.6.1.a
Agricultural land affected by the T-line Wayleave (52m wide)

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
						Kishoju	1.00	-	1.13
						Miti	6.36	4.69	2.74
						Nyakahanga	-	-	0.22
						Nyakasimbi	3.90	-	4.53
						Nyakayanja	5.80	10.16	0.29
						Rukale	0.60	-	64
						Rwandaro	1.32	-	-
		Missenyi DC	13.29	3.55	2.75	Kyaka	13.29	3.55	2.75
		Ngara DC	8.33	-	-	Rwakalemera	8.33	-	-
	TL Nyakanazi – Ibadakuli (282.25 km)	Biharamulo DC	76.26	-	1.98	Kabale	4.23	-	0.20
						Mavota	26.89	-	-
						Mgera	12.43	-	-
						Mkunkwa	7.68	-	-
						Nyakanazi	3.96	-	-
						Nyakayenze	5.42	-	1.78
						Nyantakara/Iyengamulilo	15.65	-	-
Geita		Bukombe DC	117.49	0.27	2.47	Bulega	27.98	-	-
						Busonzo	6.02	-	-
						Butinzya	26.74	-	1.93
						Ibambilo	18.60	0.27	-
						Kabagole	9.64	-	-
						Nakayenze	13.47	-	-
						Nalusunguti	4.16	-	-
						Nampalahala	10.88	-	0.54
		Chato DC	34.36	-	-	Mnekezi	17.52	-	-
						Mwabasabi	2.40	-	-
						Songambele	14.44	-	-
		Geita DC	23.39	-	-	Ntono	14.06	-	-
						Shahende	9.33	-	-

Table 7.3.6.1.a
Agricultural land affected by the T-line Wayleave (52m wide)

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
		Mbogwe DC	170.90	2.19	0.13	Bugalagala	28.61	0.19	-
						Bulongo	15.38	-	-
						Busabaga	6.54	-	-
						Bwendamwizo	6.54	-	-
						Bwendanseko	13.09	1.85	-
						Ilolangulu	17.52	-	-
						Kadoke	11.29	-	-
						Kagongo	16.44	-	-
						Kashelo	13.79	0.15	0.13
						Mwanza	11.00	-	-
						Nambubi	13.76	-	-
						Nyitundu	16.93	-	-
		Nyang'wale DC	77.46	-	-	Bukulu	3.79	-	-
						Bukwimba	2.34	-	-
						Igeka	2.28	-	-
						Isonda	28.25	-	-
						Kasubuya	13.50	-	-
						Kayenze	27.30	-	-
Shinyanga	Ibadakuli Substation Expanded:12.2 ha	Shinyanga MC	2.17	-	-	Ibadakuli	2.17	-	-
	TL Nyakanazi – Ibadakuli (282.25 km)	Msalala DC	80.47	-	-	Busulwangili	6.83	-	-
						Buyange	13.42	-	-
						Igwamanoni	27.63	-	-
						Ilogi	30.29	-	-
						Kalole	2.30	-	-
		Shinyanga DC	283.34	-	-	Bukamba	11.40	-	-
						Ichongo	12.79	-	-
						Ipango	10.45	-	-
						Iselamagazi	17.77	-	-

Table 7.3.6.1.a
Agricultural land affected by the T-line Wayleave (52m wide)

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
						Lyabusalu	5.36	-	-
						Mwabagehu	21.13	-	-
						Mwabuki	17.81	-	-
						Mwajiji	18.18	-	-
						Mwamakaranga	18.83	-	-
						Mwang'osha	26.73	-	-
						Mwasekagi	15.15	-	-
						Mwasenge	19.66	-	-
						Mwiseme	3.63	-	-
						Mwongozo	15.02	-	-
						Nyang'ombe	0.51	-	-
						Nzoza	22.60	-	-
						Pandagichiza	5.31	-	-
						Shilabela	12.13	-	-
						Solwa	10.88	-	-
						Zunzuli	18.01	-	-
		Shinyanga MC	55.57	-	0.04	Ibadakuli	8.27	-	-
						Ihapa	1.99	-	-
						Old Shinyanga	21.53	-	-
						Seseko	17.15	-	0.04
						Uzogore	6.64	-	-
Grand Total			**1,149.27**	**80.67**	**48.88**		**1,149.27**	**80.67**	**48.88**

Elaboration: JGP/BENE Consult, 2023. UTIP 400 kV ESIA. Source: satellite images (Google EARTH). . ESIA Land Occupation and Cover Map.

Land tenure in the Area of Influence

One of the main characteristics is that land, in the area of influence of the project, is most commonly owned under customary rights. However, the situation of land and housing ownership is not homogeneous and persons with title deeds as well as others with no recognizable rights can also be found. Renting exists but is an uncommon situation.

Regarding the types of ownership, there is general land, village land and reserve land. Productive land falls under village land. Village land is managed by the Village Councils on behalf of the President of Tanzania. Reserve land is managed by the authority responsible for its use (such as Tanzania Forest Service or TANROADS). General land is the land that is neither village nor reserve, including urban areas. It is managed by Commissioner for Lands on behalf of the President.

According to the 2022 Census, 38.8% of Tanzania Mainland rural population, aged 15 years and above, own land. The proportion of women owning land (35.7%) is lower than men (42.3%). 59.6% of rural population do not own land, 56.2% of men are in this situation and 62.7% of women. Of those who own land, 53.5% own it jointly. In the case of women, this situation is more common (60.6%) than in the case of men (47.1%). This implies that, in the case of men, the majority owns land on its own, and in the case of women most have a jointly ownership. In the case of Shinyanga Region, 27.6% owns land; in Geita 24.8% and in Kagera 43.3%. Of those who own land in rural areas, 59.6% do not have any legal documents. 32.4% of women in rural areas who own land jointly do have legal documents, compared to 24.8% of men in the same situation. In Kagera 43.3% do possess a title deed, while in Shinyanga 27.6% also have title deeds and in Geita 24.8%. The difference between Kagera and the other two regions is notorious.

Regarding households that own the houses where they live, according to the 2022 Census, 75.8% of the households in Tanzania Mainland in rural areas own them, 9.6% rent them privately and 5.7% live in it without paying any rent. In the case of title deeds, only 5% of the population of the rural area have them for the houses where they live, 42% have customary ownership, 10.8% has an official document from Mtaa/Kijiji/Shehia and 36.6% has no legal right. In the case of Shinyanga Region 8.0% has title deed, 7.0% a letter of offer or acknowledgment of payment, 34.7% customary ownership, 15.3% an official document from Mtaa/Kijiji/Shehia and 29% has no legal right. In the case of Kagera, 4.2% has a title deed, 4.9% a letter of offer or acknowledgment of payment, 49.5% customary ownership, 4.9% has a contract, 4.5% an official document from Mtaa/Kijiji/Shehia and 31.6% has no legal right. In Geita, 7.5% has title deed, 6.7% a letter of offer or acknowledgment of payment, 22.7% customary ownership, 6.4% has a contract, 36.3% an official document from Mtaa/Kijiji/Shehia and 19.7% has no legal right. In this case, the difference between Geita and the rest of the regions is notorious, with a lower percentage of population with no legal rights. It is important to note that in the case of the regional information it includes both rural and urban areas.

From what has been found during the fieldtrip, most common type of land ownership in the DAI is under customary right. In some cases, interviewees mentioned that members of the community have title deeds and also that they do not have titles, as can be seen in **Table 7.3.6.1.b**.

Table 7.3.6.1.b
Land tenure – Direct Area of Influence

Ward	Villages	Land Ownership	Demarcation	Land Conflicts	Reason of conflicts
Region: Shinyanga					
District: Shinyanga MC					
Mwamalili	Seseko	Customary right Title deeds	Yes, all of them	No	
Ibadakuli	Uzogore	Customary right	Some of them	Yes	Boundaries between two owners
	Ibadakuli	Customary right Title deeds	Some of them	No	
Old Shinyanga	Ihapa	Customary right	Yes, all of them	Yes	Lack of fair compensation
	Old Shinyanga	Customary right Don't have title	Yes, all of them	Yes	Unclear information
District: Shinyanga DC					
Solwa	Mwasekagi	Customary right	Yes, all of them	No	
	Mwiseme	Customary right	Yes, all of them	Yes	Boundary conflict between the village and Solwa village
	Mwabuki	Don't have title	Yes, all of them	No	
Mwakitolyoo	Mwasenge	Customary right	Some of them	No	
	Nyang'ombe	Customary right	Some of them	No	
Iselemagazi	Mwamakaranga	Customary right	None of them	Yes	Geita and - Shinyanga, said they are owner of the village.
	Ichongo	Customary right	None of them	No	
	Iselamagazi	Customary right	Some of them	No	
Nyamalogo	Mwang'osha	Customary right	Yes, all of them	Yes	Family conflicts
Pandagichiza	Shilabela	Customary right	Yes, all of them	Yes	Forgery in selling land Fighting for places to feed livestock
Mwenge	Mwongozo	Customary right	None of them	Yes	Unclear demarcation
	Zunzuli	Customary right	Yes, all of them	Yes	Unclear demarcation of the farms
	Ipango	Customary right	Some of them	No	
Lyabusalu	Mwajiji	Customary right	None of them	Yes	Lack of selling contract between buyer and land seller
	Lyabusalu	Customary right	Yes, all of them	No	
	Bukamba	Customary right	Yes, all of them	Yes	Inheritance issues
	Mwabagehu	Customary right	Yes, all of them	Yes	Boundary conflicts, inheritance issues
District: Msalala					
Bugarama	Igwamanoni	Don't have title	Yes, all of them	Yes	Inheritance issues
	Ilogi	Don't have title	Yes, all of them	Yes	Boundaries Inheritance
	Buyange	Don't have title	Yes, all of them	Yes	Boundaries
Lunguya (Runguya)	Kalole	Customary right Title deeds	None of them	No	
Bulyan'hulu	Busulwangili	Customary right	Yes, all of them	Yes	Misunderstanding between buyer and seller
Region: Geita					
District: Geita DC					
Butobela	Shahende	Customary right Title deeds	None of them	No	

Table 7.3.6.1.b
Land tenure – Direct Area of Influence

Ward	Villages	Land Ownership	Demarcation	Land Conflicts	Reason of conflicts
District: Nyang'hwale					
Kafita	Kayenze	Don't have title	None of them	Yes	Boundaries
	Bukulu	Customary right	Yes, all of them	Yes	Interactions in demarcation
Nyugwa	Isonda	Customary right	Yes, all of them	Yes	Mining activities and demarcation
Bukwimba	Kasubuya	Customary right	Yes, all of them	Yes	Unclear demarcation and immigration
	Bukwimba	Don't have title	Yes, all of them	Yes	Inheritance
District: Mbogwe DC					
Ikobe	Kagongo	Don't have title	Yes, all of them	Yes	Inheritance, boundaries, forgery
	Bugalagala	Customary right	Yes, all of them	No	
	Busabaga	Don't have title	Yes, all of them	Yes	Boundaries
Lulembela	Kashelo	Customary right	Yes, all of them	Yes	Boundaries
Ilolangulu	Ilolangulu	Customary right	None of them	No	
Mbogwe	Nambubi	Customary right	None of them	No	
	Bwendanseko	Customary right	Yes, all of them	No	
	Mwanza	Customary right	Yes, all of them	No	
Ngemo	4Nyitundu	Customary right	None of them	Yes	Interactions in demarcation
	Bwendamwizo	Customary right	Yes, all of them	No	
	Bulongo	Customary right	Yes, all of them	Yes	Boundary conflicts
Ushirika	Kadoke	Customary right	Yes, all of them	No	
District: Bukombe DC					
Busonzo	Nampalahala	Customary right	Yes, all of them	No	
	Nalusunguti	Customary right	None of them	No	
	5Busonzo	Title deeds Customary right	Some of them	No	
	Kabagole	Don't have title	Yes, all of them	Yes	Boundary conflicts
	Nakayenze	Don't have title	Yes, all of them	No	
Butinzya	5Butinzya	Title deeds	Yes, all of them	No	
2Bulega	Ibambilo	Don't have title	Yes, all of them	No	
District: Chato DC					
Iparamasa	Mnekezi	Don't have title	Yes, all of them	No	
	Mwabasabi	Customary right	Yes, all of them	No	
	Songambele	Customary right	Yes, all of them	No	
Region: Kagera					
District: Karagwe DC					
Kihanga	Katanda	Customary right Don't have title	Yes, all of them	No	
	Kihanga	Customary right	Yes, all of them	Yes	Boundary issues
	Kishoju	Customary right	Yes, all of them	Yes	Demarcation
	Mulamba	Don't have title	Yes, all of them	Yes	Boundaries
Kayanga	Miti	Customary right Don't have title	Yes, all of them	No	
Bugene	Omurushaka	Customary right Title deeds Don't have title	Yes, all of them	Yes	Inheritance issues
	Nyakahanga	Customary right	Yes, all of them	Yes	Inheritance issues
	Kishao	Customary right	Yes, all of them	No	
Ihembe	Ihembe I	Customary right Don't have title	Yes, all of them	Yes	Unclear demarcation
Nyaishozi	Rukale	Don't have title	Yes, all of them	Yes	Boundary conflicts
	Nyakayanja	Customary right Don't have title	Yes, all of them	No	

Table 7.3.6.1.b
Land tenure – Direct Area of Influence

Ward	Villages	Land Ownership	Demarcation	Land Conflicts	Reason of conflicts
Rugu	Kasheshe	Customary right	Yes, all of them	No	
Nyakasimbi	Nyakasimbi	Customary right Don't have title Title deeds	Yes, all of them	Yes	Unclear Demarcation
	Bujara	Don't have title	Yes, all of them	Yes	Boundaries
	Kahanga	Don't have title	Yes, all of them	Yes	Boundaries
	Muungano	Customary right Don't have title	Some of them	Yes	Village demarcation
Nyakahanga	Rwandaro	Customary right Don't have title	Yes, all of them	Yes	Village Demarcation
	Bisheshe	Don't have title Customary right	None of them	Yes	Boundaries
District: Biharamulo DC					
Nyakahura	Nyabugombe	Customary right	Some of them	Yes	Land for grazing
	Ngararambe	Customary right Don't have title	Yes, all of them	Yes	Inheritance and boundary issues
	Busiri	Customary right Don't have title	Yes, all of them	No	
	Mabare	Title deeds	Yes, all of them	Yes	Boundaries
Lusahunga	Nyakanazi	Customary right	Yes, all of them	Yes	Boundaries
	Kabale	Customary right Don't have title	Yes, all of them	Yes	Land for grazing
	Lusahunga	Customary right Title deeds Don't have title	Yes, all of them	Yes	Unclear Land Demarcation
	Kikoma	Customary right	None of them	Yes	Boundaries
	Nyakasenga	Customary right Don't have title	Yes, all of them	No	
Kaniha	Mavota	Customary right Don't have title	Yes, all of them	No	
	Mkunkwa	Customary right Don't have title	Yes, all of them	No	
Nyantakara	Mgera	Customary right	None of them	No	
	Nyantakara/Iyen gamulilo	Customary right Don't have title	Yes, all of them	No	
	Nyakayenze	Customary right Don't have title	None of them	Yes	Land border conflicts
District: Ngara					
Kasulo	Rwakalemera	Customary right	Yes, all of them	No	
District: Missenyi					
Mutukula	Byeju	Customary right	Yes, all of them	Yes	Interference from neighbouring villages
	Mutukula	Customary right Title deeds	Yes, all of them	Yes	Boundaries
Kassambya	Bunazi	Title deeds	Yes, all of them	No	
	Nyabihanga	Customary right	Yes, all of them	Yes	Interference from neighbouring villages
	Omudongo	Customary right	Yes, all of them	Yes	Boundary conflicts
Nsunga	Byamutemba	Title deeds	Yes, all of them	No	
	Ngando	Customary right	Yes, all of them	Yes	Boundary issues
Kyaka	Kyaka	Customary right	Yes, all of them	No	

Elaboration: JGP/BENE. Sources: Fieldword – May-July 2024.

In terms of land ownership, 83 villages mentioned that the majority owns lands based on customary rights; 13 said that some villagers have title deeds; 35 said they do not have titles. The most common situation is that of customary rights.

Regarding demarcation, which is necessary to obtain title deeds, 72 villages' representatives indicated that all the plots have been demarcated. In the case of Shinyanga Region, in 59.3% of the villages the interviewees indicated that they present this situation; in Geita 78.6% and in Kagera, 87.3%. In 15 villages, the interviewees mentioned that no plot has been demarcated and in 9 that some have been demarcated.

According to the information gathered in the fieldtrip, in more than half of the villages there is some kind of land conflicts. This was mentioned in 59% of the villages in Shinyanga; 35.7% in Geita and 53.2% in Kagera. The reasons for the land conflicts are:

- Unclear demarcation of plots.
- Boundaries issues (disagreement on the boundaries) between villages and between neighbours.
- Family conflicts, conflicts related to inheritance
- Issues between families.
- Problems related to the buying process, which includes lack of contract, misunderstandings between buyers and sellers, and forgery in the sale.
- Conflicts among neighbours, such as interference of neighbouring villages, fighting for places to feed livestock and immigration.
- Mining, when it overlaps with other economic activities such as agriculture and livestock keeping.

Lack of fair compensation was also mentioned, referring to other projects present in the area.

7.3.6.2
Water

Main sources of water for human consumption are Lake Victoria and the following rivers:

- River Kagera: Located at the border between the wards of Kyaka and Kassambya.
- River Moyowosi: Located at the border between the wards of Nyantakara and Lusahunga.
- River Muhama: Located at the border between the wards of Busonzo and Lusahunga.
- River Isanga: Located at the border between the wards of Mwenge and Mwakitolyo.
- River Nhumbu: Located at the border between the wards of Ibadakuli and Mwamalili.
- River Nyakarenzi: Located at the border between the wards of Lunguya and Bulyan'hulu.

As previously mentioned, in the villages of the DAI the main source of water for agriculture is rainfall, except for two villages (Shilabela and Nyakayenze) that have village irrigation. The problem with rainfall is that it is highly unreliable. Drought, and in general the scarcity of water, was one of the main concerns raised by the stakeholders during the interviews. Although methods to harvest and preserve water are being used, it

seems that is necessary to further develop this, both for human consumption and for the economic activities.

7.3.6.3
Other Ecosystem Services

The ecosystem services directly linked to uses of the population include feeding, natural medicine, biomass, water and ecotourism. Feeding is one of the most important ones, and depends on agriculture and livestock keeping, already presented, and on hunting, fishing, forestry and beekeeping. Hunting is, in general terms, not mentioned as it is a forbidden activity and natural reserves are protected. Fishing is specially practiced in Shinyanga MC (through aquaculture); in Geita DC, Bukombe, Chato, Karagwe, Biharamulo and Misenyi. The species mainly are tilapia, Nile perch and sardine. In the case of aquaculture, the species are catfish and tilapia. Fishing is done in Lake Victoria, Kagera and Ruyuyu Rivers and in ponds and dams.

Other important activities are beekeeping and forestry. They have been promoted by local governments, including Shinyanga MC, Bukombe District, Missenyi and Mbogwe, as a way of leveraging the preservation of reserves from encroachers who do farming and cattle herding.

Forestry is an important resource for biodiversity and livelihood for humans, as it is a source of food, has potential for income generation by selling products such as fuel woods, timber and local medicine. It is also important for the preservation of the environment. A problem faced is that its importance as a source of income has declined due to depletion. This is particularly concerning regarding charcoaling and illegal logging. Timber production is causing deforestation and exposing, which makes the soil prone to erosion. Charcoaling brings deforestation, bushfire, exposes land and also makes it vulnerable to erosion. It is important to mention that some district profiles indicate that environmental deterioration is one of the main challenges the districts face.

Table 7.3.6.3.a presents the information regarding ecosystem services in the DAI. The percentages indicate the proportion of villages where the interviewees indicated that those activities take place.

Fishing is an uncommon practice. Only few villages mentioned they practiced it, despite the closeness with important bodies of water, such as Victoria Lake. Contrary to that, plant collection is a common practice, mainly used for medicinal purposes and, in second place, also for food.

Beekeeping is an important activity in Kagera, where almost half of the villages (46%) practice it. It is less important in Geita and Shinyanga, where around a quarter of the villages are involved in this activity. It is mainly done with commercial purposes.

Table 7.3.6.3.a
Ecosytstem services in DAI

Area	Fishing	Plant Collection	Beekeeping	Forestry	Reserved/ touristic areas
Shinyanga	14.8% (Nimya Dam, Ningwa River, Mahiga Pond, Igwamanoni River.	Yes: 77.8% No: 22.2% Medicinal Herbs: 62.5% Food: 37.5	26% For Sale: 71.4%	Wood for fuel: 55.6% Carpentry: 7.4% Poles: 7.4% None: 29.6%	Reserved: 88.9% said they do have (Mawamapuli, Isubi) Touristic: 3.7% (Hot water from underground in Usogore)
Geita	3.7% (Lake Victoria)	Yes: 78.6% No: 21.4% Medicinal Herbs: 81.8% Food: 18.2%	21.4% For Sale: 100%	Wood for fuel: 53.6% Timber: 3.6% Carpentry: 7.2% Poles: 32.2% None: 3.4%	Reserved areas: 75% Touristic: No
Kagera	17% (Kagera River, Byeju and Kayanja Pond)	Yes: 100% Medicinal Herbs: 97.7% Food:2.3%	46.8% For sale: 81.8%	Wood for fuel: 57.5% Carprentry: 4.3% Poles: 36.2% None: 2%	Reserved areas: 100% Touristic: National Park in Chato Burigi

Elaboration: JGP/BENE. Sources: Field work – May-July 2024.

Forestry is important, mainly as a source of fuel, more than 50% of the villages give it this use. The second relevant use is poles, which is important for the villages in Kagera and Geita (around one third of the villages indicated they use forestry for poles), but not in Shinyanga, with only 7% of the villages. Other uses of forestry, such as carpentry and timber, are very low.

A very high number of villages (between 75 and 100%) mentioned they have reserved areas, while areas dedicated to tourism activities are less relevant.

Only one village indicated that hunting takes place, which is coherent with the fact that it is forbidden by law.

Section 8.2.3.2 of the EIA analyses the impacts of the Project on the ecosystem services. This analysis indicates that the project could affect feeding, as the project will restrict some types of land use; natural medicines will be partially affected, as vegetation will be cleared for the construction of the TL and the wayleave strip will be kept free of vegetation, also partially affecting the biomass; fertilization of crop plants may be partially affected, although in a small scale, as the clearing will reduce the habitats available for pollinating fauna. The main causes, as mentioned, are the reduction of land available for agriculture, as arable areas will decrease by 8% in the DAI, and the clearance

of native vegetation, which will decrease by 1%. Other ecosystem services, as water, disease regulation, pest regulation and ecotourism will not be impacted.

These impacts are considered negative, will occur during construction and operation phases, they will be indirect impacts, that will happen immediately, will have a long-lasting duration and will be partially reversible.

7.3.7
Education and Literacy

The structure of education in Tanzania Mainland consists of 2 years of pre-primary school, starting at age five; 7 years of primary school; 4 years of ordinary level secondary education; 2 years of advanced level secondary education and 3 or more years of university or other equivalents, such as technical education. Tanzania also offers Non-Formal Education to out-of-school students aged 11 to 18 outside the formal system, covering a period of 2 to 3 years. Adult Education is for persons aged 19 years and above, focusing on basic and post-literacy education, among other schemes of education. Tanzania has both private and public education, the latter being the most important.

Regarding Universal Primary Education, Tanzania has made an effort to increase the enrolment in primary education. To do so, fees and other monetary contributions were abolished in 2001, while sending children to school became compulsory. Additionally, in 2016 overaged children were allowed to enrol.

7.3.7.1
Education Facilities/Services

According to the district and regional reports, the problems with the education facilities are the lack of enough desks, classrooms, teachers and sanitation facilities. In general, the different reports mention these different shortages as the main problem they face. Another problem faced is that, as usually children need to move to other places for secondary education, accommodation (such as dormitories) is also required, of which there is an acute shortage. Another problem mentioned is the long distances children must walk to reach schools.

Of all the gaps between the needs or requirements and the actual facilities given, the most important are those related to the lack of teachers, and problems with basic infrastructure, such as desks, classrooms, water and sanitation.

In the DAI, according to the information provided by the interviewees, 57.3% of the villages only have access to primary schools within their area, while 39.6% do have secondary schools in their villages, while 3.1% of the villages only have pre-primary schools. For accessing secondary education, the students go to the largest town in the ward or any other close place. No village has vocational studies or universities. In the case of vocational studies, students need to go to nearby cities, while in order to go to the university, they tend to move to more distant places. This information is presented in **Table 7.3.7.1.a**.

Table 7.3.7.1.a
Education facilities in DAI

Ward	Villages	Available Services	Vocational Studies	Nearest University
Region: Shinyanga				
District: Shinyanga MC				
Mwamalili	Seseko	Primary Schools	N/A	Various universities in the country
Ibadakuli	Uzogore	Primary Schools	Shinyanga MC	UDSM, UDOM, SAUT
	Ibadakuli	Secondary Schools	Shinyanga MC	Wherever they are located
Old Shinyanga	Ihapa	Pre-primary School	Shinyanga MC	University of Dar es Salaam and other universities in the country
	Old Shinyanga	Secondary Schools	Shinyanga MC	SAUT or UDOM
District: Shinyanga DC				
Solwa	Mwasekagi	Secondary Schools	Shinyanga MC	University of Dar es Salaam and other universities
	Mwiseme	Primary School	Shinyanga MC	University of Dar es Salaam and other universities
	Mwabuki	Primary School	Shinyanga MC	University of Dar es Salaam and other universities
Mwakitolyoo	Mwasenge	Primary School	Shinyanga MC	It depends on where s/he selected to join the University
	Nyang'ombe	Primary School	Shinyanga MC	Depends on where s/he selected
Iselemagazi	Mwamakaranga	Primary School	Shinyanga MC	Dodoma, Mwanza, Dar es Salaam
	Ichongo	Primary School	Shinyanga MC	Mwanza, Dodoma, and Dar es Salaam
	Iselamagazi	Secondary Schools	Shinyanga MC	Mwanza and dodoma
Nyamalogo	Mwang'osha	Secondary Schools	Shinyanga MC	University of Dar es Salaam and other universities in the country
Pandagichiza	Shilabela	Secondary Schools	Shinyanga MC	Dodoma and University ff Dar es Salaam
Mwenge	Mwongozo	Primary School	Shinyanga MC	Udom St. Augusine and University of dar es salaam
	Zunzuli	Secondary Schools	Shinyanga MC	Anywhere s/he will be selected, it might be UDSM, ARU, OR SAUT
	Ipango	Primary School	Shinyanga MC	Anywhere in the country

Table 7.3.7.1.a
Education facilities in DAI

Ward	Villages	Available Services	Vocational Studies	Nearest University
Lyabusalu	Mwajiji	Primary School	Shinyanga MC	University of Dar es Salaam and other universities in the country
	Lyabusalu	Secondary Schools	Shinyanga MC	University of Dar es Salaam and other universities in the country
	Bukamba	Primary School	Shinyanga MC	University of Dar es Salaam and other universities in the country
	Mwabagehu	Primary School	Shinyanga MC	University of Dar es Salaam and other universities in the country
District: Msalala				
Bugarama	Igwamanoni	Primary School	Msalala, Shinyanga MC	To various universities in the country
	Ilogi	Secondary School	Msalala, Shinyanga MC	To various universities in the country
	Buyange	Primary School	Msalala, Shinyanga MC	To various universities in the village
Lunguya (Runguya)	Kalole	Primary School	Shinyanga MC	Other regions like Mwanza and Dar es Salaam
Bulyan'hulu	Busulwangili	Secondary School	Shinyanga MC	They go wherever they are located in the country (the University of Dodoma, Institute of Finance)
Region: Geita				
District: Geita DC				
Butobela	Shahende	Primary School	Geita town and other regions in the country	To various universities in the country
District: Nyang'hwale				
Kafita	Kayenze	Secondary School	Mwanza	Mwanza, Dar es Salaam, and Dodoma
	Bukulu	Primary School	Mwanza	Mwanza
Nyugwa	Isonda	Primary School	Mwanza	Mwanza, Dar es Salaam and Dodoma
Bukwimba	Kasubuya	Primary School	Geita town and other regions in	To various universities in the country

Table 7.3.7.1.a
Education facilities in DAI

Ward	Villages	Available Services	Vocational Studies	Nearest University
			the country	
	Bukwimba	Secondary School	Geita town and other regions in the country	To various universities in the country
District: Mbogwe DC				
Ikobe	Kagongo	Primary School	Geita town and other regions in the country	To various universities in the country
	Bugalagala	Primary School	Geita town and other regions in the country	To various universities in the country
	Busabaga	Primary School	Geita town and other regions in the country	To various universities in the country
Lulembela	Kashelo	Secondary School	Geita Town	Anywhere s/he wants to study after being selected
Ilolangulu	Ilolangulu	Secondary School	Geita, Shinyanga	Mwanza, Dodoma, and Dar es Salaam
Mbogwe	Nambubi	Primary School	Geita Town and Chato Town	Saut University and Udom University
	Bwendanseko	Primary School	Geita	Mwanza, Dodoma, Dar es Salaam
	Mwanza	Secondary School	Chato	They go where they are located around the country for university study
Ngemo	Nyitundu	Secondary School	Geita town and other regions in the country	Various universities in the country
	Bwendamwizo	Primary School	Geita town and other regions in the country	To various universities in the country
	Bulongo	Pre-Primary School	Geita town	Mwanza, Dodoma and Dar es Salaam
Ushirika	Kadoke	Primary School	Geita town	Mwanza and Dodoma
District: Bukombe DC				
Busonzo	Nampalahala	Primary School	Geita town	Mwanza
	Nalusunguti	Primary School	Bukombe town and other places in Geita region and	To various universities in the country

Table 7.3.7.1.a
Education facilities in DAI

Ward	Villages	Available Services	Vocational Studies	Nearest University
			other regions	
	Busonzo	Primary School	Chato Town	Anywhere but mostly goes to SAUT and UDOM
	Kabagole	Pre-Primary School	Geita town and other regions in the country	To various universities in the country
	Nakayenze	Primary School	Ruwenze or Geita town and other regions in the country	To various universities in the country
Butinzya	Butinzya	Secondary School	Geita	Mwanza
Bulega	Ibambilo	Primary School	Geita town and other regions in the country	To various universities in the country
District: Chato DC				
Iparamasa	Mnekezi	Secondary School	To the district headquarters and other regions	To various universities in the country
	Mwabasabi	Primary School	Geita	Mwanza and Geita
	Songambele	Secondary School	Geita and Chato	Geita and Mwanza
Region: Kagera				
District: Karagwe DC				
Kihanga	Katanda	Primary School	Kayanga Town	
	Kihanga	Secondary School	Kayanga Town	To various universities in the country
	Kishoju	Secondary School	Kayanga Town	Mwanza and Dodoma
	Mulamba	Primary School	Kayanga Town and other places in the region	To various universities in the country
Kayanga	Miti	Primary School	Kayanga Town	Mwanza and Dodoma
Bugene	Omurushaka	Secondary School	Karagwe town and other places in the region	Various universities in the 3
	Nyakahanga	Secondary School	Karagwe town and other places in the region	Various universities in the country

Table 7.3.7.1.a
Education facilities in DAI

Ward	Villages	Available Services	Vocational Studies	Nearest University
	Kishao	Primary School	Karagwe town and other places in the region	Various universities in the country
Ihembe	Ihembe I	Primary School	Kayanga	Dodoma, Mwanza, and Dar es Salaam
Nyaishozi	Rukale	Primary School	Karagwe town and other places in the region	To various universities in the country
	Nyakayanja	Secondary School	Kayanga	Dodoma, Dar es salaam, Mwanza
Rugu	Kasheshe	Primary School	Kayanga	Various universities in the country
Nyakasimbi	Nyakasimbi	Secondary School	Kayanga	Mwanza, SUA, Dodoma, and University of Dar es Salaam
	Bujara	Primary School	Kayanga town and other places in the region	To various universities in the country
	Kahanga	Primary School	Kayanga town and other places in the region	To various universities in the country
	Muungano	Primary School	Kayanga	Dodoma, Mwanza, and Dar es Salaam
Nyakahanga	Rwandaro	Secondary School	Nyaishozi and Bukoba	Mwanza, Dodoma, and Dar es Salaam
	Bisheshe	Secondary School	Kayanga town and other places in the region	To various universities in the country
District: Biharamulo DC				
Nyakahura	Nyabugombe	Primary School	Biharamulo town and other places in the region	To various universities in the country
	Ngararambe	Secondary School	Biharamulo town and other places in the region	Various universities in the country
	Busiri	Primary School	Biharamulo town	To various universities in the country
	Mabare	Secondary School	Biharamulo town and other places in the region	Various universities in the country
Lusahunga	Nyakanazi	Secondary School	Biharamulo	To various

Table 7.3.7.1.a
Education facilities in DAI

Ward	Villages	Available Services	Vocational Studies	Nearest University
			town	universities in the country
	Kabale	Primary School	Kahama, bukoba mwanza and geita	To various universities in the country
	Lusahunga	Secondary School	Biharamulo Town	Various universities in the country
	Kikoma	Primary School	Biharamulo town and other places in the region	Dodoma, Mwanza, Dar es Salaam
	Nyakasenga	Primary School	Bukoba	
Kaniha	Mavota	Secondary School	Runzewa	Dodoma, Mwanza, Morogoro, and Dar es Salaam
	Mkunkwa	Secondary School	Bukoba, Biharamulo	Various universities in the country
Nyantakara	Mgera	Primary School	Biharamulo town and other places in the region	Mwanza, Dodoma, and Dar es Salaam
	Nyantakara/Iyengamulilo	Secondary School	Biharamulo	
	Nyakayenze	Primary School	Biharamulo	Dodoma, Mwanza and Dar es Salaam
District: Ngara				
Kasulo	Rwakalemera	Secondary School	Ngara Town	Various universities in the country
District: Missenyi				
Mutukula	Byeju	Secondary School	Bukoba or Karagwe	Dodoma, Arusha, and Dar es Salaam
	Mutukula	Primary School	To Missenyi District, Kagera Town, and other regions in the country	To various universities in the country
Kassambya	Bunazi	Secondary School	Bukoba	Mwanza and Dodoma
	Nyabihanga	Primary School	Bukoba	Mwanza and Dodoma
	Omudongo	Primary School	Missenyi town and other places in the region	Various universities in the country
Nsunga	Byamutemba	Secondary School	Kagera	Mwanza and Dodoma
	Ngando	Primary School	Missenyi town and other places	To various universities in the country

Table 7.3.7.1.a
Education facilities in DAI

Ward	Villages	Available Services	Vocational Studies	Nearest University
			in the region	
Kyaka	Kyaka	Primary School	Missenyi town and other places in the region	Various universities in the country

Elaboration: JGP/BENE. Sources: Field work – May-July 2024.

Table 7.3.7.1.b
Education facilities in DAI Villages

Region	District	Ward	Villages	School Name	Observation
Kagera	Missenyi	Mutukula	Mutukula	Kabakesa Primary School.	Inside wayleave
	Missenyi	Nsunga	Byamutemba	Omulugando Primary School	Close to wayleave
	Missenyi	Kassambya	Omudongo	Omudongo Primary School	Close to wayleave
	Missenyi	Kyaka	Kyaka	Kyamulaile Primary School	Inside wayleave
	Karagwe	Nyaishozi	Nyakayanja	Nyakayanja Primary School	In the village
	Karagwe	Kihanga	Kishoju	Mungu Bariki Secondary School	Close to wayleave
	Karagwe	Nyakahanga	Bisheshe	Bisheshe Primary School	Inside wayleave
	Karagwe	Nyakahanga	Bisheshe	Nyakahanga Secondary School	Inside wayleave
	Karagwe	Kayanga	Miti	Rwamugurusi Primary School	Inside wayleave
	Karagwe	Kihanga	Mulamba	Mwisa Primary School	Inside wayleave
	Karagwe	Kihanga	Kishoju	Karagwe Secondary School	In the village
	Karawge	Nyakasimbi	Nyakasimbi	Kyanyamisa Primary School	Close to wayleave
	Karawge	Nyakasimbi	Nyakasimbi	Nyakasimbi Secondary School	Close to wayleave
	Biharamulo	Nyakahura	Nyabugombe	Nyabugombe Primary School	Close to wayleave
	Biharamulo	Nyakahura	Ngarambe	Mizani Secondary School	Close to wayleave
	Biharamulo	Kaniha	Mkunkwa	Mkunkwa Primary School	In the village

Table 7.3.7.1.b
Education facilities in DAI Villages

Region	District	Ward	Villages	School Name	Observation
Geita	Bukombe	Busonzo	Nampalahala	Busonzo Secondary School	Close to wayleave
Shinyanga	Shinyanga	Mwenge	Ipango	Ipango Primary School	Close to wayleave
	Shinyanga	Lyabusalu	Bukamba	Bukamba Primary School	Close to wayleave
	Shinyanga	Lyabusalu	Lyabusalu	Lyabusalu Primary School	In the village
	Shinyanga	Lyabusalu	Lyabusalu	Lyabusalu Secondary School	In the village
	Shinyanga	Iselamagazi	Ichongo	Iganza Primary School	In the village
	Shinyanga	Iselamagazi	Iselamagazi	Iselamagazi Secondary School	Inside wayleave
	Shinyanga	Old Shinyanga	Old Shinyanga	Old Shinyanga Primary School	Close to wayleave
	Shinyanga	Old Shinyanga	Old Shinyanga	Old Shinyanga Secondary School	Close to wayleave
	Shinyanga	Solwa	Mwasekagi	Ikungulabupina Primary school	In the village
	Shinyanga	Solwa	Mwasekagi	Solwa Secondary School	In the village

7.3.7.2
Education Situation

According to the district and regional reports, can be concluded that there has been an important advancement in enrolment of boys and girls in primary education. The Census 2022 also indicates that there is a low enrolment on pre-primary education in the rural areas in the country, as it is of only 22.5%. Pre-primary education still needed to be promoted and accepted by the parents.

Primary education shows an important advancement, although it is not universal yet. The census indicates that 78.4% of the children of rural areas between 7 and 13 years old are attending school, 3.6% dropped out and 17.4% never attended. The percentage of attendance among girls is higher (81.1%) than boys (75.8%), while dropouts are higher among boys (4.6%) than girls (2.7%). There are also more boys that never attended school (19%) than girls (15.7%).

However, enrolment in secondary education is smaller than in primary education. One of the reasons may be that this service is provided in the wards and not in the villages, hence being less accessible. It is also clear that girls are consistently enrolling in school, with a small gap compared to boys.

According to the census, the attendance of boys and girls drops to 60.2% in rural areas in the ages 14 to 17, being lower among the 17-year-olds. In this group, the attendance of girls is also higher (64.1%) compared to boys (56.6%), and the dropouts are lower (10% among girls and 15.9% among boys).

A problem pointed out are the dropouts among boys due to work on mining and to be trained in livestock keeping, while girls help more in the house and use their time helping their mothers to fetch water. Dropouts due to pregnancy were very few. However, the interviewees indicated that early marriage is a cause for dropouts with marriages starting as early as 14-year-olds.

In villages with presence of mining activities, the influx of workers overloads schools, with infrastructure and teachers being insufficient.

Literacy

According to the 2022 Census, the literacy rate in rural areas is of 71.9%, with a small gap between men (74.1%) and women (69.7%). This gap is smaller among youth. As a matter of fact, in the group between 15 and 19 years old, women and men are equally literate. This gap increases from 30 years old and onwards, with the biggest ones among elder population. In this case, where the gap is of 30% (literate men are 74.9% and women only 44.4% in the 65-69 group). This shows an important advancement in education itself, as more population is literate in general, and also on women's access to education.

In the case of Kagera, 80.1% of the population is literate (83.7% of men and 76.9% of women); 77.3% in Shinyanga (81.6% of men and 73.2% of women) and 70% in Geita (82.6% of men and 71.8% of women). The worst situation of education is in Geita, where also the gap between men and women is wider. It is important to point out that this data is presented for the population in general, not distinguishing it between urban and rural areas.

7.3.8
Health

7.3.8.1
Health Facilities

According to the district profiles, there is, in general, a shortage of health facilities, compared to the government goals that imply having one health centre per ward and one dispensary per village. They point out that, despite the number of health facilities has increased, the population has outgrown them. This is more acute in the villages that develop mining activities, due to the influx of workers. Dispensaries suffer from lack of regular maintenance because of insufficient funds, lack of houses for staff, shortage of trained professionals and shortage of drugs and health equipment. Reports also mention that health facilities are unevenly distributed, with some areas having a more difficult access.

The lack of sufficient health facilities imply that people need to walk longer distances and concentrate a large number of patients in the health facilities that are working. Due to this, people prefer to use complementary services. This includes Traditional Birth Attendants (TBA), Community Health Workers (CHWs) and registered Traditional Medical Practitioners. Two CHWs are allocated in each village who provide primary health care and are under the supervision of a Village Health Committee. Vulnerable people do not have enough resources to access health facilities and rely on medicinal herbs.

To face the gap of health facilities, primary rural health centres were established, operated by Village Health Workers and Traditional Birth Attendants, under the supervision of Village Health Committees.

In general terms, the problems lived in the area regarding health facilities are that they are not enough, especially considering the growing population; they are particularly difficult to access for those in rural areas (due to distance and lower population density) and that they do not have enough drugs and health equipment.

Regarding the health facilities in the DAI, **Table 7.3.8.1.a** present the ones identified in the villages intercepted by the T-Line.

Table 7.3.8.1.a
Health facilities in DAI Villages

Region	District	Ward	Villages	Health Facility	Observation
Kagera	Karagwe DC	Nyaishozi	Nyakayanja	Nyakayanja Health Center	Inside wayleave
		Nyaishozi	Rukale	Rukale Medical Center	In the village
		Ihembe	Ihembe	Ihembe Medical Center	In the village
		Nyakasimbi	Nyakasimbi	Nyakasimbi Medical Center	Close to wayleave
		Kihanga	Kishoju	Kishoju Village Dispensary	In the village
		Nyaishozi	Nyaishozi	Nyaishozi Medical Center	In the ward
		Kayanga		Karagwe District Hospital	In the ward
		Bugene	Bujuruga	Bujuruga Health Center	In the village
		Bugene	Nyakahanga	Nyakahanga Hospital	In the village
	Biharamulo	Lusahunga	Lusahunga	Lusahunga Medical Center	In the village
		Lusahunga	Nyakanazi	Nyakanazi Health Center	In the village
		Lusahunga	Lusahunga	Lusahunga Medical Center	In the village
		Lusahunga	Nyakanazi	Nyakanazi Health Center	In the village
		Kaniha	Mkunkwa	Mkunkwa Medical Center	In the village

Table 7.3.8.1.a
Health facilities in DAI Villages

Region	District	Ward	Villages	Health Facility	Observation
Geita	Bukombe	Bulega	Bulega	Bulega Medical Center	In the village
	Chato	Iparamasa	Mnekezi	Mnekezi Medical Center	In the village
	Bukombe	Bulega	Bulega	Bulega Health Center	In the village
	Mbogwe	Ngemo	Nyitundu	Mbizi Health Center	In the village
	Nyang'hwale	Bukwimba	Bukwimba	Bukwimba Dispensary	In the village
	Nyang'hwale	Bukwimba	Kayenze	Kayenze Medical Center	In the village
Shinyanga	Shinyanga	Iselamagazi	Iselamagazi	Nindo Health Center	In the village
		Mwenge	Zunzuli	Zunzuli Medical Center	In the village
		Solwa	Mwasekagi	Mwasekagi Medical Center	In the village
		Lyabusalu	Bukamba	Sarawe Health Center	Close to wayleave
		Solwa	Mwasekagi	Medical Center	In the village
		Lyabusalu	Bukamba	Sarawe Health Center	Close to wayleave
		Iselamagazi	Iselamagazi	Shinyanga Rural District Hospital	In the village
		Old Shinyanga	Ihapa	Old Shinyanga Medical Center	In the village
		Old Shinyanga	Ihapa	Old Shinyanga Medical Center	In the village

7.3.8.2
Health Situation

According to the district reports, the main causes of death, for both men and women are malaria, anaemia, and pneumonia. Malaria is also an important cause of death among people living with HIV/AIDS. Diarrhoea is also a cause of mortality, this is a preventable disease and is directly connected with the accessibility to clean water and with the incorporation of hygienic standards, for which educative programs are required. Among women, maternal complications are also among the mortality causes. These are usually related to the accessibility to health services during the pregnancy, for controls, and in the birth to be able to receive specialized attention in case of complications.

One of the main concerns that appear in the different district and regional profiles is HIV/AIDS due to its prevalence. The reports mention that it is the main threat among communicable diseases. HIV/AIDS has been socially relevant due to the increase in mortality levels among adults (25-50 years). This affected the economy of the families and the ability to take care of the children, also implying a higher burden in the elderly.

It has affected patterns of consumption, income, has obliged children to work and, in some cases, they are also obliged to take care of themselves and other members of the family, such as their siblings. HIV/AIDS has increased the number of widows and orphans, making them vulnerable to higher levels of poverty. Reports, such as Nyang w'ale's mention that it is necessary to have a better understanding of the situation of the children, especially because of the impacts of HIV/AIDS and orphanage, together with poverty and the increased weakness of extended families.

Misenyi Profile details the problems faced due to HIV/AIDS. It mentions that it has been a major health problem since its advent in 1983. The impacts mentioned are the impoverishment of the population as breadwinners are loss, the increase of widows and, especially, of orphans. The 2022 Census indicates that 10% of children in the three regions have at least one parent dead. The causes mentioned to explain HIV/AIDS prevalence include the presence of migrant workers, unprotected sex practices, polygamy. and poverty that pushes girls into sex work. Advances include the implementation of strategies, such as peer education and home-based care providers that have helped to reduce deaths at home. However, an obstacle is the lack of testing which implies that there are people who live with HIV/AIDS without knowing it.

Regarding mortality causes, an important advance is the reduction of mother and children mortality due to the vaccination coverage reached. Misenyi profile mentions that there is a reduction of deaths among children and their mothers, especially due to the improvement in coverages of immunization reached. However, it was insufficient as in 2015 only 51.2% were immunized. Among the wards of the area of influence, Kilimilile was in the worst situation, with only 29.2% of the mothers immunized, maternal mortality continued being a problem and their main causes were: maternal complications, anaemia, abruption placenta, ectopic pregnancy, eclampsia, DIC, and Pulmonary Oedema. Women go to health facilities very late. (2017). Not enough resources to attend complications in deliveries. Among children, the main causes are malaria and malnutrition. In the case of Ngara, the causes were severe malaria, diarrhoea, acute anaemia, pneumonia, prematurity, hypothermia and birth asphyxia. Among the main causes of death of the population in general, still birth, neonatal septicaemia and sudden infant death are mentioned.

No Profile presented information on the nutrition situation of children, due to the lack of data that helps to identify malnutrition levels.

Ngara Socioeconomic Profile indicates that road traffic accidents are one of the major causes of injuries, deaths and disabilities, and that this is a national problem.

Table 7.3.8.2.a presents the main diseases and causes of death in the villages intercepted by the T-line, according to the information gathered during the fieldtrip.

Table 7.3.8.2.a
Morbidity and mortality in DAI

Ward	Villages	Main diseases	Causes of death
Region: Shinyanga			
District: Shinyanga MC			
Mwamalili	Seseko	Malaria Urinary tract infection	Malaria
Ibadakuli	Uzogore	Malaria	Malaria
	Ibadakuli	Malaria Diarrhoea with no dehydration	Malaria Diarrhoea
Old Shinyanga	Ihapa	Malaria Urinary tract infection	Malaria Pneumonia Diarrhoea
	Old Shinyanga	Malaria Intestinal worm Diarrhoea with no dehydration	Malaria Diarrhoea
District: Shinyanga DC			
Solwa	Mwasekagi	Malaria	Malaria AIDS Tuberculosis
	Mwiseme	Malaria Urinary tract infection	Malaria
	Mwabuki	Malaria	Malaria Tuberculosis
Mwakitolyoo	Mwasenge	Malaria	Malaria
	Nyang'ombe	Malaria	Malaria
Iselemagazi	Mwamakaranga	Malaria Diarrhoea with no dehydration Intestinal worm Upper respiratory infection	Malaria Pneumonia Tuberculosis AIDS Diarrhoea
	Ichongo	Pneumonia non severe Malaria	Malaria Pneumonia
	Iselamagazi	Malaria Diarrhoea with no dehydration Urinary tract infection	Malaria
Nyamalogo	Mwang'osha	Malaria	Malaria
Pandagichiza	Shilabela	Malaria Diarrhoea with no dehydration Intestinal worm Urinary tract infection	Malaria Diarrhoea
Mwenge	Mwongozo	Malaria Upper respiratory infection Intestinal worm Diarrhoea with no dehydration Pneumonia non severe	Malaria Pneumonia AIDS Tuberculosis
	Zunzuli	Malaria	Malaria
	Ipango	Malaria	Malaria
Lyabusalu	Mwajiji	Malaria	Malaria AIDS

Table 7.3.8.2.a
Morbidity and mortality in DAI

Ward	Villages	Main diseases	Causes of death
			Diarrhoea
	Lyabusalu	Malaria Pneumonia non severe	Malaria Pneumonia
	Bukamba	Malaria	Malaria
	Mwabagehu	Malaria Urinary Tract Infection Pneumonia non severe	Malaria Pneumonia
District: Msalala			
Bugarama	Igwamanoni	Malaria Urinary tract infection	Malaria AIDS
	Ilogi	Malaria	Malaria AIDS
	Buyange	Malaria	Malaria AIDS
Lunguya (Runguya)	Kalole	Upper respiratory infection Malaria Diarrhoea with no dehydration Intestinal worm Urinary tract infection Pneumonia non severe	Malaria Tuberculosis Diarrhoea Pneumonia
Bulyan'hulu	Busulwangili	Malaria Diarrhoea with no dehydration	Malaria Diarrhoea
Region: Geita			
District: Geita DC			
Butobela	Shahende	Malaria Urinary tract infection	Malaria AIDS
District: Nyang'hwale			
Kafita	Kayenze	Malaria Urinary tract infection Intestinal worm Diarrhoea with no dehydration	Malaria
	Bukulu	Malaria Urinary tract infection Diarrhoea with no dehydration	Malaria Tuberculosis Diarrhoea
Nyugwa	Isonda	Malaria Urinary tract infection Intestinal worm Diarrhoea with no dehydration Pneumonia non severe	Malaria Tuberculosis Pneumonia
Bukwimba	Kasubuya	Malaria Urinary tract infection	Malaria
	Bukwimba	Malaria Urinary tract infection	Malaria AIDS
District: Mbogwe DC			
Ikobe	Kagongo	Malaria Urinary tract infection	Malaria AIDS
	Bugalagala	Malaria	Malaria

Table 7.3.8.2.a
Morbidity and mortality in DAI

Ward	Villages	Main diseases	Causes of death
		Urinary tract infection Malaria	
	Busabaga	Urinary tract infection	Malaria
Lulembela	Kashelo	Malaria	Malaria
Ilolangulu	Ilolangulu	Malaria Pneumonia non severe Urinary tract infection	Malaria Pneumonia
Mbogwe	Nambubi	Malaria	Malaria
	Bwendanseko	Malaria Diarrhoea with no dehydration Urinary tract infection Upper respiratory infection Intestinal worm	Malaria Pneumonia Tuberculosis Diarrhoea
	Mwanza	Malaria Diarrhoea with no dehydration	Malaria Diarrhoea
Ngemo	Nyitundu	Malaria Urinary tract infection	Malaria AIDS
	Bwendamwizo	Malaria	Malaria AIDS
	Bulongo	Malaria Intestinal worm	Malaria Diarrhoea
Ushirika	Kadoke	Malaria Upper respiratory infection Urinary tract infection Intestinal worm Diarrhoea with no dehydration	Malaria ARI (Acute Respiratory Infection) Tuberculosis
District: Bukombe DC			
Busonzo	Nampalahala	Malaria Intestinal worm Urinary tract infection Diarrhoea with no dehydration Pneumonia non severe	Malaria Tuberculosis
	Nalusunguti	Intestinal worm	Tuberculosis
	Busonzo	Malaria	Malaria
	Kabagole	Malaria Urinary tract infection Intestinal worm	Malaria Tuberculosis AIDS
	Nakayenze	Malaria Intestinal worm	Malaria
Butinzya	Butinzya	Malaria Urinary tract infection Upper respiratory infection Intestinal worm Diarrhoea with no dehydration Pneumonia non severe	Malaria
Bulega	Ibambilo	Malaria	Malaria

Table 7.3.8.2.a
Morbidity and mortality in DAI

Ward	Villages	Main diseases	Causes of death
District: Chato DC			
Iparamasa	Mnekezi	Diarrhoea with no dehydration Malaria	Malaria
	Mwabasabi	Malaria Urinary tract infection Intestinal worm Upper respiratory infection Diarrhoea with no dehydration	Malaria Pneumonia Tuberculosis Diarrhoea
	Songambele	Malaria Diarrhoea with no dehydration Intestinal worm Urinary tract infection Pneumonia non severe	Malaria Pneumonia Tuberculosis Diarrhoea
Region: Kagera			
District: Karagwe DC			
Kihanga	Katanda	Malaria Intestinal worm Urinary tract infection Diarrhoea with no dehydration Pneumonia non severe	Malaria AIDS
	Kihanga	Malaria	Malaria AIDS
	Kishoju	Malaria Upper respiratory infection Urinary tract infection Diarrhoea with no dehydration Intestinal worm	Malaria Tuberculosis AIDS
	Mulamba	Malaria	Malaria
Kayanga	Miti	Malaria Urinary tract infection Intestinal worm Diarrhoea with no dehydration Pneumonia non severe	Malaria AIDS Pneumonia
Bugene	Omurushaka	Malaria Urinary tract infection	Malaria Pneumonia
	Nyakahanga	Malaria Urinary tract infection Pneumonia non severe	Malaria Pneumonia
	Kishao	Malaria Urinary tract infection	Malaria
Ihembe	Ihembe I	Malaria Intestinal worm Urinary tract infection	Malaria
Nyaishozi	Rukale	Malaria Urinary tract infection	Malaria
	Nyakayanja	Malaria	Malaria

Table 7.3.8.2.a
Morbidity and mortality in DAI

Ward	Villages	Main diseases	Causes of death
		Urinary tract infection Upper respiratory infection Intestinal worm Diarrhoea with no dehydration	AIDS
Rugu	Kasheshe	Malaria Urinary tract infection	Malaria
Nyakasimbi	Nyakasimbi	Malaria Urinary tract infection Upper respiratory infection Pneumonia non severe	Malaria Pneumonia Tuberculosis
	Bujara	Malaria	Malaria
	Kahanga	Malaria	Malaria
	Muungano	Malaria Diarrhoea with no dehydration Pneumonia non severe Urinary tract infection Intestinal worm	Malaria Pneumonia ARI (Acute Respiratory Infection)
Nyakahanga	Rwandaro	Malaria Upper respiratory infection Diarrhoea with no dehydration Pneumonia non severe Intestinal worm	Malaria AIDS Diarrhoea
	Bisheshe	Malaria	Malaria
District: Biharamulo DC			
Nyakahura	Nyabugombe	Malaria Upper respiratory infection Urinary tract infection Pneumonia non severe Road traffic	Malaria AIDS Tuberculosis Pneumonia
	Ngararambe	Malaria Urinary tract infection Malaria Urinary tract infection	Malaria
	Busiri	Malaria Urinary tract infection	Malaria
	Mabare	Urinary tract infection	Malaria
Lusahunga	Nyakanazi	Malaria Urinary tract infection	Malaria
	Kabale	Malaria Diarrhoea with no dehydration Urinary tract infection Intestinal worm	Malaria Diarrhoea Pneumonia
	Lusahunga	Malaria Urinary tract infection Intestinal worm Diarrhoea with no dehydration Pneumonia non severe	Malaria Pneumonia Anaemia AIDS Tuberculosis Diarrhoea

Table 7.3.8.2.a
Morbidity and mortality in DAI

Ward	Villages	Main diseases	Causes of death
	Kikoma	Malaria Urinary tract infection	Malaria
	Nyakasenga	Malaria Diarrhoea with no dehydration	Malaria Diarrhoea
Kaniha	Mavota	Malaria Diarrhoea with no dehydration	Malaria Diarrhoea
	Mkunkwa	Malaria Diarrhoea with no dehydration Urinary tract infection Intestinal worm	Malaria Pneumonia Anaemia Diarrhoea
Nyantakara	Mgera	Malaria Urinary tract infection	Malaria
	Nyantakara/Iyengamulilo	Malaria Urinary tract infection Diarrhoea with no dehydration Road traffic	Malaria Diarrhoea
	Nyakayenze	Malaria Urinary tract infection Diarrhoea with no dehydration Intestinal worm	Malaria Diarrhoea
District: Ngara			
Kasulo	Rwakalemera	Malaria Urinary tract infection	Malaria
District: Missenyi			
Mutukula	Byeju	Malaria Urinary tract infection Pneumonia non severe Intestinal worm Diarrhoea with no dehydration	Malaria Pneumonia
	Mutukula	Malaria Urinary tract infection	Malaria
Kassambya	Bunazi	Malaria Urinary tract infection Intestinal worm Diarrhoea with no dehydration Pneumonia non severe	Malaria Pneumonia Tuberculosis AIDS
	Nyabihanga	Malaria Diarrhoea with no dehydration Intestinal worm Urinary tract infection Pneumonia non severe	Malaria AIDS Diarrhoea Pneumonia
	Omudongo	Malaria Urinary tract infection	Malaria
Nsunga	Byamutemba	Malaria	

Table 7.3.8.2.a
Morbidity and mortality in DAI

Ward	Villages	Main diseases	Causes of death
		Pneumonia non severe Diarrhoea with no dehydration Intestinal worm Urinary tract infection Upper respiratory infection	
	Ngando	Malaria	Malaria AIDS Tuberculosis
Kyaka	Kyaka	Malaria Urinary tract infection	Malaria

Elaboration: JGP/BENE. Sources: Fieldword – May-July 2024.

Malaria is the most frequent disease and the main cause of death in the DAI. Malaria is caused by a parasite that enters the body through the bite of a mosquito. It affects more the elderly, children and pregnant women. It is also a risk factor for people living with HIV/AIDS. To treat it, access to healthcare services is crucial. Other causes of death include pneumonia, AIDS, tuberculosis and pneumonia. In some cases, these causes of death may be related to HIV/AIDS.

Most common diseases, besides malaria, include diarrhoea and urinary tract infection. Diarrhoea is closely linked to the access to clean water, while urinary tract infection can have different causes.

7.3.9
Housing and Utilities

7.3.9.1
Access to Clean Water

One of the problems faced by Tanzania is the access to clean, drinkable water. The National Water Policy aims to make water accessible. This implies that every person should be able to get water within short distance from an improved source of water, such as piped water, protected boreholes, dug wells and springs.

The 2020 Water Sector Status Report indicates that the coverage of rural water services reached 70% of the population by December 2019, while urban service coverage reached 85%. The 2022 census indicates that 48% of Kagera population has access to improved sources of water, 67.2% of Shinyanga and 59.4% of Geita. However, only 6.9% of rural population has piped water into their dwellings and 20.9% to public tap. In Shinyanga the most common source of drinking water is unprotected dug well; in Kagera unprotected springs, and in Geita protected dug well and unprotected dug well.

Due to population dispersion, concretely in rural areas, houses usually do not have this service. This implies that people must displace themselves and spend long time collecting

water. This has a special impact on women and girls, who even must drop school to help their mothers (Nyang'hwale Socioeconomic Profile).

In rural areas, once the water supply scheme has been established, the maintenance is under the responsibility of the community through the Village Water Committees (VWCs) and Village Water Funds (VWFs). There can also be Water Users Groups (WUGs).

Those who are not served with clean, drinkable water access it through dams, boreholes, shallow wells, and springs. As mentioned previously, lack of access to clean water is closely related to diarrhoea, which is a cause of morbidity and mortality.

Reports explain the types of sources of water used and the technologies. Most of them do not address the difficulties faced in providing water that is actually clean. The problems they identify are the following:

- Wells can present a problem of underground water pollution, impacting health.
- Water may be treated occasionally, depending on the availability of chemicals. If they are not available, water is pumped untreated.
- Some areas present high ground water tables levels, being vulnerable to environmental pollution.
- Ground water may have the problem of high saline and fluoride contents.
- The amount of water can be below the required amount, which leads to water supply shortage which causes water flow interruptions. This was a concern expressed by the stakeholders during the first consultations held. This was associated with drought. This impacts not only households but the possibility of installing industries.
- Water produced can contain high levels of turbidity caused by clay, salt and soil particles. It can also present colloidal impurities.
- Water pollution also affects water sources through indiscriminate dumping of solid and liquid waste in undesignated areas, the discharge of industrial chemicals and the use of chemical farming fertilizers and insecticides.

Table 7.3.9.1.a presents the situation of the access to water in the DAI.

Table 7.3.9.1.a
Access to water in Villages of the DAI

Ward	Villages	Access to clean water	Sources of water
Region: Shinyanga			
District: Shinyanga MC			
Mwamalili	Seseko	Yes	Borehole/Lake Victoria
Ibadakuli	Uzogore	Yes	River/Lake Victoria
	Ibadakuli	Yes	River/Lake Victoria
Old Shinyanga	Ihapa	Yes	River/Lake Victoria
	Old Shinyanga	Yes	Rainfall Water storage in tanks/Lake Victoria
District: Shinyanga DC		Yes	

Table 7.3.9.1.a
Access to water in Villages of the DAI

Ward	Villages	Access to clean water	Sources of water
Solwa	Mwasekagi	Yes	River/Lake Victoria
	Mwiseme	Yes	River/Lake Victoria
	Mwabuki	Yes	River/Lake Victoria
Mwakitolyoo	Mwasenge	Yes	Lake Victoria
	Nyang'ombe	Yes	Borehole
Iselemagazi	Mwamakaranga	Yes	Rainfall Water storage in tanks/Lake Victoria
	Ichongo	Yes	Spring/Lake Victoria
	Iselamagazi	Yes	Spring/Lake Victoria
Nyamalogo	Mwang'osha	Yes	River/Lake Victoria
Pandagichiza	Shilabela	Yes	Spring/Lake Victoria
Mwenge	Mwongozo	Yes	Spring/Lake Victoria
	Zunzuli	Yes	Borehole/Lake Victoria
	Ipango	Yes	River/Lake Victoria
Lyabusalu	Mwajiji	Yes	River/Lake Victoria
	Lyabusalu	Yes	River/Lake Victoria
	Bukamba	Yes	River/Lake Victoria
	Mwabagehu	Yes	River/Lake Victoria
District: Msalala			
Bugarama	Igwamanoni	Yes	River
	Ilogi	Yes	River
	Buyange	No	Borehole
Lunguya (Runguya)	Kalole	Yes	Pond
Bulyan'hulu	Busulwangili	Yes	Borehole
Region: Geita			
District: Geita DC			
Butobela	Shahende	Yes	Lake Victoria
District: Nyang'hwale			
Kafita	Kayenze	Yes	River
	Bukulu	Yes	Spring
Nyugwa	Isonda	Yes	Pond
Bukwimba	Kasubuya	No	River
	Bukwimba	Yes	River
District: Mbogwe DC			
Ikobe	Kagongo	No	River
	Bugalagala	Yes	River
	Busabaga	Yes	River
Lulembela	Kashelo	Yes	River
Ilolangulu	Ilolangulu	Yes	River
Mbogwe	Nambubi	Yes	Borehole
	Bwendanseko	Yes	Pond
	Mwanza	Yes	River
Ngemo	Nyitundu	Yes	River
	Bwendamwizo	No	River
	Bulongo	Yes	NA
Ushirika	Kadoke	Yes	Lake
District: Bukombe DC			
Busonzo	Nampalahala	Yes	Borehole
	Nalusunguti	No	River
	Busonzo	Yes	Borehole

Table 7.3.9.1.a
Access to water in Villages of the DAI

Ward	Villages	Access to clean water	Sources of water
	Kabagole	Yes	Borehole
	Nakayenze	No	River
Butinzya	Butinzya	Yes	River
Bulega	Ibambilo	No	River
District: Chato DC			
Iparamasa	Mnekezi	Yes	River
	Mwabasabi	Yes	Lake Victoria
	Songambele	Yes	Lake Victoria
Region: Kagera			
District: Karagwe DC			
Kihanga	Katanda	Yes	Lake Victoria
	Kihanga	Yes	River
	Kishoju	Yes	Lake
	Mulamba	Yes	River
Kayanga	Miti	Yes	Lake Victoria
Bugene	Omurushaka	Yes	River
	Nyakahanga	Yes	River
	Kishao	Yes	River
Ihembe	Ihembe I	Yes	Borehole
Nyaishozi	Rukale	Yes	River
	Nyakayanja	Yes	River
Rugu	Kasheshe	No	River
Nyakasimbi	Nyakasimbi	Yes	Borehole
	Bujara	No	River
	Kahanga	Yes	River
	Muungano	Yes	Borehole
Nyakahanga	Rwandaro	Yes	Borehole
	Bisheshe	Yes	River
District: Biharamulo DC			
Nyakahura	Nyabugombe	No	Borehole
	Ngararambe	Yes	River
	Busiri	Yes	River
	Mabare	No	River
Lusahunga	Nyakanazi	Yes	River
	Kabale	Yes	Borehole
	Lusahunga	Yes	River
	Kikoma	Yes	River
	Nyakasenga	Yes	River
Kaniha	Mavota	Yes	River, Lake Victoria
	Mkunkwa	Yes	River, borehole
Nyantakara	Mgera	No	Borehole
	Nyantakara/Iyengamulilo	Yes	Borehole
	Nyakayenze	Yes	River, borehole
District: Ngara			
Kasulo	Rwakalemera	Yes	Borehole
District: Missenyi			
Mutukula	Byeju	Yes	Lake
	Mutukula	Yes	River
Kassambya	Bunazi	Yes	Lake Victoria
	Nyabihanga	Yes	Pond
	Omudongo	Yes	River

Table 7.3.9.1.a
Access to water in Villages of the DAI

Ward	Villages	Access to clean water	Sources of water
Nsunga	Byamutemba	Yes	Lake
	Ngando	Yes	River
Kyaka	Kyaka	Yes	River

Elaboration: JGP/BENE. Sources: Fieldword – May-July 2024.

All the villages, but 10 (Mgera, Mabare, Bujara, Nyabugombe, Kasheshe, Ibambilo, Nalusunguti, Buyange, Nakayenze and Kasubuya) considered they have access to clean water. It is important to note that this is a perception.

Regarding how they access water, in Shinyanga and Geita regions, most of the people in the project area get water from pipelines and groundwater (wells) and chacoal dams). In Kagera region, people get water from rivers, springs, groundwater (wells), and a few from pipelines. Some villages also have water collection-points. Usually, in most cases, the water is not clean and safe; however, what they value most is the availability of water.

Those that do not have this access are in a more vulnerable situation, especially with respect to diseases transmitted by water, such as diarrhoea, with, in turn, impacts in problems such as anaemia.

7.3.9.2
Sanitation

The 2022 Census characterizes toilet facilities into improved and unimproved. The latter consist only of pit latrine without slab (open pit) and bucket. All the other types of facilities are considered improved. It also includes the category of households without toilette facilities (use of open areas). According to the Census, 54.9% of households in Geita have improved facilities; 39.9% unimproved and 5.2% have no facilities. In Shinyanga Region, 48.6% households have improved facilities; 43.1% unimproved and 8.3% has no facilities. While in Kagera, only 32.2% of the households have improved facilities, 65.3% unimproved and 2.5% no facilities. It is important to take into consideration that rural areas have a higher shortage of sanitation facilities. In Mainland Tanzania, in general, 59.4% of households in urban areas use improved toilet facilities, while 40.5% in the rural ones also do so.

2020 Water Sector Status Report indicates that by 2020, only 11 Authorities had wastewater disposal, including Dar es Salaam, but none of the regions of the Area of Influence. In the cases with no sewerage system, exhauster vacuum trucks are used for emptying and transportation of faecal waste for pretreatment at sludge treatment plants. This includes, according to the Report, Geita and Bukoba. However, the Report also states that Geita and Bukoba, among others, were building modern collection and disposal facilities.

Sewage system is installed and functioning in urban areas, while in rural areas other methods are used.

Accessing wastewater disposal systems that are environmentally friendly is still one of the main challenges faced by the local governments and the population, including the Area of Influence of the project. As previously mentioned, this is reflected on the health issues faced, such as diarrhoea being included as a cause of mortality.

According to the information collected from the DAI villages, all of them have toilets outside the house, except for Bunazi and Buyange villages. Only Bunazi and Mavota villages indicated that they have a drainage system. In addition, only the villages of Mwamakaranga, Nyakasenga and Bunazi indicated that they had a sewage treatment plant.

7.3.9.3
Solid Waste Management

Most solid waste is buried and burnt in the Area of Influence. Services are provided mainly in urban areas. Shinyanga MC mentions that solid waste is collected by the municipality in urban area streets and ward centres. 8 of the 17 wards are covered.

Mbogwe Strategic Plan points out that waste management faces different problems, such as: improper solid waste disposal that pollutes land and water sources and lack of collection facilities such as dustbins, skip loader and vehicles. It also mentions that air is polluted due to bush burning, which must be associated to the lack of recollecting service. Improper waste management has environmental impacts, such as air pollution, soil pollution and increases the risk of fires (especially during droughts).

In the case of the DAI, although it has been mentioned that the villages of Ichongo and Bunazi have solid waste treatment plants, during the fieldwork, none of the villages in the direct area of influence indicated that they had such treatment plants.

Table 7.3.9.3.a
Waste disposal in the villages of DAI

Ward	Villages	Waste Disposal in the village
Region: Shinyanga		
District: Shinyanga MC		
Mwamalili	Seseko	Buried
Ibadakuli	Uzogore	Burnt
	Ibadakuli	Buried
Old Shinyanga	Ihapa	Buried
	Old Shinyanga	Thrown to an open space (dumping site)
District: Shinyanga DC		
Solwa	Mwasekagi	It is collected by the municipality
	Mwiseme	Burnt
	Mwabuki	Burnt
Mwakitolyoo	Mwasenge	Burnt
	Nyang'ombe	Burnt
Iselemagazi	Mwamakaranga	Burnt
	Ichongo	Buried
	Iselamagazi	Burnt
Nyamalogo	Mwang'osha	Buried

Table 7.3.9.3.a
Waste disposal in the villages of DAI

Ward	Villages	Waste Disposal in the village
Pandagichiza	Shilabela	Burnt
Mwenge	Mwongozo	Burnt
	Zunzuli	Thrown to an open space
	Ipango	Burnt
Lyabusalu	Mwajiji	Burnt
	Lyabusalu	Buried
	Bukamba	Thrown to an open space
	Mwabagehu	Burnt
District: Msalala		
Bugarama	Igwamanoni	Burnt
	Ilogi	Burnt
	Buyange	Burnt
Lunguya (Runguya)	Kalole	Burnt
Bulyan'hulu	Busulwangili	Buried
Region: Geita		
District: Geita DC		
Butobela	Shahende	Burnt
District: Nyang'hwale		
Kafita	Kayenze	Burnt
	Bukulu	Burnt
Nyugwa	Isonda	Buried
Bukwimba	Kasubuya	Burnt
	Bukwimba	Burnt
District: Mbogwe DC		
Ikobe	Kagongo	Buried
	Bugalagala	Burnt
	Busabaga	Buried
Lulembela	Kashelo	Burnt
Ilolangulu	Ilolangulu	Thrown to an open space
Mbogwe	Nambubi	Burnt
	Bwendanseko	Burnt
	Mwanza	Buried
Ngemo	Nyitundu	Buried
	Bwendamwizo	Burnt
	Bulongo	N/A
Ushirika	Kadoke	Burnt
District: Bukombe DC		
Busonzo	Nampalahala	Burnt
	Nalusunguti	Burnt
	Busonzo	Burnt
	Kabagole	Buried
	Nakayenze	Buried
Butinzya	Butinzya	Burnt
Bulega	Ibambilo	Buried
District: Chato DC		
Iparamasa	Mnekezi	N/A
	Mwabasabi	Burnt
	Songambele	Burnt
Region: Kagera		
District: Karagwe DC		
Kihanga	Katanda	Burnt

Table 7.3.9.3.a
Waste disposal in the villages of DAI

Ward	Villages	Waste Disposal in the village
	Kihanga	Buried
	Kishoju	Burnt
	Mulamba	Buried
Kayanga	Miti	Burnt
Bugene	Omurushaka	Burnt
	Nyakahanga	Buried
	Kishao	Buried
Ihembe	Ihembe I	Burnt
Nyaishozi	Rukale	Buried
	Nyakayanja	Burnt
Rugu	Kasheshe	Buried
3Nyakasimbi	Nyakasimbi	Burnt
	Bujara	Buried
	Kahanga	Buried
	Muungano	Burnt
Nyakahanga	Rwandaro	Buried
	Bisheshe	Buried
District: Biharamulo DC		
Nyakahura	Nyabugombe	Burnt
	Ngararambe	Buried
	Busiri	Buried
	Mabare	Buried
Lusahunga	Nyakanazi	Buried
	Kabale	Burnt
	Lusahunga	Burnt
	Kikoma	Buried
	Nyakasenga	Burnt
Kaniha	Mavota	Burnt
	Mkunkwa	Burnt
Nyantakara	Mgera	Buried
	Nyantakara/Iyengamulilo	Burnt
	Nyakayenze	Burnt
District: Ngara		
Kasulo	Rwakalemera	Buried
District: Missenyi		
Mutukula	Byeju	Burnt
	Mutukula	It is collected by the municipality
Kassambya	Bunazi	Thrown to an open space
	Nyabihanga	Burnt
	Omudongo	Buried
Nsunga	Byamutemba	Burnt
	Ngando	Burnt
Kyaka	Kyaka	Buried

Elaboration: JGP/BENE. Sources: Fieldword – May-July 2024.

In most cases, waste is either buried or burnt, which may impact the environment and the own health of the population, or thrown to open spaces. Only two villages mentioned that it is collected by the municipality.

7.3.9.4
Electricity

Access to electricity is still restricted and more accessible in urban areas. The high use of charcoal is a concern in terms of the impacts in the forestry of the area. In rural areas, the most important source of energy for cooking is firewood. The problem with this is the possibility of deforestation and depletion of natural vegetation.

Stakeholders showed their acceptance of the project as improving its supply is a demand from the population both in terms of coverage, especially for rural areas, and of power as with the current supply it is insufficient for industrial activities, hence not making possible the development plans. One of the main demands expressed in the consultations with the villages was the access to electricity as they expected that UTIP will allow them to have this resource. It was clarified that this is a transmission project.

7.3.9.5
Houses Characteristics

According to the 2022 Census, 34% of rural households in Tanzania Mainland live in unimproved houses. 9.6% of the households in Geita, 18.4% in Shinyanga and 42.9% of Kagera are in this situation. However, this information does not differentiate the situation of rural and urban areas in the regions.

Materials used for houses vary from urban to rural areas. According to the Census, in rural areas the most common roofing material is iron sheets (77.1%) and grass/leaves (18.1%). The regions maintain the same tendency, in Shinyanga 81.9% of houses have roofs of iron sheets, 12.1% of grass/leaves and 5.2% of mud and leaves. In Geita, 91.6% have iron sheets and 6.8% of grass/leaves. While in Kagera, 90.4% have iron sheets on their roofs and 8.1% of grass/leaves.

Regarding floor covering, the most used material in rural areas is earth/sand (60.8%) followed by cement (34.7%). In Shinyanga, 47.9% has cement floors and 45.4% earth/sand. In Kagera, 33% uses cement and 61.6% earth/sand. While in Geita, 54.5% use cement and 40.2% earth/sand.

Most common wall materials in rural areas are baked bricks (39.6%) sundried bricks (25.1%) and poles and mud (23.3%). The use of cement bricks/ rock bricks is low (8.3%). In Kagera, the most used materials are poles and mud (40.1%) followed by baked bricks (37%). In Shinyanga the most used materials are sundried bricks (50.5%) followed by baked bricks (23.9%) and cement bricks (21.7%). Geita's households mostly use baked bricks (64%), sundried bricks (24.3%) and cement bricks (6.1%).

A problem observed, given the average size of households, is that most houses are overcrowded which is related to health issues, especially with infectious diseases. It is also important to mention that few settlements are planned, especially in rural areas. This also applies to houses, which need to incorporate issues related to space distribution, flow of air, lighting and temperature to ensure good living conditions.

During the field trip, it was possible to observe the characteristics of the houses in the area that will be affected. The following presents the houses' general standard observed during the fieldtrip done in July 2023.

Photos 01 and 02: General Standard of Houses in Direct Area of Influence (DAI). Fieldtrip 2024.

Table 7.3.9.5.a presents the most common characteristics of the houses that are part of the DIA, according to the interviewees.

Table 7.3.9.5.a
Housing characteristics- DAI

Ward	Villages	Wall Material	Floor Material	Number of people living in houses	Overcrowding
Region: Shinyanga					
District: Shinyanga MC					
Mwamalili	Seseko	Mud	Tiles	5-6	No
Ibadakuli	Uzogore	Bricks	Soil	+ 10	No
	Ibadakuli	Concrete	Tiles	5-6	No
Old Shinyanga	Ihapa	Bricks	Soil	7-9	Yes
	Old Shinyanga	Wood	Tiles	7-9	No
District: Shinyanga DC					
Solwa	Mwasekagi	Mud	Cement	7-9	No
	Mwiseme	Bricks	Soil	7-9	Yes
	Mwabuki	Bricks	Soil	+ 10	No
Mwakitolyoo	Mwasenge	Bricks	Soil	7-9	No
	Nyang'ombe	Bricks	Soil	7-9	No
Iselemagazi	Mwamakaranga	Concrete	Tiles	5-6	Yes
	Ichongo	Concrete	Tiles	7-9	Yes
	Iselamagazi	Concrete	Tiles	5-6	Yes
Nyamalogo	Mwang'osha	Mud	Cement	7-9	No
Pandagichiza	Shilabela	Concrete	Tiles	5-6	No
Mwenge	Mwongozo	Concrete	Tiles	5-6	Yes
	Zunzuli	Bricks	Soil	7-9	No
	Ipango	Bricks	Soil	7-9	No
Lyabusalu	Mwajiji	Mud	Cement	+ 10	No
	Lyabusalu	Mud	Cement	+ 10	Yes
	Bukamba	Bricks	Soil	7-9	No
	Mwabagehu	Bricks	Soil	7-9	No

Table 7.3.9.5.a
Housing characteristics- DAI

Ward	Villages	Wall Material	Floor Material	Number of people living in houses	Overcrowding
District: Msalala					
Bugarama	Igwamanoni	Mud	Cement	7-9	No
	Ilogi	Mud	Cement	+ 10	No
	Buyange	Mud	Cement	+ 10	No
Lunguya (Runguya)	Kalole	Concrete	Wood	5-6	Yes
Bulyan'hulu	Busulwangili	Wood	Wood	5-6	No
Region: Geita					
District: Geita DC					
Butobela	Shahende	Mud	Cement	7-9	No
District: Nyang'hwale					
Kafita	Kayenze	Concrete	Wood	5-6	Yes
	Bukulu	Concrete	Wood	+ 10	Yes
Nyugwa	Isonda	Concrete	Tiles	5-6	Yes
Bukwimba	Kasubuya	Mud	Cement	+ 10	Yes
	Bukwimba	Mud	Cement	7-9	No
District: Mbogwe DC					
Ikobe	Kagongo	Mud	Cement	Less than 4	No
	Bugalagala	Mud	Cement	+ 10	No
	Busabaga	Mud	Cement	5-6	No
Lulembela	Kashelo	Mud	Cement	5-6	No
Ilolangulu	Ilolangulu	Concrete	Wood	7-9	Yes
Mbogwe	Nambubi	Wood	Wood	5-6	Yes
	Bwendanseko	Wood	Wood	+ 10	Yes
	Mwanza	Wood	Wood	5-6	No
Ngemo	Nyitundu	Mud	Cement	5-6	No
	Bwendamwizo	Mud	Cement	+ 10	Yes
	Bulongo	Concrete	Cement	+ 10	Yes
Ushirika	Kadoke	Concrete	Cement	7-9	Yes
District: Bukombe DC					
Busonzo	Nampalahala	Wood	Wood	7-9	Yes
	Nalusunguti	Mud	Soil	+ 10	No
	Busonzo	Concrete	Cement	7-9	No
	Kabagole	Mud	Cement	5-6	Yes
	Nakayenze	Mud	Cement	5-6	No
Butinzya	Butinzya	Wood	Wood	+ 10	Yes
Bulega	Ibambilo	Bricks	Soil	7-9	Yes
District: Chato DC					
Iparamasa	Mnekezi	Mud		7-9	No
	Mwabasabi	Wood	Wood	+ 10	Yes
	Songambele	Wood	Wood	7-9	Yes
Region: Kagera					
District: Karagwe DC					
Kihanga	Katanda	Wood	Wood	7-9	Yes
	Kihanga	Bricks	Soil	7-9	No
	Kishoju	Wood	Wood	5-6	No
	Mulamba	Mud		5-6	No
Kayanga	Miti	Wood	Wood	5-6	No
Bugene	Omurushaka	Concrete	Tiles	5-6	No

Table 7.3.9.5.a
Housing characteristics- DAI

Ward	Villages	Wall Material	Floor Material	Number of people living in houses	Overcrowding
	Nyakahanga	Mud	Cement	5-6	No
	Kishao	Mud	Cement	5-6	No
Ihembe	Ihembe I	Wood	Wood	7-9	Yes
Nyaishozi	Rukale	Mud	Cement	5-6	No
	Nyakayanja	Wood	Wood	7-9	Yes
Rugu	Kasheshe	Bricks	Soil	5-6	No
Nyakasimbi	Nyakasimbi	Wood	Wood	5-6	No
	Bujara	Bricks	N/A	7-9	No
	Kahanga	Mud	Cement	5-6	No
	Muungano	Wood	Wood	7-9	Yes
Nyakahanga	Rwandaro	Wood	Wood	5-6	No
	Bisheshe	Mud	Cement	7-9	No
District: Biharamulo DC					
Nyakahura	Nyabugombe	Mud	Cement	7-9	No
	Ngararambe	Mud	Tiles	5-6	No
	Busiri	Mud	Cement	5-6	Yes
	Mabare	Mud	Cement	+ 10	Yes
Lusahunga	Nyakanazi	Mud	Cement	5-6	No
	Kabale	Concrete	Cement	+ 10	Yes
	Lusahunga	Wood	Wood	7-9	Yes
	Kikoma	Mud	Cement	5-6	No
	Nyakasenga	Wood	Wood	+ 10	Yes
Kaniha	Mavota	Concrete/wood	Wood	+ 10	Yes
	Mkunkwa	Concrete	Tiles	7-9	Yes
Nyantakara	Mgera	Mud	Cement	7-9	Yes
	Nyantakara/Iyengamulilo	Concrete	Tiles	7-9	Yes
	Nyakayenze	Wood	Wood	+ 10	Yes
District: Ngara					
Kasulo	Rwakalemera	Mud	Tiles	5-6	No
District: Missenyi					
Mutukula	Byeju	Wood	Tiles	5-6	No
	Mutukula	Mud	Cement	5-6	No
		Mud	Tiles	5-6	Yes
		Concrete	Wood	5-6	No
	Omudongo	Mud	Cement	5-6	No
Nsunga	Byamutemba	Wood	Wood	7-9	Yes
	Ngando	Bricks	Soil	5-6	No
Kyaka	Kyaka	Mud	Tiles	5-6	No

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024.

7.3.9.6
Buildings Affected by the Project

Based on satellite images it has been possible to identify the number of buildings that will be affected by the TLs' wayleave and Kyaka SS's expansion area. It will be necessary to determine if they are houses, if they have other uses or none use at all.

Table 7.3.9.6.a
Infrastructure (constructions) affected by the alignment

TL	District		Villages	
	District Name	Total per District	Village Name	Total per Village
TL Mutukula - Kyaka	Misenyi DC	126	Bunazi	10
			Byamutemba	18
			Byeju	17
			Mutukula	8
			Ngando	32
			Nyabihanga	5
			Omudongo	18
Kyaka Substation			Kyaka	13
			No Information	5
TL Kyaka - Nyakanazi	Biharamulo DC	180	Busiri	1
			Kabale	21
			Kikoma	78
			Lusahunga	14
			Mabare	3
			Ngararambe	13
			Nyabugombe	46
			Nyakasenga	3
			Rugese	1
	Karagwe DC	120	Bisheshe	20
			Bujara	1
			Bujuruga	1
			Chagati	21
			Kahanga	6
			Kasheshe	4
			Kishao	7
			Kishoju	3
			Miti	29
			Mulamba	2
			Nyakahanga	2
			Nyakasimbi	1
			Nyakayanja	22
			Omurushaka	1
	Missenyi DC	9	Kyaka	9
	Ngara DC	8	Rwakalemera	8
TL Nyakanazi - Ibadakuli	Biharamulo DC	70	Mavota	15
			Mgera	11
			Mkunkwa	7
			Nyakanazi	13
			Nyakayenze	16
			Nyantakara/Iyengamulilo	8

Table 7.3.9.6.a
Infrastructure (constructions) affected by the alignment

TL	District		Villages	
	District Name	Total per District	Village Name	Total per Village
TL Nyakanazi - Ibadakuli	Bukombe DC	96	Bulega	29
			Butinzya	22
			Ibambilo	17
			Kabagole	4
			Nakayenze	5
			Nalusunguti	4
			Nampalahala	15
	Chato DC	19	Mnekezi	8
			Songambele	11
	Geita DC	7	Ntono	5
			Shahende	2
	Mbogwe DC	129	Bugalagala	31
			Bulongo	8
			Busabaga	4
			Bwendamwizo	4
			Bwendanseko	14
			Ilolangulu	4
			Kadoke	9
			Kagongo	13
			Kashelo	16
			Mwanza	7
			Nambubi	2
			Nyitundu	17
	Nyang'wale DC	16	Bukwimba	7
			Igeka	3
			Isonda	1
			Kasubuya	3
			Kayenze	2
TL Nyakanazi - Ibadakuli	Msalala DC	35	Buyange	7
			Igwamanoni	6
			Ilogi	4
			Kalole	18
	Shinyanga DC	231	Bukamba	17
			Ichongo	7
			Ipango	4
			Iselamagazi	30
			Mwabagehu	8
			Mwabuki	4
			Mwajiji	14
			Mwamakaranga	11
			Mwang'osha	12
			Mwasekagi	5
			Mwasenge	12
			Mwiseme	33
			Mwongozo	5
			Nzoza	13
			Pandagichiza	10
			Shilabela	23
			Solwa	17

Table 7.3.9.6.a
Infrastructure (constructions) affected by the alignment

TL	District		Villages	
	District Name	**Total per District**	**Village Name**	**Total per Village**
			Zunzuli	6
	Shinyanga MC	60	Ibadakuli	18
			Old Shinyanga	16
			Seseko	6
			Uzogore	20
Total		**1,106**		**1,106**

Elaboration: JGP/BENE Consult. Source: Satellite images.

A total of 1,106 buildings located in the area of the alignment, that will be directly affected by the project, have been identified. Of them, 513 are in Kagera; 326 are located in Shinyanga Region, and 267 in Geita. The districts that concentrate most of the affected buildings are Biharamulo (250 buildings) and Shinyanga DC (231).

7.3.10
Transportation and Communications

In general, trunk roads are the primary national and international roads in the regions, and they are under the responsibility of the central government. Regional roads are the secondary roads that connect district centres in a region or from an important centre to a trunk road. They are also under the responsibility of the central government. District roads connect district centres with wards. They are under the responsibility of the local councils. Feeder roads are the village access roads, they are under the responsibility of the villages. Urban roads are within an urban area.

In general terms, in the area of influence of the Project, major roads are in good condition. A problem faced is that agricultural activities require more and better roads to transport its production due to the weight of the vehicles. Although roads are passable most part of the year, during rainy season earth roads, connecting villages, present problems of transability.

Roads in IAI

Photo 03: Earth road.

Photo 04: Tarmac Road.

Source: JGP Fieldwork, 2024.

Table 7.3.10.a presents the situation of the roads in the DAI.

Table 7.3.10.a
Roads and Transportation: DAI

Ward	Villages	Types of roads	Quality of roads	Public transportation	Frequency
Region: Shinyanga					
District: Shinyanga MC					
		Highway	Regular	No	
Ibadakuli	Uzogore	Highway	Good	No	
	Ibadakuli	Tarmac Road	Good	Yes	Every hour
Old Shinyanga	Ihapa	Highway	Good	Yes	Regularly
	Old Shinyanga	Earth Surface Road	Good	Yes	Every ½ hour
District: Shinyanga DC					
Solwa	Mwasekagi	Highway	Good	Yes	Every 3 hours
	Mwiseme	Highway	Good	Yes	Not Regularly
	Mwabuki	Highway	Good	Yes	Every 3 hours
Mwakitolyoo	Mwasenge	Highway	Good	No	
	1Nyang'ombe	Highway	Regular	No	
Iselemagazi	Mwamakaranga	Highway	Good	Yes	Every ½ hour
	Ichongo	Highway	Good	Yes	Every hour
	Iselamagazi	Highway	Good	Yes	Every hour
Nyamalogo	Mwang'osha	Highway	Good	Yes	Every 3 hours
Pandagichiza	Shilabela	Highway	Good	Yes	Every hour
Mwenge	Mwongozo	Highway	Bad	No	
	Zunzuli	Highway	Regular	No	
	Ipango	Highway	Regular	No	
Lyabusalu	Mwajiji	Highway	Good	Yes	No specific time
	Lyabusalu	Highway	Good	Yes	Every 3 hours
	Bukamba	Highway	Good	Yes	Every 3 hours
	Mwabagehu	Highway	Good	No	
District: Msalala					
Bugarama	Igwamanoni	Highway	Good	No	
	Ilogi	Highway	Good	Yes	Every 1/2 hour
	Buyange	Highway	Good	No	
Lunguya (Runguya)	Kalole	Highway	Bad	No	
Bulyan'hulu	Busulwangili	Highway	Regular	No	
Region: Geita					
District: Geita DC					
Butobela	Shahende	Highway	Good	Yes	Every 2 hours
District: Nyang'hwale					
Kafita	Kayenze	Highway	Bad	No	
	Bukulu	Highway	Bad	No	
Nyugwa	Isonda	Highway	Bad	No	
Bukwimba	Kasubuya	Highway	Good	No	
	Bukwimba	Highway	Good	No	
District: Mbogwe DC					
Ikobe	Kagongo	Highway	Good	No	

Table 7.3.10.a
Roads and Transportation: DAI

Ward	Villages	Types of roads	Quality of roads	Public transportation	Frequency
	Bugalagala	Highway	Good	Yes	Every 5 hours
	Busabaga	Highway	Good	No	
Lulembela	Kashelo	Highway	Good	No	
Ilolangulu	Ilolangulu	Highway	Bad	Yes	Twice a day
Mbogwe	Nambubi	Highway	Bad	No	
	Bwendanseko	Highway	Bad	No	
	Mwanza	Highway	Regular	Yes	Every 1/2 hour
Ngemo	Nyitundu	Highway	Regular	No	
	Bwendamwizo	Highway	Good	Yes	Once a day
	Bulongo	Highway	Bad	No	
Ushirika	Kadoke	Highway	Bad	No	
District: Bukombe DC					
Busonzo	Nampalahala	Highway	Very Good	No	
	Nalusunguti	Highway	Good	No	
	Busonzo	Tarmac Road	Very Good	No	
	Kabagole	Highway	Good	No	
	Nakayenze	Highway	Good	No	
Butinzya	Butinzya	Highway	Bad	Yes	Every hour
Bulega	Ibambilo	Highway	Good	No	
District: Chato DC					
Iparamasa	Mnekezi	Highway	Good	No	
	Mwabasabi	Highway	Bad	No	
	Songambele	Highway	Bad	No	Yes
Region: Kagera					
District: Karagwe DC					
Kihanga	Katanda	Highway	Good	No	
	Kihanga	Highway	Good	No	
	Kishoju	Tarmac Road	Good	Yes	Every ½ hour
	Mulamba	Highway	Good	No	
Kayanga	Miti	Highway	Good	No	
Bugene	Omurushaka	Earth Surface Road	Good	Yes	Every ½ hour
	Nyakahanga	Tarmac Road	Good	No	
	Kishao	Tarmac Road	Good	No	
Ihembe	Ihembe I	Highway	Bad	No	
Nyaishozi	Rukale	Highway	Good	No	
	Nyakayanja	Highway	Bad	Yes	Every 2 hours
Rugu	Kasheshe	Highway	Good	Yes	Every 5 hours
Nyakasimbi	Nyakasimbi	Tarmac Road	Bad	Yes	Every 2 hours
	Bujara	Highway	Regular	No	
	Kahanga	Highway	Regular	No	
	Muungano	Highway	Bad	Yes	Every 6 hours
Nyakahanga	Rwandaro	Highway	Bad	No	
	Bisheshe	Highway	Good	No	
District: Biharamulo DC					
Nyakahura	Nyabugombe	Highway	Regular	Yes	Every hour

Table 7.3.10.a
Roads and Transportation: DAI

Ward	Villages	Types of roads	Quality of roads	Public transportation	Frequency
	Ngararambe	Earth Surface Road, Highway	Good	Yes	Every ½ hour
	Busiri	Tarmac Road, Earth Surface Road	Good	Yes	Every ½ hour
	Mabare	Highway	Regular	No	
Lusahunga	Nyakanazi	Tarmac Road	Regular	No	
	Kabale	Highway	Bad	No	
	Lusahunga			Yes	Every ½ hour
	Kikoma	Tarmac Road	Good	No	
	Nyakasenga	Highway	Regular	No	
Kaniha	Mavota	Highway	Good	No	
	Mkunkwa	Highway	Bad	No	
Nyantakara	Mgera	Tarmac Road	Good	No	
	Nyantakara/Iyengamulilo	Highway	Good	Yes	Every ½ hour
	Nyakayenze	Highway	Regular	No	
District: Ngara					
Kasulo	Rwakalemera	Highway	Good	No	
District: Missenyi					
Mutukula	Byeju	Highway	Bad	No	
	Mutukula	Tarmac Road	Good	No	
Kassambya	Bunazi	Earth Surface Road	Good	Yes	Every ½ hour
	Nyabihanga	Highway	Bad	No	
	Omudongo	Tarmac Road	Good	No	
Nsunga	Byamutemba	Tarmac road	Bad	Yes	Every ½ hour
	Ngando	Highway	Good	No	
Kyaka	Kyaka	Earth Surface Road	Good	No	

Elaboration: JGP/BENE. Source: Fieldwork, May – July 2024.

Internet and media

All the regions and districts have access to internet, which is usually provided by the mobile phones' operators. The main ones present in the area are TTCL, Tigo, Vodacom, Halotel, and Airtel.

Media consumed are mass media produced in a national level. The main radio stations consumed are TBC, RFA, Sibuka FM, RBC. The most consumed are RFA, Radio Tanzania and Radio One. In general, there are no radio stations in a regional level, apart from Radio Faraja, which is the only one based in Shinyanga. Regarding television, the most consumed are ITV, Star TV, TBC. There are also different cable television operators. Social media are also a frequently used form of communication.

7.3.11
Gender Context

Although gender relations have improved in Tanzania, with women accessing higher levels of education, incorporating themselves to the economy and holding political roles, focus groups carried out showed that a clear division of productive and reproductive roles between men and women persists. In all three regions and their villages, there is no equality in gender roles between men and women. Women engaged themselves more in reproductive care activities and community activities compared to men. These include caring for children, the elderly and/or sick family members; household chores (cooking, washing, cleaning and repairing); collection of natural resources for self-consumption (water collection, fuel wood collection, fodder collection); economic activities for self-consumption (subsistence farming, care of livestock), and supplementary economic activities (selling goods at the market or from home, informal income generating activities such as paid labour and services). Men involve themselves more in productive and political activities, such as fishing, cash crops (producing food other than for household use), formal paid employment, and in political activities such as political organizing and maintenance of community infrastructure. Men do not normally engage in reproductive activities, such as cooking or fetching water, and have time to spend on refreshments and resting. Women have more burden as they must ensure all activities at home are conducted. Furthermore, sometimes women are the breadwinners of the family.

Polygamy is frequent among the Sukumas, in the Geita and Shynyanga regions. It is a common situation for a man to have different wives, as this is part of his prestige. Usually, each wife and her children live in a different house, with farmland associated. However, there are also cases where they all live in a same house, in different rooms. Wives are not consulted in the incorporation of a new wife. In general terms, men are the decision-makers, and the one that distributes the resources among the different members of the family. In the case of Kagera, where different tribes are present, polygamy is practiced in a much lesser degree, being a minority. In all cases, they mentioned that some have two wives, while among the Sukemas they indicated that they can have several. Polygamy puts women in a more vulnerable position, as their capacity of influencing decision-making in the family and accessing to resources distributed within it is more difficult and are in a constant risk of neglect.

Access to and control of resources

Women have no equal ownership of resources such as land as compared to men, due to customs. Men still inherit the land and there is full ownership of the land title. In subsistence farming, men owe the cash crops (producing food other than for household use) and women have rights to cultivate only non-production food for the households.

- Price determination: On cash crop, during market sell, men are the ones who determine the actual price of the crops, and they are the ones responsible for selling. This has had negative impacts on the family because most men do not provide for the family. Instead, they use the money for personal refreshments; this impacts children and mothers in general because they fail to attain basic needs. As a result,

the mother becomes a breadwinner for the family.

- Education: The government efforts to provide free education has reduced gender inequality to some extent. However, few families still do not let a child pursue her career so that they may have a dowry. Others do not give a girl priority to pursue high school in the belief that this is useless as women are going to get married. In the focus groups it was constantly mentioned that girls drop school to get married, many at the age of fourteen.
- Employment: Normally, during the development of a project men are given priority compared to women. Men fear and forbid women from doing the work on projects considering that women are not supposed to do men's work. In the case of mining, due to traditional beliefs, women are not allowed to access the underground areas, not being able to directly participate in the economic activity, although they play other roles.
- Family planning: Men are the decision makers on family planning. Mostly women are prohibited on the use of these methods fearing that if they use them, they will be in prostitution/ or using them will deprive men of having many children. The result is that women face big challenges because they give birth consecutively without resting and the outcome affects their health and their capability to work which leds to their continual dependency on men and others due to having multiple children. This situation gets worse in the cases of abandonment.

In decision-making

In Political leadership, both men and women are engaged, and there is a slightly higher number of male leaders compared to female leaders in village leadership.

Reproductive Activities

Most of the burden of childcare falls upon women and, although many women wish to have fewer children, such desires are rarely shared by men, who usually want as many children as possible and who are particularly keen to have sons.

During the focus groups and in-depth discussions, women mentioned that although a husband and wife sometimes discuss the question of the size of the family, the final decision usually rests with the husband. One Muslim man mentioned that the Koran says that men are the heads of the family and are responsible for making all the final decisions in the household. He further said that if a woman insists on family planning (that is having a small number of children), the husband simply takes another wife who will be prepared to bear more children. Some women mentioned that precaution, such as contraceptives, is taken secretly at risk of a marriage crisis when the man discovers it. In Sukuma tradition contraceptives for women are taboo.

In the same discussions it was revealed that women are the ones who are responsible for taking the children to the clinic and hospital when they fall sick. It means that a woman with more children has a bigger burden compared to her counterpart. Women who are pregnant, lactating or with young children must struggle harder to accomplish their domestic rounds as well as being commercially productive for her livelihood.

Women who are most of the time either pregnant, lactating or taking care of young babies have little time for effectively engaging in mines activities or farming. Most of the time is spent on taking care of the children. This responsibility has got to be done alongside with housekeeping responsibilities as we saw in the above table.

When it comes to socialization, men have more time to socialize than women. The only time when women socialize it is when they go to the weddings, funeral ceremonies and markets.

Table 7.3.11.a
Women and Men daily division of labour

Male group	
Time of Day	**Activity**
5.00am	Wake up wash face and pray (Muslim only)
6:00 am	Wake up and listen morning news from the radio Talk to family Take shower
7:00 am	Take Breakfast Boys take the cattle for grazing
8:00 am	Go to work (business, offices)
9:00 am	
10:00 am	
11:00 am	
12:00 pm	
1:00 pm	Take lunch and read newspaper And gossip with fellow men Play pool
2:00 pm	Back to work
3:00 pm	
4:00 pm	Return home and take shower Supervise other businesses or go direct to socialize with other men (bar, club,
5:00 pm	
6:00 pm	

Female Group	
Time of Day	**Activity**
5:00 am	Wake up and pray and make the bed Prepare fire Open the door of the chicken pen
6:00 am	Fetch water Wake up children Prepare breakfast Clean the house, Sweep the compound Prepare food for sale (in the public areas) Laundry
7:00 am	Take breakfast with family Wash dishes Prepare children for school Send children to school
8:00 am	Go to work (business, farms offices)
9:00 am	Take shower Go to the market to buy food
10:00 am	
11:00 am	Look for firewood Look for vegetables Prepare lunch
12:00 pm	Give lunch to children and father Take lunch Clean up after lunch
1:00 pm	Go back to work at the business
2:00 pm	
3:00 pm	
4:00 pm	
5:00 pm	
6:00 pm	Prepare supper

Table 7.3.11.a
Women and Men daily division of labour

Male group		Female Group	
Time of Day	**Activity**	**Time of Day**	**Activity**
5.00am	Wake up wash face and pray (Muslim only)	5:00 am	Wake up and pray and make the bed Prepare fire Open the door of the chicken pen
	Kijiweni) meeting spot. Watch football marches, play pool games		
7:00 pm	…. watch TV…take supper	7:00 pm	Take Supper
8:00 pm		8:00 pm	
9:00 pm		9.00pm	Clean up after supper, prepare children to go to bed
10:00 pm	sleep/talk to wife	10:00 pm	Pray and go to bed
11:00 pm		11.00pm	
REPRODUCTIVE ROLES 5 hours	Prayers, morning news, taking showers, taking breakfast, taking lunch, Rest, watch football, read newspaper, drinking at bar, gossiping at ***kijiweni****, watch TV take super and rest	REPRODUCTIVE ROLES 9 hours	Childcare, breast feeding, taking the children to clinics welcoming visitors, mourning, giving birth, looking after children, taking care the in-laws and husband
PRODUCTIVE ROLES 7 hours	Going for work, digging using ox-plough, building for people (construction) Supervision business	PRODUCTIVE ROLES 8 hours	Going for work at the street, selling fruits, food staff, eggs from chickens,
COMMUNITY ROLES 1 hours	Visiting friends, talk politics, group prayers, helping or going for burials,	COMMUNITY ROLES 3 hours	Cleaning the church, cooking for weddings, and burials, Go to Servings groups

Source: Summary of all the meetings held in the villages in all the regions in the fieldtrips 2024.
*Kijiweni: This is a place on the street where most of men meet usually at the centre of the village and socializing.

7.3.12
Gender Based Violence and Violence Against Children

Gender based violence

According to the officers of the Gender Desks, Social Welfare and NGOs, working on gender issues, gender-based violence (GBV) is a problem present in the area. It mostly affects women, although some men have also denounced this situation. They all pointed out that different efforts have been made (National Plan of Action to End Violence Against Women and Children – NPAVAWC, NGO's work) to educate on this issue and provide support to the victims (accompaniment to present denounces, legal advice, shelter). It is important to mention that these programs do not have enough resources to cover all its implementation.

Interviewees perceive that there has been a decline of GBV, but the problem persists due to traditions, such as polygamy, perception of men as the heads of the families, attribution of a submissive role to women, denial of girl child to go to school, and women's economic dependency on their male partners.

Forms of gender-based violence identified by them include:

- Physical violence (men beating their wives, including pregnant women).
- Psychological violence.
- Sexual harassment.
- Rape.
- Family abandonment.
- No division of labour (women have a higher burden).
- Early marriages for girls.
- Women do not have part on the decision making in the household level, men dominate all the source of income.

According to the different interviewees, there is a clear connection between the increase in economic income and the increase in violence. They pointed out that when the crops are sold, violence against women tends to increase, while it decreases at the beginning of the farming process. They, both members of the communities and officers interviewed, also perceive that when mining and fishing activities generate revenue, that situation coincides with an increase in violence. They also reported that in projects where men received compensation due to displacement, this occasioned abandonment of their families.

Table 7.3.12.a
Incidence of crime on GBV. Information in Shinyanga Region as from 2021 up to 2023

S/N	Type of Crime	Year 2021	Year 2022	Year 2023
1	Rape	214	235	222
2	Sodomization	38	31	35
3	To impregnate a school pupil	58	65	63
4	Dumping a baby	02	-	06

Source: Shinyanga Regional Policer Officer 2024.

The Shinyanga Regional Police Office 2024 shows the gender-based violence cases that are reported for the past 3 years. The above GBV issues which were reported together with other crimes records for the Shinyanga Region from 2021 to 2023, shows that raping cases were 214 in 2021 increased to 235 in 2022 but decreased in 2023 to 222. Still, the rape cases are alarming which needs government initiative to rescue the life of women in the region. Sodomization in 2021 were 38 cases, in 2022 were 31 and in 2023 were 35.

As already mentioned, these institutions work to prevent and attend cases of gender-based violence. Their efforts, however, face these bottlenecks:

- Victims (and the communities in general) think it is normal practice.

- Cases are reported when it is too late to perform the forensic tests.
- The relatives of the victims resolve the cases themselves.
- The victim does not appear in court for the trial.
- Victims are threatened by the aggressor.
- Culture interferences.
- Stigmatization of the victim.

Apart from those, these institutions face problems due to lack of proper resources.

Violence Against Children (VAC)

Regarding the report by police on impregnated school pupils, in 2021 there were 58 cases, in 2022 were 65 and in 2023 were 63 cases. Dumping a baby: in 2021 there were two cases and in 2023 increased to six.

Table 7.3.12.b
Incidence of crime on VAC. Information in Geita Region as from 2021 up to 2023

S/NO	Type of offence	Jan-Dec 2021	Jan- Dec 2022	Jan- Dec 2023
2	Rape	99	107	97
3	Child desertion/ abandonment	4	7	2
4	Child stealing	7	5	3

Source: Geita Regional Policer Officer 2024.

The Geita Regional Police Office 2024 shows the gender-based violence cases that are reported for the past 3 years. The above GBV issues which were from 2021 to 2023 show that raping cases were 99 in 2021, increased to 107 in 2022 but decreased in 2023 to 97. The rape cases are still alarming and need government initiative to rescue the life of women.

The report by police on child abandonment in 2021 show that there were 4 cases, in 2022 were 7 and in 2023 they decreased to 2 cases. Regarding child stealing, in 2021 there were 7 cases, decreased to 5 cases in 2022 and in 2023 were 3 cases.

Table 7.3.12.c
Incidence of crime on GBV and VAC. Information in Kagera Region

OFFENCE	2021	2022	2023
Rape	231	181	224
Child stealing	07	05	02
Child desertion	12	09	15

Source: Geita Regional Policer Officer 2024.

The Kagera Regional Police Office 2024 shows the gender-based violence cases that are reported for the past 3 years (from 2021 to 2023). It indicates that raping cases were 231 in 2021, 181 in 2022 but increased in 2023 to 224. The rape cases are alarming and need government initiative to rescue the life of women.

Child abandonment were 7 cases in 2021; in 2022 there were 5 and in 2023 decreased to 2 cases. In 2021 there were 12 cases of child stealing, decreased to 9 in 2022 and in 2023 increased to 15 cases.

7.3.13
Culture

During the fieldwork the issue of traditional communities historically underserved was asked, and no community belonging to this group was identified in the DAI.

Table 7.3.13.a presents the tribes that are part of the Area of Influence.

Table 7.3.13.a
Area of Influence - Tribes

Area	Tribes
Shinyanga region	
Shinyanga MC	
Msalala	Sukuma Sumbwa Nyamwezi Also, Waha, Hangaza and Dakama
Geita DC	Sukuma Zinza Kara Longo
Mbogwe	Sumbwa Sukuma Others
Nyang'hwale	Sukuma (95%) Zinza Kara Longa Bukwimba ward: Sukuma. Waha, Wanyeramba and Zinza. Nyugwa ward: Sukuma, Waha, Wanyeramba, Zinza and Sumbwa.
Misseny	Haya Sukuma
Karagwe	Hangaza Subi Sukuma Kerewe
Ngara	Hangaza Subi Sukuma Ha Kerewe
Biharamulo	Hangaza Subi Sukuma Ha Kerewe

Table 7.3.13.b presents the information gathered in the villages that form part of the DAI regarding ethnic groups.

Table 7.3.13.b
Ethnic Groups in DAI

Ward	Villages	Ethnicities in villages
Region: Shinyanga		
District: Shinyanga MC		
Mwamalili	Seseko	Sukuma
Ibadakuli	Uzogore	Sukuma
	Ibadakuli	Sukuma
Old Shinyanga	Ihapa	Sukuma
	Old Shinyanga	Sukuma, jita, kurya , waha
District: Shinyanga DC		
Solwa	Mwasekagi	It is collected by the municipality
	Mwiseme	Sukuma
	Mwabuki	Sukuma
Mwakitolyoo	Mwasenge	Sukuma
	Nyang'ombe	Sukuma
Iselemagazi	Mwamakaranga	Sukuma
	Ichongo	Sukuma
	Iselamagazi	Sukuma, haya and kurya
Nyamalogo	Mwang'osha	Sukuma
Pandagichiza	Shilabela	Sukuma
Mwenge	Mwongozo	Sukuma
	Zunzuli	Sukuma
	Ipango	Sukuma
Lyabusalu	Mwajiji	Sukuma
	Lyabusalu	Sukuma
	Bukamba	Sukuma
	Mwabagehu	Sukuma
District: Msalala		
Bugarama	Igwamanoni	Sukuma
	Ilogi	Sukuma
	Buyange	Sukuma
Lunguya (Runguya)	Kalole	Sukuma
Bulyan'hulu	Busulwangili	Sukuma
Region: Geita		
District: Geita DC		
Butobela	Shahende	Sukuma
District: Nyang'hwale		
Kafita	Kayenze	Sukuma
	Bukulu	Sukuma
Nyugwa	Isonda	Sukuma
Bukwimba	Kasubuya	Sukuma
	Bukwimba	Sukuma
District: Mbogwe DC		
Ikobe	Kagongo	Sukuma, Sumbwa
	Bugalagala	Sukuma, Sumbwa
	Busabaga	Sukuma, Sumbwi
Lulembela	Kashelo	Sukuma
Ilolangulu	Ilolangulu	Sukuma and sumbwa
Mbogwe	Nambubi	Sukuma and sumbwa

Table 7.3.13.b
Ethnic Groups in DAI

Ward	Villages	Ethnicities in villages
	Bwendanseko	Sukuma and sumbwa
	Mwanza	Sukuma
Ngemo	Nyitundu	Sukuma, Sumbwa
	Bwendamwizo	Sukuma, Sumbwa
	Bulongo	Sukuma, Sumbwa
Ushirika	Kadoke	Sukuma, sumbwa nyiramba and waha
District: Bukombe DC		
Busonzo	Nampalahala	Sukuma, Sumbwa
	Nalusunguti	Sukuma, Sumbwa, Waha
	Busonzo	Sukuma, Sumbwa, Waha
	Kabagole	Sukuma, Sumbwa
	Nakayenze	Sukuma, Sumbwa, Zinza, Waha
Butinzya	Butinzya	Sukuma, Sumbwa
Bulega	Ibambilo	Sukuma, Sumbwa
District: Chato DC		
Iparamasa	Mnekezi	Sukuma, Sumbwa, Waha
	Mwabasabi	Sukuma
	Songambele	Sukuma, Sumbwa, Waha
Region: Kagera		
District: Karagwe DC		
Kihanga	Katanda	Wanyambo and Waha
	Kihanga	Nyamba and Haya
	Kishoju	Wanyambo, Wahangaza
	Mulamba	Nyambo, Haya
Kayanga	Miti	Wanyambo,Haya, and Wasubi
Bugene	Omurushaka	Nyambo, Haya
	Nyakahanga	Nyambo, Haya
	Kishao	Nyambo, Haya
Ihembe	Ihembe I	Wanyambo, Wahaya
Nyaishozi	Rukale	Nyambo, Haya
	Nyakayanja	Wanyambo ,Waha, and Sukuma
Rugu	Kasheshe	Nyambo
Nyakasimbi	Nyakasimbi	Wanyambo, Wahaya
	Bujara	Nyambo, Haya
	Kahanga	Nyambo, Haya
	Muungano	Wanyambo
Nyakahanga	Rwandaro	Wanyambo
	Bisheshe	Nyambo
District: Biharamulo DC		
Nyakahura	Nyabugombe	Subi Waha Sura Nyambo Haya Hangaza Sukuma
	Ngararambe	Subi Waha Sura Sukuma

Table 7.3.13.b
Ethnic Groups in DAI

Ward	Villages	Ethnicities in villages
	Busiri	Waha Sukuma Kurya Sumbwa
	Mabare	Waha Sukuma
Lusahunga	Nyakanazi	Waha Sukuma
	Kabale	Waha Sukuma
	Lusahunga	Waha Sukuma Wasubi
	Kikoma	Waha Sukuma
	Nyakasenga	Waha
Kaniha	Mavota	Haya, sukuma, waha, wasumbwa
	Mkunkwa	Sukuma, haya, waha, wasumbwi
Nyantakara	Mgera	Waha, Sukuma
	Nyantakara/Iyengamulilo	Waha, sukuma, haya, wasubi, sumbwa, kurya, and jita
	Nyakayenze	Wasubi,sukuma, waha and haya
District: Ngara		
Kasulo	Rwakalemera	Hangaza, Shubi
District: Missenyi		
Mutukula	Byeju	Wahaya and Sukuma
	Mutukula	Haya
Kassambya	Bunazi	Haya and Wahangaza
	Nyabihanga	Haya
	Omudongo	Haya
Nsunga	Byamutemba	Haya
	Ngando	Haya, Waha
Kyaka	Kyaka	Haya

Elaboration JGP/BENE. Source: Fieldwork May – July, 2024.

As can be seen, Geita and Shinyanga are more homogeneous, being the Sukumas the prevalent tribe, while Kagera presents a higher diversity.

Haya ethnic group

This name originated from the area called Ihaya that comprised all the area around the coast of Lake Victoria on Kagera region with two districts: Bukoba and Muleba (Ruhinda, 2005). After being colonized by Germany, they used haya language for the unification of all people in this area.

- After colonization, hayas created a unit called Buhaya Council that unifies all groups.
- Despite the area has gone through colonization processes and Islamic and Christianity religions have been introduced, traditional beliefs continue. This has

helped to increase transparency, harmony, and has enhanced development.

- The heritage of land was done by men to be responsible for controlling and managing families. Females were not allowed to inherit land, but, increasingly, they were allowed to inherit other thigs such as cows. Even up to now, land is owned mainly by men.

Nowadays, hayas depend much on bananas and coffee plantations as their main economic activities. In some places the main activity is fishing, especially around Lake Victoria zone. Other important economic activities are cattle, goat keeping and, in some places, mixed farming with maize and beans and sugar cane plantation.

Sukuma ethnic group

Found in Shinyanga, it was ruled by a hierarchical chiefdom. It has gone through many transformations since the sixteenth century. when the colonization began. This group has been characterized by the following features and belief system:

- Sukumas are divided into different groups as they separated according to geographical locations and units. This took place during the migration of the Babinza, Bakwima, Balongo, Banngolo and Basega. These groups are responsible for consolidating the sparsely populated areas in Lake Victoria.
- Sukumas still practice traditional rituals in various places, such as graving the dead body of beloved one in their own localities.
- Nowadays there is a diversity of religions. Many people practice traditional religion while others are Christians and Muslims. Sukuma's religion is practiced within the confines of the family compound. Sukumas associate their god with the sun and is honored with the external spirit of deceased ancestors.
- This group has three types of activities: hunters, gatherers, agriculturalists and pastoralists. They keep cattle, grow crops and harvest a finite supply of firewood due to tropical climate characterized by dry season and wet season. Even nowadays, these are the main economic activities. The Sukuma tribe are still very conservative and continue to practice some traditions that affect agricultural production and their economy.
- Regarding heritage system, as most of Tanzania society, men are the ones that inherit and own land, which is linked to the control of the family. Females are not allowed to own land. Men are the heads of the household and women have no say in any decision about any family matter.

Nowadays Sukumas depend much on cotton and rice plantation as major cash crops. Other crops are also cultivated for consumption, such as maize, beans, peanuts, wheat and casava. Mining is becoming an important economic activity as gold can be found in most areas. Livestock keeping of cattle and goats is practiced in most places.

Polygamy

Polygamy is mainly practiced in Shinyanga and Geita regions, where Sukumas are the prevalent tribe. During the survey it was revealed that in these regions 80% are

polygamous. In Kagera, interviewees said that Haya tribe (which includes Nyambo, Subi and Hangaza tribes) are usually monogamous. Only 20% practices polygamy and most cases are immigrants, who came to the area attracted by mining or are there due to the exchange with Uganda.

The Sukuma tribe, together with the small tribe of Subwa, primarily found in Shinyanga and Geita regions have a traditional social structure that often includes polygamous households. In these households, the organization typically revolves around the following aspects:

- *Head of Household*: The male head of the household usually has multiple wives. He is responsible for providing for the family and making decisions regarding household affairs.
- *Wives and their roles***:** Each wife may have her own designated space or home within the compound. They often manage their own children and have specific responsibilities, such as cooking, farming, and other domestic tasks. The wives may also engage in communal activities and support each other.
- *Children*: Children from different wives are generally raised together, fostering a sense of community among siblings. The father typically plays a role in the upbringing of all children, but each wife may have a particular influence over her own children.
- *Resource Allocation*: Resources such as land, livestock, and finances are often shared among the wives and their children. The head of the household may distribute resources based on need or contribution to the household.
- *Social Structure:* The social dynamics can vary, with some wives holding more influence than others, often depending on factors like seniority, the number of children, or the husband's preference.
- *Cultural Practices***:** The Sukuma tribe has specific cultural practices and rituals that govern marriage and family life, including bride price and ceremonies that reinforce the bonds within polygamous families.

Overall, the organization of polygamous households in the Sukuma tribe reflects a blend of cooperation, shared responsibilities, and cultural traditions.

Graves

In general, loved ones are buried in the compounds of each family. Interviewees mentioned that existing cemeteries are of the Catholic and that only they can be buried there.

Problems faced recently include that, as population increases and plots become smaller, families are having problems finding space to continue this practice. Also, in the case of miners who are immigrants, they need to transport the bodies to other areas of the country, which is very expensive. Additionally, it was repeatedly mentioned that having the tombs of the loved ones close brings them sorrow. Due to all this, different villagers, especially those on mining areas, mentioned that they are considering building graveyards.

7.3.14
Vulnerable Populations

A first vulnerability assessment has been carried out in the fieldtrip done. Different interviews were carried out with officers (Social Welfare, Community Development), NGOs who work with vulnerable people, village leaders and groups of vulnerable people themselves.

According to the interviews, the types of vulnerable people they identify are:

- Those with disabilities.
- People who are economically poor and receive no support.
- Those without place of residency.
- Those with many dependants and who do not receive support.
- The elderly.
- Widows.
- Women headed households.
- Youths who use drugs, among others.
- Orphan households (which are rare, as orphans are taken care by their relatives in most of the cases).

Interviewees pointed out that vulnerability increased due to:

- Poverty, as it pushes children to abandon studies and work, girls to get married early and worsens living conditions, impacting on health.
- Incapacities to produce goods or income, such as disabilities or illnesses that limit their capacities; poverty; lack of savings; lack of land and other resources.
- Lack of knowledge. Interviewees mentioned in different occasions that vulnerable people are more likely to be abused due to their lack of knowledge (for example, about their rights during compensations).
- Lack of sufficient familial support. Although they depend on the support of their neighbours and relatives, it was constantly mentioned that they live with few persons in their households, as relatives tend to distance themselves.
- Cultural beliefs. Culture was also mentioned as a cause that worsens vulnerability. In concrete, one of the representatives of NGOs interviewed mentioned that most of the elders are perceived to be witches by their communities, hence treated badly. Other beliefs, as those related to women and mining, block their opportunities. These traditions are associated with low education among the community members.
- Stigmatization. Those who are HIV/AIDS positive are more likely to be stigmatized by their communities, something which has led them to not receive proper treatment including health care services.
- Lack of support. Although there are programs that intend to bring support to vulnerable people (as TASAF) this is insufficient. In different areas was reported that the number of vulnerable people who are receiving support is a fraction of those who are qualified for it.

Most vulnerable people are involved in small-scale business, farming (gardening), petty trade, small-scale livestock keeping, and poultry keeping. Their incomes are mainly for subsistence.

Vulnerability carries out as consequences:

- Lack of capital.
- Lack of proper shelter. They own their houses but are in poor condition and have no title.
- Lack of food.
- Lack of medical services and susceptibility to diseases. They rely on medicinal herbs.
- Lack of school attendance, as they experience difficulties covering the associated costs.
- Failure to cope with climate change, which may negatively impact their different economic activities, such as farming.
- Failure to get national identity cards poses a significant obstacle for them to seek loans from various financial institutions.
- Lack of time: Vulnerable people cannot easily dispose of their own time, which makes access to opportunities difficult for them. In situations where they are required to dedicate time (i.e., get involved in building a new house due to resettlement), this condition (the lack of time) represents a major obstacle for them to successfully deal with this challenge.
- Many projects require a significant amount of time for implementation, even after the valuation process has been finalized. This situation leads to a persistent sense of uneasiness amongst vulnerable people.

The characterization of vulnerability and of the challenges faced was similar in all the areas.

The project will require to have more specific information on vulnerable population, for which a longer process, involving the participation of those in condition of vulnerability is necessary. For this, the following should be considered during the project implementation phase.

1. Direct Input and Feedback: Engaging with vulnerable groups allows for the collection of firsthand information about their specific challenges, needs, and experiences. This direct input is crucial for accurately assessing vulnerability and understanding the context in which these groups operate.
2. Community-Based Participatory Research: Involving vulnerable populations in the research process empowers them and ensures that their voices are heard. This participatory approach can lead to more relevant and effective vulnerability assessments, as it incorporates local knowledge and perspectives.
3. Tailored Interventions: By understanding the unique circumstances of different vulnerable groups, assessments can lead to tailored interventions that address specific vulnerabilities. For example, female-headed households may face different challenges compared to orphan households, and understanding these nuances is essential for effective support.

4. Building Trust and Relationships: Engagement fosters trust between assessors and vulnerable communities. When communities feel that their input is valued, they are more likely to participate in assessments and share accurate information, leading to better outcomes.
5. Capacity Building: Engaging with vulnerable groups can also involve training and capacity-building initiatives that empower these communities to advocate for their own needs and participate in decision-making processes. This can enhance the overall effectiveness of vulnerability assessments.
6. Monitoring and Evaluation: Continuous engagement with vulnerable groups allows for ongoing monitoring and evaluation of vulnerability assessments and interventions. Their feedback can help refine approaches and ensure that they remain relevant and effective over time.
7. Intersectionality Consideration: Vulnerability is often multifaceted, and engaging with diverse groups helps to identify intersecting vulnerabilities (e.g., a female-headed household with a member living with a disability). This understanding is crucial for comprehensive vulnerability assessments.
8. Policy Influence: Engaging vulnerable groups can help ensure that their needs and perspectives are reflected in policy discussions and decisions. This can lead to more inclusive policies that address the root causes of vulnerability.
9. In summary, engagement with vulnerable groups in the project implementation is essential for conducting effective vulnerability assessments. It ensures that assessments are grounded in the realities of those affected, leading to more accurate, relevant, and impactful interventions.

7.3.15 Landmines

According to the Archaeological Report (see **Annex 8**), in order to carry out the field surveys in the Kagera region, it was first necessary to consult army officers to scan areas to be excavated, to ensure that they were free of landmines.

This is because some districts in the Kagera region, specifically Missenyi, Kyerwa, Bukoba, Muleba and Karagwe[2][3][4], were affected by the conflicts of the Tanzania-Uganda War, also known as the Kagera, which took place in 1978 and 1979, and landmines may still be buried in these areas. Of these 5 districts, Missenyi and Karagwe are intercepted by the project's LTs.

The stretches of the TLs that intersect the Missenyi and Karagwe districts mentioned above total some 116 km, which includes the total length of the 400 kV Mutukula - Kyaka TL (31 km) and approximately 85 km of the 400 kV Kyaka - Nyakanazi TL (from the Kyaka SS to approximately the KN-19 vertex, located in the village of Nyakasimbi).

[2] https://www.thecitizen.co.tz/tanzania/news/africa/the-1978-war-that-pushed-idi-amin-out-of-presidency--3603576
[3] https://www.onwar.com/data/tanzaniauganda1978.html#google_vignette
[4] https://www.monitor.co.ug/uganda/special-reports/39-years-after-war-that-brought-down-amin-1749938

On this 116 km stretch it will be necessary to carry out a demining measure in the wayleave prior to the start of construction activities (see Section 5.12 of P.01 in **Chapter 10.0**).

7.4
Cultural Heritage Resources Baseline

The worldwide definition of cultural heritage was consolidated in the Convention Concerning the Protection of the World Cultural and Natural Heritage, drawn up at the General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris, France, in 1972 (UNESCO, 2017).

Heritage can be defined from the events of a place's history, taking on different dimensions. Therefore, to value heritage is to understand that historical testimonies, whether material or immaterial, lead to an understanding of who we are. In this way, the preservation of heritage assets should aim to conserve the traces of common, everyday life and show how society lived at a certain time (ARZE, 2009; TOMAZ, 2010).

Cultural heritage is made up of categories and applications of heritage that make a greater number of social actors available, including material, immaterial and natural heritage (ARZE, 2009). Cultural heritage is that which provides awareness and interaction between man and himself, with the environment in which he lives, with his history and memory (LEMOS, 2000; PELEGRINI, 2008). The value of heritage is related to its ability to stimulate memory and imagination, helping to guarantee cultural identity. As far as cultural heritage is concerned, it can be categorised in the following order:

- Material Heritage: is characterised by a set of cultural goods classified as: '[...] works, objects, documents, cities, buildings, spaces used for artistic and cultural manifestations, urban ensembles and sites of historical, landscape, archaeological, palaeontological, ecological and scientific value' (IPHAN, 2014a, p.1). These are all goods made, modified or discarded by human hands (IPHAN, 2014a; TELLES, 2010).

- Intangible Heritage: are all those practices in '[...] domains of social life that manifest themselves in knowledge, crafts and ways of doing things; celebrations; scenic, plastic, musical or playful forms of expression; and in places (such as markets, fairs and sanctuaries) that house collective cultural practices' (IPHAN, 2014b, p.1).

- Natural Heritage: is considered to be made up of remarkable landscapes and geomorphological formations, such as rivers, caves, flora and fauna of a particular region and others (ZARATO, 2010).

7.4.1
Cultural Heritage and Archaeological Potential in the Area of Influence of the Project

This section presents the surveys carried out on cultural heritage, including archaeological heritage, with the aim of assessing the potential of the Project's construction area, in order to support the analysis of the Project's impacts and risks on this heritage and propose measures to safeguard it that are based on national legislation and the guidelines of the World Bank's ESS 8. The full report can be found in **Annex 8**.

The cultural heritage impact diagnosis studies, which included prehistoric and historic archaeological sites and intangible heritage, considered the ethnohistoric survey, through visits (meetings) and face-to-face interviews, which were carried out with District Cultural Officers, District Executive Officers, Village Executive Officers, as well as members of the respective village governments. In addition, a prospective surface and subsurface archaeological survey was carried out along the transmission line. During the field surveys, the archaeologist in charge observed the archaeological features within the landscape by means of walkovers, a practical and systematic research method used to record archaeological remains visible on the surface. A literature review and analysis of the physical attributes of the archaeological finds recovered during the activities carried out in the field were also carried out, so that it would be possible to characterise the artefacts if they were identified.

During the surface prospecting stages, artefacts of archaeological interest were located, scattered in different degrees of concentration. **Table 7.4.1.a** shows that lithic remains from the Middle Stone Age (MAS) and the Late Stone Age (LFA), potsherds belonging to Early Iron Working (EIW) pottery and slags.

Table 7.4.1.a
Recorded sites with archaeological materials observed along the TLs

Site Name	Location (36 UTM ARC 1960)	Number of artefacts collected and their cultural designation	Significance	Importance	Area of influence
Ibadakuli	557,214 / 9,599,391	8 MSA/LSA and 1 EIW potsherd	Archaeological	Moderate	Based on the coordinates, the remains are at a distance of 40 metres from the Ibadakuli SS, in the DAI.
Igeka	460,547 / 9,634,512	7 Early Iron Working slags	Archaeological	High	Based on the coordinates, the remains are at a distance of 269 metres from the wayleave, in the DAI.
Mavota	333,713 / 9,640,778	8 Early Iron Working potsherds	Archaeological	High	Based on the coordinates, the remains are at a distance of 228 metres from the wayleave, in the DAI.
Burigi-Chato	318,728 / 9,647,237	7 MSA/ LSA	Archaeological	Moderate	Based on the coordinates, the remains are at a distance of 76 metres from the wayleave, in the DAI.
Nyantakara	267,697 / 9,711,501	3 MSA/LSA and 1 Potsherd	Archaeological	Low	Based on the coordinates, the remains are at a distance of 95 metres from the wayleave, in the DAI.
Nyabugombe	283,677 / 9,773,213	15 MSA/ LSA	Archaeological	High	Based on the coordinates, the remains are at a distance of 80 metres from the wayleave, in the DAI.

Map 7.4.1.a below specifies the location of the archaeological sites identified along the TLs's routes.

In order to assess the degree of significance of the fragments located on the surface, surveys (grids) of 1 m x 1 m were carried out in the vicinity of the areas where the remains were located, at specific points along the TLs' wayleave, to assess the archaeological potential. The excavations were carried out using 10 cm artificial levels and the sediments were sieved through a 5 mm mesh, with the archaeological excavations ending at the sterile level (when there are no archaeological remains). **Table 7.4.1.b** shows the seven (07) areas that received subsurface investigations.

Table 7.4.1.b
Details of subsurface prospecting areas

Prospected Area	Location (36 UTM ARC 1960)
Mavota village	36M 0333,713 / 9,640,778
Burigi Chato National Park	36M 0279,157 / 9,752,679
Burigi Chato National Park	36M 0283,677 / 9,773,213
Nyabihanga village	36M 0323,444 / 9,862,108
Omundongo village	36M 0320,170 / 9,865,357
Byamtemba village	36M 0319,586 / 9,875,380
Mutukula village	36M 0320,934 / 9,888,830

With the subsurface interventions along the TLs, a total of **29 artefacts of archaeological interest** were collected. **Physical attributes analysis** was preceded by cleaning, drying, sorting, and labelling the archaeological materials. Next was preparation and refining of Code Books (CB) (also called analytical schemes) for physical attributes analysis of lithics, metallurgical remains and potsherds. Preparation of CB was developed based on the varieties of the archaeological materials rescued from the assessment.

Mehlman (1989) was used to analyse the lithic material and the references for the ceramics were Shepard (1956), Chami 1998 and Pawlowicz (2013). As for the archaeological remains Archaeometallurgical remains, Lyaya (2013) was used. **Table 7.4.1.c** shows the materials collected during the surface and subsurface investigations.

Map 7.4.1.a
Archaeological sites along the research area

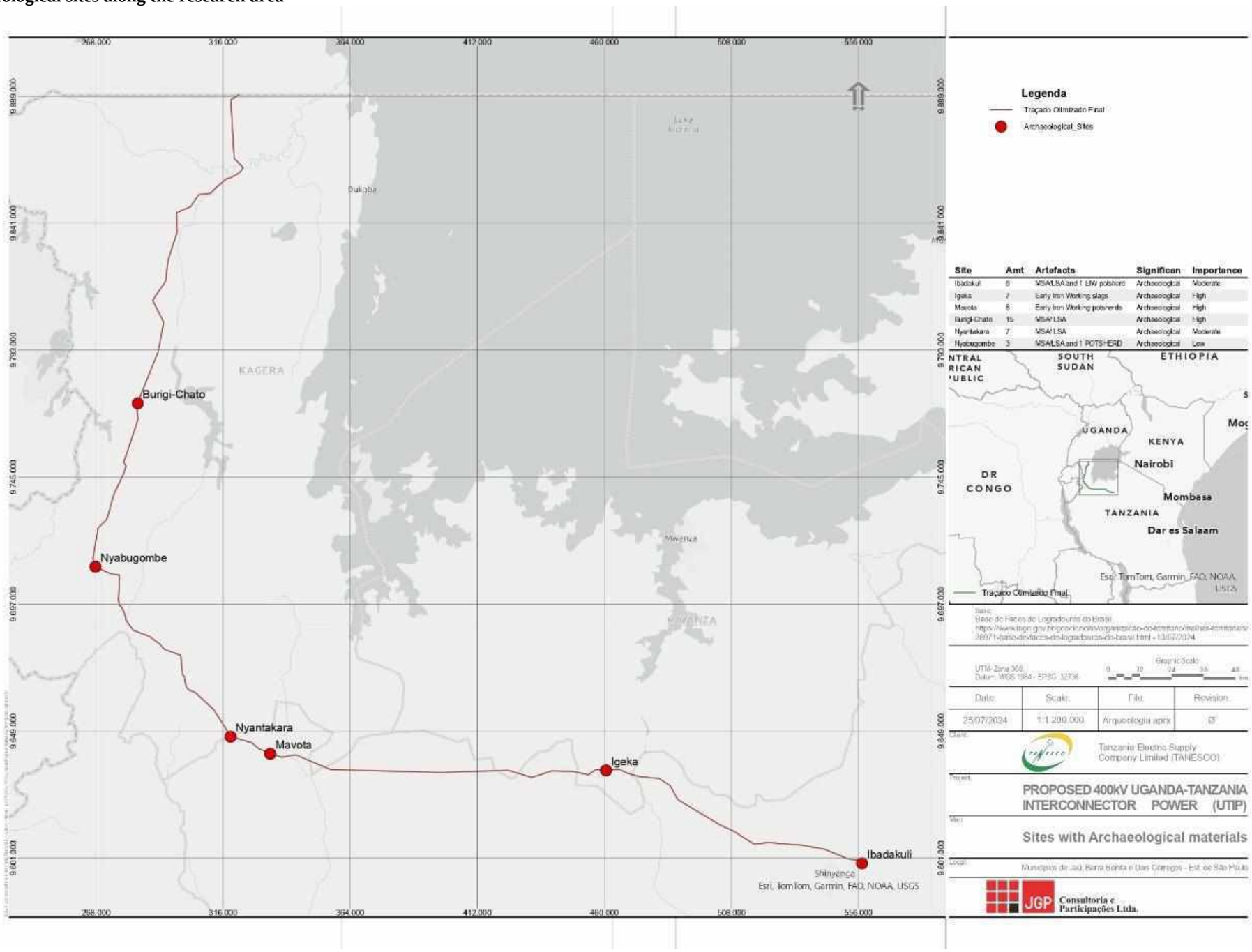


Table 7.4.1.c
Categories of artefacts recovered from surface and subsurface surveys

Artifact categories	Surface survey	Test pit	Total artefact
Flakes (Kombewa)	2	1	3
Blade	6	4	10
Levallois flake	3	0	3
Utilized flake	5	2	7
Scraper	3	2	5
Core scrapper	6	4	10
Becs/percor	0	2	2
Notched scraper	1	0	1
Bifacial point	0	2	2
Flake fragments	4	5	9
Pottery	5	7	12
Slags	7	0	7
Grand Total	**42**	**29**	**71**

The Late Stone Age (LSA) is characterized by the preponderance of microlithic implements, which include whole and broken flakes, thumbnail scrapers, a variety of geometrics e.g., lunates, wood working implements such as outils ecailles, boring implements such as burins and becs.

In addition to archaeological artefacts, during the surveys it was also possible to identify areas that we can consider to be Intangible Heritage areas. These are intangible cultural heritage that daily life customs and tradition participate in shaping the local identities at community level profound the projected area will be affecting the social and cultural fabric to the local community and nearly by community because the project will affect the ritual site and graves that are found along the line contravening local customs and tradition. The ritual sites identified along the TLs are shown in **Table 7.4.1.d**.

For the intangible heritages mentioned in **Table 7.4.1.d**, it is necessary to carry out systematic investigations, through consultation to interpret the current use of the space and conversations with the owners, especially for the sites that are in the DAA.

Other heritage sites such as: Karagwe Heritage Museum and Graves of the Chief Kyamkuma Clan covered by Dry Grasses were specified in the heritage survey for their historical relevance (**Table 7.4.1.e**).

Table 7.4.1.d
Intangible cultural heritage

Ritual Sites	Coordinates	Project's Area of influence	General comments	Photos
Kabagole	36 M UTM 0338,421 / 9,639,217	This intangible heritage is located in the wayleave (DAA).	It is found at Kabagole village, Bukombe DC and owned by Lameck Chatika Mwabahe. It is found within the wayleave, characterized by church and ritual practices whereby the owner heals people traditionally and he has his small houses to keep his patients. It is still used by the people within and outside the village.	
Mwakulali	36 M UTM 0461,078 / 9,634,533	This intangible heritage is located outside of the wayleave, in the DAI.	It is found at Igeka village, Nyang'hwale DC and located with coordinates UTM 36 0461,078 / 9,634,533. It is covered by large tree and thick forest. The site is within the wayleave and it is in use as villagers from Nyakasanza, Igeka, Bukima and Isonda villages are using it when there is a need for rainfall and other unknown problems. Also, people who are involved in mining activities they do some rituals to locate minerals. The practitioners used black cows or goats and 300m from the site they built a small house for camping. This site is too sensitive as there some rules that whoever go there without a permission should be punished by paying one million shillings as a fine.	
Nakurumbogwe	36 M UTM 0338,224 / 9,638,324	This intangible heritage is located outside of the wayleave, in the DAI, approximately 720 metres from the DAA. It is therefore outside the area of direct impact of the future project.	It is found in a Nakurumbogwe hill which is at Ilolanguru village, Mbogwe DC. It is used by the villagers from Ilolanguru, Busabaga and Bugalagala during the time when people are in need of rainfall and they use black cows and goats, traditional alcohol called Kidugugu made by sorghum and maize usually practiced Sumbwe tribe. This site is protected by village authority. The site is near the Halotel/Airtel tower but it is 300 m from TL.	

Table 7.4.1.e
Other cultural heritage of historical importance

Heritage	Observations	Photos
Karagwe Chiefdom	Karagwe historically is a home of chiefdom system known as chief Omukama descendant in the history of Wanyambo people at the Nyakahanga village. This place was too sensitive in chiefdom system and it is the home of Chief Rumanyika but it's far from the TL about 460 m. Around 1700s Chief Ntale V died of hunger at a place called Omugakorongo Mrombo and people are still doing rituals. At Omurushaka center, there is Karagwe Heritage Museum which is under Fredrick B. Ruhinda as the director of the Museum. This museum keeps history of the Nyambo tribe but it is far from the TL. It was reported by the director that there is this place called Kitengule which used to be a slave trade centre in 1700s whereby slaves were taken from Buganda Kingdom Uganda to Zanzibar via Bagamoyo but the site is also far from the proposed alignment.	
Chefia Misenyi	Historically Misenyi has been ruled by Chief Kyamkuma whose palace is at Bunazi whereby the current chief lives. It is composed of ritual house, traditional house and a palace. It is very close to the administration blocks of Misenyi DC. The clan of Chief Kyamkuma has been ruling the area for ages and they have a family farm that is used for burying the chiefs. This burying place is about 361.4 m from the TL alignment with the coordinates 36 M 0320,238 UTM 9,870,531. There are four graves of Rwekira, Omukama Seleman, Paul Ramjongo and Sarapion Paulo Kyamkuma. There are presences of rock paintings for hunters and animal keepers at Kiziba (Bugandika, Kanyigo, Kitobo and Bwanja) but the UTIP alignment does not cross these areas. The graves are located in the DAI, outside the DAA.	 Burials

7.5
Stakeholder Consultation and Involvement

7.5.1
Stakeholder Engagement and Consultation Activities

The consultation process was implemented in three phases. The first one was implemented in July 2023 and consisted of the meetings held in the national, regional and district levels. The second phase took place between May and July 2024, and the third one between October and November 2024. The social team visited the wards and villages to collect socio-economic information and held meetings with the affected villages and other stakeholders. A total of 107 consultation meetings with the villages of the Direct Area of Influence were held. 6.143 persons participated, of which 2,217 were women and 3,926 were men.

As part of the biodiversity assessment, consultations were held with the managers of the Protected Areas intercepted by the project, including TANAPA, TFS and MNRT in January, August and November 2024, as part of the biodiversity assessments. In addition, as part of the critical habitat assessment, flora experts were consulted on threatened and endemic species in the project area. These consultations were carried out remotely in January 2025.

7.5.1.1
Process of Implementation

As previously mentioned, the regional, district, wards, villages and other stakeholders have been reached by the project team (TANESCO and JGP/Bene) during the three fieldworks. This section addresses how the wards and villages were involved in the process.

As planned, the following steps were followed:

1. To reach the wards, TANESCO sent letters to the District Executive Officers asking for their support to contact the Ward and Village Executive Officers. They were then contacted by JGP/BENE team.

2. Meetings with the wards:
   - The social team held meetings with the ward representatives, where the team asked them to contact the leaders of the villages to let them know that the team will visit them. The wards representatives were asked to phone the leaders of the villages.
   - In the meeting with the ward, the social team gathered information about the villages (the team interviewed them and asked if they had any reports). The team also organized, together with the ward representatives, the meetings with the affected villages, determining if it was possible or not to gather more than one village in each meeting. In general, the WEOs and VEOs requested to carry out one meeting in each village. Only in three

cases they considered that it was possible to have the participation of more than one village, especially due to the distance between them.
- While in the ward, the social team interviewed the WEOs.

3. Meetings with the villages:
    - Project team, that included TANESCO and JGP/BENE representatives, held meetings in a total of 100 villages, with the participation of a total of members of 104 villages, inviting representatives of the affected areas.
    - Prior to the meetings with the villages, the team visited the districts again and asked for their support and participation in the general meeting.
    - Prior to the general meeting, the team visited each affected village and held a meeting with the leaders of the village (village executive officer and village chairperson), presented the project and invited them to the general meeting, asking them to bring members of the community.
    - In the general meetings with the villages TANESCO presented the project. TANESCO'S team included an environmental officer and a social specialist. Bene presented the impacts and management measures foreseen. The consultant (JGP/Bene) registered the questions and answers.
    - After the general meeting, individual and group interviews took place, and the land surveyor and valuer visited the area where of the alignment.

At these public consultations, stakeholders received feedback on the results of the ESIA process and were able to ask questions and present their opinions or complaints. The list of participants, questions and answers are in **Section 7.5.5**, as indicated in Environmental Impact Assessment and Audit Regulations (2005) Part IV – Art 17 (Public Participation), together with the records of the consultations held in the villages.

During the third fieldtrip the character of the consultation was more focused on addressing specific issues (situation of vulnerable populations, miners, cultural sites, among others), and in gathering their concerns and recommendations for the project.

7.5.1.2
Stakeholder Mapping

The stakeholder mapping has consisted of the identification of the main stakeholders and their perceptions and postures regarding the project. This will be carried out throughout the life of the project and, hence, will be enriched and updated in the future.

Mapping of stakeholders includes:

- Government entities with direct or indirect responsibilities relative to the project.
- Local government leaders.
- Community Based Organizations (CBOs)
- Members of the villages located in the alignment.
- Managers of Conservation Units in the project's DAI.

During the interviews with ward and village officers the team gathered information on who the main stakeholders were to be included in the consultation activity. Throughout the stakeholder engagement process, in the different phases of the Project, this list of stakeholders will be systematically supplemented or corrected according to information obtained in the field.

The stakeholder mapping registers the main institutions related to the project in the area, who their representatives are, and the opinions they have given regarding the project. The stakeholder mapping has identified the main concerns and requests of information the stakeholders have. This study presents the opinions given by the stakeholders, including authorities and members of the communities that participated in the consultation. It also indicates how these concerns have been answered and/or incorporated in the ESIA, when pertinent.

Additionally, during the development of the ESIA, consultations with stakeholders were carried out focusing on the priority biodiversity values identified during the development of the biodiversity baseline. These consultations include conservation entities. This is also included in the matrix that presents the results of the interviews held.

7.5.1.3
Continuous Communication with Local Communities

During the consultation in the wards, information regarding how to contact TANESCO was provided, including the address of the offices and a telephone number.

The team also gave information on the possibility of presenting grievances, questions and suggestions. During the consultation process, each village was informed that the Grievance Redress Mechanism will be implemented.

7.5.2
Aims and Objectives of Public Consultation

Public consultation ensures that the views, interests, and concerns of project stakeholders are considered in the assessment of the potential impacts of the project as well as in project decisions, particularly in project design and development of mitigation measures. In addition, public consultation improves communication between the project and impacted or interested groups.

While preparing for stakeholders' consultation, the following activities were undertaken:

- Stakeholder identification and analysis
- Preparation of Stakeholder Engagement Plan (SEP)
- Determination of types of consultation activities to be undertaken with each category of stakeholders
- Information disclosure, specifically provision of timely and meaningful information accessible to all stakeholders

- Preparation of approach to and mechanisms for obtaining stakeholder feedback on information disclosed
- Preparation of principles and ground rules guiding consultation with local communities

7.5.3
Methods of Stakeholder Involvement

The stakeholder participation process for the proposed development was designed to satisfy requirements laid down in the Environmental Management Act (EMA, 2004) and EIA Regulation 17 (URT, 2005), it is also compliant for the other relevant Acts. The process ensures that all stakeholders can air their concerns and views as part of an open and transparent process, which in turn ensures a comprehensive environmental study.

Various methods were used to ensure that all relevant stakeholders were consulted, and their views incorporated in this ESIA report. Participatory methods such as public meetings, checklists, and interviews were used. The team also visited all critical sites in the proposed project area and conducted discussions with stakeholders on site to identify their views and concerns.

7.5.4
Stakeholder Identification and Public Participation Process

Stakeholder identification and public participation are key components to developing a good relationship between the project developer, the government, and the community affected. These were conducted at the ward, district, regional and government agency levels, and then at the village level, including governmental and non-governmental bodies.

Stakeholders were chosen based on social, environmental, and economic considerations. A list of identified stakeholders is provided in **Table 7.5.4.a** and their views and concerns of a selection of them in **Section 7.5.5**. The stakeholders selected to be interviewed in this stage of the project were those who have a more direct presence in the area of influence of the project.

The **Annex 9** presents the list of NGOs that work in the area of the project.

Table 7.5.4.a
List of identified stakeholders and their relevance to the Project

Stakeholder Groups	Stakeholder	Relevance to project
Central government	President Office – RALG	Overall supervision
	Vice President Office – Division of Environment	Meeting the requirements of country's environmental policy during the implementation of the Project.
	Ministry of Energy	Client and beneficiary
	Ministry of Water (especially Lake Victoria Basin Water	Water use issues related to implementation of the proposed project and management of water

Table 7.5.4.a
List of identified stakeholders and their relevance to the Project

Stakeholder Groups	Stakeholder	Relevance to project
	Board)	resources.
	Ministry of Land, Housing and Human Settlement	Land acquisition and land rights (titles); Resettlement issues
	Ministry of Minerals (especially Resident Mining Offices)	Land acquisition issues and mining licenses; resettlement issues.
	Ministry of Finance and Planning.	Coordination of financial and economic issues related to project implementation
	Ministry of Natural Resources and Tourism	Natural resource base (water, land, wildlife, forest) use, management and issues
Regional and local government: administrative and technical	Shinyanga Regional Secretariat, Geita Regional Secretariat, Kagera Reginal Secretariat, Shinyanga Municipal Council, Msalala District Council, Nyang'wale District Council, Geita Municipal Council, Mbogwe District Council, Bukombe District Council, Chato District Council, Biharamulo District Council, Karagwe District Council and Misenyi District Council.	Beneficiaries from employment and direct and indirect economic opportunities.
Government agencies	Tanzania National Parks (TANAPA)	Intervention with protected areas (Burigi-Chato National Park)
	Tanzania Forest Services Agency (TFS)	Intervention with protected areas (Forest Reserves), and natural habitats
	The Lake Victoria Basin Board	Control groundwater areas and establish regulations for water use and quality standards.
	Occupational Safety and Health Authority (Lake zone office) Fire Force and Risks Management	Responsible for worker safety during all stages of the project
	Residence Mining Offices	Administering and Monitoring mining activities in the respective areas to ensure compliances with the existing legislations.
	National Environment Management Council (NEMC)	Issuing, varying, or cancelling EIA certificate Coordinate the EIA process
	Tanzania Rural Roads Agency (TARURA) Tanzania Roads Agency (TANROADS) Tanzania Airport Authority (TAA)	Transportation, national infrastructure
Ward, Villages and Mtaa	Ward, Village Executive Officers and Communities from proposed project site.	Community leaders and inter communities from proposed project site
	Physically and economically displaced Project Affected People (PAPs)	Land and properties owners entitled to compensation for land acquired in accordance with Land Acquisition Act and Livelihood Restoration Plans
Civil Society	National and regional NGO's	Protection of rights of residents of local

Table 7.5.4.a
List of identified stakeholders and their relevance to the Project

Stakeholder Groups	Stakeholder	Relevance to project
		communities and environment during project implementation. Education and raising awareness
Academy	Different researchers from various research institutes in Tanzania and other countries	Threatened and endemic species

7.5.5
Consultation Activities

As previously mentioned, the consultation process has been implemented in three phases, as described in this section.

7.5.5.1
First Phase

Between July 19th and July 27th, 2023. The team, composed by representatives of TANESCO and JGP/Bene Consult, held meetings with different stakeholders. A total of 39 stakeholders participated in the meetings held. **Annex 10** presents the consultation forms.

In these meetings, the team presented the project, explaining its objectives, main characteristics, and location. In concrete, the team disclosed information on which districts and wards would be intercepted. The alignment itself was not presented, as it had not been defined yet. The team also gathered the stakeholders' opinions regarding the project.

During the meeting, the team also asked for information about the area of influence, explaining that this would be an important input for the social baseline. Local authorities provided their District Profiles and Strategic Plans.

The **Table 7.5.5.1.a** below presents the stakeholders reached, their concerns and the responses given.

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
Geita	Prof. Godius W. Kahyarara (RAS)	Regional Commissioner's Office	Regional Administrative Secretary (RAS)	He advises that the consultant and TANESCO management provide the information to the affected communities before and during the implementation of the project. He advises the Experts and TANESCO to consult the District officials from the initial stage of the project to the implementation stage. The issue of compensation is very critical and should be handled with care and involving the respective councils since they know people with their properties. The alignment should be known by erecting signs such as concrete bicorns.	There will be a consultation process and information about the project will be provided. A Resettlement Plan will be designed and implemented. It will include information to the population and their participation. The final alignment will be well known to everyone to identify the affected areas once it is defined.
	Lutengano G. Mailwiba	Bukombe District Council	District Executive Officer	Their experience shows that compensation usually is a problem between the PAPs and the neighbours and the village government. There is presence of small-scale miners in the district. The alignment should be known to the small-scale miners. He advises the Experts and TANESCO to consult the district officials from the initial stage of the project to the implementation stage.	Compensation will be carefully done to avoid unnecessary conflict and delay of project implementation. Before implementation of the project in the respective areas, the stakeholders and affected communities will be clearly informed during scoping study and full ESIA study

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
				The project is good for development and it fulfils the government initiative of having an industrial economy. This means without electricity we cannot achieve the expected goals.	
	Peter Wambura Sylvester Mayala	Mbogwe District Council	District Executive Director's office Ag. District Executive Officer District Secondary Education Officer	The existing electricity is not sufficient, and they get power through rationing, not reliable. He advises that the consultant and TANESCO management provide the information to the affected communities before and during the implementation of the project. The issue of compensation is very critical and should be handled with care and involve the respective councils since they are the ones who know people. The alignment should be made known to the small-scale miners to avoid conflicts of interest. Concern about the impact (and possible destruction) of socio-economic activities in the alignment. Ugandan Oil Pipeline passes through their district. He suggested that TANESCO liaise with ECOP Management.	The project will reinforce the power supply in the country, improving it. The project focuses on the transmission line. The consultants and TANESCO officials will provide accurate information to the affected communities before and during the implementation of the project. Compensation will be considered before the implementation of the project. The final alignment will be clearly known in every area once it has been defined. The potential impacts are being taken into consideration in the definition of the alignment. The recommendation to liaise with different stakeholders will be considered.
	Kaunga O.	Nyang'wale	District	They advise that the consultant and	The information will be provided to all

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
	Amani (DAS) Manyonyi Emmanuel Sarah M Siliarius Prumu Ulzeli Makwaiya	District Council	Commissioner District Executive Director's office Ag. District Executive Director	TANESCO management provide the information to the affected communities before and during the implementation of the project. The issue of compensation is very critical and should be handled with care and involve the respective councils since they know people with their properties. The Ugandan oil Pipeline passes through their district. suggested that TANESCO liaise with ECOP Management. There are artisanal miners in most places in the region. The district has several small-scale miners, hence, the UTIP should consider bypassing their clamps and camps sites since compensation will be very costly due to the value of the land that consists of minerals and most of them are licensed. Concern about the impacts on the socio-economic activities in the area of the alignment.	stakeholders and communities in region, districts, wards and village levels. Compensations will be provided. The recommendation to coordinate with councils will be considered. The recommendations to liaise with ECOP will also be considered. Compensation will be considered to all affected socio-economic activities in the project alignment
	Kashinje Bukombe	Geita District Council	District Executive Director's office Ag. District	There are artisanal miners in most places within the district. The alignment should be known to the small-scale miners. The Ugandan oil Pipeline passes through their	The project will be well communicated to all affected communities before its implementation The recommendations to liaise with ECOP will

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
			Executive Director	district. Suggested that TANESCO liaise with ECOP Management. Advised the experts and TANESCO to consult the district Council officials from the initial stage of the project to the implementation stage. Impacts on the socio-economic activities in the alignment. The possibility of having problems due to compensation issues to the people affected by the project.	also be considered. Consultation will be effectively done in all levels. Compensation will be considered Before compensation. all affected people will be accurately identified to avoid unnecessary problems.
Kagera	Toba A. Nguvila	Regional Commissioner's Office	Regional Administration Secretary	He advises that the consultant and TANESCO management provide the information to the affected communities before and during the implementation of the project. The issue of compensation is very critical and should be handled with care and involve the respective councils since they know people with their properties. The alignment should be known by erecting signs such as concrete bicorns. The oil pipeline project may affect the alignment.	Consultation will be effectively done to all affected communities before the implementation of the project. Yes, compensation is very important for a smooth implementation of the project and will be done before implementation of the project. The alignment will be clearly identified for everyone to understand and informed once it is defined. The recommendations to liaise with ECOP will also be considered. Potential conflicts related to land ownership

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
				Expects the project will create jobs and reduce the price of power. Their experience shows that compensation usually is a problem between the PAPs and the neighbours and the village government. He advises the Experts and TANESCO to consult the district officials from the initial stage of the project to the implementation stage.	will be taken into consideration.
	Geofrey Biashara Betreace Sanga	Misenyi District	District Executive Director's Office Ag. District Executive Director	Expectation of reduction of the power cost, as currently they are not part of the national grid. Advises that the consultant and TANESCO management provide the information by liaising with the district official for them to write letters to the Wards Executive Officers who will then inform the village councils. Since the alignment will pass through the Sugar Industry land considers it will be good to consult them.	UTIP will reinforce the supply of electricity in the country. This is a project focused on transmission. Official information will be provided to all stakeholders to raise awareness and ask for support on how to access local levels such as wards and villages. The recommendation to involve Kagera sugar management will be taken in consideration.
	Julius K. Leizer DC) Michael F. Mryumu Kitila Brayson	Karagwe District Council	District Executive Director's office Ag. District Executive Director	Currently, they relay power from Uganda. They think being connected to the national grid will reduce the high tariff of electricity in the district. The consultant and TANESCO management should provide the information by liaising	UTIP will reinforce the supply of electricity in the country. This is a project focused on transmission. Official information will be provided to all stakeholders to raise awareness. Consultants and TANESCO will also ask for support on

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
			District Commissioner	with the district official for them to write letters to the Wards Executive Officers who will then inform the village councils. Concern on impact on trees. Considers TANESCO should grow trees after cutting them. TANESCO should consider the use of underground cables since they are more environmentally friendly.	how to access local levels such as wards and villages. Plans to manage environmental impacts (such as loss of trees) will be implemented.
	Solomon Kimulike	Ngara District Council	District Executive Director	Currently there is an acute shortage of electricity in the district which affects so much the health facilities and schools. Expects the project will help on this respect. The consultant and TANESCO management provide the information by liaising with the district official for them to writtn letters to the Wards Executive Officers who will then inform the village councils. Concerns on how land compensation will be managed, since there are problems such as land conflicts between the farmers and livestock keepers and conflicts/ problems with village boundaries between the villages that will benefit the project alignment. If compensation is not handled properly can create misunderstandings among the PAPs and	UTIP will reinforce the supply of electricity in the country. This is a project focused on transmission. Information will be provided to all stakeholders and affected communities. All affected people will be accurately identified for compensations to avoid unnecessary conflict during project implementation. Compensation will be properly handled to avoid misunderstandings.

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
				in the council in general.	
	Innocent T. M. Mukandara Thomas Milimo	Biharamulo District Council	District Commissioner District Executive Director District Economist District Planning Officer	Currently, there is an acute shortage of electricity in the district which affects so much the social services and economic activities. The expectation is that the project will help with this. Concerns on how land compensation will be managed since there are problems such as land conflicts between the farmers and livestock keepers and conflicts/ problems with village boundaries between the villages that will benefit the project alignment. If compensation is not properly handled can create misunderstandings among the PAPs and council in general. Loss of trees. The project should consider the restoration of the trees and other vegetation losses.	UTIP will reinforce the supply of electricity in the country. This is a project focused on transmission. Clear identification of landowners will be done to avoid misunderstandings among groups and villages. Compensation will be well handled to avoid unnecessary conflicts. Planting tree projects will be considered to replace loss of trees.
Shinyanga	Alex Mpasa	Regional Commissioner's Office	Regional Administrative Secretary (RAS)	For easy accessibility to the local communities, you need to have an interpreter who knows sukuma and other local languages in the respective areas. The project is good and will stimulate development in the countries. The issue of compensation must be carefully	Local government official who knows the languages will accompany us to simplify communication with local communities in respective areas. Compensation will be accurately done to all affected people. The project will be effectively communicated

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
				handled. Prior information must be provided to all stakeholders and affected wards and villages.	to all stakeholders and local communities.
	Duncan Kasembe	Shinyanga Municipal Council	Municipal Executive Director's office Ag. Municipal Executive Director	Advised that the consultant and TANESCO management provide the information to the affected communities before and during the implementation of the project. Ibadakuli substation is located near the Airport and part of the land will be used by the alignment. Suggested that TANESCO liaise with Tanzania Aviation Authority Management. Expect that the project will create jobs, both direct and indirect, for the population. Potential destruction of socio-economic activities in the alignment. Advised the Experts and TANESCO to consult the Municipal Council officials from the initial stage of the project to the implementation stage.	TANESCO and the project teams will provide required information to all affected communities and take note of their concerns for clarification. The recommendation to contact the airport authorities will be considered to provide them information and simplify project implementation. During the project implementation direct and indirect employment opportunities will be available. Local communities will be considered as well. Compensation will be considered Consultation will be made to all stakeholders from region to village levels.

Table 7.5.5.1.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 1 (July 19th-27th 2023)

Region	Name	Institution	Position	Concerns	Responses
	Katimba Khamis J Eikana Zablon Teddy Jacob Priscia J. Pius Judica J. Sumari Elikana Daud Zabron	Msalala District council	District Director District Planning Officer District Community Development Officer Ward executive officer – Lunguya Ward executive officer – Bugarama	Clear information must be provided to all communities where the alignment is passing through. Communities will not have any problem with this project since they will benefit from it. The major issue is compensation to the affected socio-economic activities and land which will be taken during the project implementation. For effective implementation of UTIP local leaders, such as WEO and VEO, must be involved and accompany the project teams to the local communities	UTIP will reinforce the supply of electricity in the country. This is a project focused on transmission. Communities will be informed during the meeting in ward and village levels. Compensation will be done to all affected people in the alignment. Local leaders will be involved in the project and will help to introduce the teams to their communities during the meetings.

7.5.5.2
Second Phase

The second phase was conducted between May 27th to July 13th, 2024. and it counted with the participation of the consultant (BENE team) and TANESCO representatives, A total of 93 consultation meetings in the villages were implemented, with the participation of the villages that are part of the Direct Area of Influence. Most meetings were carried out with the participation of one village only, while in one meeting participated 3 villages and in others 2 villages were present. This organization was defined in dialogue with the WEOs and VEOs with whom a previous coordination took place. A total of 5,250 persons participated.

Together with the villages' consultations, a set of meetings were carried out with the representatives of a total of 27 institutions of the three regions of the area of influence. They include local governments, police, fire and rescue forces, private companies and institutions that oversee environmental and biodiversity components. The **Table 7.5.5.2.a** below presents the opinions gathered during these interviews.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
Shinyanga					
	Alex Mpasa Leo	RC -Shinyanga Office	Ag. Regional Administrative Secretary	1. There are a lot of issues concerning power availability. 2. A lot of investors are raising complaints about power availability, hence this proposed project of 400KV came be a cure for all the complains. 3. There are areas where REA contractors are supplying electricity, and we have received a lot of complaints about villagers are not connected with electricity. We shall follow-up and see what is happening.	3. We shall note this for more information and feedback
	Mwacheni Judith Peres Kamugisha Josephat P Mushi David Rwazo Charles Victor Enock Magese Edward Mayenga Joseph Nyomelo	Shinyanga Municipal Council and Shinyanga District Council	Ag. Municipal Human Resource Officer Municipal Community Development Officer Land Officer Ag. District Executive Officer Engineer of Works Land Officer Environmental Officer District	1. We are expecting that the Municipal Council will benefit since the Contractor shall pay service levies to the Council. 2. We hope that the proposed transmission line route has avoided the designated area for the bus stand/station. 3. It is important to estimate the amount of solid waste to be generated during project implementation. 4. PAPs grievances should be handled carefully and should be given knowledge regarding their compensation payments and on how to use it wisely. 5. Preparation of the mitigation plan for the expected impacts should be considered. 6. TANESCO should ensure there is mechanism to control encroachments from the community to the way leave corridor during operation phase of the project 7. Awareness on the spread of HIV/AIDs and unwanted pregnancies should be considered throughout the project implementation 8. The contractor should consider employment	The initiative has more advantages than disadvantages when it comes to the advancement of the country and people as a whole. Yes, the project to the large extent has avoided sensitive areas like that one. Noted. However, TANESCO will enter into agreement with Village government for security and clean-up of way leave area of transmission line after construction completion. This will control encroachments problem caused by community.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
			Community Development Officer	opportunities during construction to the youth within the respective villages traversed by the transmission line project. 9. Gender Based Violence (GBV) and Violence Against Children (VAC) should be avoided during implementation of the proposed TL project.	This is well noted, all mechanism for preventing GBV and VAC will be formulated and implemented during execution of the proposed TL project.
		District Executive Director Msalala (includes Environmental Management Officer, Forest, Engineer of works and Community Development Officer) officer, Natural resources officer		1. We are grateful for the initiatives of the GOT for the decision to implement the proposed project. on our side we see more benefits 2. We acknowledge your initiatives towards the implementation of this project 3. The proposed TL project will enhance our international diplomacy with our fellow neighbours of Uganda. 4. The compensation payment should be fair and prompt to all affected villages 5. Consider consulting local leaders in all stages of project implementation 6. Kalole area has a lot of mining activities going on, hence need to work hand by hand with Resident Mining Officer (RMO) office. 7. During implementation of the proposed TL project, contractor should abide with our laws and regulations especially on paying a minimum wages and other statutory benefit to workers accordingly. 8. The project's contractor(s) should source all materials for works such as cement, aggregate, sand and gravel from authorized dealers who are available within our	This is well noted and RMO office will be consulted and work together during the assessment. Noted, Contractor will follow our national laws and regulations during implementation of the proposed TL project. Thanks for your continued cooperation. All observations and recommendations have been noted.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				Council 9. Our major concern is on the impact of the compensation payments, people should be educated on the financial management before the compensation payment. 10. In case of any problem the Contractor / TANESCO should consult the district officials	
	Fabian Balele Franaeli Sumari Victor Nkya	Tanzania Forest Service (TFS) – Shinyanga Region	District Forestry Conservation Officer Bee Keeping Officer Conservation Officer I	1. During implementation of the proposed TL project, TANESCO together with project's contractor should involve TFS when clearing trees in the way leave. 2. Indigenous trees need special ways of removing it once encountered, hence TFS should be informed so that they can provide professional advice. 3. There are three reserved forests namely Lubega, Mwantini and Nindo in Shinyanga council. Nindo reserved forest is located in Iselamagazi village. 4. Fair and prompt compensation must be attained prior implementation of the proposed TL project construction. 5. They mentioned that the proposed TL project will fasten development to people who are in need of sustainable electricity for their daily activities. 6. In case of any problem consult us, TFS is here to help anytime.	Thanks for your continued cooperation. All observations and recommendations have been noted.
	Daniel L Mapunda Selemani y Shemlugo	Shinyanga Resident Mining Office	Residence Mining Officer Mining Licensing Officer	1. The proposed project will ensure sustainability of power to many miners who are in need of power to operate their plant and crushers. 2. TANESCO need to share designed route of the proposed TL project to know where exactly the affected mining area will be.	Noted, TANESCO promised to share the design route with Resident Mining Office. Thanks for your continued cooperation.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				3. RMO office will be happy to work together with TANESCO all the time during implementation of the proposed project.	All observations and recommendations have been noted.
	Kennedy Mgawe	Police - Shinyanga	SO I	1. The Shinyanga region is safe to all, and the police is willing to corporate with all parties (TANESCO/Contractor and Consultant) during implementation of the proposed TL project. 2. No big crime scene occurred in past three years in Shinyanga region 3. Gender Based Violence and Violence Against Children has occurred in Shinyanga region. However, Police Shinyanga disseminate the knowledge about GBV and VAC frequently 4. Shinyanga police have Gender desk and social Police officer at district and ward level respectively. 5. Awareness campaign regarding GBV, VAC, STDs and HIV/AIDS during implementation of the proposed TL project is highly recommended. 6. In case of any problem consult us, Police Shinyanga region is here to help anytime. 7. They also provided the list of Crime for the past three years.	Noted, various awareness campaign including GBV, VAC, STDS and HIV/AIDS will be disseminated during implementation of proposed TL project. Thanks for your continued cooperation. All observations and recommendations have been noted.
	Kipamila F. Hans	TANROADS	Ag. Reginal Manager	1. Where the TL cross the roads, headroom height should be more than 6m to allow smooth passing of vehicles and other machines. 2. TL poles should be installed at the edge of road Right of Ways to allow future expansion of the roads without need additional costs for reallocation of utilities including TANESCO electrification lines.	Thanks for your continued cooperation. All observations and recommendations have been noted.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				3. In case of underground transmission, TANESCO should inform TANROADS for approval and supervision prior cutting off/ dismantling the roads. 4. TANESCO should work together with TANROADS during implementation of the proposed TL project. TANROADS is willing to collaborate with the project when need arise.	
	Samson Pamphili	TARURA	Ag. Regional Manager	1. Where the TL cross the roads, headroom height should be more than 6m to allow smooth passing of vehicles and other machines 2. Allowable weight for load vehicle is 10 tons, hence the Contractor's vehicles should abide with this weight to protect their bridges and culverts designed for 10 tons maximum from damage. Any above 10 tons of load, TARURA should be informed in order to grant for permit. 3. TANESCO should work together with TARURA during implementation of the proposed TL project. TARURA is willing to cooperate with the project all time.	Noted, Contractor(s) will be guided accordingly. Thanks for your continued cooperation. All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
	SF. Martin Nyambala	FIRE AND RESCURE FORCE	AG. RFO	1. Construction campsites should have all infrastructure for fire control and accident when occurs. 2. Adequately firefighting equipment such as water reserve, fire extinguishers etc. should be in place and fire warden/safety officer should be present at the sites. 3. Wayleave of TL should be clearly demarcated and clean to avoid fire incident to happen. 4. Fire rescue drill should be performed during implementation of the proposed TL project. 5. TANESCO should work together with Fire and rescue force during implementation of the proposed TL project. Fire and rescue force Shinyanga is willing to cooperate with the project all time. 6. Ensure involvement of the local leaders in this exercise in order to gain cooperation from them 7. It is good to note that at Buchambi, Masagala, Mwadui Luhumbo and Maganzo Villages are areas for small miners 8. We have no objection since the Government has a good intention in the people by implementing this project.	Thanks for your continued cooperation. All observations and recommendations have been noted for consideration.
	Jeremiah Kileo Bernard W. Maloko	Tanzania Airport Authority (TAA)	Airport Security Officer Civil Engineer	1. The height of towers should be considered to avoid unnecessary aerodrome traffic accidents. However, the proposed TL project site does not enter into DAA area 2. TAA is willing to corporate with TANESCO during implementation of the proposed TL project.	Thanks for your continued cooperation. All observations and recommendations have been noted for consideration.
Geita		Nyang'wale		1. We are grateful for the initiatives of the GOT for the decision to implement the proposed project on our	This is well noted; local leaders will be involved in all

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
	Husna Toni Ntiryo Ezekiel Mrema M Juma Mabula E Kanga Livinos J Bampabura Juliet Mfinanga	District Council officer,	District Executive Director, Environmental Management Officer, Forest officer, Land Officer, Planning Natural resources officer, Engineer of works Community Development Officer)	side we see more benefits 2. We acknowledge your initiatives towards the implementation of this project 3. The proposed TL project will enhance our international diplomacy with our fellow country of Uganda. 4. The compensation payment should be fair and prompt to all affected villages 5. Consider consulting local leaders in all stages of project implementation. 6. Isonda area has a lot of mining activities going on, hence need to work hand in hand with Resident Mining Officer (RMO) office. Furthermore, Council has area planned for small mining industries. 7. Isonda and Igeka village owned forest reserved area of 888 hectare, if the proposed TL project passes through village reserved forest, restoration activities should be implemented accordingly. 8. No historical heritage founded in the village affected by the proposed TL project. 9. During implementation of the proposed TL project, contractor should abide with our laws and regulations especially on paying a minimum wages and other statutory benefit to workers accordingly. 10. The project's contractor(s) should outsource all materials for works such as cement, aggregate, sand and gravel from authorized dealers who available within our Council. 11. Our major concern is on the impact of the compensation payments, people should be educated	stages of project implementation. Noted with consideration of contacting RMO office. Noted, Environmental and Social Management and Monitoring plans, including restoration plan, will be formulated during implementation of the proposed TL project. Noted and Project's contractor(s) will be guided accordingly. Thanks for your continued cooperation. All observations and recommendations have been noted for consideration.

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Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				on the financial management before the compensation payment has been affected. 12. In case of any problem consult us.	
	Amon C Mimata	Police - Geita	Regional Police Commander	1. The Geita region is safe to all, and the police is willing to corporate with all parties (TANESCO, Contractor and Consultant) during implementation of the proposed TL project. 2. No big crime scene occurred in past three years in Geita region 3. Sustainable availability of electricity in Geita is crucial due to the fact that electricity creates a lot of employment of people at mining industries available in Geita region, absence of it means no job to people hence number of crimes will be increased and vice versa. 4. Geita police will provide adequately security of people and project properties during implementation of the proposed TL project. 5. Gender Based Violence and Violence Against Children occurs in Geita region. However, Police Geita disseminate the knowledge about GBV and VAC frequently. 6. Geita police have Gender desk and social Police officer at district level only, plan to go up to ward level. 7. Awareness campaign regarding GBV, VAC, STDs and HIV/AIDS during implementation of the proposed TL project is highly recommended. 8. In case of any problem consult us, Police Geita region is here to help anytime	Thanks for your continued cooperation. All observations and recommendations have been noted for consideration.

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Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				9. He provided the list of crime for the past three years.	
	Joseph Kumburu	Resident Mining Office (GEITA & MBOGWE)- Kahama Office	Residence Mining Officer	1. The proposed project will ensure sustainability of power to many miners who are in need of power to operate their plants and crushers. 2. TANESCO need to share designed route of the proposed TL project to know where exactly the affected mining area will be. 3. RMO office will be happy to work together with TANESCO all the time during implementation of the proposed project.	Noted for consideration that TANESCO will share designed route for the proposed TL project Thanks for your continued cooperation. All observations and recommendations have been noted for consideration.
	Jerry Mwakapemba Eng. David J. Msechu Godfrey Vedastor Robert Daudi	TARURA - Geita	Regional Engineer Regional Manager Sociologist Environmental Management Officer	1. Where the TL crosses the roads, headroom height should be more than 6m to allow smooth passing of vehicles and other machines. 2. Allowable weight for load vehicle is 10 tons, hence the Contractor's vehicles should abide with this weight to protect our bridges and culverts, designed for 10 tons maximum. from damage. Any above 10 tons, TARURA should be informed and apply for permit. However, some of bridge and culverts in GEITA where there is route for public buses, their culverts and bridge designed for 20 tons capacity. 3. Project's contractor should apply dust control mechanism when use TARURA gravel roads when passing village towns and centres. 4. Project's contractor should take road safety measures such as speed limits when using TARURA roads. 5. TANESCO should work together with TARURA during implementation of the proposed TL project. TARURA is willing to support the project all time.	Noted, project's contractor will be guided accordingly Thanks for your continued cooperation. All observations and recommendations have been noted for consideration.
	Kalila King	Mbogwe	Ag.District	1. They mentioned that they totalaccept the project with	Thanks for your continued

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Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
	Sarah Membo Juma Marcel Manase Nkuli Sospeter Mashamba	District Council	executive officer Ag District community development officer Environmental officer Land officer HumanResource Officer	no objection. 2. Mbogwe Council has experience in pipeline from Tanga to Uganda projects by EACOP. 3. They proposed the TANESCO to adhere with all Environmental rules and regulations before starting to implement the project. 4. Since the proposed transmission line route is already known and valuation exercise is not yet done, they advised TANESCO to either conduct pre-valuation exercise i.e., counting everything within the power transmission line to minimize chances of cheating and compensation costs. There is a tendency of people who are not faithful to construct buildings and plant trees with the purpose of gaining more money within the entire line. 5. Ensure the public engagement involves local leaders in order to get positive response and cooperation. It is good to use community development officers since they are familiar with such projects in the district. 6. During implementation of the proposed TL project, contractor should abide with our laws and regulations especially on paying a minimum wages and other statutory benefit to workers accordingly. 7. The project's contractor(s) should outsource all materials for works such as cement, aggregate, sand and gravel from authorized dealers who are available within our Council 8. Our major concern is on the impact of the compensation payments, people should be educated on the financial management before the compensation	cooperation. All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				payment has been affected. 9. In case of any problem the district official should be consulted.	
	Melania D Kwai Lutengano g. Mwaliba Elisha W, Jengela Jackson S. Miagio Augustino H Simbeye Dorice Kinyaga Anastella Athanase	Bukombe District Council	Ag. District Executive Officer District Executive Director District Environmental Management Officer District Infrastructure Rural and Urban Development Officer District Land Officer District Natural Resources and Environmental Conservation Officer	1. They are willing to offer 100% support to the project during implementation. 2. No authorized and designated dumping site located within Bukombe area; they use executed borrow pits located at Liobaika area in Luzewa village as dumping sites. 3. The project's contractor(s) should outsource all materials for works such as cement, aggregate, sand and gravel from authorized dealers who are available within our Council. 4. No forest reserve which will be affected by the proposed TL project. 5. Before clearing of the way leave, the Contractor should notify District Council Forest department. 6. There are groups of people who are dealing with plantation of trees in the district, during restoration activities of the project, these groups must be considered. 7. Bukombe council has seasonal river known as Nyikonga river, However, if contractor wants to extract water from it must obtain extraction permit from Lake Victoria Basin Water Board. 8. Fair and timely compensation must be attained prior implementation of the proposed TL project to avoid future conflict from communities who will be affected by project.	All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
			District Community Development Officer		
Kagera Region	ACP. Yussufu Daniel ACP. Juma Jangila A/NSP S. S. Kamwaga	POLICE Kagera Kagera Region	Staff Officer RFBO Kagera Gender Desk	1. Provided the data on crime records for the past three years.	
	Cosmas Maganga Joseph Nyamko Issa Mohamed Philip M George Mwenda Aloyce Willson Charles	Chato District Council) TARURA Kagera	Ag. DFAO Ag. DCDO DIRUDO DNRECO Ag. DLDO Regional Manager	1. We are grateful for the initiatives of the Government of Tanzania for the decision to implement the proposed project on our side we see more benefits. 2. We acknowledge your initiatives towards the implementation of this project. 3. The proposed TL project will enhance our international diplomacy with our fellow Ugandan. 4. The compensation payment should be fair and prompt to all affected villages. 5. Consider consulting local leaders in all stages of project implementation. 6. During implementation of the proposed TL project, contractor should abide with our laws and regulations especially on paying a minimum wages and other statutory benefit to workers accordingly. 7. The project's contractor(s) should outsource all materials for works such as cement, aggregate, sand and gravel from authorized dealers who are available within our Council. 8. Chato council has seasonal river known as Ipalamasi	All observations and recommendations have been noted for consideration.

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Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				river, However, if contractor wants to extract water from it must obtain extraction permit from Lake Victoria Basin Water Board. 9. No sewage system available in Chato council, waste treatment ponds are located in Geita region. 10. Hazardous waste will be incinerated at Chato Zonal referral hospital located in Chato. 11. Our major concern is on the impact of the compensation payments, people should be educated on the financial management before the compensation payment has been affected. 12. In case of any problem consult us.	
	Col. Hamisi M. Manga	Misenyi District Council	District Commissioner	1. For some years we have been depended on electricity from Uganda of which currently starts to be not enough due to increase of demand of electricity. This new proposed TL project will carter all the challenge we face right now. 2. We are grateful for the initiatives of the Government for the decision to implement the proposed project, on our side we see more benefits. Due to war occurred at 1977-1979, some of the area (in this project ie. Nsunga and Mutukula ward) still have underground explosive booms materials which are not yet removed by special task military force expert, hence special attention is need during implementation and TANESCO should work together with the military force to disarm the explosive materials. The Military force agreed to work together with TANESCO.	Noted, during implementation of the proposed project, TANESCO will work together with this special task All observations and recommendations have been noted for consideration.
	John P Wanga	Missenyi District	District Executive	1. The proposed TL project will boost industries development in our district due to the fact that Kyaka	All observations and recommendations have been

Table 7.5.5.2.a
Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
	Beatrice N. Sanga T	Executive Directors Office	Director District Community Development Officer District Manager	substation will have high capacity of distributing enough power to all who are in need of electricity. 2. The project's contractor should pay statutory service levies accordingly 3. During implementation of the proposed TL project, contractor should abide with our laws and regulations especially on paying a minimum wages and other statutory benefit to workers accordingly. 4. The project's contractor(s) should outsource all materials for works such as cement, aggregate, sand and gravel from authorized dealers who available within our Council 5. Our major concern is on the impact of the compensation payments, people should be educated on the financial management before the compensation payment has been affected. 6. In case of any problem consult the district officials.	noted for consideration.
	Merichelavan Mani Catherine Helle Verngon Van Bleark Baraka C. Mgheni Sira Philip Laurent	Kagera Sugar Co.	Ex I Manager Electrical Engineer Project Engineer Project Engineer Factory Manager Environmentalist	1. TANESCO should consult the management and share the TL drawings which cross the company premises. 2. The company is ready to cooperate with TANESCO 3. The proposed TL project will boost industries development in our district due to the fact that Kyaka substation will have high capacity of distributing enough power to all who are in need of electricity.	All observations and recommendations have been noted for consideration.
	Henrietta Willam (DCDO)	Karagwe District Council	(DED, EMO, Land officer, Planning	1. For some years they have depended on electricity from Uganda of which currently starts to be not enough due to increase of demand of electricity. This new proposed TL project will carter all the challenge	Noted, yes, the proposed project will enhance the capacity of Kyaka substation from 220KV to 400KV.

Table 7.5.5.2.a
Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
			officer, DCDO, engineer of works,)	we face right now. 2. We are grateful for the initiatives of the government for the decision to implement the proposed project, on our side we see more benefits 3. The proposed TL project will boost industries' development in our district due to the fact that Kyaka substation will have high capacity of distributing enough power to all who are in need of electricity. 4. During implementation of the proposed TL project, contractor should abide with our laws and regulations especially on paying a minimum wages and other statutory benefit to workers accordingly. 5. The project's contractor(s) should source all materials for works such as cement, aggregate, sand and gravel from authorized dealers who are available within our Council 6. The project's contractor should pay statutory service levies accordingly. 7. Our major concern is on the impact of the compensation payments, people should be educated on the financial management before the compensation payment has been effected. 8. Since the proposed transmission line route is already known and valuation exercise is not yet done, I would advise TANESCO to either conduct pre-valuation exercise, i.e., counting everything within the power transmission line to minimize chances of cheating and compensation costs. There is a tendency of people who are not faithful to either construct buildings and/or plant trees with the purpose of	Noted, project's contractor(s) will be guided accordingly to ensure all statutory service levies are paid. All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				gaining more money within the entire right of way. 9. Ensure the public engagement involves local leaders in order to get positive response and cooperation. It is good to use community development officers as they are experts in this exercise. 10. In case of any problem consult us.	
	Thomas Mahenge George Geofrey Lydia I Nyeme Abbas Rwegamya Darra Silla N Flora Mwakalirene	Biharamulo District Council	Ag. DED, EMO, CDO, District engineer, Land officer TFS Biharamulo	1. We are grateful for the initiatives of the government for the decision to implement the proposed project, on our side we see more benefits. 2. We acknowledge your initiatives towards the implementation of this project. 3. The proposed TL project will enhance our international diplomacy with our fellow Ugandan. 4. The compensation payment should be fair and prompt to all affected villages. 5. Consider consulting local leaders in all stages of project implementation. 6. During implementation of the proposed TL project, contractor should abide with our laws and regulations especially on paying a minimum wages and other statutory benefit to workers accordingly. 7. The project's contractor(s) should outsource all materials for works such as cement, aggregate, sand and gravel from authorized dealers who are available within our Council. Sand quarry is obtained at Lukirilwe area. There are two rivers (Mwiruzi and Nyovozi river) from which the contractor can obtain water for construction, after possessing water extraction permit from authorized board. 8. The council will arrange reallocation of all graves	Noted, local leaders will be consulted throughout the implementation of the project. Noted, project's contractor(s) will be guided accordingly. All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				affected by project in collaboration with their families. 9. Awareness campaign regarding GBV, VAC, STDs and HIV/AIDS during implementation of the proposed TL project is highly recommended. 10. Ensure the public engagement involves local leaders in order to get positive response and cooperation. It is good to use community development officers are experts in this exercise 11. In case of any problem consult us.	
		Tanzania Forest Service (TFS)		1. During implementation of the proposed TL project, TANESCO together with project's contractor should involve TFS when clearing the wayleave. 2. Indigenous trees need special ways of removing it once encountered, hence TFS should be informed. 3. There are two reserved forests, namely Nyankatara and Biharamulo-Kahama in Biharamulo council. 4. Fair and prompt compensation must be attained prior implementation of the proposed TL project. 5. During construction of the proposed project, only project workers will be allowed to pass through the reserved forest. 6. All demolished trees will be utilized accordingly, TFS – Biharamulo are willing to work together with project's contractor(s) all time needed. 7. The contractor should ensure that wayleave be the only place all construction activities take place to avoid further destruction of forest reserved. 8. The proposed TL project will foster development to people who are in need of sustainable electricity for	Noted, contractor will be guided accordingly All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
Site Reconnaissance Inspection - TRIP 2 (May – July 2024)

Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				their daily activities. 9. In case of any problem consult us, TFS is here to help anytime.	
Other stakeholders	Lordgad R. Bishanga	OSHA - Lake Zone Office	Lake zone Manager	1. Contractor to ensure review of OSHA Act No.5 of 2003 and its Regulations that have outlined the responsibilities of the contractor and the project Proponent. 2. The Contractor shall ensure Safety and Health Management Plan place. 3. Contractor is required to register the workplan at OSHA and ensure certificate of registration of workplace is in place. 4. Safety and Health training to the construction crew at site shall be conducted. 5. At the construction site, the Contractor shall ensure there is Safety and Health personal to oversee all issues concerning safety and health of the workers onsite. It is important to formulate HSE committee 6. The preparation of risk assessment should be done and should be communicated to all workers onsite. 7. The contractor should ensure availability of adequate toilets and safe clean drinking water at all sites. 8. There should be adequately well trained first Aiders by OSHA. 9. All incidences and accidents need to be recorded onsite and reported at OSHA. 10. The contractor shall undertake medical examination of the workers as per the requirement of OSHA Act, 2003. 11. All the cranes and scaffold should be inspected	TANESCO will ensure compliance with the requirements of OSHA Act no.5 of 2003. All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				by inspector from OSHA office.	
	Shaban Mussa Philbert Kanoni	Fire and Rescue Force -Kagera	AG. RFO	1. TANESCO/Contractor should submit the substations and construction camps design drawings for review, recommendations and approval 2. TANESCO to prohibit any human activities under the transmission line 3. If the Transmission Line will cross the road, safety clearance should be considered 4. The submission of the drawings will require payment of the fees as stated in Fire and Rescue Act of 2007 and Building inspection regulations of 2015 5. Inspection of the substation will be conducted before operations in order to check the compliances 6. Construction campsites should have all infrastructure for fire control and accident when occur. 7. Adequately firefighting equipment such as water reserve, fire extinguishers etc. should be in place and fire warden/safety officer should be installed at the sites. 8. Wayleave of TL should be clearly demarcated and clean to avoid fire incident to happen. 9. Fire rescue drill should be performed during implementation of the proposed TL project. 10. TANESCO should work together with Fire and rescue force during implementation of the proposed TL project. Fire and rescue force Kagera is willing to support the project all time.	All observations and recommendations have been noted for consideration.
		Kagera Sugar Industry and sugar cane		1. Currently they are using 8 MW from Kyaka substation. 2. They have plan to expand their industry next year	All observations and recommendations have been noted for consideration.

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Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
		plantation estate		which will increase their electricity demand up to 15MW. 3. Currently, their area experience three projects namely (1) Kyaka – Benako (220KV) (2) Kakono – Kyaka (220KV) and this proposed project of UTIP of 400KV all these are crossing their sugar estate land. 4. All the project requires separate land which might affect their irrigation scheme designed but Kagera sugar is willing to accommodate all these projects for the sake of the country due to the fact that these projects will bring development to people and nation at large. 5. Contractor workers should obey and follow all by laws of Kagera sugar during the implementation of the proposed project while working inside Kagera sugar estate. 6. Contractor workers should have ID and must register in their registration logbook when entering Kagera sugar estate during implementation of the proposed project. 7. Contractor should work together with Kagera sugar management on issue of water for construction activities. 8. Kagera sugar is willing to support the implementation of the proposed project anytime needed.	
	Awadh Sipati Alloys N.S. Maira Ramadhani Somari	Kitengule Prison Area	HEU DPPPEO DIA	1. All project activities should be performed in collaboration with prisoner office. 2. It will be allowed to any project workers to enter in the prison area without permission and supervised by management	Noted, TANESCO will share the designed route as requested. All observations and

Table 7.5.5.2.a
Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				3. Kitengule prison is in progress of starting irrigation scheme hence TANESCO should share designed route for the proposed UTIP project to allow them to plan according without making disturbance in future. 4. Kitengule Prison management is willing to support the implementation of the proposed UTIP project anytime needed.	recommendations have been noted for consideration.
	Dr. Siima Bakengesa Daniel C. Pancras	Ministry of Natural Resources and Tourism, Dodoma Headquarters	Director of Forestry Conservation Principle Forest Officer	1. Appreciated the government initiatives. 2. They are willing to collaborate with TANESCO mainly on the issue of trees restoration and the whole issue of climate change and project's carbon footprint. 3. They propose the TANESCO to liaise with the respective TFS offices in each district for the trees plantation since they provide for free to the community who will be affected. 4. They requested the map which shows the route of the TL. 5. They were also given a questionnaire for them to fill for the study	All observations and recommendations have been noted for consideration.
	Ismail Ouri Manena Lugi Wilson Dama Kombo Athumani	TANAPA	ACC Conservation Officer Conservation Ranger Conservation Ranger	-We appreciate the project, as it will connect Kagera to the national grid, solving power outages in the district and region at large. - However, as a national park, we are concerned about infrastructure development, such as powerlines and roads, which could negatively impact the park's ecology. We are awaiting the ESIA report to understand how environmental and social impacts will be addressed, along with proposed mitigation measures.	-We acknowledge the importance of connecting Kagera to the national grid and the benefits this will bring to the region. - We note your concerns about ecological impacts and will address them in the ESIA, which will propose mitigation measures.

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Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
	Mhando			- We will provide security guards whenever you enter the national park for safety reasons. - Precautions are necessary due to the presence of bushmen hunting in the area. - The park is a major tourism attraction in the country, so mitigation measures must be carefully planned to reduce any adverse impacts. - Consult TANROADS in Kagera as they are also working on a project in Benaco. - Powerline towers could disturb animal habitats and increase mortality rates. What mitigation measures will be implemented to prevent these risks? - Secondary data on the park's biodiversity is available at the Ecology Office for your reference.	- We thank you for the offer of security guards and will ensure all necessary precautions are taken. - We will consult TANROADS as suggested. - The ESIA has involved experts from various institutions, including TAWIRI, TAFORI, and ecologists from TANAPA, to assess impacts and recommend mitigation measures. - We appreciate access to the secondary data from your office, which will complement our primary data collection.
Mwanza	Mr. Ogoma Mangase	Lake Victoria Basin Board - Mwanza	Head – Planning, Monitoring, and Evaluation	It is important that all stakeholders are involved from beginning, particularly in the Terms of Reference to ensure sustainability of the project. All sources of water that will be used during project implementation should be used with care to avoid water pollution. The sources should be protected and conserved for their sustainability. All the materials that will be used during the construction should be of high quality to avoid polluting water. This is because treating polluted water is very expensive. All national laws and regulations regarding distance	All observations and recommendations have been noted for consideration.

Table 7.5.5.2.a
Meetings held with stakeholders
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Region	Name	Institution	Position	Stakeholders' concerns	Remarks/ Response
				across water bodies need to be adhered to. There should be full engagement and participation of all stakeholders in the project. It is important to seek permit for the use of water (underground and surface) during the construction phase of the project. If the transmission line passes nearby water sources, communities living near the sources, education should be provided to them such that they can be able to take necessary precautions. The contractor should fairly treat all the workers so that they get motivated to work and accomplish the project on time.	

7.5.5.3
Village Consultations

To implement the consultation, TANESCO and the consultant contacted the districts and asked them to coordinate with the wards. The fieldtrip was divided in two phases: in the first one the social team visited the Wards' Executive Offices, presented the project and gathered socioeconomic information of their wards and coordinated the consultation with the villages' assembly meetings.

During the consultation, the following criteria were followed:

- TANESCO introduced the project and explained the stages or phases of the project.
- The consultant presented the EISA, how it was being done, the impacts expected and the environmental and social management measures that will be implemented.
- Emphasis was put on explaining the objective of the project: it is a transmission and not a distribution project. However, emphasis was also placed on explaining how this helps to improve the access and quality of electricity.
- The job offers and how jobs can be accessed were also explained.
- The team explained how any vegetation loss will be managed.
- The team explained that the land acquisition will be done later, when the final alignment is defined and that it will be accompanied by a Resettlement Plan.
- Gender Mainstreaming including SEA/SH and GBV/VAC was discussed during the meeting. The meetings were divided into 2 groups (one for women and the other for men) for the Focus Group discussions.

A total of 93 consultation meetings with the villages of the Direct Area of Influence were held. 5,250 persons participated, of which 1773 (33.8%) were women and 3477 (66.2%) men. In two of the consultations no women participated, while in other ones the number was very low. The explanation was that they were involved in their domestic labours. This demonstrated the need to reinforce their involvement in the public matters of their communities. In two of the village consultations the participation of women exceeded the number of men and in other ones it was more equal. In general, the presence of men tended to be more significant.

The **Table 7.5.5.3.a** below presents a summary of the meetings held and the positions presented in the consultation meetings. All the villages accepted the project, as they considered it necessary for the development of the country, considering that power is fundamental for economic and industrial development which, in turn, impact on the social aspect. They all also expressed that it is crucial for the project to pay the compensations fairly and on time, prior to the release of the land.

The **Annex 11** presents the minutes of the consultation meetings held in the villages and the photographic register.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Region: Shinyanga						
District: Shinyanga Municipal Council (former Shinyanga Urban)						
Mwamalili	Seseko	45	30	15	• They expressed concern regarding displacement of project affected people and land acquisition, increase in social insecurity and health problems. • Asked if compensation will be provided as per land laws and regulations. and if crops will be compensated. • Mentioned that several transmission lines have passed through their village. They expressed their concern about different lines passing through their village but they do not benefit from power connection. • They are expecting to be connected from this new transmission line. • The participants expressed that they expect to benefit from Corporate Social Responsibility (CSR) from TANESCO. • Demanded that a Grievance mechanism should be put in place. • Demanded that TANESCO should provide funds to secure the poles. • They also expressed that they accept the project as it will bring socio-economic development and enhance the relationship with Uganda, but they expect to receive a fair compensation. • They requested that during the construction, villagers should be given first priority with regards to employment. • According to the Sukuma culture, which is the dominant tribe in the project area, polygamy is allowed together with having a big number of children is a prestige to their culture. They think polygamist practices may affect the equal fair payment during the compensation process. They requested the government to intervein during the compensation process to make sure the entitled wives benefit equally from the money accrued from the compensations. • Women proposed that men should be educated on how to spend the money they got from the compensations wisely because from their past experience of such projects once the men get the payment, they misuse the money with concubines instead of their families. • Women do not have a say of how many wives their husbands should have and are not consulted when the husband wants to increase another	• TANESCO clarified that they will pay compensation but will not implement a Corporate Social Responsibility plan. • Regarding grievance redress mechanism, during the full ESIA the village Grievance Redress Committee will be formed. Observation: The village is adjacent to the Ibadakuli Power Station • The team appreciated their contribution, and the meeting was very calm and participatory.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					wife. • They wanted to know whether the compensation will be done before or after the project construction. • There are vulnerable people in their villages, if i they are impacted by the project and their houses abolished, they will not be able to build another one. They requested that, in such cases, the government should build them houses instead of paying them money. • There are no serious conflicts of land in their village, only when the livestock encroaches to the farmer's crops. When such problem happens, it is resolved by the local government office amicably.	
Ibadakuli	Uzogore	46	33	13	• The community accepted the project considering it will bring jobs, boost the economy and stimulate development. • They expressed concern regarding unexpected pregnancies and conflicts in the community. • Demanded equal rights in the project implementation and fair compensation. • They fear that the contractor might employ workers from outside the village. They proposed that priority should be given to the local communities.	• TANESCO reaffirmed that the project will create jobs for local communities. • The local content which allows all the construction materials to be procured within the area, including labour force. • Observation: The community has experience with other similar projects such as EACOP in their area.
	Ibadakuli	33	17	16	• They expressed their concerns about displacement of project affected people and land acquisition, increase in social insecurity and health problems. • Asked if compensation will be provided as per land laws and regulations. and if crops will be compensated. • Mentioned that several transmission lines have passed through their village. • They are expecting to be connected from this new transmission line. • The participants expressed that they expect to benefit from Corporate Social Responsibility (CSR) from TANESCO. • Demanded that a Grievance mechanism should be put in place. • Demanded that TANESCO should provide funds to secure the poles. • They also expressed that they accept the project as it will bring socio-economic development and enhance the relationship with Uganda, but	• The project will fairly compensate all affected people in the project according to the available laws. • Education will be provided before the implementation of the project to mitigate the spread of diseases, and cultural interference.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					they expect to receive a fair compensation. • They requested that during the construction, villagers should be given first priority with regards to employment. • They expressed their concern about different lines passing through their village, but they do not benefit from power connection. • According to the Sukuma culture, which is the dominant tribe in the project area, polygamy is allowed together with having a big number of children, is a prestige to their culture. • They think polygamist practices may affect the equal fair payment during the compensation process. They requested the government to intervein during the compensation process to make sure the entitled wives benefit equally from the money accrued from the compensations. • Women proposed that, men should be educated on how to spend wisely the money they got from the compensations because, from their past experience of such projects, once the men get the payment, they misuse the money with concubines instead of their families. • Women do not have a say of how many wives their husbands should have and are not consulted when the husband wants to increase another wife. • They wanted to know whether the compensation will be done before or after the project construction. • They said that if vulnerable people are impacted with the project and their houses abolished, they will not be able to build another one. In such cases, they are requesting the government to build them houses instead of paying them money. • There are no serious conflicts of land in their village only when the livestock encroaches to the farmer's crops. When such problem happens, it is resolved by the local government office amicably.	
Old Shinyanga	Ihapa Old Shinyanga	22	5	17	• The participants asked if there are direct benefits to the village, such as connecting the village with electricity from the project. • Expect that even their trees will be compensated. They also demanded feedback on what will happen to the trees after they have been cut.	• There will not be a direct connection of electricity from the project to the village. • Compensation will be done according to the land laws and policy of Tanzania.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Expressed their concern, as consider that there will be death due to the electricity wires and will also be unplanned pregnancies. • They need to be compensated as EACOP, that is, compensation should be the same as what has been acquired. For example, if a person's house has been affected by the project, then the affected person should be compensated with a house, not money. • Participants also asked to be provided education on how to prevent diseases and financial literacy education. • The project has been accepted. But there should be fair compensation and the affected people be provided with financial and entrepreneurship education. • They expressed that all works (such as construction, garage, truck driving, etc) are mainly for male. • Gender roles distribution of social economic are not practiced in Sukuma tribe. Cattle and all cash crops belong to men. • Decision making on how to spend the money from the sale are men dominated. • The role of women is domestic chores. they are solely responsibility of women. Men are supposed to work and provide for the family. • Education used to be for men but nowadays they are considering for boys and girls. • The number of illiterates is higher for women than for men. Most women do not know how to read and write. • They are requesting the government to have a close supervision during the compensation to make sure that both women and men will benefit equally.	• Education on how to prevent disease and financial literacy will be provided.
District: Shinyanga District (former Shinyanga Rural)						
Solwa	Mwasekagi	20	9	11	• The participants accepted the project as it will bring development to the village. • They expressed their concern regarding displacement of people, spread of communicable diseases, air and land pollution, distortion of culture • There should be negotiation on land compensation between landowners and the government.	• The process of acquisition and compensation will be implemented according to Tanzania law. • Observation: There was poor participation as reflected by the number of participants in the meeting.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• They demanded that compensation should be given on time. • They wanted to know exactly where the alignment is so that they won't develop the area. • The main tribe in this area are Sukuma and Nyamwezi and their culture is similar i.e. polygamist practices, livestock keeping and farmers. • They mentioned that the vulnerable groups should be assisted by the project by building them houses instead of paying them money as compensation. • They proposed that for those who will be impacted by the alignment should be given priority for electricity connection	•
	Mwiseme	33	10	23	• The participants accepted the project because they consider it will bring development. • Expressed concerns regarding distortion of culture, conflicts, spread of communicable diseases, and unplanned pregnancies. • They demanded that two neighbourhoods in the village should be connected to electricity. • They wanted to know who will be involved in the valuation of their properties. • The participants wanted to know how they will be paid their compensations. • The Sukuma and Nyamwezi are the main tribes in the area. • Their economy depends on livestock keeping and agriculture. If the project takes their land will lose a grazing and farming land. They are requesting the government to replace them with another land big enough for their cattle and farming. If they are given money, they think will not be enough to acquire another one. • Vulnerable groups in their area are assisted for their livelihood and medical assistance by the government through TASAF • There is no serious land conflict in their area • The gender roles and responsibility are practiced individually everyone live differently. • Polygamist is practiced among the people in the area but not everyone.	• TANESCO explained that this is a transmission project, and not a distribution, hence, it will not connect villages to electricity but will improve the provision and sustainability of power in general. • The valuation will be done according to Government regulations. • Compensation will be done according to the land laws policy of Tanzania. •

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
	Solwa	42	9	33	• The participants accepted the project because it will bring development to both the nation and the village. • Participants asked how the project will ensure the safety of the village in terms of theft and conflicts. • Expressed concern regarding emergency of communicable diseases, displacement of people, air and noise pollution. • They demanded to have electricity in the village. • The villagers should be given first priority when it comes to jobs. • The participants mentioned that they consider gender roles as equal between men and women. • In other similar project they were always promised employment for the local youth but once the project came they are not considered but only see other workers from other places. • Women are allowed to work in the construction if they are interested • Construction works are hash they need men to work such an environment. • The participants in this meeting were very hostile because they were not paid compensations from the previous project. They were worried even this one will deprive their dues. • They were wondering when the REA will bring electricity in their area.	• The project will advise the village to establish Grievance Redress Mechanism. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase. • The implementation of the project will boost the availability of electricity in the distribution line. • The villagers will be given priority regarding employment during the implementation of the project.
	Mwabuki	20	2	18	• The participants accepted the project because they consider it will bring development and boost the economy. • TANESCO should have negotiations with those who will be affected by the project when it comes to compensation • TANESCO to make sure the compensation is distributed equally within men and women, taking into consideration the issue of polygamy in the area • TANESCO to contact always with the local leaders in order to identify the disadvantaged groups who cannot attend the meeting are well informed about the project and its benefits.	• The process of acquisition and compensation will be implemented according to Tanzania law. • Observation: There was poor participation, as the number of women participants was very low.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Mwakitolyoo	Mwasenge	35	10	25	• They expressed concern regarding displacement of people and demanded fair compensation. • Education was demanded to raise awareness to the communities. • Also asked if they would be employed. • The villagers expressed concern that those whose houses will be affected by the project, their houses should be replaced in-kind instead of being compensated in cash. • The participants wanted to know about when the project will start. • The tribe in this area are mainly Sukuma who relies on their economy from livestock keeping and farming. Land has a great value for grazing their big number of cattle. • They also practice polygamy and have many children	• Compensation will be done according to the land laws policy of Tanzania. • Awareness campaigns will be conducted during the project implementation phase. • Yes, all qualified will be employed during project implementation.
	Nyang'ombe	26	6	20	• Participants asked if the villagers are going to have permanent employment. • The majority of the villagers accepted the project as they consider it will ensure a sustainable supply of power. • Expressed their concerns regarding insecurity, conflict, and unplanned pregnancies. • Demanded fair compensation and education on the project to minimize negative impacts. • Gender roles distribution of social economic are not practiced in Sukuma tribe. Cattle and all cash crops belong to men. • Decision making on how to spend the money from the sale are men dominant. • The role of women is domestic chores, which are solely responsibility of women. • Decision making is solely for men even the inheritance of the property are ventured to boy child. • There are some vulnerable groups such as elderly, widow, orphans and disabled who are assisted by TASAF, but they mentioned that it is not much to sustain the daily living.	• Villagers are going to have temporary employment based on their qualifications. • Observation: There was poor participation, particularly for women. • Education will be provided regarding security issues, unplanned pregnancies, and conflicts. • Compensation will be done according to the land laws policy of Tanzania.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Salawe	Nzoza	41	20	21	• The participants accepted the project as it will bring socio-economic development. • They asked if the project would benefit the village. • Demanded that compensation should also be in-kind. • They proposed that people who will be affected by the project to be compensated land by land, as they did in Msomera for the Maasai. • They demand that the ones who are affected should state the value of their properties. • They expressed concerns that previous TANESCO's projects destroyed their crops without prior notice. • Expressed concern regarding the destruction of their culture, air pollution, noise pollution and spread of communicable diseases. • They demanded that they should be informed of the schedule of the project implementation. • In other similar project they always promised employment for the local youth but once the project comes, they are not considered but only see other workers from other places. • Women are allowed to work in the construction if they are interested. • Construction works are harsh, they need men to work such an environment. • The participants in this meeting were very hostile because they were not paid compensations from the previous project. They were worried even this one will deprive their dues. • They were wondering when the REA will bring electricity in their area.	• There are no direct benefits to the village from the project regarding connection to electricity. • The village will benefit economically during construction period, as well as during the implementation of project because there will be enough power for distribution. • Compensation will be done according to the land laws policy of Tanzania. • Mitigation measures will be enhanced to reduce moral destruction, air pollution, noise pollution, and spread of communicable diseases.
Iselemagazi	Mwamakaranga Ichongo Iselamagazi	45	7	38	• The participants asked if the project would bring sustainable electricity. They expressed their wish that the proposed project will bring enough power to their village. • They consider that the village will benefit after the construction of the proposed project by the village being engaged for security of the transmission towers passing in their village, cutting of grasses and trees that grow under transmission line.	• The proposed project will bring sustainable availability of the electricity in the village, the Shinyanga region and county in general. • Observation: The participants were very active and receptive to the project.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• They also expect that the project will bring a transfer of knowledge within the society, increase of income to villagers and village in general. • Demanded education to know how to minimize negative impacts. • They mentioned that they do practice polygamy, and it is part of their culture for the Sukuma to have many children and many wives. • Women do not have say when it comes to the issue of family planning. However, they do it secretly. • There are vulnerable groups in their area who are assisted by TASAF and other good Samaritans	
Nyamalogo	Mwang'osha	20	0	20	• They accepted the project as it will bring development to both the nation and the village in particular but considered that the project should also benefit the village directly in terms of connection of electricity. • They demanded to be connected with electricity, as only 5% of the households had electricity. • They demanded that employment should be given to the villagers during the implementation of the project. • They demanded that there should be fair compensation. • In other similar project they always promised employment for the local youth but once the project comes, they are not considered but only see other workers from other places. • Women are allowed to work in the construction if they are interested. • Construction works are harsh, they need men to work such an environment. • The participants in this meeting were very hostile because they were not paid compensations from the previous project. They were worried that even this one will deprive their dues. • They were wondering when the REA will bring electricity in their area.	• TANESCO explained that this is a transmission project, and not a distribution, hence, it will not connect villages to electricity but will improve the provision and sustainability of power in general. • Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania. • Observation: No women participated in the meeting.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Pandagichiza	Pandagichiza	18	10	8	• The participants accepted the project because they consider it will bring development. • Expressed their concern regarding land acquisition and displacement of project affected people, spread of communicable diseases, air and noise pollution. • Demanded good practice on compensation and to manage it taking into consideration human rights. • Also expressed that the project should not start during cultivation. • They wanted to know where the alignment passes through. • They demanded that there should be fair and fair compensation, unlike what happened in the past in the similar projects. • The vulnerable groups should be handled with care since they cannot run around looking for their compensations. • If a vulnerable group is impacted, the government should build them houses instead of paying them money due to their disability.	• Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania. • The crop calendar will be observed and adhered to. • Demarcation will be inserted before the implementation of the project. • Observation: There was poor participation as reflected by the number of participants.
	Shilabela	59	12	47	• The participants asked if there are direct benefits to the village, such as connecting the village with electricity from the project. • Expect that even their trees will be compensated. They also demanded feedback on what will happen to the trees after they have been cut. • Expressed their concern, as consider that there will be death due to the electricity wires and will also be unplanned pregnancies. • They need to be compensated as EACOP, that is, compensation should be the same as what has been acquired. For example, if a person's house has been affected by the project, then the affected person should be compensated with a house, not money. • Participants also asked to be provided with education on how to prevent diseases and financial literacy education. • The project has been accepted. But there should be fair compensation and the affected people be provided with financial and entrepreneurship and education. • They expressed that works such as construction, garage, truck driving, etc are mainly for male. • Gender roles distribution of social economic chores are not practiced	• The project will not directly supply electricity at the village but will ensure sustainability in the country • Education will be provided regarding security issues, unplanned pregnancies, and conflicts. • Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					in Sukuma tribe. Cattle and all cash crops belong to men. • Decision making on how to spend the money from the sale are men dominated. • The role of women is to take care of domestic chores are solely responsibility of women. Men are supposed to work and provide for the family. • Education used to be for men but nowadays they are considering it for boys and girls • In this village they mentioned that the number of illiterate persons was higher among women than men. Most women do not know how to read and write. • They are requesting the government to have a close supervision during the compensation to make sure that both women and men will benefit equally.	
Mwenge	Mwongozo	50	12	38	• They accepted the project because they consider it will bring socioeconomic development. The participants asked if the owner of the land, which does not have any crops on it, is he going to be compensated? • Expressed concern regarding the displacement of people. • Demands of fair compensation. • Demanded the implementation of Corporate Social Responsibilities.	Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania.
	Zunzuli Ipango	45	8	37	• Participants asked where exactly the transmission line will pass. Also, what guidelines will be used during compensations. • They believe that transmission line will benefit their village in one way or another through jobs, business, and knowledge transfer. • Expressed concern regarding resettlement of the people. Demanded for compensation and education to minimize the impacts. • They mentioned that the land use in their area is for mining of gold, grazing land and for farming. Hence the compensation is higher than expected due to the value of their land. • They wanted to know whether the alignment will intercept their mining sites.	• The team of surveyors will come to demarcate the boundaries of the line. • The compensation process will be guided by Tanzanian laws, and regulations deal with land and compensation issues. • Observation: The meeting consisted of two villages. But, the participation was very poor, especially for women. However, they all accepted the project.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Lyab usalu	Mwajiji	30	5	25	• The participants accept the projects as they consider it will bring development. • Participants expressed concern for the loss of land for the cattle. • They wanted to know why the wayleave is so wide. • They wanted to know whether they can perform human activities underneath the line. • There are vulnerable groups in their village and should be considered during the compensation to be treated fairly. • There is a division of labour roles, according to gender and age. • Their culture is dominated by norms and values of Sukuma tribe. • They depend on their livelihoods, they depend on livestock keeping, farming food and cash crops.	• Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania. • For security reasons, it is prohibited to perform any other human activity underneath the line, and this is illegal and dangerous.
	Lyabusalu Bukamba	20	5	15	• Communities accept the project as they expect that it will bring development to the villages • Express concern regarding accidents from falling of the transmission towers.	• This is noted. • Observation: There was poor participation and minimal contribution from the participants.
	Mwabagehu	19	9	10	• Accepted the project because they consider it will bring development. • Expressed concern related to accidents due to the potential fall of transmission tower. • Demanded to be provided with health and safety education. • They proposed that during the compensation, the government should secure an alternative land for the loss of the previous one (which will give wayleave to the transmission line).	• The poles will be strong and metal in nature. • Education will be provided to communities to mitigate potential accidents.
District: Msalala						
Bugarama	Igwamanoni	60	16	44	• Participants accepted the project because it will bring social and economic improvements within the nation. • The project should comply to the laws of land and human rights • Tanzania will have good economic relationship with Uganda due to the project. • They expressed concerns regarding abandonment of family, air pollution, noise pollution, unplanned pregnancy, communicable diseases like HIV/AIDS and thieves. • They reported that their livelihood depends mostly on small scale	• Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project, it will affect them economically. • The residence are mixture of different tribes from the country although the indigenous tribe are Subwa and Sukuma.	• Observation: there is small scale mining activities in the village
	Ilogi	53	8	45	• Accept the project because it will help with national and village economy. • Asked how the project can solve conflicts that arise through it. • Demanded that compensation should be given according to laws and regulations in Tanzania and considering the component of human rights. Employment should be given to the villagers only. • Expressed concern regarding increase of communicable diseases, unplanned pregnancy to girl child, abandonment of family. • Proposed programs of awareness to communicable diseases. • Demanded of women to be employed to the project. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project will affect them economically. • The residence are mixture of different tribes from the country although the tribes are Subwa and Sukuma	• There will be formulation of Grievances Redress Mechanism. • Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase. • Women will be given equal chance of employment
	Buyange	51	17	34	• The community accepted the project as it will strengthen the relationship between Tanzania and Uganda and because the nation will acquire tax. • They asked if CSR will be given, and if they will receive emotional compensation. • Demanded that the project should be within time, and it should not take a long period of time.	• CSR will be given.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Expressed concern regarding death due to electricity wires, communicable diseases, like HIV. • Demanded that compensation should be negotiated and defined not only complying to the law. • Considered that there should be programs for HIV, gender-based violence and programs to educate girls, against unplanned pregnancy. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project will affect them economically. • They are mixture of different tribes from the country, although the indigenous tribe are subwa and Sukuma	• Compensation will be given based on the laws and regulations. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
Lunguya (Runguya)	Kalole	39	4	35	• The project was accepted as they considered it will contribute to boosting economic growth. • Expressed demands for local employment during the implementation of the proposed project. • CSR should be considered. • T-line should not regularly change to avoid disturbances. • They proposed to have a regular community meeting to provide updates on the project. • Education should be provided to the community to avoid wide spread of diseases and other related negative impacts. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture (both food and cash crops). • If their land will be taken by the proposed project will affect them economically. • The residents are a mixture of different tribes from the country, although the indigenous tribes are Subwa and Sukuma.	• The project will create jobs. • Employment for the local people will be considered • T line will not change • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
Bulyan'hulu	Busulwangili	71	24	47	• They accept the project as they expect it to bring social economic development. • What is the amount of Corporate Social Responsibility (CSR) from the proposed project, which will be allocated to our village? • Demanded the implementation of CSR.	• The project is at the earliest stage (ESIA), the amount of CSR will be determined later on, after knowing the actual cost of the project and obtaining the contractor of the proposed project

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Demands for local employment during implementation of the proposed project. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project, it will affect them economically. • The residents are mixture of different tribes from the country, although the indigenous tribes are Subwa and Sukuma.	• Local content will be implemented. • Observation: the village is adjacent to the big mining company (Bulyan'hulu Gold Mine)
Region: Geita						
District: Geita DC						
Bukoli	Ntono	72	32	40	• The community has accepted the project but prior to compliance with compensation, resettlement laws, and land acquisition. • Participants asked if the cost of the electricity will lower. • Asked if the towers will interfere with public roads and if it will benefit the villages. • Participants considered as positive that the project will pay for lands and bring socio-economic development to the Nation. • The residents are a mixture of different tribes from the country, although the indigenous tribes are Subwa and Sukuma. • Expressed concerns regarding impacts on health, including an increase on communicable diseases. • They demanded information on employment opportunities for both men and women. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture (both food and cash crops). • If their land will be taken by the proposed project, it will affect them economically	• The project will benefit the Nation, • The tower will not interfere public roads • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase. • Fair compensation will be provided based on the Tanzania laws and regulations • Employment will be provided to both women and men

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Butobela	Shahende	30	2	28	• The participants asked if the cost of the electricity will lower and if there is a connection between REA and the project. • Considered as positive that there will be diplomacy between Uganda and Tanzania and that it will pay for the lands. • Expressed concerns regarding potential impacts on health. • Demanded CSR to be provided to the village community. • Also indicated that there should be programs to educate the community about communicable diseases.	• TANESCO explained there is no connection with REA. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase. • The project is at the earliest stage (ESIA), the amount of CSR will be determined later on, after knowing the actual cost of the project and obtaining the contractor of the proposed project
District: Nyang'hwale						
Kafita	Kayenze	50	10	40	• Participants asked when they will be compensated. • The participants considered the project as beneficial and that it will contribute to national development but demanded fair compensations. • They demanded employment for the local communities • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture (food and cash crops). • If their land will be taken by the proposed project, it will affect them economically. • The residents are a mixture of different tribes from the country, although the indigenous tribes are Subwa and Sukuma.	• The compensation will be done after evaluation of all affected people. • Employment will be provided to the local communities.
	Bukulu	67	13	54	• The majority accepted the project with fair compensation and consideration of community social responsibility. • They demanded employment for the local communities. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture (food and cash crops). • If their land will be taken by the proposed project, it will affect them economically. • The residents are a mixture of different tribes from the country, although the indigenous tribes are Subwa and Sukuma.	• Houses and land will be affected, but fair compensation will be provided. • Employment will be provided to the local communities.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Nyugwa	Isonda	20	0	20	• The participants considered the project will contribute to national development. • Expressed concern regarding the spread of diseases like HIV/AIDS. • Demanded that employment must be provided to the local people in the village. • The majority accepted the project but demanded fair compensation. • They asked when the project will start. • They asked if they are going to be connected to electricity. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project will affect them economically. • The residents are a mixture of different tribes from the country, although the indigenous tribes are Subwa and Sukuma.	• Yes, land and houses will be affected, but fair compensation will be provided to the affected people. • The project will start when all affected people are compensated. • The community is not going to be directly connected to the electricity, though the project will improve sustainability of the power supply.
Nundu	Igeka	24	3	21	• The majority accepted the project but prior it should comply with laws, human rights, also demanded CSR. Considered that the project is for the development of the Nation. • Participants asked if the village will be compensated if the project passes through the village mountain. • Expressed concern about the loss of land for cattle. • Demanded full, fair, and prompt compensation. • They demanded for connection to the electricity at their villages. • They reported that their livelihood depends mostly on small scale mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project will affect them economically. • The residents are mixture of different tribes from the country although the indigenous tribes are Subwa and Sukuma.	• Yes, there will be compensation if the project must acquire that land. • Land and assets will be compensated fairly, according to law. • The project will assure sustainability of electricity in the distribution line which will supply enough power to the villages, but not directly through this project.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Bukwimba	Kasubuya	32	1	31	• Participants asked if this project will ensure electricity within the village. • They consider it positive because it will pay for lands. • Expressed concern about the loss of land for cattle. • They demanded electricity within the village.	• It will not ensure electricity within the village because this is an interconnector project between Tanzania and Masaka Uganda. • Fair compensation will be provided to all affected people. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Bukwimba	20	2	18	• Participants asked if there will be fair compensations for the land acquired and for resettlement. • Demand electricity within the village. • The community have accepted the project, and they demand it to be on time. They considered that it will improve its economy and sustainability of electricity in the country. • Expressed concern about the loss of land for cattle. • They demanded for fair employment opportunities for both men and women.	• Land and assets will be compensated fairly, according to law. • Fair employment opportunities will be provided to both women and men.
District: Mbogwe DC						
Ikobe	Kagongo	72	36	36	• They valued that the project will improve the power supply within the Nation. • Expressed concern regarding the loss of land for the cattle. • The community accepted the project and assured maximum support during implementation process.	• Land and assets will be compensated fairly, according to law.
	Bugalagala	25	5	20	• Asked if they were allowed to cultivate within 52 m or beyond of the project. • Project affected people request that compensation to be paid before project begins. • Expressed concern regarding the loss of land for the cattle. • They demanded for education on the potential impacts of the project.	• No, after compensation you are required to not cultivate within 52 mt of the project, but beyond 52 you are allowed to cultivate. • Education will be provided to the all affected communities to minimize the negative impacts of the project.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
	Busabaga	25	3	22	• Participants asked if there were similarities between this project with REA and if this project will benefit this village only. If the project acquires land, what will the government do? • The village have accepted the project but demanded fair compensation. • View as positive that it will help to have supply of enough power to the Nation. • Expressed concern regarding the loss of land for the cattle.	• The project is not similar to REA, • The project will benefit the Nation as a whole. • After land acquisition due to the project, the government will offer compensation.
Lulembela	Kashelo	67	29	38	• They asked if the cost of the electricity will lower. • Considered it positive because it will pay for the lands. • The project will stimulate national development. • They expressed concern because they may get sick due to the project. • Demanded fair compensation and education to minimize negative impacts.	• The project will create jobs to the local communities • Land and assets will be compensated fairly, according to law. • Education will be provided to the communities which will be affected by the project.
Ilolangulu	Ilolangulu	23	8	15	• They asked if the village will have access to electricity and if the project will pay for the lands. • Considered it positive because it will bring development. • Expressed concerns regarding impacts on health (to get sick due to the project). • Accepted the project but demanded fair compensation for the land. Also demanded education on the project.	• No, the project will benefit the country as a whole but not directly to the village. • Land and assets will be compensated fairly, according to law. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase
Mbogwe	Nambubi	100	46	54	• Asked if the land will be freely taken. • Considered positive that it will pay for the land but demanded fair compensation. • They accepted the project because it will stimulate national development. • Concern: to get sick due to cables/electricity. • They demanded for timely commencement of the project.	• The compensation will be provided to all affected resources. • The project will timely start after compensation.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
	Bwendanseko	48	17	31	• Asked if the lands will be compensated. • Considered the project positive because it will help develop industries and other economic activities and stimulate the national development. • Expressed concern that it may spread diseases like HIV and AIDS or will cause conflict and unplanned pregnancies. • Demanded fair compensations.	• There will be fair compensation according to the laws. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Mwanza	67	29	38	• Participants asked if the project will create jobs and if there will be a fair compensation for lands. • Considered it a positive project because it will pay for the lands. • Expressed concern related to the loss of land for the cattle. • They asked if the village will be responsible for the security of the towers.	• Yes, it will create jobs. • Lands and assets will be compensated fairly, according to Tanzania law. • The village will have agreement with TANESCO on how to ensure security of the towers after the completion of the project.
Ngemo	Nyitundu	38	37	1	• Participants asked if the price of the electricity will lower and if the project will provide electricity to the village. • Asked if the compensation will be given for the towers only. • They demanded regular training about the project. • Considered positive that the project will pay for the lands and that the nation will be able to acquire tax and develop. • Expressed concern regarding the loss of land for cattle. • It is necessary to develop awareness about the project and its risks, since children normally like playing and climb the towers. • Demanded that CSR should be given to the community.	• Compensation will involve trees, land, resettlement process, graves, etc. • The project will bring benefit to the country but will not provide electricity to the village directly. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Bwendamwizo	56	20	36	• They proposed that both male and female should be considered for employment to have equal opportunities without discrimination. • They requested that the project should start as planned without any delay. • Compensation should be paid fairly.	• There will be fair compensation to the all-affected people and there will be no more compensation after that. • Employment opportunities will be provided to both men and women. • The project will start after completion of ESIA study and other formalities.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• They praised the government for its initiative and for bringing such electricity project since its highly required for the nation and for their village development. • When will this project start?	
	Bulongo	27	7	20	• Participants asked if the village would access electricity. • They also asked if the compensation would continue every year. • They valued positively that the project will pay for the land. • The participants positively considered the project it will stimulate development. • Expressed concern related to the impact on birds. • Demanded fair compensation. • Also demanded balanced employment for both men and women.	• There will be fair compensation to the all-affected people and there will be no more compensation after that. • Employment opportunities will be provided to both men and women.
Ushirika	Kadoke	45	15	30	• Participants asked if houses or land will be affected. • They valued positively that the project will pay for the lands. • Expressed concerns regarding impacts on health due to electricity. • The majority accepted the project depending on fair compensation. • They demanded for employment opportunities during the project implementation.	• Land and other properties will be affected. However, fair compensation will be provided to the affected people. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase. • Employment opportunities will be provided to both men and women.
District: Bukombe DC						
Busonzo	Nampalahala	151	72	79	• Participants asked if the houses or lands will be affected. • Also asked if there would be employment for women. • Valued positively that the project will pay for lands and considered that it will boost the village economy. • Expressed concern for the loss of land for the cattle. • Demanded fair compensation and education. • The project was positively accepted at the village. • They demanded justice during evaluation process and fair compensation. • They reported that their livelihood depends mostly on small-scale	• There will be employment for both men and women. • Land and assets will be compensated fairly, according to law. • Education will be provided to all affected people to minimize the negative impacts

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project will affect them economically • The residents are a mixture of different tribes from the country although the indigenous tribes are Subway, Haa and Sukuma.	
	Nalusunguti	70	10	60	• Participants asked if the cost of electricity will lower. • Also asked how the project will guarantee employment for the village. • The participants expressed that they believe that the project will pay for the land and will help industrial development. • Expressed concern due to loss of land for cattle. • Demanded that compensation should be paid within time. • The village has accepted the project with observation to human rights.	• The cost of electricity is made by regulatory board (EWURA). However, the quality of electricity supply will increase. • The project will guarantee employment within the village. • The compensation payment will be done after statutory procedure.
	Busonzo	231	105	126	• Participants asked if the cost of the electricity will lower. Also • how long it will take for the compensation to be paid. • Participants believed that the project will pay for the land. • Participants expressed concern for the loss of land for the cattle. • The community accepted the proposed project as they considered that it will create jobs, it will increase individual income as well as benefit the village in general. • Requested the implementation of a Corporate Social Responsibility (CRS) program. • Also considered important to include education about violence against women to reduce the number of victims.	• The cost of electricity is made by regulatory board (EWURA). However, the quality of electricity supply will increase. • The compensation payment will be done after statutory procedure. • Very minimal grazing land will be impacted. • Yes, there is a possibility for the project to offer CSR during the implementation. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase. • Observations: leaders and community were proactive and enthusiastic about the proposed project and have so many expectations about this project.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
	Kabagole	76	32	44	• Participants asked if the cost of electricity will lower. Also, if compensation will be paid according to the value of the asset and when it will be paid. • The participants had a positive perception of the project because it will help the industrial development. • Expressed concern due to loss of land for cattle and demanded CSR for the improvement of village. • There are sacred places in the village. • The sacred places should be valued and respected according to their culture. • Experience from the previous similar projects shows that people were not paid their compensation. Will this project be similar to the previous ones? • How will the cemeteries be treated? • They reported that their livelihood depends mostly on small-scale mining, livestock keeping and agriculture for both food and cash crops. • If their land will be taken by the proposed project will affect them economically • The residents are a mixture of different tribes from the country, although the indigenous tribes are Haa, Subwa and Sukuma	• Yes, compensation will be paid before the project, and compensation will be paid based on the value of the asset. • Regarding the sacred places, a thorough investigation will be carried out in due course and all the legal procedures will be followed. • All the cemeteries affected by the project will be shifted to another area within the same village with all respect of the burial ceremonies.
	Nakayenze	47	17	30	• Participants asked if the cost of electricity will lower. • Also asked if they will be paid for the lands. • Considered the project important for the economic development of the Nation, the project is a potential for the Nation. It will help for the industrial development. • Expressed concern for the loss of land for the cattle. • Demanded fair and timely compensation.	• The cost of electricity is made by regulatory board (EWURA) however, the quality of electricity supply will increase • Land and assets will be compensated fairly, according to law.
Butinzya	Butinzya	71	5	66	• Participants asked if the villages will have access to electricity. • Also asked if they will be compensated. • Valued the project positively, considered that it will stimulate development between the countries. • Expressed concern for the loss of land for the cattle. • Demanded timely and fair compensation.	• All affected people will be fairly compensated. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Also demanded equal employment opportunities. • They demanded timely valuation of the affected properties	phase. • There will be equal employment opportunities. • The village will not have direct access to the electricity; however, there will sustainability of the electricity in the respective villages. • Timely valuation of the affected properties will be considered.
Bulega	Ibambilo	75	23	52	• They accepted the project. • They demanded that they should be involved in all stages of project implementation. • They demanded for fair compensation. • They demanded for employment among the local villagers. • The vulnerable group are elderly, widow, orphans and disable and facing a great hardship in their area. They requested the project to consider them during the operation of the project. • Division of roles according to gender is practiced in their area. Male are decision-makers of everything in the households, while women are taking care of domestic chores and taking care of children, elderly and sick people. • Women reported that their culture does not allow them to take contraceptive since many children are considered blessings. • Polygamy is also practiced in this area.	• All affected people will be fairly compensated. • Employment will be provided to all. • Community will be involved in all stages of the project implementation.
	Bulega	79	37	42	• Participants asked if the project will offer CSR and if the graves will be compensated. • Valued positively that it will be good for the economic development. • Expressed concern because of the loss of land for the cattle. • They demanded jobs for the the local villagers. • Division of roles according to gender is practiced in their area. Males are decision-makers of everything in the households, while women are taking care of domestic chores and taking care of children, elderly and sick people.	• Yes, the project will offer CSR, and graves will be compensated • Land and assets will be compensated fairly, according to law. • Employment will be provided to all.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Women reported that their culture does not allow them to take contraceptive since having many children is considered a blessing. • Polygamy is also practiced in this area.	
District: Chato DC						
Iparamasa	Mnekezi	41	8	33	• Participants asked if the cost of electricity will be cheaper. • Also asked if the if compensation will be given equally. • They valued the project because it will be for the development of the Nation, because it will improve electrical energy, and because it will pay for lands. • Expressed concern for the loss of land for the cattle. • They demanded that education be provided to reduce potential accidents during the project implementation.	• The cost of electricity is made by regulatory board (EWURA); however, the quality of electricity supply will increase. • No compensation will be given equally, it will be according to the value of the asset acquired. • Campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Mwabasabi	49	14	35	• Participants asked if the villages will have access to electricity. • Valued the project because it will create jobs and stimulate the villages' development. • Expressed concern due to the loss of land for agriculture. • Demanded fair compensation, clear information and education to minimize negative effects. • Division of roles according to gender is practiced in their area. Males are decision-makers of everything in the households, while women are taking care of domestic chores and taking care of children, elderly and sick people • Few vulnerable groups are assisted by TASAF a number of them are left without any support from the government • They are requesting the project to try to assist these groups in their society as CSR support	• All the acquired land will be compensated. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Songambele	67	16	51	• Participants asked if the villages will have access to electricity. • Also asked if there will be compensation. • Valued positively that it will create employment opportunities and stimulate development. • Participants expressed concern for the loss of land for cattle.	• There will be fair compensation. • No, the project will benefit the country as a whole but will not directly benefit the villages, in terms of their access to electricity.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Demanded to have, in the future, more information on the project.	• Yes, the project will create employment for the local villagers. • More information about the project will be provided.
Region: Kagera						
District: Karagwe DC						
Kihanga	Katanda	22	5	17	• Participants asked if the cost of the electricity will be reduced. • Also asked when the village will be connected to electricity. • Demanded for electricity at their houses. • Participants believed that the project will pay for the land. • The project will stimulate national development. • Expressed concern on health impacts, as the project implementation may affect them. • Demanded fair compensation and connectivity to electricity.	• REA is responsible for connecting electricity in rural areas. • No, the project will benefit the country as a whole but will not directly benefit the villages, in terms of their access to electricity. • Education will be provided to minimize potential impact of the project.
	Kihanga	66	36	30	• They also asked when the compensation will be paid. • Participants valued that the project will pay for the land. • Participants accept the project as they consider it is or the development of the Nation • Participants expressed concern for the loss of land for the cattle. • Demanded electricity within the village.	• When the project begins, lands will be compensated according to law. • No, the project will benefit the country as a whole but will not directly benefit the villages, in terms of their access to electricity.
	Kishoju	23	8	15	• The participants asked if the project will use colonial laws in the evaluation process. • Participants believed that the project will pay for the land and that it will stimulate national development. • Expressed concern on health impacts, as electricity may affect them. • Demanded fair evaluation and compensation. • Demanded clear information on where the project will pass through. • Demanded to be involved in all stages of the project implementation. • Priority should be given to the villages when it comes to employment.	• The sustainability of electricity will be achieved; jobs will be created and affected by land, and other resources will be compensated. • The compensation process will be conducted according to current land laws. • The alignment will be disclosed during the designing stage of the project. • Local content will be applied when providing employment to the local communities.
	Mulamba	32	10	22	• Participants asked if the cost of the electricity will lower. • Also asked if this project is related to REA.	No, this is transition line between Tanzania and Uganda and will not connect the villages to electricity.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• They accepted the project because it will boost development as it will improve energy/power. • Participants valued that the project will pay for the land. • Expressed concern on health impacts, as electricity may affect them. • Demanded electricity within the village. • The main tribe is Nyambo, their livelihood depends on farming of cash crops, coffee and bananas. • Their land use mostly is for agriculture and some few cattle, not as much as in Sukuma people • Their marital status is mostly monogamy unlike the Sukuma tribe. • Gender role and division of labour is practiced whereby men are decision-makers and providers in the family and women take care of domestic chores like reproductive issues, child and family caring. • Construction works are considered a masculine work (for men only).	
Kayanga	Miti	78	15	63	• Asked how long it will take for the compensation to be paid. • Participants valued that the project will pay for the land. • Considered that the project will bring social economic development within the village due to various opportunities that will arise during its implementation. • Demanded Corporate Social Responsibility (CSR). • Demanded fair, full, and prompt compensation. • They accepted the proposed UTIP project. • They demanded employment to the youth from the surrounding villages.	• Compensation will be paid after all statutory procedures are completed. Also, compensation must be fair, full, and prompt compensation. • CSR will be considered during the project implementation. • The project will provide employment opportunities to the local communities.
Bugene	Omurushaka Nyakahanga Kishao Chagati Lukajange Bugene	112	20	92	• Participants asked if the villages will have access to electricity. • Will compensation of UTIP be the same as that of Benaka kyaka? How is valuation determined? • There should be meetings on project progress. • Demanded full, fair, and prompt compensation, there should be no delay on compensation. • Considered that the project will enhance good diplomacy between Tanzania and Uganda and that it will be good for the development of energy/power and industries.	• The project will not directly provide connection of the power to the villages; however, it will improve avauilability of the electricity in the villages. • Compensation will be provided according to Laws of Tanzania, valuation is determined as per the asset acquired and through complying with the laws and regulation of Tanzania.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Participants expressed concern for the loss of land for the cattle. • Participants valued that the project will pay for the land. • The villages have accepted the project but demand the project to comply with human rights. • They proposed that the vulnerable groups should be help by the government to construct their houses instead of giving them money as compensations. • TANESCO to find a way of assist couples to make their wives to benefit from the payment of the compensation. The experience shows that in some cases men dominate the payment without sharing it with their wives.	• Human rights will be observed during project implementation. • Meetings will be regularly conducted to inform communities about the project.
Ihembe	Ihembe	**91**	**68**	**23**	• Participants asked when the surveyors will come to the site to demarcate the proposed project area. • Participants believed that the project will pay for the land. • The project will bring economic development. • Participants expressed concern for the loss of land for grazing. • Demanded Corporate Social responsibility (CSR) • Insisted on effective participation of the local community.	• After introduction of the proposed project, the surveyor team will visit the site to demarcate the proposed project areas, and the village government will be informed and participate in demarcation activities. • Very minimal grazing land will be affected by the project. • CSR might be provided during the project implementation.
Nyaishozi	Rukale	**43**	**14**	**29**	• Participants asked if they will be allowed to cultivate within the area if they are compensated. Is this project similar to REA? • Participants valued that the project will pay for the land. • Valued it positively as it will help with the development of industries. • Expressed concern on health impacts, as electricity may affect them. • They demanded that the project should not delay, so that the nation can develop energy and power. • The community has accepted the project, but prior to fair compensation	• You're required to not use the land (and cultivate) within 52 M along the line. No, the project is not similar to REA. • After compensation no economic activity will be allowed in the wayleave for security purposes. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Nyakayanja	**90**	**20**	**70**	• Participants asked if the cost of the electricity will be reduced. • How long will it take the compensation to be paid?	• Compensation will be done after all statutory procedures are completed.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Participants believed that the project will pay for the land. • They accepted the project as it will bring social benefits and economic development. • Participants expressed concern for the loss of grazing land. • Demanded management of pollution and environmental impacts in general. • They accept the proposed project, and they are willing to participate in the various opportunities during project implementation. Also, education about violence against women and children is very important to reduce the number of victims within society.	• The cost of electricity is made by regulatory board (EWURA); however, the quality of electricity supply will increase • Education will be provided to all regarding potential impacts of the project.
Rugu	Kasheshe	**33**	**10**	**23**	• How do you determine the value of the asset of compensation? • Participants belived that the project will pay for the land. • They support the project, as it will contribute to the development of power and energy • Participants expressed concern for the loss of land for grazing. • There should be early compensation to avoid difficulties. • Some of the PAP affected by a previous similar project (RUSUMO) were not compensated. Will this also happen in the current project?	• Value is based on each asset acquired,complying to the laws and regulations • All compensation will be paide based on the Land Laws of Tanzania. • The current project will not commence if the PAPs are not compensated.
Nyakasimbi	Nyakasimbi	57	9	48	• Participants asked if the cost of the electricity will lower. • How will the village benefit directly from the project? • Participants value that the project will pay for the land. • The project will bring good relations between the two countries. • Participants expressed concern for the loss of land for the cattle. • Expressed demands regarding participation (information, participation in decisions). • They accept the proposed UTIP and asked for those who will be affected to receive a full, fair, and prompt compensation. • Fair valuation of the affected properties should be taken into consideration. • They demanded information on meetings about the project.	• The project will ensure sustainability of the power supply. • The village will benefit through various opportunities (local content), by considering them in employment opportunities to youth and women, which will lead to economic growth. Also, through corporate social responsibility. • There will be fair evaluation of the properties which will be affected by the project. • Timely and fair compensation will be provided to all affected people in the project • Accurate information will be provided to the villages.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
	Bujara	**24**	**3**	**21**	• The village has accepted the project but requested that compensations should be paid on time. • Participants believe that the project will pay for the land. • Valued that it will help with the development and strengthening of power within the Nation. • Expressed concern on health impacts, as electricity may affect them. • They demanded equal provision of employment opportunities to both men and women.	• Lands and assets will be compensated according to law. • Awareness will be provided to the communities to minimize the negative impacts of the project. • Employment opportunities will be equally provided to both men and women
	Kahanga	**50**	**22**	**28**	• Will compensation have interest when delayed? • Participants believe that the project will pay for the land. • Expressed concern on health impacts, as electricity may affect them. • They demanded openness during project implementation.	• Yes, compensation will include interest if delayed. • There will be fair compensation for all the PAPs. • Information about the project implementation will be shared to all the people.
	Muungano	**57**	**7**	**50**	• Participants asked where the project will pass in the village. • Participants value that the project will pay for the land. • They considered that it will create jobs and other opportunities, so it will bring social and economic growth. • Participants expressed concern for the loss of land for the cattle. • Demanded Corporate Social responsibility (CSR) • They demanded fully participation in the project.	• The proposed project will be passing within your village, but the exact location is yet demarcated by the surveyor. The surveyors' team will come to the site, and the village government will be informed and participate in demarcation activities. • Yes, the project will create jobs to the surrounding communities • The project will consider CSR during project implementation. • The surrounding communities will be involved in the project from the beginning to the end
Nyakahanga	Rwandaro	14	4	10	Participants asked if the cost of the electricity will lower. When will compensation be done? Does delay in compensation include interest? Participants valued that the project will pay for the land. Considered the project as positive because it will enhance industrial development and energy and power. Participants expressed concern for the loss of land for the cattle.	Compensation will be according to the value of the asset acquired. Yes, delay in compensation will lead to interest.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					Demanded that there should be no delay on compensation.	
	Bisheshe	58	20	38	• Participants asked if the cost of the electricity will lower. • How long will it take for the compensation to be paid? • Participants valued that the project will pay for the land. • The project will bring economic development. • Participants expressed concern for the loss of land for the cattle. • Demanded Corporate Social responsibility (CSR). • They accepted the proposed project. • Women complained that they perform all the domestic activities without assistance from men • It was reported that there is GBV in the village	• The compensation will be paid after all statutory procedures are completed. • CSR will be considered during the project implementation.
District: Biharamulo						
Nyakahura	Nyabugombe	52	7	45	• Participants asked if the cost of the electricity will be reduced. • Participants expressed their concern for the delay of compensation. • Demanded compensation to be fair and to observe human rights. • Participants believed that the project will pay for the land. • Participants expressed concern for the loss of land for the cattle.	• Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania. • The cost of electricity is made by regulatory board (EWURA) however, the quality of electricity supply will increase. • Observation: Few women participated in the meeting.
	Ngararambe	**30**	**12**	**18**	• Participants asked if the project will reduce the cost of the electricity bills. • They accepted the project with the condition of being fairly compensated prior to the commencement of the project. • Participants believed that the project will pay for the land. • Appreciated the project as it will help with the development of energy. • Expressed concern on health impacts, during construction period.	• The project will benefit the country as a whole but will not directly benefit the villages, in terms of their access to electricity. • Fair compensation will be attained to all people affected by the project as per the laws and regulations of Tanzania.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Demanded electricity within their village.	• Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Busiri	50	15	35	• Participants asked if the cost of the electricity will be reduced. • How will PAP s be compensated? • Participants valued that the project will pay for the land. • Appreciated the project as it will help with the development of energy. • Participants expressed concern for the loss of land for the cattle. • Demanded that there should be employment within the village community when the project begins.	• The cost of electricity is made by regulatory board (EWURA); however, the quality of electricity supply will increase. • They will be compensated regarding the valuation done. • The project will offer employment to the villagers,
	Mabale	154	91	63	• Participants asked if the cost of the electricity will lower. • Will there be training on how to secure compensation money because there is a lot of misuse of project money? • Participants valued that the project will pay for the land. • For the development of industrial activities within the Nation. • Participants expressed concern for the loss of land for the cattle. • Demand the CSR to be directed on water.	• Yes, there will be training on the usefulness of project money. • They will be compensated regarding the valuation done.
	Rugese	64	14	50	• Participants accepted the project. • They demand compensation to be within time. • Appreciate the project as it will help with the economic development of the nation. • Demanded water and electricity. • Participants demanded employment for the youth within the village. • They requested to be informed about the progress of the project.	• The project will benefit the country as a whole but will not directly benefit the villages in terms of their access to electricity. • Land and assets will be compensated according to law. • Water supply and electricity might be considered as CSR during project implementation.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Lusahunga	Nyakanazi	66	36	30	• Participants accepted the project. • Will customary deed be used on compensation? • Participants believed that the project will pay for the land. • Appreciate the project as it will help with the economic development of the Nation. • Participants expressed concern for the loss of land for the cattle. • Demanded that there should be training on how to use compensation money provided. • They have experience of similar transmission line (RUSUMO Transmission Line).	• Land and assets will be compensated according to law. • Financial literacy will be provided to all the affected people during compensation.
	Kabale	118	40	78	• Participants asked if the cost of the electricity will lower. • How long will take for the compensation to be paid? • Participants valued that the project will pay for the land. • Appreciated the project as it will help with the economic development of the Nation. • Participants expressed concern for the loss of land for the cattle. • Demanded Corporate Social responsibility. • Demanded for employment opportunities during the project implementation.	The cost of electricity is made by regulatory board (EWURA) however, the quality of electricity supply will increase. • Compensation will be paid after all statutory procedures are completed. • Yes, the project will offer CSR, • Employment opportunities will be provided to the local community.
	Lusahunga	120	70	50	• Compensation payments will be done before or after project implementation? • Participants believed that the project will pay for the land. • Appreciated the project as it will bring social economic development. • Participants expressed concern for the loss of land. • Demanded Corporate Social responsibility. • They have previous experience on the similar project (Rusumo TL project)	• Compensation payments will be done before the project begins. • CSR will be considered during the project implementation.
	Kikoma	66	26	40	• How will compensation be done? • Participants believed that the project will pay for the land. • Appreciated the project as it will help with the development of energy. • Participants expressed concern for the loss of land f or the cattle. • They demand that valuation should be done fairly.	• Compensation will be conducted after valuation, and it will be done according to law. • Fair valuation will be done to all affected assets.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
	Nyakasenga	35	2	33	• Participants accepted the project. • Participants asked if compensation payments will be done before or after project implementation. • Participants believed that the project will pay for the land. • The project will bring economic development. • Participants expressed concern for the loss of land for the cattle. • Demanded Corporate Social responsibility.	• Compensation payments will be done before project implementation. • Yes, payments will be done before project implementation. • CSR might be provided during the project implementation.
Kaniha	Mavota	170	40	130	• Participants asked if the cost of the electricity will be reduced. • What criteria will be used to get jobs /opportunities in the project? • Participants valued that the project will pay for the land. • Considered that the project will bring social economic development. • Participants expressed concern for the loss of land for the cattle. • Demanded Corporate Social responsibility. • Demanded that priority be given to the villagers regarding employment. • Demanded to be provided with education to minimize potential impacts of the project.	• Compensation will be paid to all whose land and properties will be taken. • Jobs will be in various forms, requiring skills and also manpower, all projects' opportunities will have a specific procedure that will be announced before the project begins. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase.
	Mkunkwa	80	18	62	• Participants asked if the cost of the electricity will be reduced. • Will the village sign a contract with TANESCO or contractor to protect the infrastructure? • Participants valued that the project will pay for the land. • Considered that the project will bring development, and that the project will bring sustainability of energy/power. • Participants expressed concern for the loss of land for the cattle. • Demanded Corporate Social responsibility. • Mentioned that, before the valuation exercise, education is very important to reduce complaints that will arise during and after valuation. • They demanded the disclosure of the wayleave of the project. • They demanded equal rights for both genders to be executed during the compensation and project implementation.	• During project implementation, the contractor will be responsible for ensuring the security of the infrastructure, but after the implementation of the project, TANESCO will sign a contract with the village for security of their infrastructure. • There will be fair compensation according to the Land Laws of Tanzania. • Education will be provided to all the affected people about their rights during compensation period. • The alignment will be disclosed during the designing stage of the project. • Gender equality will be observed during project implementation.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Nyantakara	Mugera	64	7	57	• Participants asked if the cost of the electricity will be reduced. • Will the project benefit all the villages? • Participants believed that the project will pay for the land. • Believed the project as it will strengthen the diplomacy and improve Nation Economics. • Participants expressed concern for the loss of land for the cattle. • Demanded full fair compensation.	• The project will benefit all the villages. • The cost of electricity is made by regulatory board (EWURA); however, the quality of electricity supply will increase. • There will be fair compensation according to the Land Laws of Tanzania.
	Nyantakara /Iyengamulilo	32	5	27	Participants asked if the cost of the electricity will lower. If the proposed UTIP project will pass through the graves, what will be the procedure? Participants valued that the project will pay for the land. Considered that the project will bring economic development. Participants expressed concern for the loss of land for the cattle.	The graves will be moved, and the district council will be responsible for moving them with collaborating with the families concerned.
	Nyakayenze	94	38	56	• How will the village benefit from the proposed project? • Participants believed that the project will pay for the land. • Considered that the proposed project will bring economic development. • Participants expressed concern for the loss of land for the cattle. • They accept the proposed UTIP project. • Violence against women and children is the challenge, so education to the society is very important to reduce negative impacts within the society as well as during project implementation. • They demanded timely implementation of the project. • They demanded given priority with regards to employment. • Gender role division is practiced in their area. Males are decision maker of everything in the households while women are taking care of domestic chores and taking care of children, elderly and sick people • Women reported that their culture does not allow them to take contraceptive since having many children is considered a blessing. • Polygamy is also practiced in this area.	• Village will benefit through corporate social responsibility, also through various opportunities during the implementation of the project. • Compensation will be provided to all the affected people, based on the Land Laws of Tanzania. • Education will be provided to minimize potential impact of the project.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
District: Ngara						
Kasulo	Rwakalemera	50	7	43	• Participants asked if the cost of the electricity will be reduced. • Demanded that there should be no delay in compensation. • Participants believed that the project will pay for the land. • Considered that the project will improve energy and power. • Participants expressed concern for the loss of land for grazing. • Needed water supply, health services, and education facilities as CSR. • They wanted to know what will happen for those people who do not have land title deeds. Will they be compensated? • The RUSUMO TL Project passes through their village and there are some people who were affected by this project. • Some PAPs claimed not being compensated.	• Land and assets will be compensated according to law. • CSR might be provided during the project implementation. • Very minimal grazing land will be impacted by the project.
District: Missenyi						
Mutukula	Byeju	34	6	28	• Participants asked if the cost of the electricity will lower. • Asked if the village will be connected to the electricity. • Participants valued that the project will pay for the land. • Expressed concern on health impacts, as electricity may affect them. • Expressed discontent because the village will not be connected to electricity. • Demanded of compensation and education on evaluation and protection against diseases. • Generally, the project was accepted but demanded fair compensation.	• All affected people will be compensated according to the laws. • This project does not include the connection of villages to electricity. • Awareness campaigns regarding prevention of communicable diseases, displacement of people, air and noise pollution will be conducted during the project implementation phase,
	Mutukula	26	9	17	• Will compensation consider the value of the asset? Will the village benefit from the project? • Participants believed in the project because it will pay for the lands and will enhance development of the industry. • The village has accepted the project, but it should comply to the rules and regulations. • Participants expressed concern for the loss of land for the cattle. • Demanded campaigns on HIV/AIDS. • They demanded for employment opportunities to the youth.	• Compensation will be given as per the value of the asset; the village will benefit from the project. • The project will provide awareness campaign to minimize negative impacts of the project. • The project will provide employment opportunities to the youth.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
Kasambya	Bunazi	85	36	49	• Participants asked if the village will have access to electricity. • If the fair compensation will be provided. • They valued that it will stimulate cooperation between the countries and national development. • Expressed concern on health impacts, as electricity may affect them. • The village accepted the project but demanded fair compensation. • Also asked for education on how to minimize negative impacts of the project.	• The project will start when all preliminary stages are done. • The project will not directly connect electricity to the communities. • Fair compensation will be provided to all affected people.
	Omundongo	100	25	75	• They demanded fair compensation. • They asked if they are going to be connected to the electricity. • They demanded fair employment opportunities during project implementation. • They demanded CSR during project implementation.	• There will be fair compensation based on Tanzania laws and regulation. • The communities are not going to be directly connected to the electricity; however, REA is connecting the villages to the national grid. • Fair employment opportunities will be provided to both men and women in the villages. • The project will consider CSR during its implementation.
	Nyabihanga	133	60	73	• They demanded if the project will create jobs for the surrounding communities. • Participants asked if the village will have access to electricity and if there will be compensation. • Participants believed that the project will pay for the land. • Expressed concern on health impacts, as electricity may affect them. • Demanded to be connected to electricity as they want to access it from their homes. • Accepted the project as they considered it positive. • They follow gender roles, where men are responsible for the provision of the family and female are the caretakers.	• The project will create jobs for local communities. • The project will provide fair compensation to the all-affected properties. • Awareness will be provided to the communities to minimize negative impacts, • The project will not directly connect power to the communities.
Nsunga	Byamutemba	28	4	24	• Participants asked if the village will have access to electricity. • Participants valued that the project will pay for the land. • Also valued that it will stimulate village and national development. • Expressed concern on health impacts, as electricity may affect them.	• The project will create jobs for local communities.

Table 7.5.5.3.a
Village consultations

Ward	Village	Participants			Issues raised	Answers given
		Tl	F	M		
					• Demanded fair compensation and employment. • Also requested official and clear information in all stages of the project. • They proposed that the project should be implemented on time.	• Land and houses will be affected. However, fair compensation will be provided to the affected people. • This project will not directly connect power to the communities; however, REA is conducting another project in different villages. • Clear information will be provided to update the communities about the project. • The project will provide employment opportunities to the surrounding communities. • The project will be implemented as soon as possible after all processes are done.
	Ngando	46	4	42	• Participants asked if the cost of the electricity will lower. • The village has accepted the project due to its importance for the national development and industrial activities. • Participants valued that the project would pay for the land. • Participants expressed concern for the loss of land for the cattle. • They demanded employment to the youth. • The tribes are Haya and depend on farming of bananas, beans, sugar cane and coffee for their livelihood. • Their marital status is monogamic system, • There are vulnerable groups, but there are no houses managed by children or orphans. • They practice gender roles whereby men are the heads of the household and decisionmakers, while women are to manage household chores.	• Land and assets will be compensated according to law. • The project will not directly connect communities to power; however, REA is conducting the project which connect electricity to villagers, • The employment will be provided to the surrounding commities.
	Kyaka	72	41	31	• Asked how long it will take to compensate those who will be affected. • They believed that the project would help in national development. • Expressed concern about the health impacts, due to electricity. • The village has accepted the project, but they suggested that it should comply with the laws and regulations of the nation. • They demand that they should have electricity within their village since some of the villages don't have it.	• They will be compensated once the project begins. • Awareness will be provided to minimize negative impacts of te project • This project is not going to directly connect villages to the electricity; however, REA is conducting the project to the villages.

7.5.5.4
Third Phase

In October and November- the team, composed of representatives of TANESCO and JGP/Bene Consult, accompanied by the World Bank, held meetings with different authorities and NGOs representatives. A total of 52 stakeholders (civil servants and representatives of NGOs) participated in the meetings held. In addition, the team held consultation events in the villages, with participation of 594 residents of the villages (410 female and 193 male).

In these meetings and consultation events, the team presented the project, explaining its objectives, main characteristics, and location. In concrete, the team disclosed information on which villages would be intercepted. In several of these cases the meeting was a follow-up to meetings previously held. In this case, the emphasis was put on deepening the knowledge of the area of influence, explaining that this would be an important input for the social baseline.

All the villages accepted the project, as they considered it necessary for the development of the country, but also expressed their concerns and recommendations, specially about fair compensation in case of land acquisition. This information is presented in the tables below (**Tables 7.5.5.4.a** and **7.5.5.4.b**). The **Annex 11** presents the minutes of the consultation meetings held with the villages and other stakeholders, including those carried out during the supplementary consultations (see Annex 11.b - Third fieldtrip).

Table 7.5.5.4.a
Meetings held with institutional stakeholders - Third Fieldtrip

Region	Name	Institution	Position	Concerns	Recommendations
Geita	Dr. Elfas Msenya	Regional Government Authority- Geita	Regional Administrative Secretary	Project impacts on mining, biodiversity; compensation concerns.	TANESCO will liaise with local leaders and affected communities; compensation will follow World Bank and national guidelines.
	Samwel Shoo	Geita Municipal	Resident Mining Officer	Mining operations challenges; GBV concerns; child labor issues.	Recommendations to address unsafe practices and ensure adherence to safety standards; licensing and fair distribution of mining revenue emphasized.
	Joseph Machibya Mariana Genya Diana B Njachala	Bukombe district	Productive Social Safety Net Coordinator Community Development Officer Social Welfare Officer	GBV, VAC, polygamy, and challenges in vulnerable groups; lack of support centers for GBV survivors.	Collaboration with local institutions for project awareness; continued GBV/VAC education proposed.
	Mercy Joseph Julius B. Sumari Yusuph S. Mcheri	Mbogwe District	District Social Welfare Officer TASAF CDO	Support mechanisms for vulnerable groups; GBV situation and reporting challenges.	Training for NPAVAWC committee; emphasis on timely reporting and resource allocation.
	Jeremiah Hango	Mbogwe District	Resident Mining Officer	Impact of project on small-scale mining; cultural distortions; land ownership concerns.	Compensation for landowners only; suggestions to address cultural distortions and resource allocation.
Geita	Joseph Nyaruko	Chato District	Community Development Officer	Challenges faced by vulnerable groups; healthcare and housing issues.	Recommendations for education on proper compensation use; collaboration with village leaders.
		Nyang'hwale, District	Community Development Officer	GBV prevention measures; impacts of project construction on women.	Education on GBV prevention; support for community businesses and healthcare.
	Paulo Malimi	Bukombe Legal Aid Organization	District Coordinator	Legal aid for GBV victims; compensation concerns regarding project-affected individuals.	Recommendations for including women in compensation processes; GBV awareness programs.
	Deus Pius	Mbogwe Legal Aid	Director	Challenges in GBV reporting;	Suggestions to involve family members in

Table 7.5.5.4.a
Meetings held with institutional stakeholders - Third Fieldtrip

Region	Name	Institution	Position	Concerns	Recommendations
	Manyanda	Organization		compensation-related family abandonment.	compensation processes; improved education and legal aid.
	Alex Medard Sabina Photunatus Eva O. Nkwabi	NELICO (New Light Children Organization)	Deputy Director Project Officer Project Officer	Support for GBV victims; healthcare for vulnerable children.	Recommendations for continuous support through education and legal aid; collaborations with local health services.
	Augustino H. Simbeye	Bukombe District	District Land and Housing Development Officer	Land ownership challenges; transparency in valuation processes.	Involvement of landowners in valuation processes; adherence to national compensation laws.
	Magreth Werema Joseph Nyamko	Chato District	District Social Welfare Officer (DSWO) DCDO	Challenges in GBV case reporting; project impacts on families.	Focus on community education regarding GBV; provision of legal aid and psychological support.
	Simon N. Gambaresi	Chato District	District Valuer	Landownership types; transparency in compensation processes.	Compensation involves market-based valuation; affected individuals educated on their rights and procedures.
	Stela Kataga	Chato District -Gender Desk	Inspector Gender Desk	Prevalence of GBV in mining areas; challenges in addressing rural GBV cases.	Provision of education to communities; collaboration with Social Welfare Office for counselling; campaigns to address GBV risks during project implementation.
	Essan F. Malifedha	Bukombe District	District Coordinator, SHDEPHA+	Challenges faced by vulnerable groups, including HIV-positive individuals, elderly, and unemployed youth.	Recommendations for community education and healthcare support; leveraging NGO networks for greater outreach.
		Kashelo Village	Village Leaders	Incidences of GBV and child labor; polygamy practices; lack of grazing land.	Education campaigns on child labor and GBV prevention; planning for economic and grazing land development.
Kagera	Abdallah	Kagera Region	Regional Administrative Secretary	Courtesy call to inform about the project and seek permission for field activities.	The introduction letter was left as the meeting could not occur.

Table 7.5.5.4.a
Meetings held with institutional stakeholders - Third Fieldtrip

Region	Name	Institution	Position	Concerns	Recommendations
	Grace Matofali	Gender Desk of Police – Missenyi District	Assistant Inspector	High GBV cases; family abandonment; lack of local call center.	Collaboration with police, social welfare, and NGOs suggested; public education emphasized.
	Juliana Nghweleja	District Social Welfare Officer (DSWO)	Missenyi District	GBV impacts of the project; lack of privacy for GBV victims during reporting. Inadequate support structures for victims; potential impacts of the project on women and children.	Strengthened NPAVAWC committees; increased education on preventing GBV and economic empowerment of women recommended. Proactive measures to educate communities on project impacts and GBV risks.
	Gorge K Buberwa	MAPEC (Missenyi AIDS & Poverty Eradication Crusade)-NGO	Executive Director	GBV and VAC issues persist; lack of adequate collaboration with local NGOs in previous projects.	Use of local NGOs like MAPEC suggested; public education campaigns and integration with social welfare officers proposed.
	Avitus Kamala	Missenyi District	District Land Officer	Land ownership challenges; transparency in land valuation and compensation delays; lack of planned landownership in most villages.	Transparency in valuation procedures; timely and fair compensation prioritized. Strict adherence to valuation procedures; fair and timely compensation for affected landowners.
	Beatrice N. Sanga	Missenyi District	District Community Development Officer	Vulnerable groups face poverty, lack of healthcare, and economic hardships. Lack of identity cards for vulnerable groups; risk of land loss and livelihood disruption. Education campaigns, economic empowerment programs, and effective consultation for compensation processes.	Economic empowerment, fair compensation, and stakeholder involvement for vulnerable groups recommended. Effective consultation for compensation processes. Education campaigns.
	Vedasto Kato Deusdedith	Mutukula Church	Pastor	Relocation of church due to project alignment; compensation for church relocation.	Agreement on relocation with fair compensation requested.
	Asp. Ndaki Mayungwa Festos Kanga	Gender Desk of Police-Karagwe District	AG-OCD CPL CPL	High GBV prevalence; lack of privacy in reporting cases; challenges with victim cooperation and resources.	Collaboration with NGOs and local leaders; education campaigns through community programs and radio channels.

Table 7.5.5.4.a
Meetings held with institutional stakeholders - Third Fieldtrip

Region	Name	Institution	Position	Concerns	Recommendations
	Upendo Hilder Kulwa		CPL CPL Forensic Bureau		
	Peter John Debora Kasomwa- Joyce Cherles Niyosaba Baragondola Anastazia Msilanga	Ngara District	Social Welfare Officers	GBV, VAC, and risks during project phases; lack of resources for proper intervention.	Strengthening collaboration between local organizations and project stakeholders; providing education and capacity-building initiatives.
	Saigna Chamiti	TASAF Ngara district	Program social safety net coordinator	Lack of access to public services, challenges for vulnerable groups, loss of livelihood.	Fair compensation, construction of appropriate housing, and improvement of local infrastructure for affected communities recommended.
	Lobina Balilemwa	TASAF Karagwe District	Program social safety net coordinator	Poverty, lack of capital, and poor access to education and healthcare for vulnerable populations.	Economic empowerment programs, fair and transparent compensation mechanisms, and improved public service access.
	Dara Sila Ladslaus Laurent	Biharamulo District	CDO SWO	Prevalence of GBV and VAC; inadequate resources for addressing challenges faced by vulnerable groups.	Education campaigns; provision of resources and services to affected individuals; collaboration with local NGOs and government initiatives.
	Khadija Rajab	Ngara District Police Gender Desk		High GBV rates due to cultural practices; lack of privacy and resources for case handling; potential for increased GBV during project phases. Lack of cooperation from victims; potential project risks for women.	Collaboration with district officials and NGOs; education campaigns and establishment of grievance redress mechanisms during project implementation.
	Norbert John	Kagera Region	Resident Mining	Lack of mining equipment, electricity, and	Ensure consultation with license owners; consider

Table 7.5.5.4.a
Meetings held with institutional stakeholders - Third Fieldtrip

Region	Name	Institution	Position	Concerns	Recommendations
			Officer	infrastructure; impact of mining on nearby projects and land ownership.	alternate routes or technology to avoid project conflicts with mining activities.
	Subira Kansheba	Tumaini Orphans Support Organization (TOSO)	Secretary	GBV, VAC, and resource challenges faced by orphans and widows; project impact on vulnerable populations.	In-kind compensation for children; community education campaigns; involve local NGOs in project awareness efforts.
Shinyanga	Salum Hamduni	Shinyanga Region	Regional Administrative Secretary	Compensation challenges for miners; lack of electricity and technical resources for small-scale mining.	Proposed thorough identification of all affected individuals and fair compensation; close involvement with community leaders.
	Daniel Mapunda	Shinyanga Municipal	Resident Mining Officer	Small-scale miners face poor technology, lack of capital, and unsafe practices; limited involvement of women in mining due to cultural beliefs.	Addressing technical gaps and promoting inclusiveness in mining operations while maintaining cultural sensitivity. Suggested regular engagement with miners to improve safety, licensing processes, and technical training.
	Mrs. Octavina Kuwome Elizabeth Mweyo	Shinyanga District	Regional Community Development Officer Regional Social Welfare Officer	High GBV/VAC prevalence; polygamy practices; lack of dedicated resources for victim support.	Advocacy for improving victim support systems, including dedicated resources like call centers and one-stop service centers.
	Justa Mwaituka	KIWOHEDE-Kiota Women's Health and Development (NGO)	Executive Director	GBV, child labor, and lack of youth employment opportunities; school dropouts due to early marriages.	Implementation of education and empowerment programs targeting women and youth; enhancement of GBV awareness and support initiatives.
	Mr. Judica J Sumari. Veronica C. Mfuko	Msalala District	District Community Development Officer District Social Welfare Officer	GBV and VAC concerns linked to mining activities; limited resources for gender desks and support programs.	Suggested integrating gender desks into project planning; improving resources and collaboration with local NGOs and community leaders.

Table 7.5.5.4.b
Meetings held with villages - Third Fieldtrip

Region	Ward	Village	Participants			Concerns	Recommendations
			T	F	M		
Geita	Kafita	Igeka (Makulali Sacred Place)	6		6	Preservation of sacred sites; relocation concerns; project impacts on agriculture, mining, and GBV/VAC risks.	Sacred sites deemed non-relocatable due to cultural taboos; mitigation and community involvement stressed; educational campaigns on GBV/VAC recommended.
	Nundu	Igeka	28	23	5	GBV, early marriages, child labor, polygamy, and lack of grazing grounds; cultural norms challenging development interventions.	Involvement of local NGOs and consistent community engagement highlighted; prioritization of cultural respect while addressing community needs stressed.
	Lulembela	Kashelo	77	57	20	Child labor; polygamy; lack of grazing grounds; cultural impacts on livelihoods.	Education programs on GBV, child protection, and economic challenges suggested; construction-phase mitigation measures proposed.
	Busonzo	Kabagole (Kabagole Sacred Place)	5			Cultural and economic impacts of site relocation.	Compensation agreements and mutual relocation terms suggested; feasibility of relocation accepted with conditions.
	Busonzo	Kabagole	56	46	10	Child labor; cultural rituals; lack of grazing grounds; project impacts on agricultural and cultural practices.	Emphasis on cultural sensitivity during implementation; mitigation measures for agricultural and grazing access disruptions.
	Isamalasa	Songambele	33	23	10	GBV concerns; lack of grazing land; impacts on vulnerable households.	Proposals for compensation in housing and infrastructure support; community awareness programs.
Kagera	Nsunga	Ngando	47	32	15	Lack of grazing lands; GBV concerns; child labor; inadequate public services.	Economic training for women; improved access to water, health, and education services suggested.
	Nyakahanga	Bisheshe	87	57	40	GBV concerns; child labor; inadequate grazing grounds; lack of health facilities.	Improved healthcare infrastructure; fair compensation and education campaigns recommended.
	Nyakahura	Busiri	20	8	12	Child labor in mining; lack of grazing lands and public services; polygamy practices.	Support for vulnerable groups through economic initiatives; construction of public amenities suggested.
	Kasulo	Rwakalemera	18	2	16	Child labor, lack of grazing grounds, polygamy, GBV, and access to social	Education campaigns on GBV; fair compensation; community involvement in grazing land management

Table 7.5.5.4.b
Meetings held with villages - Third Fieldtrip

Region	Ward	Village	Participants			Concerns	Recommendations
			T	F	M		
						services.	suggested.
Shinyanga	Ibadakuli	Uzogole	59	46	13	GBV and polygamy prevalence; child labor; lack of grazing lands and infrastructure.	Recommendations for education campaigns and infrastructure improvement; addressing GBV through existing programs and resources.
	Bugarama	Buyange	77	57	20	Polygamy practices; GBV prevalence; child labor; lack of grazing grounds and health infrastructure.	Encouraged expansion of local infrastructure and strengthening GBV education programs; mitigation strategies to address child labor and community conflicts.
	Mwenge	Mwongozo	49	39	10	Mining-related child labor; insufficient grazing lands; poor agricultural productivity; high GBV and polygamy rates.	Support for education, infrastructure improvement, and provision of technical assistance to farmers and miners.
	Mwenge	Mwongozo	32	20	12	Lack of permanent contracts for miners; unsafe working conditions; unfair remuneration practices.	Recommendations for fair distribution of mining benefits; better safety measures and worker agreements proposed.

7.5.5.5
Perceptions of the Project

In general terms, the stakeholders praised the government initiative of implementing the project, based on the following reasons:

Benefits to the nation and local communities

- The proposed project is expected to benefit the nation and local communities with improvement of electricity service, as the interconnector project will make it possible to trade and exchange power in case of shortages. The network will provide avenues for the expansion of industrial development and the growth of auxiliary activities that require electricity. Geita region mentioned that they have projected the implementation of an industrial park that will attract manufacturer factories to the area. This implies a higher demand for electricity, which is not actually covered. Hence, they expect that UTIP will help them in this respect. An improved power system will benefit the nation by trading power and increasing exports of products produced by industries. Similarly, local communities will benefit through increased employment opportunities generated by the growth of industry, auxiliary activities, and the project itself. The interviewees viewed that it would help them to implement their development plans, such as the creation of industries that will process the natural resources extracted in the area. They understand that the government's vision for the country implies its industrialization and understand that, without power (or good quality power) this is not possible.
- Electricity is perceived as necessary as it brings development. This perception has been key in the villages' acceptance of the project, as they see it will be good for the economic development of the nation.
- Few people have access to electricity. In general terms, the stakeholders mentioned that the villages are not connected to the grid and, hence, cannot access this service. This is, after access to clean water, one of the most important demands of the population. Interviewees also mentioned that, for those who do access electricity, it is insufficient and not reliable as it is rationed. In the consultations in the villages this was a key issue, as they had the hope that the project will make possible for them to access electricity. It was necessary to clarify that this will not be the case, as this is not a project that deals with distribution. But that for the villages to connect, projects like this, that ensure the provision of energy, are indispensable. This aspect will be necessary to be explained in different moments of the project.
- Another benefit perceived is the creation of jobs directly linked to the project, including both skilled and unskilled workers. Stakeholders also expect that local businesses will be contracted to provide services. In the consultations, the members of the communities demanded equal access to this opportunity, also involving women.
- Villagers expect that the project will reduce the price cost of power from TANESCO. In general terms, they considered that electricity is expensive and considered that the transmission line can make it more affordable.
- Since the project involves two countries, they expect that it will stimulate peace and a good relationship. They also mentioned that the project will benefit the East Africa

Community and SADC (Southern Africa Development Community) in general. This aspect was also highly appreciated in the villages consultations and was repeatedly mentioned as a benefit.

Concerns and negative aspects

- The TL will require a wayleave of 52 m and areas designated for substations (Kyaka, Nyakanazi and Ibadakuli). The acquired land will be used for various project activities, such as the construction of towers, access roads, and substations. The proposed TL traverses agricultural lands and settlements in some villages. The issue of fair and timely compensation for land and other property, such as houses and associated structures, as well as land use value, was raised in all village meetings. Villagers cited land use value and compensation as the most significant negative impact of large development projects. According to stakeholders consulted, the land in the proposed RoW has a very high value due to the crop types grown.
- All District officials stated that land value is high in most villages of the district's high agricultural potential. Cotton, banana, maize and various vegetables are grown there, mainly due to their high market value in Dar es Salaam, Arusha, and Mwanza.
- Land is the primary source of production and livelihood for most people, so its loss will have a negative impact on household income and livelihoods. Single women (including widows and divorcees), the elderly, and livestock keepers are particularly vulnerable. Relocating these communities to another piece of land will be difficult, with compensation costs much higher than in less intensively produced land. Therefore, the proposed project should avoid intensively produced land in residential areas.
- Land compensation is very critical and should be carefully handled, as it may face resistances from some individuals. Experience shows that the compensation usually is a problem between the persons affected by the project (PAPs), their neighbours and the village government. One specific concern is that this process, if not properly managed, may create misunderstandings among the PAPs and with the council in general. Villagers also expressed their concern regarding potential conflicts among members of the communities.
- Land conflicts could make the land acquisition more complex. In Kagera, they mentioned the existence of land conflicts between farmers and livestock keepers and problems due to the lack of delimitation of village boundaries. In Geita and Shinyanga regions, the interviewees said that the presence of artisanal miners can be associated with conflicts of land which may, in turn, make the land acquisition more complex. They also said that there are several small-scale miners in their territories and that UTIP should consider bypassing their clamps and camps sites since compensations will be very costly due to the value of the land that consists of minerals. They mentioned that most of them are licensed.
- During the meetings, one significant concern raised by stakeholders was insufficient awareness about compensation issues. For example, Shinyanga, Geita and Kagera Regional officers insisted on community involvement and awareness creation before project implementation. Lack of understanding about the compensation process may be a significant source of conflict during the early stages of the project implementation. The ESIA team informed stakeholders that a Resettlement Action

Plan (RAP) report will be prepared, and a participatory awareness-raising program will be conducted alongside the ESIA process. The RAP will, among other things, inform local communities about the compensation and land-acquisition process, and propose awareness and capacity building on these issues.

- Village members raised the issue of insufficient power/electricity in their area and requested that TANESCO connect them to electricity. They stated that taking land from a community and using it for electricity development makes no sense when their villages are not connected to the grid. The ESIA team informed stakeholders that one of the TL's goals is to increase power production and improve rural electrification.
- Concerns regarding accidents, risks, and hazards was expressed by the stakeholders. Construction workers will be exposed to the risk of accidents and injuries during construction, including accidental falls from high elevations, injuries from hand tools and construction equipment, cuts from sharp objects, and vehicular accidents. Other injuries or fatalities may result from workers operating equipment without adequate training, lack of PPE, or extended exposure to outdoor weather, resulting in heat-related lethargy. Injuries and accidents may also happen to locals if the site is not well secured. The Occupational Safety and Health Act of 2003 explain and categorizes all project requirements, and states that the project must be registered on the OSHA website, which will be done by the developer. Environmental officers in the project area visited municipal and district councils, which were concerned about the safety risks associated with TL construction, especially high-tension electricity and the movement of construction equipment. The contractor must be sensitive to these issues during mobilization and provide mitigation measures.
- In the consultations, villagers also expressed concern regarding children's security, as they like to play with the towers and climb them. Also expressed fear related to the potential fall of the towers or the poles, and the possibility of being affected by the electricity (radiation).
- Because of the influx of immigrant workers interacting with locals, stakeholders associated the construction of the project with increased STDs and HIV/AIDS. Also, construction crews and drivers can cause social upheaval in nearby communities. Large gatherings of workers can potentially spread STDs and HIV/AIDS among workers and communities if preventive measures are not taken. Unwanted pregnancies are also a concern that was raised by different villages.
- Influx of workers also raised concerns among villagers regarding publics security and demanded to know what measures will be taken.
- Regarding natural resources (forest reserves and water sources**),** the proposed route corridor for the interconnection project mostly avoids protected areas and forest plantations, such as Lubega, Mwantini and Nindo Forest Reserve (In Shinyanga Municipal area), Ngitiri village reserved forest in Kahama District area, and any available water sources. In Nyang'wale District area there is Lyilu village reserved forest of about 888 ha which is owned by Isanda and Igeka Villages. Reserved forests and planted forests each require specific procedures to be followed if affected.
- Villagers expressed concern for the loss of trees and other vegetation due to the construction of the transmission line. Villagers demanded to know if the trees will be compensated and what will happen with them once they are cut.
- Archaeological issues - According to cultural tourism stakeholders, district councils,

municipals and regional cultural officers throughout the region, Shinyanga, Geita and Kagera have significant archaeological and cultural heritage resources that should be considered during project implementation. Ward officials mentioned the presence of archaeological and cultural heritage resources in their wards. Community ritual sites are likely to be affected. While some villages have burial areas, most people prefer to bury loved ones in their own homes. The ESIA team observed family graves in some villages, such as Miti village in Kayanga ward Karagwe District. Other projects or activities that may represent a challenge for the project are: Shinyanga airport, which is close to Ibadakuli substation; potential overlapping with the Ugandan oil pipeline which also passes through the districts that will be crossed by the alignment, and the overlapping with the sugar industry lands in the region of Kagera.

Regarding the election of a preferred alignment, in general, the interviewees did not have a preferred option. They mentioned that, as the communities need electricity, they would accept the project whatever alignment is chosen. However, in Ngara they pointed out that they needed to know the final alignment to comment on the land use of the proposed area. In the consultations, villagers asked to be informed regarding the specific location of the towers and the transmission line.

7.5.5.6
Recommendations Given by the Stakeholders

Table 7.5.5.6.a presents a summary of the recommendations given by the stakeholders and how they are being incorporated in the ESIA.

Table 7.5.5.6.a
Incorporation of the recommendations done in the consultation to the ESIA

Recommendations	Incorporation in the ESIA
To provide information to the affected communities before and during the implementation of the project.	This is worked in the P.12 Stakeholder Engagement Plan - SEP (Annex 14), where the information to be provided in each phase of the project is detailed.
To inform the councils, especially regarding land compensation, as they are the ones who know who the owners and possessors are.	The SEP mentions that local leaders will be informed of all the stages of the resettlement process and also that they will participate in the Grievance Redress Mechanism (GRM) as they know the area and can orientate any conflict resolution regarding land disputes.
To educate on the compensation process, explaining the criteria used and the process that will be followed. The project will need to be careful and ensure that compensation is given prior to the displacement, and that PAPs understand how their assets were valued.	Although it was already considered that the compensations should be given before the displacement and before the start of the works, a greater emphasis on this has been incorporated in the Resettlement Policy Framework (RPF). This has been incorporated to the SEP and the RPF (as part of the RAP implementation) where education to the PAPs on the measures that will be implemented and how to manage the compensation has been incorporated.
To include activities on financial education, as PAPs need to know how to handle the compensation they will receive. Whenever	This has been incorporated to the SEP and the RPF (as part of the RAP implementation) where education to the PAPs on the measures that will be

Table 7.5.5.6.a
Incorporation of the recommendations done in the consultation to the ESIA

Recommendations	Incorporation in the ESIA
resettlement is possible (to locate the PAPs in another house) this is recommended. To share information regarding all the stages of the project.	implemented and how to manage the compensation has been incorporated.
To take into consideration a potential overlap with the oil pipeline, mining activities, sugar industry and proximity to the airport.	This has been incorporated to the ESIA Chapter 8.0 (Impact and Project Alternatives Assessment).
Stakeholders intercepted by the Uganda oil pipeline suggested that TANESCO liaise with EACOP management regarding a possible overlap.	This has been incorporated to the ESIA Chapter 8.0 (Impact and Project Alternatives Assessment).
Nyang'wale and Geita district officers recommended to contact the Zonal Mining Officers to ask about the future land use plan for mining exploration areas.	This was incorporated to the third fieldtrip of the ESIA, where Zonal Mining Officers were contacted, and more detailed information was gathered.
A repeated recommendation was to make the alignment known by erecting signs such as concrete bicorns.	This does not apply to transmission lines, since the alignment signs will be marked by the positioning of the towers and cables. This concern must have been expressed with regards to oil pipelines, which are buried structures. On the other hand, regarding information on the alignment, in the RPF has been indicated that the first step of the RAP will be to disclose the alignment in a communal meeting.
To compensate any environmental loss, especially growing trees and other vegetation after cutting them.	This was already part of the EIA. This information will be shared through the implementation of the SEP, where it is mentioned that the impacts and measures will be explained to the local authorities and members of the communities of the DAI. Compensation due is handled in the RPF.
To incorporate education activities regarding communicable diseases, sexually transmitted diseases, prevention of unwanted pregnancies.	This has been incorporated to the P.17 - Occupational Health and Safety Management Programme, P.14 - Labour Management Procedures (LMP) and • P.15 - Gender Based Violence Action Plan.
To prevent risks to the safety and health of the population. Especially children, as they play close to the area and climb towers.	This has been incorporated to the P.03 - Operation Management Programme.
Implement strict procedures when hiring personnel, to avoid the risk of sexual harassment.	This has been incorporated to P.14 - Labour Management Procedures (LMP) and P.15 - Gender Based Violence Action Plan.
Avoid unwanted pregnancies due to the influx of foreign workers.	This has been incorporated to P.14 - Labour Management Procedures (LMP) and P.15 - Gender Based Violence Action Plan.
Education should be provided on potential impacts on GBV. District Social Welfare Office should be involved in providing education.	This has been incorporated in the SEP.
Participation of PAPs in all the steps of the valuation process to create trust and avoid conflicts.	Inclusion of the participation of PAPs in the process of valuation is included in the RPF
Involve religious leaders, as they are influential.	Religious leaders are being considered in the SEP

Table 7.5.5.6.a
Incorporation of the recommendations done in the consultation to the ESIA

Recommendations	Incorporation in the ESIA
In the resettlement process, consider that vulnerable people have a problem of lack of time which makes them more vulnerable in this type of situations.	The RPF is considering especial measures for vulnerable people. Consideration of the lack of time is being reinforced in the RPF.
Develop coordinations with different authorities and NGOs to accompany the project, especially the resettlement. The participation of the District Social Welfare in the resettlement is particularly important.	This recommendation has been included in the RPF.
Education about the project should also be provided to vulnerable groups.	This has been incorporated in the RPF.
To avoid delays on payments, valuation should only be done when there is assurance that funds for compensation are available.	This has been included in the RPF, in the criteria that orientate the RAP.
Educate the institutions involved with the PAPs about the project, so that they can reinforce the orientation of the population and help clarify misunderstandings.	This has been included in the SEP.
Coordinate with the different institutions (Gender Desk, Social Welfare Office, Land Valuer, etc). Include local NGOs as service providers as they know the locality.	This will be considered when implementing the RAP.

The stakeholders committed to collaborating with the project. They asked the consultant and TANESCO management to provide the information by liaising with the district official for them to write letters to the Wards Executive Officers, who will in turn inform the village councils. Villages also expressed their willingness to cooperate with the project.

8.0
Impact and Project Alternatives Assessment

8.1
Identification of Alternatives

8.1.1
Methodology

The ESIA alternatives analysis is intended to incorporate environmental and social considerations in the early stages of project development planning and other preliminary steps, as well as in the later stages of site selection, design, and implementation. Including environmental and social aspects at the early stages may reveal alternative options and ways of achieving the same cost-efficient project objectives and where the environmental and social costs (measured either by the severity of impacts or the cost of mitigation measures) are lower.

The ESIA team interacted with the engineering/survey team and, when pertinent, proposed reaches where alignment adjustments should be studied given their environmental or social impacts. The team also participated in the comparative assessment of alternatives to identify route options that can effectively avoid or mitigate impacts. It is important to note that environmental and social criteria described here for the analysis of alignment alternatives were factored in after the Engineering Preferred Alignment options had been narrowed down (**Section 8.1.2**).

Thus, regarding the alignment of the transmission line (TL), the ESIA analyses the reasonably feasible alternatives of high-impact reaches, considering the factors described here and demonstrating the preferred alternative's comparative social and environmental advantages. This evaluation contemplated at least the following aspects:

- Extension of each alternative and the number of towers.
- Accessibility and the need to open new access.
- Minimization of interference in areas of biological importance, including wetlands, large forest fragments, identified migratory bird routes, bird congregation areas, and other areas of conservation importance already registered, mapped, or recognized from the point of view of biodiversity values, with emphasis on any critical habitats whose occurrence was confirmed during the development of the ESIA.
- Minimization of interference in legally protected areas.
- Minimization of interference with KBAs (Key Biodiversity Areas), IBAs (Important Bird Areas), AZEs, IPAs (Important Plant Areas), RAMSAR Sites, World Heritage Sites, and other areas of internationally recognized biological importance.
- Hilly areas.
- Proximity to urban areas or rural communities.
- Interference with mining areas.
- Interference with areas under economic use.
- Interference with areas of speleological potential.

- Interference with archaeological, historical, cultural heritage, and areas of scenic beauty.
- Interference with bodies of water.
- Other criteria.

Where possible, the criteria have been mapped and overlaid on the alternatives considered for the analysis. This procedure allowed, data quantification and comparative analysis in addition to locational analysis, data quantification and comparative analysis.

Depending on the regional characteristics of the intercepted areas, a specific analysis of urban transpositions was carried out to find the alternative with the lowest social and environmental cost.

The description of the alternatives analysis process is supported by maps and figures that illustrate all the options contemplated and justify the selection of the preferred alternative.

8.1.2
Engineering Preferred Alignment

A Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Interim Report (Task 2) - Project Conceptual Design, was performed by CESI S.p.A. Italy (Contract No. ET-EAPP-165640-CS-QCBS), and the corresponding report was issued on 10 February 2023. **Table 8.1.2.a**, presents the number of alternatives assessed and the selected one. **Annex 2** shows a map with the different alternatives assessed in the Feasibility Study, as well as a table detailing the Regions, Districts and Wards crossed by each alternative.

Table 8.1.2.a
Route Alternatives Studied in the Feasibility Study

400 kV TL Segment	Number of alternatives assessed (February 2023)	Engineering Chosen Alternative	Total Length	Number of houses in the easement – preferable alternative[(a)]	km of crops intercepted and % of the easement affected – preferable alternative[(a)]
Mutukula-Kyaka	Option A, B, and C	Option B	31 km	108	12 km (39%)
Kyaka-Nyakanazi	Option A and B	Option A	234 km	575	20 km (8%)
Nyakanazi-Mabuki	Option A and B	Option B	260 km	452	114 km (44%)
Nyakanazi-Ibadakuli	Options 1, 2, 3, and 4	Option 1	283 km	543	150 km (53%)

Source: Adaptation JGP Consultoria, 2023 based on: Feasibility Study Update for 400kV Tanzania (Kyaka-Nyakanazi-Mabuki) – Uganda (Masaka-Mutukula) Transmission Line. Interim Report (Task 2) - Project Conceptual Design, issued 10 February 2023 by CESI S.p.A. Italy (Contract No. ET-EAPP-165640-CS-QCBS). Notes (a) JGP estimates from satellite imagery.

Note: According to the initial feasibility studies, the Nyakanazi-Mabuki route was initially considered, and preliminary alternative studies were conducted for this segment. However, as the studies progressed and technical constraints and contingencies were identified, the route starting from Mabuki was discarded, and the development of this alternative was halted and replaced by the option via Ibadakuli. Thus, in the final version of the feasibility studies, the alignment via Mabuki was not considered.

According to the initial feasibility studies, the Nyakanazi-Mabuki route was initially considered, and preliminary alternative studies were conducted for this segment. However, as the studies progressed and technical constraints and contingencies were identified, the route starting from Mabuki was discarded, and the development of this alternative was halted and replaced by the option via Ibadakuli. Thus, in the final version of the feasibility studies, the alignment via Mabuki was not considered.

The relevant results of the engineering selection of alternatives are summarized as follows.

Mutukula - Kyaka

Three options have been analysed. All three routes share the same first two points from Kyaka substation.

Option A

This option starts at the existing Kyaka substation, running parallel to the existing 132 kV TL Masaka-Kyaka. It runs at an offset of 45m from the centre of the existing TL traversing Bunazi, Ngando, Kabowa, and Mutukula. It has seven Angle Points and a distance of approximately 29.3 km. The option goes through communities at Bunazi, as most of them settled along the end of the route of the existing line. Furthermore, an existing 33 kV feeder from Kyaka substation to Kagera Sugar factory utilizes the same corridor from the substation to Bunazi trading centre.

The option is easily accessible and less affects the environment, as it uses the already opened areas for the existing TL. It also has no orphan land as it is approximately 45 m from the centre of the existing 132 kV TL Masaka-Kyaka. However, it passes through Kagera sugar plantations with irrigation schemes that may pose a challenge during TL maintenance. It also comes with many social-cultural issues since it passes through communities.

Option B (preferable)

It starts from the existing substation and deviates from the existing 132 kV TL Masaka-Kyaka. This option crosses areas approximately 2 km from the existing line. It crosses areas of Bunazi, Ngando, Kabwoba and Mutukula. It has six angle points and a total distance of approximately 31.1 km. This option affects fewer communities in Bunazi, Ngando, and Mutukula. It avoids passing through Kagera sugar fields; however, it has a small section crossing a hilly area at Ngando as one approaches Kabwoba.

Approaching Kabwoba and Mutukula, the TL route crosses an open marshland for subsistence farming. Except for the hilly area in Kabwoba, the other areas along the route are easily accessible, away from communities, and score well on the quantitative analysis below, hence making this a more preferred option.

Option C

As Option A, this route starts from the existing Kyaka substation and runs parallel with the existing 132 kV TL Masaka-Kyaka. Approaching Bunazi Town, it deviates to avoid passing through the existing communities in this area. This route has similar characteristics to Option A since most of the TL runs parallel to the existing TL. It has nine angle points and a distance of approximately 29.9 km.

Kyaka – Nyakanazi

Three options were originally considered. All options pass through the game reserves of Burigi and Biharamulo's game reserves. However, most Option C passes through the middle of the Burigi Game Reserve in hard-to-access areas. This option is not feasible and has not been further analysed. The option was rejected.

At Nyakanazi substation, Option A and Option B start at the same point (i.e., AP6), approximately 1.2 km from the Nyakanazi substation, to allow for the possible crossing with the existing 220 kV TL Nyakanazi- Benaco-Rusumo, which will occur at the substation.

Option A (Preferred)

This option runs parallel with an offset of 45m from the existing 220 kV TL Nyakanazi-Rusumo and proposed 220 kV TL Benaco-Kyaka. It crosses the areas of Biharamulo, Ngara, Karagwe, and Misenyi. It has forty-three (43) Angle Points and a distance of approximately 235 km.

From AP8 to AP10 and AP12 to AP15, continuing to run parallel to the existing TL would impact the communities along these sections. In the Feasibility Study, a diversion was proposed in these areas, moving the proposed TL route away from the existing TL and on the opposite side of the main road, avoiding the crossing of the settlements.

The section between AP19 and AP24 is located in areas with hills and valleys. However, they can easily be accessed as most of the areas have been opened up by the works on the existing TL. The section between AP26 and AP32 goes within the Burigi game reserve for approximately 45 km. AP27 is the furthest point from the trunk road, with a distance of approximately 1 km. At AP34, a communication mast would be on the route if one continued to move parallel with the proposed TL. We reviewed deviating from this area.

From AP34 to the substation, all the points are fine and continue running parallel to the proposed TL, except a small review that we carried out at AP46, as the point was falling in the middle of the existing road.

Option B

This route crosses game and forest Reserves (i.e., Burigi /Biharamulo Game Reserve and Kigosi National Forest Reserve). It crosses districts of Biharamulo, Muleba, Bukoba, and

Misenyi. It has thirty-seven (37) Angle points and a distance of approximately 225 km.

Almost all the angle points along this option are on relatively flat terrain and open**,** with no existing TLs nearby. However, APB2 and APB3, APB4 to APB8, APB9**,** and AP10 fall into the Kigosi forest reserve, the Burigi game reserve**,** and the Biharamulo game reserve**,** respectively.

The section between APB3 and APB4 passes near an airfield, at an available feasible location approximately 2.5 km away, but likely in the restricted airfield zone. Beyond this point, the route crosses a ragged terrain area of hills and valleys and passes through the middle of the Biharamulo game reserve.

Both Option A and Option B cross-game reserves. From the criteria analysis below**,** Option B would be better**,** but **Option A** is more preferable, considering that it is easily accessible since most of the areas are opened up due to the ongoing works on the existing TL**.** Option B passes close to an airfield.

The Feasibility Study Report Table 6-13 compares the characteristics of the three options. As said before, Option C is not described in detail due to its infeasibility (crossing in the middle of Burigi Game Reserve in hard-to-access areas) and the high score shown in the Feasibility Study Report Table 6-13.

Nyakanazi – Ibadakuli (Preferable)

According to the feasibility study, the preferred east-west interconnection with Nyakanazi is through Ibadakuli (TL Nyakanazi-Ibadakuli) and no longer through Mabuki (TL Nyakanazi - Mabuki). In this route, the preferred alternatives are option 1 (preferred) and option 2 (second option).

8.1.3
JGP-Bene Consult Preferred Alignment Corridor

After the project engineering team had identified the preferred routes from a technical perspective (see **Table 8.1.2.a**), the next task was to identify and evaluate a set of restrictions that would allow assessing more advantageous route alternatives from a socio-environmental point of view, when compared to those first selected routes.

In this context, technical and environmentally feasible alternatives were verified for the cases where the initially proposed alignment presented significant socioenvironmental interferences.

At this stage, this study focused on defining a preferred alignment, which can be further optimized with fine adjustments, including possible changes in the positioning of towers and angle points.

The criteria considered in this phase of the study were as follows:

- Abiotic criteria
  - Hilly areas
  - Interference in wetlands
  - Interference with bodies of water
  - Longitudinal extension near perennial bodies of water

- Biodiversity criteria
  - Interference in legally protected areas
  - Interference with Key Bird Areas
  - Interference with potential Critical Natural Habitats
  - Interference with large forest fragments

- Social criteria
  - Buildings affected
  - Accessibility and the need to open new access
  - Interference with areas under agricultural uses
  - Interference with mining concessions

It is important to note that the analysis presented below was carried out for the segments between Kyaka-Nyakanazi and Nyakanazi-Ibadakuli, where the alternatives are considerably different, resulting in the interception of different landscape matrices. As for the segment between Kyaka and Mutukula, the proposed alternatives are very close, leaving only the need to fine-tune the preferred route conceived by the project engineering since there are no significant differences from a socio-environmental point of view.

Another important appointment is that there is an existing TL between Nyakanazi and Benaco, which will be extended up to Kyaka. In the case of Option A, wayleave and preference alignment will be shared to minimize impacts like vegetation clearance, fragmentation, and interferences with buildings and residential areas.

Abiotic criteria

Hilly Areas

Incorporating this criterion is important because there are significant accessibility restrictions in hilly areas, where the implementation of a transmission system requires the opening of road accesses on high slopes, susceptible to intense surface dynamics and erosion process.

In addition to the need to open up access, there are the demands for construction services (especially excavation and earthmoving activities), which increase the potential for inducing erosion processes when carried out in high-slope areas.

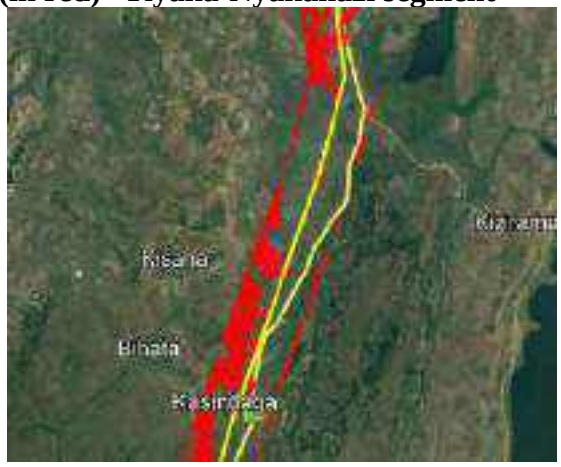
Based on the previous mappings used for the analysis presented here, it is evident that Option A of the Kyaka-Nyakanazi segment intersects longer stretches of land with slopes exceeding 15%. These areas are predominant throughout the alternative, except for a small stretch in the Mihongoro region and another at the northern end, between Kishoju

and Kyaka. It is worth mentioning that the route follows the interfluve areas or is located on the high parts of the slope near the interfluve, especially in the part where it crosses the Burigi protected area.

Regarding Option B, which is situated towards the east and nearer to Lake Victoria, has some areas with steep slopes but are not continuous. Even though this option passes through rugged terrain, more flattened areas predominate. (**Figure 8.1.3.a**).

Figure 8.1.3.a
Relief areas with slopes greater than 15% (in red) - Kyaka-Nyakanazi segment

Section of Option A with a high density of areas with slopes greater than 15%.



Option B section with a typical pattern of slopes greater than 15%.

The segment between Nyakanazi and Ibadakuli, there are has mostly lower reliefs, with the steeper parts associated with residual mountains. These areas are situated along the border of Geita and Shinyanga and intercept all proposed options. (**Figure 8.1.3.b**).

Interference in wetlands

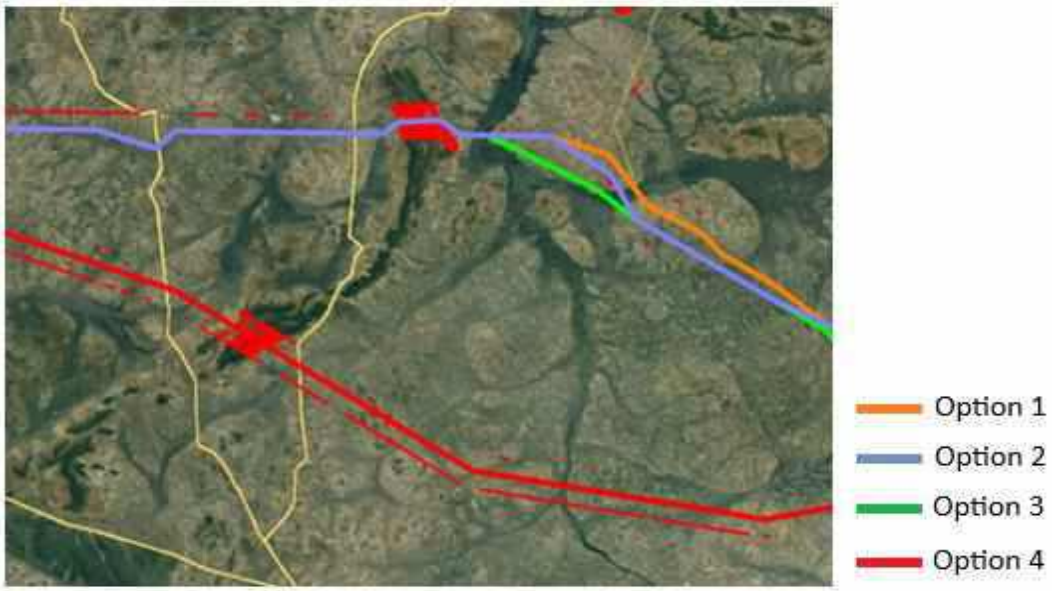
Wetlands are prone to temporary flooding and seasonal water table fluctuations. As a result, significant engineering interventions are necessary to install structures that can withstand these conditions. These interventions involve replacing soil, excavating deeply, and installing specialized structures suitable for the soil's moisture levels.

Another important factor to note about this criterion is that it can attract wildlife, as a food source or as an area for shelter and breeding. Additionally, the region's seasonal climate results in intermittent river channels, which further emphasizes the significance of these sites in terms of biodiversity.

Based on the location analysis, it has been determined that Option A, despite crossing steeper slopes, also crosses more areas that are prone to flooding in comparison to Option B, which is closer to Lake Victoria. The reason for this may be due to geological patterns, such as fault lines, that influence the direction and type of the local drainage network. The most critical areas are situated at the northern end of the segment segment's northern

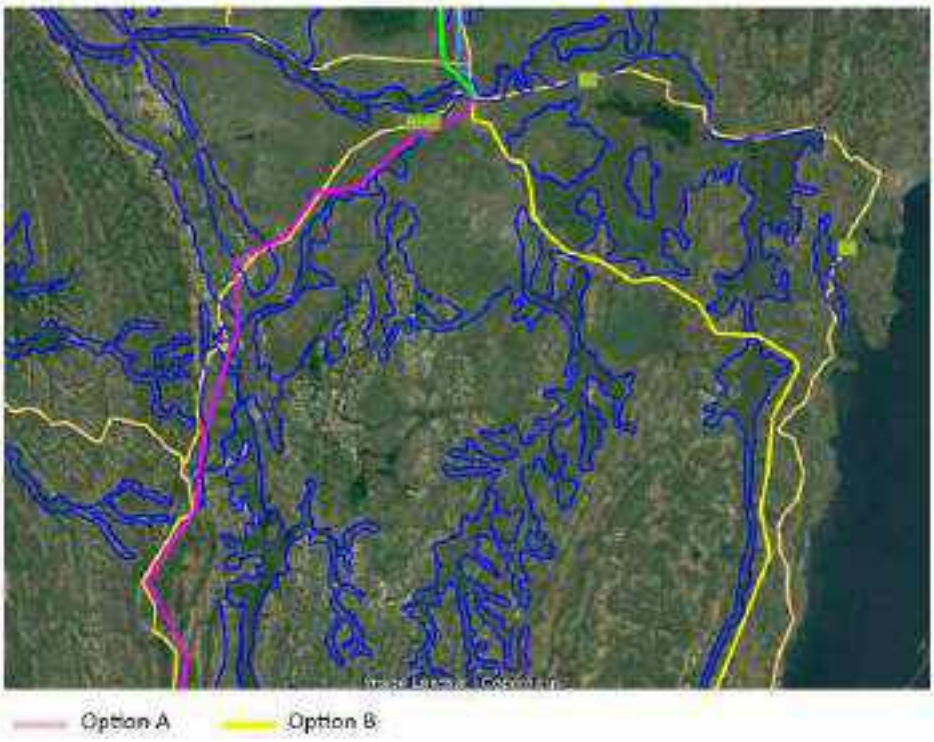
end, where the mountain areas extend in a north-south direction north-south and meet the lowlands of the Kagera River plains (as shown in **Figure 8.1.3.c**).

Figure 8.1.3.b
Relief areas with slopes greater than 15% (in red) - Nyakanazi-Ibadakuli segment



Note: Not to scale.

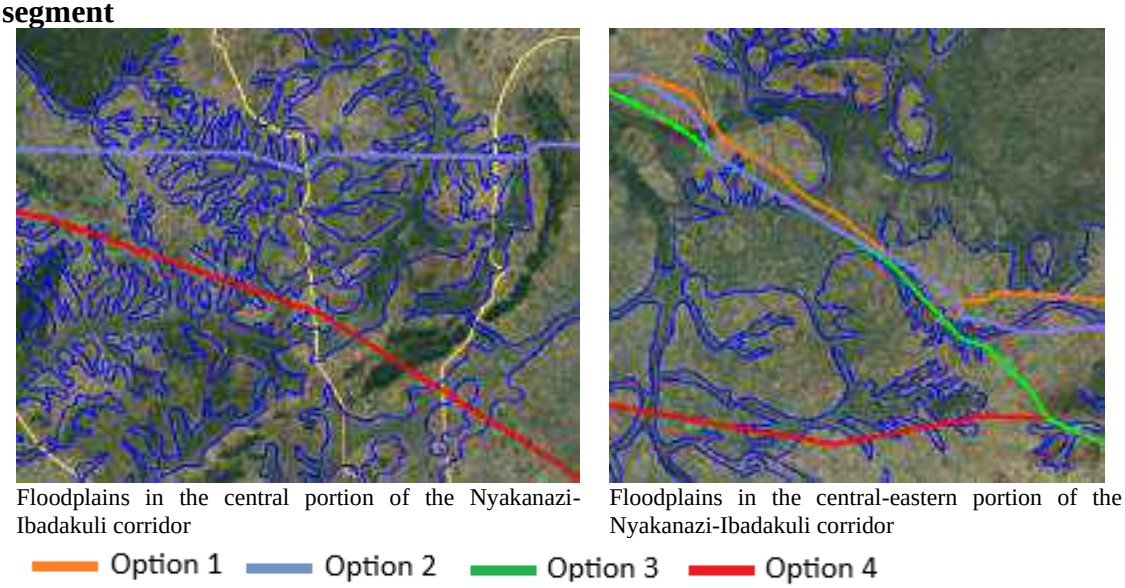
Figure 8.1.3.c
Wetlands (in blue). North of the Kyaka-Nyakanazi alignment



Note: Not to scale.

The proposed options for the Nyakanazi-Ibadakuli stretch include open valleys prone to flooding. These areas have fertile soils commonly used for agriculture. Cartographic analysis suggests that the different options have similar results regarding to the number of affected areas, with a slight advantage for Option 4 and Option 1 (represented by red and orange colours in **Figure 8.1.3.d**, respectively).

Figure 8.1.3.d
Wetlands (in blue) in the central-eastern portion of the Nyakanazi-Ibadakuli segment



Floodplains in the central portion of the Nyakanazi-Ibadakuli corridor

Floodplains in the central-eastern portion of the Nyakanazi-Ibadakuli corridor

Note: Not to scale.

Interference with bodies of water

Water bodies are highly sensitive areas as they attract a variety of wildlife and play a crucial role in providing ecosystem services for human consumption, irrigation, and animal watering.

In contrast to the floodplains, Option B intercepts more watercourses than Option A when looking at the potential interception of watercourses in the proposed alternatives for the Kyaka-Nyakanazi stretch, Option B intercepts more watercourses than Option A. It's worth noting that most intercepted channels are small, so there is no need for direct interventions on the banks or surrounding areas to carry out crossings.

For the eastern-western segment of Nyakanazi-Ibadakuli, the project engineering team has selected Option 1 as the least obstructive to water bodies, followed by Option 2 and Option 3.

Longitudinal extension close to perennial bodies of water

When analysing alternatives, it's important to consider the path taken to reach perennial watercourses. These areas serve as habitats and are attractive to local wildlife, making

them a crucial factor to consider alongside other criteria.

When implementing TL projects, it is important to pay attention to the impact on birdlife, as this can lead to species migration and displacement effects.

Based on the cartographic analysis, Option A of the Kyaka-Nyakanazi segment extends for 93.7 km in areas near permanent watercourses. In contrast, Option B is less than 60 km long in these conditions.

In terms of environmental restrictions, the east-west segment has only one option that stands out - Alternative 3. This alternative has perennial watercourses within 25 km of the proposed road. However, the restrictions are not very significant for the other alternatives. The engineering team prefers Alternative 1, which has no identified environmental restrictions related to the presence of perennial rivers.

Biodiversity criteria

Regarding biodiversity aspects, the preliminary biodiversity assessment presented in Section 4.2.1 of the Scoping Report evidenced the potential occurrence of 65 species of flora and fauna threatened with extinction in the categories Endangered (EN) and Critically Endangered (CR). Of those, 45 species may be classified as potential triggers for critical habitat, due to their threatened status, distribution, and occurrence extension.

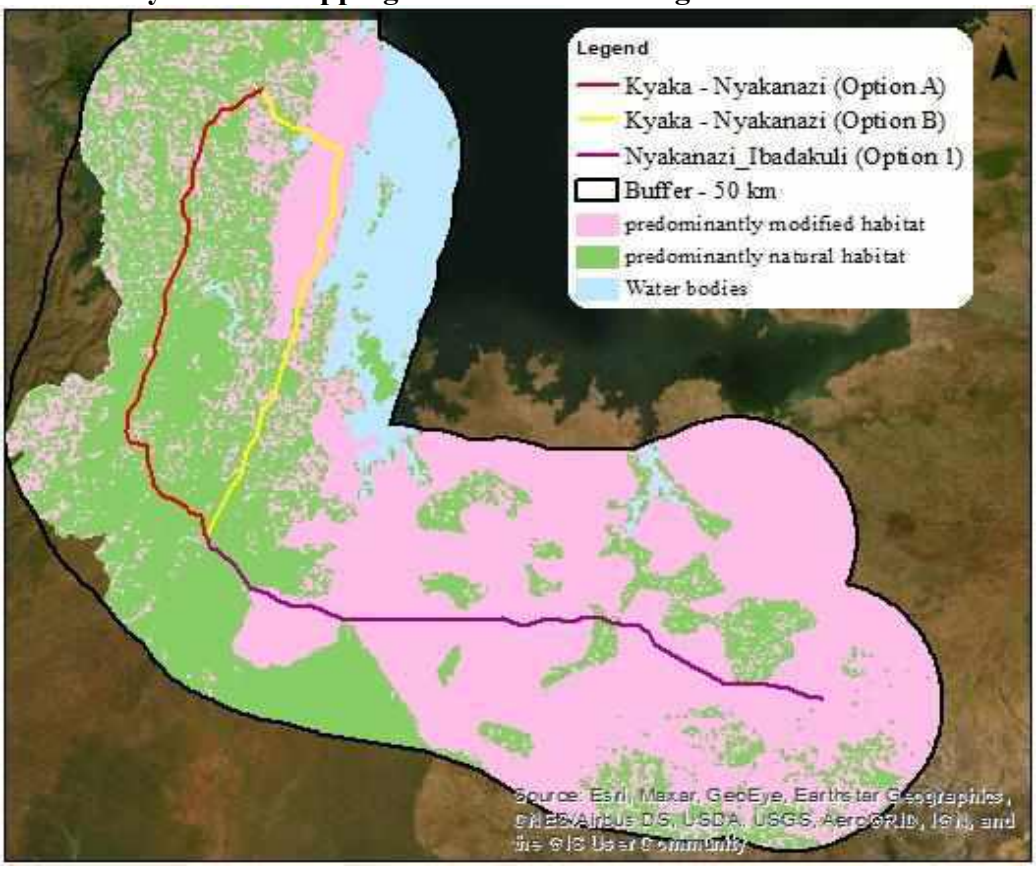
Considering the state of conservation of the region's natural habitats, based on the information obtained in the field during the reconnaissance campaign and the first biodiversity campaign[1], the presence of populations of these species is more likely along the region's north-south alignment. The east-west alignments pass through areas mainly occupied by anthropic activities (agriculture, pastures, rural population centres, etc.), and the presence of significant biodiversity values in these areas is unlikely, due to the low availability of natural habitats.

Interference with potential Critical Habitats (CH)

Those potential CH trigger species have distribution polygons that include both alternatives at the TL Kyaka – Nyakanazi. However, during the first biodiversity campaign, it was possible to observe that Option A of the TL Kyaka – Nyakanazi passes through more preserved natural habitats, which can be considered potential critical habitats (**Figure 8.1.3.e** and **Figure 8.1.3.f**) (more details in **Section 7.2.4**).

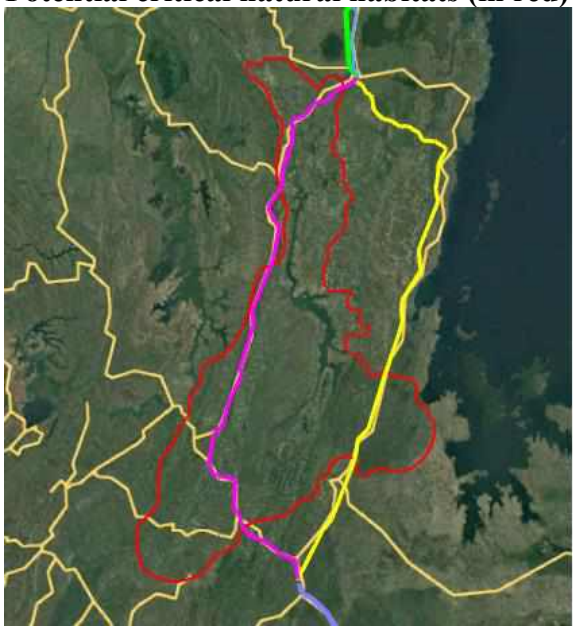
[1] Information obtained through direct observations and interviews with local workers (mainly the guards of the Burigi-Chato National Park)

Figure 8.1.3.e
Preliminary habitat mapping in relation to the alignment alternatives



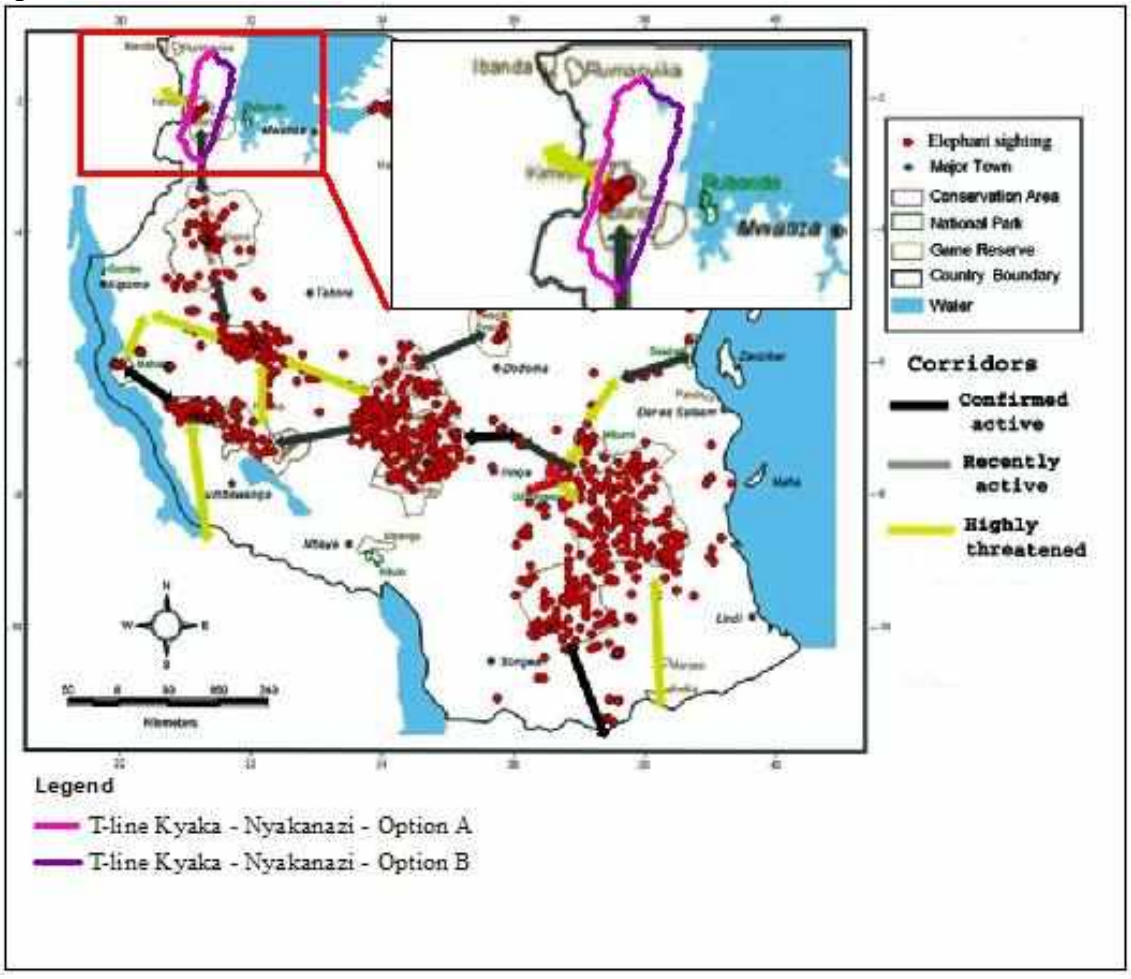
Source: Adapted from FAO, and based on visual analysis of satellite images and field information

Figure 8.1.3.f
Potential critical natural habitats (in red) along the Kyaka-Nyakanazi alignment



Additionally, Option A is closer to an ecologic corridor that connects the Akagera National Park (in Rwanda), the Burigi-Chato National Park, and the Moyowosi Game Reserve, and wet areas formed by the Kagera River, Lake Burigi, and the Moyowosi River. This corridor is a very important migration route, especially for Elephants (TAWIRI, 2010; RIGGIO & CARO, 2017). Especially the corridor between Akagera National Park and the Burigi-Chato National Park (intercepted by Option A) is classified as highly threatened (**Figure 8.1.3.g**). Information obtained from the guards of the Burigi-Chato National Park confirms that elephant herds (*Loxodonta africana*) travel this corridor annually.

Figure 8.1.3.g
Elephant migration routes in relation to the TL Kyaka – Nyakanazi alternative options



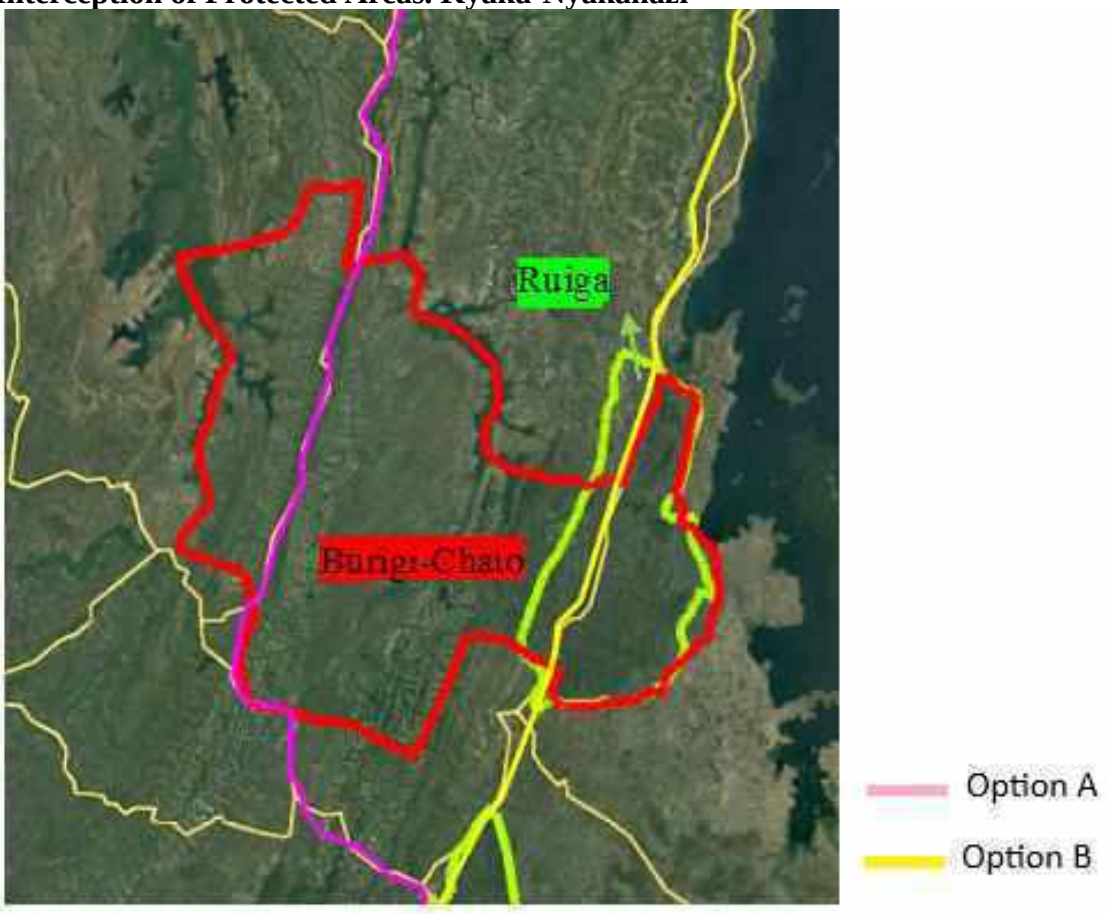
Source: Adapted from TAWIRI (2010)

Interference in legally protected areas

At this analysis stage, Protected Areas in the region where the Project is located were surveyed. We collected the necessary information to map these areas from official government and international sources, as their territories are legally defined.

When creating the alignments, the goal was to minimize interception on the Protected Areas and their immediate surroundings. Option B of the Kyaka-Nyakanazi segment crosses over parts of the Burigi-Chato National Park, overlaps with areas of the Ruiga River Protected Area, and goes through a small section of the Biharamulu area, resulting in a total of 82.3 km inside the Protected Areas. In contrast, Option A only crosses the Burigi-Chato National Park, but covers a longer distance of 90.8 km (as shown in **Figure 8.1.3.h**).

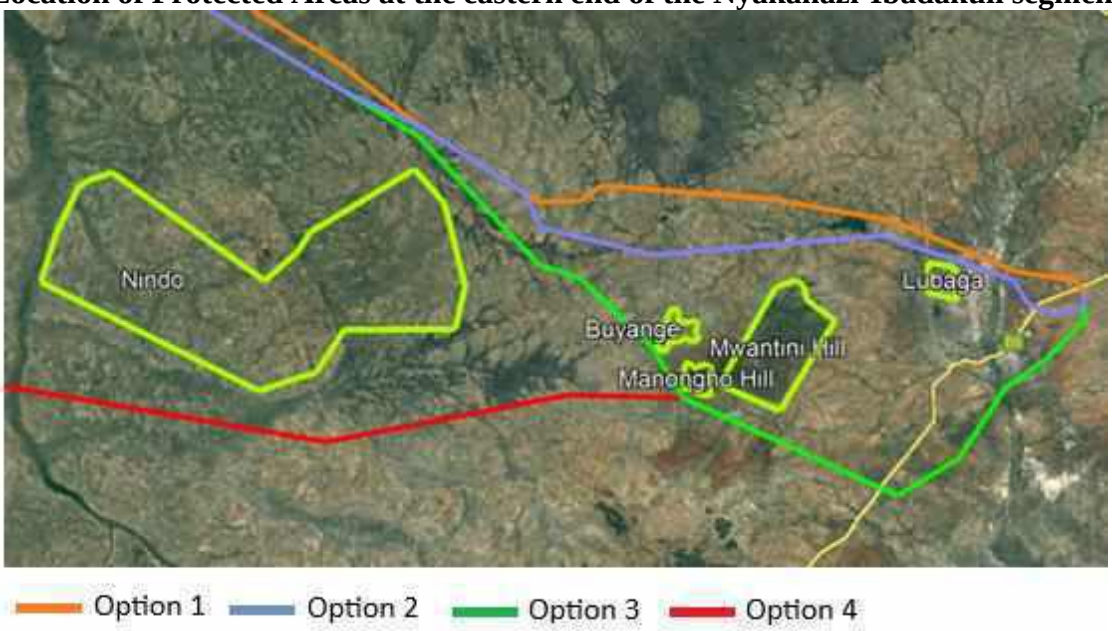
Figure 8.1.3.h
Interception of Protected Areas. Kyaka-Nyakanazi



Note: Not to scale.

For the alternatives proposed for the east-west segment, the route is shared at the western end, where it intersects the Biharamulo Protected Area. At the other end of the segment, the proposed Alternative 1 is further away from small Protected Areas near Shinyanga than the other proposed variants (**Figure 8.1.3.i**).

Figure 8.1.3.i
Location of Protected Areas at the eastern end of the Nyakanazi-Ibadakuli segment



Note: Not to scale.

Interference with Key Bird Areas (KBA)

Key Biodiversity Areas are significant locations for protecting global biodiversity, including endangered plants and animals in land, freshwater, and marine sites. The Project has identified and intercepted only one KBA, the Burigi-Chato National Park, which overlaps with the Kyaka-Nyakanazi segment alternatives. The two proposed options have comparable conditions regarding the extent of interception of these areas, with a slightly higher value for Option A (as shown in **Figure 8.1.3.j**).

Figure 8.1.3.j
Key Biodiversity Areas intercepted by Kyaka-Nyakanazi alignments

Note: Not to scale.

Interference with large forest fragments

To avoid interference with native vegetation, the most representative fragments were mapped.

After analysing satellite images and conducting field surveys, it was discovered that many areas impacted by the project were being used for agriculture and/or logging for timber and coal production. There were clear signs of tree-cutting and unregulated burning in these areas.

To assess the impact on the native vegetation, the interceptions were measured and analysed for both alternatives in the Kyaka-Nyakanazi segment. The Project will involve removing certain areas and selectively suppressing vegetation.

The findings indicate that Option A interferes more with vegetated areas (104.3 km) than Option B (53.6 km) primarily because Option A intersects a larger area of Burigi-Chato National Park. It is worth mentioning, again, that although Option A intersects more vegetated areas, it is most likely that clearing demands will be lower than Option A, once Option B will share part of an existing wayleave (200 kV Nyakanazi-Benako) and its future extension up to Kyaka.

In the east-west alignment, human activity has greatly reduced the amount of vegetation, unlike in mountainous regions, where there are large patches of isolated vegetation. After comparing the options, it was found that the corridors with preserved native vegetation

have similar alternatives, except for Alternative 4, which is located south of the others. However, the difference in length between the two corridors is almost negligible.

Social criteria

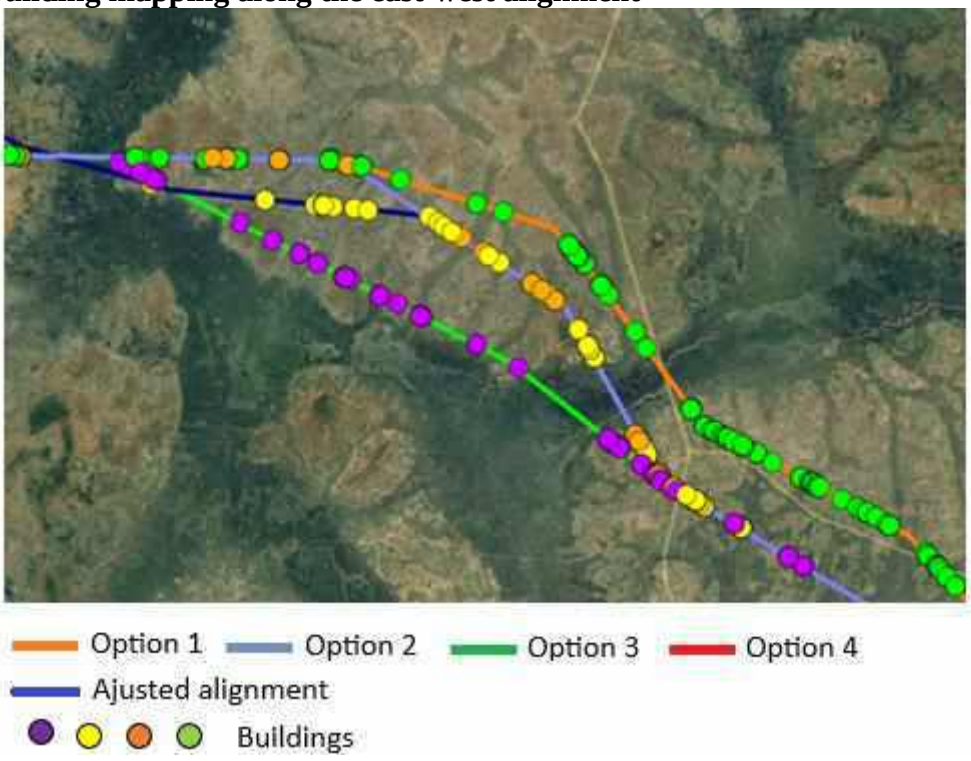
Buildings affected

The concept of consolidated anthropic occupation significantly limits the available options for the location of a TL. This type of infrastructure requires actions that have a significant impact, including expropriation, compulsory relocation of populations, and economic activities.

To compare the least interfering alternative, satellite images were used to map the existing buildings along all proposed routes.

For the TL Kyaka-Nyakanzi route, Option A has 487 buildings in the right-of-way, while Option B has 607 buildings. For the east-west segment, Alternative 3 has the least impact on existing buildings, with 549, followed by Alternative 2 with 550 buildings, and Alternative 4 with 667 buildings. The project engineering's preferred Alternative 1 affects 708 buildings (**Figure 8.1.3.k**).

Figure 8.1.3.k
Building mapping along the east-west alignment



Note: All circles represent buildings located within the easement of the alternatives. Different colors were used solely to facilitate the mapping and counting of buildings, especially in densely built-up segments. It is important to note that the colors do not reflect any specific characteristics or classifications of the buildings themselves.

Accessibility and the need to open new access

Areas with low capillarity of current access points, such as highways and secondary roads, were identified and mapped.

Overall, most areas covered by the different options have good access points already in place already have good access points. However, some sections were found to have limited access, demanding the creation of service roads during the TL works. These sections are more prominent in the Kyaka-Nyakanazi segment. Option A has a 31.7 km section with low access, while Option B has a total of 41.6 km. In the case of Option A, the real possibility of sharing access with the existing TL and its future extension should be reinforced.

The east-west section of the project, which is more developed and has established agricultural areas, typically has good access, and areas with low connectivity were no longer than 10 km in any of the evaluated options.

Interference with areas under agricultural uses

In all the proposed alternatives, mapping was done to identify areas with agricultural use, allowing a comparison of the different alignments regarding their impact on agriculture. The level of interference was quantified based on the length of the respective wayleaves.

Based on the findings, it was discovered that Option B for the Kyaka-Nyakanazi segment is longer, with a total length of 38.2 km, while Option A has a length of 22.1 km. For the Nyakanazi-Ibadakuli stretch, Alternative 2 and Alternative 4 have lengths of 169.4 km (highest interception) and 159.0 km (lowest interception), respectively, fairly similar.

Interference with mining concessions

A survey was carried out of the existing mining rights along the routes of the TLs, the boundaries of which coincide with the Direct Area of (DAI). The survey consisted of consulting the database of the Tanzanian Mining Cadastre Portal[2], prepared by the Ministry of Minerals (MADINI).

This consultation allowed the georeferenced location of the mining licenses identified in the 500 m strip for each side of the line (which includes the 52 m wide wayleave, 26 m for each side of the LT axis) and to obtain information on the area, type of license, parties involved, the commodity, and the villages where the polygons are located. **Table 8.1.3.a** summarizes the results for each alternative.

[2] https://portal.madini.go.tz/map/

Table 8.1.3.a
Number of mining concessions intercepted by the alternatives

Kyaka-Nyakanazi	Option A		Option B	
	4		0	
Nyakanazi-Ibadakuli	**Alt. 1**	**Alt.2**	**Alt.3**	**Alt.4**
	16	16	16	0

8.1.4
Quantitative Assessment and Prior Adjustment of the Preferred Option

Tables 8.1.4.a and **8.1.4.b** below show the quantitative results that supported the above analysis for the Kyaka-Nyakanazi and Nyakanazi-Ibadakuli segments.

Table 8.1.4.a
Quantification of restriction criteria for the Kyaka-Nyakanazi segment

Criteria	Option A	Option B
Interference in legally protected areas (km)	90.8	82.3
Interference with Key Biodiversity Areas (KBA) (km)	43.6	41.3
Interference with potential Critical Natural Habitats (km)	162.4	36
Interference with large forest fragments (km)	104.3	53.6
Hilly areas (km)	82.7	37.8
Interference in wetlands (km)	65.6	24.1
Interference with bodies of water (unit)	71	92
Longitudinal extension close to perennial bodies of water (km)	93.7	55.6
Buildings affected (unit)	487	607
Accessibility and the need to open new access (km)	31.7	41.6
Interference with areas under agricultural uses (km)	22.1	38.2
Interference with mining concessions (unit)	4	0

Table 8.1.4.b
Quantification of restriction criteria for the Nyakanazi-Ibadakuli segment

Criteria	Alt. 1	Alt.2	Alt.3	Alt.4
Interference in legally protected areas (km)	17.1	17.1	17.1	17.1
Interference with Key Biodiversity Areas (KBA) (km)	-	-	-	-
Interference with potential Critical Natural Habitats (km)	-	-	-	-
Interference with large forest fragments (km)	15.6	15.6	15.6	13.5
Hilly areas (km)	3.3	3.3	3.3	4.4
Interference in wetlands (km)	127	143	149	130
Interference with bodies of water (unit)	48.9	63.1	63.5	42.5
Longitudinal extension close to perennial bodies of water (km)	-	3.4	25	-
Buildings affected (unit)	708	550	549	667
Accessibility and the need to open new access (km)	6.9	6.9	8.8	8.8
Interference with areas under agricultural uses (km)	165.5	169.4	167.6	159.0
Interference with mining concessions (unit)	16	16	16	0

Based on socio-environmental aspects, the results indicate that Option B (closer to Lake Victoria) is the most advantageous for the Kyaka-Nyakanazi segment. This option is particularly favourable when considering biodiversity criteria. Option B has lower interference with Protected Areas, shorter length in KBAs, shorter length intercepted in large fragments of vegetation, and has lesser interference in areas with potential for Critical Habitats.

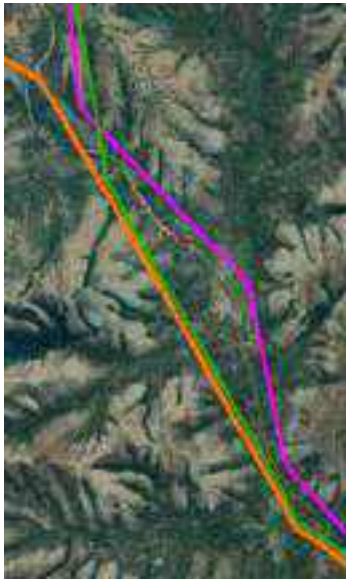
Furthermore, Option B is located in areas with gentler slopes, which decreases the likelihood of significant physical obstructions during construction. Another advantage of this option is that it intersects fewer floodplains and avoids approaching numerous permanent watercourses, even though it does intercept more bodies of water than Option A.

However, when considering the social factors, Option B presents certain drawbacks, such as more buildings being intercepted (607 against 487) and obstruction in regions with farming and low connectivity. After reviewing the information provided and the efforts made to adjust the alignment, it can be concluded that Option B is the best choice from a socio-environmental quantitative analysis.

It's important to assess the likelihood of impacts and the potential for mitigating them. The existence of the TL Nyakanazi-Benako and its future extension to Kyaka are significant in this regard. Option A was adjusted to follow the parallelism and sharing of the right-of-way of these TLs, which greatly reduces the potential for impacts on the variables considered, when compared with Option B. Option B is designed to be implemented in a green field. **Figure 8.1.4.a** illustrates Option A and its respective adjustment.

Figure 8.1.4.a
Examples of Option A adjustments

Detail 1


Detail 2

Detail 3

Proposed Benako-Kyaka TL
Adjusted Option A
Option A
Existing 220 kV Nyakanazi-Benako

After analysing the Nyakanazi-Ibadakuli segment, it was confirmed that the project engineering's preferred option could be the best choice. Alternative 1 was found to have no direct impact on Protected Areas, KBAs, or areas of potential Critical Habitat in terms of biodiversity. The difference in length of large patches of vegetation between Alternative 1 and Alternative 4, which has a lower impact, is only about 2 km and is insignificant.

When measuring abiotic criteria, the findings show Alternative 1 has minimal impact on steep slope areas, the fewest crossings over bodies of water, and no route near perennial watercourses. Even in flooded areas, the amount of interference compared to Alternative 4 (which has the least interference) is insignificant.

After a thorough investigation, it has been determined that the areas with limited access to capillarity do not significantly restrict the implementation of the TL in this segment, because it has a well-established network of access points despite being highly impacted by human activity. However, there may be some interference with extensive agricultural fields. Despite this, Alternative 1 has minimal losses compared to other options, as evidenced by the values being less than 10 km (**Figure 8.1.4.b**).

Of the three alternatives, preferred Alternative 1 causes the most impact on construction along its alignment. During the mapping process, it was discovered that 708 buildings would be impacted. To address this issue, a proposal was made to modify the route, avoiding 118 buildings. While the adjusted Alternative 1 still affects more buildings (590) than Alternative 2 (550) and Alternative 3 (549), it ultimately meets all other criteria and is therefore the preferred choice.

Figure 8.1.4.b
Comparison between Feasibility Study "Alternative 1" and JGP-Bene Consult "Adjusted Alternative 1"

Detail 1

Detail 2

Detail 3

It is worth mentioning that the minor modifications made to the more favourable alternative options did not require any major alterations to the project's engineering aspects, specifically in terms of the number of angles and length of the routes. **Tables 8.1.4.c** and **8.1.4.d** provide a detailed quantitative comparison of these factors concerning the proposed adjusted routes.

Table 8.1.4.c
Comparison of length and number of angle points between the proposed alternatives. Kyaka-Nyakanazi

Citeria	Kyaka - Nyakanazi		
	Option A	Option B	Adjusted Option A
Number of angle points	43	37	44
Total length (km)	234,7	226,3	235,6

Table 8.1.4.d
Comparison of length and number of angle points between the proposed alternatives. Nyakanazi-Ibadakuli

Critérios	LT Nyakanazi - Ibadakuli / km				
	Alt 1	Alt 2	Alt 3	Alt 4	Adjusted Alt 1
Number of angle points	36	32	32	23	35
Total length (km)	283,5	285,8	295,6	288,4	282.25

When comparing the Kyaka-Nyakanazi segment, it is evident that the adjusted route does not interfere with its length, although it does increase one vertex. When analysing the number of buildings affected, however, the route adjusted to share the wayleave and the parallelism with the other TLs drastically reduces, with the number of interferences being 18 buildings within the limits of the wayleave and 299 in the shared wayleave.

Option B may seem more appealing from a quantitative perspective. Still, Option A, despite already being implemented in a modified environment, could have a lower environmental impact due to the sharing of the right of way and the parallelism mentioned earlier. The reason for this is that Option A is taking advantage of an environment that has already been altered, and the resulting impacts are already a part of the landscape matrix.

This condition also applies to issues related to mobilizing work, opening new accesses, suppressing vegetation, moving earth, and facilitating operation and maintenance.

Regarding impacts on biodiversity, ESS6 paragraphs 22 and 24 state that projects can only be implemented in natural and critical habitats if there are no other technically and/or financially viable options in modified habitats or habitats with lower biodiversity. The project must also demonstrate that every effort has been made to avoid and minimize impacts on biodiversity, following the steps of the mitigation hierarchy.

Concerning impacts on natural habitats, the parallelism of Option A with the existing TL and the new stretch that will be implemented will concentrate the need for deforestation

by partially sharing the right of way. Thus, habitat fragmentation will be concentrated in only one stretch (the west side) rather than in two different stretches, to the west and east sides (by the Option B of the TL Kyaka-Nyakanazi).

Additional measures to reduce and minimize impacts on natural vegetation will also be proposed during the impact assessment and development of the project mitigation strategy.

The mitigation strategy for biodiversity impacts is described in the Biodiversity Management Plan (BMP), which has been developed to achieve net gains for priority biodiversity values, especially critical biodiversity values identified according to the analysis presented in **Section 7.2.4**. Based on these results, the BMP provides specific measures to address impacts on priority and critical values, as stated by ESS6 paragraph 24.

In summary, it can be seen that Option A's adoption is more environmentally favourable than Option B due to the engineering design criteria and the possibility of parallelism, joint mobilization for interference**,** and operation and maintenance facilities. In other words, implementation in an already modified environment is preferable to opening up a new vector for modification (and inducing impacts) in an unmodified environment, which is the case with Option B.

Regarding the east-west segment, the suggested modification resulted in advantages such as a decrease in the number of angle points and the overall length of the route. Specifically, one angle point was reduced, and the total length was reduced by 1.6 kilometres.

To sum up, the modifications made to the route won't significantly affect the project's engineering. However, they decrease the project's environmental impact by minimizing the restrictions identified during the initial assessment. These adjustments are assumed to be improved as the environmental studies progress and the executive engineering plans are completed.

8.2
Impact Assessment

8.2.1
Methodology

This ESIA used a well-established impact assessment methodology, based on technical literature and the current state of the art at the international level. Important literature references were the basis for the methodological structuring of this assessment, such as the works of Sánchez (2006), Morgan (1998), Porter & Fittipaldi (1998), Canter (1996), Wood (1995), Morris & Therivel (1995), Turnbull (1992), World Bank (1991), EPA (1999) and Gertler *et al*. (2016).

The environmental and social impacts and risks were identified and assessed based on the project's technical characteristics and the results obtained during the diagnostic stage (baseline).

The main methodological steps developed in this ESIA are described below.

First, all impacting actions of the project's planning, construction, and operation phases, that may cause social, economic, cultural, and environmental changes or will require the appropriation/use of natural resources or available infrastructure and utilities, were identified. The description of each action (see **Section 8.2.2**) was based on the information on the project and its construction and operational procedures presented in **Chapter 5.0** (Project Background and Description).

The environmental and social components considered likely to be affected are:

C.1 - Physical Environment Components

- C.1.01 - Soils / Relief
- C.1.02 – Superficial Water Resources
- C.1.03 – Groundwater Resources
- C.1.04 - Air Quality

C.2 - Biological Environment Components

- C.2.01 - Flora and Vegetation
- C.2.02 – Fauna
- C.2.03 - Protected Areas and Internationally Recognized Areas
- C.2.04 – Critical Habitat
- C.2.05 - Ecosystem Services

C.3 - Socioeconomic Environment Components

- C.3.01 - Employment and Local Economy
- C.3.02 - Infrastructure, Social Equipment and Public Services
- C.3.03 - Health and Safety of the Workers
- C.3.04 - Health and Safety of the Community
- C.3.05 - Livelihoods and Quality of Life of the Population
- C.3.06 - Land
- C.3.07 - Historical, Cultural and Archaeological Heritage

Based on the analysis and interpretation of the relationships between the impacting actions and the identified environmental components, the potential risks and impacts associated with the Project have been established (**Sections 8.2.3** and **8.2.4**), i.e., those that can be reasonably foreseen and are likely to occur.

Based on the description and analysis of each potential impact and risk, and by legal specificities required under this ESIA, the environmental measures were classified as preventive, mitigation, control, monitoring, and compensatory, as presented in the Environmental and Social Management Plan - ESMP in **Chapter 10.0**.

Preventive measures refer to all planned actions to ensure that previously identified risks and potential impacts can be avoided.

Mitigation measures are those measures to ensure that the intensity of identified impacts is minimised. Preventive and mitigation measures, therefore, are incorporated into current engineering practices, often becoming technical standards or legal requirements. The assurance that the works will be executed following these measures is given by the commitments made by the ESIA and the subsequent inspection, hence the importance of control and monitoring measures.

Monitoring measures are designed to assess the effectiveness of mitigation measures and to demonstrate compliance with legal requirements and also with contractual agreements.

Compensatory measures, on the other hand, refer to compensating for negative impacts that cannot be mitigated, controlled, or reversed by other measures.

Regarding positive impacts, the proposed measures aim to enhance benefits.

The proposed measures are structured in the Environmental and Social Plans and Programmes comprising the project's ESMP. The grouping of measures in the Plans and Programmes aims to make them operational and facilitate their management.

All potential impacts of the Project were cross-checked against the preventive, mitigation, control, and compensatory measures proposed in the ESMP to ensure that all were covered by some measure or some form of prevention, mitigation, control, and compensation.

The objective of the detailed risk and impact assessment is to qualify and quantify (where possible) the resulting impact, i.e., the impact that may materialise even after the actual implementation of the ESMP measures.

Taking into account the implementation and effectiveness of the proposed environmental and social Plans and Programmes and respective measures, the resulting impacts were assessed and rated according to the following set of attributes selected based on state-of-the-art environmental impact assessment methods:

- Vector (positive or negative)
- Location and spatialization
- Stage of occurrence
- Form of incidence (direct or indirect)
- Temporality – Induction (immediate, short, medium, or long term)
- Temporality – Duration (short, medium or long term, or permanent)

- Reversibility
- Probability
- Magnitude
- Cumulativeness
- Synergy

A summary characterisation of each attribute used to characterise the resulting environmental impacts is presented below.

Vector

Indicates whether the resulting impact is negative or positive. The same impact can have two opposite vectors, one positive and one negative, on the same component.

Location and spatialization

Defines the spatial spread of each impact. Impacts may occur in the Direct Area of Influence (DAI) or different geographical areas within the Indirect Area of Influence (IAI**)**, with direct and indirect action varying according to the component. However, it should be mentioned that there may be resulting impacts that, although identified, have a diffuse geographical coverage, not restricted to a defined spatial unit, and may occur in a macro regional or national context.

Occurrence phase

Indicates whether the resulting impact will occur in the planning, construction, or operation stages of the Project.

Form of incidence

Indicates whether the impact will be direct or indirect. Direct impacts have a clear and simple cause-and-effect relationship and arise directly from the impacting actions implemented in the planning, construction, and operation phases. Indirect impacts are already considered to have a secondary or indirect dependence on the impacting actions.

Temporality – Induction

This attribute is associated with the induction time of a potential impact in relation to the initiation of the impacting action. Induction can be immediate (impact starts immediately after the action), short-term (up to 2 years), medium-term (2 to 10 years), and long-term (more than 10 years).

Temporality - Duration

This attribute is associated with the time that the impact will remain after the impacting action has ceased and all planned measures have been implemented. The impact may cease immediately after the completion of the action, or it may be short term (up to 5 years), medium term (5 to 10 years), long term (more than 10 years) or for the entire

lifetime of the Project (permanent), i.e. when the impact cannot be interrupted even with the implementation of the relevant measures.

Reversibility

It defines the degree of reversibility of the impact and is directly related to the intensity. Negative impacts can be reversible or irreversible. Resulting impacts that are considered reversible cease to occur or have a negligible intensity after the impacting actions cease and/or the applicable measures are implemented. Even after measures are implemented, irreversible impacts correspond to the resulting impacts of medium to high intensity.

Probability

It is the possibility of a certain impact occurring. The environmental and social impacts identified through the interaction between the impacting actions and the environmental and social components are defined as "potential impacts", i.e., predicted impacts that may or may not occur. However, depending on the characteristics of the Project and the areas of influence, as well as experience with other projects, it is possible to assess the impact according to the degree of probability of occurrence: low, medium, or high probability and of certain occurrence.

Magnitude

The magnitude of the impact indicates the degree of change in the quality of the environmental or social component that may be affected by the Project in all its phases (planning, implementation, and operation). In other words, it is the difference between the assumed environmental and social quality after the effects generated by the Project's actions and that observed before such processes took place.

Priority was given to the use of spatial and temporal scales, i.e., the attributes of incidence, spatialization and Temporality (duration) were used to define the magnitude of the impacts.

Cumulativeness

Attribute associated with successive, incremental, and/or combined effects of a current action, project, or activity, or produced by past activities, and/or those planned for the future. It is classified as Cumulative or Non-Cumulative.

Synergy

Refers to interactions with other impacts or processes that are already in place or foreseen and that could be associated in some way, increasing the effects potentially felt in the environment. It is classified as Synergic or Non-synergic.

Table 8.2.1.a
Criteria used to define the magnitude of impacts

Incidence	Spatialization	Temporality (duration)	Magnitude
Direct	DAA/DAI	Short	Low
Direct	DAA/DAI	Medium	Low
Direct	DAA/DAI	Long	Medium
Direct	IAI	Short	Low
Direct	IAI	Medium	Medium
Direct	IAI	Long	High
Indirect	DAA/DAI	Short	Low
Indirect	DAA/DAI	Medium	Low
Indirect	DAA/DAI	Long	Medium
Indirect	IAI	Short	Low
Indirect	IAI	Medium	Medium
Indirect	IAI	Long	High

Attribution of the degree of importance and assessment of the final residual impact

As an attribute of the analysis, importance corresponds to the assessment of the value of each impact. This assessment brings together results from several attributes and indicates the degree of sensitivity of a given environmental or social impact. It therefore determines the degree of severity, even if indirectly, of each impact, supporting decision-making regarding the application of specific socio-environmental measures to optimise positive or remediate negative effects on the environment.

Within the scope of this study, the degree of importance for each impact has been defined by crossing the attributes magnitude and reversibility, as shown in **Table 8.2.1.b** below.

Table 8.2.1.b
Degree of importance of impacts based on a combination of magnitude and reversibility

Magnitude	Reversibility		
	Reversible	Partially reversible	Irreversible
Low	Low	Moderate	Medium
Medium	Moderate	Medium	High
High	Medium	High	High

Concerning the combination of attributes presented above, two factors should be highlighted. On the one hand, magnitude represents the extent of the possible effects of the interventions when comparing the quality of the environment before and after the impacting actions. On the other hand, reversibility tends to represent the vulnerability and sensitivity of each assessed component, i.e., the capacity of environmental systems to assimilate energy inputs and maintain their characteristics as close as possible to those observed before the interventions.

Following the analysis, the assessment of the final residual impact, which represents the state of the environment through the application of all relevant prevention, control, mitigation, and compensation measures proposed in the ESMP (see **Chapters 9.0** and **10.0**), was carried out. However, the analysis of the final residual impact is related to the application of another rating attribute: the degree of mitigability. This attribute refers to the levels of possibility that the negative effects of an impact can be controlled. It should be noted that mitigability depends both on the nature of the affected components and the possibility of technical and economic implementation, as well as the political and institutional effort to do so on the part of the Project developer. The classification of impacts concerning their mitigability considered the following degrees: Fully Mitigable, Highly Mitigable, Moderately Mitigable, and Low Mitigable.

In the scope of this study, the definition of the residual degree of importance has resulted from the crossing of the attributes degree of mitigability and importance, as shown in **Table 8.2.1.c**.

Table 8.2.1.c
Residual importance of impacts based on a combination of the degree of mitigability and the importance

Degree of mitigability	Importance			
	Short	**Moderate**	**Medium**	**High**
Fully Mitigable	Short	Short	Short	Medium
Highly Mitigable	Short	Short	Moderate	Medium
Moderately Mitigable	Short	Moderate	Medium	Medium
Low Mitigable	Short	Moderate	Medium	High

8.2.2
Impacting Actions

This Section identifies all actions that could to generate environmental and social impacts or risks in the project's planning, construction, and operation phases. As mentioned above, the actions were identified and described under the Project information presented in **Chapter 5.0**.

In total, 21 actions with potential impact were identified: 2 actions related to the planning phase, 16 actions related to the construction phase, and 3 actions related to the operation phase, as specified in **Table 8.2.2.a** below.

Table 8.2.2.a
Actions in the planning, construction, and operation phases of the project

Project Phase	Impacting Actions
A.1 – Planning Phase	A.1.01 Dissemination of the project
	A.1.02 Initial operational structuring
A.2 – Construction Phase (works)	A.2.01 Mobilisation of workforce
	A.2.02 Mobilisation of camp sites
	A.2.03 Negotiation and compensation of owners and occupants
	A.2.04 Vegetation clearing
	A.2.05 Demolition of improvements
	A.2.06 Implementation/improvement of accesses
	A.2.07 Flows of vehicles, equipment, and workers to the work fronts
	A.2.08 Earthworks in the substation area
	A.2.09 Excavation and installation of grounding mesh in the substation area
	A.2.10 Execution of tower foundations
	A.2.11 Assembly of towers
	A.2.12 Launching of cables
	A.2.13 Operation of camp sites
	A.2.14 Decommissioning of temporary facilities
	A.2.15 Demobilization of the workforce
	A.2.16 Recovery of direct intervention areas
A.2 – Operation Phase	A.3.01 Operation of the TLs and SSs
	A.3.02 Routine maintenance and emergency repair of the system
	A.3.03 Inhibition of secondary regeneration of native vegetation on the wayleave

Each action is described below in terms of the main executive procedures and functional aspects considered relevant to assessing environmental and social risks and impacts potentially arising from the various phases of the Project.

A.1 - Planning Phase

A.1.01 Dissemination of the project

This action includes all activities related to disseminating information about the Project construction works, involving official statements by authorities, news published by the media, or contacts established in the region by TANESCO or representatives. The impact of news linked to the works generates expectations regarding possible changes in land use along the wayleave or the immediate surroundings, as well as compensation for land and improvements on properties affected by the TLs.

A.1.02 Initial Operational Structuring

This action incorporates all activities preliminary to the works, including:

- Studies for the Environmental and Social Impact Assessment of the Project, involving field inspections and interviews with the population in the area of influence;
- Studies for the Executive Project, which involve the carrying out of drilling and topographical surveys;

- Cadastral survey of the properties affected by the Project;
- Negotiations with the owners and occupants of the areas where camp sites will be set up.

A.2 - Construction Phase (Works)

A.2.01 Mobilisation of workforce

It involves selecting and recruiting workers (direct labour) for construction works. This action is considered separately due to its relevance as an impact vector, creating jobs and corresponding income.

As reported in **Section 5.6.2** of **Chapter 5.0**, about 1,350 direct workers are expected to be hired for the works. Some of this workforce must be skilled and will not be recruited locally. However, some predominantly unskilled labour should be recruited from villages near the TLs. It is also estimated that implementing the TLs and expanding the SSs will generate around 650 indirect jobs.

A.2.02 Mobilisation of camp sites

This action includes the activities necessary to set up the areas destined for camp sites. It also includes setting up and operating borrow areas and surplus soil deposits, if they are necessary.

According to **Section 5.3.1**, it is estimated that 9 (nine) camp sites will be set up for the project, 3 (three) of them on the sites of the SSs to be expanded, in the villages of Kyaka, Nyakanazi and Ibadakuli, 1 (one) in the village of Mutukula, on the border between Tanzania and Uganda, and another 5 (five) distributed along the route, at average distances of 70 to 80 km from each other. The following villages where these 5 camp sites could be set up were estimated: Nyakasimbi, Nyabugombe, Busonzo, Ilogi, and Solwa.

The exact location of these camps is not yet available.

This impactful action encompasses all the tasks necessary to implement such facilities, such as renting or purchasing land, clearing and preparing the land, civil works, electromechanical assembly, etc. As the search for accessible sites is expected to be one of the main criteria to be considered by the contractors in the choice of land for camp site implementation, the opening of new access for such premises was not included as one of the activities related to the potential impact of this action.

A.2.03 Negotiation and compensation of owners and occupants

This action is related to the need to acquire land for the implementation of the project, both for permanent and temporary facilities. Permanent facilities include the wayleave, areas for the expansion of substations, and areas for the implementation of access sections outside the wayleave that will be used in the operation phase to maintain the TLs. Temporary facilities include areas for installing camp sites and other support areas, and

areas for implementing access to be used only during construction.

The release of the areas will involve the following activities:

- Identification of land to be interfered by the permanent and temporary structures of the project;
- Prior contact with owners or occupants of the land;
- Socio-economic census of all owners and occupants;
- Physical cadastre of all productive and non-productive improvements located in the affected areas, preferably with the accompaniment of the owner/occupant;
- Physical cadastre of the land area affected by the permanent and temporary structures of the project;
- Calculation of compensation for permanent and temporary restrictions placed on land areas and for improvements affected;
- Assessment of the value of land and improvements affected;
- Negotiation with owners and occupants;
- Compensation provided to owners and occupants.

A.2.04 Vegetation clearing

Before the start of works, vegetation cover that will interfere with the route of the TLs and the SSs expansion area will be removed. Some new access roads will also require some vegetation removal. The camp sites will preferably be located in already anthropized areas. However, the need to remove some vegetation is not ruled out.

Vegetation removal and land clearing consist of cutting trees and shrubs of any size, removing stumps, branches, entangled roots, grass, and organic matter soil layer up to a thickness of 20.0 cm. Stump removal, performed on access roads only, includes excavation and total removal of tree stumps greater than 30.0 cm in diameter and roots.

To allow cables' launching, the vegetation will be cleared along a 14.0 m wide strip in the centre of the wayleave (service strip). In sections of the route where the topography is favourable, the service trip can also be used to access the towers, without the need to open new accesses outside the wayleave.

During TLs' operation phase, the tower locations and accesses to be used for maintenance will be kept clear of vegetation. In the rest of the wayleave, selective pruning will be carried out to keep the vegetation under the cables at a height that does not endanger the TL and its components.

The removal of vegetation and clearing of land expose the soil, which, according to its susceptibilities, can induce the installation of laminar and linear erosion processes, especially if these actions are carried out during the rainy season. These processes can also lead to the sedimentation of water bodies located downstream of the intervention areas.

A.2.05 Demolition of improvements

With the study of alternatives (see **Section 8.1**), selecting routes that reduced interference with human occupation was possible. However, due to the scattering of occupations, it was impossible to propose a route that would avoid this impact, with many houses still remaining in the area of the future wayleave. These houses that coincide with the area of the future wayleave and with the Kyaka SS's expansion area, totalling around 1,106, need to be resettled.

These houses will be demolished and preferably relocated elsewhere within the property, following the owner's or occupant's wishes. The other affected improvements will also be demolished and compensated.

A.2.06 Implementation/improvement of accesses

This action includes the activities for implementing access to the tower locations at specific points around the route where the topography does not allow access through the wayleave, and their interconnection to existing roads. For the TLs that are part of this project, there should be a few stretches of access outside the wayleave, as the topography is quite favourable.

This action also includes improving existing accesses, involving small-scale earthworks, widening roads without intervening in native vegetation, and improving pavement.

A.2.07 Flows of vehicles, equipment, and workers to work fronts

This action corresponds to transporting materials, equipment, and workers necessary for the construction of the Project. Transport will be carried out along the existing roads, along the wayleave (by service strip), and along the new stretches of access that will be implemented in the sections where the topography does not allow access along the wayleave. Transport will be carried out to the location of the towers, using appropriate vehicles for each type of road, material transported and worker driving.

Due to the linear nature of the works, the flows will be diffuse, without concentrations of vehicles and equipment. In addition, consideration should be given to the short period in which the towers are erected and the overlapping of the flows of each stage, reducing the potential impact of this action, which mainly affects the population of road users and the resident population near the directly affected area.

A.2.08 Earthworks in substation area

Earthworks will have to be carried out in the expansion area of the SSs Nyakanazi, Kyaka, and Ibadakuli to shape and level the land for the implementation of the new components.

At this stage of the project, the volume of cut and fill related to the earthworks in the Kyaka, Nyakanazi, and Ibadakuli SSs' expansion areas is not known.

A.2.09 Excavation and implementation of grounding mesh in the substation area

The Kyaka, Nyakanazi, and Ibadakuli SSs' expansion areas will be equipped with a ground mesh system, which will be sized according to the design criteria and the characteristics of the equipment implemented, as well as the resistivity and stratification of the soil.

It is a ground mesh system commonly used in large electrical installations and consists of a buried network of interconnected copper cables laid horizontally in the substation.

A.2.10 Execution of tower foundations

The excavation of the tower foundations involves moving earth at the tower site. Excavation volumes are relatively small, with provisions for reusing excavated material and dispersing surplus within the wayleave, to eliminate the need to implement surplus soil deposits.

Due to the shallow depth of the excavations, there should be no significant interference with groundwater resources. If interference with cables, pipelines or other elements is possible, these should be registered before excavation begins, so that the necessary measures are taken to protect them.

A.2.11 Assembly of towers

The towers' metal structures will be assembled, piece by piece and/or by pre-assembled sections on the ground, in the assembly areas prepared along the wayleave. Impacting actions refer to noise and vibration emissions during lifting and assembly activities. Gas emissions from the equipment, such as trucks and cranes, must also be considered.

A.2.12 Launching of cables

The towers must be grounded, and the OPGW must be installed for the conductor cables' launching activity

To avoid interventions in additional areas, the cables will be launched using a crawler tractor only in the launch strip (service strip) within the wayleave. This action's impacts are mainly related to noise and vibration emissions. However, special procedures should be adopted to minimise impacts, such as traffic interruption, when launching cables, especially over road crossings, watercourses, and other interferences.

A.2.13 Operation of camp sites

Activities involving potential impacts during the operation of camp sites include handling chemicals (fuels, lubricants, paints, and varnishes), water supply and disposal of effluents (domestic and industrial) and solid waste, especially hazardous waste, operation of equipment that emits noise, gases, and particulate matter, and vehicle traffic on nearby roads.

This is an impactful action mainly linked to the risk of contamination of water resources and soil due to possible leaks or improper handling of waste and effluents, and to the disturbances and dangers to the population closest to the areas where they are installed and to those living around the accesses.

A.2.14 Decommissioning of temporary facilities

As mentioned, camp sites will preferably be implemented on sites without native vegetation. However, in some of these areas, it may be necessary to clear the land, with the possible removal of some vegetation that may be present. The temporary facilities will be dismantled at the end of the work, sometimes leaving the areas without ground cover, making them susceptible to erosive processes. It should also be considered that dismantling these temporary facilities may incur interventions on the ground, such as the opening of holes, for example, increasing the risk of erosion.

The demobilisation of these areas should also require stabilising and closing septic tanks and any trenched landfills eventually installed.

A.2.15 Demobilisation of the workforce

This action includes all procedures for workforce demobilisation, labour contract termination, and contract termination for the provision of materials and services.

Demobilisation will be gradual, i.e., as the stages defined in the works schedule are completed, leaving only a few employees needed to complete the work and start the operational phase.

A.2.16 Recovery of direct intervention areas

This action refers to the recovery and/or regularisation of the morphology and grass cover of the land directly affected by the project, covering not only the wayleave, but also the areas of the camp sites. It should be noted that these activities will be carried out at the end of each stage of construction, in parallel with the execution of the work.

A.2 - Operation Phase

A.3.01 Operation of the TLs and SSs

The operation of the TLs and SSs results from the needs described in **Section 4.1**, and the potential positive impact is associated with the reinforcement of Tanzania's electricity system through the interconnection between Tanzania and Uganda. According to Final Feasibility Report Volume II (June, 2024), this interconnection project, with the transmission of energy generated in Uganda (that has excess energy production, mainly related to hydro resources) to supply Tanzania's electricity system, will generate substantial economic benefits, promote regional collaboration, and contribute to sustainable development.

The construction of the interconnection produces favourable economic outcomes for Tanzania and Uganda. The interconnection facilitates an increase in direct exchange between the countries by optimizing the use of their domestic resources, particularly hydro and renewable energy sources**.** This results in decreasing total operating costs and Expected Energy not Served - EENS, while reducing reliance on external support.

A.3.02 Routine maintenance and emergency repair of the system

Routine maintenance actions include a set of works and services to be carried out periodically, on a preventive basis, or in case of an emergency, on a corrective basis.

Routine maintenance includes a set of services carried out on an ongoing basis to ensure the integrity of the structures and the good operating performance of the system. Routine preventive maintenance activities include selective cutting and pruning of vegetation in the wayleave, inspection of towers and cables, and inspection and maintenance of transformers.

Emergency remediation activities include responding to casual accidents that damage the system's physical or operational structures, mainly caused by cable breaks or tower falls, or natural events such as storms or strong wind gusts.

A.3.03 Inhibition of secondary regeneration of native vegetation on the wayleave

During the operation phase, vegetation will be managed along the wayleave to comply with the safety distance between conductors and trees, preventing accidental fires and risks of electric shocks.

Vegetation management will consist of maintenance cutting of regenerating vegetation in the service strip (14.0 m) and selective cutting or pruning of specimen trees in the wayleave that present a risk to the structures or cables. Maintenance cutting, pruning and selective cutting of specimen trees will occur both in sections covered by native vegetation and in areas with anthropogenic vegetation.

8.2.3
Identification and Evaluation of Potential and Resulting Impacts

The actions foreseen in the project's planning, construction, and operation phases were cross-checked with the environmental components of the areas of influence, allowing for the identification of potential environmental and social impacts.

For this purpose, an exhaustive verification was carried out, as a *checklist*, to ensure that all impacts had measures aimed at their prevention, control, mitigation, or compensation.

The following is the analysis of the project's possible environmental and social impacts, the proposal of the Plans and Programmes and respective measures, and the qualification of the resulting impacts. In total, 27 possible environmental and social impacts of the Project were identified, 5 of which were on the physical environment, 6 of which were

on the biological environment, and 16 of which were on the socio-economic environment.

With the result of the analysis described in **Sections 8.2.3.1** to **8.2.3.3**, the **Matrix 8.2.3.a - Impact Consolidation Matrix** was prepared, with the qualification of the complete set of impacts and the targeted environmental and social Plans and Programmes.

Matrix 8.2.3.a - Impact Consolidation Matrix

		Impacts	Rating of impacts														Plans and Programmes and Proposed Environmental and Social Measures
			Vector Positive or Negative	Location and spatialisation DAA / DAI / IAI / Diffuse	Stage of occurrence Planning / Construction / Operation	Form of incidence Direct / Indirect	Temporality – Induction Immediate / Short, Medium or Long Term	Temporality – Duration Short, Medium or Long Term, or Permanent	Reversibility Reversible / Partially reversible / Irreversible	Probability Low / Moderate / High / Certain	Cumulativeness Cumulative / Non-cumulative	Synergy Sinergic / Non-sinergic	Magnitude Low / Moderate / Medium / High	Importance Low / Moderate / Medium / High	Mitigability Not mitigable / Low mitigable / Moderately mitigable / Highly mitigable / Fully mitigable	Residual importance Low / Moderate / Medium / High	
Impacts																	
Physical Environment	C.1.01 - Soils / Relief	1.01 - Occurrence and/or intensification of erosion processes due to earthworks and excavations	Negative	DAA / DAI	Construction / Operation	Direct	Immediate	Short term	Reversible	Certain	Non-cumulative	Synergic	Low	Low	Fully Mitigable	Low	P.01 (5.1, 5.6, 5.14 - Decommissioning and Recovery at the End of the Construction Phase), P.02 (5.1, 5.2), P.03 (5.1, 5.3, 5.5)
	C.1.02 – Superficial Water Resources	2.01 – Alterations of surface water quality and increased turbidity	Negative	DAI	Construction	Indirect	Immediate	Short term	Reversible	High	Non-cumulative	Synergic	Low	Low	Fully Mitigable	Low	P.01 (5.1, 5.2, 5.3, 5.4, 5.6, 5.7, 5.8, 5.9), P.02 (5.1, 5.2), P.04 (5.1 to 5.3), Treated effluents monitoring (Contractors), water quality monitoring (TANESCO)
		2.02 - Siltation of watercourses	Negative	DAI	Construction	Indirect	Immediate	Medium term	Reversible	Low	Non-cumulative	Non-synergic	Low	Low	Fully Mitigable	Low	P.01 (5.1, 5.2, 5.3, 5.6), P.02 (5.1, 5.2), P.03 (5.5)
	C.1.03 – Groundwater Resources	3.01 – Alteration of groundwater quality	Negative	DAA	Construction / Operation	Indirect	Short term	Medium term	Reversible	Low	Non-cumulative	Non-synergic	Low	Moderate	Highly Mitigable	Low	P.01 (5.2, 5.3, 5.4, 5.8, 5.9), P.02 (5.1, 5.2), P.03 (5.1, 5.4, 5.9), P.04 (5.1 to 5.3), Treated effluents monitoring (Contractors)
	C.1.04 - Air Quality	4.01 - Change in air quality during construction	Negative	DAI	Construction	Direct	Immediate	Short term	Reversible	High	Non-cumulative	Non-synergic	Low	Low	Fully Mitigable	Low	P.01 (5.5), P.02 (5.1 to 5.3), atmospheric emissions monitoring (Contractors), air quality monitoring (TANESCO)
Biological Environment	C.2.01 - Flora and Vegetation	5.01 - Loss of vegetation cover and reduction of individual plants	Negative	DAA	Construction / Operation	Direct	Immediate	Permanent	Irreversible	Certain	Cumulative	Synergic	Medium	High	Moderately Mitigable	Medium	Optimisation of the route, P.01 (5.6), P.02 (5.1, 5.2), P.03 (5.1, 5.2, 5.3, 5.6, 5.12), P.07 (5.2), P.08 (5.1, 5.2), P.10 (P.10..3), P.14 (5.5, 5.6)
		5.02 - Increased landscape fragmentation and edge effect incidence	Negative	DAI	Construction / Operation	Indirect	Short term	Permanent	Partially reversible	Certain	Cumulative	Synergic	Medium	Medium	Moderately Mitigable	Medium	Optimisation of the route, P.01 (5.6), P.02 (5.1, 5.2), P.03 (5.1, 5.2, 5.3, 5.6, 5.12), P.07 (5.2), P.08 (5.1, 5.2), P.10 (P.10..3)
	C.2.02 – Fauna	6.01 - Disturbance of fauna during construction	Negative	DAI	Construction	Direct	Immediate	Ends at the end of the action	Reversible	High	Non-Cumulative	Synergic	Low	Low	Highly Mitigable	Low	P.01 (5.6, 5.7, 5.10), P.02 (5.1, 5.2), P.07 (5.1)
		6.02 - Reduction of natural habitats	Negative	DAA	Construction	Direct	Immediate	Long term	Irreversible	Certain	Cumulative	Synergic	Medium	High	Moderately Mitigable	Medium	P.01 (5.6), P.02 (5.1, 5.2), P.05, P.06, P.07 (5.1, 5.2), P.09, P.10 (P.10.1, P.10.2)
	C.2.03 - Protected Areas and Internationally Recognized Areas	7.01 – Impacts on Protected Areas and Internationally Recognized Areas	Negative	DAA / DAI	Construction / Operation	Direct/ Indirect	Short term	Long term	Partially reversible	Certain	Cumulative	Synergic	Medium	High	Moderately Mitigable	Medium	P.01 (5.6), P.02 (5.1, 5.2), P.03 (5.1, 5.2, 5.3, 5.6, 5.12), P.05, P.06, P.07 (5.1, 5.2), P.08 (5.1, 5.2), P.09, P.10 (P.10.1, P.10.2, P.10.03), P.11 (5.1 to 5.3), P.14 (5.6)
	C.2.04 - Critical Habitat	8.01 – Impacts on biodiversity in critical habitats	Negative	DAI	Construction / Operation	Direct/ Indirect	Short term	Long term	Partially reversible	Certain	Cumulative	Synergic	Medium	High	Moderately Mitigable	Medium	P.01 (5.6), P.02 (5.1, 5.2), P.03 (5.1, 5.2, 5.3, 5.6, 5.12), P.05, P.06, P.07 (5.1, 5.2), P.08 (5.1, 5.2), P.09, P.10 (P.10.1, P.10.2, P.10.03), P.11 (5.1 to 5.3), P.14 (5.6)
	C.2.05 – Ecosystem Services	9.01 – Impact on the availability and quality of relevant ecosystem services	Negative	DAI	Construction / Operation	Indirect	Immediate	Long term	Partially reversible	Certain	Cumulative	Synergic	Medium	Medium	Moderately Mitigable	Medium	P.01 (5.6), P.02 (5.1, 5.2), P.05, P.06, P.07 (5.1, 5.2), P.10 (P.10.1, P.10.2, P.10.03), P.11 (RPF)
Socio-Economic Environment	C.3.01 - Employment and Local Economy	10.01 - Generation of direct and indirect jobs during construction	Positive	IAI	Construction	Direct	Immediate	Short term	Reversible	Certain	Non-Cumulative	Synergic	Low	Moderate		Moderate	P.02 (5.1, 5.2), P.12 (4.0, 5.0, 7.0, 8.0), P.13 (5.1 to 5.4), P.14 (5.1 to 5.6)
		10.02 - Generation of direct and indirect jobs during operation	Positive	Diffuse	Operation	Direct	Immediate	Long term	Reversible	Certain	Non-Cumulative	Synergic	Low	Low		Low	P.03 (5.1, 5.8), P.12 (7.0), P.13 (5.1 to 5.4), P.14 (5.1 to 5.6)
		10.03 – Increased local consumption of goods and services during construction phase	Positive	IAI	Construction	Indirect	Immediate	Short term	Reversible	High	Non-Cumulative	Synergic	Low	Low		Low	P.02 (5.2), P.12 (4.0, 5.0, 7.0, 8.0), P.13 (5.1 to 5.4)
		10.04 - Loss of employment and reduced demand in the local economy at the end of the construction phase	Negative	IAI	End of construction / beginning of operation	Indirect	Short term	Medium term	Reversible	High	Non-Cumulative	Non-Synergic	Medium	Moderate	Moderately Mitigable	Moderate	P.02 (5.2), P.03 (5.1, 5.8), P.12 (4.0, 5.0, 7.0, 8.0), P.13 (5.1 to 5.4)
	C.3.02 - Infrastructure, Social Equipment and Public Services	10.05 - Interference with mineral rights	Negative	DAA / DAI	Construction	Direct	Immediate	Short term	Reversible	Certain	Cumulative	Non-Synergic	Medium	Moderate	Moderately Mitigable	Moderate	P.02 (5.2, 5.4), P.11 (RPF)
		11.01 - Interference with traffic conditions	Negative	DAI / IAI	Construction	Direct	Immediate	Short term	Reversible	High	Non-Cumulative	Synergic	Low	Low	Highly Mitigable	Moderate	P.01 (5.10), P.02 (5.1, 5.2), P.12 (4.0, 5.0, 7.0, 8.0)
		11.02 - Temporary overloading of waste disposal sites	Negative	IAI / Diffuse	Construction	Indirect	Short term	Short term	Reversible	Low	Cumulative	Synergic	Low	Low	Highly Mitigable	Low	P.01 (5.8), P.02 (5.1, 5.2), P.14 (5.5, 5.6)
		11.03 - Interference with airport runways	Negative	DAI	Operation	Indirect	Short term	Long term	Reversible	Low	Non-Cumulative	Non-Synergic	Medium	Moderate	Low Mitigable	Moderate	P.12 (4.0, 5.0, 7.0, 8.0)
	C.3.05 - Livelihoods and Quality of Life of the Population	12.01 - Generating public expectations	Positive/ Negative	IAI	Planning / Construction	Direct	Immediate	Short term	Reversible	Certain	Non-Cumulative	Synergic	Low	Low	Highly Mitigable	Moderate	P.02 (5.2), P.11, P.12 (4.0, 5.0, 7.0, 8.0)
		12.02 – Disturbances associated with construction activities (due to noise emissions, dust, vibrations, increased traffic)	Negative	DAI	Construction	Direct	Immediate	Short term	Reversible	Certain	Non-Cumulative	Synergic	Low	Low	Highly Mitigable	Medium	P.01 (5.5, 5.7, 5.10), P.02 (5.1, 5.2), P.12 (4.0, 5.0, 7.0, 8.0), P.14 (5.5, 5.6), atmospheric emissions monitoring and noise monitoring (Contractors), noise monitoring and air quality monitoring (TANESCO)
		11.03 – Disturbance due to increased noise during operation	Negative	DAI	Operation	Indirect	Medium term	Long term	Reversible	Medium	Cumulative	Non-Synergic	Medium	Moderate	Moderately Mitigable	Moderate	P.03 (5.1, 5.7, 5.8, 5.10), P.12 (5.0, 7.0, 8.0)
		12.04 – Changes in the landscape	Positive/ Negative	DAA / DAI	Construction / Operation	Direct	Immediate	Long term	Irreversible	Certain	Cumulative	Synergic	Medium	High	Low Mitigable	High	Adjustment of the alignment of the TLs and the new accesses, P.01 (5.6, 5.14 - Decommissioning and Recovery at the End of the Construction Phase), P.02 (5.1, 5.2), P.03 (5.6), P.10 (P.10.3), P.12 (4.0, 5.0, 7.0, 8.0)
		12.05 - Changes in land use and loss of agricultural areas	Negative	DAA	Construction	Direct	Immediate	Permanent (permanent facilities) / Short term (temporary facilities)	Irreversible (permanent facilities) / Reversible (temporary facilities)	Certain	Cumulative	Non-Synergic	Medium	High	Highly Mitigable	High	Adjustment of the alignment of the TLs and the new accesses, P.01 (5.6, 5.14 - Decommissioning and Recovery at the End of the Construction Phase), P.02 (5.1, 5.2), P.03 (5.1, 5.6, 5.7, 5.8), P.11 (RPF), P.12 (4.0, 5.0, 7.0, 8.0)
		12.06 - Interference with houses, schools, health facilities and other improvements and sources of income	Negative	DAA	Construction	Direct	Immediate	Long term	Irreversible	Certain	Non-Cumulative	Non-Synergic	Medium	High	Highly Mitigable	High	Adjustment of the alignment of the TLs and the new accesses, P.02 (5.2), P.11 (RPF), P.12 (4.0, 5.0, 7.0, 8.0)
	C.3.06 - Land	13.01 - Reduction in the available area of properties due to the land taken by the Project	Negative	DAA	Construction	Direct	Immediate	Permanent (permanent facilities) / Short term (temporary facilities)	Irreversible (permanent facilities) / Reversible (temporary facilities)	Certain	Non-Cumulative	Non-Synergic	Medium	High	Highly Mitigable	High	P.02 (5.2), P.11 (RPF), P.12 (4.0, 5.0, 7.0, 8.0)
	C.3.07 - Historical and Cultural and Archaeological Heritage	14.01 - Impact on graves	Negative	DAA	Construction	Direct	Immediate	Long term	Irreversible	High	Non-Cumulative	Non-Synergic	Medium	High	Highly Mitigable	Medium	P.02 (5.1, 5.2), P.12 (4.0, 5.0, 7.0, 8.0), P.16 (5.5)
Risks																	
Physical Environment	C.1.01 - Soils / Relief	15.01 - Risk of soil contamination (from leaks and inadequate management of effluents and waste produced)	Negative	DAA	Construction / Operation	Indirect	Immediate	Long term	Reversible	Moderate	Non-Cumulative	Non-Synergic	Low	Low	Fully Mitigable	Low	P.01 (5.2, 5.3, 5.4, 5.7, 5.08, 5.09), P.02 (5.1, 5.2), P.03 (5.1, 5.2, 5.4, 5.9)
Biological Environment	C.2.01 - Flora and Vegetation	16.01 - Increased risk of fire in adjacent vegetation	Negative	DAI	Construction / Operation	Indirect	Short term	Long term	Reversible	Medium	Non-Cumulative	Non-Synergic	Medium	Moderate	Moderately Mitigable	Moderate	P.01 (5.7, 5.9), P.02 (5.1, 5.2), P.03 (5.1, 5.2, 5.6, 5.7, 5.9), P.04 (5.1 to 5.3), P.14 (5.5, 5.6), P.17 (5.4, 5.8)
		16.02 - Expansion of invasive flora species	Negative	DAI	Construction / Operation	Indirect	Medium term	Long term	Reversible	Medium	Cumulative	Non-Synergic	Medium	Medium	Highly Mitigable	Low	P.08 (5.1, 5.2)
		16.03 - Increased illegal exploitation of natural resources	Negative	DAI	Operation	Indirect	Medium term	Medium term	Partially reversible	Medium	Cumulative	Synergic	Low	Moderate	Moderately Mitigable	Moderate	P.03 (5.1, 5.8, 5.12)
	C.2.02 - Fauna	17.01 – Risk of an increase in hunting	Negative	IAI	Construction / Operation	Indirect	Short term	Short term (due to workers) / Long term (due to the population)	Partially reversible	Low	Non-Cumulative	Synergic	High	High	Highly Mitigable	Medium	P.03 (5.1, 5.2, 5.8, 5.12), P.14 (5.5, 5.6)
		17.02 - Risk of accidents with birds during operation	Negative	DAI	Operation	Direct	Immediate	Long term	Irreversible	Medium	Non-Cumulative	Synergic	Medium	High	Moderately Mitigable	Medium	P.10 (P.10.1)
Socio-Economic Environment	C.3.02 - Infrastructure, Social Equipment and Public Services	18.01 - Risk of increased demand for health services	Negative	Diffuse	Construction	Indirect	Immediate	Short term	Reversible	Low	Cumulative	Synergic	Low	Low	Low Mitigable	Moderate	P.01 (5.6, 5.7, 5.10), P.02 (5.1, 5.2), P.17 (5.1 to 5.9), noise monitoring in workfronts and construction sites, quality of drinking water monitoring (Contractors)
		18.02 - Risk of unintended damage to crops and improvements during works	Negative	DAI	Construction	Direct	Immediate	Short term	Reversible	Low	Non-Cumulative	Non-Synergic	Low	Low	Highly Mitigable	Low	P.01 (5.10, 5.13), P.02 (5.1, 5.2), P.14 (5.2, 5.5, 5.6)
	C.3.03 - Health and Safety of the Workers	19.01 - Increasing the risk of the spread of disease among workers during construction	Negative	DAA	Construction	Direct	Immediate	Short term	Reversible	Medium	Non-Cumulative	Synergic	Low	Low	Moderately Mitigable	Low	P.01 (5.7), P.02 (5.1, 5.2), P.13 (5.1 to 5.4), P.14 (5.1 to 5.6), P.15, P.17 (5.1, 5.2, 5.5, 5.6, 5.7, 5.9), quality of drinking water monitoring (Contractors)
		19.02 - Risk of accidents involving workers	Negative	DAA	Construction	Direct	Immediate	Short term	Reversible	Medium	Non-Cumulative	Non-Synergic	Low	Medium	Highly Mitigable	Moderate	P.01 (5.6, 5.7, 5.9, 5.10), P.02 (5.1, 5.2), P.14 (5.1 to 5.6), P.17 (5.1 to 5.9)
		19.03 - Risk of accidents due to the presence of landmines and UXOs (unexploded ordnances)	Negative	DAI	Construction	Direct	Short term	Long term	Reversible	Medium	Cumulative	Non-Synergic	Medium	High	Highly Mitigable	High	P.01 (5.12), P.02 (5.1, 5.2, 5.5), P.04 (5.1 to 5.3), P.12 (4.0, 5.0, 7.0, 8.0)
	C.3.04 - Health and Safety of the Community	20.01 - Increasing the risk of workers transmitting diseases during construction, affecting the surrounding community	Negative	DAI	Construction	Direct	Immediate	Short term	Reversible	Medium	Non-Cumulative	Synergic	Low	Low	Moderately Mitigable	Low	P.01 (5.7), P.02 (5.1, 5.2), P.13 (5.1 to 5.4), P.14 (5.1 to 5.6), P.15, P.17 (5.1 to 5.9)
		20.02 - Risks to the health and safety of the community during construction	Negative	DAI	Construction	Direct	Short term	Short term	Reversible	Moderate	Cumulative	Non-Synergic	Medium	Moderate	Highly Mitigable	Moderate	P.01 (5.7, 5.10), P.02 (5.1, 5.2), P.12 (5.0, 7.0, 8.0), P.13 (5.1 to 5.4), P.14 (5.1 to 5.6), P.15
		20.03 - Risk of impact on the health of the population closest to the TL due to the effect of the electromagnetic fields	Negative	DAI	Operation	Direct	Short term	Long term	Reversible	Low	Non-Cumulative	Non-Synergic	Low	Low	Moderately Mitigable	Low	P.03 (5.7, 5.8, 5.11, 5.13)
		20.04 - Risk of child labour	Negative	IAI	Construction	Direct	Immediate	Short term	Reversible	Moderate	Non-Cumulative	Non-Synergic	Low	Low	Highly Mitigable	Low	P.02 (5.1, 5.2), P.14 (5.1 to 5.6), P.15
	C.3.07 - Historical and Cultural and Archaeological Heritage	21.01 - Risk of damage to historical, cultural and archaeological assets	Negative	DAA	Construction	Direct	Immediate	Long term	Irreversible	Medium	Non-Cumulative	Non-Synergic	Medium	High	Highly Mitigable	Medium	P.16 (5.1 to 5.4)

In blue, classification of the impact if the preventive measures adopted are ineffective and the risk materialises into an impact.

Environmental and Social Management Plan (ESMP)

P.01 - Construction Environmental Plan (CEP) - Responsible: Contractors, under the supervision of TANESCO
5.1. Erosion Prevention and Control
5.2. Control Procedures for Construction in Flooded Areas
5.3. Prevention and Control of Soil Contamination
5.4. Water and Effluent Management
5.5. Atmospheric Emissions and Noise and Vibration Control
5.6. Vegetation Clearing
5.7. Camp Sites and Workforce Housing Management
5.8. Waste Management
5.9. Hazardous Materials Management
5.10. Construction Traffic Control
5.11. GHG Emission Measurement and Mitigation
5.12. Demining of DAA
5.13. Indenisation for Unintended Damage to Crops and Rural Improvements During Works
5.14. Decommissioning and Recovery of Degraded Areas

P.02 - Environmental and Social Management Programme - Responsible: TANESCO
5.1. Construction Supervision
5.2. Coordination of Plans and Programmes of the ESMP
5.3. Greenhouse Gas Emissions Management
5.4. Management of Interference with Mining Licence
5.5. Demining of Resettlement Areas

P.03 - Operation Management Programme - Responsible: TANESCO
5.1. Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase
5.2. Environmental Training of the Maintenance Team
5.3. Monitoring of Recovered Areas
5.4. Waste Management
5.5. Maintenance and Erosion Control
5.6. Vegetation Management on the Wayleave Easement
5.7. Protection of the Wayleave Easement
5.8. Social Communication During the Operation
5.9. Emergency Response Plan (ERP) Framework for the Operation Phase
5.10. Audible Noise Monitoring
5.11. Electromagnetic Field Monitoring
5.12. Access Control Plan
5.13. Community Health and Safety

P.04 - Construction Emergency Preparedness and Response Plan - Responsible: Contractors, under the supervision of TANESCO
5.1 Risk Assessment
5.2. Emergency Preparedness and Response Procedures (EPR)
5.3. Training and Drills

P.05 - Biodiversity Offset Plan - Responsible: TANESCO

P.06 - Ecosystem Services Impact Mitigation Plan - Responsible: TANESCO

P.07 - Fauna and Flora Rescue and Relocation Plan - Responsible: TANESCO
5.1. Fauna Rescue and Relocation
5.2. Flora Rescue and Relocation

P.08 - Invasive Species Control Program - Responsible: TANESCO
5.1. Control Activities During the Implementation and Operation of the Project
5.2. Monitoring the Dispersal of Invasive Species

P.09 - Landscape Protection Program - Responsible: TANESCO
5.1. Identification of Priority Areas for Monitoring
5.2. Monitoring of New Deforestation

P.10 - Operation Biodiversity Management - Responsible: TANESCO
P.10.1 – Subprogramme of Bird Collision Monitoring
P.10.2 – Subprogramme of Fauna Monitoring During Operation
P.10.3 – Subprogramme of Native Vegetation Restoration

P.11 – Flora Active Search Programme - Responsible: TANESCO

P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF) - Responsible: TANESCO
5.1. Target flora species
5.2. Priority stretches
5.3. Active search and Mitigation Measures to be Taken

P.12 - Stakeholder Engagement Plan - Responsible: TANESCO, with some activities carried out by the Contractors

P.13 - Local Hiring Programme - Responsible: Contractors, under the supervision of TANESCO
5.1. Divulgation of Vacancies, Profiles and Requirements
5.2. CV Database Formation
5.3. Interaction with Stakeholders
5.4. Training Programme for Local Labour

P.14 - Labour Management Procedures (LMP) - Responsible: TANESCO, with some activities carried out by the Contractors

5.1. Preparation of a Human Resources Policy
5.2. Recruitment and Labour Training
5.3. Management of Working Conditions
5.3.1. Personnel Welfare Facilities Standards
5.4. Grievance Mechanism
5.5. Workers' Code of Conduct
5.6. Environmental and Social Education for Workers

P.15 - Gender Based Violence (GBV) Action Plan - Responsible: TANESCO, with some activities carried out by the Contractors

P.16 - Archaeological, Historical and Cultural Heritage Protection Plan
5.1. Prospecting in the SSs' Expansion Areas
5.2. Preparation of Guidance Material for Workers and Training
5.3. Chance Findings Procedure (CFP)
5.4. Monitoring during Vegetation Suppression and Earthworks
5.5. Relocation of Graves

P.17 - Occupational Health and Safety Management Programme - Responsible: TANESCO, with some activities carried out by the Contractors
5.1. Occupational Health and Safety Management Procedures
5.2. Health and Safety Management Personnel
5.3. Minimum Requirements for Safe Work Procedures - SWP
5.4. Occupational Safety Training
5.5. Health and Safety Supervision
5.6. Worker Health Management
5.7. Worker Participation
5.8. Emergency Preparedness and Response
5.9. Investigation of Work-related Injuries, Ill Health, Diseases and Incidents

Decommissioning Plan
Decommissioning and Recovery at the End of the Construction Phase - **Responsible: Contractors, under the supervision of TANESCO**
Abandonment Plan for the Operation Phase - **Responsible: TANESCO**

Environmental and Social Monitoring Plan
Contractors' Environmental Monitoring Programme - **Responsible: Contractors, under the supervision of TANESCO**
Atmospheric emissions monitoring

8.2.3.1
Physical Environment

1. Impacts on Soils / Relief

1.01 - Occurrence and/or intensification of erosion processes due to earthworks and excavations

Impacting actions	A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.05 Demolition of improvements A.2.06 Implementation/improvement of accesses A.2.08 Earthworks in the substation area A.2.10 Execution of tower foundations A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities A.2.16 Recovery of direct intervention areas A.3.03 Inhibition of secondary regeneration of native vegetation on the wayleave
Impactable component	C.1.01 - Soils / Relief

Analysis of potential impact

This impact results from the change in the terrain's surface dynamics due to the necessary interventions for the Project implementation works, which may induce new erosive processes or intensify existing ones.

In this case, two main aspects must be considered: the land's natural vulnerability and the characteristics and size of the interventions required to implement the Project.

Regarding the Project, several factors determine the degree of interference on the terrain, influenced as much by the environmental information incorporated in its design and detailing, as by the constructive planning and applied environmental management measures.

Earthmoving activities are the most impactful of the works to be performed, especially those involving the exposure of large surfaces and the execution of cuts and embankments, which have the potential for increased impact on steep relief and drainage crossing sites. These activities also concentrate rainwater, especially on unprotected or erosion-prone land.

Excavations for the tower foundations, which generate surplus material, are also included in actions with the potential to induce erosion processes. The risk in this case is related to disposing of surplus material within the wayleave. Even considering that the surpluses will be small, this procedure requires special care and the application of surface protection measures.

In this evaluation, the necessary interventions for the implantation of the building sites and Substations, especially the latter, that involve land regularization procedures with

material movement, presenting a risk of erosion induction and consequent impacts on surface water resources, should be considered. The opening of new accesses, involving all activities inherent to this type of structure, is considered one of the actions with the greatest impact potential of the Project. In this case, the impacts will depend on the alignments chosen for the accesses, which should be designed considering the weaknesses of the terrain crossed.

Given this framework of interventions, it is necessary to assess which sections of the Project have the greatest potential for this impact to occur, as well as the location of point structures (Substations and building sites, for example) and the alignment of planned new accesses. Based on the terrain typology, it was possible to analyse in detail the Project's Direct Influence Area (TL wayleave and Substation site), indicating the interference sections with each type of terrain, to infer the weaknesses, risks, and impacts expected with the implementation works.

As presented in the baseline description, the TL intercepts different terrain types, including level lands, fluvial plains, ridges, escarpments, and hilly and mountainous relief.

Level lands and plains occur predominantly along the E-W alignment, from Ibadakuli to Nyakanazi Substation. These are elevated, relatively flat areas, whose homogeneity of low slopes is broken only by a ridge of phyllites and meta-basalts near Mwakitolyo Ward. There are vertisols and planosols, which, in flat areas, have low or moderate susceptibility to erosion. As the alignment moves westwards, there is a predominance of cambisols, which are more susceptible to erosion when they occur on slightly steeper slopes.

Although there is some susceptibility to erosive processes, the low drainage incision and the low slope observed in these terrains impart little kinetic energy to the surface runoff. This leads to occasional and low-intensity laminar and groove processes. These terrains, therefore, are considered to be low-sensitive to erosive processes.

On the other hand, the slopes are steeper in the S-N alignment, making them more vulnerable to erosion. Fold lines supported by metasediments, oriented in a SW-NE direction, form mountainous reliefs with escarpments and steep slopes.

Creep and gully erosion processes are frequent and widespread. Although occasional, the erosive process is of high intensity when it occurs. Rocky outcrops and lithologic soils are also present, especially in inselbergs, where landslides and falling rocks are not uncommon.

Regarding areas of greater slope, especially those greater than 12%, it should be noted that in these stretches, it will not be possible to maintain access along the wayleave, which will require the opening of new transverse accesses. In these cases, it is accepted that the potential for inducing erosion may be increased due to the nature of the land and the size of the interventions.

Floodplains will also be intercepted along the entire alignment, to a greater or lesser extent depending on the size of the drainage channels and paleolacustrine areas. These terrains are aggradation areas, and erosive processes are of low intensity and generally restricted to river action. In this case, major problems may arise from the proximity of the water table to the surface, which increases the susceptibility of water and soil contamination. Highlights include the Kagera River plain and the extensive flat area between Kyaka and the Ugandan border.

It should be noted, however, that the intensity of such processes will also depend on the distribution of rainfall totals during the year. In this case, those events occur during the beginning of the rainy season (beginning of spring), especially during March and April, which are considered the rainiest months in the entire project area.

During the project's operation, the possibility of inducing erosion exists, but it depends on the natural characteristics of the terrain intercepted. There is also the possibility of it occurring along the access roads and, to a limited extent, in the vicinity of the towers.

Mitigation Measures

Given these potential conditions, measures to prevent, control, and mitigate this impact have been foreseen as part of the Project's Environmental and Social Management Plan (ESMP), which are listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Considering the application of the measures proposed in **Table 9.0.a**, it is attributed to the present impact of the construction phase, a negative nature, direct incidence, high probability of occurrence, and coverage restricted to the DAI. Induction is immediate, and the duration is short-term. It is reversible, without a cumulative effect, but synergic. The magnitude and importance are low. It is fully mitigable, keeping the residual importance as low.

Impact Qualification (attributes) **Occurrence and/or intensification of erosion processes due to earthworks and excavations**			
Vector	Negative	**Location and spatialization**	DAA/DAI
Stage of occurrence	Construction / Operation	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Certain
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Fully Mitigable		
Residual Importance	Low		

2. Impacts on Water Resources

2.01 – Alterations of surface water quality and increased turbidity

Impacting actions	A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.08 Earthworks in the substation area A.2.09 Excavation and installation of grounding mesh in the substation area A.2.10 Execution of tower foundations A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities A.2.16 Recovery of direct intervention areas
Impactable component	C.1.03 - Water Resources

Analysis of potential impact

There are a few activities inherent to the implementation of the Project that can cause alterations in water quality, some of them being continuous during the construction phase and others only due to eventual accidents on the construction fronts. In the operation phase, the risk of contamination is linked to eventual leaks of insulating oils in transformers and accidents during routine maintenance.

On work fronts, the carry-over of sewage from the concrete bases of the towers constitutes a risk to the nearest drainages, although this occurrence is associated with accidental leaks and heavy rain events. Washing the nozzles of the concrete mixer trucks is also a risk factor if the employees responsible for carrying them out are not properly advised to use only the appropriate location for this activity on the building site.

The degradation of surface water quality by organic contaminants, metals and petroleum derivatives can also occur, being predominantly associated with the transportation, storage and handling of hazardous products used in the works, such as fuels, lubricants, paints, varnishes and solvents. It is known that vehicles should be supplied at the work fronts, since the displacement of these vehicles to urban areas or commercial stations is technically unfeasible due to distances. This fuelling in the field is usually performed using gallons of fuel or tanker. Chainsaws used for vegetation suppression are also usually fuelled at the work fronts.

With the exception of fuels and lubricants, other products will be used in very small quantities and their handling and storage will be limited to the interior of building sites. In addition to the storage and handling of these products, there is a risk of contamination by diffuse loads, associated with procedures adopted in the operation of equipment during the construction phase. In this context, the following polluting loads stand out:

- Waste from maintenance, refuelling and washing areas of machines, vehicles and equipment, contaminated with oils, greases and suspended solids;

- Localized oil, grease and fuel spills from minor leaks during vehicle operation or machinery employed in normal earthmoving, material handling and/or tower assembly activities.

In the operation phase, the risk of surface water contamination due to oil spills in transformers is remote, depending on the combination of occurrence of leaks and their transport to the watercourses. Insulating oil leaks in the equipment used today are uncommon and can occur in small quantities, which allows their containment quickly within the transformer itself.

Increased surface water turbidity is an impact of some of the key impact actions that will be developed during the Project's construction phase, such as mobilization of building sites, removal of vegetation and clearing of land, implementation/improvement of accesses, execution of earthworks in the Substation areas, excavation and installation of grounding loops in the Substation areas and execution of the foundations of the towers.

In general, such services involve the removal of vegetation cover and earth moving, with consequent exposure of the surface horizons of the soil, generating the conditions for the initiation of laminar or linear erosion processes, which may, in turn, result in impacts on surface water resources by changing water quality through increased turbidity, and siltation of river channels.

Increased turbidity is associated with changes in water colour and solids concentrations. Significant changes in these water properties can result in a reduction in water column transparency and light intensity.

Mitigation Measures

The effects of this impact can be prevented, controlled, and minimized by applying the environmental programs and measures listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Considering the implementation of the measures proposed in **Table 9.0.a**, this is a negative impact with indirect incidence, of the implementation phase, with coverage restricted to the DAI, high probability of occurrence, immediate induction and duration, and fully reversible upon application of the proposed measures. It is not cumulative, but synergic. The magnitude and importance are low. It is fully mitigable, and therefore the residual importance is also low.

Impact Qualification (attributes) Alterations of surface water quality and increased turbidity			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Indirect
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	High
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Fully Mitigable		
Residual Importance	Low		

2.02 - Siltation of watercourses

Impacting actions	A.2.02 Mobilization of building sites A.2.04 Removal of vegetation and clearing of land A.2.06 Implementation/improvement of accesses A.2.10 Execution of the foundations of the towers A.2.16 Recovery of direct intervention areas
Impacted Component	C.1.02 - Surface Water Resources

Analysis of the potential impact

The assessment of actions triggering turbidity (previous impact) is also valid for the siltation impact of watercourses; however, there are some differences as to the dynamics of the processes and their effects.

In short, siltation may materialize due to the increased solid contribution exceeding the river's carrying capacity (the maximum load that the river can carry).

Considering the implantation of a transmission line, a relatively small set of potentially impacting actions can trigger laminar and groove erosion processes and, consequently, the siltation of the water bodies. These actions include vegetation suppression and land clearing, excavations for the construction of tower foundations, and especially earthmoving to open new accesses and improve existing accesses, for the implementation of the Substations, and, if necessary, for the implementation of the building sites. Due to the exposure of surface horizons of the soil and rain action, these actions can result in erosive processes and, consequently, in the siltation of the river channels.

As with the impact of increased turbidity, in addition to the typology and size of potentially impacting actions, the characteristics of the affected terrain and the natural drainage network influence the location of the areas affected by the siltation process and their magnitude. In this sense, the types of terrain identified in the DAI will undergo interventions associated with the Project implementation stage, each presenting its fragility characteristics and degree of erosion susceptibility.

In the rainy season (during summer and especially from January to May), high-intensity events during deforestation, access opening, and earthmoving services are a clear risk factor, potentially triggering the siltation impact of watercourses. It should also be noted that rainfall throughout the alignment region, although more intense during the periods mentioned, also occurs during late spring, when the rainy season begins.

The siltation of watercourses generates localized alterations of the fluvial morphology of the affected stretches, which may lead to canal obstruction (fluvial geometry alteration), with the formation of islands and sand banks, and impacts on the riparian vegetation and aquatic fauna. The long-term trend is for the gradual carry-over of the accumulated material in the downstream bed, thus characterizing a medium to long-term process.

Regarding the sections affected by the works, particularly the main watercourses, there are deposition plains, which naturally favour the accumulation of materials. The floodplains identified near Lunguya and close to the Uganda border are examples of it.

In mountainous relief forms characterized by steep slope, first and second order tributaries present sections of rapids with relief breaks and high vertical gradient, a factor that favours sediment transport, particularly during the onset of rainfall.

Opening new accesses is one of the actions considered to have the greatest impact potential foreseen during the Project's construction phase. The effects will depend on the design of the projects, the planning of the work, the vulnerability of the terrains, and the preventive and control measures to be taken.

If this impact occurs, the affected watercourses tend to recover their equilibrium profile after the sediment inflow has ceased, with the accumulated material in the bed gradually being carried over to downstream stretches, thus characterizing a long-term process. A direct relationship can be established between the intensity of the impact and its recovery, the latter being longer in critical situations.

Mitigation Measures

The preventive, control, and mitigating measures proposed for this impact are listed in **Table 9.0.a** of **Chapter 9.0**.

It is unlikely that siltation processes will develop during the operation phase. However, in the context of **Maintenance and Erosion Control**, information about their occurrence will be possible, requiring the application of the relevant measures to contain such processes.

Rating of the resulting impact

From the characteristics presented in the impact analysis, it can be seen that, for the Project in question, the intensity of this process will be small, provided that the preventive and mitigating measures indicated in **Table 9.0.a** are applied, and reversible by natural processes. Only in very critical cases, should corrective actions be taken to remove

material from the bed and restore the original morphology.

It can be concluded from the above that the effective siltation of watercourses is a potential impact of the construction phase, with a low probability of occurrence, a negative nature, DAI coverage, and indirect incidence, whose manifestation is short-term and duration is medium-term. This impact is a reversible and preventable when appropriate measures are applied. This impact has no cumulative or synergic characteristics. The magnitude and importance are low, and, because it is fully mitigable, the residual importance remains low.

Impact Qualification (attributes) Siltation of watercourses			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Indirect
Temporality (Induction)	Immediate	**Temporality (Duration)**	Medium term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Fully Mitigable		
Residual Importance	Low		

3. Impacts on Groundwater Resources

3.01 – Alteration of groundwater quality

Impacting actions	A.2.02 Mobilization of building sites A.2.08 Execution of the earthworks in the substations area A.2.09 Excavation and installation of grounding loops in the substations area A.2.10 Execution of the foundations of the towers A.2.13 Operation on building sites
Impacted Component	C.1.03 - Groundwater Resources

Analysis of the potential impact

Similar to the previous impact, groundwater will be subject to the risk of contamination during the TL implementation phase due to possible domestic effluent and sewage infiltration.

In addition, any accidents with fuels or other toxic loads during construction without proper containment techniques may cause localized problems of water table contamination.

As shown in the baseline section, the most vulnerable areas to these kinds of impacts are those constituted of recent deposits of fine clastic sediments, as those located along the river floodplains. Of particular note is the extensive deposit intercepted by the E-W route

at Shinyanga, near Solwa ward.

Most of the alignment overlaps with crystalline lithologies, which define low-permeability aquifer systems. The constituent rocks characterize a fissural aquifer, whose recharge is limited to open and interconnected fractured zones.

At the extremes of the N-S alignment, that is, where the Kyaka Substation and Uganda border are located, there is an unconsolidated intergranular aquifer system, which is also subjected to groundwater quality alteration. Due to its high porosity, it can be considered more vulnerable to contamination.

Along the entire alignment, floodplains are also intercepted, where the water table is close to the surface, making these areas equally vulnerable.

In addition, accidental leaks during construction should always be identified immediately, and environmental measures should provide immediate corrective action in such cases.

During operation, contamination is mainly due to accidental leaks of oils and grease from transformers or even accidents with hazardous products. At this stage, however, the amount of contaminant materials to be handled will be small, and the possibility of aquifer contamination is very remote.

Mitigation Measures

Table 9.0.a of **Chapter 9.0** lists the main measures to be taken in case of favourable conditions for groundwater contamination.

Rating of the resulting impact

Assuming the measures proposed in **Table 9.0.a** are adopted, contingency actions, including spill containment and removal of any contaminated soil, are expected to avoid any risk of groundwater quality deterioration.

This impact is indirect, negative, with a low probability of occurrence and short-term induction. However, if it occurs, it should have a medium-term duration. Although feasible, it is a partially reversible impact. It is non-cumulative and non-synergic. The magnitude is low, and the importance is high. It is highly mitigable, reducing residual importance to low.

Impact Qualification (attributes) Alteration of groundwater quality			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction / Operation	**Form of incidence**	Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Medium term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Moderate		
Mitigability	Highly Mitigable		
Residual Importance	Low		

4. Impacts on Air Quality

4.01 - Change in air quality during construction

Impacting actions	A.2.02 Mobilization of building sites A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Execution of the earthworks in the substations area A.2.09 Excavation and installation of grounding loops in the substations area A.2.10 Execution of the foundations of the towers A.2.13 Operation on building sites
Impacted Component	C.1.04 - Air Quality

Analysis of the potential impact

This impact is mainly associated with dust suspension and air pollutant emissions from mobile sources.

Dust suspension constitutes an impact resulting from land clearing and earthmoving activities for the execution of tower foundations, implementation of Substations, and implementation of new accesses and building sites, if necessary. It is also associated with the circulation of vehicles on unpaved roads. At the camp sites, dust suspension can also occur due to constant vehicle traffic to access their facilities.

Atmospheric emissions from mobile sources result from the use of vehicles and equipment (generators, tractors, backhoes, etc.) on the work fronts, camp sites, and during the transportation of materials along the roads to be used for the works of implementation of the TL and Substations. Combustion of hydrocarbon derivatives generates emissions of sulphur oxides, nitrogen and carbon dioxide, and carbon monoxide. In this case, the impact potential is related to the maintenance conditions of these vehicles and equipment, determining negative effects on local air quality.

With regard to dispersion conditions, it is important to note that during the rainy season, i.e., from late spring and throughout the summer, the circulation in the lower troposphere

and the high relative humidity of the air facilitate the dispersion of pollutants. Looking at the annual rainfall totals, it can be inferred that in the N-S portion of the route, the dispersion conditions are better than at the western end of the line (Shinyanga), where the annual totals do not reach 1000 mm of rain.

With regard to the average maximum winds, it can be seen that between May and November, the values oscillate between 9.0 and 10.0 m/s approximately in Shinyanga and Lunguya, and between 4.5 and 7.0 m/s in Nyakanazi and Kiaka. The region near Nyakananza has the lowest average gusts recorded.

With regard to wind direction, the entire route experiences a predominance of ESE and SE winds. W, WSW, and NW winds are the least intense throughout the year.

Regarding this factor, it is important to highlight its importance in terms of dispersion conditions, such as identifying areas most susceptible to nuisance due to changes in air quality, since the tendency is to transport pollutants in the opposite direction.

Considering that the earthmoving activities, which are the main generators of particulates, should occur preferentially in winter (dry season), it appears that the areas with the greatest potential to receive impacts are located in the locations of the new Substations, where more intense earthmoving activities will take place.

On the edges of mountainous reliefs, the presence of advection of the mountain-valley-mountain type is not excluded, where daily wind oscillations may contribute to the dispersion of pollutants.

Regarding Greenhouse Gas (GHG) emissions, it should be noted that emissions from stationary combustion sources, such as diesel generators used on camp sites, and mobile combustion sources, like vehicles used for transporting materials and workers, were evaluated as the main sources. Additionally, it is likely that emissions resulting from land-use changes, which involve the removal of native vegetation for the installation of project infrastructure, as well as emissions associated with the treatment and disposal of effluents generated during operations, are also important factors that should be considered. All these emission sources, stationary, mobile, and those from effluents, were assessed.

Considering a one-year period, preliminary modelling indicated that CO_2 emissions from stationary combustion totalled 6,057.72 tons, while mobile combustion generated 1,816.20 tons of CO_2. Methane (CH4) and nitrous oxide (N_2O) emissions were lower, with 0.28 tons of CH_4 and 0.06 tons of N_2O from stationary combustion, and 0.13 tons of CH_4 and 0.10 tons of N_2O from mobile combustion. Land-use change resulted in the highest emissions, with 342,062.85 tons of CO_2. The total CO_2 equivalent (CO2e) emissions for Scope 1 amounted to 350,070.46 tons, highlighting the significant impact of construction and operation activities on the project's total GHG emissions.

Mitigation Measures

The measures proposed for the prevention, control, and mitigation of this impact are listed in **Table 9.0.a** of **Chapter 9.0**:

Rating of the resulting impact

Considering the application of measures proposed in **Table 9.0.a**, this negative impact has a direct and restricted impact on the DAI and its surroundings (to include population that inhabits access margins to be used by construction vehicles), being of immediate and short-term induction. It is an impact considered highly likely to occur, but fully reversible. This impact has no cumulative or synergic characteristics. The magnitude and importance are low, and the residual importance remains low because it is fully mitigable.

Impact Qualification (attributes) **Change in air quality during construction**			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	High
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Fully Mitigable		
Residual Importance	Low		

8.2.3.2
Biological Environment

5. Impacts on Flora and Vegetation

5.01 - Loss of vegetation cover and reduction of individual plants

Impacting Action	A.2.02 Mobilization of building sites A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.3.03 Inhibition of secondary regeneration of native vegetation in the wayleave
Impacted Component	C.2.02 – Flora and Vegetation

Analysis of the potential impact

The main impacting action on flora and vegetation will be vegetation and land clearing (A.2.04), which will be required mainly to open the wayleave, expand the SS and accesses (where necessary). To reduce this impact, the vegetation clearing will occur along a 14-meter-wide strip (service strip) in the centre of the wayleave for launching the cables, not

in the entire wayleave of 52 meters. Where the topography allows, the service strip will also be used to access the towers, minimising the need to open new accesses outside the wayleave. As shown in **Table 8.2.3.2.a** below, this measure will allow a reduction of 73% in vegetation clearing, reducing from 1,110.97 hectares to 300.37 hectares.

Table 8.2.3.2.a
Comparison of vegetation clearing before and after the reduction measure

Class	DAA (52 m strip for the entire project)		DAA (52 m strip for arable and 14 m strip for native formations)	
	Hectares	%	Hectares	%
Native formations	**1,110.97**	**39%**	**300.37**	**14.75%**
Miombo woodland	915.2	32%	246.86	12.12%
Mixed woodland	54.35	2%	15.13	0.74%
Thicket bushland/shrubland	40.83	1%	18.11	0.89%
Grass-wooded savanna	67.32	2%	11.24	0.55%
Evergreen dry forest	4.57	0.2%	1.23	0.06%
Riverine forest	12.6	0.4%	3.46	0.17%
Riverine grassland vegetation	16.1	1%	4.34	0.21%
Modified habitats	**1,736.37**	**61%**	**1,736.37**	**93%**
Anthropic area	426.73	15%	426.73	20.95%
Cyclical agriculture	1,142.19	40%	1,142.19	56.08%
Perennial agriculture	80.67	3%	80.67	3.96%
Silviculture	47.81	2%	47.81	2.35%
Rural buildings	16.7	1%	16.7	0.82%
Substation	3.17	0.1%	3.17	0.16%
Unpaved road	16.83	1%	16.83	0.83%
Paved road	2.27	0.1%	2.27	0.11%
Water bodies	**4.17**	**0.1%**	**4.17**	**0.06%**
Total	**2,851.51**	**100%**	**1,871.55**	100%

The camp sites will be located preferentially in already anthropized areas. However, the need to cut native vegetation for their implementation is not discarded.

The state of conservation of the vegetation varies greatly along the TL. The Ibadakuli-Nyakanazi section passes through the Shynianga and Geita regions, areas of intense human occupation. Most of the route of the TL passes through areas of urban and rural occupation, agricultural plantations, and pastures. The native vegetation along this stretch is characterised by thicket bushland/shrubland and mixed miombo woodland, predominantly herbaceous shrub vegetation, with sparse trees. However, the native vegetation is quite isolated and shows intense signs of anthropisation, mainly deforestation and plant extraction for mining and firewood. Even the areas around the watercourses are dominated by agriculture. The most expressive remnants of native vegetation in this stretch are in the Isonda region, where a chain of hills stretches north-south as far as Segese (**Figure 8.2.3.2.a**). As this is an elevated area, establishing crops and pastures is more difficult, and the native vegetation has been preserved. However, in this region, the route of the TL was designed to pass through lower areas occupied by agriculture.

Figure 8.2.3.2.a
TL Nyakanazi – Ibadakuli, most expressive remnants are marked with the black polygon

Source: Google Earth image

In the far west of the stretch, where the TL will pass through the Biharamulo Forest Reserve (**Figure 8.2.3.2.b**), the miombo vegetation is in a better state of conservation. The arboreal vegetation is denser on the river's banks, with a more closed canopy. The main species recorded on this stretch include *Combretum pisoniiflorum, Brachystegia spiciformis, Julbernardia globiflora,* and *Pterocarpus angolensis*.

The region is also heavily anthropised in the stretch between Nyakanazi and near the Nyakananza area. Remnants of native vegetation in this area are more abundant and in a better state of conservation state, especially in areas of more rugged terrain and near watercourses. On this stretch, the TL Nyaka – Nyakanasi will pass close to the B3 highway and the TL Nyakanazi-Benaco (existing), minimising the need for suppression (**Figure 8.2.3.2.c**).

Figure 8.2.3.2.b
TL Kyaka - Nyakanazi, interception with the Biharamulo Forest Reserve (black polygon)

Source: Google Earth image

Figure 8.2.3.2.c
TL Kyaka - Nyakanazi stretch of parallelism with the existing Transmission Line Nyakanazi-Benaco

Source: Google Earth image

The Kyaka - Nyakanazi stretch passes through areas of Miombo vegetation in a good state of conservation, part of which is within Burigi-Chato NP. In this stretch, the alignment will be constructed in parallel with the TL Benaco-Kyaka, which is under construction, and in parallel with the B182 road (see **Figure 8.2.3.2.l**, item 8 – Impacts on Critical Habitats). The species most present in this region include species from the Combretum genus, such as *Combretum collinum, Combretum apiculatum,* and *Combretum zeyheri*, *Parinari curatellifolia,* and *Maytenus undata.*

Reducing native vegetation cover will result in the cutting of individual plants and will, therefore, reducing the local floristic diversity. It may even result in cutting individuals of endangered species, besides generating other direct and indirect impacts on flora and fauna, which will be discussed later.

During the flora survey carried out in the project's DAI, the following species were recorded: *Euphorbia hubertii*, classified as endangered (EN) by the IUCN, *Dalbergia melanoxylon*, classified as near threatened (NT), and *Pterocarpus angolensis*, included in Appendix II of CITES. Although these species are endangered, they are not restricted to the project area and occur in other parts of the country and Africa, including inside protected areas.

Although vegetation suppression causes population reduction locally, implementing the Project will not directly cause the extinction of endangered species. However, the reduction in population size of a species acts to decrease the genetic variability of populations, leading to loss of adaptive capacity and population decline (MURAWSKY & HAMRICK, 1992; MURAWSKY, 1995 *apud* MANTOVANI *et al.,* 2012). The reduction in genetic variability occurs due to loss of diversity and difficulties in allelic exchanges due to fragmentation (MANTOVANI *et al*., 2012).

Mitigation Measures

Some measures are proposed in ESMP plans and programs to reduce the inevitable negative effects of vegetation cover loss, which are listed in **Table 9.0.a** of **Chapter 9.0**.

Qualification of the resulting impact

Considering the correct implementation of the programs and measures listed in **Table 9.0.a**, this impact was considered high magnitude and high significance, given the extent of the TL and that part of the vegetation clearing will occur in protected areas.

It is characterized as negative, with a geographic impact on the DAA, and occurs mainly in the Project implementation phase but also in the operational phase. It has direct incidence, immediate induction, and permanent duration. It is irreversible, with a certain probability of occurrence (see Table below).

The impact mitigation was classified as moderate, since measures are proposed to compensate for these impacts, for example, through compensatory planting and restoration of degraded areas. However, developing the restoration areas and

compensatory planting will take a few years before they can meet the ecological needs of the impacted biodiversity values, which results in a medium residual importance.

Impact Qualification (attributes) Loss of vegetation cover and reduction of individual plants			
Vector (Nature)	Negative	**Geographical Coverage**	DAA
Occurrence Phase	Construction/ Operation	**Incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Permanent
Reversibility	Irreversible	**Probability of Occurrence**	Certain
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Significance			
Magnitude	Medium		
Importance	High		
Mitigability	Moderately Mitigable		
Residual Importance	Medium		

5.02 - Increased landscape fragmentation and edge effect incidence

Impacting Action	A.2.02 Mobilization of building sites A.2.04 Vegetation clearing A.2.06 Implementation / improvement of accesses A.3.03 Inhibition of secondary regeneration of native vegetation in the wayleave
Impacted Component	C.2.02 – Flora and Vegetation

Analysis of the potential impact

For the Project's implementation, vegetation suppression will be necessary during the construction phase, which entails the interception of patches of native vegetation. In addition, during the operation phase, vegetation management will be carried out in the wayleave to maintain a safe distance between the vegetation and the TL. Thus, where the wayleave intercepts native vegetation patches, natural regeneration will be impeded throughout the Project operation, resulting in permanent fragmentation maintenance. The same will happen with the opening of permanent access.

Fragmentation of continuous habitats can segregate animal and plant populations and disrupt gene flows due to the "barrier effect" (FORMAN & GODRON, 1986; FORMAN & ALEXANDER, 1998). Studies show that area reduction, and often isolation, affect the structure, composition, richness, and diversity of forest patches and interfere with population dynamics and reproductive capacity (BERNACCI *et al.*, 2006).

Fragmentation can also indirectly cause changes in the remaining adjacent vegetation. By creating new borders on the affected patches of vegetation, the so-called "edge effect" can be widened. Changes in the microclimate, structure, and dynamic processes of vegetation can render the environment inhospitable for many species of organisms and

favour the establishment of species characteristic of open areas (TABARELLI *et al.*, 1998 *apud* SCARIOT *et al.*, 2003). The extent of the edge effect depends on factors such as fragment area and shape, landscape characteristics (METZGER & SIMONETTI, 2004), or edge structure and density (DIDHAM & LAWTON, 1999). In isolated patches with a high edge/interior ratio, succession may be retrograde, leading to poor patches dominated by a few early pioneer and secondary species.

Vegetation fragmentation will be inevitable in this project. It will cause landscape change in a considerable part of its alignment, forming smaller patches of vegetation and/or reducing connectivity among other things. The most affected section will be on the Kyaka - Nyakanazi stretch, in the region of Kagera, where vegetation cover is more continuous and less disturbed.

However, although the opening of the service strip (14 m wide) may influence the displacement or dispersal of some species, the disruption of corridors or segregation of animal and plant populations is expected to occur at a lower density because Miombo vegetation, dominant in the Project's alignment, is already considerably open. However, in addition to other factors, such as the parallelism of the Project's wayleave with the wayleave of existing lines, these effects can be intensified.

On the stretch Nyakanazi – Ibadakuli, the creation or enlargement of border effects should be insignificant, since the vegetation of the regions crossed by the alignment is already largely altered and, in several parts, fragmented. Most vegetation is secondary, and the degree of human disturbance in vegetation ranges from moderate to high.

The predominant vegetation type in the Project's alignment is Miombo Woodland, which has an open physiognomy, with sparse arboreal individuals and without canopy formation. Thus, the indirect impacts resulting from fragmentation should have minor effects, but may be more significant in some places, varying according to the type of vegetation and the conservation status of the fragment, its size and shape, and the matrix in which it's inserted.

Mitigation Measures

Although landscape fragmentation is an inevitable impact, given the project's characteristics, it can be minimized and mitigated. **Table 9.0.a** of **Chapter 9.0** lists the full list of measures proposed to prevent, mitigate, and compensate for this impact.

Qualification of the resulting impact

Considering the application of the ESMP measures listed in **Table 9.0.a**, this impact will have a medium magnitude and medium significance. Once again, these attributes are classified based on the vegetation degradation characteristics observed along the alignment in general, and because much of the TL alignment is parallel and contiguous to an existing TL, and near roads.

This impact is negative, has geographical coverage in and around the DAI, occurs in the implementation and operation phase, and has direct and indirect incidence. Its induction is immediate, permanent, irreversible, and with a certain probability of occurrence (see Table below).

Impact Qualification (attributes) Increased landscape fragmentation and edge effect incidence			
Vector (Nature)	Negative	**Geographical Coverage**	DAI
Occurrence Phase	Construction/ Operation	**Incidence**	Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Permanent
Reversibility	Partially reversible	**Probability of Occurrence**	Certain
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Significance			
Magnitude	Medium		
Importance	Medium		
Mitigability	Moderately Mitigable		
Residual Importance	Medium		

6. Impacts on Fauna

6.01 - Disturbance of fauna during construction

Impacting actions	A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Earthworks in the substation area A.2.09 Excavation and installation of grounding mesh in the substation area A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities A.2.16 Recovery of direct intervention areas
Impactable component	C.2.02 – Fauna

Analysis of potential impact

Disturbance to fauna during construction is related to the increase in noise caused by construction activities, especially the removal of vegetation in the area of the service strip and the new accesses, the installation of the towers and the launching of cables, as well as the increased movement of people in the forested, savannah, and alluvial areas located at the accesses to the camp sites.

This disturbance will scare away wild animals present in the areas of influence, which differs from the prior targeted and synchronised scaring to be carried out as part of the

P.07 - Fauna and Flora Rescue and Relocation Plan, which aims to prevent accidents with fauna during vegetation clearing activities.

The more preserved stretches, such as savannah environments, alluvial areas, and forested areas, will experience more fauna disturbance than the more disturbed and anthropogenic areas along the TL Nyakanazi - Ibadakuli. In addition, due to the density of workers, fauna disturbance will be greater in the areas where campsites are set up, and also at the campsites during the execution of services on the home stretch.

Wild animals that are more sensitive to environmental disturbances, such as Leopard (*Panthera pardus*), Common African Pangolin (*Phataginus tricuspis*), Ground Pangolin (*Smutsia* cf. *temminckii*), African Savanna Elephant (*Loxodonta africana*), Large-eared Giant Mastiff Bat (*Otomops martiensseni*), Tawny Eagle (*Aquila rapax*), Hooded Vulture (*Necrosyrtes monachus*), Bateleur (*Terathopius ecaudatus*), Grey Crowned Crane (*Balearica regulorum*), etc., may be scared away by the increase in local noise, which increases the risk of these and other species of fauna being run over on the access roads to the works.

Mitigation Measures

The programmes and respective measures related to preventing and mitigating this impact are listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

With the correct application of the programmes and measures listed in **Table 9.0.a**, this impact is considered to have the following classification: negative, restricted to the DAI, occurring during the construction phase, direct, immediate, and ending at the end of the action. It is reversible, with a high probability of occurrence, non-cumulative, and synergic. The magnitude and importance are low, and the residual importance is kept low because it is highly mitigable.

Rating of the impact (attributes) Disturbance of Fauna During Construction			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Ends at the end of the action
Reversibility	Reversible	**Probability**	High
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Highly mitigable		
Residual Importance	Low		

6.02 - Reduction of natural habitats

Impacting actions	A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.08 Earthworks in the substation area A.2.09 Excavation and installation of grounding mesh in the substation area A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables
Impactable component	C.2.02 – Fauna

Analysis of potential impact

As mentioned, the vegetation clearing and construction activities for the TLs will cause the loss of natural environments. Therefore, some species of fauna, especially those that are more demanding in terms of habitat quality, could be affected.

The opening up of the 14-metre-wide service strip for the installation of the TL (to be used as access and for launching the cables) and the selective pruning that will be carried out on the rest of the 52-metre-wide wayleave tend to increase forest fragmentation along the route. However, when analysing the landscape along the entire length of the TLs' route, it can be seen that along the 400 kV Nyakanazi - Ibadakuli TL, which runs in a west-east direction, despite the greater anthropogenic influence, specifically between the districts of Shinyanga and Kakola, there are still small forest fragments considered to be corridors for the fauna with forest habits.

Corridors for fauna are essential for maintaining of migration routes and connections between fragments and Protected Areas. The maintenance, conservation, and protection of fauna corridors enhances the gene flow, avoids the isolation process of populations, and helps species to keep their biological interactions (BEIER & GREGORY, 2012; BERGER & CAIN, 2014). The northwestern areas (e.g. BS1, BS2, BS3, BS4, BS5, BS6), which reunite most of the mammalian species detected through standardised sampling, including those that are migrant, can be examples. An analysis of the current landscape by stretch of TL is presented below to assess this impact. Figures representing the analysed stretch and the preferred route of the TL (in black) are presented throughout the text.

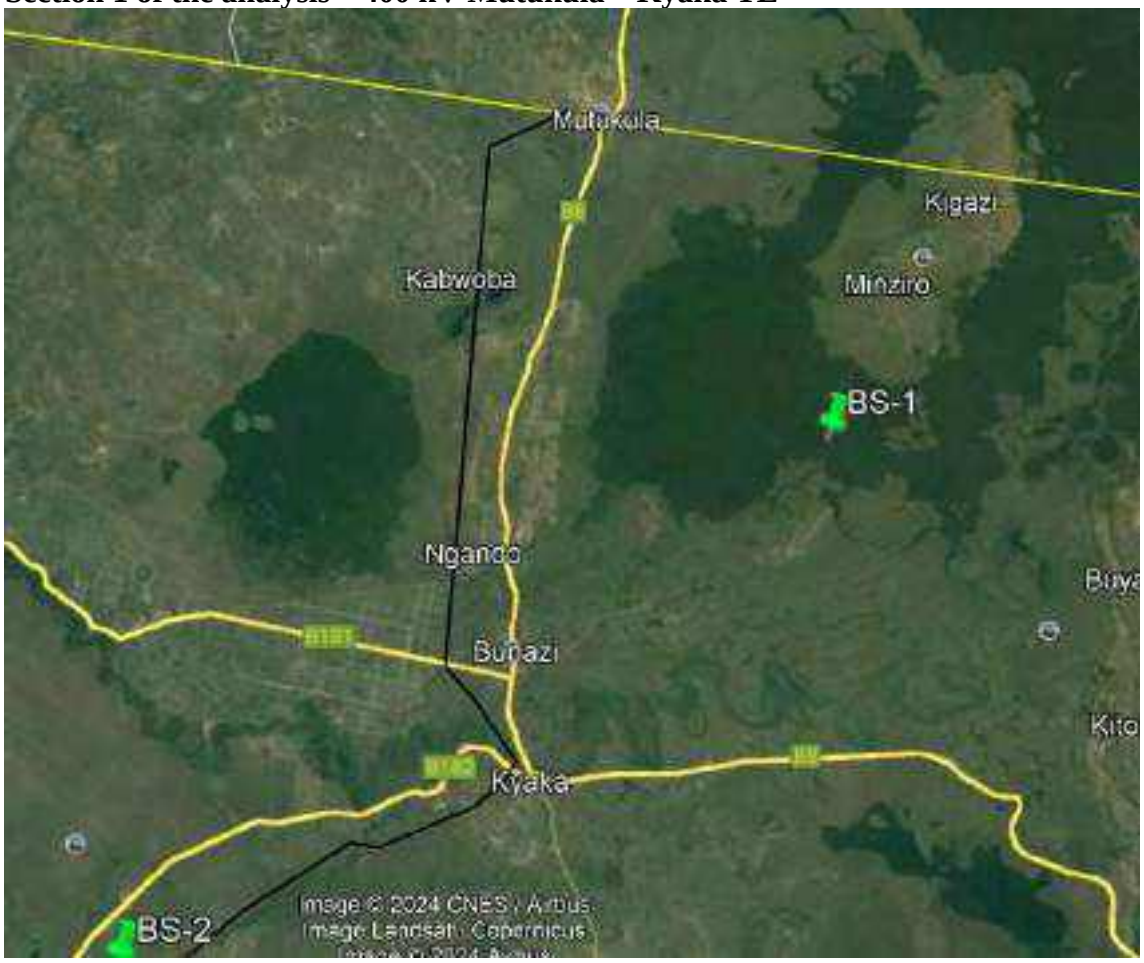
The first section analysed (Section 1) corresponds to the 400 kV Mutukula - Kyaka TL, as shown in **Figure 8.2.3.2.d**. The preferred route is between two large forest fragments characterised by Wooded Grassland vegetation, with a predominance of plant species such as *Acnathus sp* and *Flueggea virosa.*

The results of the Fauna Baseline (BS1 sampling area) in this stretch indicated a high diversity of fauna, mainly species associated with humid environments such as birds (*Plectropterus gambensis, Anastomus lamelligerus, Ciconia microscelis, Mycteria ibis, Centropus superciliosus, Butorides striata, Scopus umbretta, Threskiornis aethiopicus, Microcarbo africanus,* etc.) and amphibians (*Sclerophrys gutturalis, Kassina*

senegalensis, *Phrynobatrachus acridoides*, *Xenopus muelleri*, *Xenopus victorianus*, *Nectophrynoides* sp., *Ptychadena nilotica*).

In the rainy season (April 2024), for example, at least 4 individuals of the Grey Crowned Crane (*Balearica regulorum*), considered to be threatened with extinction, were seen in this area, as well as larger bird specimens (*Plectropterus gambensis*). Therefore, in addition to the anuran fauna identified exclusively in this area, such as the species *Xenopus muelleri* and *Xenopus victorianus*, this area may harbour various populations dependent on forest environments, such as African Sacred Ibis (*Threskiornis aethiopicus*), Blue-headed Coucal (*Centropus monachus*), Black-headed Weaver (*Ploceus melanocephalus*), etc.

Figure 8.2.3.2.d
Section 1 of the analysis – 400 kV Mutukula – Kyaka TL



Source: Google Earth (2023)

Thus, reducing natural habitats in this Section 1 due to the implementation of the TL will likely affect the most sensitive wild populations that depend on more preserved and humid environments. This habitat reduction may be more significant for species with less locomotion capacity, such as amphibians (*Sclerophrys gutturalis*, *Kassina senegalensis*, *Phrynobatrachus acridoides*, *Ptychadena anchietae*, etc) and other small terrestrial

vertebrates (*Thryonomys gregorianus, Thryonomys swinderianus*), as well as endangered species such as Angolan Colobus (*Colobus angolensis*) and Ugandan Crested Mangabay (*Lophocebus ugandae*). In addition, it is important to emphasise that in this region, due to the type of forest physiognomy, most of the primates (*Cercopithecus mitis, Chlorocebus pygerythrus, Colobus angolensis, Lophocebus ugandae, Papio anubis*) found in the samples were present. Therefore, the reduction of habitats, especially those with more arboreal vegetation characteristics, could affect this Order, as they depend on these environments.

Despite this analysis, as shown in **Figure 8.2.3.2.e**, the TL's preferred route will not intercept these two forest fragments. Therefore, the habitat loss will be less than if the forest fragments were not preserved.

Photo 01: Detail of birds (*Balearica regulorum, Plectropterus gambensis*) seen in the BS1 area, present in the humid environments.

Photo 02: Detail of the alluvial influence in the BS1 area.

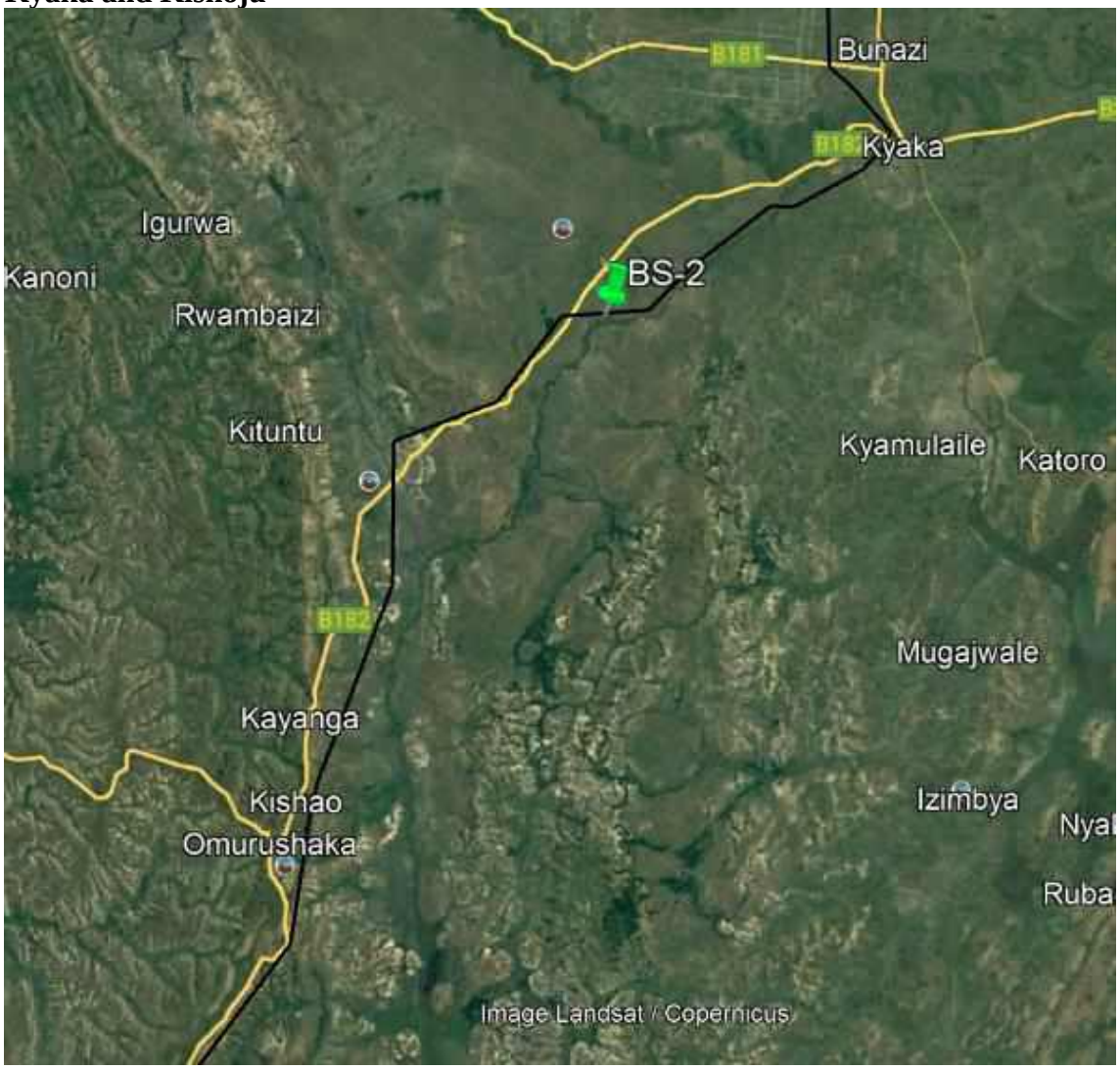
The next section (Section 2) corresponds to the 400 kV Kyaka - Nyakanazi TL, between Kyaka and Kishoju villages (between SE Kyaka and vertex KN-10), as shown in **Figure 8.2.3.2.f**. According to the Flora Baseline, this region is characterised by Evergreen Dry Forest vegetation with a predominance of the plant species *Euclea racemosa* and a predominance of a highly disturbed environment. However, it is possible to notice in this stretch that several continuums of riparian vegetation are immersed in the savannah area. These riparian continuums allow wild animals, preferably from humid environments (e.g., *Haliaeetus vocifer, Centropus monachus, Bradypterus baboecala, Bocagia minuta, Scopus umbretta, Ardeola rufiventris, etc*.) to remain in these areas, thus forming fauna corridors.

According to the Fauna Baseline, the BS2 sampling area, located on this stretch, identified many mammal species such as Impala (*Aepyceros melampus*), Dik-dik (*Madoqua* sp), Cape Bushbuck (*Tragelaphus sylvaticus*), Marsh Mongoose (*Atilax paludinosus*), Bushy-tailed Mongoose (*Bdeogale crassicauda*), Rusty-spotted Genet (*Genetta fieldiana*), Cape Hare (*Lepus* cf. *capensis*) and Vervet Monkey (*Chlorocebus pygerythrus*); as well as birds preferably from forested environments such as *Circaetus cinerascens, Kaupifalco monogrammicus, Caprimulgus pectoralis, Gallirex porphyreolophus, Schistolais*

leucopogon, Laniarius aethiopicus, Oriolus larvatus, Musophaga rossae, etc. The installation of the transmission line parallel to the vegetation corridors will therefore have an impact on animals that travel through these corridors to move between areas, such as larger migratory animals (*Giraffa tippelskirchi, Panthera leo, Panthera pardus, Loxodonta africana*).

Animal movements occur due to the search for feeding, breeding, and resting environments. Thus, during the implementation of the TL, the reduction of natural habitats due to the clearing of the service strip and towers will result in the displacement of animals with greater locomotion capacity, such as mammals and birds, and the loss of individuals with less displacement capacity, such as amphibians, reptiles and small mammals.

Figure 8.2.3.2.f
Section 2 of the analysis – 400 kV Kyaka – Nyakanazi TL, between the villages of Kyaka and Kishoju

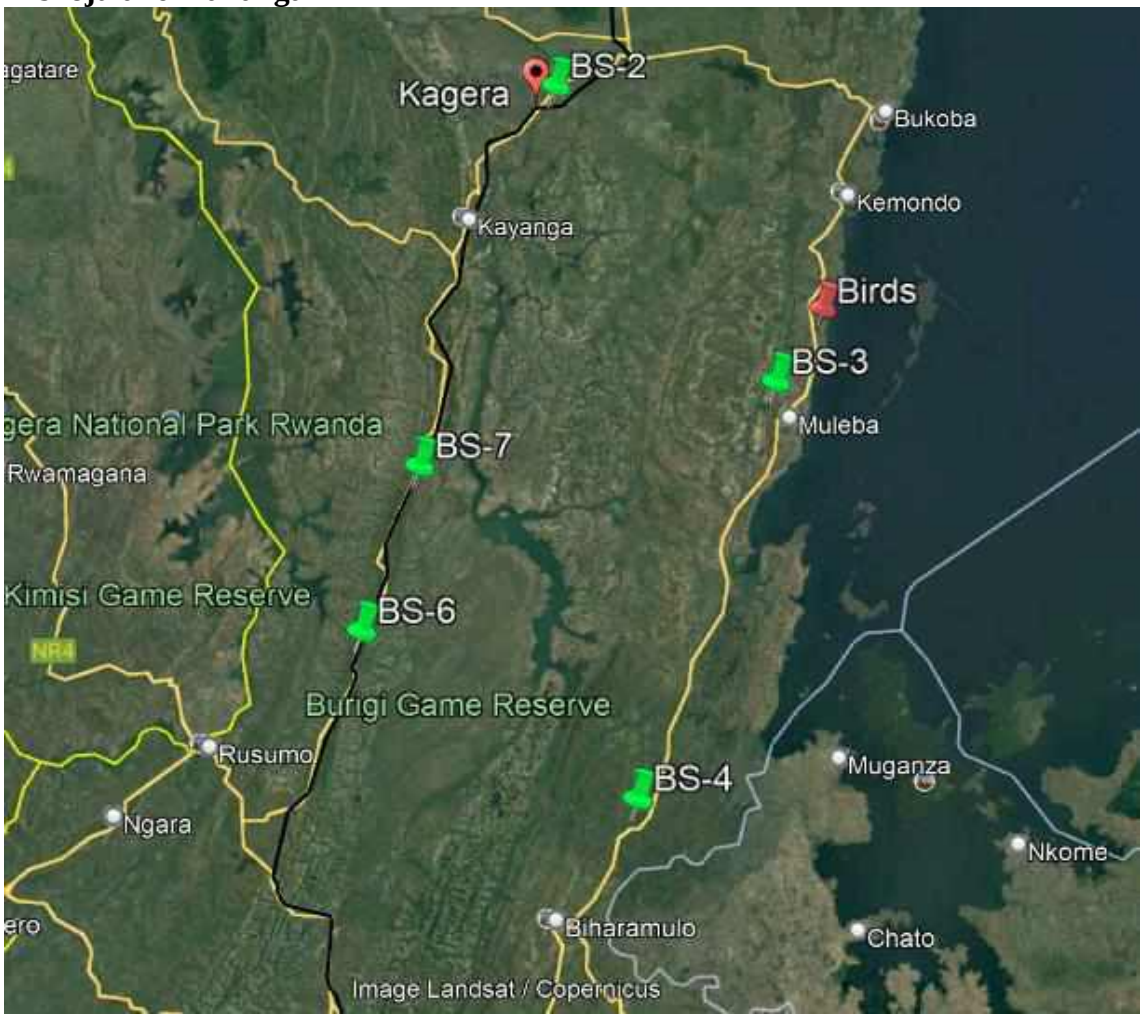


Source: Google Earth (2023)

Although the area surrounding this site is mostly savannah, the vegetation corridors, which are riparian, are of fundamental importance, as they provide shelter and food for many species during the rainy season.

In the next section (Section 3), also on the 400 kV Kyaka – Nyakanazi TL (between vertices KN-11 and KN-18), between Kishoju and Kahanga villages, and around the Burigi Game Reserve, there are three large wetlands characterised by the Kagera Swamps Protected Area, Lake Burigi, and Lake Victoria (**Figure 8.2.3.2.g**).

Figure 8.2.3.2.g
Section 3 of the analysis – 400 kV Kyaka – Nyakanazi TL, between the villages of Kishoju and Kahanga



Source: Google Earth (2023)

Photo 03: Detail of Evergreen Dry Forest vegetation and dirt track used to sample fauna.	**Photo 04:** Detail of the humid environment and typical vegetation, with the possibility of recording animals dependent on humid environments.

The remnants in these areas are mostly characterised by Savannah Woodland vegetation. According to the landscape analysis and the Flora Baseline, this stretch is one of the best-preserved regions along the TL route.

The area also has two IBAs (*International Bird Areas*) in its surroundings, known as Minziro Forest Reserve and Burigi Biharamulo Game Reserve, as well as Lake Burigi and Lake Victoria. According to secondary data surveys, these Protected Areas are home to a high diversity of wild vertebrates. Fauna sampling in zones BS4 and BS6 identified several species, including endangered vertebrates such as African Savanna Elephant (*Loxodonta africana*), giraffe (*Giraffa tippelskirchi)*, lion (*Panthera leo*), leopardo (*Panthera pardus*), Ashy Red Colobus (*Piliocolobus tephrosceles*), Bateleur (*Terathopius ecaudatus*), etc., as well as endemic species such as Ashy Red Colobus (*Piliocolobus tephrosceles*) and Maasai Giraffe (*Giraffa tippelskirchi*).

Therefore, when assessing the impact of habitat reduction in this stretch, it can be concluded that it will be significant, since these areas are known as ecological corridors. In addition, this region has been classified as Critical Habitat (see **Section 7.2.4**), thus potentiating the impact of the reduction in natural habitats.

According to Beier & Gregory (2012) and Berger & Cain (2014), many vertebrate species such as elephants (*Loxodonta africana*) and *giraffes (Giraffa tippelskirchi*), as well as migratory birds (*Clamator glandarius, Cinnyricinclus leucogaster, Apus affinis*), move through these areas. Therefore, the implementation of linear structures such as the TLs has the potential to cause habitat loss and disruption of corridors and connections (RICHARDSON *et al*., 2017).

Benítez-López *et al*. (2010) detected that mammal population densities tend to decline with their proximity to human infrastructure, especially in open landscapes. This pattern is more evident for the medium and large-sized mammals, which depend more on landscape connectivity and present larger home ranges than small mammals.

In this way, reducing natural environments could alter the movements of many fauna species during construction. Despite this, significant population reductions are not expected, but rather an influence on the ecological factors of these populations, i.e., some populations will avoid the areas with environmental disturbances due to the LT works and will start to use other areas, thus affecting other populations of the same species.

The literature has not recorded any agglomerations of birds with semi-aquatic habits in the wetlands near this stretch. These environments allow many preferentially alluvial specimens, such as birds and amphibians, to remain in the region. Thus, reducing wetland environments could impact associated animals due to the loss of resting, breeding, and feeding environments.

Photo 05: Detail of the vegetation in the fauna area BS 6.

Photo 06: Detail of the rocky outcrop located in area BS4.

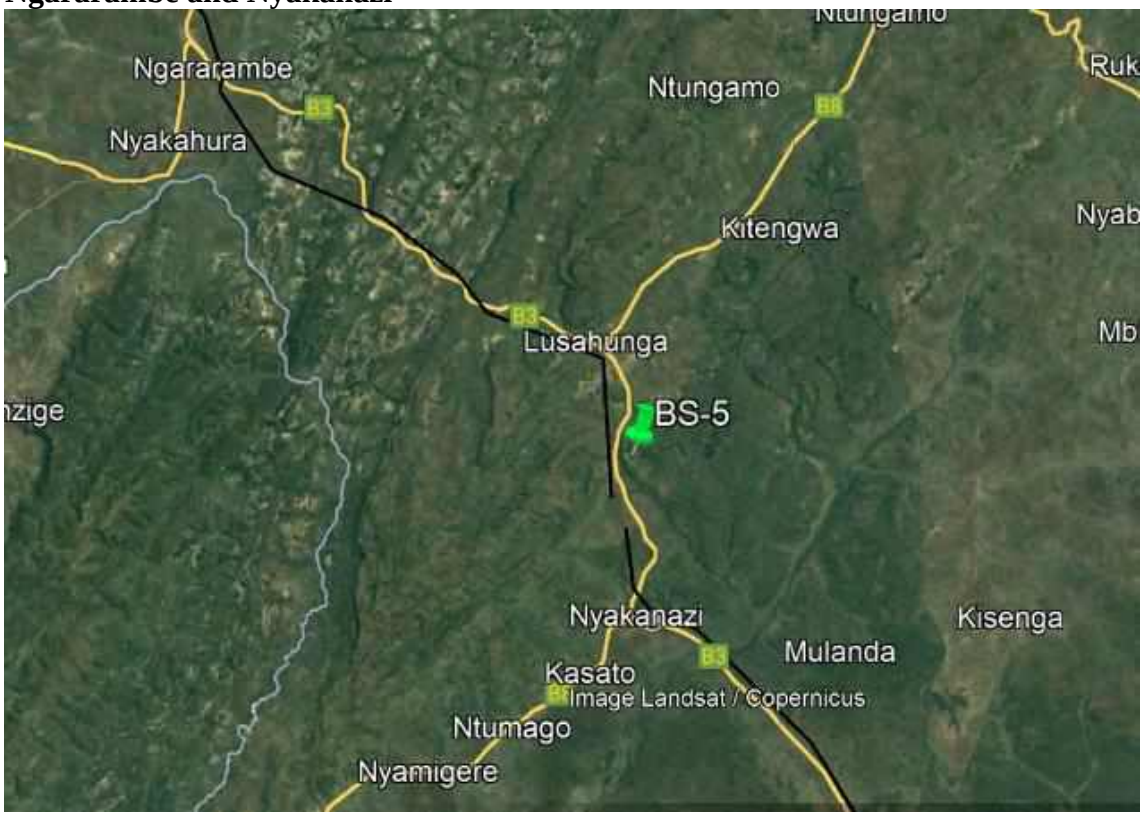
The next section to be analysed (Section 4) covers the remainder of the 400 kV Kyaka - Nyakanazi TL, between the villages of Ngararambe and Nyakanazi (**Figure 8.2.3.2.h**). According to the landscape, the continuum of riparian vegetation is still visible on this stretch. To the south of the LT 400 kV LT Nyakanazi - Ibadakuli, there is the Kigosi Game Reserve.

The BS5 fauna and flora sampling area was set up along this stretch, with Open Miombo Woodland vegetation characteristics. In terms of fauna, hundreds of species of vertebrates were identified, including migratory bird species such as Tawny Eagle (*Aquila rapax*), Black Kite (*Milvus migrans*), White-headed Saw-wing (*Psalidoprocne albiceps*) and Violet-backed Starling (*Cinnyricinclus leucogaster*); medium and large mammals (*Madoqua* sp., *Caracal caracal, Atilax paludinosus, Papio anubis, Piliocolobus tephrosceles);* and many species of herpetofauna (*Sclerophrys gutturalis, Agama mwanzae, Trachylepis maculilabris, Philothamnus hoplogaster, Naja haje, Dendroaspis polylepis, Python sebae*).

Most of this stretch has small villages, dirt, and pavement access roads. As such, the reduction in habitats due to implementing the TL will not be as significant for the fauna. Other impacts associated with increased light, noise, hunting, etc., are described separately below. What should be considered in this Section 4 is that fauna is already

somewhat accustomed to disturbed environments, and therefore the reduction in natural habitats occurred some time ago.

Figure 8.2.3.2.h
Section 4 of the analysis – 400 kV Kyaka – Nyakanazi TL, between the villages of Ngararambe and Nyakanazi



Source: Google Earth (2023)

Photo 07: Detail of vegetation located in the fauna area BS5.

Photo 08: Detail of the vegetation located in the area BS5 (Open Miombo Woodland).

The next section (Section 5) corresponds to the 400 kV Nyakanazi - Ibadakuli TL route, which runs in a west-east direction (**Figure 8.2.3.2.i**). The BS8 and BS9 fauna and BS8,

BS9, and BS10 flora sites are located along this TL. According to the Flora Baseline, the region is highly anthropized. The field inspections identified that trees are being burnt for charcoal production and other human interests. The region also suffers from hunting. This impact has also been observed in the Burigi-Chato Park area, but with greater intensity in the areas that are not inspected.

Figure 8.2.3.2.i
Section 5 of the analysis – 400 kV Nyakanazi – Ibadakuli TL

Source: Google Earth (2023)

In this way, the reduction of natural habitats along the 400 kV Nyakanazi - Ibadakuli TL will be an impact of lesser importance, since various anthropogenic actions currently characterise this region and certainly the remaining fauna in this region is represented by animals with more general habits and a wide distribution, such as *Terathopius ecaudatus, Caprimulgus pectoralis, Cisticola natalenses, Crithagra mozambica, Turdoides jardineii, Laniarius funebris, Lamprotornis chalybaeus, Aquila rapax, Crithagra mozambica, Turdoides jardineii, Laniarius funebris,* etc.

As already mentioned, this is the most anthropized stretch intercepted by the Project's TLs, with several villages present and alterations that occurred decades ago. As such, the works to install the TL, including the opening of the service strip and the construction of the towers, will have a lesser impact than on the forested areas that exist on the TLs in the north-south direction.

Finally, it is important to note that transmission lines, unlike other linear developments such as roads and railways, allow fauna to travel under the cables.

Mitigation Measures

Table 9.0.a of **Chapter 9.0** lists the programmes and measures designed to prevent and mitigate this impact.

Rating of the resulting impact

Considering the implementation of the measures proposed for this impact in **Table 9.0.a**, it is classified as a construction phase impact, negative, restricted to the DAA. It is direct, induced immediately, lasts for a long time, and is irreversible. It has a certain probability of occurrence, is cumulative, and synergic. The magnitude is medium, and the importance is high (due to its long duration and irreversibility). It is moderately mitigable, reducing the residual importance to medium.

Rating of the impact (attributes) Reduction of natural habitats			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Irreversible	**Probability**	Certain
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Moderately mitigable		
Residual Importance	Medium		

7. Impacts on Protected Areas and Internationally Recognized Areas

7.01 – Impacts on Protected Areas and Internationally Recognized Areas

Impacting actions	A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities A.2.16 Recovery of direct intervention areas
Impactable component	C.2.01 - Flora and Vegetation C.2.02 - Fauna C.2.03 - Critical Habitat C.2.04 - Ecosystem Services

Analysis of potential impact

As demonstrated in **Section 7.2.3** the project will directly intercept three Protected Areas, according to the Table below:

Protected area	Internationally Recognized Area	IUCN Category	Interception of the project	Extension of interception (km)
Burigi-Chato National Park	Yes, IBA Burigi-Biharamulo Game Reserve	II	Intercepted by T-line Kyaka - Nyakanazi	65.92
Biharamulo Forest Reserve	No	Not reported	Intercepted by T-line Nyakanazi - Ibadakuli	17.12
Uyovu Forest Reserve	No	Not reported	Intercepted by T-line Nyakanazi - Ibadakuli	0.000137

In the Burigi-Chato National Park (also the IBA Burigi-Biharamulo Game Reserve), the project will run parallel to the existing B182 road, linking the towns of Nyakasanza and Kyaka. The TL will also be constructed in parallel with the existing TL Nyakanazi-Benaco and its future extension to Kyaka (see **Figure 8.2.3.2.l** in item 8).

The project will also cross the Biharamulo Forest Reserve for 17.12 km. This has been designed to take advantage of the existing Transmission Line between. The entire extension of the TAZA project within the Biharamulo Forest Reserve will parallel this existing line and close to the existing Singida-Rusumo Road.

The interception with the Uyovu Forest Reserve is very short (only 137 metres) and can be avoided during project detailing for the implementation phase.

The potential impacts on these areas will be related to vegetation clearing, which will lead to habitat reduction, loss of flora individuals, fragmentation, and risks of bird collisions, already discussed in the other impacts. However, considering the parallelism with the existing infrastructure, these impacts can be minimized by using the existing structure and partial sharing of the right-of-way.

Environmental and social international requirements include restrictions on projects implementation within protected area unless some conditions are met.

Paragraph 26 of World Bank ESS6 states that the activities undertaken in these areas must align with the area's legal protection status and management goals. It also requires assessing and mitigating potential project impacts to prevent harm to the area's integrity, conservation objectives, or biodiversity significance.

Regarding the mitigation strategy, as demonstrated in **Section 8.1** and the next section on impacts on Critical Habitat, it is impossible to avoid passing through the Burigi-Chato National Park, which stretches from the shores of Lake Victoria through the border with Rwanda. Therefore, the project's design was developed with the consideration of minimizing the impacts, as the T-Line will be constructed in parallel with existing infrastructures, as already mentioned above. This strategy will make it possible to optimize the use of the ancillary facilities, such as accesses and camp sites, minimizing the need for vegetation clearing. Other measures to minimize the impacts include

avoiding opening new accesses within the protected areas (prioritizing the use of the wayleave) and reducing the vegetation clearance strip for 14 metres in total in areas with natural habitat. The mitigation and compensation measures are detailed in Annex 13.

Furthermore, paragraph 27 of the World Bank's ESS6 includes some additional requirements that must be met in the case of impacts on protected areas, in addition to those already detailed in paragraphs 13 to 25, which include:

(a) Demonstrate that the proposed development in such areas is legally permitted;

Section 2.9 of the National Policies for National Parks (1994) states that Environmental Impact Assessments are required for major projects within and near national parks to prevent environmental harm.

The Environmental Management Act (2004) establishes the legal framework for Environmental Impact Assessment, tasking the National Environment Management Council (NEMC) with determining whether an Environmental Impact Assessment is necessary, assessing potential environmental impacts, and recommending projects for ministerial approval and certification.

The Wildlife Conservation Act (2009) mandates that significant developments in wildlife-protected areas, buffer zones, and migratory routes must undergo an Environmental Impact Assessment and receive certification before beginning. This act applies to mining, road construction, pipelines, permanent establishments, and infrastructure projects.

Therefore, national legislation does not prohibit the construction of infrastructure projects in Protected Areas, but it does require that any intervention in these areas or their buffer zones be assessed through of an Environmental Impact Assessment and approved by the national competent authorities prior to any intervention.

(b) Act in a manner consistent with any government recognized management plans for such areas; and (c) Consult and involve protected area sponsors and managers, project-affected parties including Indigenous Peoples, and other interested parties on planning, designing, implementing, monitoring, and evaluating the proposed project, as appropriate; and

The intercepted protected areas do not have an approved management plan. However, consultations were carried out during the development of this study, including the Tanzania Forestry Research Institute (TAFORI), Tanzania National Parks (TANAPA), and Tanzania Forest Services Agency (TFS). The consultations included the presentation of the project, identification of important biodiversity values and ecosystem services.

During the consultation process, it was agreed between the parties that the implementation of this project is strategic both nationally and internationally. Although there is no formal consent yet, by the formal procedures of the licensing process, TANESCO, through the Ministry of Energy and the Ministry of Tourism and Natural

Resources, will seek a formal agreement with TANAPA/TFS to enable the start of construction activities. This agreement will include mitigation measures needed to minimize the project's impact, and the compensation measures that TANAPA and TFS deem appropriate.

This process is carried out after obtaining a non-objection from NEMC and the project's sponsors, and before starting the project's implementation.

(d) Implement additional programs, as appropriate, to promote and enhance the area's conservation aims and effective management.

The measures to mitigate and enhance biodiversity values within these areas are detailed in the Biodiversity Programs and Plans presented in **Annex 13**. Additionally, TANESCO will develop an understanding with Tanapa and TFS regarding additional measures to be implemented in the protected areas.

Mitigation Measures

The set of programmes and measures designed to prevent and mitigate this impact is listed in the Biodiversity Management Plan (Annex 13) and includes a **Biodiversity Offset Plan** with goals to achieve biodiversity gains; **Flora Active Search Programme**, to carry out an active search for critical habitat trigger flora species in the area directly affected by the project; an **Ecosystem Services Impact Mitigation Plan**; **Fauna and Flora rescue and Relocation Plan**; **Invasive Species Control Programme**; **Landscape Protection Programme** includes measures to check whether the implementation of the project is causing the expansion of anthropized areas, and identify and prevent illegal activities, informing the competent authorities whenever new deforestation is detected; and the **Operation Biodiversity Management Programme,** including monitoring of fauna and bird collisions and guidelines for developing native vegetation restoration projects.

The **Labour Management Procedures** include environmental and social education for workers.

As detailed in Sectio 6.5 of the BMP (Annex 13), as part of the project approval process, TANESCO and TANAPA/TFS/MNRT will jointly draw up a memorandum of understanding containing the mitigation measures needed to minimize the impacts. This protocol should be formalized once formal approval has been obtained from the NEMC and the project's financial backers. Meanwhile, during the consultations conducted in the EIA process, TANAPA signalled that some of the measures to be requested include support for the establishment of ranger posts in the Burigi-Chato National Park, restoration of degraded areas, staff training, and assistance with the purchase of equipment such as drones for monitoring.

Rating of the resulting impact

Considering the implementation of the measures proposed for this impact, it is classified as a construction and operational phase impact, negative, restricted to the DAI. It is direct, induced immediately, and lasts for a long time, and is partially reversible. It has a certain probability of occurrence, is cumulative, and synergic. The magnitude was increased to medium, and the importance was increased to high, considering that they are protected areas. It is moderately mitigable, reducing the residual importance to medium.

Rating of the impact (attributes) Impacts on Protected Areas and Internationally Recognized Areas			
Vector	Negative	**Location and spatialization**	DAA/DAI
Stage of occurrence	Construction / Operation	**Form of incidence**	Direct and Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Long term
Reversibility	Partially reversible	**Probability**	Certain
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Moderately mitigable		
Residual Importance	Medium		

8. Impacts on Critical Habitat

8.01 – Impacts on biodiversity in critical habitats

Impacting actions	A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.08 Earthworks in the substation area A.2.10 Execution of tower foundations A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities A.2.16 Recovery of direct intervention areas A.3.03 Inhibition of secondary regeneration of native vegetation on the wayleave
Impactable component	C.2.05 – Critical habitats

Analysis of potential impact

As shown in **Section 7.2.4**, the project region was classified as a critical habitat activated by 12 priority biodiversity values. The critical habitat was delimited based on an ecologically appropriate analysis area (EAAA), which considered the ecological characteristics of the CH triggers. The final CH delimitation includes three main areas:

- Minziro Forest Reserve (in Tanzania), and part of the IBA Sango Bay (in Uganda).
- Burigi-Chato National Park, part of the Ruiga River Forest Reserve, the Akagera

National Park and the IBA Kagera Swamps (in Rwanda), and the two ecological corridors that connect these Protected Areas to the Moyowosi - Kigosi Game Reserve.

- Part of the Mwantini Hill Forest Reserve, in the Shinyanga region.

Although there are CH triggers, the Project only directly intercepts the EAAA of the African Elephant *L. africana* (criterion a) and the wildlife corridor delimited for this species (criterion e). The CH triggers are detailed below:

1. Criteria (a) and (b): 7 flora species triggered criteria a and b: *Albertisia exelliana, Blotiella trichosora, Emilia cryptantha, Oxyanthus ugandensis, Thunbergia laborans, Tinnea physalis,* and *Vernonia tinctosetosae*. All are classified as EN or CR and have an EOO of less than 50,000 km². None of the species is exclusive to the project region and also occurs in Uganda, Rwanda and other parts of Tanzania.

   None of the trigger species were found in the DAI field surveys. The species were included through secondary data, and the project does not directly intercept the delineated EAAA. For four of these species, *B. trichosora, E. cryptantha, O. ugandensis,* and *V. tinctosetosa,* the known records for the Project region are in the Bukoba region, close to Lake Victoria, and the preferred ecosystem is associated with humid environments. *A. exelliana* is a shrub that grows in riverine forests. Humid environments and riverine forests represent only 1.2% of the Project's DAI (see **Table 7.2.2.1.4.a** in **Section 7.2.2.1.4**). The location of these environments can be seen on the land use and land cover map of the area directly affected by the project (**Map 7.2.2.1.1.a**, **Annex 4)**. In addition, vegetation will not be cleared in the riverine forests for project implementation.

   T. physalis is a shrub that grows on rocky outcrops in the Shinyanga region. The region is heavily anthropised and the land use and cover are dominated by human occupation, crops, and pastures. The known records for this species are also very old, the most recent dating from 1958, so the presence of the species in the region is uncertain. However, at the western end of the LT Nyakanazi-Ibadakuli, there are some stretches with rocky outcrops, an environment where the species occurs. On this stretch, the line will be built parallel to an existing transmission line, minimising the impacts of fragmentation in a landscape that is already extremely altered and fragmented.

   T. laborans is an herb found in woodlands and bushlands of the BCNP and three other regions. The known record for the BCNP was on the east side of Lake Burigi (near Lake Victoria), far from the Project alignment. Although this species was not found in the DAI, there are favoured phytophysiognomies in the project region where *T. laborans* may occur. Considering this distribution, the section with the highest probability of this species occurring in the areas directly affected by the TL is where the Project intercepts the BCNP.

   Regarding this, the Programme **P.11 - Flora Active Search Programme** includes measures to verify the presence of these flora trigger species in the area directly

affected by the Project and, in case individuals of these species are evidenced, refine the executive project (fine-tunning) to avoid potential impacts on the population of these species.

2. Criterion (a): 3 species of fauna triggered the classification under criterion (a), the mammals Common African Pangolin *Phataginus tricuspis*, Ashy Red Colobus *Piliocolobus tephrosceles*, and the African Savanna Elephant *Loxodonta africana*. The three species that triggered CH were registered during field surveys. For two of these species, the project will not directly intercept the EAAA delineated: the common african pangolin *P. tricuspis* were registered only through interviews and, according to available information, Minziro Forest Reserve is an important habitat for this species population; and the primate ashy red colobus *P. tephrosceles* were in the sampling points BS4 and BS5, outside the area directly affected by the project. For the African elephant *L. africana*, the project is intercepting the EAAA delineated for the species. Although the CH threshold was triggered for all three species, according to the available records of individuals (IUCN and GBIF), the most expressive population of the three species is not in the project region.

   According to the Tanzania Elephant Management and Action Plan 2023-2033 (MNRT, 2023), the estimated population in Burigi-Chato National Park is 100 individuals. The population in the surrounding areas, such as the Moyowosi-Kigosi, part of the Elephant corridor, has 59,946 individuals. The main threat to elephants is related to poaching for ivory (Wittemyer et al. 2014; Thouless et al. 2016; MNRT, 2023) and habitat loss and fragmentation due to anthropogenic activities, mainly related to expansion of agricultural areas and infrastructure development (Thouless et al. 2016; Mpakairi et al. 2019; MNRT, 2023).

   Regarding infrastructure development, the main concerns are projects and structures that may lead to severe natural habitat fragmentation and physical barriers (AMENT *et al*., 2021; MNRT, 2023), causing a reduction in the natural habitats that provide food, shelter, and other ecological needs for the species and to changes in behaviour and migration routes, leading to an increase in human-elephant conflicts (HEC), changes in gene flows, and a reduction of individuals.

   However, the TL design includes specific measures to avoid these potential impacts. The towers will be between 49 and 52 metres high, much higher than an elephant can reach, avoiding potential electrocution impacts. In addition, they will be 400 m apart from each other. There will be no physical barriers along the wayleave, just a 14-metre strip free of arboreal vegetation, which will be occupied by herbaceous and shrubby vegetation and/or exposed soil. As elephants are adapted to diverse habitats, including anthropized areas, this clear strip of vegetation will not prevent their migratory behaviour. These measures also comply with the recommendations from TANAPA and TFS. Therefore, the likelihood of a significant reduction in the population of these species is low.

   Ivory poaching is one of the main threats to African elephants, and the implementation of the project could increase the risk of poaching due to the increased

movement of workers in protected areas where there are registered herds. However, in the areas of interception with the wildlife corridor, the project will be implemented in areas where there are already roads and movement of people, and the project will not promote new access in areas that are currently inaccessible.

To minimize this risk, the **Labour Management Procedures** include the definition of the project's labour Policy; recruitment and labour training; Workers' Code of Conduct; and environmental and social education for workers. Also, the **Landscape Protection Programme** includes measures to check whether the implementation of the project is causing the expansion of anthropized areas, identify and prevent illegal activities, and inform the competent authorities whenever new deforestation is detected.

Additionally, as part of the project approval process, Tanesco and Tanapa will jointly draw up a memorandum of understanding containing the mitigation measures needed to minimize the impacts. This protocol should be formalized once formal approval has been obtained from the NEMC and the project's financial backers, as detailed in Section 6.5 of the BMP (Annex 13) and in P.05 Biodiversity Offset Plan. Meanwhile, during the consultations conducted in the EIA process, TANAPA signalled that some of the measures to be requested include support for the establishment of ranger posts in the Burigi-Chato National Park, staff training, and assistance with the purchase of equipment such as drones for monitoring.

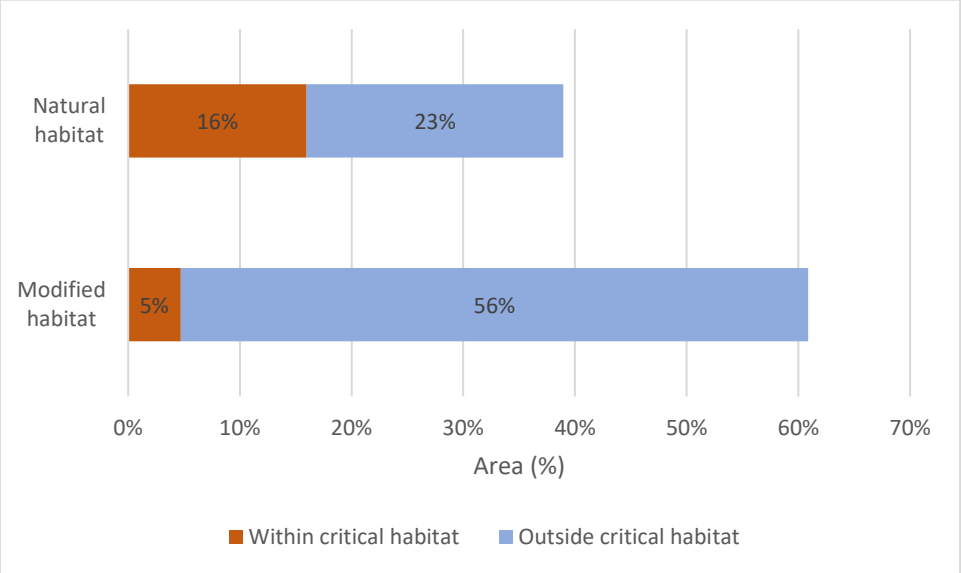
3. Although Criterion (c) refers to species congregations, it is well known that large lakes and wetlands act as aggregating environments for species, especially in arid zones. As there was no specific information on species and their populations, the entire Lake Burigi region was considered a critical habitat according to the criterion. However, the project will not directly affect this CH trigger.

4. Criterion (e): the region between Akagera National Park (in Rwanda), through Burigi-Chato NP to Moyowosi - Kigosi Game Reserve is an important ecological corridor in the region, used as a migratory route mainly by elephants, but also by other species of fauna. It has been classified as one of the country's 10 most important ecological corridors. It is important for maintaining the region's ecological balance, favoring the gene flow exchange between different populations, and conserving transboundary and internal connections between protected areas. Both the location and importance of these corridors were confirmed by TANAPA and TFS during a meeting held in November 2024 to present the Project. The project intersects the wildlife corridor connecting the BCNP with the protected areas to the south, mainly Moyowosi and Kigosi Forest Reserves. The section of the corridor intercepted by the project is a densely anthropised region, with urban occupations, crops, and pastures. In this stretch, the TL will pass close to the B3 road and parallel to the existing TL Nyakanazi-Benaco. As such, implementing the project will not cause a significant change in the landscape or land cover along this stretch. The rest of the delimited EAAA refers to the BCNP boundary, part of the connection network between the corridors and the Akagera National Park in Rwanda.

As already mentioned above, the distance between the towers (~400 metres) and their height (between 49 and 52 metres) will not prevent animals from passing through, as there will be no physical barriers. It follows TANAPA and TFS requirements that the towers should be higher than 40 m.

The area delimited as CH includes both natural and modified habitats (see **Table 7.2.4.2.a**, **Section 7.2.4.2**). According to the land use and cover map elaborated for this study (**Map 7.2.2.1.1.a**, **Annex 4** of the ESIA), the area directly affected by the project, which corresponds to the 52-metre-wide wayleave, has 1.110,97 ha of natural habitats, 39% of the total area. Of this total, 21% (589.84 ha) is in critical habitat, with 16% (455.54 ha) being critical natural habitat and 5% (134.30 ha) being critical modified habitat (**Figure 8.2.3.2.j**).

Figure 8.2.3.2.j
Habitat quantification in the Project wayleave (directly affected area)

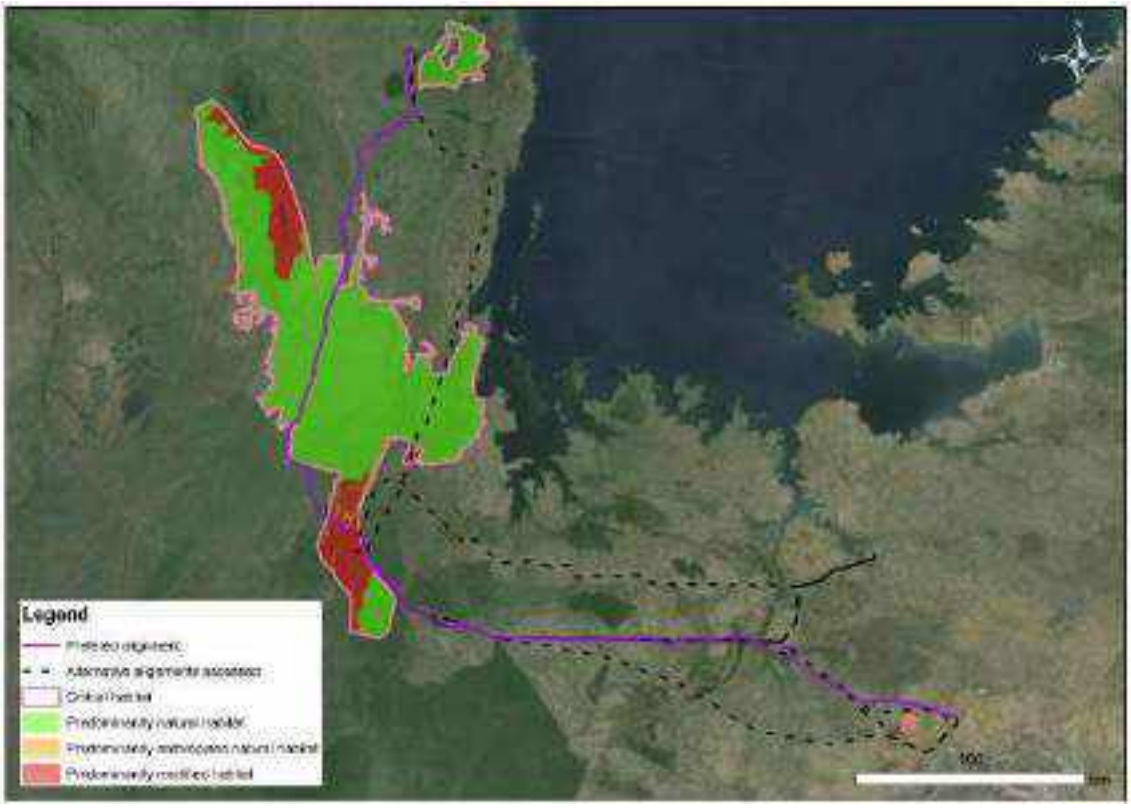


According to paragraph 24 of ESF 6, in critical habitat areas, no project activity with potential adverse impacts can be implemented unless a few conditions are met. The conditions established by paragraph 24 are assessed below:

(a) No other viable alternatives within the region exist for the development of the project in habitats of less biodiversity value:

As shown in **Figure 8.2.3.2.k** below, the east-west stretch of the project will not directly interfere with CH. On the north-south stretch, the critical habitat region is broad, stretching from the shore of Lake Victoria to the Akagera region in Rwanda, and it is not possible to avoid CH in any of the alternatives evaluated. Among the viable alternatives for this segment, as shown in the alternatives analysis chapter (Chapter 5), although the alternative near Lake Victoria intercepts less CH, this alternative would imply higher social costs, which could make the project unfeasible.

Figure 8.2.3.2.k
Critical habitat



Source: JGP analysis. Google Earth Satellite image

In addition, as shown in the figures presented in **Section 7.2.4.2**, although 12 biodiversity values triggered the CH trigger, the project route directly interferes with the EAAA of only 2 triggers, the elephant *L. africana* and the ecological wildlife corridor of which the BCNP is an integral part.

Additionally, as part of the analysis of alternative routes for this project, and to achieve the lowest socio-environmental impact, the Kyaka-Nyakanazi segment was adjusted to follow the parallelism and sharing of the wayleave of the existing TL Nyakanazi-Benako and its future extension to Kyaka, reducing the cumulativeness of some impacts.

Although sharing with this TL under construction does not prevent the vegetation clearing (due to the need for safety distance), parallelism allows for avoiding and minimizing the fragmentation of new areas of native vegetation by concentrating infrastructure works in the same corridor.

Parallelism with this TL will run along the entire length of the project within the BCNP and the CH boundary (**Figure 8.2.3.2.l**). Proximity to a project under construction will make it possible to use structures such as camp sites, support areas, and accesses, minimising the need to open new ancillary facilities. Both projects were also designed parallel to the B182 road, with an average distance of ~ 400 metres between the TL and the road, minimising the length of new accesses needed in areas with a steeper slope.

Figure 8.2.3.2.l
Parallelism with TL under construction in the Burigi Chato National Park and the Critical Habitat stretch

Source: Google Earth Satellite image

(b) All due process required under international obligations or national law that is a prerequisite to a country approving project activities in or adjacent to a critical habitat has been complied with:

The project complies with this requirement. This environmental impact study is being prepared following the work plan approved by the NEMC and local legislation. The study will go through the approval process as required by national legislation and will also be carried out following the requirements of the World Bank's socio-environmental standards.

After obtaining non-objection for NEMC and projects sponsors, Tanesco, through the Ministry of Energy, to the Ministry of Tourism and Natural Resources, will seek a formal agreement from TANAPA/TFS to allow the commencement of construction activities within protected areas.

(c) The potential adverse impacts, or likelihood of such, on the habitat will not lead to measurable net reduction or negative change in those biodiversity values for which the critical habitat was designated; and (d) The project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered, or restricted-range species, over a reasonable period:

As demonstrated in the analysis of the other impacts of the biotic environment, the conversion of natural habitats for the implementation of the project, although it implies direct and disturbing impacts on the local fauna and flora, will not lead to the local extinction of species or a significant reduction in the population. Considering the correct implementation of the mitigation measures adopted, such as a reduction in the service strip for the implementation of the TL (reducing the need for vegetation clearing), measures to control the suppression of vegetation, actions to rescue and relocate fauna and flora, as well as actions to restore areas degraded by the project and compensatory planting for suppression, the impacts on the CH trigger biodiversity values can be mitigated.

Additionally, as mentioned above, the known records in the literature for 6 trigger species of flora, in addition to the primate *P. tephrosceles*, are close to the shore of Lake Victoria. During primary data collection, the primate *P. tephrosceles* was also recorded in the sampling plots close to Lake Victoria (BS4 and BS5). In other words, most of the known records for the CH triggering species are outside the area directly affected by the project, indicating that there are no significant populations of these species in the Project's DAA.

The trigger for criterion (c) is also outside the Project's DAA. As for the trigger for criterion (e), the ecological corridor passes through areas of natural and modified habitats, including a landscape that has already been partially altered in the current scenario. The mitigation measures planned for the project, including those in the Construction Environmental Plan (CEP), Operation Management Programme (OMP), and Biodiversity Management Plan (BMP), make it possible to minimize impacts on the ecological corridor.

Regarding criterion (e), the distance between the towers (~400 metres) and their height (between 49 and 52 metres) will not impede the passage of elephant herds, the main species that use the wildlife corridor.

(e) The project will not involve significant conversion or significant degradation of critical habitats;

The native vegetation clearance for implementing the TL was reduced to a total width of 14 metres, instead of the 52 metres of the wayleave. This measure makes it possible to decrease the vegetation clearance from 1,110.97 ha to 300.37 ha, a reduction of 810.6 ha (73%). Considering the footprint of the Project that overlaps the critical habitat, the conversion of natural critical habitat decreases from 455.55 to 109.69 hectares, a reduction of 345.86 hectares (76%). Therefore, the total vegetation clearance for the project implementation will be 300.37 ha (109.69 ha in natural critical habitat), and 16.61 ha in modified critical habitat.

Considering the total extent of the CH (**Figure 8.2.3.2.k**), the habitat conversion caused by the implementation of the project represents 0,007% of the total natural critical habitat, and 0,3% of the total natural habitat within the Project's DAI. The entire stretch within the CH will be in parallel with an TL under construction, making it possible to reuse infrastructure (such as accesses and camp sites) and concentrate the impacts of the edge effect in a single corridor.

(f) The project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated;

The mitigation strategy to achieve gains for the values that triggered the CH trigger is presented in the Biodiversity Offset Plan of the Biodiversity Management Plan. The details are presented in the stand-alone document in **Annex 13**.

(g) A robust and appropriately designed, long-term biodiversity monitoring and evaluation programme aimed at assessing the status of the critical habitat is integrated into the Borrower's management programme:

The Biodiversity Management Plan includes monitoring of fauna, flora, and landscape, which should be carried out during the project's operation. These mitigation measures will effectively achieve net gains for the project. The details are presented in the stand-alone document in **Annex 13**.

Mitigation Measures

Therefore, as demonstrated above, the Project complies with all the requirements of paragraph 24. As requested in paragraph 25 of ESS 6, the **Biodiversity Management Plan** demonstrates the project mitigation strategy, including measures to achieve net gain.

The full list of measures proposed to compensate for this impact is in **Table 9.0.a** of **Chapter 9.0**.

Qualification of the resulting impact

Considering the application of the ESMP measures listed in **Table 9.0.a**, this impact will have a medium magnitude and medium significance. Once again, these attributes are classified based on the vegetation degradation characteristics observed along the alignment in general, and based in the fact that much of the TL alignment is parallel and contiguous to an existing TL, and near roads.

This impact is negative, has geographical coverage in and around the DAI, occurs in the implementation and operation phase, and has direct and indirect incidence. Its induction is immediate, permanent, irreversible, and with a certain probability of occurrence. The importance was raised to high since it is a critical habitat (see Table below).

Impact Qualification (attributes) **Impacts on biodiversity in critical habitats**			
Vector (Nature)	Negative	**Geographical Coverage**	DAI/DAA
Occurrence Phase	Construction/ Operation	**Incidence**	Direct and Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Long term
Reversibility	Partially reversible	**Probability of Occurrence**	Certain
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Significance			
Magnitude	Medium		
Importance	High		
Mitigability	Moderately Mitigable		
Residual Importance	Medium		

9. Impacts on Ecosystem Services

9.01 – Impact on the availability and quality of relevant ecosystem services

Impacting actions	A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.08 Earthworks in the substation area A.2.10 Execution of tower foundations A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities A.2.16 Recovery of direct intervention areas A.3.03 Inhibition of secondary regeneration of native vegetation on the wayleave
Impactable component	C.2.06 – Ecosystem services

Analysis of potential impact

Ecosystem services are defined as a priority when the impacts of a given project affect the general well-being (e.g., way of life, health, safety, culture) of the beneficiaries of that service, or those services that can provide the planned operational performance for certain projects (HANSON, 2008; LANDSBERG *et al*., 2013). According to Landberg *et al*. (2013), the prioritization of ecosystem services should be related to assessing the significance of the project's impacts and dependencies on ecosystem services and identifying which services require mitigation or management measures.

According to paragraph 24 of IFC PS 6, priority ecosystem services are classified into two types:

- Type I: Services where project operations are most likely to have an impact and therefore result in adverse impacts to those affected by the project.
- Type II: Services on which the project depends directly for its operations.

Impacts on priority ecosystem services are estimated by establishing a cause-and-effect relationship between impacts on physical and biotic environments and the benefits that human populations derive from ecosystems. These impacts induce ecosystems changes that can alter the quality/quantity of ecosystem services available (LANDSBERG *et al*., 2013).

Prioritization of relevant ecosystem services

The prioritization of ecosystem services sought to get as close as possible to the impacts that may be directly derived from the project, and that affect local communities, or that the project depends on for its operation.

The prioritization was based on the analysis spreadsheet prepared by Landsberg et al. (2013)[3] that correlates three variables: (1) the allocation of services by the impacts of the project, (2) the importance of the service for the well-being of the population, and (3) whether there are viable alternatives for the relevant service.

As detailed in **Table 8.2.3.2.b** below, five priority ecosystem services have been identified: three provisioning services and two regulation services, all type 1.

Although the project will impact ecosystem services, which are considered a priority, it is also necessary to assess the intensity of this impact. As shown in the table above, five priority services have been identified in the project region. The ecosystem service ‘feeding’ is directly linked to the availability of arable land in the project area, and the impact on this service can be assessed based on the areas of farmland directly impacted by the implementation of the project.

[3] Available here: Weaving Ecosystem Services into Impact Assessment | World Resources Institute (wri.org)

The other priority ecosystem services, natural medicines, biomass, pollination, and life cycle maintenance are linked to the availability, and quality of native vegetation in the region, and the intensity of the impact can be assessed based on the impact of project implementation on areas of native vegetation.

Therefore, the intensity of the impact on these ecosystem services was based on the project's footprint on the agricultural and native forest areas. **Table 8.2.3.2.c** shows the amount of arable land and native vegetation that will be impacted, compared to the region's current scenario. As seen in the table below, there was a slight reduction in the availability of ecosystem services after the project was implemented. The arable areas (including Anthropic area, Cyclical agriculture, Perennial agriculture, and Silviculture) responsible for the food service will decrease by 8% in the DAI. The area of native vegetation, responsible for the services of natural medicines, biomass, pollination, and life cycle maintenance, will decrease by 1% in the DAI.

Table 8.2.3.2.b
Prioritisation of Ecosystem Services

Relevant ecosystem services	Potentially affected benefits	Sub-step 2.1: Could the project affect the ability of others to benefit from this ecosystem service?		Sub-step 2.2: Is this ecosystem service important to beneficiaries' well-being?		Sub-step 2.3: Do beneficiaries have viable alternatives to this ecosystem service?		Priority ecosystem services
		Y *Yes* ***N*** *No* ***?*** *Unknown*	**Comments or supporting information**	***Y*** *Yes* ***N*** *No* ***?*** *Unknown*	**Comments or supporting information**	***Y*** *Yes* ***N*** *No* ***?*** *Unknown*	**Comments or supporting information**	***1*** *Priority ecosystem services* ***0*** *Non-priority ecosystem services*
Feeding	Crops, livestock	**Y**	Establishing the project's wayleave will restrict some types of land use, especially in the cable-laying area.	**Y**	Agriculture and livestock keeping are the main economic activities in the region	**N**	No, since it represents the source of sustenance for the population.	**1**
Natural medicine	Extraction of native plants for medicinal use	**Y**	It will be partially affected, as vegetation will have to be cleared for the construction of the TL, and the service strip inside the wayleave will have to be kept free of vegetation. This suppression will reduce the number of individuals of the flora species with medicinal uses.	**Y**	Most people interviewed said they used medicinal herbs, indicating that this is an important ES for the population.	**N**	No, considering that it is a cultural habit.	**1**
Biomass	Extraction of wood for charcoal and as a source of energy/heat for domestic use	**Y**	It will be partially affected, as vegetation will have to be cleared for the construction of the TL, and the service strip will have to be kept free of vegetation. This suppression will reduce the availability of wood.	**Y**	Most of the people interviewed said they used wood for energy and charcoal.	**N**	There are no other widely accessible energy and heat sources in the region.	**1**
Water	Water for own consumption and crop irrigation (minor scale since the main water source for crops is rain).	**N**	The project will not affect the availability of water.	**Y**	The availability of drinking water is vital for any population.	**N**	There is no alternative to water.	**0**
Climate regulation	Tackling climate change	**N**	Although suppressing part of the native vegetation in the wayleave will cause local carbon emissions, in the long term the project tends to positively impact climate regulation by increasing access to renewable energy.	**Y**	The ES service of climate regulation is essential.	**N**	There is no alternative for a stable climate.	**0**
Water regulation	Availability and quality of water	**N**	The project will not affect water regulation. Removing vegetation for the project will preserve the riparian forest around the rivers.	**Y**	The availability of drinking water is a major issue in the region, which is highly dependent on agriculture and water catchment from rivers and lakes for consumption.	**N**	The water sources in the region are wells and direct catchment from the river or lake.	**0**
Disease regulation	Disease vector control	**N**	The spread of diseases such as malaria and intestinal tract illnesses is already a reality in the region, and it is understood that the project will make little or no contribution to changing this dynamic.	**Y**	An ecologically balanced environment that contributes to the natural control of diseases in the region is essential for any community	**N**	There is no alternative for an ecologically balanced environment	**0**
Pest regulation	Control of agricultural pests	**N**	The region already has consolidated agricultural use, with methods to control and combat pests. It is understood that the changes in land use and cover the project will cause will not cause an imbalance in this dynamic.	**Y**	Yes, considering that agriculture and livestock are the main economic activities.	**Y**	The population already makes extensive use of pesticides and fertilisers.	**0**
Pollination	Fertilisation of crop plants	**Y**	It may be partially affected, albeit on a small scale. The native vegetation in the service strip will have to be cleared for the construction of the TL, and the service strip will have to be kept free of vegetation, reducing the habitats available to pollinating fauna.	**Y**	Yes, considering that agriculture is one of the main economic activities. However, the region's anthropisation is already extensive and consolidated, and the impact on pollinating agents is already a reality.	**N**	There is no alternative for pollinators.	**1**

Table 8.2.3.2.b
Prioritisation of Ecosystem Services

Relevant ecosystem services	Potentially affected benefits	Sub-step 2.1: Could the project affect the ability of others to benefit from this ecosystem service?		Sub-step 2.2: Is this ecosystem service important to beneficiaries' well-being?		Sub-step 2.3: Do beneficiaries have viable alternatives to this ecosystem service?		Priority ecosystem services
		Y *Yes* ***N*** *No* ***?*** *Unknown*	**Comments or supporting information**	***Y*** *Yes* ***N*** *No* ***?*** *Unknown*	**Comments or supporting information**	***Y*** *Yes* ***N*** *No* ***?*** *Unknown*	**Comments or supporting information**	***1*** *Priority ecosystem services* ***0*** *Non-priority ecosystem services*
Lifecycle maintenance	Seed dispersal and gene flow	**Y**	The project's construction stage could momentarily affect the region's natural migration and displacement of fauna.	**Y**	It is a service that contributes to an ecologically stable environment, sustaining populations of fauna and flora used by the population.	**N**	Considering that it is a service that contributes to an ecologically stable environment to sustain populations of fauna and flora used by the population.	**1**
Ecoturism	The natural environment, which is a tourist attraction of the protected area	**N**	Although the construction of the TL may cause inconvenience and momentary interruptions, it will not jeopardise ecotourism activities in the region's protected areas.	**Y**	Ecotourism is an important activity in the region, directly and indirectly boosting the economy.	**Y**	Although it is an important activity in the region, the local population's main economic activity is agriculture and grazing.	**0**

Source: JGP analysis, based on the study by Landsberg *et al.* (2013).

Table 8.2.3.2.c
Comparison between the availability of native vegetation and arable areas before and after project implementation

Clas	DAI (hectares)	DAA (52 m strip for arable and 14 m strip for native formations) (hectares)	Final area available in the DAI after implementation (hectares)	Reduction	
				hectares	%
Native formations	**19,242.32**	**300.37**	**18,941.95**	**300.37**	1.6%
Miombo woodland	15,689.78	246.86	15,442.92	246.86	1.6%
Mixed woodland	729.44	15.13	714.31	15.13	2.1%
Thicket bushland/shrubland	707.00	11.24	695.76	11.24	1.6%
Grass-wooded savanna	1,262.14	18.11	1,244.03	18.11	1.4%
Evergreen dry forest	34.29	1.23	33.06	1.23	3.6%
Riverine forest	605.33	3.46	601.87	3.46	0.6%
Riverine grassland vegetation	214.36	4.34	210.02	4.34	2.0%
Arable areas	**33,921.21**	**1,697.40**	**32,223.81**	**1,697.40**	5.0%
Anthropic area	12,567.03	426.73	12,140.30	426.73	3.4%
Cyclical agriculture	19,011.82	1,142.19	17,869.63	1,142.19	6.0%
Perennial agriculture	1,709.77	80.67	1,629.10	80.67	4.7%
Silviculture	632.60	47.81	584.79	47.81	7.6%

Mitigation Measures

ESMP Plans and Programs propose measures to prevent, mitigate, or compensate the project's impact on ecosystem services, as listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

With the application of all the planned measures listed in **Table 9.0.a**, the resulting impact of the construction phase is characterised as construction phase's resulting impact is negative, indirect (because it is a consequence of loss of vegetation and restrictions to land use), covering the IAI. It is certain to occur, immediate (considering impacts on land use) and medium-term (during the construction and operation of the TLs and expansion of the SSs), partially reversible, cumulative (considering the consolidated anthropogenic use in the region, and the impacts already caused on the ES) and with a synergistic effect. The magnitude is medium (because it is medium term), and the importance is also medium (because it is partially reversible). The residual importance is moderate.

Rating of the impact (attributes) **Impact on the availability and quality of relevant ecosystem services**			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction / Operation	**Form of incidence**	Indirect
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Partially reversible	**Probability**	Certain
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	Medium		
Mitigability	Moderately Mitigable		
Residual Importance	Medium		

8.2.3.3
Socio-Economic Environment

10. Impacts on Employment and Local Economy

10.01 - Generation of direct and indirect jobs during construction

Impacting actions	A.2.01 Mobilisation of workforce
Impactable component	C.3.01 - Employment and Local Economy

Analysis of potential impact

This impact refers to jobs generated by the project's implementation. As stated in **Section 5.6.2**, the estimated workforce required to implement the TLs and expand the SSs will be around 1,350 direct workers at the peak of construction. The construction phase is expected to last 36 months.

It is estimated that the project will also generate around 650 indirect jobs. This estimate took into account a methodology for employment generation, according to which, in the construction sector, every 100 direct jobs generate 47 indirect jobs[4].

In this way, the selection and hiring of labour in the IAI villages could be directed towards professionals who are currently out of the labour market or in informal jobs.

Of the total number of jobs expected, the construction sector possibilities stand out, considering that they could be extended to the unskilled and semi-skilled parts of the population.

Specific jobs requiring greater specialisation are likely to be carried out by labour from other regions, usually workers from the contractors themselves.

This impact could be optimised by recruitment actions using regional CV database tools and job offer portals, and by training the workforce to carry out functions during the project's construction stage.

Considering this premise of hiring as much labour as possible in the villages and wards intercepted, and the specific characteristics of an TL, i.e., a linear project whose work fronts are itinerant and of short duration in each section of the route, it is understood that the risk of population influx caused by the project is considered low.

Historically, this type of project has not encouraged workers to migrate with their families, as there is no prospect of long-term employment in a single location. When hired, workers from outside the region tend to stay temporarily in the camp sites' accommodation, moving with the work front as it progresses.

[4] TEIXEIRA, C. A. N. *et al*. (2022). Revisiting the BNDES' job creation model: updating the income effect calculation. R. BNDES, Rio de Janeiro, v. 29, n. 58, p. 87-159, December 2022.

The strategy mentioned above, prioritizing the hiring of local labour and taking advantage of the workers' availability in the villages and wards intercepted by the TLs, contributes to improving the local economy and minimizing the need for external workers.

Given these factors, the potential for a significant population influx is negligible, and no significant overload is expected on public health, education, or urban infrastructure services in the localities within the area of influence.

Considering that these workers to be directly involved in the works will be part of the workforce of contractors and subcontractors, which may have different levels of management or even no management of human resources and working and employment conditions, there is a risk that the requirements laid down in Tanzanian labour legislation and applicable international standards (EES2 and ILO conventions) will not be met. These risks may include precarious or informal work, especially for indirect hires (by contractors and subcontractors); child labour and forced labour; inadequate occupational health and safety conditions in activities that involve risks to workers; lack of effective mechanisms for communication and resolution of labour complaints, which can lead to conflicts and dissatisfaction among workers, especially external workers; and discrimination, unequal opportunities, gender-based violence, sexual exploitation or abuse, and sexual harassment.

For this reason, to prevent the labour-related risks, measures to ensure that the hiring and management of these workers comply with Tanzanian labour legislation and applicable international standards are being considered as part of the project (see P.14 - Labour Management Procedures - LMP).

Enhancement Measures

To maximise the positive effects of this impact, the complete set of programmes and measures to be implemented is listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

With the application of all the planned measures listed in **Table 9.0.a**, the resulting impact of the construction phase is characterised as positive, direct, covering the IAI, but mainly the villages where the camp sites are located. It is certain to occur, immediate and short-term (during the construction of the TLs and expansion of the SSs), totally reversible, non-cumulative, and with a synergistic effect. The magnitude is low (because it is short-term), and the importance is also low (because it's reversible). Considering the number of workers expected and the local hiring percentage, the importance has risen to moderate.

Rating of the impact (attributes) Generation of direct and indirect jobs during construction			
Vector	Positive	**Location and spatialization**	IAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Certain
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Moderate		
Mitigability	-		
Residual Importance	Moderate		

10.02 - Generation of direct and indirect jobs during operation

Impacting actions	A.3.01 Operation of the TLs and SSs A.3.02 Routine maintenance and emergency repair of the system A.3.03 Inhibition of secondary regeneration of native vegetation on the wayleave
Impactable component	C.3.01 - Employment and Local Economy

Analysis of potential impact

Although the operation phase is permanent, as opposed to the temporary nature of the construction phase, the generation of direct jobs should be low, mainly for local workers, due to the characteristics of the Project. Due to the degree of specialisation required by the sector, its maintenance and control require a significantly smaller and more specialised workforce, for example, the one that will be involved in maintenance actions of the TLs and SSs, such as cleaning insulators, replacing parts, repairing towers and cable signalling elements, among other essential activities for the correct operation of the system.

In principle, the number of workers needed for this type of activity positively impacts the regional labour market, but with a very small magnitude. However, these are quality jobs associated with technical qualifications, formality, and duration.

Enhancement Measures

The measures listed in **Table 9.0.a** of **Chapter 9.0** will be implemented to increase the positive effects.

Rating of the resulting impact

With the implementation of all planned measures listed in **Table 9.0.a**, the impact resulting from the operation phase is positive and direct. It is certain, of immediate occurrence after the start of operation, and of long duration. It is diffuse in coverage and fully reversible. It has no cumulative effect but is synergic. Due to the small number of jobs to be generated, it is considered an impact of low magnitude and low importance.

Rating of the impact (attributes) Generation of direct and indirect jobs during operation			
Vector	Positive	**Location and spatialization**	Diffuse
Stage of occurrence	Operation	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability**	Certain
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low*		
Importance	Low		
Mitigability	-		
Residual Importance	Low		

* Considering the methodology for determining magnitude in **Section 8.2.1**, this direct, diffuse, and long-duration impact would be of high magnitude. However, this attribute was downgraded to low, given the small number of places to be offered in the operation phase, and the technical qualifications required, which limit the coverage.

10.03 – Increased local consumption of goods and services during the construction phase

Impacting actions	A.2.01 Mobilisation of workforce A.2.02 Mobilisation of camp sites A.2.13 Operation of camp sites
Impactable component	C.3.01 - Employment and Local Economy

Analysis of potential impact

The acquisition of goods and services in local communities begins before construction, during the development of the environmental and social studies, and the studies required for the engineering project. The presence of technicians in the region, and the development of field inspections, and public consultation processes require the consumption of goods and services, which positively impacts the local economy.

During the construction period, estimated at 36 months, the direct demand for goods and services from the Contractors and subcontractors in the area of influence of the Project is expected to increase, especially for inputs to the works (construction materials, aggregates for the production of concrete or ready-mixed concrete, fuel), consumer goods (foodstuffs, medicines, personal hygiene products, cleaning products, among others), goods for maintenance (parts for equipment and vehicle repairs), and services (equipment and vehicle repairs in local workshops, transport services, food, telecommunications, banking services and energy supply).

The villages where camp sites will be located are expected to concentrate a significant part of this demand and to be the main beneficiaries of the effects of this impact, since part of the workers' payment will be spent in the region.

Enhancement Measures

Table 9.0.a of **Chapter 9.0** proposes a list of measures to maximise the positive effects of this impact.

Rating of the resulting impact

Overall, this impact is positive, with a high probability of occurrence, coverage in the IAI, and indirect. It is immediate, has a duration corresponding to the construction period (short term), and is reversible. It's not cumulative but has a synergistic effect.

Considering the implementation of the list of measures to potentiate this impact proposed in **Table 9.0.a**, it is classified as being of low magnitude (as it is short-term) and low importance (as it is reversible). Considering the number of workers expected and the size of the villages where the camp sites should be implemented, the importance has risen to moderate.

Rating of the impact (attributes) **Increased local consumption of goods and services**			
Vector	Positive	**Location and spatialization**	IAI
Stage of occurrence	Construction	**Form of incidence**	Indirect
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	High
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	-		
Residual Importance	Low		

10.04 - Loss of employment and reduced demand in the local economy at the end of the construction phase

Impacting actions	A.2.14 Decommissioning of temporary facilities A.2.15 Demobilization of the workforce
Impactable component	C.3.01 - Employment and Local Economy

Analysis of potential impact

As assessed above, the project's impact on local economic activities will be positive due to increased financial resources channelled to the region, income from job creation, and consumption of goods and services.

However, the mobilization of local economies will be limited to the construction period, causing a possible retraction at the beginning of the operation. With the gradual demobilization of labour at the end of the construction phase, the demand for goods and services will lessen, due to the drop in consumption and income levels.

In the villages where the camp sites will be located, the impact should be more significant, since the mobilization of the economies in the construction phase will also be greater here. These locations, if the suggestion made in this ESIA is confirmed, are Kyaka, Nyakanazi, Ibadakuli, Mutukula, Nyakasimbi, Nyabugombe, Busonzo, Ilogi, and Solwa,

which are likely to have the greatest effects of the economic cooling inherent in the completion of the works.

Therefore, the intensity of the impact will differ according to the specific characteristics of each village close to the route.

It is not enough, however, to analyse and evaluate the impact from the abstract perspective of the local economy. More importantly, for direct and potentially lasting effects, the impact of job loss on the livelihoods of affected family's needs to be assessed.

The construction period, estimated at 36 months, is sufficiently long for the employment opportunities generated to become a regular source of income, albeit temporarily, for the beneficiary families and to improve their quality of life.

With the end of the construction phase, this source of income ceases, causing people to return to situations of financial instability. Terminating this significant positive impact in a vulnerable socio-economic environment results in a significant negative impact.

Mitigation Measures

Although impacts on the local economy and households cannot be avoided, various mitigation measures, such as those listed in **Table 9.0.a** of **Chapter 9.0**, can be applied.

Rating of the resulting impact

The impact is negative, with geographical coverage in the IAI, but mainly in the villages where the camp sites will be located. It has an impact relative to the end of the construction phase and the start of operation. It is an indirect, short-term induction and of medium-term duration impact. The probability of occurrence is high, but it is reversible. It has no cumulativeness or synergy. Considering the implementation of the list of measures to mitigate this impact proposed in **Table 9.0.a**, it has a medium magnitude and a moderate importance. It is moderately mitigable, keeping the residual significance as moderate.

Rating of the impact (attributes) Loss of employment and reduced demand in the local economy at the end of the construction phase			
Vector	Negative	**Location and spatialization**	IAI
Stage of occurrence	End of construction/beginning of operation	**Form of incidence**	Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Medium term
Reversibility	Reversible	**Probability**	High
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	Moderate		
Mitigability	Moderately Mitigable		

Rating of the impact (attributes) Loss of employment and reduced demand in the local economy at the end of the construction phase	
Residual Importance	Moderate

10.05 - Interference with mineral rights

Impacting actions	A.2.03 Negotiation and compensation of owners and occupants
Impactable component	C.3.01 - Employment and Local Economy

Analysis of potential impact

According to information from the Tanzanian Mining Cadastre Portal, made available by the Ministry of Minerals (MADINI), the wayleave of the 400 kV Kyaka - Nyakanazi TL intercepts 4 polygons with a mining licence, and 400 kV Nyakanazi - Ibadakuli TL intercepts another 16 polygons with a mining licence.

Of the 20 areas intercepted, 14 are exclusively for gold exploration. Another two are for gold and copper and gold, and for nickel exploration, and the fourth is for nickel. Of these 20 areas, 16 are of the “Prospecting Licence – Metalic Minerals” type, 1 are “Prospecting Licence - Energy Minerals”, 1 of the “Primary Mining Licence - All Minerals other than Building Material” type, 1 of the “Processing Licence” type and 1 of the “Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds” type.

The area of the TL's wayleave that intersects the mining licence area may be restricted for mining activities, especially if the mining operation poses a risk to the TL’s safety. Blocking the wayleave may be necessary to guarantee the TL’s integrity and the safety of workers, both mining and TL maintenance.

Some national laws provide for land use conflicts, including those between mining activities and other infrastructure, such as transmission lines.

The Land Act, 1999, deals with compensation for the compulsory acquisition of land, including land under mining licences, when necessary for public infrastructure purposes.

The Mining Act, 2010 establishes some cases in which the holder of a mining right cannot exercise any of its rights under the licence or this Law. One of these is when the activity coincides with an area of land dedicated or set aside for any public purpose other than mining. Another of these cases is when the activity coincides with infrastructure, including power lines.

Of the mining licences directly impacted by the wayleave of the Project's TLs, the majority of them, 17 polygons, are of the "Prospecting Licence" type, generally allowing initial prospecting activities. If the passage of a TL impacts these activities, compensation may be required, especially if planned activities are significantly prejudiced. However, as these licences are less intrusive, compensation can be negotiated depending on the extent of the impact.

Compensation is more likely to be required for the other 3 impacted polygons, which are of the "Primary Mining Licence", "Processing Licence" and "Mining Licence" types. These licences imply significant investments, and any impact that interrupts the operation may result in compensation for the licence holder. The amount and nature of the compensation will depend on the extent of the impact, including possible relocations or adjustments to the mining plans.

It should be noted that the interference of the TLs with mineral activities is very small. In addition, the impact occurs almost exclusively in the wayleave, yet in a very localised manner. The areas of the processes interfered with by the wayleave will be compensated, and the amounts will depend on the value of the mineral resources present in the affected area; the loss of production during the time operations are interrupted; the value of the investment already made in the area; and the potential costs of relocating operations or adjusting mining plans.

The licences located in the DAI, outside the wayleave, may be developed, but they are subject to practical restrictions (use of explosives, for example) where necessary. For these processes, attention should be paid only to controlling and restricting excavation, blasting, and equipment operation activities near the future TLs.

Mitigation Measures

The list of measures to mitigate and compensate for this impact is presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Considering the implementation of the measures proposed in **Table 9.0.a**, this impact, which occurs in the construction phase, is negative, of certain occurrence, whose coverage is in the DAA and its immediate surroundings (DAI, where restrictions on practices, such as the use of explosives, will occur). This impact is direct, immediately induced, has a long duration, and is reversible. It is cumulative, but non-synergic. It has a medium magnitude and a moderate importance. It is moderately mitigable, keeping the residual significance as moderate.

Rating of the impact (attributes) Interference with mineral rights			
Vector	Negative	**Location and spatialization**	DAA / DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Certain
Cumulativeness	Cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	Moderate		
Mitigability	Moderately Mitigable		
Residual Importance	Moderate		

11. Impacts on Infrastructure, Social Equipment, and Public Services

11.01 - Interference with traffic conditions

Impacting actions	A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.12 Launching of cables
Impactable component	C.3.02 - Infrastructure, Social Equipment and Public Services

Analysis of potential impact

The TLs that are part of the Project will be built close to existing roads and rural paths. The 400 kV Kyaka – Nyakanazi TL even has most of its route following existing roads, specifically the B182 and the B3.

In the case of other LTs that are not parallel to roads or that are, but aren't that close to them (for example, the 400 kV Kyaka - Mutukula TL runs parallel to the B8 road, but about 1 to 4 km away from it), there are local paths perpendicular to the main roads that can be used to access the construction fronts. It may also be possible to access the site of each tower through the service strip that will be opened in the axis of the wayleave, as the TL crosses some regions of flat relief. Therefore, it is very likely that only a few access sections will need to be opened as part of the project.

In the construction phase, construction vehicles will use existing roads and tracks or the service strip to transport workers and materials and drive the necessary machinery to camp sites and fronts.

This increase in vehicle traffic, especially heavy vehicles, on roads and paths will tend to cause degradation of pavements, whether asphalt or dirt. In addition, the increased number of vehicles in circulation may increase the risk of traffic accidents on the roads and paths to be used, especially those that allow for slightly higher speeds, such as the B8, B182, B3 and B6 Roads, which are paved. Still, also the Geita-Bukoli-Msalala, the Nyang'huale-Busangi, the Didia-Solwa and Shinyanga – Bubiki Roads, which are dirt roads, but have good travelling conditions.

There is a risk of accidents between vehicles or involving pedestrians. In the latter case, the risk is higher on road sections that pass through the villages, and this transposition of inhabited areas occurs both on the main roads and on the secondary and minor paths.

In addition to the risk of accidents, the movement of machinery and vehicles, mainly on stretches crossing villages and where the surroundings are densely populated, will cause disturbance related to increased noise, dust, and exhaust emissions. Journeys, mainly within urban or densely populated areas, should be optimised as much as possible. Circulations should be made at low speed and with the necessary precautions.

It is also important to mention the inconvenience caused by the temporary traffic interruption at points where the TLs crossroads during cable laying. This impact will be greatest at intersections with busy roads, such as B181, B182, B3, B6 and Geita-Bukoli-

Msalala and Nyang'huale-Busangi Roads.

The number of crossings of each TL with the roads is shown below. The crossing points, including coordinates, are shown in **Figure 8.2.3.3.a**.

- 400 kV Mutukula – Kyaka TL: 1 crossing with B181 Road and 1 crossing with B182 Road;
- 400 kV Kyaka – Nyakanazi TL: 8 crossings with B182 Road and 9 crossings with B3 Road;
- 400 kV Nyakanazi – Ibadakuli TL: 1 crossing with B3 Road, 1 crossing with Geita-Bukoli-Msalala Road, 1 crossing with Nyang'huale-Busangi Road, 1 crossing with Didia-Solwa Road, 1 crossing with Shinyanga – Bubiki Road, and 1 crossing with B6 Road.

Figure 8.2.3.3.a
Main road crossings

400 kV Mutukula – Kyaka TL	
Crossing between Mutukula – Kyaka TL and B181 Road, between vertices MK-1 and MK-2 (320,176.75 m E and 9,865,402.70 m S, 36M WGS-84).	Crossing between kV Mutukula – Kyaka TL and B182 Road on arrival in Kyaka SS (323,403.59 m E and 9,861,703.68 m S, 36M).
400 kV Kyaka – Nyakanazi TL	
1rst crossing between Kyaka – Nyakanazi TL and B182 Road, between vertices KN-6 and KN-7 (307,379.58 m E	

Figure 8.2.3.3.a
Main road crossings

and 9,851,833.00 m S, 36M).
2nd crossing between Kyaka – Nyakanazi TL and B182 Road, between vertices KN-9 and KN-10 (298,496.72 m E and 9,842,806.37 m S, 36M).
3rd crossing between Kyaka – Nyakanazi TL and B182 Road, between vertices KN-18 and KN-19 (283,785.61 m E and 9,766,555.32 m S, 36M).
4th crossing between Kyaka – Nyakanazi TL and B182 Road, between vertices KN-18 and KN-19 (281,977.65 m E and 9,761,135.85 m S, 36M).
5th and 6th crossings between Kyaka – Nyakanazi TL and B182 Road, between vertices KN-18 and KN-19 and between KN-19 and KN-20 (278,554.96 m E and 9,750,869.36 m S; 278,504.85 m E and 9,750,540.70 m S, 36M). This stretch could be optimized in the route refinement phase by reducing the crossings.

Figure 8.2.3.3.a
Main road crossings

Crossings between Nyakanazi - Ibadakuli TL and Shinyanga – Bubiki Road and another path, near Old Shinyanga, between vertices NI-29 and NI-30 (545,914.42 m E and 9,603,275.82 m S, 36M).

Crossing between Nyakanazi - Ibadakuli TL and B6 Road, between vertex NI-31 and Ibakuli SS (556,685.06 m E and 9,599,633.28 m S, 36M).

In addition to these, the routes will also cross other rural roads and paths with less traffic, which are used for the circulation of the population of the communities, which are dirt roads without signposting. Care must be taken here because, during the rainy season, roads that are not asphalted or paved become inaccessible. These transpositions will be carried out with appropriate machinery and gantry protection structures to interfere as little as possible with traffic. The traffic interruption will be punctual and for a short period, subject to the times when the cables are launched at the crossing points with roads and paths.

On the final stretch of the 400 kV Nyakanazi - Ibadakuli TL, about 2 km before the IN-31 vertex, it intersects the Dar Es Salaam-Mwanza Railway Line, as shown in **Figure 8.2.3.3.b**. Interference with this railway will also be punctual and occasional, only during the launching of the cables, and will require communication measures with the operator, adequate signalling and safety measures.

Figure 8.2.3.3.b
Crossing of the 400 kV Nyakanazi - Ibadakuli TL with the Dar Es Salaam-Mwanza Railway Line

Mitigation Measures

Adopting the measures listed in **Table 9.0.a** of **Chapter 9.0** can prevent or mitigate this impact.

Rating of the resulting impact

The impact of the project on traffic conditions will be felt on the DAI and the IAI. Considering the list of measures proposed in **Table 9.0.a**, this impact is direct, immediate, and short-term duration (until the end of the works). It is reversible and has a high probability of occurrence. It is not cumulative but synergic. It is of low magnitude and importance. This impact is highly mitigable, resulting in low residual importance. However, the residual importance has been increased to moderate due to the number of stretches where roads and paths cross densely populated areas.

Rating of the impact (attributes) Interference with traffic conditions			
Vector	Negative	**Location and spatialization**	DAI / IAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	High
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Highly Mitigable		
Residual Importance	Moderate		

11.02 - Temporary overloading of waste disposal sites

Impacting actions	A.2.04 Vegetation clearing A.2.08 Earthworks in the substation area A.2.09 Excavation and installation of grounding mesh in the substation area A.2.10 Execution of tower foundations A.2.12 Launching of cables A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities
Impactable component	C.3.02 - Infrastructure, Social Equipment and Public Services

Analysis of potential impact

As noted in **Section 5.3.1**, nine camp sites are planned. Three will be located on the SSs' expansion sites, in the villages of Kyaka, Nyakanazi, and Ibadakuli, and the others in the villages of Mutukula, Nyakasimbi, Nyabugombe, Busonzo, Ilogi, and Solwa. A special area for waste management will be among the camp sites facilities.

A wide range of waste types will be generated at the camp sites and work fronts, including domestic (or common) waste and hazardous waste, as detailed below:

- Common waste (office waste, food waste, food packaging, toilet paper, PPE – personal protective equipment waste);
- Waste from the first aid rooms;
- Contaminated soil as a result of possible leaks or spills of fuels, oils, and grease, chemical containers, used towels, and other materials soiled with oil;
- Surplus soil from excavation;
- Waste from vegetation clearing.

It is estimated that the generation of this solid waste at the camp sites and work fronts will impact the waste disposal infrastructure in the region.

The wards and districts in the IAI do not have sanitary landfills. As mentioned in **Section 7.3.9.3**, most solid waste is buried and burned in the IAI. The nearest landfills are the

Buhongwa Landfill in Mwanza, about 140 km from Ibadakuli, and the Kiteezi Landfill in Kampala, Uganda, about 223 km from Mutukula.

As waste generated during the works should not be sent to open dumps or burned, arrangements should be made to dispose of it in the sanitary landfill closest to the IAI, or the Contractors should implement controlled trench landfills at the camp sites.

Mitigation Measures

To mitigate the negative effects of this impact, the complete set of programmes and measures to be implemented is listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Considering the correct implementation of the measures foreseen in the ESMP for this impact (**Table 9.0.a**), it is classified as negative, with geographical coverage in IAI or diffuse, as the correct destination of the waste certainly goes beyond the boundaries of the IAI.

It will occur in the construction phase of the Project, with an indirect incidence, short-term induction, and duration. It is completely reversible, and its probability of occurrence is low, because, as already mentioned, there are no sanitary landfills in the IAI. Due to the distances covered by the TLs in the Project, it is unlikely that the solution adopted for the Mutukula - Kyaka TL will be the same as that for the Nyakanazi - Ibadakuli TL. It has characteristics of cumulativeness and synergy.

The magnitude and importance are considered low, due to reversibility and short-term duration. The residual importance is kept low because this is a highly mitigable impact.

Rating of the impact (attributes) Temporary overloading of waste disposal sites			
Vector	Negative	**Location and spatialization**	IAI or Diffuse
Stage of occurrence	Construction	**Form of incidence**	Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Highly Mitigable		
Residual Importance	Low		

11.03 - Interference with airport runways

Impacting actions	A.2.11 Assembly of towers A.2.12 Launching of cables A.3.01 Operation of the TLs and SSs
Impactable component	C.3.02 - Infrastructure, Social Equipment and Public Services

Analysis of potential impact

To verify the existence of airfields and airstrips near the TLs, the data available on the Humanitarian Data Exchange website[5], provided by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), was consulted.

Based on the information obtained, it was verified that there is one airport and one airstrip near the TLs.

Ihanda Airstrip is a small airport in Kagera, at latitude -1.55043 and longitude 31.10637. The runway has approximately 986 m[6] and the head is about 6.5 km from the 400 kV Mutukula-Kyaka TL, in the region of the vertices KN-11 and KN-12. However, as the runway is approximately parallel to the TL (see **Figure 8.2.3.3.c**), the distance from it to the TL in the landing-take-off direction is about 18 km. Therefore, the TL does not pose a risk to landings and take-offs on this runway.

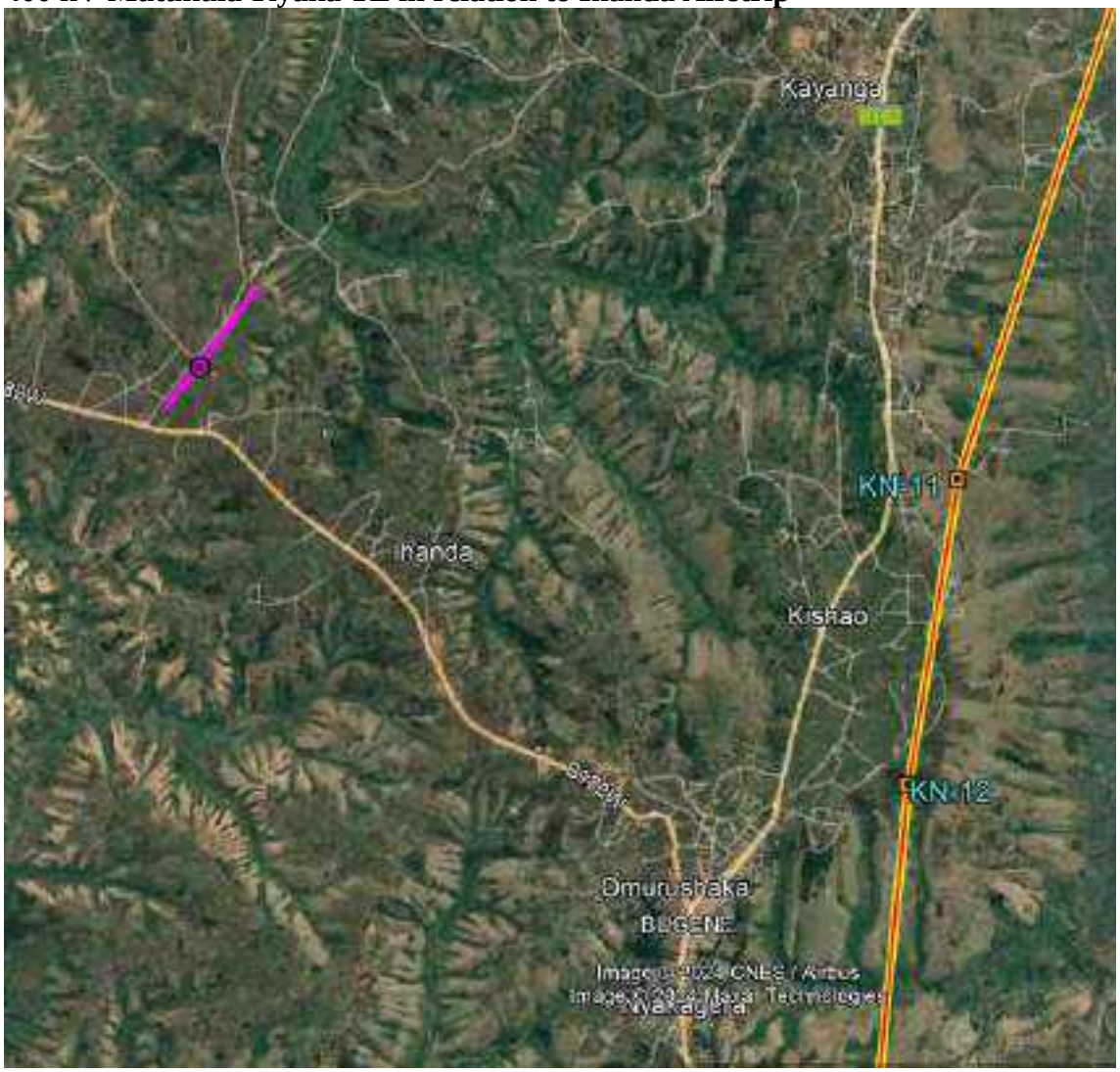
The other nearby runway is at Shinyanga Airport, a small airport in Shinyanga, located at latitude -3.60927 and longitude 33.50328[7]. Shinyanga Airport, also known as Ibadakuli Airport, is a public airport operated by the Tanzania Airports Authority (TAA)[8]. The airport runway is predominantly gravel and grass, measuring 2 km long and 30 m wide.

Although the runway is very close to the 400 kV Nyakanazi – Ibadakuli TL (about 800 m north of vertex NI-31), it is parallel to it (see **Figure 8.2.3.3.d**), so the TL should not pose a risk to runway operations either.

Shinyanga Airport is classified under ICAO's Aerodrome Category 3 (CAT III) – CODE 3C and is certified to operate aircraft such as the Bombardier Dash 8 Q400. According to information provided by the TAA/TANROADS during interviews, the UTIP alignment, which runs parallel to an existing T-line located even closer, remains outside the *Runway Safety Area*, declared 300 meters.

[5] https://data.humdata.org/dataset/hotosm_tza_airports?
[6] https://metar-taf.com/airport/TZ-0072-ihanda-airstrip
[7] https://metar-taf.com/TZ-0154
[8] TANROADS is now responsible for implementing the Rehabilitation and Upgrading of Shinyanga Airport through a construction contract with SMEC that started in April 2023 and will last 30 months, financed by the European Investment Bank. This contract includes the paving of the runway and improvements to the passenger terminal.

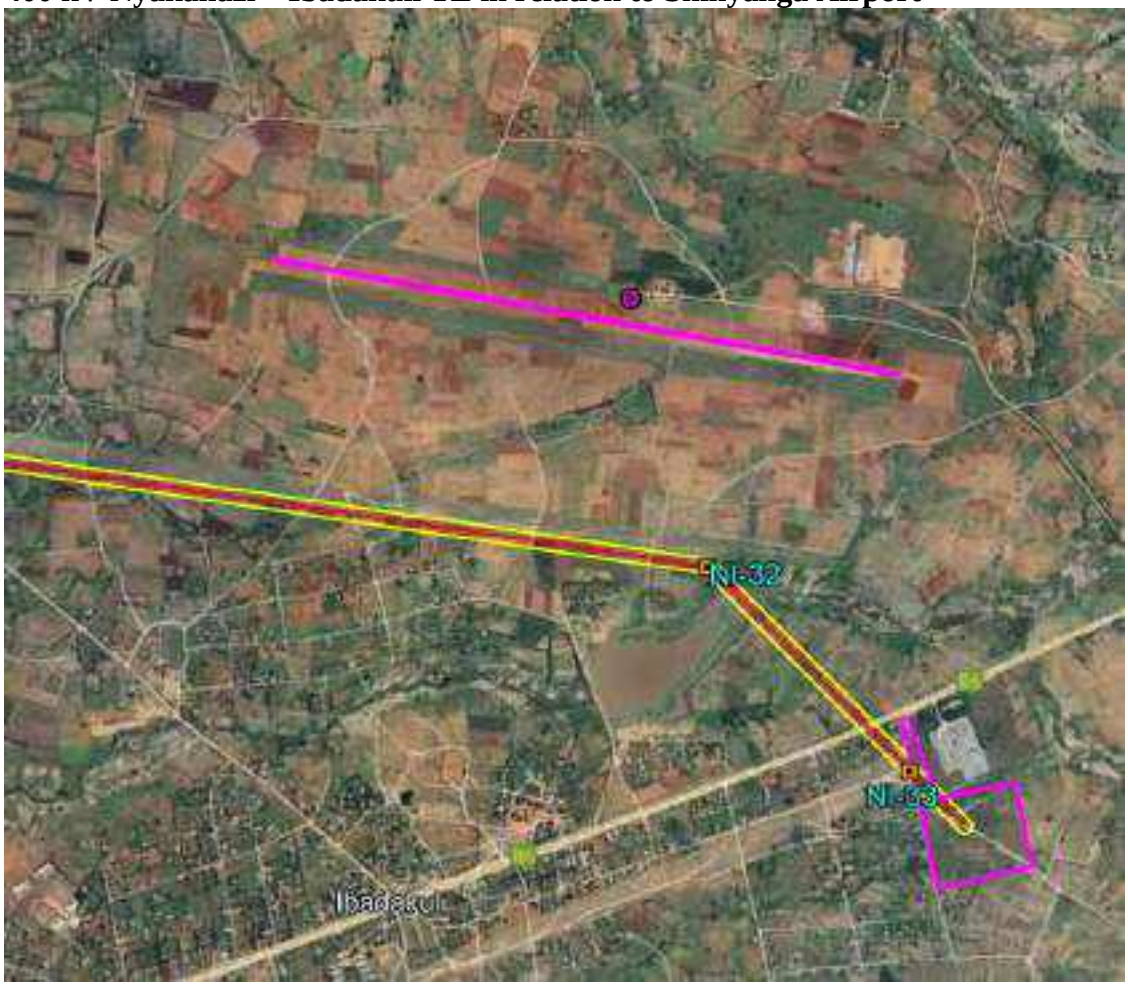
Figure 8.2.3.3.c
400 kV Mutukula-Kyaka TL in relation to Ihanda Airstrip



Legend:

	400 kV Mutukula-Kyaka TL route
	Wayleave
	Ihanda Airstrip runway

Figure 8.2.3.3.d
400 kV Nyakanazi – Ibadakuli TL in relation to Shinyanga Airport



Legend:

	400 kV Nyakanazi-Ibadakuli TL route
	Wayleave
	Shinyanga Airport runway

Mitigation Measures

The UTIP project does not interfere with operations at Shinyanga Airport, as the alignment is outside the Runway Safety Area (RSA), as explained above. However, it is recommended that Shinyanga Airport be included in the **P.12 - Stakeholder Engagement Plan** by implementing the good stakeholder engagement practices during construction and operation listed in **Table 9.0.a** of **Chapter 9.0** as part of the implementation.

Rating of the resulting impact

Considering the implementation of the measures listed in **Table 9.0.a**, the impact, related to the operational phase is classified as negative, with geographical coverage in the DAI. It has an indirect incidence, short-term induction, and long-term duration. It is reversible

(in the unlikely event of TL removal), has a low probability of occurrence, and has no cumulativeness or synergy. It has medium magnitude (because it has long-term duration) and moderate importance. It is low mitigable, with residual significance remaining moderate.

Rating of the impact (attributes) Interference with airport runways			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Operation	**Form of incidence**	Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	Moderate		
Mitigability	Low Mitigable		
Residual Importance	Moderate		

12. Impacts on Livelihoods and Quality of Life of the Population

12.01 - Generating public expectations

Impacting actions	A.1.01 Dissemination of the project A.1.02 Initial operational structuring A.2.01 Mobilisation of workforce A.2.02 Mobilisation of camp sites A.2.03 Negotiation and compensation of owners and occupants
Impactable component	C.3.05 - Livelihoods and Quality of Life of the Population

Analysis of potential impact

Social impacts do not start with the construction phase, but rather at the moment that parties potentially affected or interested by a particular project become aware of its existence, either through public news, through public consultations and meetings with local entities and authorities, from field inspections for topography, engineering and environmental studies, including interviews with the population and other situations.

This movement of project-related technicians in the region before the start of construction, if not accompanied by a good communication strategy, could generate fears about possible negative impacts and conflicts between these workers and residents. This is because many activities require these strangers to enter fenced-in properties, whether to carry out topographical surveys, field markings, geotechnical studies, as well as surveys for the ESIA, which include flora and fauna surveys and interviews with residents, which can be seen as an invasion of these people's privacy.

Even in the preliminary stages, the mere announcement that there will be a TL can already generate the feeling that a decision was made without the community's involvement. Once the type of project to be built has been communicated, the fears become those related to

the construction phase, such as disturbance and hazards caused by construction activities, restriction of land use in the properties affected by the institution of the wayleave, presence of workers from outside the region, among others. There are also positive expectations, such as those related to compensation for land use and improvements affected, the possibility of employment at the works, the possibility of receiving electricity or having the service improved, other benefits for the community in general, among others.

The issue of electrification, i.e. that the construction of the TL will bring electricity or a better service to the communities, should be among the main points to be addressed in communication strategies, since it is one of the points that most aggravates the frustration of stakeholders: often, the communities impacted by a TL will not have direct access to the energy that is being transported by that structure that crosses their land, alters their landscapes and affects their way of life. In other words, they suffer the impacts - such as property devaluation, land use restrictions and environmental effects - without enjoying the most expected benefits, such as an improvement in the local electricity supply. This intensifies the sense of injustice, since the infrastructure passes through there, but the gains go to other urban centres or consumers further away.

In case of uncertainties resulting from a lack of information about the project and the interaction between potentially affected and interested people, both fears and expectations may be exaggerated or may not correspond to the reality resulting from the Project. Situations of uncertainty can create concern and distress and may even lead to contentious and conflicting attitudes and actions.

Mitigation and Enhancement Measures

For the Projects, it is important and necessary to start developing information, communication, and participation processes with the affected people and other interested parties on the characteristics of the Project and the possible impacts as soon as possible, in order to reduce uncertainty and, on the other hand, to gather contributions to the design of the best solutions to mitigate impacts.

In the context of this ESIA, consultations were held with different stakeholders (a total of 39 stakeholders) during the socio-economic fieldwork.

As set out in the **Stakeholder Engagement Plan (SEP)**, another round of consultations will take place after the ESIA is completed, to present the final version of the proposed ESMP's Plans and Programmes and respective measures.

The complete set of Plans and Programmes and respective measures to prevent and mitigate this impact is presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

With the correct and full implementation of the measures proposed in **Table 9.0.a**, this impact can be characterised as having both positive and negative vectors, with a

geographical coverage in the IAI, starting in the planning phase, but mainly related to the construction phase of the Project. It has a direct incidence, immediate induction, and short-term duration. It is certain, but reversible. It is not cumulative, but it is synergic. It has low magnitude (because it's short-term) and low importance (because it's reversible). It is easily mitigated with the planned communication measures, resulting in low residual significance. However, even though studying alternative routes has greatly reduced the impact, the areas crossed are densely occupied, and the number of people affected is still high. Given this, the residual importance was reclassified as moderate.

Rating of the impact (attributes) **Generating public expectations**			
Vector	Positive and Negative	**Location and spatialization**	IAI
Stage of occurrence	Planning/Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Certain
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Highly Mitigable		
Residual Importance	Moderate		

12.02 – Disturbances associated with construction activities (due to noise emissions, dust, vibrations, increased traffic)

Impacting actions	A.2.04 Vegetation clearing A.2.05 Demolition of improvements A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Earthworks in the substation area A.2.09 Excavation and installation of grounding mesh in the substation area A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables A.2.13 Operation of camp sites
Impactable component	C.3.05 - Livelihoods and Quality of Life of the Population

Analysis of the potential impact

Some construction activities, such as increased noise and vibration, dust, gas emissions, and traffic, have the potential to affect the well-being of residents in close proximity to camp sites, work fronts, and access roads.

In addition to noise and vibration, dust suspension is part of the disturbance caused by the work activities, as set out in the Physical Environment Impact "Change in air quality at the work fronts and camp sites during construction". In this case, the activities with the greatest potential for causing impact are those that directly involve land movement, in the case of earthworks in the substation areas, and for implementation/improvement of

accesses, and the excavations for the foundations of the towers. Another activity that causes dust emissions is vehicle traffic on dirt roads.

A few stretches of the TLs are completely unobstructed, and their surroundings are unoccupied. There are isolated houses near the TLs, more or less close to them, and some intercepted by the wayleave, practically all along the route. However, when passing through some villages, the density of occupation is higher, as in the following sections (**Figure 8.2.3.3.e**), which are considered to be the stretches where this impact is of greater magnitude, as it affects a greater number of people:

Figure 8.2.3.3.e
TLs' stretches where the surrounding area is more densely occupied and which are most critical to the effects of this impact

<table>
<tr><td> </td><td>
</td></tr>
<tr><td>400 kV Mutukula-Kyaka TL passing through the village of Nyabihanga.</td><td>400 kV Kyaka-Nyakanazi TL (in the region of vertex KN-12) passing through the village of Chagati.</td></tr>
<tr><td> </td><td> </td></tr>
<tr><td>400 kV Kyaka-Nyakanazi TL (in the region of vertex</td><td>400 kV Kyaka-Nyakanazi TL (in the region of vertex</td></tr>
</table>

Figure 8.2.3.3.e
TLs' stretches where the surrounding area is more densely occupied and which are most critical to the effects of this impact

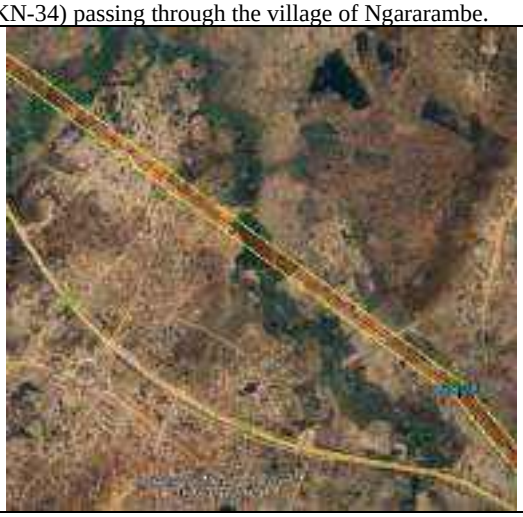
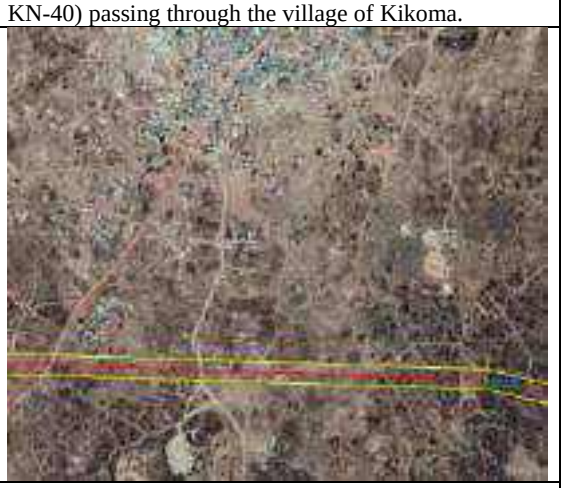
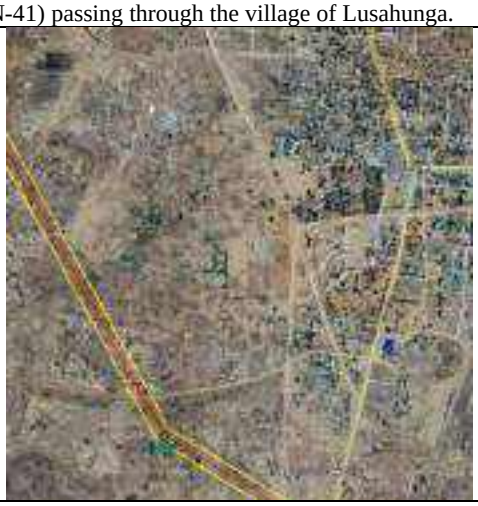
KN-34) passing through the village of Ngararambe.	KN-38) passing through the village of Busiri.
	
400 kV Kyaka-Nyakanazi TL (in the region of vertex KN-39) passing through the village of Kikoma.	400 kV Kyaka-Nyakanazi TL (in the region of vertex KN-40) passing through the village of Kikoma.
	
400 kV Kyaka-Nyakanazi TL (in the region of vertex KN-41) passing through the village of Lusahunga.	400 kV Nyakanazi-Ibadakuli TL (in the region of vertex NI-15) passing through the village of Kalole.
	
400 kV Nyakanazi-Ibadakuli TL (in the region of vertex NI-23) passing through the villages of Mwiseme and Solwa.	400 kV Nyakanazi-Ibadakuli TL (in the region of vertex NI-26) passing through the village of Iselamagazi.

Figure 8.2.3.3.e
TLs' stretches where the surrounding area is more densely occupied and which are most critical to the effects of this impact

400 kV Nyakanazi-Ibadakuli TL (in the region of vertex NI-31) passing through the village of Uzogore.	400 kV Nyakanazi-Ibadakuli TL (in the region of vertex NI-33 and Ibadakuli SS) in the village of Ibadakuli.

These communities and the isolated houses closer to the work fronts will be susceptible to discomfort from increased noise and vibration levels due to machinery operation and from dust caused by the excavation of trenches for tower foundations and earthworks at the SS expansion sites, especially during construction in the dry season.

The choice of camp site areas should favor places that are relatively far from houses. If this is not possible, the residents of the nearest houses will also be disturbed by noise and emissions caused by the operation of the concrete plants, carpentry and ironwork activities, and the operation of other equipment and machinery. Dust generated by the handling of aggregates for concrete production will also be generated.

The residents of the houses along the access roads will be disturbed by noise, vibrations, and gases emitted by vehicles using fossil fuels, and those living near dirt roads will also be disturbed by increased dust.

Mitigation Measures

The prevention and mitigation measures for this impact are listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Considering the implementation of the measures proposed in **Table 9.0.a**, this negative impact of the construction phase will be direct, with a geographical coverage mainly in the DAI, including the DAI around access roads. It is of immediate induction and short duration (construction period). It is reversible and is certain to occur. It's not cumulative,

but it is synergic. When applying the methodology, the magnitude and significance are low due to the short duration and reversibility of the impact. Although highly mitigable, the high density of the surrounding population along some stretches of the route and the existence of isolated houses along practically the entire length of the route led to an increase in residual importance to medium.

Rating of the impact (attributes) Disturbances associated with construction activities (due to noise emissions, dust, vibrations, increased traffic)			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Certain
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Highly Mitigable		
Residual Importance	Medium		

12.03 – Disturbance due to increased noise during operation

Impacting actions	A.3.01 Operation of the TLs and SSs
Impactable component	C.3.05 - Livelihoods and Quality of Life of the Population

Analysis of the potential impact

During the operation phase, noise may also discomfort the population close to the boundary of the TL's wayleave and the SSs' expansion areas.

Due to the Corona Effect, the operation of TLs produces a wide-range noise, usually described as humming, clicking, or whistling. Although this noise is rarely of sufficient intensity or volume to cause discomfort and provoke complaints from the neighbouring population, it is an impact to be considered.

Atmospheric conditions can cause significant variations in the intensity of the Corona Effect, especially in TLs with tension above 220 kV, which is the main source of noise emissions from TL operation. In rainy and humid weather, the noise generated by the operation of TLs can reach relatively high sound levels and be a source of discomfort for the surrounding populations.

As stated in **Section 5.1** of this ESIA, the audible noise calculated for the 400 kV TLs in this Project will be around 50.03 dB in heavy rain and 39.25 dB when the conductor is wet, both at the edge of the wayleave.

To check the current noise levels in the regions along the Project, a sound pressure level measurement campaign was carried out during the day between June 10th and 15th, 2024,

at 8 selected points located in the vicinity of the Project. The results of this noise measurement campaign are presented in **Section 7.1.9** of the Physical Environment diagnosis.

The occupation around the SSs and TLs is predominantly residential, with sparse residences, so the noise limits set by Government Notice - GN No. 32 published on 30/01/2015 are 50 dB for the daytime and 35 dB for the night-time. All the noise points measured in the June 2024 campaign showed values below the limits defined in this standard. The highest values between those measured and the standardized norms, i.e., 50 dB and 35 dB for the daytime and night-time periods, respectively, prevail for establishing the baseline.

To estimate future noise, it is necessary to add up the noise forecast for the project with the ambient noise (50 dB and 35 dB), using the following formula:

$$L_{esp} = 10.\log_{10} (10^{Ltot/10} - 10^{Lres/10})$$

Where:
L_{esp} is the sound pressure level of the specific sound (emitted by the project)
L_{tot} is the total sound pressure level
L_{res} is the residual sound pressure level

For the wet conductor, the predicted noise at the edge of the wayleave is 50.4 dB during the day and 40.6 dB at night. For days of heavy rain, the calculations result in 53 dB during the day and 50.2 dB at night.

Noise acceptance levels vary depending on the receiver and the existing background noise. A community generally reacts negatively to a sound source at 65 dB, when rare complaints arise. These become widespread when the noise level reaches 75 dB, with noise pollution becoming unacceptable at 80 dB[9].

The Organisation for Economic Co-operation and Development (OECD) (1986) presented the following noise levels as annoyance thresholds (L_{Aeq}) for the daytime period:

- from 55-60 dB (A), noise annoys;
- between 60-65 dB (A), annoyance increases considerably;
- from 65 dB (A) onwards, disturbances in behavioural patterns appear, symptomatic of serious damage caused by noise.

According the International Finance Corporation (IFC)'s recommendations, in the case of residential areas, the noise impacts of new projects should not exceed 3 dB and/or result in levels higher than 55 dB for the daytime period and 45 dB for the nighttime period.

Although the results of the calculations indicate an increase of more than 3 dB at night in

[9] Murgel, Eduardo – "Vamos Respirar? ", in Ecópolis, Fundação SOS Mata Atlântica, S. Paulo, 1996 apud SANTOS, C. R. R. Alteamento de torres de linha de transmissão de energia para minimização de impactos ambientais. Monografia para conclusão do Curso de Especialização em Gestão Ambiental e Negócios do Setor Energético do Instituto de Eletrotécnica e Energia da Universidade de São Paulo, 2012.

both conditions (wet conductor and heavy rain), the results of the acoustic monitoring carried out by JGP in the vicinity of a 500 kV TL in operation in Brazil[10] showed that of the 14 points evaluated (all in rural areas), located at distances of 0 to 30 meters from the edge of the wayleave, only 6 showed a sound pressure level higher than that measured before the operation of the TL (baseline).

The points where the values were exceeded were located in rural settlements, and at none of the points was the increase attributed to noise from the TL, but rather to sources in the neighbourhood itself. As shown in **Table 8.2.3.3.a**, there was no increase in noise levels at farm and ranch sites (isolated residences).

Table 8.2.3.3.a
Baseline values x measured values in the operation of a 400 kV TL

Occupation type	Distance to the edge of the wayleave (m)	Baseline values (dB)	Measured Operation Values (dB)
Village	0	40.0	42.9
Detached residence	5	43.3	41.3
Detached residence	0	45.0	41.3
Detached residence	1	40.0	39.9
Village	7	40.3	39.5
Village	8	42.1	38.8
Village	14	42.7	42.9
Village	27	40.0	41.4
Village	30	41.3	46.6
Village	30	40.0	40.0
Village	6	49.1	40.2
Village	11	41.2	44.7
Village	22	40.0	47.9
Village	0	41.0	40.2

Fonte: JGP (2017).

Based on the results of this study, a 50-metre *buffer zone* around the expansion area of the SS was proposed for assessing the noise levels of the project's operation. Noise measurement points were also indicated in the nearest residences (within the 50 m buffer zone), which will be more exposed and therefore more susceptible to discomfort from increased noise. However, occupation in these areas is not very dense, as seen in **Figures 8.2.3.3.f**, **8.2.3.3.g**, and **8.2.3.3.h** below.

Regarding the TLs, measurements will be taken at the same points as the baseline (presented in **Section 7.1.9**), also choosing the residences closest to the wayleave.

[10] LT 500 kV Morro do Chapéu Sul II – Sapeaçu – da Odoyá Transmissora de Energia (JGP, 2017).

Figure 8.2.3.3.f
SS Ibadakuli

Legend:

	Houses closer and more susceptible to noise disturbance during SS operation
	50 m buffer zone around the SS
	SE Ibadakuli expansion area
	Nyakanasi – Ibadakuli TL

Figure 8.2.3.3.g
SS Nyakanazi

Legend:

	Houses closer and more susceptible to noise disturbance during SS operation
	50 m buffer zone around the SS
	SE Nyakanasi expansion area
	Kyaka - Nyakanasi TL

Figure 8.2.3.3.h
SS Kyaka

Legend:

	Houses closer and more susceptible to noise disturbance during SS operation
	50 m buffer zone around the SS
	SE Kyaka expansion area
	Kyaka - Nyakanasi TL

Mitigation Measures

To mitigate the negative effects of this impact, the ESMP includes a list of measures presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

With the implementation of the measures shown in **Table 9.0.a**, the impact of the operation phase is considered negative, restricted to the portion of the DAI closest to the DAA. It has an indirect incidence, medium-term induction, and long duration. It has a medium probability of occurrence and is reversible with the implementation of mitigation

devices, if necessary, which may include the construction of substation walls, equipment enclosures, etc. It is cumulative but not synergic. According to the methodology, the magnitude is medium, and the importance is moderate. It is moderately mitigable, resulting in moderate residual significance.

Rating of the impact (attributes) Disturbance due to increased noise during operation			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Operation	**Form of incidence**	Indirect
Temporality (Induction)	Medium term	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability**	Medium
Cumulativeness	Cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	Moderate		
Mitigability	Moderately Mitigable		
Residual Importance	Moderate		

12.04 – Changes in the landscape

Impacting Action	A.2.02 Mobilization of building sites A.2.04 Removal of vegetation and clearing of land A.3.01 Operation of the TLs and SSs A.3.03 Inhibition of secondary regeneration of native vegetation in the wayleave
Impacted Component	C.3.05 - Livelihoods and Quality of Life of the Population

Analysis of the potential impact

The changes in the landscape will result from the wide range of interventions that will be carried out for the implementation of the TLs and expansion of the SSs, which will guarantee the conditions of operation. In addition to these interventions, temporary and punctual operations are also expected at sites that will serve as support facilities for works, such as building sites. It should be emphasized that changes in the landscape will have both a temporary and a permanent character, the latter being due to the incorporation of new objects (fixed) that will last throughout the useful life of the Project.

The landscape characteristics in the IAI are defined by two main components, namely (1) the presence of metasedimentary rocks associated with mountainous relief, and (2) high-elevated plains and alluvial plains on crystalline rocks of the Tanzanian Craton. At the regional scale (IAI), plutonic rocks, granites, and rocks of different grades of metamorphism, such as migmatites, stand out.

The E-W corridor has relatively flat terrain whose monotony is only broken by groups of hills or even residual ridges that form restricted mountainous areas, such as those near Solwa. North of Nyakanazi, in the N-S portion of the TL, there is a predominance of steeper slopes and mountainous areas, which can rise to an altitude of 1,700m. The alluvial deposits form pleasant plains that are extensively used for agriculture, as seen in

the Kagera river valley and in some areas of Shinyanga.

About the vegetation compartments, a succession of mosaics, mainly formed by secondary vegetation, are mentioned in the project area, due to the strong anthropic influence (agriculture and livestock). There are, however, large areas covered by vegetation, mainly from Nyakanazi up to Kyaka. In general, vegetation covers typologies such as semi-deciduous dry forests, wetland vegetation accompanying rivers, undifferentiated vegetation, and fallow fields (including regenerating forests), which were characterized within the baseline.

The construction of the towers and the presence of cables for the UTIP Project will introduce a new element in these regional landscapes, where the effects of the impacts will have different intensities. The linear element will have a permanent character and be incorporated into the human elements that define the regional cultural landscape.

An important factor to mention is that all landscapes are cultural and read from human references, which attribute value to both the natural and human aspects that come together to define a landscape arrangement. Thus, it is fundamental to consider the landscape references from objective recipients, that is, from communities and populations that are in direct contact with the landscape, and therefore, able to evaluate the meaning of introducing a new element in it, as is the case with a TL.

In theory, the intensity of the landscape impact is dependent on the visual distance of the perceiver, that is, it is a function of the distance of the TL from the nearest communities. Added to this element of perception is the everyday use of the spaces where the TL is planned, which will make this new element to be introduced into the landscape an element with a significant spatial dimension in the people's experience.

The alignment and alternatives studies tried to distance the TL from areas of human clusters to avoid impacts with these characteristics. Despite the attention given to these factors, the TL will pass very close to several communities and even consolidated urban areas, such as the approach to Old Shinyanga and Kyaka.

It is worth mentioning that the insertion of a linear object into the landscape, such as a TL, is an inherent condition of the project, and the occurrence is certain and irreversible. In addition to the TL's own insertion, punctual and temporary elements, such as camp sites, will also be inserted into the landscape.

Suppressing vegetation along the TL's wayleave may constitute, together with the insertion of physical elements, one of the main actions with the potential to modify the landscape. Replacing the vegetation cover by the imposition of the wayleave will be equally permanent and necessary for the implementation and proper functioning of the Project components. The effects of imposing the wayleave will also be on the agricultural areas, particularly the subsistence farming areas, which constitute an important activity along a good part of the alignment.

In addition to these components, the changes in the landscape resulting from the camp sites are not ruled out. In selecting areas, those relatively close to urban centres will be chosen, but with the distance necessary to avoid annoyances related to noise and atmospheric emissions, and possible conflicts with the population due to the presence of workers from outside the region. In such cases, the effects on the landscape will be temporary and therefore reversible.

Mitigation and Enhancement Measures

Considering the general characteristics of the impact on the agenda, and to mitigate the importance of its effects, several measures were proposed. They are listed in **Table 9.0.a** of **Chapter 9.0**.

Qualification of the resulting impact

When considering the effectiveness of implementing all the measures mentioned in **Table 9.0.a**, this impact is treated as negative, from the implementation and operation phases, with direct incidence, restricted to the DAI. It is a certain, irreversible, immediately occurring, and lasting impact throughout the Project's lifecycle. It has cumulative and synergic effects. It presents medium magnitude and high importance, due to its proximity to areas of human occupation, to a greater or lesser extent, for most of the alignment. As it is low mitigable, its residual importance remains high.

Impact Qualification (attributes) Changes in the landscape			
Vector	Positive / Negative	**Location and spatialization**	DAA/DAI
Stage of occurrence	Construction / Operation	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Irreversible	**Probability**	Certain
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Low Mitigable		
Residual Importance	High		

12.05 - Changes in land use and loss of agricultural areas

Impacting actions	A.2.03 Negotiation and compensation of owners and occupants A.2.04 Vegetation clearing A.2.05 Demolition of improvements A.3.03 Inhibition of secondary regeneration of native vegetation on the wayleave
Impactable component	C.3.05 - Livelihoods and Quality of Life of the Population

Analysis of the potential impact

Implementing a TL imposes restrictions and/or changes in land use and occupation, due to the establishment of the wayleave. The removal of vegetation to implement the project will be carried out in an area smaller than the wayleave, which has been called the service strip, 14 metres wide. The native vegetation within this service strip will be completely removed along the entire length of the route, as will the vegetation in the area of the towers (see **Figure 5.1.1.e** in **Section 5.1.1**) and the areas where the SEs are being extended. However, the entire 52 metres of wayleave will be cleared for the crops.

Vegetation and crops will also need to be removed temporarily in areas the project uses, such as camp sites, other support areas, and access roads. However, the selection of areas for implementing such structures will prioritise those already anthropised, preferably with herbaceous vegetation or exposed soil. Estimating this impact is impossible, as the areas for these temporary facilities have not yet been defined and will be chosen by the contractors in the future.

The **Table 8.2.3.3.b** below shows the impact on cyclical and perennial crops and forestry by TL and by Region, District, and Village, considering the establishment of the 52-metre wayleave and the expansion areas of the SS (which are the areas permanently affected by the project, not including definitive access sections outside the wayleave, because it is not known whether they will be necessary or what their route will be).

The intervention area resulted in 2,888.48 ha (2,854.33 ha of the wayleave and 34.15 ha of the SSs' expansion areas), of which 1,274.68 ha (44.13%) correspond to crops and forestry. The largest part, 1,149.27 ha (90.2%), corresponds to annual crops, 76.53 ha (6.0%) to perennial crops, and 48.88 ha (3.8%) to forestry.

As can be seen in **Table 8.2.3.3.b**, the greatest impact on crops, especially annual crops, is on the 400 kV Nyakanazi - Ibadakuli TL, confirming the greater degree of anthropisation in the region crossed by this TL compared to the other TLs, which run in a N-S direction. On the 400 kV Kyaka - Nyakanazi TL, which is not much shorter than the 400 kV Nyakanazi - Ibadakuli TL, only 48 km shorter, the total area of crops impacted is 196.58 ha, 21.3% of the total impacted on the 400 kV Nyakanazi - Ibadakuli TL (923.88 ha).

In turn, the LTs in the N-S direction impact more native vegetation. Adding up all the phytophysiognomies, the native vegetation impacted on the two TLs in the N-S direction totals 864.88 ha, while on the 400 kV Nyakanazi - Ibadakuli TL (W-E direction), the native vegetation totals 244.65 ha (28.3% of the total in the other TLs), confirming the greater degree of anthropisation of the landscape in this part of the Project.

Of the 157.47 ha of annual crops impacted in 400 kV Kyaka - Nyakanazi TL, 30% are concentrated in 2 villages, 3 wards, Nyakahura (the villages of Mabare, Nyabugombe, and Kikoma). Another 30% are in Kyaka, Lusahunga, Ngararambe, and Rugese villages.

The impact of 400 kV Nyakanazi - Ibadakuli TL is more distributed, with the highest values, above 20 ha, occurring in the villages of Bulega, Butinzya, Bugalagala, Ilogi, Igwamanoni, Kayenze, Isonda, Nzoza, Mwabagehu, and Mwang'osha. These 10 villages account for 34% of the total area of annual crops affected by this TL.

About the perennial crops impacted, **Table 8.2.3.3.b** shows that their total, 76.53 ha, considering the 3 TLs, represents only 6.7% of the total annual crops impacted, which total 1,149.27 ha. However, evaluating the 3 TLs separately, it can be seen that the largest amount in terms of area, 39.11 ha, occurs on the 400 kV Kyaka - Nyakanazi TL, while the 400 kV Mutukula - Kyaka TL has 34.96 ha, and the 400 kV Nyakanazi - Ibadakuli TL only 2.46 ha of this type of crop. However, comparing the first two in terms of their length, it can be seen that perennial crops are much more representative in the northern part of the Project, since the 34.96 ha occur on just 31 km of track, while the 39.11 ha occur on 235.65 km. The information gathered indicates that banana, avocado, and coffee perennial crops are very important for economic activities in the Kagera region.

As mentioned, the Project will also impact forestry (silviculture) areas. As shown in **Table 8.2.3.3.b**, they are most affected along the 400 kV Kyaka - Nyakanazi TL. Compared to the 400 kV Nyakanazi - Ibadakuli TL, which has a length of the same order of magnitude, the area affected in the second (4.62 ha) is 14.1% of that affected in the first (32.73 ha). However, even though the greatest impact in absolute numbers is on the 400 kV Kyaka - Nyakanazi TL, it is on the 400 kV Mutukula-Kyaka TL that the impact on forestry is greatest, considering that it is only 31 km long. The linear length of forestry fragments intercepted on the 400 kV Mutukula - Kyaka TL (2.22 km) corresponds to 7.2% of its route, while the linear length of reforestation fragments intercepted on the 400 kV Kyaka - Nyakanazi TL (6.30 km) corresponds to 2.70% of its route.

Table 8.2.3.3.b
Affected area (52-metre wayleave) of cyclical and perennial crops and reforestation, by LT and by Region, District, and Village

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
Outside of Tanzania	TL Mutukula - Kyaka	Outside of Tanzania (i.e., Uganda)	-	0.95	0.00	Outside of Tanzania (i.e., Uganda)	-	0.95	0.00
Kagera	TL Mutukula – Kyaka (31.01 km)	Missenyi DC	70.38	34.00	11.54	Bunazi	3.59	1.85	1.43
						Byamutemba	12.19	2.30	2.80
						Byeju	13.49	9.28	1.85
						Mutukula	8.61	2.41	2.92
						Ngando	15.27	13.09	0.65
						Nyabihanga	3.74	1.03	-
						Omudongo	8.58	4.05	0.82
	Kyaka Substation Existing area: 1.14 ha Expanded: 8.65 ha					Kyaka	3.77	-	1.06
						No Information	1.14	-	-
	TL Kyaka – Nyakanazi (235.65 km)	Biharamulo DC	106.35	2.43	10.08	Kabale	7.89	-	0.45
						Kikoma	21.13	-	3.35
						Lusahunga	12.50	-	0.49
						Mabare	6.16	-	2.32
						Ngararambe	12.98	-	2.27
						Nyabugombe	25.30	2.43	0.94
						Nyakasenga	9.63	-	0.25
						Rugese	10.75	-	-
		Karagwe DC	29.51	37.28	19.88	Bisheshe	0.46	7.94	2.68
						Bujara	1.11	1.53	1.09
						Bujuruga	-	0.85	-
						Chagati	1.50	1.95	2.95
						Ihembe I	-	1.57	-
						Kahanga	2.50	1.46	-
						Kasheshe	3.66	2.43	0.67
						Katanda	-	-	0.69
						Kishao	1.30	0.55	2.23

Table 8.2.3.3.b
Affected area (52-metre wayleave) of cyclical and perennial crops and reforestation, by LT and by Region, District, and Village

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
						Kishoju	1.00	-	1.13
						Miti	6.36	4.69	2.74
						Nyakahanga	-	-	0.22
						Nyakasimbi	3.90	-	4.53
						Nyakayanja	5.80	10.16	0.29
						Rukale	0.60	-	64
						Rwandaro	1.32	-	-
		Missenyi DC	13.29	3.55	2.75	Kyaka	13.29	3.55	2.75
		Ngara DC	8.33	-	-	Rwakalemera	8.33	-	-
	TL Nyakanazi – Ibadakuli (282.25 km)	Biharamulo DC	76.26	-	1.98	Kabale	4.23	-	0.20
						Mavota	26.89	-	-
						Mgera	12.43	-	-
						Mkunkwa	7.68	-	-
						Nyakanazi	3.96	-	-
						Nyakayenze	5.42	-	1.78
						Nyantakara/Iyengamulilo	15.65	-	-
Geita		Bukombe DC	117.49	0.27	2.47	Bulega	27.98	-	-
						Busonzo	6.02	-	-
						Butinzya	26.74	-	1.93
						Ibambilo	18.60	0.27	-
						Kabagole	9.64	-	-
						Nakayenze	13.47	-	-
						Nalusunguti	4.16	-	-
						Nampalahala	10.88	-	0.54
		Chato DC	34.36	-	-	Mnekezi	17.52	-	-
						Mwabasabi	2.40	-	-
						Songambele	14.44	-	-
		Geita DC	23.39	-	-	Ntono	14.06	-	-
						Shahende	9.33	-	-

Table 8.2.3.3.b
Affected area (52-metre wayleave) of cyclical and perennial crops and reforestation, by LT and by Region, District, and Village

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
		Mbogwe DC	170.90	2.19	0.13	Bugalagala	28.61	0.19	-
						Bulongo	15.38	-	-
						Busabaga	6.54	-	-
						Bwendamwizo	6.54	-	-
						Bwendanseko	13.09	1.85	-
						Ilolangulu	17.52	-	-
						Kadoke	11.29	-	-
						Kagongo	16.44	-	-
						Kashelo	13.79	0.15	0.13
						Mwanza	11.00	-	-
						Nambubi	13.76	-	-
						Nyitundu	16.93	-	-
		Nyang'wale DC	77.46	-	-	Bukulu	3.79	-	-
						Bukwimba	2.34	-	-
						Igeka	2.28	-	-
						Isonda	28.25	-	-
						Kasubuya	13.50	-	-
						Kayenze	27.30	-	-
Shinyanga	Ibadakuli Substation Expanded:12.2 ha	Shinyanga MC	2.17	-	-	Ibadakuli	2.17	-	-
	TL Nyakanazi – Ibadakuli (282.25 km)	Msalala DC	80.47	-	-	Busulwangili	6.83	-	-
						Buyange	13.42	-	-
						Igwamanoni	27.63	-	-
						Ilogi	30.29	-	-
						Kalole	2.30	-	-
		Shinyanga DC	283.34	-	-	Bukamba	11.40	-	-
						Ichongo	12.79	-	-
						Ipango	10.45	-	-
						Iselamagazi	17.77	-	-

Table 8.2.3.3.b
Affected area (52-metre wayleave) of cyclical and perennial crops and reforestation, by LT and by Region, District, and Village

Region	T-line Segment	District	Affected Area of crops (ha)			Villages	Affected Area of crops (ha)		
			Annual	Perennial	Forestry		Annual	Perennial	Forestry
						Lyabusalu	5.36	-	-
						Mwabagehu	21.13	-	-
						Mwabuki	17.81	-	-
						Mwajiji	18.18	-	-
						Mwamakaranga	18.83	-	-
						Mwang'osha	26.73	-	-
						Mwasekagi	15.15	-	-
						Mwasenge	19.66	-	-
						Mwiseme	3.63	-	-
						Mwongozo	15.02	-	-
						Nyang'ombe	0.51	-	-
						Nzoza	22.60	-	-
						Pandagichiza	5.31	-	-
						Shilabela	12.13	-	-
						Solwa	10.88	-	-
						Zunzuli	18.01	-	-
		Shinyanga MC	55.57	-	0.04	Ibadakuli	8.27	-	-
						Ihapa	1.99	-	-
						Old Shinyanga	21.53	-	-
						Seseko	17.15	-	0.04
						Uzogore	6.64	-	-
Grand Total			**1,149.27**	**76.53**	**48.88**		**1,149.27**	**76.53**	**48.88**

As mentioned, TANESCO's practice is to suppress the cultivated areas in the entire wayleave, not allowing even low-lying crops such as corn, rice, beans, and those that don't use fire as management, such as sugar cane, to continue to be planted in the wayleave during the operation of the TLs. For this reason, the impact on agricultural and reforestation areas will be permanent, not only in the areas of expansion of the SS, but also throughout the entire wayleave. TANESCO must indemnify it through the measures provided in the **Resettlement and Livelihood Restoration Programme**.

TANESCO will also indemnify the temporary loss of any crops or forestry that might be affected by setting up camp sites, other support areas, and access roads to be used during construction, will also be indemnified by TANESCO through the **Resettlement and Livelihood Restoration Programme**.

In addition to restrictions on cultivation and reforestation, the operation of the TLs is also incompatible with the presence of any kind of improvements within the wayleave, including houses and other installations such as fences, posts, sheds, irrigation pivots, etc.

It is important to remember that it will be necessary to suppress native vegetation of arboreal size in the service strip to launch the cables during construction and to ensure the safety of the TLs' operation. During operation, it may even be necessary to selectively prune specimens located in the rest of the wayleave, which, due to their height, could jeopardise the safety of the TLs. The impact on native vegetation is analysed under the Biotic Environment, in Impact 6.01.

Even if we consider the negative environmental impacts resulting from the reduction in vegetation cover, this suppression will benefit the population of the affected areas, since it will provide greater availability of areas for planting certain crops, where before this activity would not have been possible, precisely because of the presence of vegetation.

Mitigation Measures

Mitigation and compensation for this impact will take place mainly through the **Resettlement and Livelihood Restoration Programme**, which includes measures for communicating with those affected, valuing land and improvements, and fair compensation, taking into account criteria based on the corresponding regulations, to safeguard the current living conditions of the affected population.

Table 9.0.a of **Chapter 9.0** presents the complete set of programmes and measures to mitigate and compensate for this impact.

Rating of the resulting impact

Considering the application of the measures proposed in **Table 9.0.a**, this impact, from the implementation phase, restricted to the DAA, is considered negative, of certain occurrence, of direct incidence, immediate (after the start of impacting action A.2.04 Vegetation clearing), permanent and irreversible for some project facilities (wayleave, SS expansion areas and permanent accesses) and short-term and reversible for other facilities

(camp sites and other support areas and temporary accesses). It is cumulative but not synergic.

Due to its direct incidence, limitation to the DAA and permanence, this impact is considered medium magnitude. Its importance is high, considering its irreversibility.

It is highly mitigable through the Resettlement and Livelihood Restoration Programme measures. Still, given the possibility of very small plots being affected and the likely predominance of small subsistence production areas, the residual importance was kept high.

Rating of the impact (attributes) **Changes in land use and loss of agricultural areas**			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Permanent (permanent facilities) / Short term (temporary facilities)
Reversibility	Irreversible (permanent facilities) / Reversible (temporary facilities)	**Probability**	Certain
Cumulativeness	Cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Highly Mitigable		
Residual Importance	High		

12.06 - Interference with houses, schools, health facilities, and other improvements and sources of income

Impacting actions	A.2.03 Negotiation and compensation of owners and occupants A.2.05 Demolition of improvements (houses, health facilities, etc.)
Impactable component	C.3.05 - Livelihoods and Quality of Life of the Population

Analysis of the potential impact

As presented in **Section 8.1**, the alternatives study for the TLs greatly reduced the impact of establishing the TL wayleave on homes and other improvements. Despite this effort, there are still a large number of houses in the area of the future wayleaves, due to the total length of the project (548.91 km in total) and the interception of densely occupied areas, and even for those areas where there is no agglomeration of houses, these are present and scattered, and avoiding all of them would be impossible unless a much larger number of vertices were included.

It is estimated that 1,106 buildings and other improvements (including schools and health facilities) will be affected, of which 1,088 will be affected by the TLs' wayleave and 18

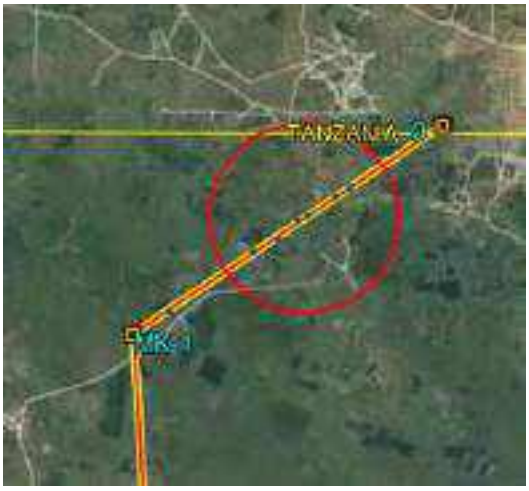
by the expansion of the Kyaka SS.

As detailed in **Section 7.3.7.1**, 15 schools and 11 health centres are directly affected by the t-line's wayleave, either inside or close to the designated area. Among the educational facilities, 6 schools (40%) are situated within the wayleave, with the highest concentrations found in the villages of Bisheshe (Karagwe District), hosting Bisheshe Primary School and Nyakahanga Secondary School, and Kyamulaile (Missenyi District), where Kyamulaile Primary School is impacted. The ward of Nyakahanga (Karagwe District) stands out, encompassing these two critical facilities entirely within the easement. Additionally, the ward of Kihanga (Karagwe District) reports multiple schools close to or within the wayleave, including Mwisa Primary School and Rwamugurusi Primary School, reinforcing the district's vulnerability.

Regarding health facilities, 1 center (9%) is located inside the wayleave, specifically Nyakayanja Health Center in Nyakayanja Village (Karagwe District), highlighting its direct exposure. The Karagwe District again exhibits the highest density of affected health facilities, with 5 centres inside or close to the wayleave, such as Nyakasimbi Medical Center (close) and Karagwe District Hospital (within the ward). The villages of Lusahunga and Nyakanazi (Biharamulo District) also report a notable cluster of medical centers, albeit with no direct intersection with the wayleave. Overall, the districts of Karagwe and Missenyi emerge as critical areas of concern, representing the majority of affected institutions. These findings underline the need for targeted mitigation measures in wards such as Nyakahanga and Kihanga to address the high concentration of directly impacted infrastructure.

Figure 8.2.3.3.i shows some examples of sections of the TLs where buildings (houses and other improvements) are more affected by the wayleave. The same figure shows photos of these areas taken with a drone. One photo also shows the existing houses in the Kyaka SS's expansion area. The other SSs to be expanded won't impact houses and other improvements.

Figure 8.2.3.3.i
Example of areas with a concentration of houses and other improvements in the wayleave, along the routes



400 kV Mutukula – Kyaka TL, before the MK-1 vertex.

400 kV Mutukula – Kyaka TL, about 12.5 km after MK-1

Figure 8.2.3.3.i
Example of areas with a concentration of houses and other improvements in the wayleave, along the routes

400 kV Mutukula – Kyaka TL, about 4 km before MK-2

400 kV Mutukula – Kyaka TL, in the region of the MK-2

In the SE Kyaka extension area

Figure 8.2.3.3.i
Example of areas with a concentration of houses and other improvements in the wayleave, along the routes

400 kV Nyakanazi – Ibadakuli TL, about 1 km before NI-26

Other drone photos are shown in **Annex 12**, on which the TL and its wayleave have been superimposed, simulating the impact on some stretches with the presence of houses.

As most of the impact on houses and businesses is related to establishing the 52-metre-wide wayleave, it is understood that houses and businesses will likely be relocated within the same area, without the need to resettle in more distant locations. In this case, it is understood that the risk of social fragmentation is greatly reduced, with family and community ties being preserved. As resettlement should occur within the same territorial and cultural context, productive and social routines remain virtually intact, and there will be no significant loss of access to services, infrastructure, or support networks, which is an important factor in preventing fragmentation.

During the interviews carried out with the population in the area of influence for the ESIA, characteristics of vulnerability were identified in the affected population and other Project's stakeholders. During the consultations, an effort was made to include the vulnerable population among the participants. Even with this effort in mind, there is a risk that vulnerable affected people have been left out of these consultations.

In any case, the **Resettlement and Livelihood Restoration Programme** provides for a socio-economic cadastre of those affected. This social cadastre will collect all information about the stakeholders affected by the Project will be collected, including data on the affected improvements, information on the affected businesses, information on houses that are also used as places of business, as well as information on the socio-economic characteristics of all family residents, including vulnerability characteristics. This will allow an assessment to be made of whether the impact falls most significantly on these vulnerable affected people, so that additional measures can be defined if necessary.

Mitigation Measures

As presented in **Chapter 6.0** of this ESIA, Tanzanian Legislation (see **Table 6.1.b**, Land Use and Occupation) ensures the rights to a fair assessment and expropriation that

compensates owners for the market value of their properties.

Mitigation and compensation for this impact will occur mainly through implementing the **Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)**. In addition to including valuation and compensation measures, the RPF includes actions specifically targeted at the population relocated due to the Project, in order to guarantee living conditions equal to or better than their current ones. This Programme includes measures to pay special attention to the needs of vulnerable and disadvantaged people.

Table 9.0.a of **Chapter 9.0** presents the environmental programs and measures planned to mitigate and compensate for this impact.

Rating of the resulting impact

Considering the implementation of the measures listed in **Table 9.0.a**, this impact is negative, with a geographic scope restricted to the DAA, occurring during the project's construction phase. It has a direct incidence, immediate induction, and long-term duration. It is reversible, with a certain occurrence. It does not present cumulativeness or synergy. The magnitude is medium, and the importance is high. It is highly mitigable through the measures established in the Resettlement and Livelihood Restoration Programme. However, the residual importance was maintained as high, given the still significant number of houses and other improvements impacted.

Rating of the impact (attributes) **Interference with houses, improvements, and sources of income**			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Irreversible	**Probability**	Certain
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Highly Mitigable		
Residual Importance	High		

13. Impacts on Land

13.01 - Reduction in the available area of properties due to the land taken by the Project

Impacting actions	A.3.01 Operation of the TLs and SSs
Impactable component	C.3.06 - Land

Analysis of the potential impact

As mentioned in **Section 5.1.3**, a wayleave will be necessary for the Project's TLs, which

cannot be used subsequently by the current landowners or extra-legal land users (people who have no recognizable legal rights to the land). This wayleave will be 52 metres wide along the entire length of the TLs, thus adding up to a total area of 2,853.8 ha. Considering the intercepted villages, the area affected for forming the wayleave in each of them is shown in **Table 8.2.3.3.c** below.

Table 8.2.3.3.c
Area to be occupied by the wayleave in each village

Villages	Area (ha)	Villages	Area (ha)
Outside of Tanzania (Mutukula village in Uganda)	0.95	Ibambilo	24.83
Mutukula	18.41	Bulega	37.,86
Byeju	44.41	Butinzya	41.14
Byamutemba	19.76	Kashelo	27.55
Ngando	36.48	Kagongo	16.94
Bunazi	11.27	Bugalagala	29.97
Omudongo	17.91	Busabaga	10.17
Nyabihanga	11.20	Ilolangulu	33.64
Kyaka	35.01	Nambubi	16.88
Mulamba	72.26	Bwendanseko	15.43
Katanda	68.00	Mwanza	19.79
Kihanga	12.66	Bulongo	15.94
Kishoju	26.76	Bwendamwizo	6.61
Miti	39.64	Nyitundu	17.45
Bujuruga	2.32	Kadoke	17.85
Chagati	11.41	Ntono	17.99
Kishao	8.21	Shahende	11.57
Omurushaka	2.77	Buyange	21.91
Nyakahanga	8.71	Ilogi	36.74
Bisheshe	47.42	Igwamanoni	30.20
Rwandaro	10.08	Busulwangili	7.71
Nyakayanja	29.20	Kalole	16.47
Rukale	2.81	Kasubuya	21.18
Ihembe I	7.41	Bukwimba	9.88
Kasheshe	16.01	Bukulu	6.40
Nyakasimbi	26.38	Kayenze	30.37
Bujara	14.70	Igeka	4.99
Kahanga	154.94	Isonda	43.08
Muungano	87.80	Nyang'ombe	0.51
Rwakalemera	166.81	Mwongozo	21.39
Nyabugombe	119.49	Mwasenge	23.54
Ngararambe	40.10	Zunzuli	18.87
Rugese	47.37	Ipango	10.95
Mabare	38.34	Nzoza	24.21
Busiri	13.24	Solwa	13.08
Kikoma	46.87	Mwiseme	16.56
Lusahunga	28.98	Mwasekagi	23.90
Nyakasenga	20.33	Mwabuki	24.40
Kabale	21.19	Mwabagehu	26.31
Nyakanazi	42.13	Mwajiji	30.36
Mgera	85.47	Lyabusalu	6.86
Nyantakara/Iyengamulilo	42.99	Bukamba	12.02
Nyakayenze	29.65	Ichongo	16.07

Table 8.2.3.3.c
Area to be occupied by the wayleave in each village

Villages	Area (ha)	Villages	Area (ha)
Mavota	34.65	Iselamagazi	25.62
Mkunkwa	16.80	Mwamakaranga	29.63
Kabagole	13.60	Mwang'osha	29.76
Busonzo	8.08	Shilabela	24.53
Nakayenze	21.32	Pandagichiza	24.47
Nampalahala	25.58	Old Shinyanga	36.61
Nalusunguti	14.26	Ihapa	6.90
Songambele	14.92	Seseko	25.10
Mnekezi	18.08	Uzogore	14.17
Mwabasabi	2.62	Ibadakuli	16.98
Total		**2,851.05**	

The **Table 8.2.3.3.c** shows that 105 villages in Tanzania and part of Mutukula village in Uganda (since 400 kV Mutukula – Kyaka TL starts in this country) are affected, but only three villages, Rwakalemera, Kahanga, and Nyabugombe (highlighted in green) account for 15% of the impact of land taking, totalling 441.24 ha ha out of 2,851.05 ha.

The area occupied by the Project also includes the areas where the SSs are being expanded, totalling 34.55 ha, 8.65 ha for the expansion of Kyaka SS (in the village of Kyaka), 13.70 ha for Nyakanasi SS (in the village of Kabale), and 12.20 ha for Ibadakuli SS (in the village of Ibadakuli).

At the current stage of the project, the number of landowners or extra-legal land users affected and the area of the wayleave located on each property are not known. Quantification of the individualised impact on each affected party will only be obtained when the physical cadastre is carried out as part of the RPF (P.11).

The impact of existing uses in this area of the wayleave has already been dealt with and quantified in previous impacts. The area of impact on native vegetation was quantified in impact 5.01; the impacted crops (including reforestation) were evaluated in impact 12.05; the areas with mining rights in impact 10.05; and the houses and other improvements in impact 12.06. This impact, however, deals with the area lost on each property, regardless of use, since no further use will be possible in this wayleave in the operation phase.

The landowner will be compensated for the land taken by the Project. The extra-legal land users will be compensated only for the impact on houses, improvements and crops, and not for the land.

In addition, for very small properties, the remaining area of the property, discounting the area of the wayleave, may be insufficient to develop the current activity and to obtain the same productivity. As mentioned, at this stage we don't have the size of the plots affected, but using data from the Fund and Agriculture Organization of the United Nations (FAO)[11], it is known that in the Tanzanian context, the average farm size for small

[11] https://www.fao.org/family-farming/countries/tza/en/

scale small-scale farmers is 0.9 to 3 ha. Taking this range of areas as a parameter, if the wayleave intercepts a plot with the smallest area, 0.9 ha (9,000 m^2), the strip would occupy more than half its area (5,200 m^2). In this case, the landowners or legal land users will be compensated for the whole property.

On the other hand, regarding the SSs, due to the size of the expansion areas, it will certainly be necessary to acquire areas of different plots for each SS.

The respective landowners will also be compensated for the temporary use of the areas to be used temporarily by the project, including those used to set up camp sites and any other necessary support areas**,** and to implement temporary access routes outside the wayleave. After this use, the landowner's interest in keeping the area stabilized but unoccupied or in restoring its vegetation cover will be assessed.

Mitigation Measures

As presented in **Chapter 6.0** of this ESIA, Tanzanian Legislation (see **Table 6.1.b**, Land Use and Occupation) ensures the rights to a fair assessment and expropriation that compensates owners for the market value of their properties. The measures proposed to mitigate and compensate for this impact are presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Considering the implementation of the measures listed in **Table 9.0.a**, this impact is characterized as negative, occurring during the construction phase of the Project. It has an immediate induction (once negotiating and acquiring land to establish the wayleave starts), with a certain occurrence. It's permanent and irreversible for some project facilities (wayleave, SS expansion areas and permanent accesses) and short-term and reversible for other facilities (camp sites and other support areas, and temporary accesses). It does not present cumulativeness or synergy.

Due to its direct incidence, the spatialization limited to the DAA and the permanence, this impact is considered medium magnitude. Its importance is high, considering its irreversibility.

It is highly mitigable through the measures established in the Resettlement and Livelihood Restoration Programme. Still, the residual importance was kept high given the possibility of very small plots and a large number of extra-legal land users being affected.

Rating of the impact (attributes) **Reduction in the available area of properties due to the land taken by the Project**			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Permanent (permanent facilities) / Short term (temporary facilities)

Rating of the impact (attributes) Reduction in the available area of properties due to the land taken by the Project			
Reversibility	Irreversible (permanent facilities) / Reversible (temporary facilities)	**Probability**	Certain
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Highly Mitigable		
Residual Importance	High		

14. Impacts on Historical, Cultural, and Archaeological Heritage

14.01 - Impact on graves

Impacting actions	A.2.03 Negotiation and compensation of owners and occupants A.2.04 Vegetation clearing A.2.10 Execution of tower foundations
Impactable component	C.3.07 - Historical, Cultural and Archaeological Heritage

Analysis of the potential impact

The field surveys carried out to prepare the Resettlement and Livelihood Restoration Programme (P.11) identified graves located in the routes' regions that could be affected by the construction works for the TLs. According to the expert's survey, the number of graves that could be affected in each region is shown in the following **Table 8.2.3.3.d**.

Table 8.2.3.3.d
Estimated number of possible graves affected by the routes of the TLs and the villages/wards where they are located

Villages	No. of Affected Graves	Wards	No. of Affected Graves	Wards	No. of Affected Graves
Mwamalili	01	Ngemo	03	Kayanga	05
Nyamalogo	01	Ikobe	02	Bugene	11
Lyabusalu	03	Ilolangulu	03	Nyakahanga	12
Mwenge	02	Butinzya	02	Nyaishozi	01
Iselamagazi	03	Bulega	04	Rugu	01
Solwa	08	Busonzo	03	Nyakasimbi	09
Salawe	01	Iparamasa	05	Nyakahura	03
Bugarama	05	**Total**	**22**	Lusahunga	04
Total	**24**			Nsunga	07
				Mutukula	13
				Kassambya	08
				Kyaka	03
				Total	**77**

Source: Inventory (Spotting) Valuation. Annex to the RPF. Data from Field Visit, June 2024

The following photos show two examples of graves identified during the fieldwork.

Photos 01 and 02: Graves located in the region of the Project.

As these are isolated graves and not cemeteries, it is difficult to change the route to avoid all possible impacts. It is therefore understood that some graves will need to be removed and relocated, and compensated for, as provided for in the Graves (Removal) Act, 1969.

Subject to the provisions of this Act, where any land on which a grave is situated is required for a public purpose the Minister may cause such grave and any dead body buried therein to be removed from the land and, in such case, shall take all such steps as may be requisite or convenient for the re-instatement of the grave and the re-interment of the dead body in a place approved by him for the purpose.

The numbers in **Table 8.2.3.3.d** are estimated. In addition, the graves listed are not properly localised with their coordinates. The number of graves that will be affected will only be defined once the executive project for the TLs has been finished and the cadastre to be carried out as part of the Resettlement and Livelihood Restoration Programme has been completed.

Mitigation Measures

Graves (Removal) Act, 1969. According to the Graves (Removal) Act, 1969, a grave "includes a burial vault, tomb, mausoleum or coffin and any gravestone, tablet, inscription, monument or memorial to the dead associated therewith''. The measures provided for in the ESMP for impacts on graves are listed in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Implementing the measures directed at this impact in **Table 9.0.a**, it is characterized as negative, with a geographic scope restricted to the DAA, occurring during the project's implementation phase. It has a direct incidence, immediate induction, and short-term duration. It is irreversible, with a high probability of occurrence. It does not present cumulativeness or synergy. The magnitude is medium, and the importance is high. It is highly mitigable through the measures established in the Resettlement and Livelihood Restoration Programme; therefore, the residual importance is medium.

Rating of the impact (attributes) Interference with houses, improvements, and sources of income			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Irreversible	**Probability**	High
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Highly Mitigable		
Residual Importance	Medium		

8.2.4
Identification and Assessment of Risks Associated with the Project

This section analyses the risks associated with the Project on physical, biological and socio-economic environment components, which will not necessarily materialise as negative impacts if the proposed preventive measures are effective. Finally, if it materializes, the rating of the eventual impact associated with this risk is assessed.

As can be seen, 13 risks associated with the Project were identified, all in the construction phase, 1 in the physical environment, 5in the biological environment and 7 in the socio-economic environment.

Matrix 8.2.3.a in **Section 8.2.3** shows the risks and associated preventive measures.

8.2.4.1
Physical Environment

15. Risks to Soils / Relief

15.01 - Risk of soil contamination (from leaks and inadequate management of effluents and waste produced)

Impacting actions	A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Earthworks in the substation area A.2.10 Execution of tower foundations A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities A.2.16 Recovery of direct intervention areas A.3.01 Operation of the TLs and SSs A.3.02 Routine maintenance and emergency repair of the system
Impactable component	C.1.01 - Soils / Relief

Analysis of the risk

Eventual leaks of hazardous and/or toxic products or improper disposal of contaminant effluents have the potential to negatively impact the soil, and consequently on water (surface and underground).

The occurrence of the impact, however, depends on several factors, including the type of substance, leakage volume, product characteristics such as viscosity, volatility, reactivity, solubility, etc., and environment characteristics such as effective soil porosity, water table depth, type of constituent material, aquifer type, and presence of structures (fractures and faults).

In this case, any leakage that occurs will first reach the ground, but will not necessarily reach the water table and surface drainage, which will depend on the product characteristics and the properties of the environment.

During the TL implementation works, the risk of soil contamination is associated with the movement of equipment and machinery in the accesses and towers implementation areas, the implementation or expansion of Substations, and the handling of hazardous products on the work fronts and building sites. Regarding the types of terrain, it is worth noting that the risk of contamination is higher in the floodplains, given the occurrence of clayey, soft alluvial soils and high-water table levels, as indicated by the baseline.

It should be noted that plains are intercepted along the entire TL alignment, with special emphasis on those that form a paleolacustrine environment observed from Ibadakuli up to Lunguya. The same applies to the areas at Kagera Plains and the region close to the Uganda border.

Therefore, special care should be taken in operations near work fronts with this type of terrain. In other types of terrain, the risk of significant soil contamination, considering the possibility of contaminant infiltration, is restricted to refuelling machines and vehicles on the work front.

However, particular emphasis should be given to the areas of planosols, which, due to their particle size characteristics, have high infiltration capacity. This capacity may condition the increase of contamination plumes in case of leaks.

The risk of soil contamination is higher on camp sites due to the presence of structures such as waste plants, chemical storage areas, and septic tanks, among others.

Tank trucks, either individually or in convoy, will be fuelled at commercial depots to later supply the vehicles on the building sites and work fronts. Gallons of fuel will also be used. Similarly, the operation of mechanic workshops in the building sites will require the use of lubricants and solvents, both of which have the potential for soil contamination.

Contamination is also associated with improper disposal of hazardous solid waste (oil-contaminated waste, concrete waste, lubricant and solvent containers, etc.) and improper

wastewater management, whether domestic (restrooms and dining halls and tents on the work fronts) or industrial (effluent from the mixer nozzle and workshop floor).

Mitigation Measures

The measures to prevent, control, and mitigate this impact are part of the Project's ESMP are presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

The risk is considered moderate given the set of measures presented in **Table 9.0.a**. If the impact occurs even with the measures, it will be negative, but limited to DAA. It is mainly of the construction phase, but it is not ruling out the possibility of it occurring in the operation phase.

It has indirect incidence, immediate induction, and long duration (although there is greater risk in the short term). It is fully reversible. It is neither cumulative nor synergic. The magnitude and importance are low. As it is fully mitigable, the residual importance is also low.

Impact Qualification (attributes) Risk of soil contamination			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction / Operation	**Form of incidence**	Indirect
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability**	Moderate
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Fully Mitigable		
Residual Importance	Low		

8.2.4.2
Biological Environment

16. Risks to Flora and Vegetation

16.01 - Increased risk of fire in adjacent vegetation

Impacting Action	A.2.02 Mobilization of building sites A.2.04 Removal of vegetation and clearing of land A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.13 Operation on building sites A.3.02 Routine maintenance and emergency system repair A.3.03 Inhibition of secondary regeneration of native vegetation in the

	wayleave
Impacted Component	C.2.02 – Flora and Vegetation

Analysis of the risk

Although the Project region has no pronounced arid climate characteristics, fires occur regularly and frequently in the region, originating from people preparing land for cultivation, collecting honey, or making charcoal (TIMBERLAKE & CHIDUMAYO, 2011) (**Section 7.2.1**).

The increased traffic of machinery, equipment, and workers on the work fronts during the construction of the TL will increase the risk of fire in surrounding native vegetation patches, especially in the driest months. The predominant vegetation in the alignment is Miombo, which is very susceptible to fire due to its seasonal behaviour, characterized by the deciduousness of tree leaves, and the dryness of the herbaceous stratum, which leads to the accumulation of combustible material (dry biomass) during the dry season.

The main factors related to the increased risk of fire during the TL deployment phase are as follows:

- Unregulated engines of machines and vehicles.
- Presence of flammable substances on the work fronts.
- Inadequate practices on work fronts, such as using small fires to heat food.
- Inadequate behaviour on work fronts, such as smoking and throwing cigarette butts into the surrounding vegetation.

During the operation phase, fire can also occur, affecting the surrounding vegetation, which can be caused by the following factors:

- Contact between cables and vegetation due to a lack of maintenance (pruning), resulting in sparks;
- Atmospheric discharge (lightning);
- Electrical arcing due to failure in insulators or cables, due to maintenance problems, wear of components, or damage caused by animals such as birds or rodents.
- Overloading and overheating of cables, which can generate sparks or come into contact with dry vegetation.
- Mechanical failures and component wear, resulting in short circuits or even cables falling.
- Strong winds and cable oscillation, which, if they come too close, can create arcs or even sparks.

The clearing of the vegetation itself, selective cutting in the wayleave, and other maintenance activities will ensure the TL operates in good condition and the maintains of a safe distance between the vegetation and the TL, reducing the possibility of electrical discharges and, consequently, fires. On the other hand, the dry plant material generated from the clearing may function as fuel in the event of a fire, endangering the patches of native vegetation surrounding the TL.

Mitigation Measures

While this represents a risk, the situation is mitigable. **Table 9.0.a** of **Chapter 9.0** presents the set of measures proposed to prevent this risk.

Qualification of the resulting impact

With the implementation of the preventive measures proposed in **Table 9.0.a**, it is considered that this risk has a medium probability of occurrence. If the impact occurs even with the application of the listed above, it will be classified as negative nature, coverage restricted to the DAI, occurrence in the implementation and operation phases, indirect incidence, short-term induction, long-term duration (as includes the operational phase), reversible, without cumulativeness and synergy, and with a medium magnitude and moderate importance. It is moderately mitigable, keeping the residual importance as moderate.

Rating of the impact (attributes) **Fire in adjacent vegetation**			
Vector (Nature)	Negative	**Geographical Coverage**	DAI
Occurrence Phase	Construction/ Operation	**Incidence**	Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability of Occurrence**	Medium
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Significance			
Magnitude	Medium		
Importance	Moderate		
Mitigability	Moderately Mitigable		
Residual Importance	Moderate		

16.02 - Expansion of invasive flora species

Impacting Action	A.2.02 Mobilization of building sites A.2.04 Removal of vegetation and clearing of land A.2.06 Implementation/improvement of accesses A.3.02 Routine maintenance and emergency system repair A.3.03 Inhibition of secondary regeneration of native vegetation in the wayleave
Impacted Component	C.2.02 – Flora and Vegetation

Analysis of the risk

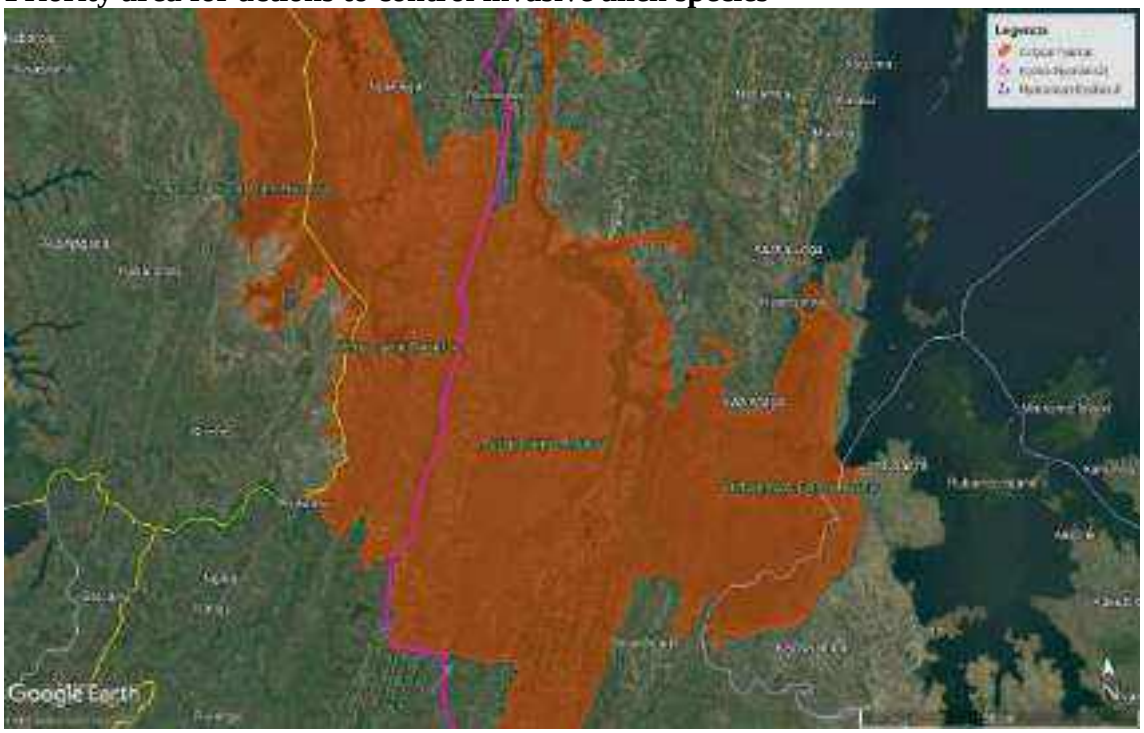
Removing vegetation for the implantation of transmission lines, substations, camp sites, and accesses may contribute to the dispersal and establishment of invasive flora species, which may cause long-term negative effects on the native vegetation. Invasive species may colonize new open areas and proliferate at the edges and inside intercepted patches of vegetation.

In addition, opening new access could facilitate and/or create conditions for people's movement, which may lead to increased human intervention in areas that are currently little anthropized, such as the opening of crops and pastures. Human presence can be a vector for the expansion of invasive species, especially those that have some utility for the population.

Among the invasive species recorded in the study area, we highlight *Lantana camara*, which was observed in various locations throughout the project area, with infestation points mainly in the Nyang'hwale district, near the Biodiversity Sampling plot 9 (BS9).

The potential for invasion by exotic species is most significant at the western end of TL Nyakanazi - Ibadakuli, which passes through Biharamulo FR, where native vegetation is in a good state of conservation. The risk is also higher along TL Kyaka - Nyakanazi, with native vegetation also in a good state of conservation, and in part of the stretch within Burigi-Chato National Park (**Figure 8.2.4.2.a**).

Figure 8.2.4.2.a
Priority area for actions to control invasive alien species



Source: Google Earth (2023)

Mitigation Measures

Table 9.0.a of **Chapter 9.0** presents the mitigation measure to prevent this risk.

Qualification of the resulting impact

Implementing the preventive measures proposed in **Table 9.0.a**, this risk is considered with a medium probability of occurrence. If the impact occurs even with the application of the listed above, it is qualified as negative, restricted to the DAI, occurrence in the construction and operation phases, indirect incidence, medium-term induction, long-term duration, reversible, cumulative, and without synergic effects. The magnitude and importance are medium. It is highly mitigable, reducing its importance to a low level.

Impact Qualification (attributes) Expansion of invasive flora species			
Vector (Nature)	Negative	**Geographical Coverage**	DAI
Occurrence Phase	Construction/ Operation	**Incidence**	Indirect
Temporality (Induction)	Medium term	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability of Occurrence**	Medium
Cumulativeness	Cumulative	**Sinergy**	Non-synergic
Magnitude and Significance			
Magnitude	Medium		
Importance	Medium		
Mitigability	Highly Mitigable		
Residual Importance	Low		

16.03 - Increased illegal exploitation of natural resources

Impacting Action	A.2.04 Removal of vegetation and clearing of land A.2.06 Implementation/improvement of accesses A.3.02 Routine maintenance and emergency system repair A.3.03 Inhibition of secondary regeneration of native vegetation in the wayleave
Impacted Component	C.2.02 – Flora and Vegetation

Analysis of the risk

The land clearing for the construction of the TL implies the opening of new accesses necessary for the construction, which will also facilitate the population's access to places that are currently less frequented. The potential consequence is increased illegal exploitation of natural resources by local communities and commercial exploiters, such as firewood, charcoal, timber, medicinally, and/or food-relevant species. The wayleave can also be used as a route by the communities during the operation phase, facilitating access to and exploitation of the mentioned resources.

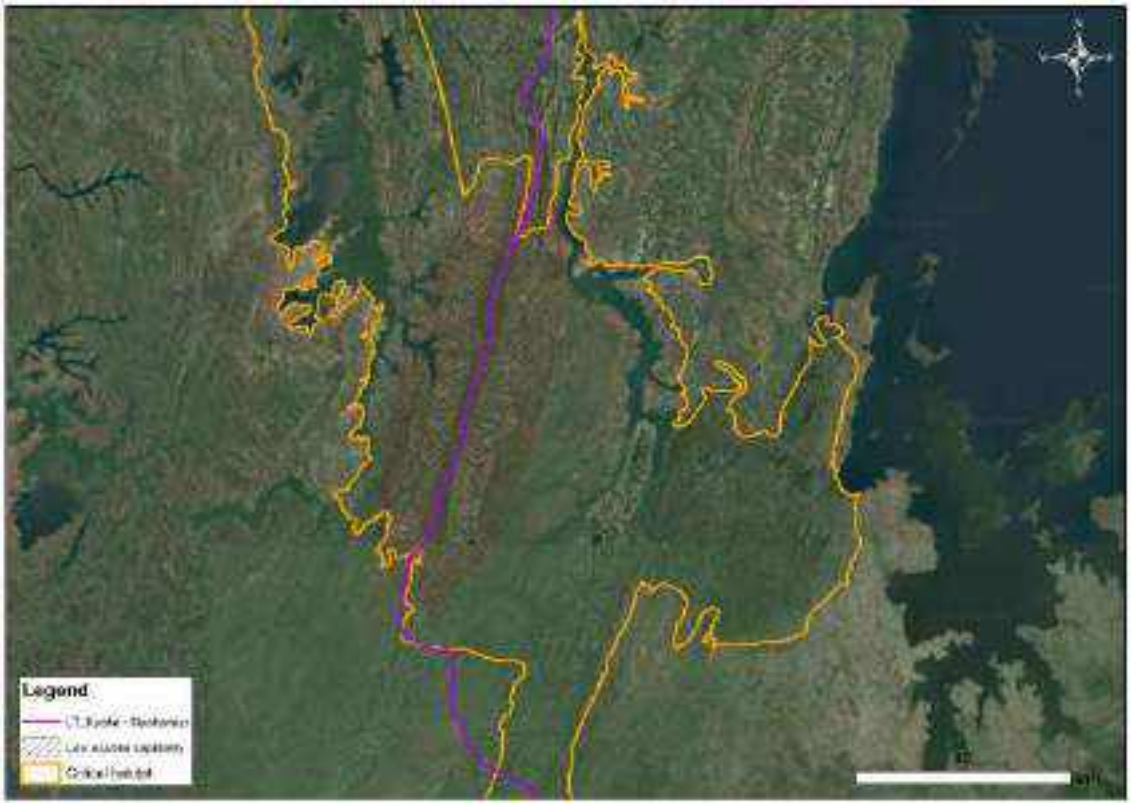
In the diagnosis of ecosystem services relevant to the population, the common practices in the region were the extraction of wood for use as firewood or charcoal, mainly for personal use (mainly cooking), and the popular use of medicinal plants. The main health centres are far from some villages, and minor ailments are often treated with medicinal

herbs, probably extracted from the woods. No medicinal plant markets were observed throughout the villages during the study; however, they probably exist in large cities. However, the origin of medicinal plants in large cities is unknown.

Agriculture and livestock keeping were also the main economic activities identified. Facilitating access to currently inaccessible areas can encourage the opening of new crops and pastures.

This risk is more significant in areas with less capillary access and more preserved vegetation, mainly outside protected areas, as shown in **Figure 8.2.4.2.b**.

Figure 8.2.4.2.b
Area with low access capillarity



Source: Google Earth (2023)

Mitigation Measures

Measures to prevent and mitigate this impact are listed in **Table 9.0.a** of **Chapter 9.0**.

Qualification of the resulting impact

Even implementing the preventive measures proposed in **Table 9.0.a**, this risk is considered to have a medium probability of occurrence. If the impact occurs even with the application of the listed above, it will have the following qualification: negative nature, coverage restricted to the DAI and near surroundings, occurrence in the operation phase, indirect incidence, medium-term induction, long-term duration, reversible, cumulative, and synergic. The magnitude is low, and the importance is moderate. It is moderately mitigable, keeping the residual importance as moderate.

Impact Qualification (attributes) **Increased illegal exploitation of natural resources**			
Vector (Nature)	Negative	**Geographical Coverage**	DAI
Occurrence Phase	Operation	**Incidence**	Indirect
Temporality (Induction)	Medium term	**Temporality (Duration)**	Medium term
Reversibility	Partially reversible	**Probability of Occurrence**	Medium
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Significance			
Magnitude	Low		
Importance	Moderate		
Mitigability	Moderately mitigable		
Residual Importance	Moderate		

17. Risks to Fauna

17.01 – Risk of an increase in hunting

Impacting actions	A.2.01 Mobilisation of workforce A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.13 Operation of camp sites
Impactable component	C.2.02 – Fauna

Analysis of the risk

The increase in workers in the intervention areas can contribute to an increase in hunting pressure. Although many animals have ecological plasticity that guarantees them good tolerance to anthropisation, many may have their populations reduced due to the local increase in hunting. It should also be remembered that the region along the route of the TLs currently suffers from hunting by local human populations. This statement is corroborated by the records observed during the fauna surveys, both inside the Parks and outside the Protected Areas.

Sampling in the field allowed us to identify a variety of species targeted for food, such as *Aepyceros melampus, Damaliscus lunatus, Hippotragus equinus, Kobus ellipsiprymnus, Ourebia ourebi, Redunca redunca, Sylvicapra grimmia, Tragelaphus oryx,*

Phacochoerus africanus, Lupulella adusta, Felis lybica, Leptailurus serval, Atilax paludinosus, Panthera leo, Mungos mungo, Genetta fieldiana, Oryctolagus cuniculus, Equus quagga, Phataginus tricuspis, Cercopithecus mitis, Chlorocebus pygerythrus, Colobus angolensis, Lophocebus ugandae, Thryonomys gregorianus, Loxodonta africana, Papio anubis, etc.

For herpetofauna, the species targeted for hunting include *Varanus niloticus, Naja haje, Dendroaspis polylepis, Python sebae, Bitis arietans,* and *Stigmochelys pardalis.*

For birds, representatives of the families Anatidae (ducks, geese, swans), Ciconiidae (storks), Columbidae (pigeons, doves), Numididae (guineafowl), Phasianidae (pheasants, partridges, turkeys, grouse), Ardeidae (herons), and Threskiornithidae (ibises, spoonbills) stand out. Species from these families may be under hunting pressure, mainly for food consumption (FERNANDES-FERREIRA, 2014). On the other hand, birds belonging to the families Bucerotidae (hornbills), Ploceidae (weavers), Accipitridae (hawks, eagles), Falconidae (falcons, caracaras) and Psittacidae (parrots) tend to be hunted by local communities for the pet trade or use in traditional and/or ritual practices (FERNANDES-FERREIRA, 2014).

These hunting practices vary from region to region and are influenced by cultural, economic, and environmental factors. In some cases, hunting can negatively impact the populations of these species, especially in areas where hunting pressure is high or bird populations are already in decline.

In this context, we highlight the recorded species threatened with extinction and are also targets for hunting, which further exacerbates their conservation status. Examples include the Tawny Eagle (*Aquila rapax*), Hooded Vulture (*Necrosyrtes monachus*), Bateleur (*Terathopius ecaudatus*), and Grey Crowned Crane (*Balearica regulorum*). In addition to the various threats that already impact their populations, such as agriculture, livestock, mining, transport, services, pollution, and more, hunting is an additional factor that could jeopardise the long-term viability of these species.

In addition to the risk of an increase in hunting due to the presence of workers, it is also worth highlighting the risk that the service strip, which will be kept permanently clean, and some new accesses opened for the works, but which will be used during the operation phase to TL maintenance the TL, will allow the population access to previously inaccessible preserved areas. This access could increase both the risk of illegal suppression of vegetation and the risk of hunting in these areas during the operation phase.

Mitigation Measures

To minimise the potential for this impact, the ESMP provides a list of preventive measures shown in **Table 9.0.a** of **Chapter 9.0**. The training's effectiveness will be verified in the field, and workers' hunting will be repressed according to its seriousness and/or effectiveness.

Rating of the resulting impact

With the implementation of the preventive measures proposed in **Table 9.0.a**, this risk is considered to have a low probability of occurring. However, if despite the correct application of all the measures, the impact materialises, it will be negative, from the implementation and operation phases (considering the risk of hunting by the population using the Project's accesses and the service strip), covering the IAI, of indirect incidence, with short-term induction and long duration. It is partially reversible, non-cumulative, but synergic. The magnitude and importance are high, but it is a highly mitigable impact, reducing the residual importance to medium.

Rating of the impact (attributes) Increase in hunting			
Vector	Negative	**Location and spatialization**	IAI
Stage of occurrence	Construction/Operation	**Form of incidence**	Indirect
Temporality (Induction)	Short term	**Temporality (Duration)**	Short term (due to workers) / Long term (due to the population)
Reversibility	Partially reversible	**Probability**	Low
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	High		
Importance	High		
Mitigability	Highly mitigable		
Residual Importance	Medium		

17.02 - Risk of accidents with birds during operation

Impacting actions	A.3.01 Operation of the TLs and SSs
Impactable component	C.2.02 – Fauna

Analysis of the risk

The first studies to identify the interaction between birds and TLs as a problem for nature conservation emerged between 1975 and 1980, highlighting collision and electrocution as the main challenges. A third aspect of this interaction is the use of these structures for nesting. Studies on collision were conducted in the Netherlands by Renson (1975) and Heijnes (1980). In the United States, Beaulaurier (1981) made the first major effort to identify the causes of bird mortality. Olendorff *et al*. (1981) began the first studies on bird electrocutions and hawks nesting on electrical system structures in the United States. From the 1980s onwards, various electricity companies began to study and implement conservation plans.

Thus, throughout recent history, the environmental impact related to TLs has required more in-depth studies on the effects of these undertakings on zoological communities, particularly on birds (AVERY *et al*., 1976; AVERY *et al*., 1980). Most accidents and

negative impacts between birds and TLs have been reported on other continents, such as Europe, Africa, and North America (SAVERENO *et al*., 1996; JENKINS *et al*., 2010). The flow of migratory species such as geese, storks, and cranes is very high on these continents. Differences in the structure of bird communities influence the magnitude of impacts, especially in the migratory movements of large flocks.

The location of TLs' structures near important areas for gregarious species and on known migratory routes can result in many collisions, since species move in large flocks, increasing the likelihood of collisions with structures. Areas with a high concentration of birds and migratory routes are essential for exchanging worn feathers and acquiring the energy reserves they need for their long journeys (HUTTO, 2000; PETIT, 2000; LEU & THOMPSON, 2002). Therefore, it is important to detail studies when defining macro-guidelines for TLs' routes to avoid areas at greater risk of collision.

In addition, the size and alignment of TLs can influence the risk of collision, since birds may not visualise the structures, especially in adverse weather conditions that reduce visibility, thus increasing the risk. No less important are the disturbances caused during the installation of TLs, such as increased noise, suppression of vegetation, and increased luminosity, which can affect bird behaviour and contribute to increased collision risk (STRAUBE & URBEN-FILHO, 2024).

The sample areas that were the subject of the bird surveys in this study have different characteristics, leading to different types of environments and, consequently, different bird communities. The morphological and behavioural diversity among the different bird families suggests that they do not respond uniformly to the presence of TLs and their structures (BIASOTTO *et al*., 2017). The literature reports several studies on bird accidents with TLs, most of which associate these accidents with the wingspan, flight characteristics, and gregarious habits of some species (MICHENER, 1928; BENSON, 1980, 1982; HAAS, 1980; JANSS, 2000; BEVANGER & BROSETH, 2001; FROST, 2008; SHAW, 2010; STRAUBE & URBEN-FILHO, 2024).

Currently, there are no standardised methods widely accepted by the scientific community for assessing collision risks with TLs (BERNARDINO *et al*., 2018). Thus, using the results of the bird surveys in the sample areas carried out for this ESIA, a selection was made based on a series of biological attributes, which were given importance weights, creating an overview directly related to the likelihood of collision risk between the species recorded and the future TLs. The selection of species took into account information such as the preferred habitat, the bird's body size, congregation habits, and flight abilities, resulting in a numerical value that represents the risk of collision (STRAUBE & URBEN-FILHO, 2024).

To assess the risk of collision, **Table 8.2.4.2.a** was drawn up, which scores various attributes, defined by a graduated scale, directly proportional to the risk of collision. The attributes were classified with weights ranging from 0 to 4.

Table 8.2.4.2.a
List of attributes, variables, scores, and observations used to estimate the potential collision of the birds recorded

Attribute			Variable	Score	Observations
RE	Risk of Extinction	C	Officially threatened with extinction in 'Critically Endangered' (CR) status, at the world, national, and/or state level	4	The risk of extinction, associated with the threat category, increases the severity of collisions, as the loss of individuals of threatened species disproportionately impacts their populations. Although, unrelated to collision risk, this factor justifies the attention given to transmission lines as impact elements.
		E	Officially threatened with extinction at 'Endangered' (EN) status, at the world, national, and/or state level	3	
		V	Officially threatened with extinction in 'Vulnerable' (VU) status, at the world, national, and/or state level	2	
		N	Taxon not indicated as endangered at any level	1	
MI	Migration and other displacements	M	Migratory	3	Migratory species are more vulnerable to collisions with transmission lines than resident species, which, because they know their flight areas well, avoid these obstacles more effectively. Although prolonged presence in the region seems to increase the risk of collision, the learning of resident birds tends to reduce this danger.
		P	Partially migratory	2	
		R	Resident	1	
HU	Habitat Use	A	Open environment species	3	Species that prefer open habitats and have large flight areas are more exposed to collisions with transmission lines, which usually cross these landscapes.
		G	Generalist species	2	
		F	Forest species	1	
ET	Ecological Type	A	Aquatic	3	Water birds, often gregarious, tend to congregate in open areas with bodies of water, increasing the risk of collisions. Birds that spend most of their time in the air, even in flocks, are also more exposed to these risks.
		F	Flying/Aericultural	2	
		T	Terrestrial	1	
DA	Dependence on the Aquatic Environment	D	Dependent	3	This categorisation allows for the inclusion of species that are not considered in more general assessments. Species
		I	Independent	2	
		B	Dependent and confined to the basal aquatic	1	

Table 8.2.4.2.a
List of attributes, variables, scores, and observations used to estimate the potential collision of the birds recorded

Attribute			Variable	Score	Observations
			environment		confined to aquatic environments have a lower chance of collisions.
AE	Alar Extension	L	Large wingspan	3	There is a direct relationship between birds' wingspan and the risk of collision, and species with larger wingspans are more likely to have accidents due to the greater body surface exposed.
		M	Medium wingspan	2	
		S	Small wingspan	1	
AA	Air stratum	P	Perform aerial stratum	2	Flight behaviour, especially using thermals, influences the risk of collision with transmission lines. Birds that use thermals daily and/or seasonally are more susceptible to collisions.
		D	Does not perform aerial stratum	1	
FS	Cruising Flight Speed	F	Fast	3	Flight speed is proportional to the risk of collision, with faster-flying birds being more prone to accidents, regardless of their agility.
		M	Medium	2	
		S	Slow	1	
GR	Gregarism	G	Gregarious with large flocks (more than 10 individuals recorded in a group)	2	Gregarious species, which form medium to large flocks, have a higher risk of collision, especially if the flocks are disorganised. The risk is lower for species that form small groups or are solitary.
		F	Familiar or solitary (up to 10 individuals recorded in a group).	1	

Based on these criteria, it was possible to identify the species most likely to collide, categorizing them into four levels of dangerousness: ‘low’ (score between 11 and 13), ‘medium’ (score between 14 and 16), and ‘high’ (score between 17 and 20). The different categorizations were based on information from the literature, mainly data consolidated in the AVONET digital spreadsheet (TOBIAS *et al*., 2022). However, it is important to mention that, in the absence of suitable literature, adaptations were necessary, which depended on empirical information and/or information from the literature, generally based on analogies with data available in the literature on related or morphologically similar species (SCHULENBERG *et al*., 2024; IUCN, 2024, BIRDLIFE INTERNATIONAL, 2024; STEVENSON & FANSHAWE, 2020).

Considering the attributes and variables applied to each of the species recorded throughout the campaigns in sampling areas BS1, BS2, BS4, BS5, BS6, BS8, and BS9, using standardized and non-standardized methodologies, it is possible to observe a trend of proportionality between species richness and abundance. Areas with higher species richness tend to have more records, indicating a positive correlation between diversity

and the number of individuals observed.

The result of this analysis is shown in **Table 8.2.4.2.b**, which presents all the attributes and variables for each species recorded, which were used to estimate the potential for birds to collide with TLs, along with their respective weights and final risk classification. Again, most the attributes and variables were adapted from the recent work by Straube & Urben-Filho (2024).

As shown in **Table 8.2.4.2.b**, 23 species were identified in birds at high risk of collision with the TL, representing the lowest richness of the three categories, with an abundance of 503 records. This number corresponds to approximately 11% of the total species and 14% of the total abundance. Birds at medium risk of collision include 62 species, representing around 30% of the total species recorded. The abundance associated with this category is 1,529 records, corresponding to 43% of the total abundance. Finally, the low-risk category had the highest richness, with 122 species, corresponding to 59% of the total species. The abundance in this category is 1,542 individuals, representing 43% of the total number of individuals recorded, as shown in **Figure 8.2.4.2.c** below.

Figure 8.2.4.2.c
Distribution of bird richness, exclusivity, and records between primary and secondary data

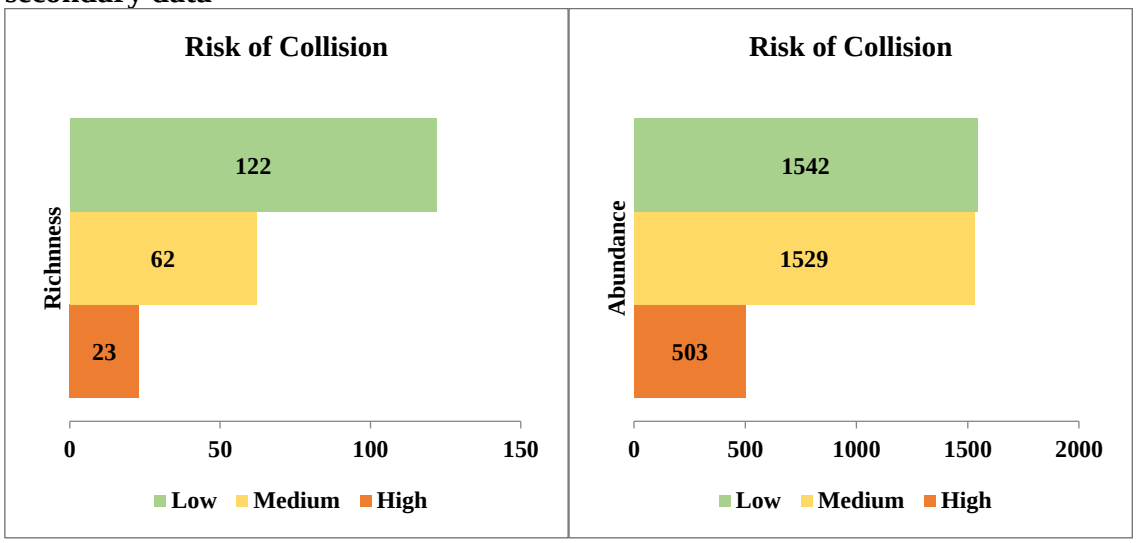


Table 8.2.4.2.b
List of bird species recorded with the highest risk of collision with power transmission lines, including attributes, variables, scores, and risk of collision

Species	Common name	Sampling Areas						Total	Attributes and Variables									Scores									Risk	
		BS1	BS2	BS5	BS6	BS8	BS9		RE	MI	HU	ET	DA	AE	AS	FS	GR	RE	MI	HU	ET	DA	AE	AS	FS	GR		
Milvus migrans	Black Kite			1				1	-	M	O	F	I	L	S	F	F	1	3	3	2	2	3	2	3	1	20	High
Anastomus lamelligerus	African Openbill	165				8	10	183	-	P	O	A	D	L	N	S	G	1	2	3	3	3	3	1	1	2	19	High
Egretta garzetta	Little Egret	6	1	1			41	49	-	P	O	A	D	L	N	S	G	1	2	3	3	3	3	1	1	2	19	High
Plegadis falcinellus	Glossy Ibis						37	37	-	P	O	A	D	L	N	S	G	1	2	3	3	3	3	1	1	2	19	High
Scopus umbretta	Hamerkop	16	3	1			2	22	-	P	O	A	D	L	N	S	G	1	2	3	3	3	3	1	1	2	19	High
Balearica regulorum	Grey Crowned Crane	4						4	EN	R	O	A	D	L	N	S	F	3	1	3	3	3	3	1	1	1	19	High
Aquila rapax	Tawny Eagle			1			2	3	VU	M	G	T	I	L	S	F	F	2	3	2	1	2	3	2	3	1	19	High
Plectropterus gambensis	Spur-winged Goose	3						3	-	M	O	A	D	L	N	S	F	1	3	3	3	3	3	1	1	1	19	High
Haliaeetus vocifer	African Fish-eagle		1					1	-	R	G	A	D	L	S	F	F	1	1	2	3	3	3	2	3	1	19	High
Necrosyrtes monachus	Hooded Vulture		1					1	CR	R	G	T	I	L	S	F	F	4	1	2	1	2	3	2	3	1	19	High
Falco biarmicus	Lanner Falcon		1					1	-	P	O	F	I	L	S	F	F	1	2	3	2	2	3	2	3	1	19	High
Nycticorax nycticorax	Black-crowned Night-heron		1					1	-	M	O	A	D	L	N	S	F	1	3	3	3	3	3	1	1	1	19	High
Ardea cinerea	Grey Heron	5				2	12	19	-	R	O	A	D	L	N	S	G	1	1	3	3	3	3	1	1	2	18	High
Mycteria ibis	Yellow-billed Stork	1				6		7	-	P	O	A	D	L	N	S	F	1	2	3	3	3	3	1	1	1	18	High
Terathopius ecaudatus	Bateleur		1		1	1		3	EN	R	G	T	I	L	S	F	F	3	1	2	1	2	3	2	3	1	18	High
Ardea alba	Great White Egret			1				1	-	P	O	A	D	L	N	S	F	1	2	3	3	3	3	1	1	1	18	High
Ardeola ralloides	Squacco Heron		1					1	-	M	O	A	D	M	N	S	F	1	3	3	3	3	2	1	1	1	18	High
Cecropis abyssinica	Lesser Striped Swallow	88		1	10	25		124	-	R	O	F	I	M	N	F	G	1	1	3	2	2	2	1	3	2	17	High
Ardea melanocephala	Black-headed Heron	9				3	7	19	-	R	O	A	D	L	N	S	F	1	1	3	3	3	3	1	1	1	17	High
Psalidoprocne albiceps	White-headed Saw-wing	5		1		3		9	-	M	G	F	I	M	N	F	F	1	3	2	2	2	2	1	3	1	17	High
Threskiornis aethiopicus	African Sacred Ibis	1				7	1	9	-	R	O	A	D	L	N	S	F	1	1	3	3	3	3	1	1	1	17	High
Ciconia microscelis	African Woollyneck	3		1				4	-	R	O	A	D	L	N	S	F	1	1	3	3	3	3	1	1	1	17	High
Accipiter badius	Shikra					1		1	-	M	G	T	I	M	S	F	F	1	3	2	1	2	2	2	3	1	17	High
Buteo augur	Augur Buzzard	1	1		1			3	-	R	G	T	I	L	S	F	F	1	1	2	1	2	3	2	3	1	16	Medium
Circaetus cinereus	Brown Snake-eagle	1					4	5	-	R	G	T	I	L	S	F	F	1	1	2	1	2	3	2	3	1	16	Medium
Gypohierax angolensis	Palm-nut Vulture	4	6	1				11	-	R	G	T	I	L	S	F	F	1	1	2	1	2	3	2	3	1	16	Medium
Hieraaetus wahlbergi	Wahlberg's Eagle	4						4	-	R	G	T	I	L	S	F	F	1	1	2	1	2	3	2	3	1	16	Medium
Kaupifalco monogrammicus	Lizard Buzzard	2	1	2	1	2		8	-	R	O	T	I	M	S	F	F	1	1	3	1	2	2	2	3	1	16	Medium
Lophaetus occipitalis	Long-crested Eagle	3	1	1				5	-	R	G	T	I	L	S	F	F	1	1	2	1	2	3	2	3	1	16	Medium
Apus affinis	Little Swift		1		5			6	-	M	F	F	I	M	N	F	F	1	3	1	2	2	2	1	3	1	16	Medium
Psalidoprocne pristoptera	Black Saw-wing	1						1	-	P	G	F	I	M	N	F	F	1	2	2	2	2	2	1	3	1	16	Medium
Bradypterus baboecala	Little Rush-warbler	1	2		2	1		6	-	R	O	A	D	S	N	M	F	1	1	3	3	3	1	1	2	1	16	Medium
Bocagia minuta	Marsh Tchagra		1					1	-	R	O	A	D	S	N	M	F	1	1	3	3	3	1	1	2	1	16	Medium
Ploceus melanocephalus	Black-headed Weaver	92				70		162	-	R	G	A	D	S	N	M	G	1	1	2	3	3	1	1	2	2	16	Medium
Cinnyricinclus leucogaster	Violet-backed Starling	30		1		36		67	-	M	G	T	I	M	N	M	G	1	3	2	1	2	2	1	2	2	16	Medium
Ardeola rufiventris	Rufous-bellied Heron		2					2	-	R	O	A	D	M	N	S	F	1	1	3	3	3	2	1	1	1	16	Medium
Butorides striata	Green-backed Heron	1	2	1		1		5	-	R	O	A	D	M	N	S	F	1	1	3	3	3	2	1	1	1	16	Medium
Accipiter tachiro	African Goshawk	1						1	-	R	F	F	I	M	S	F	F	1	1	1	2	2	2	2	3	1	15	Medium
Circaetus cinerascens	Western Banded Snake-eagle		1					1	-	R	F	T	I	L	S	F	F	1	1	1	1	2	3	2	3	1	15	Medium
Polyboroides typus	African Harrier-hawk	2						2	-	R	F	T	I	L	S	F	F	1	1	1	1	2	3	2	3	1	15	Medium
Stephanoaetus coronatus	Crowned Eagle		1					1	-	R	F	T	I	L	S	F	F	1	1	1	1	2	3	2	3	1	15	Medium
Oena capensis	Namaqua Dove						3	3	-	P	O	T	I	M	N	M	F	1	2	3	1	2	2	1	2	1	15	Medium
Spilopelia senegalensis	Laughing Dove	2					27	29	-	R	O	T	I	M	N	M	G	1	1	3	1	2	2	1	2	2	15	Medium
Streptopelia capicola	Ring-necked Dove	10	7	10	5	29	2	63	-	R	O	T	I	M	N	M	G	1	1	3	1	2	2	1	2	2	15	Medium
Streptopelia semitorquata	Red-eyed Dove	38	7	6	3	7	5	66	-	R	O	T	I	M	N	M	G	1	1	3	1	2	2	1	2	2	15	Medium
Treron calvus	African Green-pigeon	26		1		1		28	-	P	G	T	I	M	N	M	G	1	2	2	1	2	2	1	2	2	15	Medium
Corythornis cristatus	Malachite Kingfisher	6				4		10	-	R	G	A	D	S	N	M	F	1	1	2	3	3	1	1	2	1	15	Medium
Centropus monachus	Blue-headed Coucal	4	2	1				7	-	R	F	A	D	M	N	M	F	1	1	1	3	3	2	1	2	1	15	Medium
Centropus superciliosus	White-browed Coucal	11	5	3				19	-	R	F	A	D	M	N	M	F	1	1	1	3	3	2	1	2	1	15	Medium
Cisticola carruthersi	Carruthers's Cisticola	1						1	-	R	G	A	D	S	N	M	F	1	1	2	3	3	1	1	2	1	15	Medium

Table 8.2.4.2.b
List of bird species recorded with the highest risk of collision with power transmission lines, including attributes, variables, scores, and risk of collision

Species	Common name	Sampling Areas						Total	Attributes and Variables									Scores									Risk	
		BS1	BS2	BS5	BS6	BS8	BS9		RE	MI	HU	ET	DA	AE	AS	FS	GR	RE	MI	HU	ET	DA	AE	AS	FS	GR		
Corvus albus	Pied Crow	3	1	10	1		10	25	-	P	O	T	I	L	N	S	F	1	2	3	1	2	3	1	1	1	15	Medium
Laniarius mufumbiri	Papyrus Gonolek		1					1	-	R	G	A	D	S	N	M	F	1	1	2	3	3	1	1	2	1	15	Medium
Lamprotornis chalybaeus	Greater Blue-eared Starling	2		1		30		33	-	R	O	T	I	M	N	M	G	1	1	3	1	2	2	1	2	2	15	Medium
Bubulcus ibis	Cattle Egret	5	53	1			22	81	-	P	O	T	I	M	N	S	G	1	2	3	1	2	2	1	1	2	15	Medium
Microcarbo africanus	Long-tailed Cormorant	1						1	-	R	O	A	B	M	N	M	F	1	1	3	3	1	2	1	2	1	15	Medium
Bycanistes subcylindricus	Grey-cheeked Hornbill	33		2				35	-	R	G	T	I	L	N	S	G	1	1	2	1	2	3	1	1	2	14	Medium
Cypsiurus parvus	African Palm-swift					1		1	-	R	F	F	I	M	N	F	F	1	1	1	2	2	2	1	3	1	14	Medium
Caprimulgus pectoralis	Fiery-necked Nightjar		4		3	8		15	-	P	G	T	I	M	N	M	F	1	2	2	1	2	2	1	2	1	14	Medium
Leptoptilos crumenifer	Marabou	1					2	3	-	R	O	T	I	L	N	S	F	1	1	3	1	2	3	1	1	1	14	Medium
Turtur chalcospilos	Emerald-spotted Wood-dove	2	6	8		19	26	61	-	R	G	T	I	M	N	M	G	1	1	2	1	2	2	1	2	2	14	Medium
Halcyon leucocephala	Grey-headed Kingfisher	9					5	14	-	P	G	T	I	M	N	M	F	1	2	2	1	2	2	1	2	1	14	Medium
Coracias caudatus	Lilac-breasted Roller						2	2	-	P	G	T	I	M	N	M	F	1	2	2	1	2	2	1	2	1	14	Medium
Merops superciliosus	Olive Bee-eater		3					3	-	P	G	T	I	M	N	M	F	1	2	2	1	2	2	1	2	1	14	Medium
Chrysococcyx caprius	Diederik Cuckoo	14	1			1	5	21	-	R	G	T	I	M	N	M	G	1	1	2	1	2	2	1	2	2	14	Medium
Cuculus solitarius	Red-chested Cuckoo	7		2		5	1	15	-	P	G	T	I	M	N	M	F	1	2	2	1	2	2	1	2	1	14	Medium
Campocolinus coqui	Coqui Francolin		5					5	-	R	O	T	I	M	N	M	F	1	1	3	1	2	2	1	2	1	14	Medium
Pternistis afer	Red-necked Francolin	2	19	1	1			23	-	R	G	T	I	M	N	M	G	1	1	2	1	2	2	1	2	2	14	Medium
Crinifer zonurus	Eastern Plantain-eater	1	7	1				9	-	R	O	T	I	M	N	M	F	1	1	3	1	2	2	1	2	1	14	Medium
Musophaga rossae	Ross's Turaco		23	1				24	-	R	G	T	I	M	N	M	G	1	1	2	1	2	2	1	2	2	14	Medium
Cisticola woosnami	Trilling Cisticola	4	21	17	20	11		73	-	R	O	T	I	S	N	M	G	1	1	3	1	2	1	1	2	2	14	Medium
Dicrurus adsimilis	Fork-tailed Drongo		5	5		2		12	-	R	O	T	I	M	N	M	F	1	1	3	1	2	2	1	2	1	14	Medium
Lanius excubitoroides	Grey-backed Fiscal	1						1	-	R	O	T	I	M	N	M	F	1	1	3	1	2	2	1	2	1	14	Medium
Turdoides sharpei	Black-lored Babbler		12		11		9	32	-	R	G	T	I	M	N	M	G	1	1	2	1	2	2	1	2	2	14	Medium
Saxicola torquatus	Common Stonechat	5						5	-	P	O	T	I	S	N	M	S	1	2	3	1	2	1	1	2	1	14	Medium
Passer domesticus	House Sparrow						80	80	-	R	O	T	I	S	N	M	G	1	1	3	1	2	1	1	2	2	14	Medium
Passer griseus	Northern Grey-headed Sparrow	8					62	70	-	R	O	T	I	S	N	M	G	1	1	3	1	2	1	1	2	2	14	Medium
Passer suahelicus	Swahili Sparrow						20	20	-	R	O	T	I	S	N	M	G	1	1	3	1	2	1	1	2	2	14	Medium
Euplectes axillaris	Fan-tailed Widowbird	69						69	-	R	O	T	I	S	N	M	G	1	1	3	1	2	1	1	2	2	14	Medium
Quelea quelea	Red-billed Quelea		1	1				2	-	P	O	T	I	S	N	M	F	1	2	3	1	2	1	1	2	1	14	Medium
Lamprotornis purpuroptera	Rüppell's Starling	11	11	1		1		24	-	R	O	T	I	M	N	M	F	1	1	3	1	2	2	1	2	1	14	Medium
Lamprotornis unicolor	Ashy Starling						16	16	-	R	G	T	I	M	N	M	G	1	1	2	1	2	2	1	2	2	14	Medium
Turdus pelios	African Thrush	16						16	-	R	G	T	I	M	N	M	G	1	1	2	1	2	2	1	2	2	14	Medium
Bostrychia hagedash	Hadada Ibis	9	6	2			60	77	-	R	G	T	I	L	N	SL	G	1	1	2	1	2	3	1	1	2	14	Medium
Campethera bennettii	Bennett's Woodpecker		1					1	-	R	O	T	I	M	N	M	F	1	1	3	1	2	2	1	2	1	14	Medium
Uraeginthus angolensis	Blue-breasted Cordon-bleu				3	56	83	142	-	R	O	T	I	S	N	M	G	1	1	3	1	2	1	1	2	2	14	Medium
Phoeniculus purpureus	Green Woodhoopoe			6				6	-	R	G	T	I	M	N	M	F	1	1	2	1	2	2	1	2	1	13	Low
Rhinopomastus cyanomelas	Common Scimitarbill	1	1		1			3	-	R	G	T	I	M	N	M	F	1	1	2	1	2	2	1	2	1	13	Low
Colius striatus	Speckled Mousebird	6	6	1		28	42	83	-	R	G	T	I	S	N	M	G	1	1	2	1	2	1	1	2	2	13	Low
Turtur afer	Blue-spotted Wood-dove	2	3	2				7	-	R	G	T	I	M	N	M	F	1	1	2	1	2	2	1	2	1	13	Low
Turtur tympanistria	Tambourine Dove		2	1				3	-	R	G	T	I	M	N	M	F	1	1	2	1	2	2	1	2	1	13	Low
Eurystomus glaucurus	Broad-billed Roller	1	1		1			3	-	R	G	T	I	M	N	M	F	1	1	2	1	2	2	1	2	1	13	Low
Chrysococcyx cupreus	African Emerald Cuckoo	1						1	-	R	G	T	I	M	N	M	F	1	1	2	1	2	2	1	2	1	13	Low
Numida meleagris	Helmeted Guineafowl	4	1			3		8	-	R	G	T	I	L	D	S	F	1	1	2	1	2	3	1	1	1	13	Low
Ortygornis sephaena	Crested Francolin		3				5	8	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Pternistis hildebrandti	Hildebrandt's Francolin	5	2			14	1	22	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Corythaixoides personatus	Brown-faced Go-away-bird		1					1	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Gallirex porphyreolophus	Purple-crested Turaco	3	2	1				6	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Cisticola erythrops	Red-faced Cisticola	15	10	5	6			36	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Schistolais leucopogon	White-chinned Prinia	14	1					15	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Estrilda astrild	Common Waxbill	10	1	1				12	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low

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Species	Common name	Sampling Areas						Total	Attributes and Variables									Scores									Risk	
		BS1	BS2	BS5	BS6	BS8	BS9		RE	MI	HU	ET	DA	AE	AS	FS	GR	RE	MI	HU	ET	DA	AE	AS	FS	GR		
Lagonosticta senegala	Red-billed Firefinch		1			3	24	28	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Spermestes cucullata	Bronze Mannikin		1	1		130	31	163	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Uraeginthus bengalus	Red-cheeked Cordon-bleu	2	2	1				5	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Lanius collaris	Common Fiscal						4	4	-	R	A	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Turdoides jardineii	Arrow-marked Babbler	2	2			3	4	11	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Laniarius aethiopicus	Tropical Boubou		6	9	2	12	1	30	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Laniarius funebris	Slate-coloured Boubou	11	12	1	8	12	37	81	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Tchagra senegalus	Black-crowned Tchagra	1	2	8	5	9		25	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Macronyx croceus	Yellow-throated Longclaw	1	2			1		4	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Motacilla aguimp	African Pied Wagtail	4				20	10	34	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Cercotrichas leucophrys	White-browed Scrub-robin			3	1	3	17	24	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Cossypha heuglini	White-browed Robin-chat	5	7	1	4	17		34	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Cossypha natalensis	Red-capped Robin-chat	18	1	6	1	4		30	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Myrmecocichla nigra	Sooty Chat				1			1	-	S	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Chalcomitra senegalensis	Scarlet-chested Sunbird	1	2	1	1		1	6	-	P	G	T	I	S	D	M	F	1	2	2	1	2	1	1	2	1	13	Low
Cinnyris mariquensis	Marico Sunbird	1	1	1	3	1		7	-	R	A	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Oriolus auratus	African Golden Oriole			1	10	1		12	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Oriolus larvatus	Eastern Black-headed Oriole		1	4	5	6		16	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Gymnoris pyrgita	Yellow-spotted Bush-sparrow		1					1	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Anaplectes rubriceps	Southern Red-headed Weaver						11	11	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Bubalornis niger	Red-billed Buffalo-weaver		1					1	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Euplectes albonotatus	White-winged Widowbird		3					3	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Euplectes ardens	Red-collared Widowbird	2			9			11	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Euplectes capensis	Yellow Bishop			1				1	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Euplectes hordeaceus	Black-winged Bishop			2		1		3	-	R	O	T	I	S	D	M	S	1	1	3	1	2	1	1	2	1	13	Low
Histurgops ruficauda	Rufous-tailed Weaver		1					1	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Atimastillas flavigula	Pale-throated Greenbul			3	4	9		16	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Chlorocichla flaviventris	Yellow-bellied Greenbul					16	1	17	-	R	F	T	I	M	D	M	G	1	1	1	1	2	2	1	2	2	13	Low
Pycnonotus barbatus	Common Bulbul	40	26	4	8	36	15	129	-	R	G	T	I	S	D	M	G	1	1	2	1	2	1	1	2	2	13	Low
Lamprotornis splendidus	Splendid Starling	8						8	-	P	F	T	I	M	D	M	F	1	2	1	1	2	2	1	2	1	13	Low
Turdus libonyana	Kurrichane Thrush					2		2	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Prionops plumatus	White-crested Helmetshrike				6			6	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Vidua chalybeata	Village Indigobird			1		12		13	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Vidua macroura	Pin-tailed Whydah	2	1	9			1	13	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Vidua obtusa	Broad-tailed Paradise-whydah			2				2	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Vidua paradisaea	Long-tailed Paradise-whydah			3	1	4	1	9	-	R	O	T	I	S	D	M	F	1	1	3	1	2	1	1	2	1	13	Low
Indicator indicator	Greater Honeyguide	1		1	3			5	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Trachyphonus vaillantii	Crested Barbet		1					1	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Campethera nubica	Nubian Woodpecker	1	2	1				4	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Poicephalus meyeri	Brown Parrot	2	8	1				11	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Otus senegalensis	African Scops-owl				1			1	-	R	G	T	I	M	D	M	F	1	1	2	1	2	2	1	2	1	13	Low
Lophoceros nasutus	African Grey Hornbill	5		1				6	-	R	G	T	I	M	D	S	F	1	1	2	1	2	2	1	1	1	12	Low
Turnix sylvaticus	Common Buttonquail		1					1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Urocolius macrourus	Blue-naped Mousebird	8	2	1		4	1	16	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Halcyon chelicuti	Striped Kingfisher		2					2	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Halcyon malimbica	Blue-breasted Kingfisher	6						6	-	R	F	T	I	M	D	M	F	1	1	1	1	2	2	1	2	1	12	Low
Halcyon senegalensis	Woodland Kingfisher	3	1					4	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Merops pusillus	Little Bee-eater	3		1			11	15	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Chrysococcyx klaas	Klaas's Cuckoo	4	1	1		2	1	9	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Corythaeola cristata	Great Blue Turaco	11			1			12	-	R	F	T	I	L	D	S	F	1	1	1	1	2	3	1	1	1	12	Low

Table 8.2.4.2.b
List of bird species recorded with the highest risk of collision with power transmission lines, including attributes, variables, scores, and risk of collision

Species	Common name	Sampling Areas						Total	Attributes and Variables									Scores									Risk	
		BS1	BS2	BS5	BS6	BS8	BS9		RE	MI	HU	ET	DA	AE	AS	FS	GR	RE	MI	HU	ET	DA	AE	AS	FS	GR		
Tauraco livingstonii	Livingstone's Turaco			3	10			13	-	R	F	T	I	M	D	M	F	1	1	1	1	2	2	1	2	1	12	Low
Tauraco schuettii	Black-billed Turaco	1						1	-	R	F	T	I	M	D	M	F	1	1	1	1	2	2	1	2	1	12	Low
Apalis flavida	Yellow-breasted Apalis	3	4	1	2	6	11	27	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Camaroptera brachyura	Bleating Camaroptera	25	9	1	3	8	12	58	-	R	F	T	I	S	D	M	G	1	1	1	1	2	1	1	2	2	12	Low
Cisticola brachypterus	Short-winged Cisticola		1					1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cisticola chiniana	Rattling Cisticola		1	1			5	7	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cisticola natalensis	Croaking Cisticola		1			10		11	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Prinia subflava	Tawny-flanked Prinia	2	4	5	6	8	5	30	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Emberiza flaviventris	Golden-breasted Bunting						3	3	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Pytilia melba	Green-winged Pytilia			4		8		12	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Spermestes bicolor	Black-and-white Mannikin	6		1				7	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Crithagra mozambica	Yellow-fronted Canary	1	4	2	3	3	3	16	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Crithagra sulphurata	Brimstone Canary		1					1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Lanius souzae	Souza's Shrike				4			4	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Melocichla mentalis	Moustached Grass-warbler	2	2					4	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Sylvietta whytii	Red-faced Crombec		1	1			1	3	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Chlorophoneus sulfureopectus	Orange-breasted Bush-shrike	4	5	1	1	2	9	22	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Dryoscopus cubla	Black-backed Puffback	5		4	4	10	5	28	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Dryoscopus gambensis	Northern Puffback				1			1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Laniarius erythrogaster	Black-headed Gonolek		1					1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Nilaus afer	Brubru		2					2	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Tchagra australis	Brown-crowned Tchagra	1	1	1			5	8	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Terpsiphone viridis	African Paradise-flycatcher	4	2	6		1		13	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Anthus leucophrys	Plain-backed Pipit	6	1	1				8	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Bradornis microrhynchus	African Grey Flycatcher				2		10	12	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cercotrichas hartlaubi	Brown-backed Scrub-robin	4	3		1	1	2	11	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cichladusa guttata	Spotted Palm-thrush						1	1	-	R	G	T	I	P	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cossypha niveicapilla	Snowy-crowned Robin-chat	3	1					4	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Anthreptes longuemarei	Western Violet-backed Sunbird				1			1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cinnyris bifasciatus	Purple-banded Sunbird	3	1	2	3	5	1	15	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cinnyris venustus	Variable Sunbird	3					5	8	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Cyanomitra verticalis	Green-headed Sunbird	5		4	1			10	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Hedydipna collaris	Collared Sunbird	1	2	3				6	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Nectarinia kilimensis	Bronze Sunbird		1	1				2	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Batis molitor	Chinspot Batis	3	6	1	1	1	2	14	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Platysteira cyanea	Brown-throated Wattle-eye	7	1					8	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Anaplectes leuconotos	Northern Red-headed Weaver	1	1		5	2		9	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Ploceus baglafecht	Baglafecht Weaver	1	1					2	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Ploceus luteolus	Little Weaver		6					6	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Ploceus nigerrimus	Vieillot's Black Weaver	1						1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Ploceus ocularis	Spectacled Weaver	1	6			1		8	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Indicator minor	Lesser Honeyguide			1	1	5	6	13	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Lybius torquatus	Black-collared Barbet				2			2	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Pogoniulus chrysoconus	Yellow-fronted Tinkerbird	1	1		1			3	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Pogoniulus pusillus	Red-fronted Tinkerbird						4	4	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Trachyphonus darnaudii	D'Arnaud's Barbet					1		1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Tricholaema lacrymosa	Spot-flanked Barbet		1					1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Dendropicos fuscescens	Cardinal Woodpecker		1					1	-	R	G	T	I	S	D	M	F	1	1	2	1	2	1	1	2	1	12	Low
Lophoceros alboterminatus	Crowned Hornbill	7	1	7				15	-	R	F	T	I	M	D	S	F	1	1	1	1	2	2	1	1	1	11	Low
Ispidina picta	African Pygmy-kingfisher				1			1	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low

Table 8.2.4.2.b
List of bird species recorded with the highest risk of collision with power transmission lines, including attributes, variables, scores, and risk of collision

Species	Common name	Sampling Areas						Total	Attributes and Variables									Scores									Risk	
		BS1	BS2	BS5	BS6	BS8	BS9		RE	MI	HU	ET	DA	AE	AS	FS	GR	RE	MI	HU	ET	DA	AE	AS	FS	GR		
Eminia lepida	Grey-capped Warbler	4	2	1				7	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low
Sheppardia polioptera	Grey-winged Akalat	1						1	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low
Cyanomitra olivacea	Olive Sunbird	2	1	2				5	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low
Platysteira peltata	Black-throated Wattle-eye			3				3	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low
Eurillas virens	Little Greenbul	9						9	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low
Stizorhina fraseri	Rufous Flycatcher-thrush	1						1	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low
Pogoniulus bilineatus	Yellow-rumped Tinkerbird	7						7	-	R	F	T	I	S	D	M	F	1	1	1	1	2	1	1	2	1	11	Low
Total		**1079**	**431**	**231**	**202**	**766**	**865**	**3574**																				

Legend: RE - Risk of Extinction: C - Officially threatened with extinction under the status 'Critically Endangered' (CR), at world, national and/or state level; E - Officially threatened with extinction under the status 'Endangered' (EN), at world, national and/or state level; V - Officially threatened with extinction under the status 'Vulnerable' (VU), at world, national and/or state level; N - Taxon not indicated as threatened with extinction at any level; **MI - Migration and other displacements:** M - Migratory, P - Partially migratory, R - Resident; **HU - Habitat Use:** O - Open environment species, G - Generalist species, F - Forest species; **ET - Ecological Type:** A - Aquatic, F - Flying/Aericultural, T - Terrestrial; **DA - Dependence on the Aquatic Environment:** D - Dependent, I - Independent, B - Dependent and confined to the basal aquatic environment. **AE - Alar Extension:** L – Large wingspan, M - Medium wingspan, S - Small wingspan; **AS - Aerial Stratum:** P - Performs aerial soaring, D - Does not perform aerial soaring; **FS - Cruising Flight Speed:** F - Fast, M - Medium, S - Slow; **GR - Gregarism:** G - Gregarious with large flocks (more than 10 individuals recorded in a group), F - Familiar or solitary (up to 10 individuals recorded in a group). **Attributes and variables were adapted from Straube & Urben-Filho (2024).**

Among the species at high risk of collision, which deserve greater attention, are those that, in addition to being at greater risk of colliding with the TL and its structures, are also threatened with extinction: Tawny Eagle (*Aquila rapax*), Hooded Vulture (*Necrosyrtes monachus*), Grey Crowned Crane (*Balearica regulorum*), and Bateleur (*Terathopius ecaudatus*) (**Table 8.2.4.2.b**).

In addition to these, it is important to highlight those that were abundant in the study, such as: African Openbill (*Anastomus lamelligerus* - N=183), Lesser Striped Swallow (*Cecropis abyssinica* - N=124), Little Egret (*Egretta garzetta* - N=49), Glossy Ibis (*Plegadis falcinellus* - N=37), Hamerkop (*Scopus umbretta* - N=22), Grey Heron (*Ardea cinerea* - N=19), and Black-headed Heron (*Ardea melanocephala* - N=19) (**Table 8.2.4.2.b**). Gregarious species, i.e., those that form large groups, are among the most likely to suffer collisions, and this increases considerably when groups are disorganised (JENKINS *et al*., 2010; STRAUBE & URBEN-FILHO, 2024).

Another group of birds worth mentioning is waterfowl, which are more likely to collide with transmission line cables due to the need for a more explosive take-off to enter and/or exit the water, which generates less manoeuvrability control. In addition, a wide variety of waterbirds tend to make regular flights at dawn and dusk between their roosts and feeding areas (JANSS, 2000; JANSS & FERRER, 1998; MCNEIL *et al*., 1985; MURPHY *et* al., 2009; SCOTT *et al*., 1972; TERE & PARASHARYA, 2011). In this sense, the presence of species such as African Openbill (*Anastomus lamelligerus*), Black-headed Weaver (*Ploceus melanocephalus*), Little Egret (*Egretta garzetta*), Glossy Ibis (*Plegadis falcinellus*), Hamerkop (*Scopus umbretta*), Grey Heron (*Ardea cinerea*), Black-headed Heron (*Ardea melanocephala*), White-browed Coucal (*Centropus superciliosus*), Malachite Kingfisher (*Corythornis cristatus*) is recorded in this study (**Table 8.2.4.2.b**).

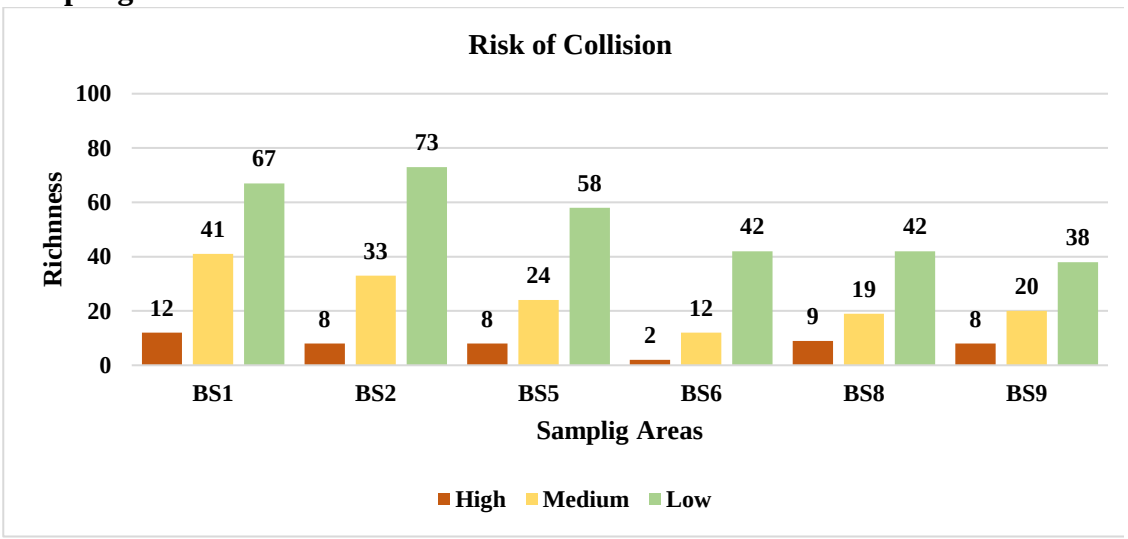
Concerning species that fly at heights that may be compatible with the LT cables, this includes flying/aircraft species, such as the following: Lesser Striped Swallow (*Cecropis abyssinica*), White-headed Saw-wing (*Psalidoprocne albiceps*), Little Swift (*Apus affinis*), Black Saw-wing (*Psalidoprocne pristoptera*), and African Palm-swift (*Cypsiurus parvus*). These species, representatives of the Hirundinidae and Apodidae families, have a predominantly insectivorous diet, catching their prey in mid-flight, and are therefore known as aerial insectivores. During their flights in search of food, these species are often fast, reaching 20 to 30 kilometres per hour. Like swifts and taperuçus (Apodidae), swallows (Hirundinidae) suffer from strong winds and heavy rains, and bad weather is a risk factor for collisions with transmission lines (SICK 1997; APLIC, 2012; DREWITT & LANGSTON, 2008).

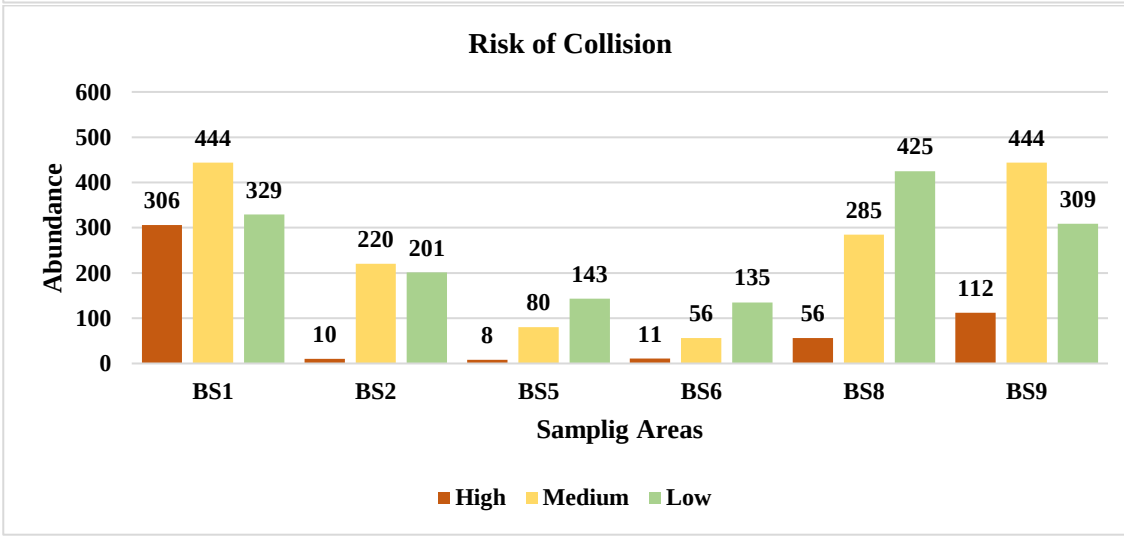
Raptor species (Accipitridae and Falconidae) take daily flights or glide for prolonged periods. They often use rising and thermal air currents to gain height and glide for long distances, which is categorised in this study as aerial soaring. These species use this tactic to avoid losing energy, since flapping flights generate a great deal of energy, which becomes even more important when you take into account that these animals need to hunt almost daily, generating daily exposure to the risk of collision with LT (MENQ & DELARIVA, 2015). Among the species in this category that deserve to be highlighted are: Black Kite (*Milvus migrans*), Lanner *Falcon* (*Falco biarmicus*), African Goshawk

(*Accipiter tachiro*), Tawny Eagle (*Aquila rapax*), Hooded Vulture (*Necrosyrtes monachus*), Bateleur (*Terathopius ecaudatus*), Shikra (*Accipiter badius*), Augur Buzzard (*Buteo augur*), Brown Snake-eagle (*Circaetus cinereus*), Palm-nut Vulture (*Gypohierax angolensis*), Wahlberg's Eagle (*Hieraaetus wahlbergi*), and others (**Table 8.2.4.2.b**).

When analysing species richness between the sampling areas (BS1, BS2, BS5, BS6, BS8, and BS9), it can be seen that BS1 stands out for having the highest number of species in the high-risk category, with 12 species, corresponding to 14.1% of the total recorded in this area. BS8 came next with nine high-risk species (10.8%), while BS2, BS5, and BS9 had eight species each, corresponding to 7.5%, 7.4%, and 8.8%, respectively. BS6 had the lowest value, with only two high-risk species, corresponding to 2.9 per cent of the total species recorded in this category (**Figure 8.2.4.2.d**).

Figure 8.2.4.2.d
Distribution of the richness and records of the birds most at risk of collision in the Sampling Areas





Regarding species abundance, BS1 also leads the high-risk category, with 306 records, corresponding to 29.7% of the total recorded in this area. BS9 follows with 112 records of species at high risk of collision (14.6%), followed by BS8, which had 56 records (8.7%). BS2 and BS5 had significantly lower numbers, with only 10 (2.4%) and 8 (2.7%) records, respectively. BS6 recorded the lowest number, with only 11 records in the high-risk category, corresponding to 4.0% of the total recorded in this area (**Figure 8.2.4.2.d**).

The richness generallyshowed the same pattern in the three risk categories. Birds classified as high risk were less representative in all the sampling areas, followed by medium risk species, and low risk species, which were more representative. Regarding abundance, sample areas BS1, BS2, and BS9 showed a similar pattern, with medium-risk species predominating, followed by low- and high-risk species. On the other hand, areas BS5, BS6, and BS8 showed a different pattern, with low-risk species being the most abundant, followed by medium- and high-risk species (**Figure 8.2.4.2.d**).

Based on these results, sample area BS1 is the most important regarding bird collision risk. However, areas BS2, BS5, BS8, and BS9 also revealed a significant wealth of species at high risk of collision. Regarding abundance, areas BS1, BS8, and BS9 also stood out, with high records of birds at high risk of collision (**Figure 8.2.4.2.d**).

Based on the analyses above, the stretches close to sampling areas BS1, BS8, and BS9 should be considered as the focus of collision prevention measures, as they present the greatest risk. However, the possibility of collisions in other environments, especially those associated with humid environments, is not ruled out.

Mitigation Measures

The ESMP includes measures to reduce the risk of birds colliding with TLs' cables and towers. Theseare presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Even with the implementation of the measures proposed in **Table 9.0.a**, the risk of this impact occurring has been classified as medium. If the impact occurs despite the planned measures, it will be negative, during the LT operation phase, restricted to the DAA, direct, with immediate induction and long-term duration, and irreversible. It is not cumulative but synergic. The magnitude is medium, and the importance is high. It is considered moderately mitigable, reducing the residual importance to medium.

Rating of the impact (attributes) Accidents with birds during operation			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Operation	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Irreversible	**Probability**	Medium
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Moderately mitigable		
Residual Importance	Medium		

8.2.4.3
Socio-Economic Environment

18. Risks to Infrastructure, Social Equipment, and Public Services

18.01 - Risk of increased demand for health services

Impacting actions	A.2.01 Mobilisation of workforce A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.05 Demolition of improvements A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Earthworks in the substation area A.2.09 Excavation and installation of grounding mesh in the substation area A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities
Impactable component	C.3.02 - Infrastructure, Social Equipment and Public Services

Analysis of the risk

The risk of occupational accidents is inherent in this type of work. However, in the event of a possible accident, the impact takes on a different magnitude if those involved need to be attended by the IAI health infrastructure.

In addition to this increased demand for health services due to the risk of occupational accidents, it may be necessary to attend, for example, cases of snake bite accidents involving both the workers responsible for the vegetation clearing and the population near the works, who may be victims of snakes scared away by the project activities.

The camp sites that support the work will have first aid rooms. However, this structure will not be sufficient to deal with all types of cases that may occur during the construction works. As a result, there may be additional demand on existing health infrastructure in or near the IAI. As pointed out in **Section 7.3.8.1**, there are hospitals in Shinyanga, Geita, Bukombe, Ngara, and Misenyi, and health centres in Shinyanga, Msalala, Geita, Mbogwe, Bukombe, Karagwe, Ngara, and Misenyi.

The increase in demand for health services could also occur if the project causes the spread of diseases in the population. This risk will be assessed below (risk 20.01) and is related to the possibility that diseases will not be detected in workers from outside the region by the admission examinations provided for in P.17, and that they will spread to the population closer to the work fronts and camp sites.

Mitigation Measures

The programmes and measures proposed to prevent and mitigate this impact are presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Considering that the Contractors will implement first aid rooms in all camp sites and that all the measures foreseen in **Table 9.0.a**, especially those in the OHS Programme, will be complied with, it is considered a risk with a low probability of occurrence. If, despite the measures, the impact materialises, it will be negative, from the construction phase, with diffuse coverage, since the lack of healthcare facilities in the IAI will lead to the need to seek services in neighbouring towns. It is an indirect, short-term induction and short-term duration impact. It has cumulativeness and synergy.

If the impact occurs, it will be of low magnitude. Considering its reversibility, its importance will also be low. It is low-mitigable, and due to the lack of health infrastructure in the IAI and the need to seek services elsewhere, the residual importance was increased to moderate.

Rating of the impact (attributes) Increased demand for health services			
Vector	Negative	**Location and spatialization**	Diffuse
Stage of occurrence	Construction	**Form of incidence**	Indirect
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Low mitigable		
Residual Importance	Moderate		

18.02 - Risk of unintended damage to crops and improvements during works

Impacting actions	A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables A.2.13 Operation of camp sites
Impactable component	C.3.02 - Infrastructure, Social Equipment and Public Services

Analysis of the risk

During the works, the Contractors and their workers will be instructed to use only the defined accesses, including the existing roads and rural paths, the service strip within the wayleave, and any new access stretches built for the works. However, there may be situations in which construction vehicles and machinery invade the surrounding agricultural areas, either inadvertently, due to a lack of appropriate technical skills, or even on purpose, in situations where, due to a lack of prior planning, there is a need to invade areas outside the DAA to carry out manoeuvres or even in the case of equipment or vehicles that are too large for the size of the access, among other situations.

The improper use of heavy machinery, such as cranes, excavators, and tractors, can excessively compact the soil in agricultural areas, damaging its structure and reducing its capacity to absorb water and nutrients. This soil compaction can reduce crop yields and jeopardise future harvests. In addition, machinery can inadvertently destroy crops, causing immediate crop loss and generating financial losses for farmers.

In addition, the uncontrolled passage of heavy vehicles can damage or destroy existing agricultural infrastructure, such as irrigation systems, fences, and access roads. This damage disrupts farming operations and generates additional costs for repairs or replacements, putting financial pressure on farmers.

Mitigation Measures

The programmes and measures proposed to prevent and mitigate this impact are presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

The impact is considered to have a low probability of occurrence after implementing the set of prevention measures listed in in **Table 9.0.a**.

If, despite the measures, the impact materialises, it will be negative, related to the construction phase, with coverage in the DAI, direct, immediate, short-term duration, and reversible. It has no characteristics of cumulativeness or synergy. The magnitude and importance are low. It is highly mitigable, keeping the residual importance as low.

Rating of the impact (attributes) Unintended damage to crops and improvements during works			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Highly mitigable		
Residual Importance	Low		

19. Risks to Health and Safety of the Workers

19.01 - Increasing the risk of the spread of disease among workers during construction

Impacting actions	A.2.01 Mobilisation of workforce A.2.13 Operation of camp sites
Impactable component	C.3.03 - Health and Safety of the Workers

Analysis of the risk

Due to the need to hire workers from other regions outside the IAI, the risk of introducing and/or spreading vector and/or contagious diseases among the workers cannot be ruled out. In this context, these risks are associated with the following aspects:

- Workers coming from other regions who may be affected by common diseases that occur in the project area, or who, asymptomatic carriers of certain illnesses, act as vectors, considering mainly waterborne diseases and those transmitted by insect vectors (mosquitoes, flies, bedbugs, soft ticks);
- A possible overload of sanitation systems increasing the incidence of waterborne diseases;
- A possible increase in sexually transmitted diseases (STDs) as a result of contact between the labour force and the local population.

As noted in **Section 7.3.8.2**, malaria appears as a main cause of mortality in general and among men and women in most of the districts through which the LTs pass. Malaria is also an important cause of death among people living with HIV/AIDS. HIV/AIDS also appears among the main causes of death in the districts of Shinyanga, Msalala, Biharamulo, and Ngara, among both men and women. In other districts like Bukombe, Nyang'hwale, Missenyi, and Geita, where HIV/AIDS does not appear as one of the main causes of mortality, it is listed as an important disease, with high rates which cause concern.

During the construction phase of the Project, with camp sites management measures in place, no variations are expected in the number of waterborne illnesses related to workers.

Therefore, the most important efforts should be focused on preventing STDs, and on measures to avoid vector-borne diseases, especially malaria, filariasis, dengue, chikungunya and Zika viruses, and also African trypanosomiasis (sleeping sickness), tick-borne relapsing fever, Onchocerciasis, and the diseases caused by houseflies.

Mitigation Measures

This risk can be minimised by applying preventive health programmes and other measures proposed in **Table 9.0.a** of **Chapter 9.0**. As the list of programs and measures shows, in addition to the **P.17 - Occupational Health and Safety Management Program** measures to be implemented by Contractors to ensure compliance with the relevant legislation and with good practices in the sector, including carrying out admission and periodic examinations.

Care will also be taken regarding the cleanliness and organisation of camp sites and work fronts.

The need to prevent STDs will be covered in the Worker Training and the Worker's Code of Conduct.

In addition, it helps to reduce this risk by hiring as much labour as possible in the IAI villages.

Rating of the resulting impact

With the comprehensive set of proposed prevention measures (see **Table 9.0.a**), the impact is considered to have a low probability of occurrence.

If the impact materialises even with the proposed measures, it will be negative, restricted to the construction phase, with coverage in the DAA. It will be direct, immediately induced, and of short duration. It is reversible, not cumulative, but synergic. The magnitude and importance are low. It is moderately mitigable, and therefore, the residual importance remains low.

Rating of the impact (attributes) Spread of disease among workers during construction			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Medium
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Moderately mitigable		
Residual Importance	Low		

19.02 - Risk of accidents involving workers

Impacting actions	A.2.01 Mobilisation of workforce A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.05 Demolition of improvements A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Earthworks in the substation area A.2.09 Excavation and installation of grounding mesh in the substation area A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables A.2.13 Operation of camp sites A.2.14 Decommissioning of temporary facilities
Impactable component	C.3.03 - Health and Safety of the Workers

Analysis of the risk

Construction works will involve several activities with specific risks to the health and safety of workers, of which the following are highlighted:

- Transport, handling, storage, and operation of machinery, equipment, and work tools;
- Transport, handling, and storage of hazardous materials, including fuels and flammable materials;
- Work involving electrical hazards;
- Work at heights;
- Transport of persons;
- Contact with dangerous animals;
- Exposure to high noise levels when operating machinery and equipment such as chainsaws;
- Excavations;
- Cutting down trees;
- Work at high temperatures;
- Work in confined spaces.

The risks resulting from these activities vary significantly, ranging from minor injuries to more serious life-threatening cases. The significance of these risks will depend to a large extent on the implementation of appropriate management measures and workers' compliance with them.

Part of the workforce to be recruited is local, and most of these workers, even though they are aware of the identified above, are not accustomed to adopt appropriate protective measures, including using personal protective equipment (PPE). Thus, there is a risk of accidents occurring during work.

About the contact with dangerous animals mentioned above, it is important to highlight the risk of accidents due to poisonous snake bites during vegetation clearing along the service strip.

Mitigation Measures

The measures listed in **Table 9.0.a** of **Chapter 9.0** aim to reduce this risk.

Rating of the resulting impact

Considering the correct and effective implementation of the measures proposed in **Table 9.0.a**, this risk is rated as having a medium probability of occurrence.

If, even with the proposed measures, accidents with workers occur during the construction phase, i.e., if the impact materialises, it will be negative and direct, mainly affecting the DAA. It is an impact of immediate induction and short-term duration, generally reversible, without cumulativeness or synergy. It is of low magnitude and moderate importance, but it has been upgraded to medium because its consequences may be irreversible. It is highly mitigable, resulting in moderate residual importance.

Rating of the impact (attributes) Accidents involving workers			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Medium
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Medium		
Mitigability	Highly mitigable		
Residual Importance	Moderate		

19.03 - Risk of accidents due to the presence of landmines and UXOs (unexploded ordnances)

Impacting actions	A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.05 Demolition of improvements A.2.06 Implementation/improvement of accesses A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Earthworks in the substation area A.2.10 Execution of tower foundations A.3.02 Routine maintenance and emergency repair of the system
Impactable component	C.3.03 - Health and Safety of the Workers

Analysis of the risk

According to the Archaeological Report (see **Annex 8**), to carry out the field surveys in the Kagera region, army officers had to be consulted first to scan the areas to be excavated to ensure that they were free of landmines and UXOs (unexploded ordnances).

This necessity is related to the fact that some districts in the Kagera region, specifically Missenyi, Kyerwa, Bukoba, Muleba, and Karagwe[12][13][14] (see **Figure 8.2.4.3.a**), were affected by the conflicts of the Tanzania-Uganda War, also known as the Kagera, which took place in 1978 and 1979. And landmines and UXOs may still be buried in these areas.

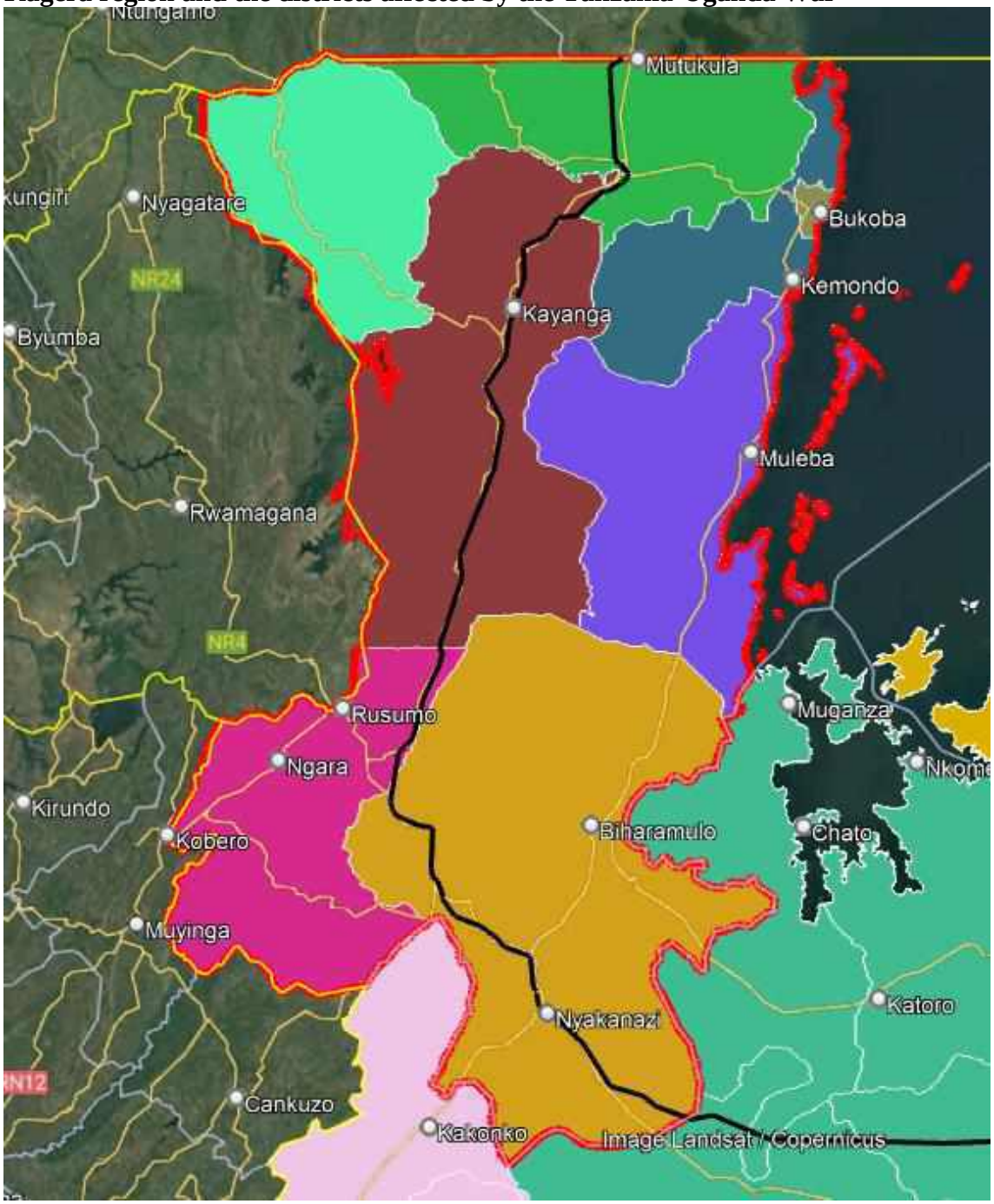
For this reason, during the works on 400 kV Mutukula – Kyaka TL and part of 400 kV Kyaka – Kyakanazi TL (up to vertex KN-19), there is a risk of accidents involving landmines and UXOs in activities carried out on sections of the TLs in Missenyi, Kyerwa, Bukoba, Muleba and Karagwe districts, specifically during the activities of vegetation suppression, land clearance and earthworks in the DAA, including the wayleave, the Kyaka SS expansion area, the sections of any new accesses needed outside the wayleave, and the area where camp sites are being set up.

In addition to the risk to workers, it is understood that in this part of the Project between the districts of Missenyi and Karagwe (up to the KN-19 vertex of the 400 kV Kyaka – Kyakanazi TL), there is also a risk of landmine and UXOs accidents involving the population, more specifically those to be resettled due to the Project. Therefore, the areas where people will be resettled on this part of the route, whether on the same property or another property, should also be subject to prior demining measures.

Therefore, before these activities begin, a demining measure must be carried out throughout the DAA and the areas destined for resettlement to ensure no worker accidents. The risk area mentioned in the Archaeological Report (**Annex 8**) has not yet been fully mapped, only briefly checked with a metal detector, and therefore needs further investigation as to its boundaries.

[12] https://www.thecitizen.co.tz/tanzania/news/africa/the-1978-war-that-pushed-idi-amin-out-of-presidency--3603576
[13] https://www.onwar.com/data/tanzaniauganda1978.html#google_vignette
[14] https://www.monitor.co.ug/uganda/special-reports/39-years-after-war-that-brought-down-amin-1749938

Figure 8.2.4.3.a
Kagera region and the districts affected by the Tanzania-Uganda War



Legend:

	400 kV Mutukula - Kyaka TL route
	Kagera region
	Kyerwa district
	Karagwe district
	Missenyi district
	Bukoba district
	Muleba district

Mitigation Measures

The measures presented in **Table 9.0.a** of **Chapter 9.0** aim to reduce this risk.

Rating of the resulting impact

Since the end of the conflict, several demining operations have been carried out in Kagera. International organisations and the Tanzanian government have been working to remove landmines and UXOs in the area. However, there may be areas where demining has not yet been fully completed or where remaining mines and UXOs have not been detected. Therefore, even with the effective implementation of the measures listed in **Table 9.0.a**, this risk is considered to have a medium probability of occurrence.

If the impact materializes even with the proposed measures, it will be negative, with occurrence in the construction phase, coverage in the DAI, indirect, immediate, and short-term duration. It is irreversible, because landmine and UXO accidents often result in serious or fatal injuries. It has no characteristics of cumulativeness or synergy. The magnitude is medium, and the importance is high. It is highly mitigable, but the residual importance was maintained as high, due to the severity of possible injuries, risk of death, psychological and infrastructural damage, the possibility of significant disruption to community life, and long-term social and economic effects.

Rating of the impact (attributes) **Accidents due to the presence of landmines and UXOs (unexploded ordnances)**			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Short term	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability**	Medium
Cumulativeness	Cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Highly mitigable		
Residual Importance	High		

20. Risks to Health and Safety of the Community

20.01 - Increasing the risk of workers transmitting diseases during construction, affecting the surrounding community

Impacting actions	A.2.01 Mobilisation of workforce A.2.13 Operation of camp sites
Impactable component	C.3.04 - Health and Safety of the Community

Analysis of the risk

As analysed in risk 19.01, workers from outside the Project regions could introduce and/or spread vector and/or contagious diseases to the population closer to the work fronts and camp sites. These risks are associated with the following aspects:

- Workers coming from other regions who, asymptomatic carriers of certain illnesses, act as vectors, considering mainly water-borne diseases and those transmitted by insect vectors (mosquitoes, flies, bedbugs, soft ticks);
- A possible overload of sanitation systems increasing the incidence of waterborne diseases;
- A possible increase in sexually transmitted diseases (STDs) as a result of contact between the labour force and the local population.

The effort to hire as many local workers as possible will help to reduce this risk. As discussed before, the most important efforts should be focused on preventing STDs and on measures to avoid vector-borne diseases, especially malaria, filariasis, dengue, chikungunya, and Zika viruses, and also African trypanosomiasis (sleeping sickness), tick-borne relapsing fever, Onchocerciasis, and the diseases caused by houseflies.

Mitigation Measures

As mentioned, this risk can be minimised by maximising the number of local hires and applying preventive health programmes, in addition to the **P.17 - Occupational Health and Safety Management Programme** measures to be implemented by Contractors to ensure their compliance with the relevant legislation and with good practices in the sector. One of the measures provided for in this programme is to assess and monitor the health of hired workers through admission and periodic examinations that will allow the detection of viral, bacterial, and parasitic diseases, among others.

Care will also be taken regarding the cleanliness and organisation of camp sites and work fronts.

The need to prevent STDs, as well as teenage pregnancy, will be included as a topic to be covered in the Worker Training and the Worker's Code of Conduct.

The full set of measures to be implemented is presented in **Table 9.0.a** of **Chapter 9.0**.

Rating of the resulting impact

Properly implementing all the measures proposed in **Table 9.0.a**, the impact is considered to have a low probability of occurrence.

If the impact materialises even with the proposed measures, it will be negative, restricted to the construction phase, with coverage in the DAI. It will be direct, immediately induced and of short duration. It is reversible, not cumulative, but synergic. The magnitude and importance are low. It is moderately mitigable, and therefore the residual importance

remains low.

Rating of the impact (attributes) Transmission of workers' diseases affecting the surrounding community			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Medium
Cumulativeness	Non-cumulative	**Sinergy**	Synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Moderately mitigable		
Residual Importance	Low		

20.02 - Risks to the health and safety of the community during construction

Impacting actions	A.2.07 Flows of vehicles, equipment, and workers to the work fronts A.2.08 Earthworks in the substation area A.2.10 Execution of tower foundations A.2.11 Assembly of towers A.2.12 Launching of cables A.3.01 Operation of the TLs and SSs
Impactable component	C.3.04 - Health and Safety of the Community

Analysis of the risk

As mentioned in Impact 11.01, during construction an incremental increase in heavy vehicle traffic is expected on the Project access roads, mainly the B8, B181, B182, B3, B6, Geita-Bukoli-Msalala, Nyang'huale-Busangi, Didia-Solwa, and Shinyanga – Bubiki Roads, and also the minor roads and rural paths that will be used to access the wayleave.

As mentioned above, in addition to the road damage and interruptions to traffic during the cables' launch, heavy vehicle traffic increases the risk of accidents between vehicles and pedestrians. This risk increases on stretches where the margins are occupied.

In addition to the risk associated with increased traffic, contact between workers and the community increases the risk of social conflict, which may arise due to cultural or religious differences or competition for local resources.

The presence of workers also increases the risk of illicit behaviour and crime. The influx of workers and service providers into local communities may increase the rate of crime and/or the perception of insecurity by residents of DAI communities. Such illegal behaviour or criminality may include theft, physical assault, alcohol and substance abuse, gender-based violence, sexual harassment, or abuse.

This risk of conflicts between workers and the community, and illegal behaviour by workers that threatens the safety of the population, is greater around camp sites, where

workers will be more concentrated and where they will be housed. Although there are sections of the TLs where there is a higher concentration of people around (see **Figure 8.2.3.3.e**), as the TLs are built in stages, there will always be only one group of workers located in each section, i.e. first the topographic surveying workers arrive, then the vegetation clearing workers, then the foundation trench diggers, and so on. So, the risk of conflict caused by contact between workers and the population is lower along the route than around the camp sites. On camp sites, it may also be necessary to hire security services. Suppose these professionals do not receive proper training and do not follow clear rules of conduct, there may be a risk of abuse and inappropriate use of force when dealing with community members and other workers.

As mentioned in **Section 5.3.1**, there is no exact definition of the plot where the camp sites will be installed at this stage. The Contractors will define this, following the selection criteria set out in **Section 5.3.1**. However, an estimate has been made of the number of camp sites required and their distribution along the routes, considering a certain equidistance between them and their positioning in villages that appear to have adequate structures to support the activities. The proposed locations were the villages of Kyaka, Nyakanazi, and Ibadakuli (on the sites of the SSs that will be expanded) and Nyakasimbi, Nyabugombe, Busonzo, Ilogi, and Solwa.

Considering the areas of the SEs and locations close to the LTs and accesses in the other villages mentioned, more than one possible nearby locations were identified that could be used to install the camp site, without having too many houses in the vicinity that could be impacted. These are shown in **Figure 5.3.1.b**. As emphasised in **Section 5.3.1**, it is clear that the alternatives proposed in **Figure 5.3.1.b** are just an exercise, as the actual location will depend on negotiations between the Contractors and the owners or occupiers of the land. Among the areas close to the SSs, the greatest difficulty in finding nearby areas relatively free of occupation in the surroundings occurred at the Kyaka SS. As for the sites along the TLs, the most densely occupied village is Solwa, whose intercepted and surrounding areas have many houses and agricultural areas.

Mitigation Measures

The measures proposed in **Table 9.0.a** of **Chapter 9.0** aim to reduce this risk.

Rating of the resulting impact

With the effective implementation of the measures listed in **Table 9.0.a**, this risk is considered to have a low probability of occurrence. However, considering that the TLs will pass through areas with dense occupation in the surroundings and that there are isolated occupations close to the wayleave practically throughout the route, the risk was raised to moderate.

If even with the proposed measures the impact materialises, it will be negative and will occur during the construction phase. It will have a coverage in the DAI, direct incidence, short-term induction, and also short-term duration. It is reversible, cumulative, and not synergic. The magnitude is medium, and the importance is moderate. It is highly

mitigable, but the residual importance was maintained as moderate.

Rating of the impact (attributes) Risks to the health and safety of the community during construction			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Short term	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	Moderate		
Mitigability	Highly mitigable		
Residual Importance	Moderate		

20.03 - Risk of impact on the health of the population closest to the TL due to the effect of the electromagnetic fields

Impacting actions	A.3.01 Operation of the TLs and SSs
Impactable component	C.3.04 - Health and Safety of the Community

Analysis of the risk

The effect of EMF on the health of the population adjacent to TLs is an aspect that has been monitored and studied. Studies have not found any conclusive evidence of a correlation between EMFs and health problems. From the point of view of international experience, the concept of 'prudential avoidance' has been adopted (MORGAN, 1994), i.e., the set of attitudes aimed at avoiding unnecessary exposure to EMFs. Internationally accepted measures, within the scope of the 'prudential avoidance' concept, include observing a safety distance from populated areas during the design of the route, as well as controlling exposure levels, which is ensured by establishing the TLs' wayleave. In this respect, it is understood that establishing the wayleave and its subsequent maintenance to keep it free from occupation, prevents the EMF from reaching the population, even if they are on the outer edge of the wayleave.

The population most at risk of exposure to EMF will be those located in the portions closest to the easement, including those living at the clusters already mentioned in **Figure 8.2.3.3.e** of Impact 12.02, as well as residents of smaller groups of houses and isolated residences close to the wayleave.

The Reference Levels established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and recommended by the WHO for TLs with a frequency of 50 Hz are 5 kV/m for electric fields and 100 μT for magnetic fields, as shown in **Table 5.1.i** in **Section 5.1**.

Section 5.1 also presents the electric and magnetic field values expected at the edge of the wayleave, considering the characteristics of the 400 kV TLs. For the electric fields,

the 2.09 kV/m expected at the edge of the wayleave is less than the 5 kV/m specified by the ICNIRP. For magnetic fields, the resulting 3 µT also fulfils the limit of 100 µT.

Considering the values, this impact can only occur in cases of long-term exposure, immediately under the cables of the TL, i.e., in situations of invasion of the wayleave by housing and other installations involving permanent or long-term occupation. In any case, no construction will be allowed either under the cables or in the rest of the wayleave area, so it is considered that the impact will not occur if this determination is respected. As for non-permanent and short-term activities, such as cropping or grazing, it is not considered that this impact will occur even within the wayleave and immediately under the cables.

Mitigation Measures

Table 9.0.a of **Chapter 9.0** presents a set of measures to reduce this risk.

Rating of the resulting impact

Considering the EMF values used in the project and the establishment of the wayleave, this risk is considered to have a low probability of occurrence.

If even with the implementation of the measures set out in **Table 9.0.a**, the impact materialises, it will be negative, of occurrence in the operation phase, and coverage in the DAI. It will be direct, short-term induction, and long-term duration. It is reversible, not cumulative, and not synergic. The magnitude and importance will be low. It is moderately mitigable, keeping the residual importance as low.

Rating of the impact (attributes) **Risk of impact on the health of the population closest to the TL due to the effect of the electromagnetic fields**			
Vector	Negative	**Location and spatialization**	DAI
Stage of occurrence	Operation	**Form of incidence**	Direct
Temporality (Induction)	Short term	**Temporality (Duration)**	Long term
Reversibility	Reversible	**Probability**	Low
Cumulativeness	Non-Cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Moderately mitigable		
Residual Importance	Low		

20.04 - Risk of child labour

Impacting actions	A.2.01 Mobilisation of workforce A.2.13 Operation of camp sites
Impactable component	C.3.04 - Health and Safety of the Community

Analysis of the potential impact

Child labour is a high risk in Tanzania. According to the Bureau of International Labor Affairs[15], in 2023, 20.4% (3,345,516) of the population aged between 5 and 14 worked and didn't study. Another 18.4% between the ages of 7 and 14 combined work and study. Agriculture accounted for most of this child labour (84.8%).

According to the NBS/ILO (2016) report, published in 2016[16], of the 5,066,890 children aged between 5 and 17 who were working, only 5,868 (0.12%) were in the construction sector. However, commerce (wholesale and retail trade; repair of motor vehicles and motorcycles) employed 154,997 children (3.1%), and accommodation and food services employed another 46,553 (0.92%).

Thus, this risk should be considered for the Project. It is expected that the construction companies to be contracted for the work should be larger companies with a more robust structure and management procedures, even if not formalised, that prevent them from hiring minors. However, there is a risk that smaller subcontractors, and even suppliers of construction materials and raw materials, including concrete aggregates (sand, gravel), cement, lime, iron, wood, and others, and companies supplying food and transport for workers, may employ child labour.

According to Chapter 5.0 of P.15 - Gender Based Violence (GBV) Action Plan (Annex 16), the Project has potential risks associated with child labour (children dropping out of school to work with contractors) as well as risks of underage/school-going girls eloping with project workers or be married off to project workers or people affected by the Project in exchange for resources to the girl's family and a result of having compensation monies. Drug addiction is also a risk if children access money. As previously mentioned, unwanted and early pregnancies are also a risk that girls face. Children also face another risk emanating from the practices of child labour and incidences of child defilement.

Mitigation Measures

The measures presented in **Table 9.0.a** of **Chapter 9.0** aim to reduce this risk.

Rating of the resulting impact

Even considering the measures of **Table 9.0.a**, supervising small suppliers may pose some difficulty, which raises the risk to a moderate probability.

If the impact materialises, it will be negative, direct, of immediate occurrence, and short-term, as it is concentrated in the construction phase. It is reversible and covers the AII, its cumulative, but non-synergic. Due to its short duration, its magnitude is low and its importance is also low due to its reversibility. It is highly mitigatable, keeping its residual importance low.

[15] https://www.dol.gov/agencies/ilab/resources/reports/child-labor/tanzania

[16] Tanzania National Bureau of Statistics (NBS). International Labour Organization (ILO). Tanzania National Child Labour Survey 2014. Analytical Report. 2016.

Rating of the impact (attributes) Risk of child labour			
Vector	Negative	**Location and spatialization**	IAI
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Short term
Reversibility	Reversible	**Probability**	Moderate
Cumulativeness	Non-Cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Low		
Importance	Low		
Mitigability	Highly mitigable		
Residual Importance	Low		

21. Risks to Historical, Cultural, and Archaeological Heritage

21.01 – Risk of damages to historical, cultural, and archaeological assets

Impacting actions	A.2.02 Mobilisation of camp sites A.2.04 Vegetation clearing A.2.06 Implementation/improvement of accesses A.2.08 Earthworks in the substation area A.2.10 Execution of tower foundations
Impactable component	C.3.07 - Historical, Cultural and Archaeological Heritage

Analysis of the potential impact

As seen in **Section 7.4.3**, the potential of the Project's implementation area concerning the Historical, Cultural, and Archaeological Heritage is high.

The field surveys identified 6 (six) archaeological sites outside the DAA but close to it, resulting in 71 recovered artefacts from the seven areas prospected.

Intangible heritage along the route was also identified, including two ritual sites inside the wayleave (DAA), as mentioned in **Table 7.4.3.d** in **Section 7.4.3**. For these 2 intangible heritages within the DAA, an effort was made to fine-tune the TL alignment to avoid impact, as shown in **Figure 8.2.4.3.b**. In the case of the ritual site called **Mwakulali**, it is partially within the easement. During the consultation, the landowner said that he does not accept compensation for the impact. So, an adjustment was made to the route so that it would no longer be affected by the wayleave, as shown in **Figure 8.2.4.3.b**. In the case of the ritual site called **Kabagole**, in consultation with the owner, he reported that he preferred compensation for the impact. However, the possibility of diverting the line was also evaluated. As the expectation of compensation arose from the consultation, with the possibility of building a new church on a new site, TANESCO agreed that the best option would be to maintain the alignment and provide compensation to those affected. (see **Figure 8.2.4.3.b**).

Figure 8.2.4.3.b
Adjustment of the route to avoid intercepting the ritual sites called Mwakulali and Kabagole

Legend:

	400 kV Mutukula-Kyaka TL route
	Wayleave easement
	400 kV Mutukula-Kyaka TL route adjusted
	Wayleave easement adjusted

However, other cases like these, especially archaeological sites, may be identified during construction activities.

As for possible interference with any archaeological heritage present in the Project area and not identified during the ESIA surveys, the impact is related to their possible remobilisation, burial, and partial or total destruction during construction activities,

especially during land clearing and earthmoving.

Any physical interference in the land could cause the remobilisation and/or destruction of possible archaeological remains and structures on the surface or inside the soil or sediment. This impact is of great importance, considering that the study and interpretation of archaeological sites depend on the integrity of the remains and their sedimentary matrix, as well as the relationship between elements that form their material, spatial, and temporal context. The movement of machinery for both the removal and installation of structures can thus lead to the revolving of the surface layers of the soil, significantly disturbing the integrity of the cultural remains. This impact can occur during land clearing activities, excavations to lay the foundations for the towers, and earthworks to create new accesses, to expand the Substation areas, and to implement camp sites, if necessary.

Mitigation Measures

The ESMP provides measures to safeguard archaeological heritage, as **Table 9.0.a** of **Chapter 9.0** shows.

Rating of the resulting impact

Considering the project region's high potential, even with the implementation of the measures proposed in **Table 9.0.a**, the risk of this impact occurring is considered medium.

If, even with the prevention measures set out in P.16, the impact materialises, it will be negative, with a geographic scope restricted to the DAA, related to the construction phase of the Project. It has a direct incidence, immediate induction, and long-term duration. It is irreversible, but without the characteristics of cumulativeness or synergy.

The magnitude is medium, and the importance is high. It is highly mitigable through the measures established in the Plan mentioned above, so the residual importance is considered medium.

Rating of the impact (attributes) Damages to historical, cultural, and archaeological assets			
Vector	Negative	**Location and spatialization**	DAA
Stage of occurrence	Construction	**Form of incidence**	Direct
Temporality (Induction)	Immediate	**Temporality (Duration)**	Long term
Reversibility	Irreversible	**Probability**	Medium
Cumulativeness	Non-cumulative	**Sinergy**	Non-synergic
Magnitude and Importance			
Magnitude	Medium		
Importance	High		
Mitigability	Highly Mitigable		
Residual Importance	Medium		

8.2.5
Cumulative Impact Assessment

The previous sections presented the interaction matrices between the impacting actions, the environmental components, the Environmental Programs proposed for each impact, and the assessment of each resulting impact.

Considering the results obtained and those that make up the environmental diagnosis developed for the physical, biotic, and socio-economic environments, we proceed to assess the possible cumulative and synergistic effects of the project.

The methodological proposals presented in the following documents were used for this assessment. Other scientific publications, including articles and books used as references, are cited throughout this section.

- Good Practice Hand Book: Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. IFC: World Bank Group, 2013.
- Practical Guide for the Evaluation and Management of Cumulative Impacts in Latin America and the Caribbean (BID Invest, 2023).
- United States Environmental Protection Agency. Framework for Cumulative Risk Assessment. (U.S. EPA, 2003)
- Cumulative Environmental Impact Assessment Industry Guide. Minerals Council of Australia (2015)

Various guidelines, assessment and approval requirements, and legal findings define the CIA. Globally or nationally, no methodology for quantifying cumulative impacts has been established that has gained wide acceptance.

In the "*Practical Guide for the Evaluation and Management of Cumulative Impacts in Latin America and the Caribbean* (IDB Invest, 2023)", which defines that cumulative impacts generally refer to changes in the behavior of the environment resulting from multiple activities or projects over time, including those generated by the project under evaluation.

According to Performance Standard 1 of the International Finance Corporation (IFC, 2012), cumulative impacts result from the successive, incremental, or combined effects of an ongoing action, project, or activity, or are produced by past and planned future activities.

Minerals Council of Australia (2015) proposes a differentiation between the impact of combined elements of a single project/activity, the contributing impacts of a single project/activity on an existing baseline or current health of the system, and the cumulative impact of multiple projects/ activities on a single environmental value or asset.

The EPA (1999; 2003) defines cumulative impacts as those resulting from interacting and superimposing environmental effects from one or more human actions over time and

space. The International Association for Environmental Impact Assessment (IAIA, 2015) suggests the term is related to the aggregate effects of actions that produce impacts that accumulate incrementally or synergistically over time and space.

The European Commission (1999) defines cumulative impacts as the result of incremental changes caused by past, present, and reasonably foreseeable future actions acting together. Hegmann et al. (1999) also clearly shares this definition, associating cumulative effects with combined actions over time that cause changes in the environment.

The U.S. Council on Environmental Quality (CEQ) regulations, implemented by the National Environmental Policy Act (NEPA, 1977; 2020), emphasize that, despite the possibility of being linked to individual actions, cumulative impacts are usually the result of collective actions over a period of time.

In these terms, and in line with the guidelines of the World Bank Group (IFC, 2013) and the aforementioned IDB Investment Practice Guide (2023), the main task of the cumulative impacts analysis process is to differentiate between the changes that occur naturally in socio-environmental systems and those that are driven by the combined action of several projects in the area of intervention.

To achieve these objectives, this study's evaluation will focus on VECs (Valued Environmental Components). This term, first introduced by Beanlands and Duinker (1983), refers to attributes of environmental and social systems considered by the community or group carrying out the analysis to be important or sensitive to the incremental effects of a project or projects.

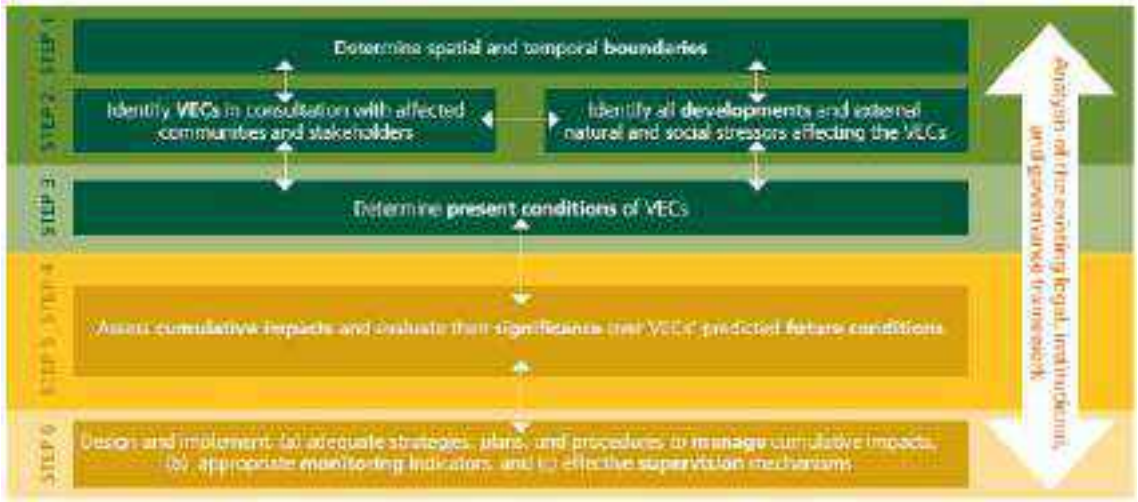
In the context of this definition, the methodological approach to be used in this study results from a combination of the proposals put forward by the IFC (2013) and BID Invest (2023), which includes the following methodological steps (see **Figure 8.2.5.a**):

(a) selection of VECs;
(b) definition of temporal and spatial scales;
(c) description of the basic conditions of the VECs;
(d) identification of other collocated projects and natural and social variables that affect the VECs;
(e) identification and assessment of cumulative impacts;
(f) assessing the degree of significance of cumulative impacts; and
(g) defining management and mitigation measures for cumulative impacts on each VEC.

It should be noted that the public consultation process extends throughout the entire methodological perspective to guarantee the direct involvement of interested parties.

These procedures are briefly described below, and the results are presented together.

Figure 8.2.5.a
Six-Step approach for CIA



Source: (IFC, 2013)

- Definition of scope

(a) Definition of temporal and spatial scale;

Identifying the spatial and temporal scales is a fundamental step in this assessment, as it establishes the scope of the analysis. The basic premise considered was that the spatial delimitation of cumulative effects expands to a point where the environmental components considered are no longer affected by the actions that cause them, or where the intensity levels of the impacts are considered irrelevant or non-material.

For the analysis, the spatial coverage area was considered to be the area defined by a 40 km corridor on either side of the TLs. The districts where the substations are located were also included in this polygon, and the most important projects at a regional level were considered. However, it is known that the most intense cumulative effects will occur in the vicinity or in the area directly used by the project.

Despite the possibility and feasibility of using different geographical areas for each VEC, this assessment prioritized homogenizing the data to include an integrated analysis of the impacts. However, this delimitation ensured that all areas of manifestation of the different VECs and impacts were included in the polygonal analysis.

Concerning the time scale, a prospective approach of five years was adopted, a period compatible with the probability of success of the impact monitoring and control programs planned for the project's operation phase. The same applies to the past time limit, since impacts generated more than five years in the future are already assimilated into the dynamic characteristics of the environment. In addition, it should be noted that the effects of past projects (whether abandoned or in operation) are already taken into account when determining the “current” state of the VECs.

(b) selection of VECs;

The baseline analyses presented in the ESIA elucidated the main characteristics of the environmental and social components susceptible to adverse effects from the project, such as:

- Main characteristics of the project area, including those related to physiographic aspects and their dynamic processes;
- Main aspects of vegetation cover;
- Main species of terrestrial fauna;
- Existence of protected or important habitats;
- Existence of endangered species;
- Main characteristics related to human occupation and the population's living conditions.

The collection of social information was based on interviews with the project's stakeholders (already presented in previous sections), the results of which contributed to the selection of the VECs.

Selected VECs

Considering the projects that may be concurrent with the project (see Step d) at the defined spatial and temporal scales (see Step b), the following VECs were selected:

- Vegetation and Habitat
- Employment and local economy
- Infrastructure
- Quality of life of the population

(c) description of the (baseline) conditions of the VECs

The diagnosis and characteristics of the selected VECs were drawn up in the baseline phase developed for this ESIA. The information collected and presented in the previous sections is sufficient to support the analysis of possible cumulative impacts, so it was not necessary, in the case under study, to apply additional efforts to complement the characterization of the selected VECs.

(d) identification of collocated projects and natural and social variables affecting the VECs

At this stage, the main actions of the project with the potential to cause undesirable impacts were identified. Regarding other projects that have already been implemented, their effects have already been assimilated into the context of the current organization of space, as reflected in the diagnosis chapter of the ESIA.

Concerning the effects arising from projects planned for the future, a consultation was held with the main planning bodies, including transnational projects, and a public

consultation in the press.

Based on the exercise carried out, the following publicly known development projects or programs were identified that have the potential to cause cumulative impacts (see **Table 8.2.5.a**):

- East Africa Crude Oil Pipeline (EACOP, 2019)
- Rehabilitation of Lusahunga-Rusumo Road (92km) (TANROADS, 2022)
- 87 MW Kakono Hydropower Project and Associated 220kV Transmission Line (TANESCO, 2022)
- 220Kv Benaco-Kyaka Transmission Line (TANESCO, 2023)

Table 8.2.5.a
Project with potential cumulative impacts with UTIP

Project	Description	Overlap in space and time with the UTIP
East Africa Crude Oil Pipeline (EACOP)	The East African Crude Oil Pipeline Project (EACOP) is a pipeline that will transport oil produced from Uganda's Lake Albert oilfields to the port of Tanga in Tanzania, where it will be sold to world markets. The pipeline is buried, and once topsoil and vegetation have been re-instated, people and animals will be able to cross freely anywhere along its length. The pipeline is buried and once topsoil and vegetation have been re-instated people and animals can cross freely along its length. The first 296 km of EACOP are in Uganda, and the remaining 1147 km are in Tanzania. Once constructed and buried, the topsoil and surface vegetation will be reinstated and people and animals can pass freely across. Equally, the pipeline will pass under crossing points with other infrastructure such as roads, rail lines, or cables. During operations, in agricultural areas, crossing of the corridor by pedestrians and livestock will be unimpeded, with provision for vehicle crossings at existing roads. During operations, the pipeline RoW will continue to be 30 m. Several above-ground facilities are also part of the EACOP system. The principal ones are the six pumping stations, 2 in Uganda and 4 in Tanzania, and 2 further pressure reduction stations and the oil terminal in Tanzania. The pipeline will also have 76 mainline Block Valves installed along its length. These valves can be closed to isolate the pipeline sections if needed. In addition to the pipeline, high-voltage electrical cables and a Fibre-Optic cable will be laid and buried along the same right of way.	Cross Ibadakuli-Nyakanazy TL close to Lulembela in Geita Region, and come very close to Kyaka-Mutukula TL in Kagera Region.
Rehabilitation of Lusahunga-Rusumo Road (92km) (TANROADS)	The project road starts at Lusahunga Centre through Nyakasanza and Benako and ends at Rusumo Border (Tanzania and Rwanda). Out of 92Km of the project road 63Km are located in Biharamulo district and the remaining 29Km are located in Ngara District. The Project Road traverses through four important administrative villages in Biharamulo district namely Lusahunga and Kikoma (Lusahunga Ward), Ngararambe and Nyabugombe, (Nyakahura ward) while on the Ngara district side there are two important villages: Kasulo (Kasulo ward which include Benaco center), and Rusumo (Rusumo ward). This is rehabilitation of the existing tarmac road; therefore, project road will retain the existing horizontal profile except for some segments which shall undergo very minor realignments such as sharp corners and steep slopes at several places of the road. In addition, an important feature of the rehabilitation project is the fact that the road will be widened. Currently, the road has a width from a total of 10.5 m (3.25 m lanes, 1.5 m shoulders and 0.5	The TL Kyaka-Nyakanazi follows the existing road, which will be rehabilitated from Lusahunga to the vicinity of Nyakasanza, when it turns definitively towards the north of the Kagera Region.

Table 8.2.5.a
Project with potential cumulative impacts with UTIP

Project	Description	Overlap in space and time with the UTIP
	m outer shoulder) with the rehabilitation project it will have a total of 12.0 m (3.5 m lanes, 2.0 m shoulders and 0.5 m outer shoulder). However, the project will not add any additional lanes and will remain with two lanes.	
87 MW Kakono Hydropower Project and Associated 220kV Transmission Line (TANESCO)	TANESCO plans to develop the 87.8 MW Kakono Hydropower Project (HPP) on the Kagera River and to construct a 38.5 km long 220 kV Transmission Line (TL) from the planned Kakono hydropower plant to the 132 kV/33 kV Kyaka substation in Missenyi District. The overall project objective is to provide stability of power supply in the Lake Victoria Zone and to supply electric power to the national grid. The Kakono dam is located in Kagera Region in the North-western corner of Tanzania near the border with Uganda, approximately 90 km west of Bukoba Municipality. The dam is planned to be a 61 m high concrete gravity dam, with a 1,259 m long embankment section on the right abutment and a 124 m long embankment section on the left abutment. The proposed powerhouse is at the foot of the dam. The dam will create a reservoir with a volume of 150 MCM and a footprint of 17 km² at full supply level. It will extend about 35 km upstream from the dam. A 220 kV Transmission Line will be constructed to connect Kakono HPP to Kyaka Substation. The TL will be 38.5 km length with 35 m wide wayleave, include Kyaka Substation extension.	Come closer to the 400 kV Kyaka-Nyakanazi and 400 kV Kyaka-Mutukula TLs in Kagera Region. Will share Kyaka Substation with UTIP TLs.
220Kv Benaco-Kyaka Transmission Line (TANESCO)	The ultimate development objective of the project is to improve power supply through provision of main grid electricity to the whole Kagera Region, the project will also provide reliability and affordability of electricity in the country, enhance power evacuation for the proposed 87MW Kakono HPP and job creation. The project will improve the supply of electricity in Tanzania in the short to long term by connecting the Power National grid to the isolated grid. The 220kV Benaco - Kyaka Transmission Line Project comprises of: (i) Design and construction of 220kV transmission line from Benaco in Ngara District to Kyaka in District (166.17km). (ii) Design and construction of 2x40MVA, 220/33kV substation at Benaco in Ngara District. 220kV transmission line will be 166.17 km length with 35 m wide wayleave.	Parallel with 400 kV Kyaka-Nyakanazi Transmission Line in Kagera Region.

External natural environmental and social drivers

The following stressors and external factors were considered in the CIA:

Climate change - changes in the environment related to climate change in the near future are directly related to the potential cumulative impacts identified here. These include the availability of water for electricity generation, irrigation projects, inducing development and altering habitats, as well as the possibility of intense events that could cause changes in the cycle of the projects identified.

Land use and habitat changes - changes in land use and occupation can be driven by growth in agricultural practices, animal husbandry, deforestation, consumption of natural goods, urban sprawl, among others.

Mining - as already mentioned in the previously presented diagnosis, the entire region intercepted by the Project has mining activities of different sizes and extraction methods. The increase or decrease in mineral production could lead to changes in the dynamics of space occupation, as well as generating impacts inherent to the activity.

Demographics and urban expansion - demographic growth and, above all, the growth of urban centers in the intercepted region are factors that could lead to an increase in the cumulative effects identified, especially those deriving from changes in habitats and increased consumption of goods, including food.

- Assessment

(e) identification and assessment of cumulative impacts

Considering the list of impacts identified in the previous sections, the projects that could be simultaneous with the project on a spatial and temporal scale (and the external stressors), those that are cumulative and could affect the VECs listed in step 1 were selected.

The cumulative impacts were identified taking into account the interaction effects between the impacts and their implications for the quality of the environments (**Table 8.2.5.b**).

Table 8.2.5.b
Impacts and effects on VECs

VEC	Impacts
Vegetation and Habitats	Vegetation and Habitat Loss
Employment and Local Economy	Jobs and income
	Stimulation of development
Infrastructure	Increased availability of electricity
Quality of life of the population	Landscape changes

Considering the impacts identified above, it is important to note that they are different from those of an *accumulative* nature, such as temporary impacts that may accumulate during the concurrent execution of different projects. An example is the creation of jobs during construction, which are temporary and reversible, with no long-term effects.

With regard to the methodology for assessing cumulative impacts, the analysis of assimilation capacity proposed in the "Practical Guide for Assessing and Managing Cumulative Impacts in Latin America and the Caribbean (IDB Invest, 2023)" was adapted. Given the unavailability of some quantitative data on collocated projects, as well as some applicable legal parameters that could serve as a safety factor on the carrying capacity of some VECs, a qualitative assessment procedure was adopted. To this end, and in order to provide a context for the incremental and cumulative effects, a comparative weighting scale was applied, taking into account the nature and size of the projects. The scale used ranges from -5 to 5, with numbers below zero being associated with negative effects. Milestone zero was adopted as the current condition, reflecting the interference of the projects already implemented.

Cumulative impacts on the VEC Vegetation and Habitats

The impacts on vegetation cover and habitats in the study area stem from the need to suppress them in order to carry out the projects. These impacts are permanent, negative and difficult to reverse, although there is the possibility of compensatory planting and restoration of already degraded areas. As indicated in the previous sections, these impacts will occur during the construction phase and their effects will be long-term.

The cumulative nature of these impacts is therefore derived from the increase in areas to be deforested in a landscape matrix that already has fragmentation characteristics derived from previous activities. Unlike other effects already discussed throughout this assessment, it is not fortuitous to admit that the probability of effects on this VEC is certain. There is therefore an increase in the rates of habitat conversion and fragmentation, in addition to the total loss of area.

In practical and comparative terms, the removal of vegetation and habitats is conditional on the width of the easement strip required for the implementation of each collocated project identified. It is important to mention that the 220Kv Benaco-Kyaka Transmission Line and the Rehabilitation of Lusahunga-Rusumo Road run parallel to the Project, and in many cases the lengths of the tracks may be shared. The EACOP pipeline will cross the 400 kV Nyakanazi - Ibadakuli- TL and the 132 kV TL coming from the Kakono HPP will only intercept the spatial limits considered, as well as sharing the Kyaka Substation.

Table 8.2.5.c shows the width of the easement strips and the size of the areas to be converted for the implementation of each project. It should be noted that the number of areas to be converted includes not only vegetated areas, but all categories of land use and occupation, thus indicating the size of each project's footprint.

Table 8.2.5.c
Wayleave footprint of selected projects

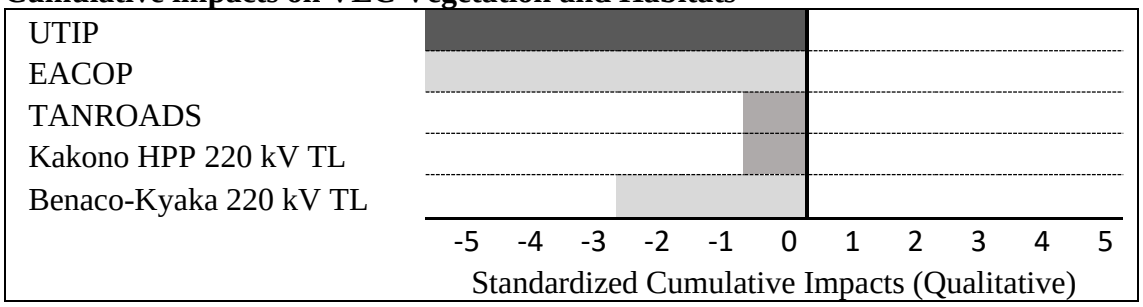
Project	Wide (m)	Area (ha)
UTIP	52	2.853,8
EACOP	30	3.441,0
TANROADS	12	110,4
Kakono HPP 220 kV TL	35	134,7
Benaco-Kyaka 220 kV TL	35	581,6

It can be seen that the greatest demand for land conversion will be generated by the EACOP project (3,441 ha). It should be noted, however, that part of this demand goes beyond the analysis area considered in this assessment, since this project extends to the far east of the country.

The UTIP will require the conversion of 2,853 ha of land, and the demand for these two projects is much higher than the others. In the case of the Lusahunga-Rusumo Road, it is worth noting that most of the area has already been converted, as it is a project to rehabilitate an existing road. In addition to the total loss of habitat, the main impacts could be fragmentation and an increase in conversion rates at a regional level.

Figure 8.2.5.b shows the incremental comparative analysis of the effects on the Vegetation and Habitat VEC.

Figure 8.2.5.b
Cumulative impacts on VEC Vegetation and Habitats



Cumulative impacts on Employment and Local Economy

With regard to the economic dynamics of the region, it is important to note that the generation of jobs during the operation of the projects will contribute to an increase in wages in the region where they are located, with a consequent increase in the circulation of goods and merchandise.

Although the generation of jobs during project implementation works is significant, during operation the amounts are significantly lower. In any case, this is a vector for inducing development, which could have an impact on various areas of the local economy, with special attention to the productive sector and the provision of services. In addition to the direct impact on the generation of jobs at a regional level, there is also the

possibility of increasing the training levels of the workforce and, consequently, improving the quality of life of part of the population affected.

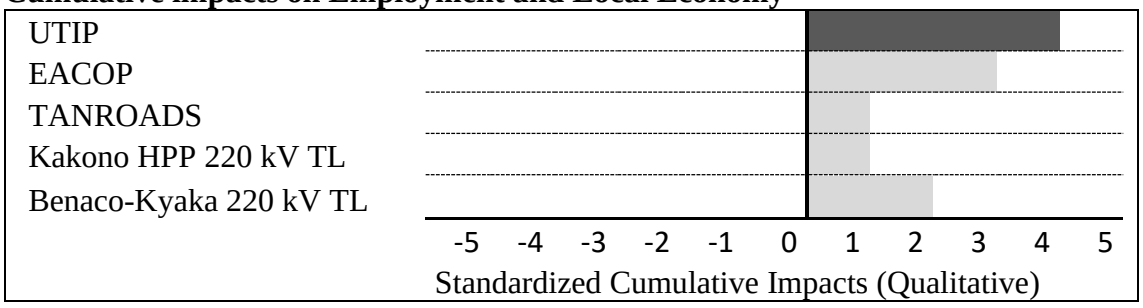
All the projects identified have the potential to generate jobs during operation, particularly for maintenance activities. Due to the size of each project, it is clear that the demands will be greater for the UTIP and EACOP when compared to those to be generated by the other projects.

As stated above, the cumulative impacts considered here refer to those that will occur during the operation phase of the projects, since during construction these effects are temporary and reversible.

According to information consulted in the available environmental studies, the Lusahunga-Rusumo maintenance activities will generate 100 jobs, the same number as for the maintenance of the 220 kV Kakono HPP TL, considering the demobilization of 90% of the personnel involved during the construction phase. Approximately 300 personnel are planned and will be positioned at the EACOP project facilities. UTIP will demand approximately 405 workers during operational phase, considering the demobilization of 70% of the construction workforce. No data was found on the workforce to be deployed for the operation of the 220 kV TL Benaco-Kyaka.

Figure 8.2.5.c shows the comparative assessment of the effects on the VEC Employment and Local Economy.

Figure 8.2.5.c
Cumulative impacts on Employment and Local Economy



Cumulative impacts on Infrastructure

The main cumulative impact on the VEC Infrastructure will be an increase in the availability of electricity. For this positive impact to occur efficiently, there must be routine maintenance and emergency repair of the LTs and SEs, so that there is no loss or waste in energy transmission.

No less important is the implementation of the EACOP oil pipeline, the consolidation of which will also reinforce the country's infrastructure system, bringing the opportunity for new investments and inducing economic activity. The same positive character applies to the rehabilitation of the Lusahunga-Rusumo Road, which will allow land traffic to be

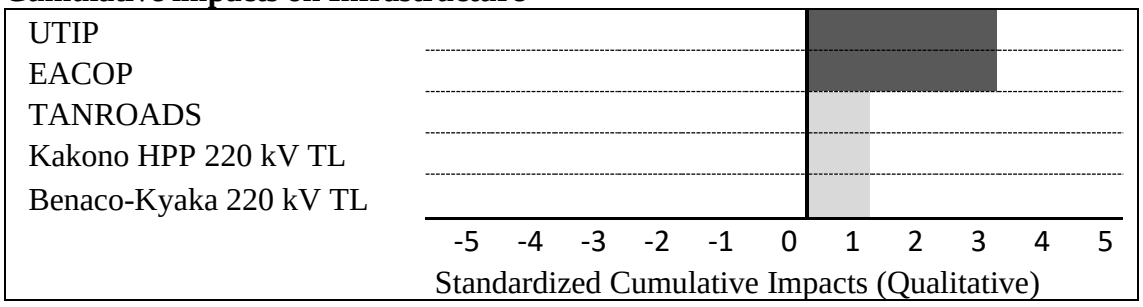
organized and increase mobility and fluidity for the north-western region of Tanzania.

The cumulative effects on the VEC Infrastructure considered here should be distinguished from those temporary effects that may occur during construction activities, such as the increased demand for infrastructure to provide services such as health, basic sanitation and education. These impacts have been duly dealt with in the previous sections and are different from those considered here, particularly as they are reversible and have a duration restricted to the construction period.

Considering the size of the projects, it can be inferred that UTIP and EACOP are the projects with the greatest cumulative effects on the VEC Infrastructure, especially as they are large-scale projects.

Figure 8.2.5.d shows the incremental comparative analysis of the effects on the VEC Infrastructure.

Figure 8.2.5.d
Cumulative impacts on Infrastructure



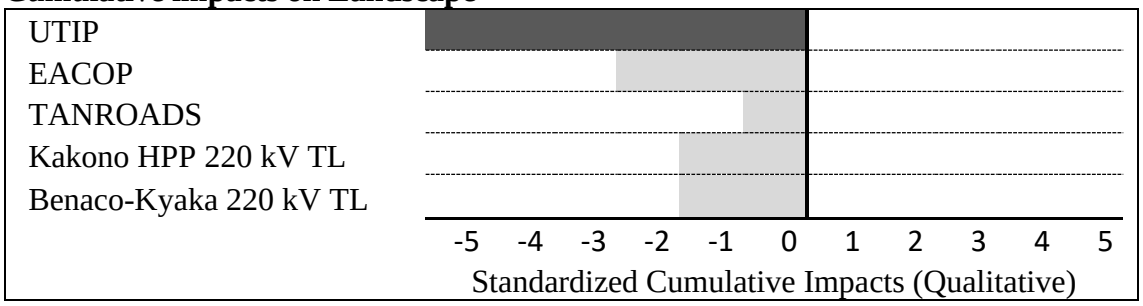
Cumulative impacts on Landscape

In the case of the Landscape VEC, cumulative impacts would be associated with the addition of new fixed elements in the regional spatial organization. There is no doubt that the 400 kV transmission lines will have the greatest comparative impact, as they involve the installation of a large-scale structure in a landscape devoid of any such infrastructure. In the case of EACOP, although surface structures are planned, these will be isolated, and the pipeline's large extension will be buried.

There are also possibilities of inducing new investments due to increased mobility in the region, as well as the increase in energy availability, which has even more potential to transform the structures comprising the spatial organization.

In this sense, the high performance of the enterprise (UTIP) is acknowledged in terms of inducing this type of cumulative impact compared to other collocated programs and projects, as can be seen in **Figure 8.2.5.e**.

Figure 8.2.5.e
Cumulative impacts on Landscape



Summary of Cumulative Impact Assessment

Table 8.2.5.d summarizes the cumulative effects on the assessed VECs and the potential for induction of each project.

Table 8.2.5.d
Summary of cumulative effects on the assessed VECs

VECs \ Projects	UTIP	EACOP	TANROADS	Kakono HPP 220 kV TL	Benaco-Kyaka 220 kV TL	Total Effect on the VEC
Vegetation and Habitat	-5	-5	-1	-1	-3	-15
Employment and Local Economy	3	2	1	1	1	8
Infrastructure	3	3	1	1	1	9
Landscape	-5	-3	-1	-2	-2	-13

It is observed that the main cumulative effects will occur on the Vegetation and Habitats VECs and the Landscape VEC. These are negative effects, related to vegetation suppression and landscape alteration, which are prominent due to the changes they bring to natural environments and areas with a moderate degree of modification, in addition to introducing new elements to the organization of space.

Among the positive cumulative effects, job creation, induction of economic activities, and reinforcement of infrastructure systems stand out. These impacts may also have a diffuse nature by fostering regional development.

(f) Assessment of the Importance of Cumulative Impacts

At this stage, the importance of the identified cumulative impacts is consolidated. In the literature, there are various criteria used to assess the significance of impacts, which have already been mentioned in previous sections of this ESIA.

In addition to these attributes, and in the context of the evaluation presented here, it is understood that "the significance of a cumulative impact is represented by a measure of the extent of change in the state of a specific VEC and its tolerance to that change, that is, whether this variation is reversible or if a threshold condition (assimilation capacity) is exceeded" (Bid Invest, 2023).

The ecological context was also considered as a criterion related to the conditions in which the impact is situated, that is, the identification of the integrity of the environments. In already altered environments, cumulative impacts tend to have more intense effects than in environments that have not yet been modified by human activities.

In this context, and based on the qualitative assessment presented, the following assessment premises were adopted, as shown in **Table 8.2.5.e**. It should be noted, however, that in the case of positive impacts, the tolerance and resilience capacity of the VECs is not considered, as these limits do not apply to this type of analysis.

The degree of significance of the VECs under study is presented in **Table 8.2.5.f**.

Table 8.2.5.e
Rationale for determining the degree of importance of impacts on the VECs

Importance of the impact	Description
Insignificant	VEC does not experience a noticeable change
Moderate	The VEC would exhibit appreciable variations, but within the limits of natural variation
Substantial	The VEC would exhibit variations beyond natural variation, but within its capacity for resilience or tolerance
High	The VEC would experience variations that exceed its capacity for resilience and/or tolerance, resulting in irreversible effects

Source: Bid Invest, 2023.

Table 8.2.5.f
Importance of impacts on the VECs

VECs	Degree of Importance
Vegetation and Habitat	Substantial
Employment and Local Economy	Moderate
Infrastructure	Moderate
Landscape	Substantial

Cumulative Impact Management Plan

All projects identified for the analyzed geographical area, with impacts that could accumulate with those of the UTIP, are already or will be subjected to individual environmental licensing processes with the GoT. Through these processes, environmental and social programs and measures are established, which are mandatory in accordance with the respective environmental licenses.

Thus, as the first measure in the strategy to prevent, mitigate, control, and compensate for negative impacts and maximize the effects of positive impacts, both cumulative and temporary impacts that occur during construction, but which may have combined effects from several projects with concurrent schedules and work fronts, it must be ensured that each involved project fully complies with the commitments established in their respective licensing processes. This compliance is monitored and guaranteed by the GoT. This is necessary because there are impact effects beyond the control of the developer, which are the responsibility of other developers.

In addition to the measures that each project promoter must individually implement, there are also measures that can be applied jointly, which can optimize efforts and ensure that aspects not identified in individual processes are addressed. In this regard, the following programs are proposed:

Distribution of Responsibilities

It is also important to mention that the vast majority of the cumulative effects analyzed here are associated with the UTIP, which, due to its size and nature, has a greater potential to cause incremental alteration in the VECs. From this fact, it is feasible for this developer to take the lead in the strategies for controlling cumulative impacts. Similarly, it is suggested that the NEMC take on the role of monitoring authority to ensure that the measures are being implemented and properly complied with.

9.0
Impacts Management or Environmental Mitigation Measures

The following **Table 9.0.**a shows the impacts and risks identified for the different phases of the Project and for the different components of the physical, biological and socio-economic environments, and the prevention, mitigation, control and compensation measures proposed for them. These measures are detailed in **Chapter 10.0**, organised into Plans and Programmes that make up the Project's Environmental and Social Management Plan - ESMP.

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
Impacts			
Physical Environment	Soils / Relief	1.01 - Occurrence and/or intensification of erosion processes due to earthworks and excavations	• **P.01 - Construction Environmental Plan (CEP):** – Erosion Prevention and Control; – Vegetation Clearing; – Decommissioning and Recovery of Degraded Areas. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Program** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Monitoring of Recovered Areas; – Maintenance and Erosion Control.
	Superficial Water Resources	2.01 – Alterations of surface water quality and increased turbidity	• **P.01 - Construction Environmental Plan (CEP)** – Erosion Prevention and Control; – Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Water and Effluent Management; – Vegetation Clearing; – Camp Sites and Workforce Housing Management; – Waste Management; – Hazardous Materials Management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.04 - Construction Emergency Preparedness and Response Plan** – Construction emergency preparedness and response measures. • **Environmental and Social Monitoring Plan**

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Contractors' Environmental Monitoring Programme ▪ Treated effluents monitoring – TANESCO's Environmental and Social Monitoring Programme ▪ Water quality monitoring
		2.02 - Siltation of watercourses	• **P.01 - Construction Environmental Plan (CEP)** – Erosion Prevention and Control; – Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Vegetation Clearing. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures.
	Groundwater Resources	3.01 – Alteration of groundwater quality	• **P.01 - Construction Environmental Plan (CEP)** – Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Water and Effluent Management; – Waste Management; – Hazardous Materials Management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Program** – Supervision of Compliance with the Measures of ESMP Plans and Programs that Extend to the Operation Phase; – Waste Management; – Emergency Response Plan (ERP) Framework for the Operation Phase. • **P.04 - Construction Emergency Preparedness and Response Plan** – Construction emergency preparedness and response measures.

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			• **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ Treated effluents monitoring.
	Air Quality	4.01 - Change in air quality during construction	• **P.01 - Construction Environmental Plan (CEP)** – Atmospheric Emissions and Noise and Vibration Control. • **P.02 - Environmental and Social Management Program:** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. – Air quality monitoring; – Greenhouse Gas Emissions Management. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ Atmospheric emissions monitoring – TANESCO's Environmental and Social Monitoring Programme ▪ Air quality monitoring
Biological Environment	Flora and Vegetation	5.01 - Loss of vegetation cover and reduction of individual plants	• **Optimisation of the route** in order to avoid intervention in socio-environmentally sensitive areas • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing: ▪ reduce the clearing of native vegetation (which will be restricted to a 14-metre-wide service strip for laying cables); ▪ use the service strip for access to the towers; ▪ vegetation removal only in authorized area; ▪ protective procedures of the surrounding vegetation; ▪ prioritise degraded areas for the camp sites and access roads; ▪ riverine vegetation should not be cleared closer to the river at a distance of 60 m while constructing the transmission line; ▪ measures to guide the correct disposal of suppressed plant material. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted;

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Programme - Responsible: TANESCO** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental Training of the Maintenance Team; – Monitoring of Recovered Areas; – Vegetation Management on the Wayleave Easement; – Access Control Plan. **As part of the Biodiversity Management Plan (BMP):** • **P.07 - Fauna and Flora Rescue and Relocation Plan** – Flora rescue and relocation to surrounding vegetation patches or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation and operation of the project; – Monitoring the dispersal of invasive species. • **P.10 - Operation Biodiversity Management** – P.10.3 – Subprogramme of Native Vegetation Restoration ▪ Native vegetation restoration. • **P.14 - Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and social education for workers.
		5.02 - Increased landscape fragmentation and edge effect incidence	• **Optimisation of the route** in order to prioritise anthropized areas, to reduce the impact of suppressing vegetation and, consequently, increasing fragmentation and the edge effect. • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing: ▪ reduce the clearing of native vegetation (which will be restricted to a 14-metre-wide service strip for laying cables); ▪ use the service strip for access to the towers; ▪ vegetation removal only in authorized area; ▪ protective procedures of the surrounding vegetation; ▪ prioritise degraded areas for the camp sites and access roads; ▪ riverine vegetation should not be cleared closer to the river at a distance of 60 m

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			while constructing the transmission line; ▪ measures to guide the correct disposal of suppressed plant material. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Programme - Responsible: TANESCO** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental Training of the Maintenance Team; – Monitoring of Recovered Areas; – Vegetation Management on the Wayleave Easement; – Access Control Plan. **As part of the Biodiversity Management Plan (BMP):** • **P.07 - Fauna and Flora Rescue and Relocation Plan** – Flora rescue and relocation to surrounding vegetation patches or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation and operation of the project; – Monitoring the dispersal of invasive species. • **P.10 - Operation Biodiversity Management** – P.10.3 – Subprogramme of Native Vegetation Restoration; ▪ Native vegetation restoration.
	Fauna	6.01 - Disturbance of fauna during construction	• **P.01 – Construction Environmental Plan** – Vegetation Clearing; – Construction Traffic Control; – Camp Sites and Workforce Housing Management. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Flora rescue and relocation to surrounding vegetation patches or intended for educational and/or research institutions.
		6.02 - Reduction of natural habitats	• **P.01 – Construction Environmental Plan** – Vegetation Clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate losses for natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches or intended for educational and/or research institutions. • **P.09 – Landscape Protection Program** • **P.10 – Operation Biodiversity Management** – P.10.1 - Subprogramme of bird collision monitoring; – P.10.2 - Subprogramme of fauna monitoring during operation.

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
	Protected Areas and Internationally Recognized Areas	7.01 – Impacts on Protected Areas and Internationally Recognized Areas	• **P.01 – Construction Environmental Plan** – Vegetation Clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures.**As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate losses for natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation and operation of the project; – Monitoring the dispersal of invasive species. • **P.09 – Landscape Protection Program** • **P.10 – Operation Biodiversity Management** – P.10.1 - Subprogramme of bird collision monitoring; – P.10.2 - Subprogramme of fauna monitoring during operation; – P.10.3 – Subprogramme of Native Vegetation Restoration. • **P.11 – Flora Active Search Programme** • **P.14 - Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and Social Education for Workers.
	Critical Habitat	8.01 – Impacts on biodiversity in critical habitats	• **P.01 – Construction Environmental Plan** – Vegetation Clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			enhancement measures. • **P.03 - Operation Management Programme - Responsible: TANESCO** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental Training of the Maintenance Team; – Monitoring of Recovered Areas; – Vegetation Management on the Wayleave Easement; – Access Control Plan. **As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate losses for natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches or intended for educational and/or research institutions. • **P.08 - Invasive Species Control Programme** – Control activities during the implementation and operation of the project; – Monitoring the dispersal of invasive species. • **P.09 – Landscape Protection Program** • **P.10 - Operation Biodiversity Management** – P.10.1 – Subprogramme of Bird Collision Monitoring; – P.10.2 – Subprogramme of Fauna Monitoring During Operation; – P.10.3 – Subprogramme of Native Vegetation Restoration. • **P.11 – Flora Active Search Programme** • **P.14 - Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and Social Education for Workers.
	Ecosystem Services	9.01 – Impact on the availability and quality of relevant ecosystem services	• **P.01 – Construction Environmental Plan** – Vegetation Clearing • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted;

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. **As part of the Biodiversity Management Plan (BMP):** • **P.05 – Biodiversity Offset Plans** – Measures to compensate losses for natural habitat conversion. • **P.06 – Ecosystem Services Impact Mitigation Plan** • **P.07 – Fauna and Flora Rescue and Relocation Plan** – Scaring away and rescuing fauna before vegetation suppression begins; – Flora rescue and relocation to surrounding vegetation patches or intended for educational and/or research institutions. • **P.10 - Operation Biodiversity Management** – P.10.2 – Subprogramme of Fauna Monitoring During Operation; – P.10.3 – Subprogramme of Native Vegetation Restoration. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF**1**)** – Includes measures to compensate for the impacts on the losses of agricultural and pasture areas.
Socio-Economic Environment	Employment and Local Economy	10.01 - Generation of direct and indirect jobs during construction	**P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; – Monitoring of the communication measures.

[1] As required by TANESCO in the ToR, this is an stand-alone document not included as an annex to this ESIA and presented separately for analysis.

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			• **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[2] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Definition of the project's labour Policy; – Recruitment and labour training; – Management of working conditions; – Grievance mechanism from workers; – Workers' Code of Conduct; – Environmental and social education for workers; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy.
		10.02 - Generation of direct and indirect jobs during operation	• • **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Social communication during operation. • **P.12 - Stakeholder Engagement Plan** – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; • **P.13 - Local Hiring Program** – Communication about job opportunities for the operation phase through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect3 for facilitate this

[2] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/
[3] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			stage of the project by mediating the contact between TANESCO and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites; – Training of the operation and maintenance (O&M) team. • **P.14 - Labour Management Procedures (LMP)** – Definition of the project's labour Policy; – Recruitment and labour training; – Management of working conditions; – Grievance Mechanism; – Workers' Code of Conduct; – Environmental and social education for workers; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy.
		10.03 – Increased local consumption of goods and services during construction phase	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.13 - Local Hiring Program** – Dissemination of the list of products and services with the possibility of local acquisition, in advance so that potential local suppliers are prepared to meet the increased demand; – Measures to maximise the hiring of local suppliers of inputs and services.
		10.04 - Loss of employment and reduced demand in the local economy at the end of the construction phase	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction; – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; – Monitoring of the communication measures. • **P.13 - Local Hiring Programme** – Informe contracted workers about the duration of the construction works and the position created, so that they can plan and manage their lives in an informed manner; – During construction, train workers to enable them to perform the tasks for which they were hired and at the same time increase their skills and employability after the end of their employment contract relating to this work; – Train workers to maximise opportunities for their transition to activities associated with the operation of the Project; – Maintain close and continuous cooperation with community leaders and residents of local communities to clarify and manage opportunities for employment and procurement of goods and services in the local market.
		10.05 - Interference with mineral rights	• **P.02 - Environmental and Social Management Programme** – Coordination of Plans and Programmes of the ESMP; – Management of Interference with Mining Licences ▪ Contact with the Mining Commission; ▪ Exclusion of the area of the wayleave from the exploration concession polygon; ▪ Total or partial wayleave blockade, with mining activities relocated and operations adjusted so as not to jeopardize the TLs; ▪ hiring of an independent valuer company or professional to value, and negotiate with the holders of the mining rights. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Indenisation measures for the impact in mining activities.
	Infrastructure, Social Equipment	11.01 - Interference with traffic conditions	• **P.01 - Construction Environmental Plan (CEP)** – Construction Traffic Control Program, including: ▪ scrupulously respect speed limits in populated areas; ▪ install traffic signs on the local roads and paths to be used for the works, on sections that cross populated areas;

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			▪ take special care in areas where there is more pedestrian traffic; ▪ reduce traffic within populated areas to what is strictly necessary; ▪ keep vehicles in good working and safe condition; ▪ repair the roads and paths, in case of serious damage; ▪ implement adequate signage at the cable launching at road crossing points. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction, especially those who live near the access roads, informing about the schedule of works and peak traffic periods on each section; – Coordination with the traffic department on traffic disruption during cable launching; – Grievance mechanism from external stakeholders; – Grievance mechanism from workers; – Monitoring of the communication measures.
		11.02 - Temporary overloading of waste disposal sites	• **P.01 - Construction Environmental Plan (CEP)** – Waste Management: ▪ implementation of waste deposits in the camp sites, where waste will be temporarily stored until the final destination; ▪ sell or donate the recyclable part of the waste to duly authorised recycling companies; ▪ send to authorised final processors the hazardous waste and non-inert waste that cannot be recycled, so that they can dispose of them properly. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Environmental and social education for workers

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			▪ explanations about rules and notions of environmental education to workers when they are hired, including the appropriate waste management practices to be followed at the camp sites and work fronts. – Worker Code of Conduct.
		11.03 - Interference with airport runways	• **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during operation; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
	Livelihoods and Quality of Life of the Population	12.01 - Generating public expectations	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Specific communication on the process of establishing the wayleave, explaining the measures that will be adopted to evaluate and compensate/indemnify for the land and improvements impacted; – Resettlement measures and compensation measures for the loss of livelihood. • **P.12 - Stakeholder Engagement Plan** – Project stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction and operation; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
		12.02 – Disturbances associated with construction activities (due to noise emissions, dust, vibrations, increased traffic)	• **P.01 - Construction Environmental Plan (CEP)** – Atmospheric Emissions and Noise and Vibration Control; – Construction Site and Workforce Housing Management; – Construction Traffic Control Program. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans,

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			accompanying the schedule and implementation of their impact mitigations and enhancement measures; – Environmental and Social Monitoring: • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.14 - Labour Management Procedures (LMP)** – Environmental and social education for workers ▪ explanations about rules and notions of environmental education to workers when they are hired. – Worker Code of Conduct. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ atmospheric emissions monitoring; ▪ noise monitoring in workfronts and construction sites. – TANESCO's Environmental and Social Monitoring Programme ▪ noise monitoring in inhabited areas; ▪ air quality monitoring.
		12.03 – Disturbance due to increased noise during operation	• **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase – Protection of the wayleave easement, to ensure that the wayleave remain unoccupied; – Social communication during the operation; – Audible noise monitoring ▪ a noise measurement campaign to be carried out before energization and another in the first month of operation, covering 23 measurement points, including the 8 points measured in the baseline campaign (**Section 7.1.9**). The comparison between these two campaigns will aim to verify the need to develop studies on noise attenuation solutions. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction;

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
		12.04 – Changes in the landscape	• **Adjustment of the alignment of the TLs and the new accesses and planning of the building site's location** • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing ▪ keeping vegetation suppression to a minimum, to reduce the negative effect on the landscape; – Decommissioning and Recovery of Degraded Areas. ▪ restoring areas degraded by the works at the end of construction. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Programme** – Vegetation management on the wayleave easement and areas under recovery. • **P.10 - Operation Biodiversity Management** – P.10.3 – Subprogramme of Native Vegetation Restoration ▪ Native vegetation restoration. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
		12.05 - Changes in land use and loss of agricultural areas	• **Adjustment of the alignment of the TLs and the new accesses to reduce the impact on crops** • **P.01 - Construction Environmental Plan (CEP)** – Vegetation clearing ▪ keeping the suppression of vegetation and other land uses to a minimum; – Decommissioning and Recovery of Degraded Areas. ▪ restoring areas degraded by the works at the end of construction.

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			• **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Physic cadastre, to evaluate the land and improvements impacted; – Indenisation for impacts on crops; – Specific Grievance Mechanism; – Monitoring. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
		12.06 - Interference with houses, improvements and sources of income	• **Adjustment of the alignment of the TLs and the new accesses to reduce the impact on houses, improvements and sources of income** • **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Physic cadastre, to evaluate the land and improvements impacted; – Social cadastre; – Compensation/indenisation, including for loss of sources of income; – Relocation support; – Post-relocation monitoring; – Specific Grievance Mechanism; – Monitoring. • **P.12 - Stakeholder Engagement Plan**

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
	Land	13.01 - Reduction in the available area of properties due to the land taken by the Project	• **P.02 - Environmental and Social Management Programme** – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)** – Physic cadastre, to evaluate the land impacted; – Social cadastre; – Indenisation for impacts of land taking; – Specific Grievance Mechanism; – Monitoring. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
	Historical, Cultural and Archaeological Heritage	14.01 - Impact on graves	• **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.16 - Archaeological, Historical and Cultural Heritage Protection Plan** – Measures for removal, transportation, reinstatement and re-interment of the graves ▪ the process of removal, transportation, reinstatement and re-interment of the grave or dead body and any placatory or expiatory rites or other ceremony accompanying such removal and re-internment is conducted and supervised by local Authority (District Authority) through Land and Health Department or Resettlement Action Plan - RAP expertise. ▪ Before removal of graves a leaf is obtained from the respective court (district court) which makes the local Authority (District Authority) capable of removing the graves. ▪ The relatives of the deceased (Interested Person) receive only condolences (costs of the ceremony according to their known traditions) and receive a fixed/equal fee for all relatives of the deceased.
Risks			
Physical Environment	Soils / Relief	15.01 - Risk of soil contamination (from leaks and inadequate management of effluents and waste produced)	• **P.01 - Construction Environmental Plan (CEP)** – Control Procedures for Construction in Flooded Areas; – Prevention and Control of Soil Contamination; – Water and Effluent Management; – Camp Sites and Workforce Housing Management ▪ provide all areas at risk of contamination at the building sites with material kits for use in emergencies; ▪ connect the sanitary facilities in the building sites to septic tanks.

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Waste Management, including provide appropriate structures at the Waste Shelter (waterproof flooring, cover, retaining dike, and drainage leading to water and oil separator boxes); – Hazardous Materials Management, including provide appropriate structures on site for the storage of hazardous products (waterproof flooring, cover, retaining dike, and drainage leading to water and oil separator boxes). • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Program** – Supervision of Compliance with the Measures of ESMP Plans and Programs that Extend to the Operation Phase; – Environmental Training of the Maintenance Team; – Waste Management (operation phase); – Emergency Response Plan (ERP) Framework for the Operation Phase • **P.04 - Construction Emergency Preparedness and Response Plan** – Construction emergency preparedness and response measures.
Biological Environment	Flora and Vegetation	16.01 - Increased risk of fire in adjacent vegetation	• **P.01 - Construction Environmental Plan (CEP)** – Construction sites and workforce housing management; – Hazardous materials management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental training of the maintenance team; – Vegetation management on the wayleave easement;

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Protection of the wayleave easement; – Emergency Response Plan (ERP) Framework for the Operation Phase. • **P.04 - Construction Emergency Preparedness and Response Plan** – Emergency Preparedness and Response Procedures (EPR) for fires and explosions, including sequential actions to respond to accidental events involving fires in the project areas. • **P.14 – Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and social education for workers, including training of construction company employees and subcontractors on appropriate environmental protection practices. • **P.17 - Occupational Health and Safety Management Programme** – Training in emergency procedures for fire workers (among other themes).
		16.02 - Expansion of invasive flora species	**As part of the Biodiversity Management Plan (BMP):** • **P.08 - Invasive Species Control Program** – Preventive and corrective measures to be implemented continuously both during the construction and operation of the project, including monitoring the dispersal of invasive species; – Inspection, quarantine, and cleaning measures for vehicles and construction equipment entering high-risk areas.
		16.03 - Increased illegal exploitation of natural resources	• **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Social Communication During the Operation, including providing for activities to disseminate relevant legislation and strengthen community awareness of the conservation of natural resources around the Project; – Access Control Plan.
	Fauna	17.01 – Risk of an increase in hunting	• **P.03 - Operation Management Programme** – Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase; – Environmental Training of the Maintenance Team ▪ workers will receive instructions on hunting bans and the legal implications of such acts; ▪ the information will necessarily be included in the workforce's environmental

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			training modules; ▪ the effectiveness of the training will be verified in the field and acts of hunting by workers will be repressed according to the seriousness and/or effectiveness of the act. – Social Communication During the Operation; – Access Control Plan. • **P.14 – Labour Management Procedures (LMP)** – Workers' Code of Conduct; – Environmental and social education for workers.
		17.02 - Risk of accidents with birds during operation	**As part of the Biodiversity Management Plan (BMP):** • **P.10- Operation Biodiversity Management** – P.10.1 - Subprogramme of bird collision monitoring ▪ installation of signalling devices (flight diverters) in the stretches of the BS1, BS 8 and BS9 sampling zones and other sections with risk of bird collisions with TLs' cables (environments with alluvial influence, areas of forest vegetation and places with conglomerations of semi-aquatic or larger birds); ▪ monitoring of the chosen stretch (with and without signalling devices).

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
Socio-Economic Environment	Infrastructure, Social Equipment and Public Services	18.01 - Risk of increased demand for health services	• **P.01 - Construction Environmental Control Plan** – Vegetation clearing; – Construction traffic control; – Construction sites and workforce housing management. • **P.02 - Environmental and Social Management Program** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.17 - Occupational Health and Safety Management Programme** – Establishment of OHS procedures; – Establishment of Safe Work Procedures; – Recruitment of OHS management staff; – Training in occupational safety; – OHS supervision; – Worker health management; – Implementation of first aid rooms on all camp sites. • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ noise monitoring in workfronts and construction sites; ▪ quality of drinking water monitoring
		18.02 - Risk of unintended damage to crops and improvements during works	• **P.01 - Construction Environmental Control Plan** – Construction traffic control (avoid travelling outside the access roads, passing through cultivated areas); – Indenisation for unintended damage to crops or rural improvements by the contractors. • **P.02 - Environmental and Social Management Programme:** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Recruitment and labour training;

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Workers' Code of Conduct; – Environmental and social education for workers, with a focus on the rules for driving vehicles and machinery, to avoid passing outside accesses and impacting cultivated areas, and taking care with improvements near the work fronts.
	Health and Safety of the Workers	19.01 - Increasing the risk of the spread of disease during construction	• **P.01 - Construction Environmental Plan (CEP)** – Construction site and workforce housing management. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[4] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Observation of World Bank EHS Guidelines, particularly with respect to health management; – Worker health monitoring, and appropriate medical assistance and first response capabilities at work fronts; – Working conditions at camp sites and work fronts aligned with international standards; – Ensure adequate hygiene conditions in camp sites; – Ensure adequate accommodation conditions for workers, including mosquito nets and insect protection; – Ensure distribution of insect repellent to workers and encourage its use;

[4] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Recruitment and labour training, including informing on risk behaviours and preventive care, such as condom use; – Workers' Code of Conduct. • **P.17 - Occupational Health and Safety Management Program** – Establishment of OHS procedures; – Recruitment of OHS management staff; OHS supervision; – Worker health management, including carrying out admission and periodic examinations; – Implementation of first aid rooms on all camp sites. • **Gender Based Violence (GBV) Action Plan** • **Environmental and Social Monitoring Plan** – Contractors' Environmental Monitoring Programme ▪ quality of drinking water monitoring
		19.02 - Risk of accidents involving workers	• **P.01 - Construction Environmental Plan (CEP)** – Construction site and workforce housing management; – Vegetation clearing and footprint management; – Hazardous materials management program; – Construction traffic control program. • **P.02 - Environmental and Social Management Programme:** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Worker training; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy; – Worker's Code of Conduct; – Grievance mechanism for workers; – Observation of World Bank EHS Guidelines, particularly with respect to OHS management; – Working conditions at camp sites and work fronts aligned with international standards. • **P.17 - Occupational Health and Safety Management Program**

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Establishment of OHS procedures; – Establishment of Safe Work Procedures; – Recruitment of OHS management staff; – Training in occupational safety; – OHS supervision; worker health management; – Implementation of first aid rooms on all camp sites.
		19.03 - Risk of accidents due to the presence of landmines and UXOs (unexploded ordnances)	• **P.01 - Construction Environmental Plan (CEP)** – DAA demining. • **P.02 - Environmental and Social Management Programme** – Demining of Resettlement Areas; – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.04 - Construction Emergency Preparedness and Response Plan** – Risk assessment and emergency preparedness and response procedures (EPR) in case of fires / explosions. • **P.12 - Stakeholder Engagement Plan** – Project stakeholder mapping and analysis; – Public consultation with stakeholders; – Social communication during the works; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures.
	Health and Safety of the Community	20.01 - Increasing the risk of the spread of disease among workers during construction	• **P.01 - Construction Environmental Plan (CEP)** – Construction site and workforce housing management. • **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team;

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[5] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Observation of World Bank EHS Guidelines, particularly with respect to health management; – Worker health monitoring, and appropriate medical assistance and first response capabilities at work fronts; – Working conditions at camp sites and work fronts aligned with international standards; – Ensure adequate hygiene conditions in camp sites; – Ensure adequate accommodation conditions for workers, including mosquito nets and insect protection; – Ensure distribution of insect repellent to workers and encourage its use; – Recruitment and labour training, including informing on risk behaviours and preventive care, such as condom use; – Workers' Code of Conduct. • **P.15 - Gender Based Violence Action Plan** • **P.17 - Occupational Health and Safety Management Program** – Establishment of OHS procedures; – Recruitment of OHS management staff; – OHS supervision; – Worker health management; – Implementation of first aid rooms on all camp sites.
		20.02 - Risks to the health and safety of the community during construction	• **P.01 - Construction Environmental Plan (CEP)** – Construction traffic control program; – Camp sites and workforce housing management. • **P.02 - Environmental and Social Management Programme**

[5] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
			– Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.12 - Stakeholder Engagement Plan** – Social communication during construction; – Grievance mechanism from external stakeholders; – Monitoring of the communication measures. • **P.13 - Local Hiring Program** – Communication about job opportunities through a social communication team; – Use of tools such as Tanzajob.com, Cvpeople Tanzania, KaziConnect[6] for facilitate this stage of the project by mediating the contact between contractors and workers; – Partnership with the villages administration and other measures to maximise the hiring of local labour; – Worker training; – Establishing channels for receiving CVs and communicate them to the population: through the TANESCO ombudsman channels, through the grievance mechanism, through the tools mentioned above, received at specific locations on camp sites. • **P.14 - Labour Management Procedures (LMP)** – Worker training; – Monitoring of contractors and subcontractors with respect to worker management issues and compliance with the project's Labour Policy; – Worker's Code of Conduct; – Grievance mechanism for workers. • **P.15 - Gender Based Violence Action Plan**
		20.03 - Risks to the health of the population closest to the TLs due to the effect of the electromagnetic fields	• **P.03 - Operation Management Programme** – Electromagnetic field monitoring; – Protection of the wayleave; – Social communication during the operation, training of the maintenance team; – Community health and safety.

[6] https://www.tanzajob.com/cv-database; https://cvpeopletanzania.zohorecruit.com/jobs/Careers; https://kaziconnect.co.tz/

Table 9.0.a
Impacts and risks identified for the Project and targeted measures for prevention, mitigation, control, monitoring and compensation

Impacts			Measures
		19.04 - Risk of child labour	• **P.02 - Environmental and Social Management Programme** – Construction supervision (site inspections and audits) to be carried out by the E&S Management Team of TANESCO or by a supervision company to be contracted; – Coordination of Environmental, Biodiversity and Social Management Plans, accompanying the schedule and implementation of their impact mitigations and enhancement measures. • **P.14 - Labour Management Procedures (LMP)** – Definition of the project's Human Resources Policy; – TANESCO supervision to monitor and verify the effective implementation of the Policy by Contractors, subcontractors, and suppliers; – Grievance mechanism for workers. • **P.15 - Gender Based Violence (GBV) Action Plan** – Stipulates that the contracts to be signed with Contractors and subcontractors and with suppliers must include clauses to inhibit and penalise acts of violence against children; – Sensitization on children labour and their protection laws; – Code of Conduct must include content about Child Abuse/Exploitation.
	Historical, Cultural and Archaeological Heritage	21.01 - Risk of damage to historical, cultural and archaeological assets	• **P.16 - Archaeological, Historical and Cultural Heritage Protection Plan** – Prospecting in the SSs' expansion areas; – Preparation of guidance material for workers and training; – Chance Findings Procedure (CFP) ▪ To be prepared and implemented during the works, including training workers to recognise possible heritage sites, and guidelines in the event of finds, which include interrupting activities on the work front, calling in the specialist, fencing the area, and implementing the measures recommended by the specialist and agreed with the competent institution to safeguard the asset, which may include fencing and signalling to keep the asset in place if it is not at risk, or proceed with the rescue. – Monitoring during vegetation suppression and earthworks.

10.0
Environmental and Social Management Plan (ESMP)

The measures proposed to prevent, mitigate, control, monitor, and compensate the environmental and social impacts and risks of the Project's TLs and SSs have been organised into Plans and Programmes that comprise the Project's Environmental and Social Management Plan (ESMP). This organisation aims to facilitate their implementation and management throughout the Project's planning (pre-construction), construction, and operation stages. These Plans and Programmes have been verified as necessary to satisfy the set of impacts and risks assessed in Chapter 8 of the ESIA.

Mitigation strategies have been organized according to the mitigation hierarchy (avoid/mitigate/remediate/compensate) as per guidance in WB ESS 1. Further, measures to enhance positive impacts were also contemplated.

The SMART principle (specific/measurable/assignable/realistic/time-bound) was adopted to assure that proposed measures are reasonable and implementable. Where measures require engineering adjustments, they focus on sound technical and engineering standards.

Monitoring and capacity building requirements (training) are specified in the proposed measures.

As mentioned, all measures were grouped into environmental, biodiversity, and social Management Plans. This grouping is based on technical, organizational (per responsible party – TANESCO or Contractors), and chronological (per project phase – planning, construction, decommissioning, or operation) criteria.

The Environmental, Biodiversity, and Social Management Plans that constitute the Project's ESMP are listed in **Table 10.0.a** below and detailed in **Section 10.1**. Section 4 of each Plan establishes who is responsible for its implementation and for forming the necessary team. A summary of those responsible is presented in **Table 10.0.a**.

Table 10.0.a
ESMP Plans and those responsible for their implementation

ESMP Plans		Responsible
P.01 - Construction Environmental Plan (CEP)		Contractors, under the supervision of TANESCO
P.02 - Environmental and Social Management Programme		TANESCO
P.03 - Operation Management Programme		TANESCO
P.04 - Construction Emergency Preparedness and Response Plan		Contractors, under the supervision of TANESCO
Biodiversity Management Plan (BMP)	P.05 - Biodiversity Offset Plan	TANESCO
	P.06 - Ecosystem Services Impact Mitigation Plan	TANESCO
	P.07 - Fauna and Flora Rescue and Relocation Plan	TANESCO
	P.08 - Invasive Species Control Programme	TANESCO

Table 10.0.a
ESMP Plans and those responsible for their implementation

ESMP Plans		Responsible
	P.09 - Landscape Protection Programme	TANESCO
	P.10 - Operation Biodiversity Management Programme P.10.1 – Subprogramme of Bird Collision Monitoring P.10.2 – Subprogramme of Fauna Monitoring During Operation P.10.3 – Subprogramme of Native Vegetation Restoration	TANESCO
	P.11 – Flora Active Search Programme	TANESCO
P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)		TANESCO, with the involvement of other institutions, such as the Project Contractor, the Chief Government Valuer, Local Government Authorities (District, wards, and Village/Mtaa leaders), Non-Governmental Organisations, and Community-Based Organisations (NGOs and CBOs).
P.12 - Stakeholder Engagement Plan		TANESCO, with some activities carried out by the Contractors
P.13 - Local Hiring Programme		Contractors, under the supervision of TANESCO
P.14 - Labour Management Procedures (LMP)		TANESCO, with some activities carried out by the Contractors
P.15 - Gender Based Violence Action Plan		TANESCO, with some activities carried out by the Contractors
P.16 - Archaeological, Historical and Cultural Heritage Protection Plan		TANESCO, with some activities carried out by the Contractors (CFP)
P.17 - Occupational Health and Safety Management Programme		Contractors, under the supervision of TANESCO
Decommissioning Plan – see **Chapter 13.0**	Decommissioning and Recovery at the End of the Construction Phase	Contractors, under the supervision of TANESCO
	Abandonment Plan for the Operation Phase	TANESCO
Environmental and Social Monitoring Plan (ESMP) – see **Chapter 11.0**	Contractors' Environmental Monitoring Programme Atmospheric emissions monitoring Noise monitoring Treated effluents monitoring Drinking water quality monitoring	Contractors, under the supervision of TANESCO
	TANESCO's Environmental and Social Monitoring Programme Noise Air quality Water quality	TANESCO

10.1
Environmental Management Plans

P.01 - Construction Environmental Plan (CEP)

1. Justification

The Construction Environmental Plan (CEP) presents the guidelines and procedures to be followed by the Contractors and subcontractors for the construction works of the TLs and SSs of the Project.

The Plan will be applied throughout the construction phase of the projects, focusing on the TLs and SSs works, accesses, and camp sites. It also includes measures for recovering of degraded areas due to the works, clearing areas at risk of landmine accidents and indemnifying for possible unintended damage to crops or agricultural infrastructure during the works.

The environmental management procedures during construction will include various prevention, mitigation, and control measures for all construction activities and/or facilities involving specific environmental risks or impacts. They will also include guidelines for corrective actions as applicable. The measures listed in this Plan will constitute binding contractual requirements and the Contractors, and all subcontractors will be required to comply with them continuously throughout the construction cycle. Compliance will be ensured not only by the Contractors' environmental and social management team but also through the supervision of TANESCO (see P.02).

2. Main Objectives

The general objective of the CEP is to provide technical guidance to minimise the negative environmental impacts and risks of the construction of the TLs and SSs of the Project. In addition to this main objective, this Plan also provides for:

- Provide technical guidance to minimise negative environmental impacts of construction;
- Ensure that support areas are implemented and operated by environmental control procedures that ensure effective minimisation of negative impacts;
- Standardise environmental procedures to be adopted by Contractors and subcontractors and include them as part of the construction contracts;
- Ensure good traffic conditions for vehicles providing services at the works, as well as for other vehicles using the roads that form part of the Project's area of influence;
- Controlling greenhouse gas emissions;
- Carry out the work without risk of accidents involving landmines;
- Avoiding damage to crops and agricultural infrastructure outside the DAA during the works and, if it does occur, assessing the damage and paying indemnification for it.

3. Applicable Legislation

- All Tanzanian legislation related to pollution control applies (see **Tables 6.1.a** and **6.1.b** in **Section 6.1** and **Table 6.2.a** in **Section 6.2**).
- Land Act, 1999 (Cap 113)
- Village Land Act, 1999 (Cap 114)
- Environmental Management Act, 2004 (Cap 191)
- Local Government (Urban Authorities) Act, 1982
- Constitution of Tanzania

International

- World Bank Environmental and Social Standards (ESS) 1 and 3
- WB/IFC General EHS Guidelines, 2007
- World Bank / IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, 2007
- Ottawa Convention (Anti-Personnel Mine Ban Treaty), of which Tanzania has been a signatory since 12/3/97
- United Nations Mine Action Service

4. Responsibilities

The Contractors who will execute the works for the construction of the TLs and expansion of the SSs will be responsible for carrying out the activities under the prevention, control and mitigation measures foreseen in each section of this Plan, under the supervision of TANESCO, through the supervision and monitoring team (see P.02).

For this, it is recommended that each Contractor have a permanent coordinating team, consisting of: 1 environmental specialist, 1 specialist in health and safety and a person trained in social communication to carry out the activities provided for in the Stakeholder Engagement Plan – SEP (P.12) that are the Contractors' responsibility. The workers of the Contractors and subcontractors must be trained by the specialists of the coordinating team, under the supervision of TANESCO.

5. Methodology

The measures adopted in this Plan are described below:

5.1. Erosion Prevention and Control

All areas with exposed soil in the project will be provided with erosion prevention devices, including the wayleave, camp sites, borrow and surplus soil deposit areas, and areas where earthmoving activities are necessary to expand the SSs and construct new accesses, if necessary.

A diversified set of measures and strategies will be implemented to minimise the risk of erosion and runoff on exposed soil areas, retain sediment within the project area to the extent possible, and control erosion and runoff downstream of the Project area, including, where necessary, corrective actions.

The measures to be applied are as follows:

- Access along the wayleave will be preferred, avoiding the opening of a new access point for each tower.
- The limits established for excavations and earthworks shall be respected, strictly following the dimensions, quotas, and slopes indicated in the project.
- Vegetation clearing shall be carried out to the extent necessary for the works.
- Temporary drainage devices will be installed in areas with steep slopes to prevent erosion, sediment transport, and siltation of watercourses.
- Drainage system devices must be maintained in operational condition, i.e., able to capture, convey, and dissipate rainwater so that no soil transport occurs.
- Loose soil piles shall only be permitted on flat sites and outside the preferential runoff course.
- Trenches or other soil retention devices must be installed downstream of all exposed soil areas, sized to the extent of their contributing areas.
- Sediment retention devices downstream of earthwork areas must be constantly cleaned.
- The flow orientation over the exposed soil areas must be constantly adjusted to ensure that flows are directed towards the drainage devices.
- Surface protection shall be carried out in areas of exposed soil.
- Vegetation recovery shall be implemented in exposed soil areas as soon as possible.
- Soil accumulated in river channels shall be removed manually (if there is a risk to riparian vegetation) or mechanically.

As corrective measures to mitigate erosion processes, the following will be adopted:

- All erosion occurring in earthwork areas should be corrected or stabilised immediately.
- Examples of erosion correction measures include diversion of runoff upstream of erosion areas, correction of grooves and ravines, removal or compaction of loose soil piles, raising of perimeter dykes in areas of temporary material deposition, others.
- Erosive processes near towers or accesses will be registered as Control Points under Construction Supervision to be carried out by TANESCO (see P.02) to monitor their evolution and the possible risk to the structure's stability.
- The Contractors shall remove soil whenever a significant accumulation is verified in areas downstream of the works. Clearing or removal shall be carried out using the best available technique. Where necessary, removal shall be manual to ensure the preservation of riparian vegetation.

Excavation for the construction of the tower foundations

During excavation for the construction of the tower foundations, environmental control procedures will be adopted to prevent soil loss in the direction of watercourses effectively. These are:

- Excavated material that can be used for backfilling shall be stockpiled close (~ 2.0 m) to the trench.
- Due to its small volume, the material that cannot be used to fill the trench will be dispersed within the wayleave, respecting the characteristics of the original terrain. The material shall be spread evenly, so as not to produce slopes or unevenness that could increase erosion.
- Because trenches for tower foundations may remain open for a relatively long period until the subsequent steps are completed, they should be covered with planks or remnants of conductors' coils to prevent wildlife specimens from falling in. The protectors should only be removed after the trench has filled with concrete.
- When the excavation of tower foundations reaches the water table and it is necessary to drain the trench, the pumped water must first be directed to an accumulation trench for solids retention before being released into a water body.
- If borrow material is required for the backfill of tower foundations, it will be obtained from previously authorised areas.
- The site's vegetation cove will be restored (revegetation), using the most appropriate surfacing for protection.

Earthworks for the implementation of new accesses

Existing roads and tracks will preferably be used for the works. Due to the relief conditions along the route, access is also expected to be largely possible via the wayleave. However, where new access to the tower site is required, this will be done with monitoring and guidance related to environmental protection.

The following design guidelines shall be observed:

- The vertical and horizontal geometry of the accesses will be designed to minimize interference with the environment.
- The accesses will follow contour lines as much as possible, transposing them smoothly where necessary.
- Drainage will be designed to prevent erosion.
- On slopes, accesses will preferably be designed in cut, minimising the occurrence of segments in landfill. The cross slopes of the platforms will always be in the direction of the cut, without allowing drainage of the platform in the direction of the landfill slopes, regardless of the geometry of the curves.
- Perennial or intermittent watercourse crossings will be provided with culverts of adequate size for the contributing area.

- For watercourse crossings, prior diversion of the watercourse will always be necessary. The diversion period should be as short as possible, restoring the water flow to the natural bed before embankment for the transposition.
- Accesses that cross fragments of native vegetation will be avoided.

The following measures should be taken in the access implementation works:

- Soil fragilities must be considered to minimise impacts.
- Temporary drainage devices should be installed to guide and reduce surface runoff velocity and retain soil.
- The start of earthworks for access roads should be preceded by the removal and accumulation of organic soil, which will be used to recompose the areas immediately after the works are completed.
- The creation of unstable areas shall be avoided by controlling the steepness of slopes and restricting the stockpiling of loose soils.
- To prevent erosion, continued surface protection of areas with exposed soil, including compaction and appropriate shaping, anticipation of the recomposition of vegetation cover, and installation of emergency plastic cover in particularly unstable sections shall be carried out. These measures shall be taken as soon as excavation and backfill construction work are completed. Landfills and cuts must receive vegetation cover replanting immediately after implementation.
- Areas with exposed soil should be covered with topsoil stockpiled at the beginning of the activities, to favour the rapid recomposition of native vegetation and control of erosion.
- To ensure that they do not lose their function, the temporary drainage devices shall be cleaned and the soil removed permanently.
- Emergency stabilisation must be carried out in all areas where erosion occurs.
- In accesses that will remain in the project's operation phase, temporary drainage devices will be replaced by final drainage as necessary in accordance with the project.

5.2. Control Procedures for Construction in Flooded Areas

Different construction procedures will be adopted in the sections of the route and accesses that cross flooded areas, considering that the terrain is not compatible with the traffic of vehicles and equipment necessary for the works.

Temporary landfills will be constructed to access the towers' site located in flooded areas. The soil for these landfills will be obtained from a borrow area. It will be mixed with gravel or stone to obtain a material with sufficient capacity to allow construction vehicle traffic. The material will be dispersed and compacted in the tower access area. At the end of the work in this section, the material will be removed with a backhoe and sent to the place of origin or to a surplus soil deposit.

All surplus material from excavation in flooded areas should be sent to a properly authorized surplus soil deposit and not be dispersed on the same site.

In areas with soft soil removal, dikes or other devices shall be installed to prevent rainwater from flowing from the surrounding areas into the work area, minimising the need for pumping.

Water pumped from the soft soil replacement area will always pass through a sedimentation basin before release into a downstream watercourse.

These access sections will be monitored to verify the need for overlay application/replacement (primary granular overlay) to maintain the road quota.

The components of the drainage system will also be monitored for the risk of clogging/sedimentation.

Access roads within the floodplains shall be kept to a minimum and preferably follow the routes contained entirely within the wayleave. Preferably, these will be constructed only for use during dry periods, and their quota will be increased to allow their use all year round. They will be surfaced with primary granular material from borrow areas, and, if necessary, soil replacement will be carried out.

In this case, the length of the road will be limited, and it will be ensured that there is no significant reduction in the total hydraulic cross-section available for flood flows. The access will also be checked to ensure that there are no points or obstructions that could result in water retention.

5.3. Prevention and Control of Soil Contamination

To avoid soil contamination by fuels, oils, and grease from the use of vehicles and equipment such as generators, compressors, and pumps, various non-degradable chemicals, and waste water, especially from concreting and washing of concrete mixer trucks, the following preventive measures shall be taken:

- All equipment must be in good condition and not leak.
- Defective or leaking vehicles (trucks, tractors, etc.) or equipment must be removed from the work fronts.
- If it is impossible to remove the defective equipment from the work front, it may be allowed to be repaired on site, but the TANESCO supervision team must be notified. It will verify the conditions under which such work will be carried out. In all such cases, temporary leak retention devices, including rustic ones, should be provided to prevent soil contamination.
- Oil changes or maintenance activities on construction vehicles and equipment will not be permitted outside the camp sites' workshops unless unavoidable. Vehicle and equipment washing will also be restricted to designated facilities at camp sites.
- Fixed equipment that uses fuel (generators, compressors, others) should always have a dam, tray, or other leak containment device with a capacity greater than the maximum possible leak volume.
- All fuel, lubricant, chemical, or hazardous product storage tanks shall be stored in impermeable areas with berms as secondary containment in case of spills.

- All hazardous waste, including empty hazardous product packaging, will be stored with secondary containment.
- In case of soil contamination, the following measures should be taken: removal of the source of contamination, scraping of the contaminated soil, and collection of the material to be properly disposed of.
- Fuels and lubricating oils must not be stored at the work front. These tanks should be located in the camp sites workshops. Equipment should preferably be supplied by truck, but other approved means can be used to transport smaller volumes.
- Chemicals considered hazardous to the environment should be stored in the workshop or other designated area in the camp site. Only a reasonable amount should be left for immediate use at work fronts.
- Underground storage of fuels or other hazardous products shall not be permitted on the project.
- Emergency kits will be implemented in appropriate locations, with sufficient equipment to handle at least the initial levels of a spill.

5.4. Water and Effluent Management

- Water supply to camp sites will be provided by wells or from nearby watercourses, provided the appropriate permits for using water resources have been obtained. Water consumption for workers at peak construction was estimated at 74.93 m^3/day (considering the 1,350 workers, divided along the TLs' route and across the nine construction sites), as set out in **Section 5.3.1**. Water for concrete mixing and other construction needs, as set out in **Section 5.4.2.7**, is estimated at 50-100 m^3/km, or 27,445.5-54,881 m^3 for the entire project.
- Each work front and camp site should have adequate sanitary facilities.
- Latrines shall be installed in isolated work fronts.
- Toilets in camp sites and latrines on work fronts should be in good condition and sufficient for the number of workers in the area (at least 1 toilet for every 20 workers). Some toilets should be specifically for women.
- The estimate of the volume of wastewater produced was made considering that sewage production corresponds to approximately 80% of the water consumed. Based on this assumption, the estimated volume of domestic sewage will be 54.94 m^3/day, while industrial sewage will be 21,956.4-43,912.8 m^3.
- Discharge of effluent generated in the camp site should preferably be into the public sewage system, if available, or should be used appropriately sized septic tanks.
- The contractors will monitor the effluents generated in the water and oil separator devices installed in the workshops monthly (see **Section 11.1**), verifying compliance with the emission standards established in the IFC's General EHS Guidelines. Discharge of effluents that do not comply with the standards is prohibited.
- To pre-separate fatty substances, effluent from kitchens and the cafeteria must have a grease trap (siphon box).
- The Contractors will install a concrete mixer washing plant, preferably near the concrete plant. The treatment will be carried out based on the physical and chemical characterisation of the effluent, ensuring compliance with the standards set out in the

General EHS Guidelines of the IFC. The usability of the effluent will always be considered.

- At this site, facilities should be provided with a settling box, which should operate in a closed circuit. Where necessary, flocculants and pH neutralisers should be used. Periodically, the water in the circuit should be cleaned and exhausted. This type of effluent should not be discharged into watercourses without prior treatment. If the operation is not a closed circuit, the effluent can be used to wet dirt accesses to prevent dust emission.

In the concreting of foundations, the Contractors must comply with the following measures:

- Temporary and properly signalized locations should be provided for emptying of mixing trucks. Accumulated sediments must be disposed of periodically and properly deposited in sanitary landfills (trenched landfill installed in the camp site by the contractor or the nearest existing sanitary landfill).
- Mixer truck drivers should be instructed not to empty concrete waste and not to wash the mixer nozzle outside of the designated locations.
- Concrete mixer trucks should be washed only at the appropriate place in the camp site and never near watercourses. The Contractors must define the washing place in advance, and the drivers must be instructed to use this place only. Only nozzle washing of mixer trucks shall be allowed on the work fronts.
- The drainage system around concrete plants and storage areas shall have settling boxes or similar devices to ensure that fine sediments are retained and not transported into the surrounding watercourses.
- All wastewater from concreting shall be treated as industrial effluent, and uncontrolled run-off outside the intervention areas shall not be allowed.
- Constant cleaning of the settling boxes incorporated in the drainage system around the concrete plants will be carried out.

5.5. Atmospheric Emissions, Noise, and Vibration Control

Dust and smoke emission control

The Contractors will monitor the emission of pollutants and the level of dust during the works (see **Section 11.1**). The objectives of the control are: to reduce negative impacts on air quality in nearby residential areas, provide comfort to workers, assist in maintaining air quality, and prevent accidents at the work fronts. The main measures to control air pollution will be as follows:

- Dust control at work fronts with exposed soil, in camp sites, and on dirt accesses where houses are in close proximity, shall be carried out by wetting the soil with tanker trucks or treated effluent from settling boxes, as often as necessary, and especially in dry seasons.
- All trucks transporting dry earth outside the camp sites and on roads where houses are nearby will be protected with canvases.
- Maximum speed limits will apply on dirt accesses during dry or windy conditions.

- In construction camps, piles of dry materials shall be located in protected areas, away from environmentally sensitive areas and those with a high concentration of workers. Where necessary, piles of material shall be wetted during storage (when the material permits). If it's not possible, they shall be stored in such a way as to avoid material dispersal due to wind.
- Raw material loading and storage areas outside the concrete plant on the camp site, should be protected to prevent the dispersion of particulate matter.
- Concrete plants shall be located as far as possible from workers' accommodation and nearby populated areas.
- Areas of accommodation with regular movement of vehicles shall have a suitable pavement.
- In high wind situations, dust-generating operations shall not be permitted within 200 m of inhabited areas in the prevailing wind direction.
- All construction vehicles and machinery shall be maintained in good operating condition and with engines switched off when not in use.

Noise management

- The operation of all mechanical equipment and construction processes inside and outside the camp sites and work fronts shall not cause unnecessary or excessive noise, and the monitoring to be carried out (see **Section 11.1**) shall verify compliance with the noise limits set by the Tanzanian legislation or international standards (whichever is more restrictive).
- Noise impacts shall not exceed the levels listed in Table 1.7.1 of the IFC General EHS Guidelines, 2007, and shall not result in a maximum increase in background noise levels of 3 dB at the nearest receptor.
- Restrictions for noisy night work where there are adjacent population / sensitive receptors, such as hospitals.
- The contractor shall prioritise the choice of equipment with low noise levels.
- The contractor will regularly maintain vehicles and equipment to eliminate mechanical malfunctions and control noise emissions. In maintenance, priority will be given to adjusting machines and parts that produce excessive noise, such as compressors and breakers.
- Work will be carried out during the day in areas close to noise receptors (residential areas, schools, and hospitals). This area merits special consideration in the plan of attack to enable the works to be concluded in the shortest possible time.
- Noise receptors close to camp sites should be informed of the works so that they can be prepared.
- Industrial plants and/or equipment emitting excessive noise in construction camps shall be located as far as possible from workers' accommodation and surrounding inhabited areas (more than 200 m) and surrounded by noise barriers where necessary.
- In camp sites, dormitories must comply with night noise limits set by Tanzanian legislation or international standards (whichever is more restrictive). As applicable, daytime standards will be met in administrative areas, cafeterias, and industrial areas (workshops, concrete plants).

5.6. Vegetation Clearing

- Vegetation removal and land clearing shall be limited to the strictly necessary areas and conducted to not disturb the vegetation adjacent to the cleared perimeters.
- Special care will be taken in wooded segments to ensure removal is carried out within the authorized boundaries. After the germplasm rescue activities are completed (see P.07 - Fauna and Flora Rescue and Relocation Plan, in **Annex 13**), the Contractors or companies contracted to carry out the vegetation removal will pre-delineate the polygons of all authorised areas with marking tape or other suitable material to allow the team to view them quickly.
- Before clearing, a flora/vegetation specialist will verify the presence of protected flora species within the area. In case the presence of endangered, threatened (according to the IUCN red list and/or CITES), or endemic species is detected within the area to be cleared, efforts will be made to collect seeds if the species' phenological cycle allows it at that time. In case of interest, all rescued material can be donated to educational and/or research institutions, nurseries, parks, etc.
- All major vegetation clearing will be preceded by wildlife scaring activities, carried out by a team using noise-generating devices, through extensive rounds of the areas to be cleared. As necessary, animals with limited mobility may be assisted in relocation (see P.07 - Fauna and Flora Rescue and Relocation Plan, in **Annex 13**).
- Depending on the project facilities, two types of clearing procedures will be carried out: linear clearing along the TL wayleave and/or accesses and clearing of non-linear areas, including the substations expanding areas, and camp sites, if necessary.
- In both cases, logging procedures will be adjusted so that the trees fall into the cleared area and not into areas to be preserved.
- Creepers, climbing plants, and other similar plants will be observed before logging. A clump of creepers on trees may cause other trees to fall undesirably, resulting in the expansion of the clearing area and injuries to workers. Creepers and climbing plants should be cut before further deforestation.
- The cut material must be removed through the authorized intervention area and never through the remaining vegetation.
- Wherever possible, the use of tractors in clearing will only be permitted where there is more than 10 metres from the boundaries of the clearing area, 60 metres from rivers, streams or water bodies, and 30 metres from any special habitats identified above. Within these buffer zones, clearing shall be done exclusively with chainsaws. Root removal in these areas, where necessary, will only be carried out later and may involve using tractors.
- Riverine vegetation should not be cleared closer to the river at a distance of 60 metres.
- All areas considered sensitive from an environmental or topographical point of view within the clearing perimeters shall be delimited and marked in advance, and chainsaws shall be used to clear them. Tractor use is not permitted within these areas.
- In the case of accesses, all clearing will be done with chainsaws. Fallen vegetation will continue to protect the ground in the cleared areas until the construction equipment is ready to begin earthworks. At that time, fallen vegetation will be removed, and trees will be uprooted. Efforts will be made to minimise the time

between root removal, and completion of cut and fill, and implementation of erosion control devices, especially in steep slopes.

- Along the 52-metre-wide TL wayleave, root removal will be carried out only in sections where the wayleave will be used to access tower locations and maintenance in the operation phase. However, in flat areas, the use of tractors for clearing will be accepted, provided that the buffer distances indicated above concerning the limits of the wayleave and watercourses are respected.
- In the 14 m service strip, vegetation shall be cleared completely to allow access to the tower site and for the launching of cables. The only exceptions will be river and stream crossings that intersect the wayleave. In these sections, different techniques will be used to launch the cables, such as drones, for example, to allow the vegetation surrounding the watercourses not to be suppressed.
- At forest fragment crossings, taller towers will be used to maintain the 14 m wide clearing strip.
- Only selective clearing will be carried out in the rest of the width of the wayleave. Selective clearing consists of cutting only the tallest trees, but maintaining a continuous or almost continuous vegetation cover of lower trees.
- Where valleys are deep enough to allow electrical conductors to pass over the treetops at a safe distance, vegetation shall not be touched. Selective felling shall be carried out only when necessary.
- During operation, periodic selective clearing of the lower forest (approximately every two years) and clearing of overgrown trees will be carried out to ensure the presence of the tree canopy while at the same time not allowing the forest's growth to become a risk to the continuity of power transmission.
- At substations and camp sites (in the latter case, if it is not possible to find an area free of native vegetation), clearing will begin at the edge, with the use of chainsaws and tree felling control. Tractors will be allowed for the rest of the clearing perimeter, subject to the previous flora and fauna measures mentioned above.
- The vegetation removed shall be utilised to the maximum extent possible. The timber from the removal shall be made available to landowners and land users along the route. If they are not interested, this vegetation should be disposed differently. In this case, transporting and marketing of timber and other forest products require permits.
- Pruned or cleared vegetation that does not constitute commercial timber shall be used according to its characteristics: timber stakes, preliminary protection works, erosion control, camp site fencing, or other construction uses. As applicable, cleared vegetation will be used to control sediment discharge to streams adjacent to construction areas.
- Other non-commercial timber and large branches could be cut to sizes suitable for sale to industry or other establishments for use in boilers, or donated to the population, which usually uses it as a source of energy and heat.
- After proper compaction and backfilling with soil, tree roots will be buried in the surplus soil deposit areas, and then overburden will be placed on top.
- Non-commercial timber and large branches from clearing for the TL wayleave could be left along the line, parallel to the contour lines, to act as slope containment to aid erosion control.

- Along segments of the TL near agricultural and/or degraded areas, branches and leaves can be used for recovery. This activity will involve shredding the biomass to form a mulch that will be mixed with topsoil to promote soil enrichment.
- Elsewhere, where branches and leaves cannot be left on cleared areas, they will be buried in surplus soil deposits.
- Alternative uses for generating biomass will be evaluated and implemented where possible.
- The topsoil shall be removed from the cleared areas using equipment that removes only the organic horizon without mixing it with the underlying material. Soil or organic material removed in this manner shall subsequently be used to reclaim disturbed areas. The remaining organic soil that is not usable shall be taken to the surplus soil deposit areas.
- After construction, the organic mulch (topsoil) used in reclamation shall be collected and stockpiled in piles along the wayleave or the edge of cleared areas. Temporary piles of excavated or cleared soil shall not be located within 30 m of surface watercourses, in steep areas, or along the flow of rainfall. Containment berms shall surround all soil piles to prevent surface runoff and sediment from soil piles. The containment berms shall be constructed of soil sufficiently permeable to allow the passage of surface runoff water but trap the sediment contained in the surface runoff. The height and slope of each pile shall be adequate to prevent foundation and slope failure.

5.7. Camp Sites and Workforce Housing Management

Criteria for the selection of areas for camp sites and other temporary facilities

In the search for and selection of sites for camp sites, the contractor shall seek to meet the following criteria:

- Give preference to flat areas that can be used without significant earthworks.
- Keep a minimum distance of 200 metres between noise and/or air emission generating points and the nearest houses. For schools and health centres, keep a minimum distance of 300 m.
- Look for already degraded areas where it is not necessary to remove native vegetation, but have some trees to provide shade.
- The intended uses for each selected site must be consistent with the land use planning legislation.
- No camp sites shall be allowed near properties of historical or cultural interest, including ritual sites.
- All camp sites must have the necessary permits and authorisations before the work.
- TANESCO will review and approve all proposed camp site locations and plans.
- Installations shall be planned so as not to obstruct the passage of vehicles or workers, the daily activities of the community, or the traffic of road users, or hinder rapid evacuation;
- Areas used for agriculture should be avoided, especially those with a more intense use;

- Areas with mining rights should be avoided;
- Avoid areas that are occupied by people, i.e., where there are inhabited houses, so that the installation of temporary facilities, such as camp sites, does not lead to the need to resettle people.

Criteria for defining the layout of accesses outside the wayleave

- Use existing roads to reduce the need for new accesses;
- Prefer routes that cut across flat areas, avoiding steep and unstable slopes;
- Prioritise areas that have already been anthropised, preferably covered by pasture or areas of exposed soil;
- Avoid passing through Protected Areas;
- Avoid areas with frequent flooding and waterlogged soil;
- Avoid crossing rivers or streams whenever possible;
- Prioritise routes through existing easements, existing tracks between planting areas, etc.;
- Avoid routes that cut through productive areas, especially those with intensive agriculture, permanent crops, or high-value pastures;
- Avoid routes that hinder access by landowners;
- Avoid areas with land conflicts;
- Keep away from sensitive areas such as schools, health centres, and vulnerable communities;
- Avoid areas of cultural and historical importance.

Procedures for the establishment and operation of camp sites and other support areas

- Sanitary control, cleaning, and monitoring of hygienic conditions should be in place in camp sites and other support areas, emphasizing toilets, changing rooms, kitchens, cafeterias, and accommodation.
- The rainfall drainage system will control runoff from around the camp site's perimeter and. It consists of an interconnected perimeter system of ditches and grease traps, which will allow for controlled discharge from the facility. Alternating sediment retention basins will be installed at key locations in the drainage system, where they will be readily accessible to equipment for periodic cleaning.
- Designated areas for parking vehicles and machinery will be signposted and delimited to allow manoeuvrability.
- Water for human consumption shall be supplied from sources that ensure quality of service and potability. If such sources are unavailable, a treatment system will be implemented, adopting the recommendations of potability for human consumption suggested by the World Health Organisation (WHO).
- Drinking water troughs will be distributed in all accommodation and work areas, with periodic verification of water potability.
- Systems for the efficient and rational use of water will be implemented.
- Wastewater from toilets, kitchens, cafeterias, laundry, and other areas of the camp sites will be directed to septic tanks or to public sewage system (if available). Septic tanks will be periodically monitored to detect any infiltration problems.

- The kitchen effluent will pass through a grease trap before being routed to the septic tanks. Grease shall be periodically removed, separated, and sent to a suitable destination (approved company or landfill).
- Latrines may be used along the TLs' route at work fronts, providing one for every 20 workers.
- All waste generated at the work fronts and camp sites will be sent to the camp sites' Waste Deposit.
- All vehicle and equipment maintenance workshops will be located at the camp sites. They will be installed on covered impermeable surfaces and all work areas will have perimeter drainage leading to oil and grease traps. Fuel, lubricant, and other chemicals will be stored in areas with secondary containment.
- Equipment and machinery washing will be restricted to specific locations in camp sites. These will consist of impermeable areas with drains that convey water to a grease and sediment interceptor, preventing the seepage of contaminated water into the natural environment.
- Fuel and lubricants shall be stored in metal tanks or containers over impermeable areas with secondary containment. The capacity of the secondary containment shall be greater than the capacity of the larger metal tank or container inside itUnderground tanks or piping shall not be permitted.
- Chemicals shall be stored in special tanks. These tanks shall have impermeable floors and concrete berms to provide secondary containment. Adequate ventilation shall be ensured at all times.
- Storage rooms shall be locked, and only authorised and trained personnel shall be allowed to enter. All product safety data sheets shall be available and organised at all times.
- The settling boxes incorporated in the drainage system around concrete plants will be constantly cleaned to ensure their effectiveness is always maintained.
- The separated lubricating oil residue in the siphon decanting boxes shall be stored in suitable containers for subsequent delivery to the specialised company.
- Periodic cleaning of air emission control devices in concrete plants shall be carried out during the period of use.
- Ongoing maintenance of all dust suppression systems incorporated in concrete plants, open-air stockpiles and other facilities will be carried out.
- If power generators are used to supply electricity to camp sites, they will receive regular preventive maintenance to ensure their proper operation and to control emissions from the combustion system.
- Generators shall be located in covered and ventilated areas, on confined surfaces that prevent soil contamination in the event of fuel spillage during refuelling or maintenance activities, or due to system failure.
- Generators and other noise sources shall be as far away as possible from accommodation and administrative areas, and a noise barrier shall be installed around them if necessary.
- All stationary equipment using fuel and lubrication systems shall be installed on confined surfaces to avoid soil contamination in case of a possible fuel or lubricant spill.

- Fire extinguishers shall be placed in all storage areas for fuels, lubricants, chemicals, and other hazardous products.
- Generator areas and generator fuel storage areas shall be provided with all elements to ensure the safety of the installations, fire prevention, and fire control.

Labour aspects in the operation of construction camps

- All workers coming from outside the region and hired by the Contractors and subcontractors must be accommodated in dormitories in the camp sites.
- The conditions of accommodation, toilets, and cafeterias in camp sites must comply with the standards set out in the IFC's Workers Accommodation: Process and Standards.
- Any work area in the camp site or any other temporary facility must have access to restrooms (with a toilet and sink) within 100 metres. Employees using vehicles are exceptions to this rule.
- Changing rooms, cafeterias, toilets, or other facilities in the camp sites shall meet the needs of all workers involved in the Project, not just those housed.
- The temperature in the camp site facilities should be around 20 ºC, with adequate ventilation.
- Dormitories, cafeterias, and administrative areas will have insect repellent-treated screens on all windows and main entrances.
- Special cleaning procedures (fumigation or similar) shall be carried out when necessary.
- The noise level in dormitories shall not exceed 45 dB(A) during the day or 35 dB(A) at night, as set out in the Tanzanian Environmental Management (Standards for the Control of Noise and Vibrations Pollution, 2015). These values are more restrictive than the IFC's General EHS Guidelines. Background noise may not exceed 50 dB(A) in administrative areas and canteens.
- Fire prevention devices should be maintained in all support areas and installed where they can be reached quickly.
- In the layout of camp sites and other temporary facilities, a minimum distance of 150 metres should be observed between fuel or flammable product deposits and dormitories. For cafeterias and administrative areas, the minimum distance should be 70 metres.
- Suppose power generators are used for the electricity supply, they shall be installed as far as possible from dormitories, cafeterias and administrative areas. If necessary, they shall be fenced with noise barriers to comply with the noise limits set out above.
- All construction camps will be fenced and have a restricted main entrance with access and control registers.
- Parking areas for vehicles and motorbikes will be available at the camp sites near the entrance checkpoint.
- The Contractors will provide transport for local workers living in nearby communities.
- There will be leisure areas in the camp sites.

Minimum requirements to be included in the camp site operating rules

- The camp sites will be the start and end of each working day for all workers, including workers in the camp site and those residing in nearby communities. There will be time clocks to monitor all workers' arrival and departure times.
- The Contractors shall determine arrival and departure times in mutual agreement with TANESCO.
- The Contractors will provide transportation for workers from the meeting points in the communities to the camp sites and between the camp sites and the work fronts.
- All Contractor employees shall always wear an identification badge and uniforms in good condition when on the camp site or work front.
- The project's Code of Conduct will be distributed to all employees and will have contractual force. Any conduct in breach of the Code of Conduct will not be permitted, and non-compliance with it will be sanctioned.
- Equipment or activities that generate noise above the permitted standards will have restricted hours of operation to what is strictly necessary.
- Keeping domestic animals in camp sites and other temporary facilities is not permitted.
- Pest control will use low human toxicity products permitted by law to prevent the spread of diseases in the camp sites.

5.8. Waste Management

Solid waste management will aim to reduce the risks of contamination of soil and water bodies through improper handling, treatment, and disposal of waste generated during the project's construction. To this end, guidelines will be established for the contractor regarding the classification, storage, and final disposal of the waste generated.

Sections 5.4.5 and **5.51** of **Chapter 5.0** describe the types of waste that must be generated at the works and during operations.

Waste management strategies shall be based on the following hierarchy: prevention and minimisation, sorting and reuse, and treatment and disposal, following relevant legislation and good practice.

All rubbish and general waste should be cleared from all work areas daily.

The waste will be disposed of in collectors made available at camp sites and work fronts, appropriate to the type of waste generated and identified. Waste will be collected separately, initially considering Hazardous and Non-Hazardous Waste.

Waste will not be allowed to accumulate on the work fronts. The waste from the collectors will be collected periodically and taken to the camp sites' Waste Deposit, except for organic waste and common non-recyclable waste, which will be sent directly to the camp sites' trench landfill or to the nearest existing sanitary landfill.

Segregation

- Drums with lids will be placed at all camp sites. Workers will be trained in waste sorting.
- In the Waste Deposit, waste will be sorted according to the provisions of Regulation No. 114, 2009, which is part of the Environmental Management (Solid Waste Management) Regulations, 2009, and segregated to avoid mixing hazardous and non-hazardous waste, organic and non-organic waste, and recyclables. All employees, regardless of their position, will be trained to carry out the segregation stage, especially those who deal with hazardous waste. The waste generated on camp sites will be disposed of in collection containers (drums or plastic bags) at the Waste Deposit, initially identified in 5 categories:
  - Hazardous waste (e.g., materials contaminated with oil, fuel, paint, solvent, etc.);
  - Organic waste (e.g., food waste and sweeping residues);
  - Ordinary waste (plastic plates, plastic packaging, and cutlery with leftover food, napkins, and toilet paper);
  - Recyclable waste (clean plastic water, coffee, and soft drink cups; clean plastic bags; clean plastic bottles; clean plastic parts and packaging; cardboard; cans; cable reels; etc.);
  - Construction waste (general construction waste, wood, ferrous waste, shavings, etc).
- Surplus soil, sand, gravel, and other construction aggregates shall not be considered waste unless contaminated.
- Cleared vegetation will also not be considered waste and must be handled and disposed of according to the Vegetation Clearing procedure.
- Waste paint, lubricants, and other oily wastes will be classified as hazardous waste, and special controls will be imposed to regulate their storage, labelling, transport, and disposal. All empty chemical and hazardous packaging will also be considered hazardous waste, as will contaminated soil.
- Waste from the maintenance workshop, soiled with oil and grease, will also be treated as hazardous.
- Sludge from septic tanks and settling boxes will also be treated as hazardous waste.

Packaging

- The waste produced must be properly treated and/or disposed of to avoid risks to the health and safety of workers and the surrounding population.
- Temporary storage of the materials collected will be carried out in an organised manner, respecting the prior segregation carried out during collection, with identification of the materials, protection from the degrading action of weather agents (wind, rain, and sunlight), and protection from the proliferation of disease vector animals.
- Areas for the temporary storage of materials contaminated with oil/grease or chemical products considered dangerous will always be covered, waterproof, and have leak-containment devices.

- Light bulbs and batteries will preferably be stored in their packaging and identified containers.
- Health service waste will be packaged in suitable containers that are waterproof and leakproof and resistant to breakage, leakage, and tipping.

Storage (Waste Deposit)

- All waste generated at the work fronts and camp sites will be sent for sorting at the Waste Deposit, which will be implemented at the camp site. There, it will be packaged and stored.
- The characteristics of the waste will determine storage conditions at the waste deposit. Some waste may be stacked on the ground, while others will be in covered containers installed within impermeable areas with secondary containment. Waste Deposits will be fenced.
- In the Waste Deposit, storage may not occur outside the specific containers corresponding to each type of waste, according to the segregation made at the place of generation.
- The storage area will have a capacity compatible with the project's waste generation, sufficient to house the amount generated between external transport intervals.
- An area compatible with the type and quantity of waste to be stored will be provided for each item of waste, which may be bays, containers, or other forms of storage.
- Storage should be as brief as possible to avoid excessive accumulation of waste and mixing of it.
- Disposal of hazardous and non-inert waste on bare soil will not be permitted.
- Burial of any waste will also not be permitted.
- Hazardous waste will be provisionally stored in a covered, contained, and waterproofed area, provisionally adapted to the Waste Deposit, in specific containers with sufficient capacity to store the quantity generated in the period between collections. Access to this area will be restricted.
- The storage area for drums containing oil will be equipped with a containment dyke in case of an oil leak or spill. The oil spilled on the dyke will be packed in a container (metal drum) for later collection by a specialised and duly licensed company for recycling.
- All waste storage areas will be equipped with stock control. The Contractors shall maintain detailed records of all waste generated by type (i.e., brought into the Waste Deposits) and of all waste sent to authorised recyclers/haulers. The loading manifests shall constitute evidence of the dispatch of the waste to the authorised waste handlers.

External Transport

- Waste will be collected and transported regularly to prevent the proliferation of animals and insects, especially those that can be disease vectors. The intervals may vary depending on the volume produced.
- Recyclable waste will be transported by Contractors' lorries to the villages or district councils where the camp sites are located, for sale, or may be collected at the camp site by the companies that have acquired it, which must be duly licensed.

- In the case of recyclable waste, a collection plan compatible with the quantities generated will be agreed upon between the Contractors and the companies to which it will be sold or donated.
- The transport of hazardous waste will require the contracting of a registered and licensed solid waste service provider. This company must have appropriate vehicles, trained personnel for this type of service, and the necessary equipment in case of possible emergencies. The company must have the necessary permits and licences for the collection and transportation of hazardous waste and must carry the permit document at all times.

Recycling

- All inert and non-inert waste that can be recycled or reused will preferably be destined for this purpose.
- Hazardous and non-inert waste that cannot be recycled will be sent to licensed final processors.
- Non-inert materials, such as wood, glass, plastics, steel, and metals, shall be recycled as far as possible. If recycling is not possible, the contractors shall transport the waste to the nearest existing sanitary landfill. Recyclable waste may be donated to NGOs for social purposes or sold to authorised companies. Scrap rubber and tyres will be returned to suppliers or processed in cement kilns. In the latter case, the company in charge of final disposal will collect the waste from the camp site.
- The cable reels will be checked for origin and whether the wood they were made from has been chemically treated to increase durability and resistance. If they have been chemically treated, the reels will be dismantled, subjected to reverse logistics, and returned to their suppliers. Contracts with these suppliers must include responsibilities and conditions for transporting the material.
- In the case of reels made from non-chemically treated wood, the dismantled parts can be reused on-site, donated, or sold for use as fuel for ceramic, steel, or thermoelectric furnaces without risk to the environment. Only as a last resort will they be disposed of in a landfill.

Requirements for final waste disposal

- The organic waste will be deposited in the trench landfill in the camp site or sent to the nearest existing sanitary landfill (the nearest are the Buhongwa Landfill, in Mwanza, about 140 km from Ibadakuli, and the Kiteezi Landfill, located in Kampala, Uganda, about 223 km from Mutukula). Ordinary non-organic and non-recyclable waste (plastic plates, containers, and cutlery with food leftovers, napkins, toilet paper) must be disposed of in the trench landfill in the camp site or sent to the nearest sanitary landfill.
- Waste disposal in dumps or burning will not be allowed on camp sites, in accommodation, or on work fronts.
- All waste that is not recycled will be sent to final processors licensed by competent environmental bodies, regardless of its class.

- Inert materials left over on the camp site will be categorised as miscellaneous waste and deposited in the trench landfill or sent to the nearest existing sanitary landfill.
- Surplus soil will preferably be used on the site itself. The material that cannot be used will be disposed of in a licensed dumpsite that already operates commercially in the region.
- As already stated, the reels will be subject to reverse logistics and returned to their suppliers if they have received chemical treatment. If they have not received chemical treatment, the wood will be reused on site, donated, or sold.
- Contaminated soil generated from any leaks/spills will be disposed of appropriately.
- Hazardous waste will be sent to industrial landfills or to duly authorised companies for incineration.
- Used engine oils and lubricants shall be stored in properly sealed drums in a separate and identified area of the Waste Deposit, with containment in case of oil spillage or leakage. An authorised waste disposal and/or recycling company will collect the oil regularly. The same procedure shall be adopted for oil and grease removed from grease traps.
- Health service waste should be sent for incineration.
- Workshop waste, due to the predominance of non-inert or hazardous materials, must be managed in a specific way and disposed of as follows:
  - Tyres and batteries should be returned to their suppliers;
  - Used oils should be sent to/recollected by recycling companies;
  - Parts can be managed as scrap;
  - Uncontaminated packaging should be disposed of as normal waste;
  - Mercury fluorescent lamps will be stored appropriately, returned to the supplier, or collected by specialised processors for decontamination.
- The disposal by throwing or burning of batteries of any kind will be prohibited. They must be separated from ordinary waste and delivered to any establishment that sells them, which is obliged to receive them and pass them on to the manufacturers or importers.
- Where appropriate, vegetation clearing waste will be made available for the landowner's use. The material cut without commercial use (branches and smaller trunks) will be chopped up and spread over the suppression areas so that it can be incorporated into the soil.

Preliminary list of waste disposal sites

The information presented below provides an overview of waste disposal facilities, including treatment plants, incinerators, and landfills, located in the project regions (i.e., Shinyanga, Geita, Mwanza, and Kagera). The main sources include institutional reports, municipal data, and environmental studies by reputable organizations such as Netherlands Development Organisation (SNV) and local authorities. These references describe the types of waste managed, including health, and faecal sludge, and highlight operational practices. During the construction stage, the Contractor will be obligated to verify the existence of operating licenses and permits applicable to these facilities, as their absence or non-compliance with legal standards poses significant risks, including environmental degradation, legal liabilities, and threats to public health. A thorough analysis of

adherence to regulations will be mandatory to ensure sustainable and legal waste management practices.

Shinyanga Region:

1. Kizumbi Faecal Sludge Treatment Plant (FSTP):
    - Location: Kizumbi area, Shinyanga Municipality.
    - Type: Faecal Sludge Treatment Plant.
    - Operational License: Operated by Shinyanga Water Supply and Sanitation Authority (SHUWASA).
    - Permitted Waste Types: Faecal sludge from pit latrines and septic tanks.
    - Notes: Officially launched on January 26, 2022, this facility provides safe and effective sanitation for approximately 200,000 residents.

2. Nhelegani Disposal Site:
    - Location: Kisumbi Ward, Shinyanga Municipality.
    - Type: Wastewater disposal pond.
    - Operational License: Managed by local authorities; specific licensing details not provided.
    - Permitted Waste Types: Wastewater and faecal sludge.
    - Notes: This site lacks a treatment plant, leading to challenges such as slow infiltration and overflow during the rainy season.

3. Shinyanga Regional Referral Hospital Waste Disposal:
    - Location: Shinyanga Municipality.
    - Type: On-site incineration and off-site disposal.
    - Operational License: Operated by the hospital; specific licensing details not provided.
    - Permitted Waste Types: Healthcare waste, including infectious materials.
    - Notes: The hospital employs incineration and off-site disposal methods for managing healthcare waste.

4. Kolandoto Designated District Hospital (DDH) Waste Disposal:
    - Location: Kolandoto area, Shinyanga Municipality.
    - Type: On-site burning and land disposal.
    - Operational License: Operated by the hospital; specific licensing details not provided.
    - Permitted Waste Types: Healthcare waste.
    - Notes: The hospital practices on-site burning and land disposal for healthcare waste management.

5. Kambarage Urban Health Centre (UHC) Waste Disposal:
    - Location: Shinyanga Municipality.
    - Type: Incineration, land disposal, and burning.
    - Operational License: Operated by the health center; specific licensing details not provided.
    - Permitted Waste Types: Healthcare waste.

- Notes: The center utilizes multiple methods for healthcare waste disposal.

Geita Region:

- Specific information on waste disposal facilities in the Geita District Council, Nyang'hwale, and the Mbogwe District Council is not readily available.

Kagera Region:

- Specific information on waste disposal facilities in the Karagwe District Council, the Biharamulo District Council, Ngara, and Missenyi is not readily available.

Mwanza Region:

- Specific information on waste disposal facilities in Mwanza is not readily available.

Kahama Town Council:

- Studies indicate challenges in managing urban solid waste in Kahama Town Council, with collection services and revenue generation issues.

Trench Landfill

Implementing a simple trench landfill for solid waste disposal is a traditional and practical technique used in places where waste generation is low and the infrastructure for complex landfills is unavailable. The measures to implement a simple trench landfill are presented below:

- Choosing the site
  - The terrain should be slightly sloping, allowing surface water to run off and preventing it from entering the trench.
  - The site should be chosen away from water sources, residential areas, and ecologically sensitive sites to avoid contamination and minimise environmental impacts.
  - The site must be accessible to facilitate waste transport from other areas of the camp sites and from work fronts.
- Trench design and excavation
  - The trenches are generally 1.5 to 2 metres deep and about 1 metre wide, but the length can vary depending on the amount of waste to be disposed of.
  - Space must be left between the trenches to allow machinery and people to move when filling and covering the waste.
  - It must be ensured that the base and sides of the trench are well compacted to prevent liquids from seeping into the ground.
  - In areas with high rainfall, it may be necessary to install a basic drainage system to collect and treat leachate.

- Waste disposal
  - Waste should be deposited in thin layers and compacted to reduce volume and limit the presence of air, which helps minimise odours and the proliferation of vectors.
  - Each layer of waste should be covered with a thin layer of soil (around 15-20 cm) at the end of each day or when the trench reaches a specific height. Covers must be applied correctly to reduce the presence of rodents and other animals.
- Final Cover
  - When the trench is full, it should be covered with a final layer of soil (approximately 50 cm thick) to seal in the waste and prevent exposure to vectors.
  - The cover layer should be sloped to allow water to run off and prevent erosion.
- Monitoring and Maintenance
  - It is necessary to check regularly for signs of erosion or leakage and make repairs as necessary.
  - After closing each trench, the surface vegetation should be recovered to help stabilise the soil and improve the aesthetics of the site.

5.9. Hazardous Materials Management

- Machine and equipment operators will receive spill / leak prevention training. This training will also include specific exercises on hazardous products as part of the training provided in the Construction Emergency Preparedness and Response Plan (P.04).
- All storage tanks for fuel (if any), lubricants, chemical or hazardous products shall be installed over covered and impermeable areas with secondary containment in case of spills / leaks.
- Hazardous chemicals should be stored in predetermined locations in the camp sites. At work fronts, only a reasonable amount should be left for immediate use.
- Storage areas for hazardous waste (including empty containers of hazardous products and soiled oil rags and wipes) at Waste Deposits must be covered and have impermeable floors and leak containment devices.
- Fuels and lubricating oils should not be stored at the work fronts. These tanks should be located in the camp site workshops. Equipment should preferably be supplied by truck or using appropriate containers.
- The storage of fuels or chemicals in underground tanks shall not be permitted.
- Stationary or mobile equipment (generators, compressors or other) using fuels or other hazardous products shall always have a tray for leak containment.
- No oil changes or vehicle maintenance activities will be permitted outside the camp site workshops, except where unavoidable. Washing of vehicles and equipment will also be restricted to designated place in the camp sites.
- Workshop areas for equipment maintenance services shall have a cover and impermeable floor with a perimeter channel to collect spilled liquids. A siphon box should also be provided for the separation of water and oil, with subsequent disposal of oil.

- Facilities for washing concrete mixers should be provided, preferably close to concrete plants. Such facilities should have separation/settling boxes, where possible with closed circuit operation, with treatment and recirculation of wash water.
- If it is impossible to remove the defective equipment, it may be allowed to be repaired on the work front, but the Supervision Team must be notified and will verify the conditions under which such work will be carried out. In all such cases, temporary leakage retention devices, even rough ones, shall be provided to prevent soil contamination.
- Hazardous materials shall only be used in accordance with the instructions given in a Safety Data Sheet which shall be available in all hazardous product storage areas and at camp sites when hazardous products are being used.
- Chemicals shall preferably be stored on wooden pallets. Compatibility between products shall be checked and any product that may react chemically in case of mixing shall be stored at a distance. The space between product containers must allow, in case of leakage, the identification of the container with the leakage without the need to touch any object.
- Appropriate fire extinguishers shall be placed in all storage areas for hazardous products.
- Repairs shall not be made to chemical stores unless all explosive and/or flammable materials have been removed.
- Small quantities of solvents, paints and lubricants may be stored in workshops for use mainly in on-site maintenance and repair of construction equipment.
- Storage sites shall be appropriately marked and/or identified.
- No open fires, smoking, or localised heat of any kind shall be permitted near chemical/hazardous product storage areas.
- Mixing of chemicals shall be done outside the storage areas.
- Storage containers shall be inspected regularly for rust, corrosion and leaks.
- A chemical register shall be kept.
- Gas cylinders shall be stored away from direct sources of localised heat or flammable sources. Empty gas cylinders shall be stored with closed valves and shall always have safety caps and shall not be exposed to any direct light. Gas cylinders shall not be lifted by the valve cap. Trolleys shall be used to transport gas cylinders to and from storage areas.
- Storage of fuel and lubricants shall comply with the following:
  - Fuel storage tanks shall have secondary containment with appropriate valves.
  - Periodic inspections will be scheduled to identify retaining wall repair needs.
  - The area to be occupied shall be limited to the minimum area required, taking into account operational and security needs.
  - All areas occupied for fuel storage shall be marked, clearly indicating to personnel the type of activities that can be conducted in the area and the precautions to be taken.
  - Fuel supply and transportation activities will be conducted by a supplier company.
  - A record shall be kept to monitor fuel and lubricants, specifying their use or destination, to facilitate the identification of sources of oily waste and lubricants.

– All fuel storage areas shall be grounded and equipped with a fire-fighting system.

For spills occurring during construction activities, the following remediation and notification procedures should apply:

- Immediately following a spill that poses a health risk, non-essential personnel in the area will be evacuated.
- All spills will be reported immediately to the Contractor's environmental specialist, who will mobilise the emergency response team.
- The Contractor shall maintain an internal communication system for requesting external assistance in response to spills (by telephone or radio) if necessary, and for notifying the authorities.
- The Contractors and subcontractors shall maintain portable fire extinguishers, fire control equipment, spill control equipment (including buffers and plastic film) and decontamination equipment at strategic locations in the camp sites, as relevant.
- All soil spills will be contained by applying/constructing perimeter dikes around the spill. If the spill presents a fire risk, all fuels and ignition sources, such as running engines, shall be removed from the vicinity.
- Soil contaminated with spillage shall be excavated and disposed of in properly sealed drums and subsequently treated or sent to specialised and duly certified companies for treatment. In the rainy season, prior to soil disposal, the affected area shall be protected by plastic sheets.
- Oil spills in watercourses shall be contained with floating barriers and absorbent material. Containment barriers shall be used to control the spread of the spilled product and concentrate the product in thicker layers on the water surface, facilitating the removal of the product.
- The removal of any wildlife that may be present in the affected area will be encouraged to the best of their ability and they will not be allowed to return until the emergency has been resolved.
- If there are potentially affected water users downstream of the leak/spill site, they will be notified of the spill as soon as possible.
- Environmental emergency kits will be installed at strategic locations (workshops, hazardous waste storage area at Waste Deposits, etc.) containing sufficient equipment to control at least the initial stages of a spill / leak.
- The Contractors and subcontractors must demonstrate the availability of sufficient trained workers, protective equipment and other resources to deal with an emergency spill / leak of hazardous products.
- Specific training on spills / leaks will at least include identification procedures to follow when a spill occurs, emergency communication actions, measures to ensure worker safety and methods to contain the spill.
- If fuel or other hazardous material is spilled on roads during transport to/from project sites, immediate measures will be taken to contain the leak or spill. All fuels and ignition sources, such as running engines, which could cause fires, will be removed from the spill environment.

5.10. Construction Traffic Control

The following general guidelines will apply to transport activities during the construction of the Project:

- All project vehicle drivers will comply with Tanzanian driving requirements.
- Project transport vehicles will not be used to transport local residents, except in the case of medical emergencies.
- Project transport vehicles shall not be used to carry more passengers than their estimated maximum load.
- On existing roads, if necessary or at the request of the surrounding local communities, speed reducers will be installed, with appropriate signage.
- All vehicles will have signs that identify them as part of the Project. Neighbours will be informed that, in case of vehicles exceeding the permitted speed or other problems that may raise, they can report these situations through the Grievance Mechanism.
- The works for the construction of the TLs and SSs will be executed in such a way as to provide the least possible interference with traffic safety and fluidity on existing roads.
- During the dry season, unpaved roads in sections where there are inhabited areas around access roads will be wet to avoid dust emission. Drivers will be instructed that when passing by residential areas, speed should be lowered.
- The social team will identify if there are schools in the area, in which case special support will be given at the entrance and exit of the school, with flaggers who will organize the pedestrian access.
- The Contractors shall install traffic signs at the required locations in accordance with Tanzanian traffic legislation.
- The Contractors shall obtain prior approval from the local authorities before closing or restricting access to any road or path. Appropriate traffic signs must be installed prior to closing any road.
- On sections with heavy traffic, with significant interference with local traffic and/or pedestrians, appropriate signage may be required to ensure safety.
- All drivers of construction vehicles shall be instructed to observe the speed limits stipulated and to strictly follow the instructions on the signs.
- Drivers may not make unauthorised stops in surrounding communities, except in the case of a mechanical problem.
- All construction vehicles will operate under optimal maintenance and safety conditions. The Supervision Team will require the removal of vehicles or equipment with excessive noise generation, black smoke emission or oil leaks.
- Devices and signs that are no longer required shall be removed immediately.
- Pedestrian crossing points shall be clearly identified on roads.
- If an accident occurs, all traffic will be interrupted. If necessary, first aid will be provided and medical assistance will be called. In case of serious life-threatening injuries, an ambulance will be called to the scene of the accident, in addition to the police. Any traffic collision resulting in non-life-threatening injuries shall be reported immediately to the police.

- Vehicles broken or involved in minor collisions without injury will be temporarily moved to the side of the track as soon as possible after observing and noting the details of the collision site. Details of all incidents will be reported to the police.
- The Contractors shall be responsible for the state of conservation of all existing roads to be used (pavement conditions, signage, drainage), taking responsibility for maintaining them in adequate traffic conditions throughout the period, and for restoring them to a standard at least equivalent to the initial standard at the end of the works.
- All vehicles, machinery and heavy equipment will meet noise standards.
- Periodic maintenance of vehicles, machinery and equipment will be carried out to ensure good conditions.
- Overloading of trucks during the movement of machinery and equipment shall be avoided. When this is not possible, due to the shape or dimensions of the load, appropriate signage shall be placed. Where required, authorisation shall be sought from the relevant government authority.
- Dumpers transporting construction materials, surplus excavated earth, cleared vegetation and solid waste or rubble shall be covered with tarpaulins.
- A speed limit of 25 km/hour will be set as the maximum speed for vehicular traffic within the camp sites. On public roads and other accesses, the respective speed limits shall be observed.
- Damage or deterioration of public access roads to camp sites or adjacent third-party property will be reported to TANESCO in a timely manner.
- Before work begins, the Contractors must inform TANESCO Environmental and Social (E&S) Team of the following:
  - Expected volume of construction vehicle traffic;
  - Roads to be used;
  - Speed limits;
  - Indication of need for additional signage.

5.11. GHG Emission Measurement and Mitigation

In order to avoid or minimise greenhouse gas (GHG) emissions related to the project, estimates of GHG emissions were made for the construction and operation phases of the project, using internationally recognised methodologies. The results are presented in **Annex 1**.

During construction, the Contractors will be responsible for conducting a construction phase emissions inventory to confirm the estimates presented in this ESIA. The GHG Protocol tool, available on the Greenhouse Gas Protocol website, can be used for the calculations.

In the event that the estimate for the operation phase results in the Project producing more than 25,000 tonnes of CO_2 equivalent per year, the TANESCO E&S Team will be required to conduct the annual GHG emissions inventory.

5.12. Demining of DAA

As assessed in **Section 8.2.4.3** (risk 18.03), in the works to be carried out in the Kagera region, more specifically in the Missenyi, Kyerwa, Bukoba, Muleba and Karagwe districts, there is a risk of accidents with landmines and UXOs (unexploded ordnances) involving workers. Therefore, it is necessary to carry out a demining measure in the DAA (wayleave, Kyaka SS expansion area, new accesses outside the wayleave, camp site areas) of the 400 kV Mutukula – Kyaka TL and part of the 400 kV Kyaka – Nyakanazi TL (up to vertex KN-19), prior to the start of vegetation suppression and land clearing and earthmoving activities. This activity will be carried out by the Contractor, under the supervision of TANESCO.

In addition to the construction areas, it is also necessary to demine the areas where people whose homes will be affected by the project will be resettled. This demining does not need to be carried out before construction begins, but as soon as the resettlement sites are defined, before construction of the new houses begins. Unlike DAA's demining, which will be carried out by the Contractor, this activity to clear the resettlement areas will be carried out by TANESCO, and therefore the respective measure has been included in Program P.02.

The demining process involves the detection, identification and removal or neutralisation of landmines and other unexploded ordnance (UXOs). This work can be done manually by trained specialists, with the use of metal detectors, trained sniffer dogs, or through advanced technology such as armoured vehicles or drones equipped with specialised sensors.

There are two main types of demining, the humanitarian and the military. The type required for the Project is the humanitarian, which is focussed on removing landmines and other explosives from areas that will be used by civilians, to ensure that the land is safe for use after a conflict.
Regardless of whether the demining is humanitarian type, to avoid accidental detonations, it should be carried out by specialised teams, such as military forces trained to deal with explosives, and with a focus on international standards and practices. Therefore, the first step to be taken by the Contractor is to contact with the Tanzania People's Defence Force (TPDF) which operates under the supervision of the Ministry of Defence and National Service (MODANS). In addition to the Armed Forces, Tanzania collaborates with organizations specializing in demining, such as APOPO, an NGO that has been operating since 2000 in partnership with the TPDF, using innovative techniques to complement demining efforts in the country.

All necessary security measures will be taken. It will be evaluated if neighbours of the Project face any kind of danger and if they need to take action. In this case, this will be previously communicated and explained, answering all the questions that they may pose.

Some of the steps that may be included in the demining process are:

- Pre-construction survey and mapping, including analysis of military records and old maps; interviews with local residents; and visual inspections and drone flyovers.
- Marking the suspected area with stakes, flags, or safety tape, and using specific signs to indicate dangerous areas.
- Technical scanning (detection), using metal detectors (to locate metal components of mines), GPR sensors (to detect non-metallic objects), ground-penetrating radar, sniffer dogs trained to detect explosives, drones used for preliminary inspections in hazardous terrain.
- Marking and fencing any areas that are suspected to contain mines or UXO to prevent accidental entry.
- Removal and deactivation using manual (specialized operators carefully excavate until the mine is exposed) or mechanical methods (use of armored machines to detonate or expose mines) or neutralization (manual disarming or controlled detonation).
- Inspection of the cleared area to ensure it is risk-free.

5.13. Indenisation for Unintended Damage to Land, Crops, Structures and Rural Improvements During Works

It is the Contractors' responsibility to indemnify those affected for damage caused during construction, including damage to land, crops, structures, land prepared for cultivation and agricultural infrastructure, including irrigation systems, fences and access roads.

In these cases, the damage is temporary, caused during construction, mainly accidentally, but in some cases, it can be intentional, due to lack of planning or unforeseen events.

The first step is to carry out a detailed assessment to identify all the damage caused to crops, soil and agricultural infrastructure. This assessment must be conducted by an agronomist, together with representatives of the Contractors and the affected farmers.

Prior to the construction, potentially affected persons will be informed of the existence of the Grievance Mechanism and of the possibility of presenting grievances related to damages to crops or infrastructures. Potentially affected persons will have clarity on how to access the Grievance Mechanism, and the social team will periodically visit the area to verify if any problem of this type has arisen.

Each damage identified must be quantified in terms of loss of agricultural productivity, the cost of repairing or replacing infrastructure, and environmental impacts such as soil erosion or contamination of water bodies.

Indenisation for lost crops must be calculated and compensated on the basis of the measures established in the P.11 (Resettlement Policy Framework). The cost of repairing or replacing damaged infrastructure must be estimated on the basis of estimates provided by construction companies or specialised suppliers.

If the soil has been compacted or degraded, the indenisation must cover the costs of recovery measures, such as soil aeration, nutrient replacement and erosion control.

Contractors must obtain the agreement of those affected on the scope of the measures to repair the damage and the timeframe for implementation. A form, that demonstrates that this topic was consulted and that registers the affected people's decision, will be filled and signed, and a copy will be handled to the affected.

Indenisation can be paid in cash directly to the affected farmers, based on calculated values, or in the form of services (such as the reconstruction of damaged infrastructure) or the provision of goods (such as fertilisers, seeds or new machinery). This method may be preferable if the farmers do not have the resources or expertise to carry out the repairs themselves.

All cases must be documented photographically and in writing by the Contractors, including evidence of post-indemnity monitoring to ensure that the measures have been effective. All this should be registered in the Grievance Mechanism. A form indicating that the grievance was closed and the level of satisfaction should be signed and a copy handled to the affected person.

The damage will be considered repaired after obtaining the approval of the TANESCO Management Team and the affected party.

5.14. Decommissioning and Recovery of Degraded Areas

At the end of construction, Contractors shall implement measures to demobilise temporary facilities, including camp sites and other support areas, and temporary accesses, and restore these areas.

Decommissioning and recovery measures are described in **Section 13.1** of **Chapter 13.0**.

6. Performance Indicators

The following indicators are proposed to monitor the implementation of this Plan:

Measure	Indicators
Erosion Prevention and Control	• Evidence of implementation of erosion prevention devices at work fronts and camp sites.
Control Procedures for Construction in Flooded Areas	• Evidence of implementation of temporary landfills • Evidence of properly destination of surplus material from excavation in flooded areas • Evidence of treatment of water pumped from the soft soil replacement area before discharge • Evidence that there are no obstructions created by the access that could result in water retention
Prevention and Control of Soil Contamination	• Number of workers trained in the prevention and response to leaks and spills of hazardous materials in relation to the total number of workers hired.
Hazardous Materials Management	
Water and Effluent Management	• Number of toilets in relation to total number of workers • Number of toilets specifically for women in relation to the number of women workers • Maximum distance of toilets from each work front

Measure	Indicators
	• Number of non-conformities related to effluent recorded through site supervision conducted within the scope of the Environmental and Social Management Programme (P.02).
Atmospheric Emissions Control	• Evidence of soil wetting • Evidence of tarpaulin protection of earth transport trucks • Number of complaints related to atmospheric emissions from camp sites registered through the Stakeholder Engagement Plan's Grievance Mechanism • Number of complaints related to atmospheric emissions from camp sites addressed/resolved
Noise and Vibration Control	• Evidence of regular maintenance of vehicles and equipment • Evidence of compliance with the time limits determined • Evidence of communication to nearby residents about noise-generating activities • Number of noise related complaints registered through the Stakeholder Engagement Plan's Grievance Mechanism • Number of noise related complaints addressed/resolved
Vegetation Clearing	• Number of workers trained in relation to the total number of workers involved in vegetation clearing • Evidence of carrying out germplasm rescue prior to vegetation clearance • Evidence of carrying out of wildlife scaring and rescue prior to vegetation clearance • Volume of wood reused in the works in relation to total vegetation cleared • Number of environmental non-conformities recorded through P.02 Supervision related to vegetation clearing activities
Camp Sites and Workforce Housing Management	• Evidence of the installation of camp sites and other support facilities in anthropized sites • Evidence that fire extinguishers have been installed in camp sites and that their validity has been monitored • Evidence of installation of protective measures in places where hazardous products are stored or handled • Evidence of compliance with standards in accommodation, cafeterias and toilets
Waste Management	• Periodic inventories of waste generated at work fronts and camp sites • Quantity of solid waste destined in relation to the total waste generated • Evidence of waste transport manifests • Evidence of regularity of destination sites and companies contracted for special/hazardous waste disposal • Number of workers trained in the chance discovery protocol • Evidence of the implementation of trench landfills using all contamination prevention measures and of their correct operation
Construction Traffic Control	• Number of complaints related to construction traffic or road interruptions registered through the Stakeholder Engagement Plan's Grievance Mechanism • Number of accidents related to construction vehicles
Decommissioning and Environmental Recovery	• Evidence of recovery of areas degraded by construction works

Measure	Indicators
GHG Emission Measurement and Mitigation	• Evidence of periodic calculations of GHG emissions during construction work
Demining of DAA	• Evidence of contact with the TPDF or APOPO, to coordinate the demining activities • Carry out demining in 100% of the 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL (up to vertex KN-19)'s DAA before the construction begins
Indenisation for Unintended Damage to Land, Crops, Structures and Rural Improvements During Works	• Reports documenting the damage, the assessment, the negotiations with the affected party, the measures established, the timetable for their implementation and evidence of their fulfilment.
Decommissioning of Works and Recovery of Degraded Areas	• Quantity of areas recovered or rehabilitated in relation to the total area degraded by the works; • Compliance with the deadlines and frequency established for recovery.

7. Reports and Documentation

The Contractors shall provide and organise in monthly reports the documents, information and evidence of adoption of all environmental control measures and procedures contained in this Plan.

The report shall contain the following:

- Atmospheric emissions control:
  - quantification and evidence of dust emission control;
  - tests for measuring black smoke emissions from vehicles;
  - evidence of preventive and corrective maintenance to reduce black smoke emission;
- Soil and water pollution control:
  - quantification and evidence of implementation and maintenance of soil and water pollution control equipment such as septic tanks, latrines, oil and water separation devices, grease traps;
  - evidence of measures taken in case of spills with soil contamination.
- Solid waste and sanitary effluent management:
  - waste inventories and quantification and evidence of collection, segregation, storage and disposal of waste.
  - evidence of septic tanks monitoring and measures applied in the event of problems detected.
- Supplier qualification: list of suppliers of environmental concern and evidence of their environmental regularity.
- Environmental regularity: operating permits for contracted companies, environmental licences (including for water collection).
- Record of maintenance actions taken on access roads and information on the state of their conservation until the effective completion of their use.

- Emergency response records under the P.04 - Construction Emergency Preparedness and Response Plan.
- Summary of the progress of construction activities, highlighting the activities of most interest for environmental monitoring.
- Evidence of demining of the 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL (up to vertex KN-19)'s DAA.
- Record of vegetation suppression control measures, indicating:
  - Chainsaw licence;
  - Records and evidence of chainsaw operator training;
  - Summary of progress of vegetation clearing activities;
  - Reports of suppressed wood content;
  - Terms of timber donation to landowners/occupants.
    Record of any unforeseen damage to crops or other agricultural infrastructure outside the DAA, the assessment to identify the damage, the negotiations with those affected, the measures established, the timetable for their implementation and evidence of compliance.
- Reports on documenting the damage to land, crops, structures or improvements, including the assessment, the negotiations with the affected party, the measures established, the timetable for their implementation and evidence of their fulfilment.
- Records of activities carried out to implement projects for the recovery of degraded areas.

8. Schedule

The CEP shall be implemented throughout the construction phase of the TLs and SSs.

The demining of the 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL (up to vertex KN-19)'s DAA (measure 5.12) must be carried out before activities begin in the areas.

Demobilisation and recovery activities will begin with the deactivation of each camp site or support area and may continue until the end of the first year of the operational phase. Monitoring and necessary maintenance actions in the recovered areas shall be carried out for 12 months or until stabilisation (under measure 5.3 of P.03).

P.02 - Environmental and Social Management Programme

1. Justification

The Environmental and Social Management Programme will be a tool for TANESCO to have full control over the activities carried out by Contractors and subcontractors during the construction phase, following the works schedule, and over the implementation of all the Plans and Programmes and respective measures established in the Project's Environmental and Social Management Plan (ESMP).

The programme will also include measures to manage compensation for impacts on mining rights, to calculate the Greenhouse Gas (GHG) emissions and to demining the areas chosen to resettle the houses and businesses impacted by the Project.

2. Main Objectives

The main objective of the Environmental and Social Management Programme is to guarantee the environmental and social quality of the area where the Project is located, through the integrated management of all the ESMP Plans and Programmes and the actions proposed for the prevention, mitigation, control and compensation of environmental and social impacts for the construction phase.

In addition, the Programme has the following specific objectives:

- Ensure that all construction services are carried out in accordance with the measures established in the PEC (P.01);
- Monitor and manage environmental and social impacts and/or risks and control their actions or activities;
- Monitor the progress and results of all ESMP Plans and Programmes;
- Ensure the disclosure and correct understanding of all relevant environmental and social control commitments and/or measures with those directly and indirectly responsible for the implementation process;
- Avoid or minimise project-related greenhouse gas (GHG) emissions in operational phase;
- Coordinate the process of interaction with the National Environment Management Council (NEMC) and other agencies regarding environmental and social aspects of the Project and with civil society in general;
- Coordinate interaction with the Mining Commission to assess the measures to be taken in the stretches where the TLs' wayleave intersects polygons with mining licences and in the rest of the route, to avoid future conflicts;
- Coordinate the process of evaluation and compensation for the impact on mining rights;
- Ensure that there are no accidents involving landmines that may be located in the wayleave and in the areas where the houses and businesses impacted by 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL (up to the KN-19 vertex) will be resettled;Ensure full compliance with all requirements established by NEMC.

3. Applicable Legislation

- Mining Act, 2010;
- Environmental Management Act, 2004;
- Environmental Management (Air Quality Standards) Regulations, 2007;
- Environmental Management (Standards for the Control of Noise and Vibrations Pollution), 2015;
- Land Act, 2019;
- National Environmental Policy, 2021.

International

- World Bank Environmental and Social Standards (ESS):
  - ESS 1: Assessment and Management of Environmental and Social Risks and Impacts;
  - ESS 2: Labour and Working Conditions;
  - ESS 3: Resource Efficiency and Pollution Prevention and Management;
  - ESS 4: Community Health and Safety;
  - ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement.
  - ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
  - ESS 7: Sub-Saharan African Historically Underserved Traditional Local Communities;
  - ESS 8: Cultural Heritage;
  - ESS 10: Stakeholder Engagement and Information Disclosure.
- WB GPN on Addressing SEA/SH in Investment Project Financing involving Major Civil Works;
- World Bank / IFC General EHS Guidelines of the IFC, 2007;
- World Bank / IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, 2007;
- Ottawa Convention (Anti-Personnel Mine Ban Treaty), of which Tanzania has been a signatory since 12/3/97;
- United Nations Mine Action Service.

4. Responsibilities

The Environmental and Social Management Programme is the responsibility of TANESCO.

TANESCO will establish a dedicated Supervision Team, either through its own internal personnel or by hiring a specialised consultancy firm, to ensure compliance with the environmental, social and occupational health and safety (OHS) measures described in this ESMP. This team is structured to include a multidisciplinary staff composed of professionals in environmental management, social development, OHS, and stakeholder engagement, among others. The Management Team will continuously support the Contractors and subcontractors involved in the construction of the Project, verifying compliance, requesting corrective measures and helping to design appropriate strategies and technical solutions to control social and environmental impacts and risks, including those not initially foreseen.

These are responsibilities of the TANESCO Management Team:

- Ensure compliance with environmental, social and OHS legislation related to the Project, including the WB's ESSs and EHS Guidelines, and relevant international conventions;
- Ensure that all environmental, social and OHS commitments are disseminated and understood by all involved;

- Ensure that any changes to the Project take into account environmental, social and OHS aspects;
- Monitor and manage environmental and social impacts and/or risks and control actions or activities that generate impacts and ensure that Contractors produce adequate documentation of impacts resulting from third party actions as necessary to clearly establish the boundaries of TANESCO responsibility;
- In conjunction with the Contractors and subcontractors, design strategies and/or measures that can improve control over environmental, social and OHS aspects and contribute to the improvement of the Project's performance;
- Advise the Contractors and subcontractors on adjustments and/or improvements to environmental, social and OHS measures as necessary during construction;
- Review and approve Contractors' reports;
- Verify relations with residents of communities in the area of influence, appropriate flow of information, mitigation measures as specified in the CEP (P.01), and proper management of the Grievance Mechanism;
- Conduct periodic audits of environmental, social and OHS performance, which will include a more detailed review of related documentation, monitoring the results achieved by Contractors and verifying the adequacy of environmental, social and OHS management and personnel.
- Request corrective actions where relevant and monitor their implementation;
- Attend construction planning meetings as necessary to ensure that specific impacts and risks associated with future activities are adequately identified and that the full list of applicable mitigation and control measures are implemented in advance;
- Organise all environmental, social and health and safety monitoring documentation in a database.
- Ensure that documentary evidence of the proper implementation of each environmental, social and OHS commitment is available;
- Ensure the environmental regularity of the Project, checking that all necessary permits are in place, including those for which the Contractors are responsible;
- Monitor the construction schedule, identifying any necessary permits or authorisations and ensure they are obtained in advance;
- Participate in inspections and meetings with environmental, social and OHS authorities and respond to any requests;
- Carry out GHG emissions estimates for the construction (with input from Contractors) and operation phases of the Project, using internationally recognised methodologies;
- Establish the necessary procedures and negotiations to avoid conflicts between the construction and operation of the TLs and the mining activities in the areas directly affected by them;
- Contact with the government, specifically the armed forces, to coordinate the process of demining the wayleave and the areas where the houses and businesses impacted by 400 kV Mutukula – Kyaka TL and 400 kV Kyaka – Nyakanazi TL (up to the KN-19 vertex) will be resettled;
- Prepare quarterly environmental, social and health and safety compliance reports, documenting the progress of the works.

The coordination of the implementation of the other Plans and Programmes proposed in the ESMP will also be carried out by TANESCO Management Team.

5. Methodology

5.1. Construction Supervision

The TANESCO Supervision Team (own or contracted) shall verify compliance with all measures to be complied with by the Contractors and subcontractors, in particular those provided for in PEC (P.01). This verification shall be carried out through systematic inspections and audits of construction activities and associated environmental, social and OHS documentation, which includes not only the Contractors work, but also those within the contractual scope of key subcontractors and suppliers. The documentation to be analysed will be that provided in the reports to be prepared by the Contractors, including the content listed in Section 7 of the CEP. The performance indicators listed in Section 6 of the CEP, which will form part of the monthly reports, will reflect the effectiveness of the measures taken.

Routine inspections will focus on:

- Verification of compliance with all components of the CEP (P.01).
- Verification of the scope and intensity of the E&S impacts induced by the Project.
- Verification of the changes caused by the project on the local population.

To ensure accuracy of verification, the TANESCO Supervision Team will prepare detailed inspection checklists according to each type of Project site or activity. Decommissioning checklists will be developed during the final stages of construction. Key aspects of E&S construction management that will be routinely checked will include:

- Main construction processes:
  - Vegetation clearing;
  - Excavations and earthworks;
  - Concrete and cement work;
  - River crossings;
  - Erection of towers;
  - Launching of cables;
  - Decommissioning, recovery and recuperation.

- Aspects to be verified:
  - Cleanliness and general organisation and prevention of contamination;
  - Erosion control;
  - Handling of hazardous materials;
  - Waste management;
  - Effluent management;
  - Drinking water quality;
  - Atmospheric emissions management;

  - Noise and vibration management;
  - Traffic control.

- Corrective and preventive actions and the main environmental impacts to be monitored will include:
  - Management of the area occupied by the Project;
  - Water quality upstream and downstream the effluent discharge point;
  - Erosion and runoff;
  - Spills and other types of contamination.

- Corrective and preventive actions for social impacts to be monitored will include:
  - Conflict between workers and the community;
  - Traffic on public roads;
  - Impacts caused by accesses closures;
  - Atmospheric emissions control;
  - Noise and vibration generation and control;
  - Damage to third party property;
  - Failure to meet commitments and manage community expectations (hiring of local workers and suppliers);
  - Spread of transmissible diseases including STDs and HIV/AIDs;
  - Cases of gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH);
  - Impacts on cultural heritage;
  - Other problems that generate complaints from the community.

Socio-environmental baseline conditions will be adequately documented to support the assessment of construction impacts.

5.1.1. Compliance Assurance Procedure

All violations of the commitments of the CEP (P.01) will be documented and trigger a corrective action request. The TANESCO Supervision Team will issue two levels of corrective action requests:

- Observations on environmental and social (E&S) issues
- Notification of Non-Conformity (NNC)

Observations on E&S issues will be registered for minor issues that do not result in any material impact and can be easily resolved. Observations shall be consolidated in a follow-up table, which shall contain clear specifications on the missing aspect, the location of the problem, the recommended corrective actions, the deadline for implementation and the responsible person.

Observations that occur repeatedly will lead to the issuance of an NNC. The same applies to observations not resolved within the stipulated time. NNCs will be issued for more significant breaches or those that require a more complex set of actions to resolve.

The NNC shall be issued in a standard format and, where possible, include photographic documentation. In all cases, it shall indicate the missing items on the Supervision Checklist and the corresponding location on the Project. The coding of NNCs will be based on this information. NNCs that do not have a specific location will be given a special code.

Where relevant, NNCs will differentiate between two types of required actions: immediate action and corrective action. Immediate action may be a work stoppage request or an emergency clean-up. Corrective action in some cases may be the submission of a Corrective Action Plan. However, it is anticipated that most NNCs will not require the preparation of a Corrective Action Plan, with the necessary corrective actions defined at the time of the action. As a general rule, the NNC should target problems rather than solutions, as the responsibility for the effectiveness of the corrective action rests entirely with the Contractors. The NNC will also record timeframes for implementing the requested corrective actions.

Corrective Action Plans will be submitted by the Contractors when the NNC indicates the need for them. As stated above, the Corrective Action Plan is requested on a selective basis and shall include a detailed description of any proposed corrective action and the timeline for implementation consistent with the overall deadline set forth in the NNC. This shall also include a description of the documentation to be submitted to demonstrate compliance. Corrective Action Plans will be approved by the TANESCO Supervision Team, which may request modifications or further details as appropriate.

NNC closure forms will be prepared by the TANESCO Supervision Team to formalise acceptance of the corrective action taken by the Contractor (or subcontractors) to remedy the NNC. These will be based on inspection of the implemented corrective actions, which will be triggered when the Contractor notifies that the NNC has been resolved. If closure is confirmed, the date of the Contractor's notification of completion will be recorded on the NNC closure form.

5.2. Coordination of Plans and Programmes of the ESMP

To ensure the correct implementation of the Environmental, Social and OHS Plans and Programmes proposed in the ESMP, with technical quality, the TANESCO Management Team must develop a wide range of activities.

As set out in **Table 10.0.a** at the beginning of the **Chapter 10.0**, the team will be responsible for the implementation of all the Plans and Programmes of the ESMP, except the CEP (P.01), the Construction Emergency Preparedness and Response Plan (P.04), the Local Hiring Programme (P.13), and the Occupational Health and Safety Management Programme (P.17), which will be implemented by the Contractors, under the supervision of TANESCO Management Team’s.

Other ESMP Plans and Programmes, such as the Labour Management Procedures (P.14), the Stakeholder Management Plan (P.12), the Gender Based Violence Action Plan (P.15) and the Archaeological, Historical and Cultural Heritage Protection Plan (P.16), will be

the responsibility of TANESCO, but some measures will be implemented by the Contractors.

The coordination activities of the ESMP Plans and Programmes will be implemented during the planning, construction and operation phases of the Project. The main activities will be the following:

5.2.1. Planning for the Implementation of ESMP Plans and Programmes

Implementation of the ESMP Plans and Programmes will require comprehensive planning focused on the whole rather than on each individual Plan or Programme.

The following basic guidelines will be defined for planning the implementation of the Plans and Programmes:

- Strategies for contracting specialised companies or experts;
- Definition of criteria for the selection of responsible executors;
- Guarantee that the Plans and Programmes of the ESMP are included in the contracts;
- Management of technical cooperation agreements with research institutions.

5.2.2. Structure Specialised Teams and Training

A team of experts should be organised and maintained during the implementation schedule of the Plan or Programme, and the necessary material resources should be designated. These teams should meet the human and material resource needs specified for each E&S Plan or Programme included in each contract.

The expert teams will depend on the local infrastructure provided by TANESCO, which will provide the necessary logistical support for systematic monitoring campaigns, events in neighbouring communities or other planned activities.

The expert teams will be technically responsible for carrying out field activities and also for analysing the results.

To conduct this analysis, the contracted expert teams must interact with the TANESCO Management Team. If causal relationships are observed between Project construction or operation actions and negative changes in any parameters greater than those predicted in the ESIA impact and risk assessment, the Management Team will make the necessary adjustments to the Plans and Programmes and respective impact and risk control and mitigation measures.

Once the expert teams have been formed, they must receive training on the content of the ESMP Plans and Programmes and the impacts that their respective measures are designed to prevent, mitigate, control or monitor. The training should include content aimed at:

- Understanding the ESMP's Environmental and Social Plans and Programmes: present in detail the objectives, targets, timetables and measures envisaged, ensuring that all team members understand their importance and detailed content, and know how to apply them in their daily work.
- Knowledge of Applicable Legislation and Standards: train participants in the environmental and social legislation relevant to the project, ensuring compliance with legal requirements and avoiding environmental or social liabilities.
- Performance Monitoring and Reporting: train the team in methods and tools for continuous monitoring of the actions set out in the programmes, including the importance of producing data to meet the performance indicators set out in the programmes, and the reports to be produced.

The training will be carried out using a practical and theoretical approach:

- Lectures on the concepts and standards.
- Technical visits to camp sites to apply the knowledge acquired.

5.2.3. Supervise the Implementation of ESMP Plans and Programmes

On an ongoing basis during the implementation schedule of the ESMP Plans and Programmes, the TANESCO Management Team will systematically monitor the work contracted with the expert teams. This activity will require:

- Quality control ("assurance") of each ESMP Plan or Programme, managing deadlines and deliverables, verifying the allocation of human and material resources as planned, requesting corrective actions and monitoring their implementation.;
- Technical engagement with those responsible for each Plan or Programme, promoting adjustments when necessary;
- Coordination with other companies carrying out studies/projects;
- Selective monitoring of the performance of field campaigns of the Plans and Programmes or systematic monitoring measures.
- Detailed review of all reports generated for each Plan or Programme;
- Systematic evaluation of the compliance of each Plan or Programme with the ESIA and/or the respective contract;
- Monitoring of the Grievance Mechanism for Workers implemented by Contractors (see P.12 and P.14).
- Dissemination of the Grievance Mechanism for the community implemented in the scope of Stakeholder Engagement Plan (P.12) and the available channels;
- Systematic evaluation of the results obtained in each Plan or Programme and comparison with the objectives/desired results when formulated;
- Identification, based on the analysis of the results of the Plan or Programme, of unforeseen impacts and risks and/or of different intensity than expected, and discussion of management/mitigation strategies;
- Organisation of all documentation related to the implementation process of the ESMP Plans and Programmes.

5.2.4. Analysis of the Results of the ESMP Plans and Programmes

As mentioned above, all results of the activities carried out within the ESMP Plans and Programmes will be subject to systematic evaluation by the TANESCO Management Team, together with the responsible specialist teams.

This will include reviewing and assessing deviations from performance standards set by law or as foreseen in the Plan or Programme. For example, any noise or atmospheric emissions measurement that exceeded the limits, among others.

Systematic (periodic) monitoring-based Programmes will also include the identification of changes from the baseline developed in the ESIA, and based on the evolution of construction activities during each monitoring period under review, seeking to establish causal relationships.

5.2.5. Corrective Action Management

When the results obtained in any of the Plans or Programmes indicate the need for corrective action with respect to the Project's construction activities (such as the need to improve erosion control procedures, for example), the TANESCO Management Team will promote the necessary interaction with the corresponding sectors of TANESCO and the Contractors.

When necessary, due to the complexity of the action required, the head of the Management Team will prepare a Corrective Action Plan, which will contain as a minimum:

- List of actions to be taken;
- Main expected results/indicators;
- Distribution of responsibilities;
- Timetable;
- Reporting and documentation.

5.2.6. Improvement of ESMP Plans and Programmes

Based on the evaluation of the results, the TANESCO Management Team may, where appropriate, propose adjustments to improve the ESMP Plans and Programmes. These adjustments may include:

- Adequacy of the sampling grid, if any of the sampling sites are inadequate or additional sites should be considered;
- Adequacy of measurement parameters, based on observed variations;
- Change of target stakeholder (in Programmes that involve working with the local population);
- Changes in other specific aspects of the proposed methodologies.

5.2.7. Closure of E&S Plans and Programmes

Once finalised, according to the deadlines established for the Plans and Programmes, these will be subject to a closure procedure that will be stipulated in the contracts to be signed with the companies contracted for their execution. This will include:

- Issuance of the Final Report of the Plan or Programme and its approval by the TANESCO Management Team;
- Other closing activities specific to each Plan or Programme.

5.3. Greenhouse Gas Emissions Management

The TANESCO Management Team will carry out the periodic monitoring of the GHG estimative to be executed by Contractors during the construction phase, as foreseen in the CEP (P.01).

In the operation phase, the Management Team will not need to conduct the annual GHG emissions inventory, as the estimate for the operation phase carried out in this ESIA (see **Annex 1**) resulted that the Project will not produce more than 25,000 tonnes of CO_2 equivalent per year.

5.4. Management of Interference with Mining Licence

The existence of 17 polygons with a mining licence intercepted by the wayleave of the 400 kV Kyaka – Nyakanazi TL (3 licences) and 400 kV Nyakanazi – Ibadakuli TL (14 licence) was identified. Thirteen of these licences are exclusively for gold exploration. Another two are for gold and copper and gold and nickel exploration, and the one is for nickel. Fourteen licences are of the "Prospecting Licence Metallic Minerals" type, 1 is of the "Primary Mining Licence - All Minerals other than Building Material" type, 1 is of the "Processing Licence" type and 1 is of the "Mining Licence - Metallic Minerals, Energy Minerals and Kimberlitic Diamonds" type.

These interferences with areas of mining make this measure necessary.

The TANESCO Management Team will have to establish the necessary negotiations with the Mining Commission of the Ministry of Minerals (MADINI) to define the operating rules for mining in the areas crossed to guarantee the safety of the TLs. As discussed in **Section 8.2.3.3** (impact 9.05), it should be assessed whether the mining activities could impact the operation of the TL, and on this basis define whether the area of the wayleave should be completely blocked or just partially blocked, with the relocation of mining activities or adjustments to mining operations.

The feasibility of blocking off the rest of the wayleave to prevent future mining licence applications should also be discussed with the Mining Commission. This is usually done to avoid conflicts between mining operations and the TL, ensuring that future mining activities do not prejudicated the safety or operation of the TL. This is provided for by Tanzanian legislation, for which areas reserved for public infrastructure, such as TLs,

must be protected against new developments that could interfere with the safe and efficient operation of the infrastructure. This means that the wayleave can be excluded from the process of granting new mining licence.

In the case of the areas impacted by the wayleave, to ensure that the rights holders are not economically harmed, as provided for in the legislation, the TANESCO Management Team must hire an independent valuer or a team of experts to calculate the value of the compensation, which takes into account:

- The value of the mineral resources located in the affected area.
- The loss of production during the time operations are interrupted.
- The value of the investment already made in the area.
- Potential costs for relocating operations or adjusting mining plans.

During these meetings, TANESCO team will also address the procedure to be implemented in the cases of artisanal mining, where no license has been issued.

5.5. Demining of Resettlement Areas

As seen in **Section 8.2.4.3** (risk 19.04), there is a risk of landmines in the portions of the Project located in Kagera, more specifically in the districts of Missenyi, Kyerwa, Bukoba, Muleba and Karagwe. In addition to the risk of accidents during some construction activities, there is also a risk of accidents involving the population to be resettled as part of the Project.

The measure to prevent risk related to the works is within the scope of the P.01 (measure 5.4), and will be implemented by the Contractors. This measure is aimed at preventing the risk of landmine accidents in the areas destined for the resettlement of the population with homes and businesses impacted by the Project.

The process of detecting, identifying and removing or neutralising mines is the same as that to be implemented in the P.01 measure, following international standards and carried out by specialised teams, such as the military forces trained to deal with explosives. However, TANESCO is responsible for implementing this measure.

6. Performance Indicators

The following indicators are proposed to monitor the implementation of this Programme:

Measure	Indicators
Management Team and functions	• Evidence of the institution of the Management Team, including environmental, social an OHS professionals or contracting of a consulting firm • Evidence of sufficient number of supervisory professionals hired to be part of the Supervision Team for the number of Project work fronts • Number of periodic Project's performance audits • Number of construction planning meetings attended

Measure	Indicators
	• Effectiveness of the Project works schedule
Construction Supervision	• Number of inspections carried out by type of area, activity, etc., in the period • Number of non-conformities (NNC) recorded in the period • Number of non-conformities (NNC) corrected within the established timeframe in the period
Coordination of Plans and Programmes of the ESMP	• Number of ESMP Plans and Programmes reports issued within the implementation schedule • Frequency of co-ordination meetings between Plans and Programmes • Consolidation of evidence and progress information from all ESMP Plans and Programmes
Greenhouse Gas Emissions Management	• Evidence of the inclusion of the results of periodic calculations of GHG emissions in contractors' monthly reports • Annual calculation of GHG emissions from operation (if applicable)
Management of Interference with Mining Licences	• Total or partial blocking of the wayleave for mineral exploration • Evidence of hiring an independent valuer or a team of experts to calculate the value of the compensation • Compensation paid to mining licence holders in relation to total impacted polygons
Demining of Resettlement Areas	• Evidence of contact with the armed forces team responsible for demining • Carry out demining in 100% of the areas where the impacted houses and businesses will be resettled, before the construction of the new houses and businesses begins and before the construction of the TLs.

7. Reports and Documentation

The recording and management of ESMP Plans and Programmes and respective measures will be done through standardised and systematic records and reports, which will be produced with defined function and frequency. According to the existing details, the following documents can be foreseen to be produced:

Plans and Programmes Management Reports: the TANESCO Management Team will produce simplified monthly reports (forms), with records of the execution of the ESMP Plans and Programmes, which will relate the activities developed in the period, evaluated the implementation of the Plan or Program based on the comparison of planned and carried out activities, and perform a critical analysis of the results.

These simplified reports will include results of the Construction Supervision, with the deviations and non-conformities recorded in the period, with a deadline for adequacy / correction, record of preventive actions, monitoring of implemented corrective actions, record of deactivation of work fronts.

Plans and Programmes Management Reports for the WB: these will be prepared by the TANESCO Management Team every six months or as defined by the WB. These reports

will highlight and consolidate information on the progress of the ESMP Plans and Programmes over the period.

In addition, the complete ESMP Management Reports will highlight the environmental, social and OHS performance of the Contractors, the results of which will be described in the CEP and in other Plans and Programmes under their responsibility.

Serious Incident Report

As per World Bank Environmental and Social Incident Report Toolkit (ESIRT 2023), in the event of any serious incident or accident related to environmental, social, occupational health and safety (OHS), or labour issues (including but not limited to fatalities, life-threatening injuries, major environmental spills, or incidents of sexual exploitation and abuse/sexual harassment – SEA/SH), TANESCO shall notify the World Bank **within 48 hours** of becoming aware of the event. The initial notification should include available key facts, including date, location, nature of the incident, number of affected individuals (if applicable), and immediate response actions undertaken.

A detailed incident report shall then be submitted to the World Bank within **10 business days**, including:

- Root cause analysis;
- Actions taken and planned to address the incident;
- Measures to prevent recurrence;
- Timeline for implementing corrective measures;
- Stakeholder engagement and communication (if applicable).

TANESCO will ensure that all such incidents are recorded and tracked, and that corrective and preventive actions are monitored through the ESMP implementation framework.

8. Schedule

This Programme will be carried out during the construction and decommissioning phases of the works. Construction Supervision (routine inspections) to assess Contractors' activities will be periodic and on a sample basis.

The demining of resettlement areas must be carried out as soon as the areas where the impacted homes and businesses will be resettled have been defined, before construction begins.

P.03 - Operation Management Programme

1. Justification

The Operation Management Programme is justified by the need to manage the potential environmental and social (E&S) impacts and risks associated with the operation phase of the Project.

In addition, it provides for the continuity of measures established in the construction phase ESMP Plans and Programmes, which will be continued in the operation phase, such as the recovery of degraded areas and the restoration of vegetation cover, the Grievance Mechanism, in addition to measures to monitor electromagnetic fields and audible noise.

2. Main Objectives

The main objective of this Programme is to manage the potentially impacting actions arising from the operation phase of the Project in E&S components, to minimise impacts on the surrounding areas and reduce possible disturbances to the local population.

The specific objectives are:

- Standardise the criteria and methodological procedures to be applied in the process of controlling the E&S aspects of the operation;
- Monitor and manage E&S impacts and/or risks and control their actions or activities;
- Train TLs and SSs maintenance personnel to comply with E&S impact minimisation guidelines, with special attention to the protection of native vegetation remnants in the wayleave and surrounding areas, and the implementation of provisional measures in case of emergencies;
- Identify and monitor the areas requiring recovery in the operation phase and implement the necessary measures in each case;
- Manage waste generated in the operation phase of the Project, aiming to reduce the amount of waste generated and minimise the risk of contamination of soil and water bodies through inappropriate handling, treatment and disposal;
- Control erosion on access roads;
- Keep the wayleave permanently clear and unobstructed and vegetation at a height that does not endanger the functioning of the TLs;
- Monitor areas where recovery and/or restoration of vegetation has taken place within the PEC (P.01), identifying and executing the necessary maintenance measures to promote the re-establishment and recovery of the vegetation cover of the areas in accordance with the standards to be established;
- Maintain operational communication channels between TANESCO and the population;
- Ensure the planning of actions to be applied in any emergency situation during operation;
- Take measurements of audible noise and electromagnetic fields at the start of operation and afterwards, in the event of any complaints.

3. Applicable Legislation

- National Environmental Policy, 2021
- Environmental Management Act, 2004
- Environmental Management (Air Quality Standards) Regulations, 2007
- Environmental Management (Standards for the Control of Noise and Vibrations Pollution), 2015

International

- World Bank Environmental and Social Standards (ESS) 1 to 8 and 10
- World Bank / IFC General EHS Guidelines of the IFC, 2007.
- World Bank / IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, 2007

4. Responsibilities

The Operation Management Programme is the responsibility of TANESCO, through its Management Team. For certain activities, such as noise and electromagnetic field measurements, it may be necessary to hire specialised professionals or companies.

Some actions that may extend into the operation phase are the responsibility of the Contractors, such as the completion of the reclamation of areas degraded by the works.

5. Methodology

5.1. Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase

It will be TANESCO's responsibility to:

- Monitor the execution of all campaigns, surveys and other activities that are part of E&S and OHS Plans and Programmes of the operation phase;
- Supervise the work of specialised companies and consultants involved in the implementation of the Plans and Programmes of the operation phase;
- Identify deviations from the Plans and Programmes and coordinate the necessary actions to correct them;
- Analyse and evaluate the results of each Plan and Programme, including verification of their sufficiency and/or relevance and coordination with the National Environment Management Council (NEMC), when necessary to adjust their scope or technical specifications;
- Produce Operation Phase ESMP Plans and Programmes Monitoring Reports on an annual basis in accordance with the standardised procedures and documentation standards defined in the construction phase.

5.2. Environmental Training of the Maintenance Team

In addition to environmental integration training, TLs and SSs maintenance personnel will receive technical guidance to adapt their routine procedures to E&S impact minimisation guidelines, and will be informed of the possible consequences of performing services without appropriate precautions.

Special attention will be given to the care of native vegetation remnants in the wayleave and surrounding areas, as well as to fire control. Likewise, priority will be given to training in the prior identification of unstable areas in the wayleave and accesses, and in the implementation of provisional (emergency) and definitive measures to stabilise erosion processes that may be identified.

Topics to be addressed in the environmental training for the operational phase include:

- Fundamentals of E&S legislation;
- Care for flora, fauna and water resources;
- Prevention of forest fires;
- Importance of erosion prevention and control, and environmental pollution;
- Reuse, recycling, segregation, control and disposal of waste;
- Traffic education measures;
- Recognition of poisonous animals and procedures in case of bites;
- SS equipment leakage procedures. In this regard, it is emphasised that all equipment using cooling fluids must have adequate leak containment devices;
- Procedures for action in case of environmental accidents.

Initially, it is expected that training events will be implemented annually. However, the frequency should be defined according to need, verified according to the number of cases related to non-compliance with the technical guidelines transmitted.

5.3. Monitoring of Recovered Areas

The recovery of areas degraded by construction works is foreseen as part of the CEP (P.01). These measures will ensure that there are no environmental liabilities related to the Project or that put its operation at risk. However, in certain situations / locations, it may be advisable to continuously monitor the stability and/or effective consolidation of the decommissioning and reclamation measures and procedures undertaken.

Remediation or stabilisation activities of the areas subject to this measure will always be carried out according to specific projects for each intervention / recovery site, providing both structural measures (containment, earthworks) and non-structural measures (slope stabilisation, manual watercourse cleaning), with priority given to non-structural interventions whenever possible.

Ongoing maintenance activities of the areas will be incorporated into TANESCO's operational management routines.

Sites that require remediation/monitoring, but are located in surrounding areas and are therefore the responsibility of third parties, will also be monitored and, if they present an imminent risk to the Project's TLs and SSs, will be notified to the relevant environmental authorities for appropriate action.

Monitoring activities will begin as soon as an area is included in the list of areas to be monitored under this measure and will continue even after recovery activities have been carried out. Post-recovery monitoring will be discontinued when the activities carried out are fully consolidated and/or it is certain that the situation will not recur.

The list of areas under recovery/monitoring will be updated periodically, as will the programme of recovery action, stabilisation, ongoing maintenance and/or monitoring for the following year.

5.4. Waste Management

The procedures envisaged are the same as those specified for the construction phase (Waste Management measures of the CEP – P.01), readjusted for the operation phase.

However, in general, the generation of waste in the operation phase of the TLs and SSs is negligible, with greater control over the contracted companies that will carry out some work in this phase.

In general, waste management in the operational phase should consider the following:

- Establish measures that promote the reduction of waste generation at source;
- Ensure the adoption of specific and appropriate procedures for the collection, handling, packaging and final disposal of waste;
- Promote the proper disposal of non-recyclable waste, ensuring that only specialised companies licenced are contracted to dispose of waste requiring special disposal;
- Promote, wherever possible, the reuse and recycling of materials.

Classification

Waste must be sorted according to the provisions of Regulation No. 114, 2009, which is part of the Environmental Management (Solid Waste Management) Regulations, 2009.

Collection and segregation

Appropriate collectors for each type of waste generated and in adequate quantity will be available in the Project's SSs.

Transport of solid waste

Collected waste will be transported by authorised companies to appropriately licenced treatment or disposal sites.

In cases of transport of hazardous waste, the procedures specified in relevant legislation and technical standards shall always be adopted. Regardless of whether the company is accredited for the transport and disposal of waste, there is co-responsibility of the generator until such time as it is disposed of in accordance with the requirements set by the competent environmental agency.

Final disposal of waste

Regarding the final destination of waste, the following procedures can be defined:

- Ordinary waste should be sent to trench landfills to be implemented by TANESCO in the SSs areas (see Waste Management in CEP – P.01) or to the nearest existing sanitary landfill (after agreement with the village/ward/district administration). Disposal in open dumps will not be permitted.
- Under no circumstances may household waste be thrown away or burned;
- Due to the great variety of materials, a prior selection must be made to separate specific materials, especially recyclable materials (metals, plastics, paper and glass);
- Miscellaneous remnants from maintenance and cleaning of the wayleave will also have a wide variety, but can be easily segregated into recyclable and non-recyclable materials, so that it is feasible to return for reuse or recycling, or sale to recyclers. Ordinary waste will be disposed of in a landfill, in accordance with the above procedure;
- Pruning waste generated in the clearing of the wayleave will preferably be used in the recovery and/or environmental enrichment of degraded areas in or around the wayleave itself;
- Sludge from septic tanks (if any) will be collected by specialised companies with appropriate environmental permits;
- Used oils will be collected on site by a licenced refining company);
- Replaced parts will be stored and sold to recycling companies;
- Miscellaneous waste contaminated with oils, lubricants, greases, paints and varnishes will be disposed of in hazardous waste landfills.

Monitoring and inspection

The Environmental Manager of the operation phase will require from the waste transport companies the certificates of final destination, issued by the treatment and/or disposal companies that will receive the waste.

5.5. Maintenance and Erosion Control

Erosion control should be a continuous activity during the operation phase, not only in the wayleave, but also along all service accesses used in the operation phase.

Erosion problems can arise not only as a result of situations induced by the accesses themselves, but also as a result of situations originating in the surrounding areas, with an impact on their stability.

In this context, it is important to highlight some different situations with regard to the distribution of responsibilities for the maintenance of access roads.

The responsibility for maintaining the roads within the wayleave will be solely and exclusively TANESCO's. This will also be the case for service accesses outside the wayleave (in third party areas), without excluding the possibility of sharing maintenance responsibilities when the use of the access is not exclusively TANESCO's.

Finally, the responsibility for the maintenance of some pre-existing service accesses in areas outside the wayleave, used (and in some cases improved) during the works and which should continue to be used for maintenance of the TLs, but which are often used by their owners and/or third parties, should initially continue with them, without ruling out operational arrangements that commit TANESCO, due to the overriding need to ensure that these roads are in operational condition.

As a result, the maintenance teams will perform annual inspection on all service accesses necessary for the maintenance of the TLs, promoting the correction of what is necessary. The schedule of these inspections will be adjusted as necessary.

During these inspections, all incipient erosion processes will be identified and immediately stabilised temporarily. Such interventions may include the execution of small works such as diversion of water flow over destabilised areas, placement of stone in the preferred watercourse, stabilisation works.

5.6. Vegetation Management on the Wayleave

The vegetation cover in the wayleave may consist of herbaceous species or remnants of forests whose height allowed them to be preserved during the works. In this second case, periodic selective pruning must be carried out, maintaining the safety distance between the cables and the tree crown, so that the vegetation does not endanger the TL and its components (maintain the safety distance recommended in the TANESCO's "Electricity (Safety, Quality and Continuity) Regulations", which is 5 to 6 metres measured between the cables and the tree crown for high-voltage TLs.

Shrub vegetation will be cut periodically by the maintenance teams, only when necessary, maintaining the herbaceous vegetation. In the scheduling of these works, the risks of fire spread shall be considered, ensuring extensive clearing before the dry seasons of the year, as well as more frequent clearing in firebreaks along forest fragments vulnerable to fire.

In unstable areas or those that have been subject to temporary or definitive stabilisation measures, herbaceous vegetation shall be allowed to develop until the stabilisation process is consolidated, unless otherwise indicated for specific points.

During vegetation clearing, maintenance teams may collect and dispose of waste discarded by third parties on the wayleave. These residues, as well as vegetation residues generated during clearing, shall be disposed of as specified in the **Section 5.4** of this Programme.

5.7. Protection of the Wayleave

In accordance with TANESCO's guidelines, all crops grown in the 52-metre-wide wayleave will be removed, compensated to the respective owners and may no longer be grown during the operational phase. The guideline is that the wayleave must remain completely free, without any type of cultivation, even those of low height, such as maize, sorghum, millet, rice, wheat, beans, and others.

Therefore, this measure is aimed at monitoring the wayleave to ensure that it is not occupied by any type of planting, especially reforestation with pines, cypress, eucalyptus and teak trees, which are tall and could jeopardise the safety of the TLs.

In addition to cultivation and reforestation, any type of physical installations (housing and other improvements such as irrigation pivots and equipment) is also prohibited in the area of the wayleave.

To guarantee this condition of the wayleave, TANESCO will carry out periodic inspections during the operating phase. All inspections will be carried out annually by any member of the TANESCO team and will include verification of any irregular activity or use within the wayleave. Procedures for notifying the responsible person (landowner, occupant or others) will be defined on a case-by-case basis.

In sections where the route intersects more occupied regions, there is a risk of irregular encroachment into the wayleave. However, any situation requiring the relocation of families, especially vulnerable people, will always be carried out with the participation of the districts, wards or villages authorities, as appropriate.

5.8. Social Communication During the Operation

The communication measures to be adopted in the operation phase are set out in the SEP (P.12).

5.9. Emergency Response Plan (ERP) Framework for the Operation Phase

TANESCO shall comply with the following guidelines for the preparation of its Emergency Response Plans (ERP) for the operation phase:

<u>Risk Assessment</u>

TANESCO will be required to implement a hazard identification to evaluate potential sources of emergencies, such as technical failures, fires, explosions, and natural disasters. Risk assessment will include a review of existing hazards and their associated risk control measures. As a result, new risk control measures (or changes to existing risk control measures) may be identified for consideration, both where there are gaps in existing procedures and where risk controls need to be enhanced. A vulnerability assessment will determine the most susceptible areas and potential impacts on infrastructure and personnel.

Organizational Structure

TANESCO will assign a team responsible for emergency management. Roles and Responsibilities of each team member will be clearly defined, including the emergency manager, coordinators, and response brigades.

Emergency response Procedures

The ERP for the operation phase to be prepared by TANESCO, will define a set of Emergency Action Procedures with clear instructions to be adopted in the case of the following accidental hypotheses:

- Storms and Severe Winds: can cause damage to transmission lines and towers.
- Flooding: can affect tower bases and cause short circuits.
- Earthquakes: can topple towers and damage infrastructure.
- Landslides: especially in mountainous areas, they can destabilize towers.
- Forest Fires: can damage lines and cause power outages.
- Pollution: spills of transformer oil and other hazardous materials.
- Impact on Fauna and Flora: damage to local biodiversity due to the operation of transmission lines.
- Accidents involving the community: electrical shock from contact with transmission line cables or other energized equipment. Traffic accidents with project vehicles; falling cables or towers; improper entry into risk areas, etc.
- Social Conflicts: protests or disturbances affecting the operation of the lines.
- Medical Emergencies and First Aid: emergency situations, work accidents or accidents involving the community that result in injuries and require prompt medical attention by the project.

Emergency Response Provisions

The following requirements must be incorporated when drawing up emergency response procedures:

- Fire and emergency alarm systems that are both audible and visible
- Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.
- Evacuation Routes and Emergency Exits: Evacuation routes and safe meeting points. Standard Operating Procedures (SOPs) should be developed for equipment shutdown, including an evacuation plan. Emergency exits should always be unobstructed and clearly marked to be visible in total darkness.
- First Aid: Training and resources for immediate medical attention. TANESCO should ensure that qualified first aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work.

- Area signage and labelling of risk equipment and electrical circuits: Hazardous areas (electrical rooms, etc.), installations, materials, safety measures, and emergency exits, etc. should be marked appropriately.
- Remote sites: should have written emergency procedures in place for dealing with cases of trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.
- Equipment Failure: a transformer failure at a substation causes a fire. Immediate Actions include to activate fire suppression systems and isolate the affected area.
- Contact List: for each critical facility, TANESCO will develop a list of contact information for all internal and external resources and personnel. The list should include the name, description, location, and contact details (telephone, email) for each of the resources, and be maintained annually.

Other Specific World Bank Requirements

The following are the main requirements established by the WB/IFC General EHS Guidelines, 2007, which must be observed by TANESCO during the process of drawing up emergency action plans:

Fire Precautions and Provisions

The workplace should be designed to prevent the start of fires through the implementation of fire codes applicable to industrial settings. Other essential measures include:

- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment, particularly in the substations. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.
- Provision of manual firefighting equipment that is easily accessible and simple to use Fire and emergency alarm systems that are both audible and visible.

TANESCO should ensure that fire extinguishers in sufficient number and type for initial firefighting. Designing of the firefighting system and emergency response provisions both for transmission line and substations will comply with the following international codes and standards:

- The IFC Life and Fire Safety Guideline should apply to TANESCO operational buildings.
- NFPA 850: Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations.
- NFPA 70: National Electrical Code (NEC), which includes guidelines for electrical installations and safety.
- NFPA 72: National Fire Alarm and Signalling Code, which covers the installation, performance, and maintenance of fire alarm systems.
- IEEE 979: Guide for Substation Fire Protection.

- IEEE 1584: Guide for Performing Arc-Flash Hazard Calculations, which helps in assessing the risk of arc-flash incidents in electrical substations.
- UNECE International Fire Safety Standards (IFSS) provide common principles for fire safety, including strategies and measures for ensuring the safety of buildings and infrastructure.

As required by WB/IFC General EHS Guidelines, 2007, TANESCO should consider the level of local firefighting capacity and whether equipment is available for use at facilities such as the Substations, in the event of a major emergency or natural disaster. If insufficient capacity is available, firefighting capacity should be acquired that may include pumps, water supplies, trucks, and training for personnel.

Carbon Dioxide (CO_2) extinguishers for electrical fires as they displace oxygen and cool the fire without leaving residue. Dry Chemical Powder Extinguishers for electrical fires, as they interrupt the chemical reaction of the fire.

Inert Gas Systems using gases like Argonite or Inergen to suppress fires by reducing oxygen levels. Synthetic Gas Systems like Novec 1230 is a common choice, effective and environmentally friendly.

Specific PPE to deal with fire such as heat-resistant clothes, gloves, helmet, respirators, safety goggles shall be provided.

Particularly in the substation areas, fire detection systems, smoke detectors and alarms should be installed. The installation of heat detectors, capable of detecting rapid temperature rises, should also be considered. Automatic Shut-Off Systems to cut power in case of fire, reducing the risk of electrical hazards, must also be in place. These should be displayed on fire alarm panels, which should be part of TANESCO's centralized control for monitoring and alerting.

Personal Protective Equipment (PPE) may include but not limited to: (i) insulated gloves to protect against electrical shocks; (ii) flame-resistant clothing to protects against heat and flames and appropriated safety helmets. Additional equipment may include: (i) fire blankets for smothering small fires; (ii) non-conductive rescue hooks for safely removing individuals from electrical sources; (iii) sand buckets, for extinguishing small fires and absorbing spills; (iv) fire hoses, equipped with nozzles suitable for electrical fires.

First Aid and Emergency Medical Support

TANESCO must have paramedics on standby who are properly trained to deal with the main scenarios of medical emergencies and first aid, particularly accidents related to falls from a height and electrical discharges.

Training and resources for immediate medical attention must be implemented. TANESCO should ensure that qualified first aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work.

TANESCO should also provide first aid attendants for the facility as well as medical equipment suitable for the personnel, type of operation, and the degree of treatment likely to be required prior to transportation to hospital. The general first aid kit for the operation phase should include but not be limited to the following items:

- Adhesive bandages (various sizes)
- Sterile gauze pads and rolls
- Antiseptic wipes and solutions
- Medical adhesive tape
- Scissors and tweezers
- Disposable gloves
- CPR mask or pocket mask
- Thermal blanket
- Instant cold packs
- Burn dressings and gel

Considering the high exposure to working with electrical hazards during operations, TANESCO must have some of the following equipment for rescue and first aid:

- Non-conductive rescue hook or shepherd's crook
- Insulated gloves
- Burn treatment supplies (e.g., burn sheets, hydrogel dressings)
- Automated External Defibrillator (AED)
- Cardiopulmonary resuscitation (CPR) equipment (e.g., bag valve mask)

Considering the high exposure to working at heights during operations, TANESCO must have some of the following equipment for rescue and first aid at heights:

- Rescue harnesses
- Ropes and carabiners
- Pulleys and descenders
- Fall arrest systems
- Spinal board and cervical collars
- Splints (for fractures and immobilization)
- Evacuation chair or stretcher

Monitoring and diagnostic tools may include, but are not limited to:

  - Stethoscope
  - Blood pressure cuff
- Pulse oximeter
- Thermometer

Ambulance Equipment

The number of ambulances must be sufficient to quickly attend to all the work fronts being carried out simultaneously. TANESCO and its operation subcontractors (if any) must ensure that the ambulance is fully equipped with essential medical equipment, such as:

- ECG Monitor and Defibrillator: For monitoring vital signs and managing cardiac emergencies.
- Spinal Board: For immobilizing patients with suspected spinal injuries.
- Transport Ventilators: For patients who cannot breathe independently.
- Suction Units: For clearing airways in cases of internal bleeding or vomiting.
- Infusion Syringe Pumps: For administering medications and fluids.
- First Aid Kits: Stocked with bandages, antiseptics, and other basic supplies.

Training

Training programs and practice exercises provide for testing systems to ensure an adequate level of emergency preparedness. Training programs should:

- Identify training needs based on the roles and responsibilities, capabilities and requirements of personnel in an emergency.
- Develop a training plan to address needs, particularly for firefighting, spill response, and first aid and evacuation.
- Conduct annual training, at least, and perhaps more frequent training when the response includes specialized equipment, procedures, or hazards, or when otherwise mandated.
- Provide training exercises to allow personnel the opportunity to test emergency preparedness, including: (i) Desk top exercises with only a few personnel, where the contact lists are tested and the facilities and communication assessed; (ii) Response exercises, typically involving drills that allow for testing of equipment and logistics; (iii) Debrief upon completion of a training exercise to assess what worked well and what aspects require improvement.

Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the employer adequate training documentation before start of their assignment.

Internal and External Communication

Communication protocols within the organization must be in place and also coordination with local emergency services and other interested parties. Emergency Notification Systems should include a Worker Notification Systems, using automated systems to quickly alert all employees and TANESCO clients via text, email, and phone calls. Public Address Systems for immediate, widespread announcements within the facility should also be implemented.

Review and Update

Emergency preparedness facilities and emergency response plans require maintenance, review and updating to take account of changes in equipment, personnel and facilities. Periodic review of the plan to identify areas for improvement should be carried out at least once a year. Updating can include necessary modifications based on new threats or changes in infrastructure.

Documentation and Disclosure

TANESCO will be required to maintain detailed records of all activities related to emergency preparedness and response and inform all employees and interested parties about the plan and its updates.

For each emergency event, an Environmental Incident Report - EIR shall be prepared by TANESCO, which shall contain at least the following information:

- Incident identification;
- Date, time and day of the week of the incident;
- Incident location;
- Description of third-party participation;
- Victims, including names and place of assistance;
- Affected areas, discriminating zones of protection of water sources, adjacent forests, etc.;
- Structures affected;
- Equipment used in the assistance;
- Cause(s), discriminating between:
  - Natural / induced;
  - Equipment failure;
  - human failure;
  - Failure of containment structures;
  - Failure of the facilities;
  - Other (specify).
- Personnel involved in the assistance:
  - Internal: members of the fire brigade, engineer and occupational safety technician, and others;
  - External: Tanzania Fire and Rescue Force (TFRF), NEMC, etc.
- Additional information from the report:
  - Description of the accident or incident, including types of human error and other data for better understanding;
  - Provisions / consequences, briefly reporting the actions taken to neutralize the damage to safety and the environment;
  - Information on the disclosure of the accident / incident (if it was public knowledge);
  - Preventive measures necessary to prevent similar incidents.
- Information on the person responsible for the report.

5.10. Audible Noise Monitoring

The basic project of the TLs considered the audible noise at the limit of the wayleave at the maximum operating tension, as 50.03 dB in heavy rain and 39.25 with wet conductor (see **Section 5.1**).

In the operation phase, TANESCO will monitor the audible noise to confirm the levels at the limit of the wayleave. The monitoring points will be the sections of the TL where the occupations are very close to the wayleave. In addition, measurements will have to be taken around the SSs' expansion areas, where the greatest increases in noise are expected due to the operation of the equipment. It is therefore recommended that the same points be monitored as the noise monitoring to be carried out by TANESCO during the construction phase (see **Section 11.3** of the **Environmental and Social Monitoring Plan** (**Chapter 11.0**) .

Although by the end of construction there will already be a database of noise levels at each point (23 monitored during construction, 8 of which were also measured for the base line), it is recommended that a measurement campaign be carried out before the system is energized, and another in the first month of operation, covering all the points.

As the operation of the TLs and SS will be continuous, the measurements will be carried out at night. The results of these measurements will be compared to the limits established in Tanzanian Environmental Management (Standards for the Control of Noise and Vibrations Pollution, 2015) and in the IFC General EHS Guidelines, and the highest value should be considered for the constitution of the Baseline (campaign before energization). The result of the comparison between the campaigns before and after energization will make it possible to verify the need for alternative mitigation studies.

In the case of complaints received through the Grievance Mechanism planned as part of P.12 – Stakeholder Engagement Plan (SEP), other points may be added to the planned campaign or may require re-measurement.

In this case, the measurements will be carried out under the conditions and times reported by the complainant, and must be performed by a specialised team.

5.11. Electromagnetic Field Monitoring

There is no specific national law in Tanzania that obliges transmission line concessionaires to measure electromagnetic fields. However, the Tanzania Atomic Energy Commission (TAEC) and the Energy and Water Utilities Regulatory Authority (EWURA) follow international guidelines to ensure that measurements are made as necessary to protect public health. These measurements are based on International Commission on Non-Ionising Radiation Protection (ICNIRP) recommendations, and compliance is monitored by the regulatory authorities.

Although there is no evidence that the Electric Field and Magnetic Field (EMF) pose a health risk to DAI residents, during the consultation activities in the villages, it was clear

that one of their concerns are the potential impacts on health from the electricity transmission.

For this reason, this measure is proposed for the Project, through which the EMF will be measured in a single campaign to confirm the following values, considered in the basic project of the Project's TLs, at the wayleave boundary (see **Section 5.1** of this ESIA):

- Electric field = 2.09 kV/m
- Magnetic field = 3 μT

It is recommended that the measurement campaign be carried out during the first month of full operation. The measurements of EMF shall be made inside the Nyakanazi SS, Kyaka SS and Ibadakuli SS, to assess the exposure of the occupational population, and at the perimeter of each SS to verify the exposure of the general public, as well as inside the wayleave to assess the occupational exposure of the maintenance workers, and at the boundary of the wayleave, where there are occupations closer to its limit, to verify the exposure of the population (the points can be the same as those used in the noise measurements of the previous measurement).

The measured values shall be compared with the reference levels set by ICNIRP, which are shown in the following **Table 5.11.a**.

Table 5.11.a of P.03
Reference levels established by ICNIRP and recommended by WHO

	TLs with a frequency of 50 Hz	
	Electric field (kV/m)	**Magnetic field (μT)**
Population	5.00	200.00
Workers	10.00	1000.00

In addition to the measurement, it will be necessary to implement educational and communication activities where information is provided regarding if the Project poses any risk to health and safety, explain the monitoring done, the results and its implications. This information will first be shared with the wards and villages authorities, agreeing with them the best way to reach the general population.

5.12. Access Control Plan

In the operation phase, TANESCO will evaluate the accesses that were opened by the Project and that will be maintained after the end of the works, for maintenance of the TLs, and will identify those that correspond to facilitating access to areas of preserved native vegetation remnants and that before the opening of these accesses were inaccessible to the population. Control will be established on these paths to prevent access by the population, in order to prevent the degradation of the fragments through illegal logging.

The result of this analysis will have to be consolidated into an Access Control Plan, which will also include a proposal for the most feasible ways of establishing this control, including the installation of a padlocked gate.

For accesses in areas of greater risk to biodiversity, TANESCO should evaluate the possibility of not maintaining this access for maintenance of the TL, closing and recovering it, and checking another alternative form of access through areas of lower risk.

5.13. Community Health and Safety

Health Risks during operation include mainly electromagnetic fields (EMFs) and noise. Safety risks normally include electrical hazards and fire that may be induced by the TL operation or during an operational incident. These will be prevented mainly through engineering measures adopted by international safety standards for electrical installations, which will be incorporated into the design of the TLs and SS, mainly through safety distances, access control to risk areas and risk warning signs.

Community emergency scenarios involving fires that may have been caused by the operation of the transmission line and that jeopardise its operation and the surrounding community will be addressed by the ***Operation Emergency Response Plan (ERP)***. Similarly, accidents involving the community, such as falling cables or towers, electric shock from contact with transmission line cables or other energised equipment, as well as traffic accidents with project vehicles, including social conflicts such as protests or disturbances that affect the operation of the lines, will also be dealt with by the operation ERP.

The ***monitoring of electromagnetic fields***, as proposed in measure 5.11, will be carried out in a single campaign at the start of full operation of the TLs, since, although there is no significant evidence of negative effects on human health caused by EMF, the population expressed this concern in the consultations carried out, and it is important to have at least one measurement as evidence of the absence of impact.

Regarding ***noise***, it will be part of the operational monitoring programme (see measure 5.10) and the results of this monitoring, based on international standards, must be disseminated to the community in the manner defined in the Stakeholder Management Plan (SEP).

During consultations and engagement with stakeholders, a major concern reported in these interviews that children climb the transmission towers, causing the risk of falling or electrocution. To mitigate this risk, TANESCO will implement ***awareness campaigns in schools and communities*** about the restrictions on the use and occupation of the right-of-way, as well as the risks inherent in the operation of transmission lines and electrical substations, as well as the measures that should be taken in the event of emergencies involving falling towers and wires, fires, etc. Special emphasis should be placed on the prohibition and serious risks of people climbing transmission towers.

TANESCO will implement appropriate ***hazard warning signs at operational facilities***, including mainly transmission towers and electrical substations, in accordance with local and international standards. This signage shall include visible and clear warning signs informing about the dangers of climbing towers or entering electrical substations. They must include danger symbols and messages in the local language, positioned in strategic locations around the operational facilities.

On a best effort basis, TANESCO will implement ***tower designs that make it difficult for people (i.e. children or others) to climb***. This will include Anti-Climbing Devices, which can consist of spikes and Barbed Wire Rolls that can be installed on the lower parts of the towers. These should be installed at a height that prevents climbing but does not cause serious injury.

6. Performance Indicators

The indicators of this Programme are:

Measure	Indicators
Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase	• Execution of campaigns and other activities of operational phase ESMP Plans and Programmes at the required periodicity • Number of operational phase ESMP Plans and Programmes reports issued within schedule • Consolidation of evidence and progress information from all operational phase ESMP Plans and Programmes
Environmental Training of the Maintenance Team	• Frequency of O&M team training events and number of participants
Monitoring of Recovered Areas	• Time elapsed between the start of the operation and the full recovery/recomposition of degraded areas
Waste Management	• Periodic inventories of waste generated in the operation and waste transportation manifests
Maintenance and Erosion Control	• Evidence of inspections along accesses and wayleave at the required frequency • Evidence of the application of stabilization measures in relation to the total number of erosions identified
Vegetation Management on the Wayleave	• Evidence of periodic pruning
Protection of the Wayleave	• Occurrence of encroachment on the wayleave by third parties
Social Communication During the Operation	• Number of consultations and complaints received through the Grievance Mechanism of the operation phase, under the SEP • Compliance and response rate within the specified timeframe according to the complexity of the complaint • Number of wards and villages reached with information on the electromagnetic field monitoring
Emergency Action Plan for the Operation Phase	• Response time in case of environmental emergencies
Audible Noise Monitoring	• Evidence of noise monitoring at the required frequency and at the total number of points proposed • Evidence of attenuation measures in the event of parameters exceeding the limits • Number of complaints related to audible noise received through the Grievance Mechanism

Measure	Indicators
Electromagnetic Field Monitoring	• Evidence of Electromagnetic Field campaign on the proposed date and at the total number of points defined
Access Control Plan	• Evidence of preparation of the Access control plan • Number of points with access control in relation to the total number established in the Access control plan • Evidence of illegal deforestation in areas accessed through the paths opened and maintained by the project
Community Health and Safety	• Number of awareness campaigns in schools and communities carried out in relation to the total planned

7. Reports and Documentation

The following documents / reports should be prepared / filed:

- Photographic records and attendance list of training events applied to maintenance personnel;
- Annual inspection to detect erosion and correction measures adopted;
- Annual inspection to detect encroachments on the wayleave;
- Evidence of solid waste management;
- Evidence of periodic clearing vegetation along the wayleave;
- Records of consultations, suggestions and complaints received by TANESCO during operation;
- Emergency action plan, reviewed annually;
- Report of audible noise measurements, including at least the methodology used, the applicable legislation, a map showing the measurement points, a photographic record of the measurements, results, conclusions and recommendations, and attenuation measures adopted, if necessary;
- Report of electric and magnetic field measurements, including at least the methodology used, the applicable legislation, a map showing the measurement points, a photographic record of the measurements, results, conclusions and recommendations, and the person responsible for the report;
- Evidence of access control at the points defined in the Access control plan.
- Evidence of awareness campaigns in schools and communities provided for in measure 5.13 and their results.
- Monitoring reports of the Environmental Management Programme of the Operation Phase, to be prepared and sent annually to NEMC, or at other intervals to be defined by the institution.

8. Schedule

The Programme will remain active for the life of the Project. Some measures will have specific periodicities, as follows:

- Annual training of the maintenance team;

- Continuous erosion monitoring at service accesses and annual inspections by maintenance team;
- Monitoring and necessary maintenance actions in the recovered areas during the first year of operation or until stabilisation;
- Annual inspection along the wayleave to identify possible encroachments and irregular constructions;
- Measurement of audible noise before energization, in the first month of operation and whenever a complaint related to this issue is registered in the Grievance Mechanism;
- Measurement of electric and magnetic fields in the first month of operation.

P.04 - Construction Emergency Preparedness and Response Plan

1. Justification

The Construction Environmental Plan (CEP) provides procedures to mitigate or prevent impacts during construction and operation of the project. However, emergency situations may arise in which the and construction company must be prepared to act quickly. The **Construction Emergency Preparedness and Response Plan** will minimize the environmental and health consequences to workers and the community of any accidental scenario through rapid and effective emergency action.

2. Main Objectives

The objective of the Construction Emergency Preparedness and Response Plan is the establishment of technical and administrative procedures for immediate, disciplined and efficient actions, through the use of trained manpower and appropriate equipment and materials to be applied in any emergency situation. The main objective is, in case of accident or disaster, to obtain a quick and effective action aimed at preserving lives, preventing or minimizing the destruction of the project, protecting the neighbouring communities and the environment of the region.

The objective of this Plan is also to communicate to all those involved about operational accidents and the accidental release of contaminants, as well as occurrences that may endanger the population, workers and the environment.

This Construction Emergency Preparedness and Response Plan includes:

- Description of the emergency or disaster scenarios considered;
- The organs to be involved according to the type of situation;
- The logical sequence of actions to be implemented in each case;
- The equipment and material and technical resources that the contractor and its subcontractors must have to support emergency actions;
- The delimitation of responsibilities.

3. Applicable Legislation

- *Tanzania Emergency Preparedness and Response Plan (TEPRP):* The TEPRP is a comprehensive plan developed by the Disaster Management Department (DMD) in the Prime Minister's Office. It provides guidelines for coordination and response to all types of disasters and emergencies at all levels of government. The TEPRP conforms to the Disaster Relief Coordination Act, No. 9 of 1990, and the National Operational Guidelines for Disaster Management (NOG).
- *Disaster Relief Coordination Act, No. 9, of 1990*. Establishes a comprehensive framework for managing disaster situations, through the Tanzania Disaster Relief Committee (TANDREC) and the Disaster Prevention Subcommittee to oversee and coordinate disaster relief efforts. The Act covers both natural and man-made disasters, including earthquakes, floods, droughts, fires, epidemics, and civil disturbances.
- *National Operational Guidelines for Disaster Management (NOG)*. Outlines the roles and responsibilities of various stakeholders, including government ministries, departments, non-governmental organizations, international agencies, and volunteer organizations.
- *Occupational Health and Safety Act* No. 5, *2003:* This Act aims to ensure the safety, health, and welfare of workers in all workplaces, including camp sites. Employers are required to implement safety measures, conduct risk assessments, and develop emergency response plans to protect workers from potential hazards.
- *Environmental Management Act, 2004:* This Act provides a legal framework for sustainable management of the environment, including the prevention and control of environmental hazards. It mandates the development of emergency response plans for environmental incidents, such as spills and pollution, which could impact construction projects.

International

- World Bank ESS 1 - Assessment and Management of Environmental and Social Risks and Impacts
- World Bank ESS 2 - Labor and Working Conditions
- World Bank / IFC General EHS Guidelines, 2007
- World Bank / IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, 2007

4. Responsibilities

The Contractor shall be responsible for implementing the Construction Emergency Preparedness and Response Plan. TANESCO shall be responsible for supervision, verifying compliance with the requirements set out in this plan. The Contractor shall structure the construction emergency preparedness and response team according to the key positions detailed below:

Team Coordinator

- *Role:* The Team Leader is responsible for overall coordination and management of the emergency response.
- *Responsibilities:* Command and Control: Lead the emergency response team and make critical decisions during an emergency.
- *Situation Assessment:* Assess the situation and determine the appropriate response actions.
- *Resource Allocation:* Allocate resources and personnel as needed to manage the emergency.
- *Liaison:* Act as the primary point of contact with external agencies, such as local authorities and emergency services.
- *Documentation:* Ensure all actions and decisions are documented for post-incident review.

First Aid Coordinator

- *Role:* The First Aid Officer provides immediate medical care to injured individuals.
- Responsibilities:
- *Initial Assessment:* Quickly assess the condition of injured individuals and provide appropriate first aid.
- *Stabilization:* Stabilize patients using first aid techniques, such as CPR, bleeding control, and fracture management.
- *Medical Supplies:* Ensure first aid kits are stocked and accessible.
- *Training:* Conduct regular first aid training sessions[1] for team members and workers.
- *Coordination with Medical Services:* Coordinate with ambulance services and hospitals for the transport of injured individuals.

Fire Safety Coordinator

- *Role:* The Fire Safety Officer is responsible for fire prevention and response.
- *Responsibilities:* Fire Prevention: Implement fire safety measures, such as regular inspections and maintenance of fire extinguishers and alarms.
- *Fire Response:* Lead the response to fire incidents, including the use of fire extinguishers and evacuation procedures.
- *Training:* Conduct fire safety training and drills for workers.
- *Coordination with Fire Services:* Liaise with local fire departments to ensure a coordinated response.
- *Risk Assessment:* Identify potential fire hazards and implement mitigation measures.

[1] The Occupational Safety and Health Authority (OSHA) in Tanzania provides comprehensive first aid training to ensure workplace safety and preparedness.

Communication Coordinator

- *Role:* The Communication Officer manages all communication during an emergency.
- *Responsibilities:* Internal Communication: Ensure clear and timely communication within the emergency response team and with workers.
- *External Communication:* Communicate with external stakeholders, including local authorities, emergency services, and the community.
- *Public Information:* Disseminate accurate information to the public and media as needed.
- *Notification Systems:* Maintain and operate emergency notification systems, such as alarms and public address systems.
- *Documentation:* Record all communication activities for post-incident review.

Logistics Coordinator

- *Role:* The Logistics Coordinator manages the resources and logistics required during an emergency.
- *Responsibilities:* Resource Management: Ensure the availability and distribution of necessary resources, such as medical supplies, PPE, and emergency equipment.
- *Transport Coordination:* Arrange for the transport of injured individuals to medical facilities and the movement of resources to the emergency site.
- *Supply Chain Management:* Maintain relationships with suppliers to ensure a steady supply of emergency materials.
- *Facility Management:* Ensure that emergency facilities, such as assembly points and shelters, are prepared and maintained.
- *Inventory Control:* Keep an updated inventory of emergency supplies and equipment.

Concerned Local Authorities

- *District Councils:* Responsible for implementing disaster management plans and coordinating relief efforts at the district level.
- *Municipal Councils:* Focus on urban areas, ensuring that cities and towns are prepared for and can respond to emergencies.
- *Ward and Village Committees:* These grassroots-level committees play a crucial role in community-based disaster risk management and response.

5. Methodology

5.1 Risk Assessment

The main contractor and its relevant subcontractors, according to their scopes of work, will identify what can go wrong, how it can happen and what the possible consequences are using techniques such as brainstorming, checklists, interviews, and historical data analysis to identify risks, recording them in a Risk Register, detailing their sources, potential events, and possible impacts.

A Risk Analysis will be performed to understand the nature of the risk and its characteristics, including the likelihood and potential impact. Qualitative analysis should be carried out to assess risks based on descriptive scales (e.g. high, medium, low), defining parameters for their severity and probability, in order to develop and implement strategies to manage risks, through detailed action plans specifying the steps, responsibilities, and timelines for risk treatment.

5.2. Emergency Preparedness and Response Procedures (EPR)

As a result of implementing the risk Assessment process described above, the following risk scenarios should be considered.

- Landslide with sedimentation of watercourses and impact on vegetation.
- Emergency Action Plan in case of spillage of hazardous products into watercourses and on land.
- Emergency action plan for fires / explosions.
- Emergency action plan for extreme events, such as storms, floods, and tornadoes.
- Emergency evacuation.
- Medical emergencies and first aid.
- Accidents involving the community.

The bodies or entities that can be activated vary according to the hypothesis considered. However, depending on the accidental hypotheses considered, the following entities, bodies or intervening elements can be preliminarily considered:

- TANESCO
- NEMC
- Disaster Management Department (DMD)
- Hospitals, ambulance service and first aid brigade
- Tanzania Forest Service (TFS)
- Tanzania Fire and Rescue Force (TFRF)
- Tanzania Red Cross Society (TRCS)
- Water User Associations (WUAs).
- Tanzania Meteorological Authority (TMA)
- Concerned Local Authorities

Based on the emergency scenarios listed above, general guidelines have been formulated as following, which should be detailed by the contractor when drawing up and/or adjusting their Emergency Action Plans.

Preliminary Standard Emergency Action Plans

5.2.1. EPR in case of Landslide with sedimentation of watercourses and impact on vegetation

The purpose of this **Construction Emergency Preparedness and Response Plan** is to define actions to address accidental events involving landslides with sedimentation of watercourses and impact on vegetation.

Resources required

- Plastic or tarpaulin to cover the slide, and the respective fasteners;
- Polypropylene bags for the formation of dikes or other erosion containment devices;
- Shovels and wheelbarrows;
- Excavators;
- Backhoe loaders;
- Dump trucks;
- Signalling equipment (cones, tapes, plastic fences);
- Victim rescue equipment (stretcher, first aid, etc.).

Organs to be activated

- TANESCO
- Water User Associations (WUAs)
- Disaster Management Department (DMD)
- NEMC

Procedures

This Emergency Action Plan will be implemented with the support of the existing communications systems at the construction fronts and camps. Any situation that represents an imminent risk, as well as any accidental event contemplated in this Plan, will be immediately communicated to the person responsible for the camp or construction front, which will activate the Emergency Team Leader.

The procedures to be adopted in the event of a landslide with sedimentation of watercourses and impact on vegetation are as follows:

1. After identifying the landslide, the person responsible for the work front will isolate the area and prohibit access;
2. Communication with the Emergency Team Leader, Communication and Logistics Coordinator with a description of the size and severity of the situation;
3. Communication to TANESCO's environmental supervision and monitoring team;
4. Inspection of the area to identify imminent preliminary risks of other landslides;
5. Verification of downstream occupied areas at risk of being affected;
6. Provide rescue of affected fauna, when appropriate;

7. Verification of the dimensions of the landslide and damage to vegetation and watercourse reached;
8. If vegetation has been affected, inform the NEMC;
9. Technical inspection by a qualified professional (geologist or geotechnical engineer) to assess the risk of landslide aggravation;
10. Emergency (temporary) stabilization of unstable areas (tarpaulins, bags, other measures);
11. After the release of the areas, final stabilization, removal of the transported material and cleaning of the watercourses affected by the landslide;
12. If necessary, recomposition of the affected vegetation.

5.2.2. EPR in Case of Spillage of Hazardous Products on Watercourses and on the Ground

The purpose of this **Construction Emergency Preparedness and Response Plan** is to define actions to respond to accidental events involving the release of hazardous products into watercourses and soil during construction activities.

Resources required

- Containment barriers;
- Industrial absorbents;
- Swabs for fuel/oil collection;
- Barrels to receive collected fuel/oil or contaminated soil;
- Absorbent foam for fuel and/or lubricant leaks in sufficient quantity.

Organs to be activated

- TANESCO
- Disaster Management Department (DMD)
- Tanzania Fire and Rescue Force (TFRF)
- NEMC
- Water User Associations (WUAs)
- Tanzania Fire and Rescue Force (TFRF)
- Concerned Local Authorities

Procedures

This Construction Emergency Preparedness and Response Plan will be implemented with the support of existing communications systems at camp sites and work fronts. All leaks of fuels and/or hazardous products will be reported immediately to the person responsible for the camp site or work front, which will activate the Emergency Team Leader.

The procedures to be adopted in case of spillage of hazardous products on watercourses and on the ground are as follows:

1. Immediate stoppage of the activities that gave rise to the leak, as appropriate (pumping, unloading, others);
2. Elimination of all nearby ignition sources (turn off vehicles and equipment);
3. Identification of the leakage point and detention when possible (broken hoses, tanks, others);
4. After the above initial actions, the person responsible for the work front will isolate the area and prohibit access;
5. Identification of the spilled product using the MSDS;
6. Communication with the Emergency Team Leader with a description of the size and severity of the situation;
7. Activation of the NEMC and Tanzania Fire and Rescue Force (TFRF) if necessary;
8. Communication to TANESCO's environmental supervision and monitoring team;
9. Activation of the trained service team and fire brigade;
10. Identification of the points reached by the leak/spill, including land areas and water bodies;
11. After assessing the situation, the trained team, equipped with the necessary PPE, will carry out the appropriate measures;
12. Implementation of containment measures followed by absorption and placement of spilled products in drums or other devices.
13. Implementation of containment measures with floating barriers, followed by absorption (or pumping suction) procedures.
14. When the leakage reaches the margins of water bodies, the sensitivity index, the type of margin affected and the possible consequences of the contamination will be identified.
15. If a spill reaches water bodies where there are users downstream, it is very important to report the emergency to the Water User Associations (WUA).
16. Implementation of remediation procedures, including scraping and stockpiling of contaminated soils and clean-up of the margins reached through the application of industrial absorbents and other measures that the manufacturer of the spilled product may indicate.
17. In case the leak/spill reaches the ground, industrial absorbents shall be applied in the area of the leak/spill;
18. All absorbents and contaminated soil should be packed in appropriate drums and then sent to treatment, recycling or disposal companies.

5.2.3. EPR for Fires / Explosions

This Emergency Action Plan is intended to define sequential actions to respond to accidental events involving fires in the project areas, followed by explosion or reaching the surrounding forests.

Resources required

- Fire extinguishers in sufficient number and type for initial firefighting;
- Tank truck or towable water tank;
- Tractor to make emergency firebreaks.

- Fire warning sirens;
- Specific PPE: gloves, helmet, respirator, chemical safety goggles;

Organs to be activated

- TANESCO
- Tanzania Red Cross Society (TRCS)
- Tanzania Fire and Rescue Force (TFRF)
- Disaster Management Department (DMD)
- NEMC
- Hospitals, ambulance service and first aid brigade
- Concerned Local Authorities

Procedures

This Emergency Action Plan will be implemented with the support of the existing communications systems at the camp sites and work fronts. All fires will be reported immediately to the person responsible for the camp or construction front, which will activate the Emergency Team Leader and Fire Safety Coordinator.

The procedures to be adopted in case of fire/explosion are as follows:

1. Upon identifying the fire, communicate to the Emergency Team Leader and Fire Safety Coordinator with a description of the size and severity of the situation;
2. Removal of victims (if any);
3. Actuation of emergency medical care according to the nature of the injuries;
4. Activation of the Tanzania Fire and Rescue Force (TFRF) as pertinent and the contractor's/executing company's fire brigade (in the construction phase);
5. Isolation of the area within a radius of at least 300 (meters) if there is an explosion, with only members of the service teams remaining near the site;
6. Transfer to the location of the water truck and tractor for firebreak implementation;
7. Initial combat with water and use of manual shock absorbers;
8. Cooling (laterally with water) of equipment exposed to flames, even after extinguishing the fire;
9. Execution of the emergency firebreak around the burned area using the tractor, where the topography allows it;
10. Monitoring of brazier reactivation situations;
11. Elimination of nearby flammable materials that could be affected by fire;
12. In case of fire affecting forest areas, inform the NEMC.
13. In case of fire affecting homes or public/institutional buildings, inform the Disaster Management Department (DMD).

5.2.4. EPR for Extreme Events, such as Storms, Floods and Tornadoes

This Emergency Action Plan aims to define actions for the TANESCO team to respond to extreme accidental events in the operation phase of the project, including storms, floods and tornadoes.

The following emergency situations are considered in these events:

- Collapse of transmission line towers under erection due to winds or debris flow;
- Flooding of camp sites and/or work fronts.

Resources required

- Access to data from meteorological and hydrological stations in the project region;
- Communication system for the community adjacent to the transmission line, with a continuous social communication system;
- Wind Speed Monitors to provide real-time data on wind conditions.
- Temporary Bracing Materials such as steel cables, braces, and guy wires to stabilize towers.
- Inflatable flood barriers and sandbags.
- Submersible water pumps for removing water and temporary drainage pipes and channels.
- Personal Protective Equipment (PPE) such as helmets, gloves, safety harnesses, and high-visibility clothing.
- Emergency Communication Devices such as two-way radios for coordination.
- Erosion Control Materials such as retaining walls, sandbags, and erosion control blankets.
- Debris flow barriers such as flexible barriers and nets to catch debris.
- Excavators and bulldozers for clearing debris.
- Portable shelters for workers.
- Waterproof Storage: Containers for protecting equipment and materials.
- Emergency lighting (i.e., portable, battery-operated lights).
- First aid kits, including food, water, blankets, and medical supplies.

<u>Organs to be activated</u>

- TANESCO
- Tanzania Red Cross Society (TRCS)
- Tanzania Fire and Rescue Force (TFRF)
- Disaster Management Department (DMD)
- Tanzania Meteorological Authority (TMA)
- NEMC
- Hospitals, ambulance service and first aid brigade
- Concerned Local Authorities

Procedures

The procedures to be adopted in case of collapse of transmission line towers under erection due to winds are as follows:

1. Upon identifying the approaching of extreme events, such as storms, floods and tornadoes, the Emergency Team Leader, Communication and Logistics Coordinator should be notified with a description of the size and severity of the situation;
2. In these situations, a procedure for monitoring wind conditions should guide the stoppage of activities at height, especially during the erection of towers, including the stoppage of load lifting.
3. In case of collapse of transmission line towers, emergency coordination shall activate the Tanzania Fire and Rescue Force (TFRF) and the nearest fire brigade to the occurrence;
4. Emergency coordination shall communicate the nearest owners of the occurred one;
5. Upon arrival at the site, a reconnaissance shall be performed to verify the occurrence of casualties;
6. Emergency medical care should be triggered depending on the nature of the injuries;
7. In case of fires, the water truck and tractor will be moved to the site for firebreak implementation;
8. The blockade of the access roads, with licence plates and the presence of a traffic/police officer, must be enforced;

The procedures to be adopted in the event of flooding are as follows:

1. Upon identifying the potential risk of flooding of the camp sites and/or work fronts, the Emergency Team Leader, Communication and Logistics Coordinator should be notified with a description of the size and severity of the situation;
2. If a flood warning is issued, evacuate all personnel to designated safe areas immediately. Use pre-identified evacuation routes.
3. Once a flood event has occurred, the electricity must be disconnected immediately (if any);
4. Continuously monitor water levels and ensure that all personnel and assets are accounted for and safe.
5. Activate inflatable water barriers or traditional sandbags to create temporary dams or barriers to redirect floodwaters away from vulnerable areas such as hazardous waste or fuel storage, as well as energized areas or areas with deep excavations.
6. If a critical installation is submerged and needs to be drained quickly, activate the emergency submersible water pumps to remove standing water from flooded areas.
7. Emergency coordination shall activate the Tanzania Fire and Rescue Force (TFRF) and the nearest fire brigade to the occurrence;

8. The traffic officer/National Police shall present alternative local traffic routes while the service is being provided, with guidance to pedestrians and motorists in general;
9. Access to the affected area will only be allowed to TFRF, Police, Rural Patrols, Army, Ambulance, TANESCO and support entities;
10. Upon arrival at the site, a reconnaissance shall be performed to verify the occurrence of casualties;
11. Emergency medical care should be triggered depending on the nature of the injuries;

Whenever periods of ***extreme events such as storms, floods and tornadoes*** are foreseen, the institutions involved will receive warning bulletins.

5.2.5. ERP for Accidents Involving the Community

Resources required

- Updated lists of key contacts, including local authorities and emergency services and exit routes;
- Two-Way Radios for communication between emergency response team members;
- First aid kits.

Organs to be activated

- TANESCO
- Tanzania Red Cross Society (TRCS)
- Tanzania Fire and Rescue Force (TFRF)
- Disaster Management Department (DMD)
- NEMC
- Hospitals, ambulance service and first aid brigade
- Concerned local authorities

Procedures

1. Ensure Safety:
    - Immediately stop all construction activities that contributed to the incident. Secure the accident scene to prevent further injuries.
    - Ensure all personnel are safe and away from potential hazards.

2. Assess the Situation:
    - Quickly assess the condition of the pedestrians and any other injured parties.
    - Identify any immediate dangers such as fire, fuel leaks, or unstable structures.

3. Provide First Aid:
    - Administer first aid to the injured if trained personnel are available.
    - Use first aid kits available on-site.

4. Call for Emergency Services:
    - Dial the local emergency number to request medical assistance, fire services, and police.
    - Provide clear information about the location, nature of the accident, and number of injured persons.

5. Notify Site Management and the Emergency Coordinator:
    - Inform the site manager or supervisor immediately.
    - Provide details of the accident and the current situation.

6. Activate Internal Emergency Team:
    - Mobilize the internal emergency response team (i.e., Team Coordinator, First Aid Coordinator, Communication Coordinator and Logistics Coordinator) to manage the situation.
    - Ensure they are equipped with necessary tools and protective gear.

7. External Notification:
    - Notify Relevant Local Authorities (e.g., Village Officer, other).
    - Contact the local police to report the accident.
    - Notify the Occupational Safety and Health Authority (OSHA) in Tanzania.

8. Inform Project Stakeholders:
    - Notify TANESCO, contractors, and any other relevant stakeholders about the incident.

9. On-Site Management:
    - Restrict access to the accident scene to authorized personnel only.
    - Set up barriers and signage to keep unauthorized individuals away.

10. Document the Incident:
    - Take photographs and videos of the accident scene.
    - Record witness statements and gather all relevant information.

11. Coordinate with Emergency Services:
    - Assist emergency services upon their arrival.
    - Provide them with all necessary information and support.

12. Support for Affected Individuals:
    - Offer counselling and support services to those affected by the accident.
    - Ensure ongoing support for injured persons during their recovery.

5.2.6. Evacuation Plan

Resources required

- Two-Way Radios for communication between emergency response team members.
- Audible warning system.
- Updated lists of key contacts, including local authorities and emergency services and *exit routes*.
- Stretcher to remove the injured. Rigid boards used to immobilize patients with suspected spinal injuries.
- Cervical Collars: Soft or hard collars used to stabilize the neck and prevent further injury.
- Splints: Devices used to immobilize broken or injured limbs. They can be made of various materials, including metal, plastic, or inflatable materials.
- Ambulance service and/or a dedicated vehicle.

Organs to be activated

- TANESCO
- Tanzania Red Cross Society (TRCS)
- Hospitals, ambulance service and first aid brigade
- Concerned local authorities

Procedures

1. As soon as an emergency is detected, activate the alarm system to alert everyone in the building and/or in the work front. This can include fire alarms, sirens, or announcements.
2. Communication with the Emergency Team Leader, Communication and Logistics Coordinator and First Aid Coordinator with a description of the size and severity of the situation;
3. Depending on the severity of the emergency and the need for medical assistance outside the camp site, the Communications and Logistics Coordinator and the First Aid Coordinator will call the ambulance service to request an emergency medical rescue.
4. In cases of fire evacuation or extreme weather events, the Fire Safety Coordinator will help guide the use of the safest and closest exit routes and ensure that these routes are clear of obstructions and clearly marked with ‘EXIT’ signs to reach designate safe assembly points.

5.2.7. First Aid and Medical Response

Resources required

First Aid Kits

First aid kits should be distributed in the main camp sites and should contain as a minimum:

- Adhesive Bandages: Various sizes for covering small cuts, blisters, and abrasions.
- Antiseptic Wipes and Ointments: For cleaning wounds and preventing infections.
- Sterile Gauze Pads and Rollers: Essential for controlling bleeding and dressing wounds.
- Adhesive Tape: Used to secure gauze pads and dressings.
- Elastic Bandages: Useful for sprains and strains.
- Burn Gel: Provides relief and treatment for minor burns.
- Antiseptic Solution: For wound cleaning and infection control.
- Scissors and Tweezers: Necessary for cutting tape, gauze, and removing splinters.
- Instant Cold Packs: For reducing swelling and numbing pain in injuries.
- CPR Mask: For safe and effective resuscitation in emergencies.
- First Aid Manual: Provides guidance on how to use the supplies and perform basic first aid.

Ambulance Equipment

The project must be equipped with an ambulance for rescue and appropriate removal in the event of emergencies. The number of ambulances must be sufficient to quickly attend to all the work fronts being carried out simultaneously. TANESCO and its construction subcontractor must ensure that the ambulance is fully equipped with essential medical equipment, such as:

- ECG Monitor and Defibrillator: For monitoring vital signs and managing cardiac emergencies.
- Spinal Board: For immobilizing patients with suspected spinal injuries.
- Transport Ventilators: For patients who cannot breathe independently.
- Suction Units: For clearing airways in cases of internal bleeding or vomiting.
- Infusion Syringe Pumps: For administering medications and fluids.
- First Aid Kits: Stocked with bandages, antiseptics, and other basic supplies.

Organs to be activated

- TANESCO
- Tanzania Red Cross Society (TRCS)
- Tanzania Fire and Rescue Force (TFRF)
- Disaster Management Department (DMD)

- NEMC
- Hospitals, ambulance service and first aid brigade

1. General First Aid Principles

1.1.Initial Assessment

- Assess the Situation: Ensure the scene is safe before approaching the injured person.
- Call for Help: Immediately alert the emergency response team and call for medical assistance if needed.
- Provide Care: Administer first aid based on the type of injury or medical emergency.

1.2. Basic First Aid Procedures

- Airway, Breathing, Circulation (ABC):
  - Airway: Ensure the airway is clear. If the person is unconscious, tilt their head back and lift their chin to open the airway.
  - Breathing: Check for breathing. If the person is not breathing, provide rescue breaths.
  - Circulation: Check for a pulse. If there is no pulse, begin chest compressions.
- *Control* Bleeding*:* Apply direct pressure to any bleeding wounds using a clean cloth or bandage.
- *Immobilize Injuries:* If there are suspected fractures or spinal injuries, immobilize the affected area to prevent further damage.
- *Treat for Shock: Keep the person warm and comfortable. Elevate their legs if there are no injuries to the head, neck, or spine.*

2. Common Construction Injuries and First Aid Procedures

2.1.Cuts and Lacerations

- Control Bleeding: Apply direct pressure to the wound using a clean cloth or bandage.
- Clean the Wound: Rinse the wound with clean water to remove dirt and debris.
- Dress the Wound: Cover the wound with a sterile dressing or bandage.
- Seek Medical Attention: If the cut is deep or does not stop bleeding, seek professional medical help.

2.2.Burns

- Cool the Burn: Immediately cool the burn with running water for at least 10 minutes.
- Protect the Burn: Cover the burn with a sterile, non-stick dressing or clean cloth.
- Avoid Ice: Do not apply ice directly to the burn as it can cause further damage.

- Seek Medical Attention: For severe burns, seek immediate medical assistance.

2.3.Fractures and Sprains

- Immobilize the Area: Use a splint or padding to immobilize the injured area.
- Apply Ice: Apply ice packs to reduce swelling and pain.
- Elevate the Limb: If possible, elevate the injured limb to reduce swelling.
- Seek Medical Attention: Transport the injured person to a medical facility for further evaluation and treatment.

2.4.Electrical Shock

- Turn Off Power: Ensure the power source is turned off before approaching the injured person.
- Check for Breathing: If the person is not breathing, begin CPR immediately.
- Treat Burns: Follow burn treatment procedures if there are any visible burns.
- Seek Medical Attention: Electrical shocks can cause internal injuries, so professional medical evaluation is necessary.

2.5.Falls

- Check for Injuries: Assess the injured person for any fractures, head injuries, or spinal injuries.
- Immobilize if Necessary: If a spinal injury is suspected, immobilize the person and avoid moving them.
- Provide Comfort: Keep the person warm and comfortable while waiting for medical help.
- Seek Medical Attention: Transport the injured person to a medical facility for further evaluation.

2.6.Special Considerations for Remote Areas

- Emergency Kits: Ensure that well-stocked first aid kits are available at multiple locations along the camp site.
- Communication Devices: Equip teams with reliable communication devices to call for help in remote areas.
- Transport Arrangements: Have arrangements in place for rapid transport to medical facilities, including vehicles and contact information for local medical services.

3. Medical Emergency List of Contacts

- Create a quick reference guide with the most critical emergency numbers prominently displayed.
- List all nearby hospitals, including specialized facilities (e.g., trauma centres, paediatric hospitals). Include: Name of the Hospital, Address, Emergency

Department Phone Number, General Contact Number and Specialties (e.g., burn unit, cardiac care).

- Coordinate with local clinics and hospitals to ensure they are aware of the project and can provide support in emergencies.
- Maintain an updated list of emergency contacts, including local hospitals, ambulance services, and key personnel.

5.3. Training and Drills

Training

TANESCO and its construction subcontractors will develop training materials covering emergency procedures, roles and responsibilities, and the use of emergency equipment. Training methods will include a mix of methods such as lectures, hands-on practice, and interactive sessions to engage participants.

Schedule Training Sessions will be implemented in a monthly basis to ensure all employees are trained and updated on emergency procedures. Regular first aid training sessions will be conducted regular for all workers, focusing on the specific risks associated with transmission line construction. Emergency drills will be held regularly to ensure that all staff are familiar with the procedures and can react effectively.

Execution of Drills

A schedule of drills must be submitted for approval by TANESCO's Environmental Supervision and Monitoring team and must include the execution of at least 01 (one) drill per month, according to the emergency scenarios foreseen. Construction subcontractors will conduct a pre-drill briefing session to explain the drill objectives, procedures, and safety precautions. Drill execution will be carried out according to the planned scenario, ensuring all participants follow the procedures. Monitoring and evaluation will be implemented in each exercise, through observers monitor to identify strengths and areas for improvement.

Post-Drill Review

Post-Drill Review will include a *Debriefing Session* immediately after the drill to discuss what went well and what could be improved. *Feedback Collection* should be carried out and include gather feedback from participants and observers to understand their perspectives and suggestions. A *Drill Action Plan* will include an action plan to address any issues identified during the drill and improve future responses.

6. Performance Indicators

Some of the main indicators that can be used to assess the performance of the implementation of this Plan are:

- Number of workers trained in emergency response activities;

- Number of emergencies controlled, considering the following aspects: extent of damage, applicability of procedures, response time and efficiency of the workers involved in the action;
- Evidence of the preparation of the Environmental Incident Report (EIR) for each accidental event that occurred.

7. Reports and Documentation

For each accidental event, the Environmental Incident Report (EIR) shall be prepared, which shall contain at least the following information:

- Incident identification;
- Date, time and day of the week of the incident;
- Incident location;
- Description of third-party participation;
- Victims, including names and place of assistance;
- Affected areas, discriminating zones of protection of water sources, adjacent forests, etc.;
- Structures affected;
- Equipment used in the assistance;
- Cause(s), discriminating between:
  - Natural / induced;
  - Equipment failure;
  - human failure;
  - Failure of containment structures;
  - Failure of the facilities;
  - Other (specify).
- Personnel involved in the assistance:
  - Internal: members of the fire brigade, engineer and occupational safety technician, and others;
  - External: Tanzania Fire and Rescue Force (TFRF), NEMC, etc.
- Additional information from the report:
  - Description of the accident or incident, including types of human error and other data for better understanding;
  - Provisions / consequences, briefly reporting the actions taken to neutralize the damage to safety and the environment;
  - Information on the disclosure of the accident / incident (if it was public knowledge);
  - Preventive measures necessary to prevent similar incidents.
- Information on the person responsible for the report.

The EIR will be prepared by the Environmental Management of the contractor/executing company and sent to TANESCO's Environmental Supervision and Monitoring team.

8. Schedule

The Construction Emergency Preparedness and Response Plan will begin with the start of the construction works of the TL and the Substations and will be applied during the entire construction period, including the period of deactivation of the work fronts and closure of works.

10.2
Biodiversity Management Plan (BMP)

The Biodiversity Management Plan (BMP) and the programmes included in it (**P.05- Biodiversity Offset Plan**, **P.06 - Ecosystem Services Impact Mitigation Plan**, **P.07 - Fauna and Flora Rescue and Relocation Plan**, **P.08 - Invasive Species Control Program**, **P.09 - Landscape Protection Program, P.10 - Operation Biodiversity Management** and **P.11 – Flora Active Search Programme**, are presented as a stand-alone document, included in **Annex 13**.

10.3
Social Management Plans

The Social Management Plan includes the Resettlement Programme; the Stakeholder Engagement Plan; Local Hiring Programme; Labour Management Procedures; Gender Based Violence Action Plan; and the Archaeological, Historical and Cultural Heritage Protection Plan.

P.11 - Resettlement and Livelihood Restoration Programme (i.e., Resettlement Policy Framework – RPF)

As required by TANESCO in the ToR, the Resettlement Policy Framework (RPF) is presented as a stand-alone document, therefore it has not been included as an annex to this ESIA and presented separately for analysis.

P.12 - Stakeholder Engagement Plan

The Stakeholder Engagement Plan (SEP) is presented as a stand-alone document in the **Annex 14** of this ESIA.

P.13 - Local Hiring Programme

1. Justification

This Programme aims to enhance the positive impacts of the Project related to the generation of direct and indirect jobs during construction and operation phases, as well as the related indirect impact of increasing local consumption of goods and services during construction phase and consequent dynamization of the local economy. It also aims to reduce the magnitude of negative impacts such as the economic retraction at the

end of the construction work, with the demobilisation of labour from outside the region and their return to their place of origin.

Finally, hiring local workers reduces the probability of some of the risks of negative impacts, such as increasing the demand for health services during construction, spreading of disease during construction, conflicts between workers and communities, others.

2. Main Objectives

The main objective of the Local Hiring Programme is to benefit the population of the districts, wards and villages of the IAI, through the use of local labour in activities of the Project, mainly during construction, but also during the operation phase, and also prevent negative impacts that may occur as a result of migration of people from other regions.

To this end, the Programme includes the following specific objectives:

- Publicise the vacancies available, the profiles required and the hiring requirements clearly communicating for how long the jobs will last;
- Create channels for sending CVs and create a CV database;
- Create opportunities to increase the percentage of women hired;
- Interacting with the authorities and other interested stakeholders in the IAI to obtain data on available labour and publicise vacancies available;
- Establish a training programme for local labour.

3. Applicable Legislation

- National Employment Policy, 2003
- National Women and Gender Development Policy, 2000
- Employment and Labour Relations Act (Act No. 6), 2004
- Labour Institutions Act (Act No. 7), 2004
- Law of the Child Act, 2009

International

- World Bank Environmental and Social Standards (ESS) 1 and 2

4. Responsibilities

The responsibility for implementing measures to increase the hiring of workers locally belongs to TANESCO. However, the activities proposed will be implemented by the Contractors, with the support and supervision of TANESCO, through its Management Team.

5. Methodology

5.1. Divulgation of Vacancies, Profiles and Requirements

The Project will make every effort to hire local labour (belonging to the villages, wards and districts in its IAI), whenever necessary and whenever the requirements for the type of work offered are met. When recruiting, efforts will also be made to ensure that women and men have equal opportunities.

Local communities will be informed about the profiles required for skilled and unskilled labour, according to the needs of the Project. Hiring rules will be aligned to the nature of each activity and the type of hiring. They will also be informed of the temporary nature of the work.

The contracting requirements will be disclosed by the Project, explaining the qualifications and documents to be submitted.

The following professionals are expected to be partly or fully recruited locally: topographer's assistants; drivers; assistants / general services; bricklayer / ironworker / carpenter; tractor operator; machine operator; administrative officer; chainsaw operator.

Other professionals, including manager / supervisor, topographers and assemblers, will be recruited from outside the region and may be part of the Contractors' permanent team.

Disclosure will be made through the contact channels of the Stakeholder Engagement Plan (SEP), and also as part of the continuous dissemination of information to local stakeholders during construction works carried out as part of this Plan.

It will also be verified the possibility of posting signs in places of large circulation in the villages and disseminate on radio.

5.2. CV Database Formation

In the publicity described in the previous measure, the channels to which the local population can send CVs will be indicated, including:

- Through the SEP's Grievance Mechanism. The SEP manager will forward to the Contractors all CVs submitted by local people through the contact channels.
- Through a designated CV reception point at camp sites and/or other convenient locations in the communities.
- Through the SEP team responsible for the continuous dissemination of information to local stakeholders during construction works, who may also receive CVs and pass on contacts about employment interests to Contractors.

5.3. Interaction with Stakeholders

Aiming to comply with the maximum hiring of local workers, the Contractors will seek data on available labour in the region and through contact with:

- Village Executive Officers, Councils and Assemblies;
- Ward Development Committees and Ward Executive Officers;
- District Councils and District Executive Directors.

During construction the team will maintain close and continuous cooperation with community leaders and residents of local communities to clarify and manage opportunities for employment.

They will also advertise the available positions and search for CVs on platforms online such as the following:

Zoom Tanzania (https://kupatana.com/)
Emprego.co.tz (https://www.emprego.co.tz/)
MyJobs in Tanzania (https://www.myjobstanzania.com/)
Job Junction Tanzania (https://www.jobjunction.co.tz/)

5.4. Training Programme for Local Labour

Also to maximise local recruitment, a training and apprenticeship programme will be developed for local residents, which will expose them to the fundamentals of the skills necessary for the job performance, such as the purpose of the work, safe use of tools, interpersonal relations, teamwork, workplace safety, environmental care, obligations (schedule, non-alcohol consumption, etc.), among others.

Based on the CVs received, information on available labour in the region and the specifics of the jobs available, the team responsible for this Programme will identify the skills gaps in the communities and the training needs.

Training modules will be developed to cover technical skills and practical knowledge of the job to be performed. The training will be structured in short-term programmes (3 months), with lessons on the fundamentals and practical sessions.

During the training, workers will be provided with clear and objective information about the duration of the construction works and the vacancy created, so that they can plan and take advantage of opportunities to improve their skills in order to change jobs and even apply for a position in the Project's operation, e.g. in the maintenance and conservation of the wayleave, which will take place on a regular basis.

6. Performance Indicators

The following indicators are proposed to monitor the implementation of this Programme:

Measure	Indicators
Divulgation of Vacancies, Profiles and Requirements	• Number of contacts to send CVs through the SEP's Grievance Mechanism • Number of local workers in relation to the total number of workers employed • Number of women and minority representatives of sexual minorities among the total number of local workers hired and among the total number of employees
CV Database Formation	• Number of CVs received from local residents
Interaction with Stakeholders	• Number of meetings with held
Training Programme for Local Labour	• Number of trained workers in relation to the total number of workers employed

7. Reports and Documentation

Contractors' compliance with the measures set out in this Programme will be evidenced by the monthly reports generated by them during construction.

In these reports the Contractors shall submit to TANESCO a Workforce Composition Report, indicating the total number of Project workers (including subcontractors) at the end of each month, their functions/grades of qualification, place of origin, and the number of women and other gender minorities hired.

8. Schedule

Measures to recruit local workers will start at the planning stage and may extend through much of the construction phase.

P.14 - Labour Management Procedures (LMP)

The Labour Management Procedures (LMP) is presented as a stand-alone document in the **Annex 15** of this ESIA.

P.15 - Gender Based Violence Action Plan

The Gender Based Violence Action Plan is presented as a stand-alone document in the **Annex 16** of this ESIA.

P.16 - Archaeological, Historical and Cultural Heritage Protection Plan

1. Justification

Considering the archaeological, ethnohistorical and historical context of occupation in Tanzania, as well as the results of the field activities along the Project described in **Section 7.4.3** and presented in full in the report in **Annex 8**, the existence of archaeological potential in the territory is noteworthy.

As mentioned in **Section 7.4.3**, six archaeological sites have been identified in the vicinity of the DAA, in addition to the presence of intangible heritage that has even required a route adjustment to avoid direct impact (see risk 20.01 in **Section 8.2.4.3**). In addition, as seen in impact 14.01 of **Section 8.2.3.3**, there are graves scattered around the properties intercepted by the TLs' route that will probably be impacted and will need to be duly removed and relocated, following all the measures provided for by law for this situation.

The above justifies the proposal of this Plan, which brings together the prevention, mitigation and compensation measures planned for these impacts and risks to the Archaeological, Historical and Cultural Heritage, as well as a specific measure to safeguard the Palaeontological Heritage during the works.

2. Main Objectives

The objectives of this Plan are linked to the need to prevent possible impacts on archaeological, historical or cultural assets that potentially exist in the area where the project will be located. To this end, the following specific objectives are proposed:

- Prospect the SSs' expansion areas;
- Delimit and rescue and/or fence off all archaeological, historical or cultural assets identified in the areas for SSs expansion that may be at risk.
- Prepare a Chance Findings Procedure (CFP) and implement this procedure during vegetation suppression and land clearing activities and during earthworks;
- Hire a specialist to prepare guidance material, train workers in recognising chance findings and in the CFP, and monitor vegetation suppression and earthworks activities and take action in the event of chance findings;
- Identify and map all the graves impacted by the route of the TLs once the final route has been defined, and carry out all the procedures provided for their removal and relocation and other measures established for this impact in Graves Removal Act No.9, 1969.

3. Applicable Legislation

- The Antiquities Act, 1964 and its Amendment Act of 1979
- Graves Removal Act No.9, 1969
- Cultural Policy, 1997
- Environmental Management Act, 2004
- National Cultural Heritage Policy, 2008

With regard to the protection of cultural heritage, Tanzania's guidelines include the cultural heritage protection policies mentioned in **Section 7.4.1**.

<u>International</u>

- World Bank Environmental and Social Standards (ESS) 1 and 8

4. Responsibilities

Responsibility for this Plan lies with TANESCO, which will carry it out by hiring a specialist to execute the prospection in the SSs' expansion areas, prepare the guidance material, train the workers, monitor the vegetation suppression and earthworks activities and act in the event of chance findings.

TANESCO will include in the contracts to be established with the Contractors the obligation to comply with the CFP.

5. Methodology

5.1. Prospecting in the SSs' Expansion Areas

In the expansion areas of the Kyaka SS, Nyakanazi SS and Ibadakuli SS, boreholes (test wells) will be drilled approximately 50 metres apart, forming a prospecting grid. A hand digger (manhole type) will be used to open the boreholes. The depth may vary according to soil conditions, but a depth of 1 m should be considered, with artificial levels of 10 cm. If the test wells do not reach the expected level, a justification must be provided. **Figure 5.1.a** shows the type of test well that will be carried out.

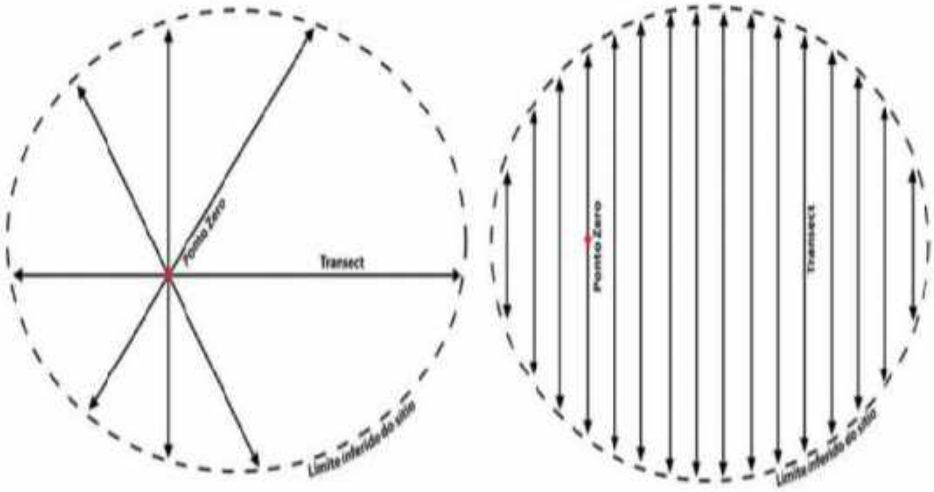
Figure 5.1.a of P.16
Examples of test well opening

Source: JGP Consultoria (2023).

Delimitation of archaeological sites

In the event of archaeological sites being located, the delimitation of archaeological sites can be carried out using a methodology that includes walking along 10 m transects (which can be altered according to soil conditions), in a north-south or east-west orientation, based on the methodology proposed by Chartkoff (1978). **Figure 5.1.b** below shows the delimitation model. The test wells can be carried out with a hand digger (manhole type), with a depth of 1 metre and artificial levels of 10 cm. It is at the archaeologist's discretion to interrupt the test wells when a considerable number of boreholes with sterile soil are found during the delimitation process.

Figure 5.1.b of P.16
Site delimitation model



Source: Caldarelli (2010).

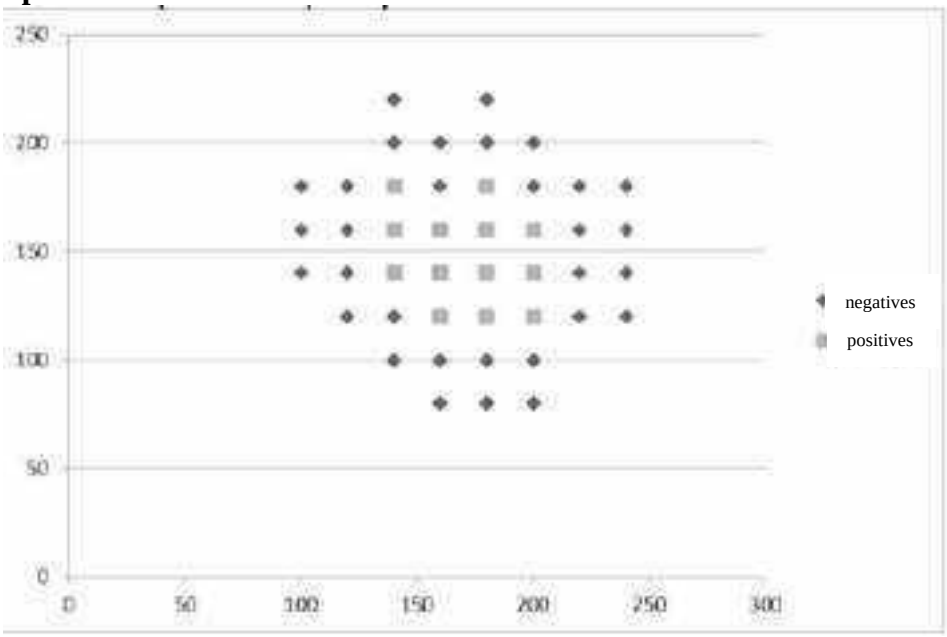
This delimitation will result in a detailed sketch with the coordinates of the positive and negative points according to the sketch model (**Figure 5.1.c**), which will show the dispersion of the material, among other information about the depositional context.

It is important to note that the archaeological material that may appear during the process of delimiting the site should be collected according to the artificial levels and sieved through the sediment to locate small traces.

In view of the information presented, the general sequence should be carried out in the following order:

- Delimitation by walking 10 metre transects, in a north-south or east-west orientation, until the boundaries of the site have been inferred;
- Locating the vertices using GPS equipment;
- Georeferencing of materials scattered on the surface; and
- Photographic recording of the activities.

Figure 5.1.c of P.16
Spatial delimitation sketch model



Rescue of the archaeological site

After delimiting the area of the archaeological site, if there are materials in the area of direct impact of the Project and it is not possible to preserve them in their place of origin, partial rescue of the archaeological site present in the DAA can be considered.

With this, the areas with the highest incidence of remains will be established, and archaeological squares will be set up (1 x 1 m excavation units, 1-metre-deep, at artificial levels of 10 cm), one on the central coordinate of the site and the others on the areas with the highest concentration of surface material, so that the depth of the stratigraphic horizon of interest to the study can be investigated. Boreholes can also be established at each of the sites that will be the object of archaeological recovery and positioned on the ground forming a 'grid' of boreholes so as to cover various portions of the ground equally, in order to ascertain the dimensions of the dispersion of remains both on the surface and in depth.

This approach is based on the geometric sampling method suggested by Redman *et al*. (1974) for application in large territorial spaces in order to facilitate the identification of archaeological sites. However, these methodological guidelines will be adapted for the target area of the Project, taking into account the criteria adopted by the archaeologist in the field.

The resulting soil will be inspected in its entirety by dry sieving all the archaeological sediment during the interventions. The sediment remaining from the boreholes must be dry sieved with meshes between 2 mm and 6 mm (at the discretion of the archaeologist

responsible for excavating the site). The size of the sieve mesh can be chosen according to the region's soil.

The interventions will be accompanied by survey sheets with photographic records and notes of the information in field notebooks. Once the prospecting and excavations have been completed, the ground will be recomposed.

The sieving mesh with which the material was obtained will always be recorded on the survey sheets. All traces collected, including surface traces, will be packed in sealed plastic bags, according to depth, and grouped in a larger bag according to survey, with internal and external labelling. In addition, a collection form will be filled out listing the samples, with detailed information on each one.

All the interventions will be located using specialised topography (Geodetic GPS or Total Station), depending on their accuracy and precision. The data obtained through specialised topography will produce sketches, maps and floor plans containing: the configuration of the Areas of Archaeological Interest under study, the dispersion of the surveys, the distribution of structures and/or archaeological materials on the surface and sub-surface, and environmental and topographical aspects.

Laboratory procedures

Laboratory work must follow the rules of the institution that will have final custody of the archaeological material.

Any archaeological material recovered will be subject to laboratory processing in accordance with the specific characteristics of each vestige and taking as a preliminary criterion the raw material, origin and use, diagnostic material and variability in which it occurs in the field. Laboratory work will therefore follow the following basic sequence of operations:

- Sorting the material;
- Hygienisation;
- Cataloguing;
- Techno-typological analysis;
- Photographic recording;
- 6) Packaging and suitability for the collection.

It should be noted that the methodology can be adapted to the requirements of the institution that will be responsible for the archaeological material. It is up to the archaeologist responsible for the analysis to carry out the laboratory analyses in the best possible way.

5.2. Preparation of Guidance Material for Workers and Training

The archaeologist hired to conduct preliminary prospecting in the SS areas (described in the measure 5.1) must provide training to the workers, especially those involved in land

clearing and earth moving activities. This training will be aimed at raising awareness among the workers on the construction fronts about preservationism through information regarding the importance of preserving the national archaeological heritage and the legal implications of failing to comply with recommendations regarding actions that are harmful to the local archaeological heritage. In addition, they will be introduced to the different types of finds that may occur, so that they can become familiar with them and be able to identify them in the event of chance findings. The training will also introduce the CFP (see measure 5.3) to the workers, guiding them on the procedures to follow in the event of locating materials of archaeological interest, in this case, the suspension of activities in the area until the archaeologist arrives at the site.

To support the training, the archaeologist will produce materials that may include a PowerPoint presentation indicating the locations of archaeological sites already identified in the surveys conducted, emphasizing the likelihood of identifying other remains during the works along the TLs, reinforcing safety measures against any type of impact to cultural heritage (material or immaterial). A folder with guidelines on the CFP may also be produced, in simple and easy-to-understand language.

5.3. Chance Findings Procedure (CFP)

Chance findings are defined as objects, features, sites (archaeological or palaeontological) of potential cultural property that are identified during construction, usually while clearing vegetation and/or removing topsoil. Although less likely, deeper chance finds may occur during excavation.

Chance findings usually include parts of objects and very rarely whole objects. Objects may include: ceramic fragments, stone objects, bones, skeletons, metal objects, textiles, glass fragments, animal and plant remain, graves, cemeteries, archaeological remains, others.

Newer objects found are not classified as chance findings. However, this assessment should always be carried out by a professional specialist.

In the case of identification of chance findings by workers, work must be stopped immediately. The Supervisor/Contractor must be notified and arrange for danger tape to be installed around the find to prevent immediate damage while in contact with the specialist, who must inspect the objects identified and confirm whether or not they constitute archaeological or cultural heritage.

Once the chance findings are confirmed by the specialist, the Contractor shall demarcate and isolate the area, in accordance with the most appropriate delimitation measures provided by the specialist.

After this, TANESCO will be notified, as well as the Antiquities Division of the Ministry of Natural Resources and Tourism, if it is an archaeological or cultural find.

Subsequently, additional strategies for the protection of cultural property will be assessed, which may include:

- Changes to the Project design, if possible, such as modifications to the access road layout and TLs or SSs layout, modification of the location of temporary facilities (such as the camp sites), or other changes.
- Adoption of specialised construction techniques to minimise disruption.
- Fencing and signage if there is no risk of direct damage and it is possible to keep the find on site.
- Removal of artefacts and remains if it is not possible to change the Project or keep the finding on site.

Recovery and rescue excavations will be carried out if unavoidable and only after a formal permit has been issued by the competent government authority. In any case, efforts shall be made to minimise artefacts collected.
Once the rescue work has been completed, the inspection will be carried out by the cultural heritage or palaeontological specialist.

Once all rescue work has been completed and all necessary field investigations (excavations) have been carried out, construction will be allowed to resume in the area.

All chance findings procedures will be thoroughly documented through photographs, annotations and maps. All artefacts recovered will be coded and catalogued. Daily monitoring records will be kept registering areas of recovery and artefacts found.

All artefacts, once they have been documented and catalogued, will be handed over to the institution indicated by the Antiquities Division.

5.4. Monitoring during Vegetation Suppression and Earthworks

Due to the identification of archaeological sites and other types of heritage in the vicinity of the TLs during the surveys carried out for the ESIA, which contributes to the recognition of the high potential of the region, it is recommended that archaeological monitoring be adopted during the construction activities.

The archaeologist(s) hired for prior prospecting in the SS expansion areas and to train the workers will also be responsible for monitoring the works, more specifically the activities of removing vegetation and clearing the land and earth movements (earthworks in the areas of new accesses that may be built and in the areas of camp sites, if necessary, in addition to excavations for the foundations of the towers).

5.5. Relocation of Graves

Graves are among land interest which are affected, as mentioned in impact 13.01, **Section 8.2.3.3**.

The Graves (Removal) Act, 1969 defines grave “includes a burial vault, tomb, mausoleum or coffin and any gravestone, tablet, inscription, monument or memorial to the dead associated therewith’’.

Subject to the provisions of the Graves (Removal) Act, 1969, where any land on which a grave is situated is required for a public purpose the Minister may cause such grave and any dead body buried therein to be removed from the land and, in such case, shall take all such steps as may be requisite or convenient for the re-instatement of the grave and the re-interment of the dead body in a place approved by him for the purpose.

The process of removal, transportation, reinstatement and re-interment of the grave or dead body and any placatory or expiatory rites or other ceremony accompanying such removal and re-internment is conducted and supervised by local Authority (District Authority) through Land and Health Department or Resettlement Action Plan - RAP expertise. Before removal of graves a leaf is obtained from the respective court (district court) which makes the local Authority (District Authority) capable of removing the graves. The relatives of the deceased (Interested Person) receive only condolences (costs of the ceremony according to their known traditions) and receive a fixed/equal fee for all relatives of the deceased in the amount of TShs 400,000.

The procedures established in the Graves (Removal) Act, 1969 for the event of the need to relocate graves impacted by a project is according to the following:

Notice of intention to remove graves

- If the Minister is satisfied that any land on which a grave is situated is required for a public purpose he shall before causing a grave or dead body to be removed therefrom, give notice of his intention to do so and every such notice shall;
  - be served on persons interested as shall, after reasonable enquiry, be known to him;
  - where the land is or forms part of a cemetery appropriated to the burial of members of a particular religious' community, be served on the controlling body of the religious community concerned; and
  - be published in Gazette as soon as may be practicable after the Notice has been served.
- If removal is urgently necessary, the President may, at his discretion, waive the formal notice of intent to remove, ordering publication in the manner or to the persons he specifies.
- The notice must be delivered personally or, if the person cannot be found, shall be affixed upon some conspicuous part of the land in respect of which the notice is given.
- Where a notice under this section has been published in the Gazette the removal of a grave or a dead body buried therein from the land in respect of which the notice is given shall not be invalid by reason only of any irregularity in the service of the notice or by reason of it having been published prior to its service on the persons required to be served therewith.

The content of the notice is specified in the report in Graves (Removal) Act, 1969.

Conditions of removal of graves

The removal, transportation and re-instatement or re-interment of a grave or dead body authorized under the Graves (Removal) Act, 1969 shall be undertaken:

- as far as is possible, with due regard to the views of the persons interested and the religious susceptibilities of the members of the religious community to which the person belonged whose grave or dead body it is;
- with due solemnity and respectful treatment of the dead;
- so far as is practicable, without unnecessary damage to the grave and the dead body;
- so that a dead body which is disinterred is transported and re-interred without undue delay;
- under such conditions of privacy as ensures that no dead body is exposed to public view;
- in a manner which is not injurious to public health; in accordance with such directions as may be given by a public officer appointed by the Minister to supervise the undertaking.

Approval of places to which graves may be removed

- The Minister may approve places to which graves or dead bodies may be removed under the Graves (Removal) Act, 1969 and where he proposes to approve a cemetery as such a place he shall, before approving the cemetery, consult the authority which appointed or set aside the area as a cemetery as to its suitability for that purpose. Notwithstanding any other written law, where the Minister has approved a place to which graves or dead bodies may be removed, no permission or approval of any other authority shall be required for the reburial of a dead body on such site in accordance with the provisions of the Act.

Compensation payable in certain cases

- Where the removal of a grave or dead body is undertaken by a person interested, the Minister may, on behalf of the Government, pay in respect thereof, out of moneys provided for the purpose by Parliament, such compensation as may be agreed upon or determined in accordance with the Act.
- The compensation payable shall be limited to the reasonable expenses incurred in the removal, transportation, reinstatement and re-interment of the grave or dead body and any placatory or expiatory rites or other ceremony accompanying such removal and re-interment.
- A claim for compensation may be made by a person interested where he has duly notified the Minister that he himself would undertake the removal of the grave or dead body and the undertaking has been approved by the Minister and carried out in accordance with the provisions of the Act and any directions given thereunder.
- Every claim for compensation shall be submitted in writing by the person interested, to the public officer appointed by minister who may, after requiring the production

of any evidence in support thereof or otherwise satisfying himself that such claim is reasonable, agree to the claim.

- If any dispute or disagreement arises as to the right of any person to claim compensation, the amount of compensation or the apportionment of compensation between the persons entitled where there is more than one person interested, the dispute or disagreement shall be determined by the Minister whose decision shall be final and conclusive.

6. Performance Indicators

These Plan indicators should manage/monitor the following key issues:

Measure	Indicators
Prospecting in the SSs' Expansion Areas	• Evidence of prospective surveys in all SSs' expansion areas • Occurrence of work stoppages due to discoveries not identified during prospective surveys • Occurrence of delay in the work schedule due to archaeological rescue (if applicable)
Preparation of Guidance Material for Workers and Training	• Evidence of the preparation of the materials to be used in the training • Number of trained workers in relation to the total number of workers involved in the activities of land clearing and earth moving activities
Chance Findings Procedure (CFP)	• Number of workers trained in the CFP
Monitoring during Vegetation Suppression and Earthworks	• Proportion of the total area of the work that was effectively monitored • Number of identified sites that have been preserved or whose integrity has been guaranteed • Average time between the identification of a possible archaeological site and the implementation of protection or mitigation measures.
Relocation of Graves	• Proportion of graves that were adequately documented (photographs, written records, etc.) before being moved • Total number of graves that were relocated in accordance with established plans • Average duration of the relocation process, from identification of graves to completion of the transfer • Degree of compliance with cultural and religious practices during the relocation process • Level of satisfaction of families involved with the relocation process • Number of meetings and consultations held with local communities and families of buried individuals prior to relocation • Incidence of conflicts or disputes resulting from the relocation process, such as community resistance or family disagreements • Degree of approval and support from local authorities and community leaders regarding the relocation process • Record of reburial rituals or ceremonies performed in accordance with local traditions • Assessment of how relocated graves were integrated into the new location, ensuring continued access to families for visits and religious practices

7. Reports and Documentation

After completing the prospecting in the SSs' expansion areas, a report must be produced describing the activities carried out, the results found and the measures adopted in the event of sites being identified.

The Plans and Programmes Management Reports to be produced monthly by the TANESCO Management Team as part of P.02 must include a description of the training activities for workers, evidence of archaeological monitoring carried out during land clearing and earthmoving activities and a record of all cases of CFP activation, if any.

8. Schedule

Prospecting in the areas of expansion of the SSs' must be carried out before any activity in the areas. Worker training must be carried out before the start of the land clearing and earthmoving activities.

Archaeological monitoring must be carried out concomitantly with the land clearing and earthmoving activities.

The application of the CFP may be activated at any time during the works and therefore the archaeologist must be on standby to be activated when necessary.

P.17 - Occupational Health and Safety Management Programme

1. Justification

The construction and operation activities for the 400kV Uganda-Tanzania Interconnector Power (UTIP) will involve activities with risks to the health and safety of workers, including earth moving, load handling, transportation, operation of machinery and equipment, handling of hazardous products, working at heights, electrical installation, vegetation cutting, among others.

Therefore, the implementation of the Project requires that TANESCO and its contractors establish rules and implement procedures aimed at maintaining adequate conditions for the health and safety of all working people directly involved, to be complied with by the Contractor and subcontractors in the construction phase and by TANESCO in the operation.

Occupational health standards shall comply with the requirements of Tanzanian legislation related to Occupational Health and Safety (OHS) in addition to applicable international requirements.

In this sense, the contract to be established with the Contractor and other companies contracted for the works must include the mandatory implementation of this Program, which brings together the relevant standards and procedures and guides compliance with legal requirements.

2. Main Objectives

The main objective of the Occupational Health and Safety Management Programme (OHSMP) is to establish minimum standards of compliance with international best practices in occupational health and safety management, with application to employees and service providers of the main Construction Contractor, subcontractors, suppliers and other contracted companies, and TANESCO in the operation, in order to anticipate, recognize, evaluate and control the risks that exist or may exist in the workplace.

The Program also has the following objectives:

- Reduce the occurrence of occupational accidents and illnesses during construction, operation and maintenance, and mitigate their consequences if they occur;
- Establish contractually binding occupational health and safety guidelines that must be systematically adopted by the Contractor and other contracted companies throughout the duration of the Project;
- Ensure compliance with all health and safety requirements;
- Stipulate minimum health and safety requirements to be met by all contractors, standardizing some Safety Work Procedures - SWP for the Project;
- Implement systematic self-monitoring so that all services performed are routinely inspected and evaluated;
- Implement an efficient procedure for responding to corrective action requests and/or notifications of non-compliance with respect to SWPs;
- Train workers to comply with SWPs and the corresponding legal requirements;
- Evaluate and monitor the health of hired workers through admission and periodic examinations that will allow the detection of viral, bacterial, and parasitic diseases, among others, as well as hearing, vision, and examinations of other physical capacities relevant to the activities that workers will perform;
- Collaborate to maintain favourable sanitary conditions for workers;
- Provide emergency medical assistance to personnel in case of accidents;
- Transport cases requiring hospital medical assistance to contracted health services;
- Notifying the competent authorities in case of notifiable diseases.

3. Applicable Legislation

Applicable Local Legislation

As detailed in **Chapter 6** of the UTIP ESIA Report, in Tanzania, the key legislation governing health and safety includes:

- Occupational Health and Safety Act, 2003: This is the primary legislation that outlines the responsibilities of employers and employees regarding workplace safety and health.
- National Occupational Health and Safety Policy, 2010: This policy provides guidelines for implementing health and safety measures in various industries.

- Employment and Labour Relations Act, 2004: This act includes provisions related to the health and safety of employees.
- The Occupational Safety and Health (Building and Construction Industry) Rules, 2015.
- Public Health Act, 2009: This act addresses public health concerns, including workplace health and safety.
- The Occupational Safety and Health (Notification of Occupational Diseases, Injuries and Dangerous Occurrence) Rules of 2016. These rules provide the procedures and means of notifying and reporting injuries and dangerous occurrences of events at workplaces.
- Industrial and Consumer Chemicals Act, 1985: This act regulates the use of chemicals in the workplace to ensure safety.

International

- World Bank ESS 1 - Assessment and Management of Environmental and Social Risks and Impacts
- World Bank ESS 2 - Labor and Working Conditions
- World Bank / IFC General EHS Guidelines, 2007
- World Bank / IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, 2007
- ILO Guidelines on Occupational Safety and Health Management Systems (ILO-OSH 2001)
- Recommended Practices for Safety & Health Programs in Construction. US Occupational Safety and Health Administration (OSHA), 2016.

4. Responsibilities

The Contractor shall be responsible for the implementation of health and safety procedures during the works. TANESCO shall be responsible for supervision, checking compliance with the minimum health and safety requirements to be met by the Contractor and by subcontractors and suppliers, including compliance with SWPs. The Contractor shall be responsible for ensuring compliance by subcontractors and suppliers.

The Contractor shall structure occupational health and safety team and TANESCO shall have an occupational health and safety supervisor as part of the supervisory team to verify compliance with the SWPs at the work fronts.

In the operation phase, TANESCO will ensure that the personnel responsible for the operation receive the necessary training to comply with the OSH procedures.

5. Methodology

5.1. Occupational Health and Safety Management Procedures

The health and safety professional who will be part of TANESCO's Management Team will develop health and safety procedures to be followed during the works and other Project activities, including the operation stage. These procedures, as well as other activities to be described in this Program, will be included as an annex to the contracts with the Contractors.

Among the procedures to be developed is that of supervision and assurance of compliance, to be implemented in the OSH inspections to be performed by TANESCO's Management Team (or a specialized consultant to be hired by TANESCO), to verify compliance by the Contractor, subcontractors and suppliers.

5.2. Health and Safety Management Personnel

For the management of health and safety issues the Contractor must have an Occupational Health and Safety (OSH) manager as part of the team. Depending on local regulations and laws, based on the number of workers and the type of service to be developed, it may be necessary to have more OSH professionals. These are functions of the Contractor's Health and Safety manager:

- Ensure that all machinery, equipment, facilities and construction activities are routinely inspected for health and safety aspects;
- Inform workers of any risks that may arise;
- Instruct workers on Safety Work Procedures - SWP to avoid injuries;
- Provide the necessary and appropriate personal protective equipment (PPE) and collective protective equipment (CPE) for each type of activity;
- Ensure that adequate working conditions are provided to all workers;
- Coordinate health and safety training;
- Ensure that first aid and medical assistance is available for workers;
- Having appropriate resources to respond to emergencies;
- Coordinate accident investigation.

5.3. Minimum Requirements for Safe Work Procedures - SWP

Hazards and risks to workers' safety and health should be identified and assessed on an ongoing basis during construction and operation phases and should: (i) be adjusted to the specific hazards and risks presented in each activity during construction and operation phases and should: (i) be adjusted to the specific hazards and risks presented in each of the project activities; (ii) be reviewed and modified if necessary on a regular basis; (iii) comply with national laws and regulations, and reflect good practice detailed in **Chapter 6** of ESIA Report; and (iv) consider the current state of knowledge, including information or reports from organizations, such as labour inspectorates, occupational safety and health services, and other services as appropriate.

As per required by World Bank / IFC General EHS Guidelines, 2007, preventive and protective measures should be introduced according to the following order of priority: (i) Eliminating the hazard by removing the activity from the work process; (ii) minimizing the hazard through design of safe work systems and administrative or institutional control measures; (iii) Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

The application of prevention and control measures to occupational hazards should be based on comprehensive job safety or job hazard analyses. The results of these analyses should be prioritized as part of an action plan based on the likelihood and severity of the consequence of exposure to the identified hazards.

Safe Working Procedures for High-Risk Activities

The OSH professional of the TANESCO team must detail the SWPs for the activities below. These SWPs must be incorporated into the contract to be signed with the Constructor Contractor(s) and must also be complied with by all main constructor subcontractors.

1. Transport, handling and storage of materials
2. Transportation and storage of hazardous materials, including handling of fuels and flammable materials
3. Transportation of workers
4. Operation of hazard machinery and equipment including lifting works
5. Excavations
6. Concrete works
7. Work at heights
8. Felling of trees
9. Work with electrical risk

Permit-to-Work System

Hazardous activities that involve relevant risks (i.e. that could lead to serious accidents or fatalities), for example during work at height or activities with exposure to electricity, will be preceded by a formal written authorization process, called a "permit to work" system. A "permit to work" form states exactly what work is to be done and when, and what the risks are and the prevention and control measures necessary for its safe execution (in this case, the corresponding SWP). The contractor's and/or TANESCO's work safety supervisor must assess the work and check safety at each stage and upon completion. The people carrying out the work must sign the permit to show that they understand the dangers and the necessary precautions.

Risk of Encountering Landmines or other UXOs (unexploded ordnances)

Building on land where there is a risk of encountering landmines or other UXOs remains requires strict adherence to safety protocols to protect workers and the public.

When working in such areas, organizations and individuals must be aware of the physical threats posed by a huge variety of armaments left during and after armed conflict. In north-western Tanzania, particularly near the border with Uganda, the Kagera Region is one of the areas most at risk of finding mines or bomb remnants. This region was significantly affected during the Uganda–Tanzania War (1978-1979), where heavy fighting and military activities took place. TANESCO must ensure that the following preventive and management measures are implemented:

Therefore, in the works to be carried out in the project section located in the Kagera region (400 kV Mutukula – Kyaka TL and part of the 400 kV Kyaka – Nyakanazi TL - up to vertex KN-19), Contractors must implement the DAA's demining measures set out in measure 5.12 of P.01. In addition, demining measures must also be applied by TANESCO in the resettlement areas to be defined in this same region, in accordance with measure 5.5 of P.02.

In addition to the demining measures for the areas covered by P.01 and P.02, the following other measures are included: *Safety Training:* ensure all personnel involved in the construction are trained in recognizing and responding to explosive hazards. This includes understanding warning signs and emergency procedures.

Emergency Procedures: establish clear emergency procedures for dealing with the discovery of mines or UXO. This includes evacuation plans, first aid training, and communication protocols. ***5.4. Occupational Safety Training***

Training related to compliance with the SWPs will be the ongoing responsibility of the Contractor throughout the construction period.

During the intake process, all workers will receive health and safety training on SWPs and other health and safety requirements.

Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or colour coding in use should be thoroughly reviewed as part of orientation training. TANESCO and its subcontractors should ensure that workers and contractors, prior to commencement of new assignments, have received adequate training and information enabling them to understand work hazards and to protect their health from hazardous ambient factors that may be present. The training should adequately cover:

- Knowledge of materials, equipment, and tools
- Known hazards in the operations and how they are controlled
- Potential risks to health
- Precautions to prevent exposure
- Hygiene requirements
- Wearing and use of protective equipment and clothing
- Appropriate response to operation extremes, incidents and accidents reporting

During construction, all workers at the work fronts will receive weekly orientations of at least 15 minutes' duration. In addition, daily safety talks are planned.

If accidents occur or observations of non-compliance with OSH procedures are deemed too frequent, the TANESCO supervisory team may require the Contractor to intensify training.

The health and safety training to be provided by the Contractor shall include at least the following modules:

- Induction training
- First aid
- Contact with poisonous animals
- Use of PPE and installation of CPE
- Safety Work Procedures - SWP
- Daily safety talks

5.5. Health and Safety Supervision

As mentioned above, OSH monitoring is foreseen to be carried out by TANESCO's team during the works. In addition, the Contractor himself will have to carry out self-monitoring.

The Contractor's OSH manager will conduct inspections on an ongoing basis at the work fronts (self-monitoring) to verify compliance with the provisions of the SWPs. Safety inspections, mainly of a preventive nature, are intended to detect unsafe conditions and/or behaviours which, in turn, could indicate the necessary steps to control and reduce the observed risks and reinforce training.

The Contractor's OSH manager will also supervise the activities of subcontractors, evaluating compliance with the SWPs and also with other commitments, such as training, worker participation, among others.

The Contractor's OSH manager shall produce evidence of compliance with all applicable commitments.

Health and safety supervision by the Contractor's team will, in turn, include the following activities:

<u>Handling of non-conformities</u>

A procedure shall be implemented that responds to all Notices of Non-Conformity issued by the TANESCO OSH supervisor regarding non-compliance with OSH procedures. This procedure shall include as a minimum the following:

- Corrective Action Plan, which shall detail the actions/measures to be taken to correct the problems, identify the persons responsible for each action, specify the

evidence to be presented to demonstrate compliance and the time period for each action;
- Notification of compliance, which is the document to be sent to the TANESCO team informing the conclusion of the Corrective Action Plan and attaching the corresponding evidence.

The nonconformity management procedure shall also apply in the case of nonconformities due to the activities of subcontractors and suppliers.

Accident investigations

All accidents will be methodically investigated by the OSH manager. Reports of accidents or fatalities will be reported to TANESCO and the competent authority. All accidents will be investigated and documented, with the following information as a minimum:

- Personal injury
- Name of person involved
- Name of injury
- Injury site
- Description of the accident
- Type of accident
- Reason for accident
- Corrective action (as warranted)

The results of the accident investigation will be recorded and will conclude whether the cause of the accident was linked to the worker's non-compliance with the SWP or to the deficiency of the SWP, which did not predict a certain aspect of the hazards of the activity. Corrective actions will be planned according to this conclusion.

Accident statistics

Accident statistics shall be continuously updated by the Contractor's OSH Manager. These shall at least report the frequency rate and severity rate of accidents, as well as incidents that, although they may not have resulted in personal injury or property damage, could have had a high potential to result in serious injury or significant property damage (i.e. near misses).

5.6. Worker Health Management

Worker health management includes:

- Perform medical examinations required by law or others at the time of admission, periodically, after returning to work (absence of more than 15 days), at the time of changes in functions and at the time of dismissal;
- Monitor groups of workers subject to specific health risks;
- To prepare and keep the health records of the workers;

- Request relocation or dismissal of workers when necessary for medical reasons and issue notifications of work-related accidents;
- Maintain equipment, materials and personnel capable of administering first aid;
- Establish agreements with hospitals and other medical institutions that can attend working people who require additional assistance.

5.7. Worker Participation

Worker participation is an essential element of the OSH management system in the organization or a project and is therefore a key requirement for compliance with ILO and World Bank requirements. TANESCO and its subcontractors should ensure that workers and their safety and health representatives are consulted, informed and trained on all aspects of OSH, including emergency arrangements, associated with their work.

Workers should know how to report injuries, incidents, and concerns and are encouraged to do so. The reporting system is easily accessible, and reports reach upper management. Workers should also have access to injury and illness logs, incident investigations, Safety Data Sheets, job hazard analyses, industrial hygiene monitoring results, and other information indicative of hazards in the workplace.

Safety and Health Committee

TANESCO and its subcontractors should make arrangements for workers and their safety and health representatives to have the time and resources to participate actively in the processes of organizing, planning and implementation, evaluation and action for improvement of the OSH management system. TANESCO and its contractors should ensure, as appropriate, the establishment and efficient functioning of a safety and health committee and the recognition of workers' safety and health representatives, in accordance with national laws and practice.

Right to Refuse Unsafe Work

According to the International Labour Organization (ILO), workers have the right to refuse work that they believe poses a serious risk to their health or safety. This is part of the broader framework established by ILO Convention No. 190, which addresses violence and harassment in the world of work.

5.8. Emergency Preparedness and Response

Emergency prevention, preparedness and response arrangements should be established and maintained. These arrangements should identify the potential for accidents and emergency situations and address the prevention of OSH risks associated with them. They should:

- ensure that the necessary information, internal communication and coordination are provided to protect all people in the event of an emergency at the worksite;

- provide information to, and communication with, the relevant competent authorities, and the neighbourhood and emergency response services;
- address first-aid and medical assistance, firefighting and evacuation of all people at the worksite; and
- provide relevant information and training to all members of the organization, at all levels, including regular exercises in emergency prevention, preparedness and response procedures.

Emergency prevention, preparedness and response arrangements should be established in cooperation with external emergency services and other bodies where applicable.
First Aid Provisions

A first aid kit will be provided in support areas and work fronts at all times.

5.9. Investigation of Work-related Injuries, Ill Health, Diseases and Incidents

The investigation of the origin and underlying causes of work-related injuries, ill health, diseases and incidents should identify any failures in this OSH management system and should be documented. Such investigations should be carried out by competent persons, with the appropriate participation of workers and their representatives.

The results of such investigations should be communicated to the safety and health committee, and the committee should make appropriate recommendations. The results of investigations, in addition to any recommendations from the safety and health committee, should be communicated to appropriate persons for corrective action, included in the management review and considered for continual improvement activities.
The corrective action resulting from such investigations should be implemented in order to avoid repetition of work-related injuries, ill health, diseases and incidents.

Reports produced by external investigative agencies, such as inspectorates and social insurance institutions, should be acted upon in the same manner as internal investigations, taking into account issues of confidentiality.

6. Performance Indicators

Procedures to monitor, measure and record OSH performance on a regular basis should be developed, established and periodically reviewed. Responsibility, accountability and authority for monitoring at different levels in the management structure should be allocated.

This Program will use the following indicators:

Measure	Indicators
Health and Safety Procedures (SWP)	• Health and safety procedures drawn up prior to the start of construction work • Evidence of inclusion of health and safety procedures as an annex to contracts signed with the Contractor.
Health and safety management personnel	• Evidence of hiring an Occupational Health and Safety (OHS) manager as part of the Contractor's team.
Minimum Requirements for Safe Work Procedures - SWP	• SWP detailed prior to start of work • Evidence of inclusion of the SWPs as an annex to the contracts signed with the Contractor. • Number of non-conformity notifications resulting from non-compliance with any of the SWPs.
Occupational safety training	• Number of workers trained on OSH issues in relation to the total number of workers admitted. • Evidence of weekly orientations on OSH issues • Evidence of daily safety talks conducted
OSH Statistics	• Number of man-hours worked • Number of accidents with injury • Number of non-injury accidents • Number of days lost due to occupational accident or occupational disease • Number of fatal accidents
Health and safety monitoring	• Number of OSH inspections carried out in relation to the total number planned • Number of OSH non-conformity notifications recorded • Number of nonconformity notifications corrected within the established timeframe
Employee health management	• Evidence of the performance of periodic examinations required by law • Number of cases of work-related diseases • Number of cases of infectious diseases among working people

7. Reports and Documentation

Arrangements and procedures should be established and maintained for: (i) receiving, documenting and responding appropriately to internal and external communications related to OSH; (ii) ensuring the internal communication of OSH information between relevant levels and functions of the project, and (iii) ensuring that the concerns, ideas and inputs of workers and their representatives on OSH matters are received, considered and responded to.

The Contractor shall prepare monthly OSH reports for submission to the TANESCO E&S Team during construction.

The reports will list all subcontractors operating in the construction fronts and support areas, specifying the respective number of workers and the activities performed or under their responsibility.

Information/evidence of the effectiveness indicators listed in the previous section for the period will be presented.

Serious Incident Report

In case of any serious incident or accident related to labour conditions, occupational health and safety, sexual harassment, or SEA/SH—including fatalities, life-threatening injuries, or significant environmental or social risks—TANESCO shall notify the World Bank within 48 hours of becoming aware of the event. A detailed report including root cause analysis, corrective measures, and timeline shall be submitted within 10 business days, as per World Bank ESIRT (Environmental and Social Incident Response Toolkit).

8. Schedule

The program must be maintained throughout the construction period in order to minimize the risk of accidents and ensure the health and safety of workers. OSH training will be carried out during the admission process and will be reinforced weekly for a minimum period of 15 minutes. OSH supervision will be periodic and continuous during construction and during the operation stage.

11.0
Environmental and Social Monitoring Plan

11.1
Introduction

This document presents the Environmental and Social Monitoring Plan (ESMP), outlining the comprehensive framework for monitoring environmental and social impacts associated with the project's construction and operational phases. The ESMP aims to ensure compliance with regulatory requirements, international standards, and best practices in environmental and social management.

It does not include the measure *Construction Supervision*, which is part of the Environmental and Social Management Programme (P.02) for the construction phase, since the main purpose of this measure is to ensure compliance with environmental and social guidelines, standards and procedures during the execution of the works, acting in a preventive and corrective manner on the actions of the Contractors. This is an inspection and management control activity, which focuses on verifying the compliance of the practices adopted with what was established in the ESMP, environmental licences and Tanzanian legislation and international standards, also covering occupational health and safety aspects. On the other hand, the present Environmental and Social Monitoring Programme is technical and operational in nature and aims to systematically collect and analyse data on environmental quality (such as noise, air, water and effluents) to assess impacts and trends over time. Thus, *Construction Supervision* is part of the construction management process, while monitoring is part of the strategy for the continuous assessment of environmental effects.

Purpose of the Document

The primary objective of this plan is to:

- Guide Implementation: Provide detailed procedures for monitoring environmental and social aspects of the project.
- Ensure Compliance: Maintain adherence to Tanzanian environmental laws, IFC General Environmental, Health, and Safety (EHS) Guidelines, and project-specific commitments.
- Support Decision-Making: Facilitate informed decision-making through evidence-based assessments of environmental and social performance.

Document Structure

The document is organized into the following sections:

- Introduction: Overview of the document's purpose, scope, and organization.
- Contractors' Environmental Monitoring Programme: Specifications for monitoring atmospheric emissions, noise, treated effluents, and drinking water quality during construction, to be undertaken by contractors.

- TANESCO's Environmental Monitoring Programme: Monitoring measures performed by TANESCO's Supervision Team, focusing on air and water quality, noise levels, and compliance with environmental standards.
- TANESCO's Social Monitoring Programme: Social monitoring strategies to evaluate community well-being, effectiveness of local hiring programs, health indicators, and commitments to stakeholder engagement.
- Performance Indicators and Reporting: Key indicators and reporting requirements to track progress and ensure transparency.

This plan is integral to achieving sustainable development outcomes by minimizing negative impacts and fostering positive contributions to the local environment and communities.

11.2
Contractors' Environmental Monitoring Programme

The following environmental monitoring activities will be carried out by the Contractors during construction works to ensure that the pollution control measures adopted as part of P.01 are being effective.

Atmospheric emissions monitoring

- Dust emissions from the concrete plant and the aggregates plant (PM_{10} and $PM_{2.5}$) will be measured by the Contractors with electronic meters at least once every six months. The monitoring should be located 50 metres from the source, in the direction of the wind.
- Dust level monitoring (including PM_{10} and $PM_{2.5}$) will be conducted at work fronts with electronic meters. Monitoring shall be carried out by the Contractors on a monthly basis during the dry season at work fronts with considerable activity, with nearby houses. Compliance will be verified at a monitoring point that will be located 50 metres from the source, in the direction of the wind.
- Contractors will conduct visual emission monitoring (Ringelmann scale) on their vehicle and equipment fleets. This measurement shall be carried out at least once a year.
- Emissions from stationary sources such as power generators will be monitored by the Contractors at least semi-annually, including particulate matter, NO_x, SO_2 and CO.
- All these measurements will be compared to the limits established in Tanzanian Environmental Management (Air Quality Standards) Regulations, 2007 and to the standards of the IFC General EHS Guidelines (whichever is more restrictive).

Noise monitoring

- Noise levels in accommodation, cafeterias and administrative areas will be monitored monthly with windows open and closed. Noise monitoring in the accommodation will include daytime and night-time measurements.

- The limits of Tanzanian Environmental Management (Standards for the Control of Noise and Vibrations Pollution, 2015) or the IFC General EHS Guidelines (whichever is more restrictive) shall be complied with.

Treated effluents monitoring

- If the camp sites are not located in an area with a sewage system, and the effluents from oil-water separation devices, concrete plant settling boxes or concrete mixer washing areas are discharged into watercourses, these effluents must be monitored by the Contractors. Emission standards set out in the IFC General EHS Guidelines must be met.
- The monitoring frequency shall be monthly for the parameters pH, COD, Total Nitrogen, Total Phosphorus, Oils and Fats and Total Suspended Solids.

Drinking water quality monitoring

- Drinking water used for workers' consumption will be monitored according to the WHO standard of potability, based on random samples. Contractors company will check a minimum of 10 samples monthly.

The TANESCO Supervision Team may issue requests for supplemental monitoring when specific high-risk activities or vulnerable areas of the Project warrant a more thorough inspection than described above.

Performance Indicators

The following indicators will be used to measure the results of the monitoring carried out as part of this Programme:

Atmospheric emissions	• Evidence of monitoring of gas emissions at the required frequency and number of vehicles and equipment monitored in relation to total number of vehicles and equipment • Evidence of monitoring of particulate matter at the required periodicity and at the total number of points proposed • Evidence of monitoring of emissions from stationary sources and number of monitored equipment in relation to the total number of points proposed
Noise	• Noise baseline campaign carried out prior to construction works at the points where monitoring will be carried out • Evidence of noise monitoring at the required frequency and at the total number of points proposed and that the results meet the standards
Treated effluents	• Evidence of monitoring of industrial effluents (oil-water separator devices, concrete plant settling box or concrete mixer washing area) treated, at the required frequency and at the total number of points proposed and that the results meet the standards
Drinking water quality	• Evidence of drinking water quality monitoring at the required periodicity and number of samples taken and that the results meet the standards

Reports and Documentation

As mentioned in the P.01, the Contractors shall provide and organise in monthly reports the documents, information and evidence of adoption of all environmental control measures and procedures. These reports shall include the following:

- Atmospheric emissions monitoring:
  - results of dust monitoring (including PM_{10} and $PM_{2.5}$);
  - results of the monitoring of emissions from stationary sources (particulate matter, NO_x, SO_2 and CO).
- Water pollution control:
  - results of monitoring of effluents discharged into watercourses.

11.3
TANESCO's Environmental Monitoring Programme

This Section includes monitoring measures to be carried out by TANESCO's Supervision Team or by specialised consultants, to ensure that the pollution control measures adopted by the Contractors as part of P.01 are effective and are not causing a deterioration in environmental quality and disturbance and damage to the health of the surrounding population.

The monitoring measures to be carried out by the TANESCO Supervision Team will include the following:

- Monitor water quality at points upstream and downstream the treated effluent discharge points and the areas with earth movements;
- Monitor air quality in inhabited areas very close to camp sites, work fronts and accesses;
- Monitor noise in inhabited areas very close to camp sites, work fronts and accesses;

The water quality, air quality and noise monitoring will be carried out by TANESCO's own Supervision Team, or this team will be responsible for drawing up terms of reference for contracting such monitoring and evaluating the campaign reports prepared by the companies contracted to conduct the activities.

The following monitoring will be carried out by the TANESCO Supervision Team or by specifically contracted companies:

- Noise

  - Noise monitoring will be carried out in inhabited areas very close to camp sites, work fronts and accesses;
  - The monitoring points near the work fronts will be the 8 (eight) points (Noise 1 to 8) where noise was measured for the base line (see **Table 7.1.9.1.a** in **Section 7.1.9.1**) and other 5 (five) points chosen on some of the stretches where the route

passes through villages where the surroundings are more densely populated (some of the stretches indicated in **Figure 8.2.3.3.f** of impact 13.02 in **Section 8.2.3.3**). The coordinates of these 5 points (Noise 9 to 13) are shown in the following **Table 11.3.a**, together with 4 (four) other points (Noise 14 to 17) defined mostly in school close to accesses to be used by the construction vehicles.

Table 11.3.a
Noise measurement points during construction work

Points	UTM coordinates (zone 36M)		Village
	X	Y	
Noise (9)	295,167.94 m E	9,825,794.15 m S	Chagati
Noise (10)	278,762.04 m E	9,693,248.76 m S	Muzani
Noise (11)	291,160.00 m E	9,682,638.39 m S	Kikoma
Noise (12)	447,337.11 m E	9,633,918.40 m S	Kalole
Noise (13)	488,173.76 m E	9,622,862.41 m S	Mwiseme
Noise (14)	324,068.00 m E	9,861,963.00 m S	Nyabihanga (near B8 Road)
Noise (15)	278,073.00 m E	9,693,118.00 m S	Muzani (near B3 Road)
Noise (16)	299,527.00 m E	9,678,531.00 m S	Lusahunga (near B3 Road)
Noise (17)	456,307.00 m E	9,631,177.00 m S	Bukwimba (near Nyang'huale-Busangi Road)
Noise (18)	556,938.00 m E	9,599,037.00 m S	Close to the extension limit of the SE Ibadakuli
Noise (19)	557,299.00 m E	9,599,151.00 m S	Close to the extension limit of the SE Ibadakuli
Noise (20)	301,397.00 m E	9,669,143.00 m S	Close to the extension limit of the SE Nyakanazi
Noise (21)	301801.00 m E	9669294.00 m S	Close to the extension limit of the SE Nyakanazi
Noise (22)	323,198.00 m E	9,861,192.00 m S	Close to the extension limit of the SE Kyaka
Noise (23)	323,438.00 m E	9,861,277.00 m S	Close to the extension limit of the SE Kyaka

Obs.: The location of the suggested points can be adjusted by the team in the field, following the criterion of selecting houses close to the work fronts.

- In addition to the 23 points, other points should be chosen and incorporated to the monitoring if there are houses close to noisy areas of camp sites (concrete plant, workshop, ironwork shop, generators).
- Monitoring will be carried out on a quarterly basis. Night-time measures will be taken where appropriate.
- The results will be compared to the limits established in Tanzanian Environmental Management (Standards for the Control of Noise and Vibrations Pollution, 2015) or the IFC General EHS Guidelines (whichever is more restrictive).
- Additional monitoring will be carried out if there are complaints about noise at unmonitored points and in periods between campaigns (registered by the Stakeholder Engagement Plan's Grievance Mechanism).

- Air quality

  - Air quality monitoring will be carried out in inhabited areas very close to camp sites, work fronts and accesses.
  - The monitoring points near the work fronts will be some of the points chosen to the noise monitoring, including the points Noise 1 to 13 and Noise 17 mentioned in the item above. In addition to these, another four points (Air 1 to Air 4) will be

monitored where there are houses very close to dirt roads. These points are shown in the following **Table 11.3.b** bellow.

Table 11.3.b
Air quality monitoring points during construction work

Points	UTM coordinates (zone 36M)		Village
	X	Y	
Air (1)	433355.00 m E	9625967.00 m S	Lunguya (near Geita-Bukoli-Msalala Road)
Air (2)	435731.00 m E	9609217.00 m S	Segese (near Geita-Bukoli- Msalala Road)
Air (3)	450759.00 m E	9596287.00 m S	Busangi (near Nyang'huale-Busangi Road)
Air (4)	449973.00 m E	9608393.00 m S	Chela (near Nyang'huale-Busangi Road)

Obs.: The location of the suggested points can be adjusted by the team in the field, following the criterion of selecting houses close to the work fronts and to dirt roads used by the construction vehicles.

- In addition to the 18 points, other points should be chosen and incorporated to the monitoring if there are houses close to camp site areas with atmospheric emissions, such as concrete plants and aggregate deposits.
- The parameters to be monitored include particulate matter (PM_{10}), NOx, CO, Lead and Ozone, and shall comply with the standards of the Tanzanian Environmental Management (Air Quality Standards) Regulations, 2007 and of the IFC General EHS Guidelines (whichever is more restrictive).
- Monitoring will be carried out on a quarterly basis.
- Additional monitoring will be carried out if there are complaints about air quality at unmonitored points and in periods between campaigns (registered by the Stakeholder Engagement Plan's Grievance Mechanism).

- Water quality

  - If treated effluents are discharged into water bodies, water quality monitoring will be carried out upstream and downstream of the discharge point.
  - The points cannot be chosen at this stage, but only once the location of the camp sites has been defined.
  - This monitoring will be carried out on a quarterly basis.
  - The parameters to be monitored include Temperature, pH, Dissolved Oxygen (D.O.), Turbidity, BOD, COD, and Suspended Solids.
  - Every two weeks, TANESCO must conduct turbidity monitoring in watercourses near earthwork activities. Sampling points should be considered upstream and downstream of construction activities.
  - If the water quality monitoring carried out by TANESCO shows a significant variation in the monitored parameters, the Contractor must be notified immediately and corrective measures must be taken.

Performance Indicators

The following indicators will be used to measure the results of the monitoring carried out as part of this Programme:

- Evidence of noise, air quality and water quality monitoring at the required frequency and at the total number of points proposed
- Evidence of corrective measures demanded of Contractors in the event of parameters exceeding the limits

Reports and Documentation

The Plans and Programmes Management Reports to be prepared by the TANESCO Management Team will also include the results of the noise, air quality and water quality monitoring carried out during the period, the results and a critical analysis of them, any deviations found and the measures and adjustments to be demanded of the Contractors to correct the deviations.

11.4
TANESCO's Social Monitoring Programme

This Section includes monitoring measures to be carried out by TANESCO Management Team or by specialised consultants, to monitor the situation of the population in the area of influence during the construction phase, especially those in the villages where the camp sites will be located, in order to guide and evaluate the social protection actions taken as part of the ESMP Plans and Programmes.

The monitoring measures to be carried out by the TANESCO Management Team will include the following:

- Monitor the effectiveness of the measures of the **P.13 - Local Hiring Programme**, through a quarterly survey to be carried out with representatives of the councils and executive offices of the villages and wards, and also through interviews with community leaders. Data from the indicators generated by P.13 will also be used.

  Interviews will also be carried out with local businesses in the locations where the camp sites will be set up, in order to identify the effects of the increase in local employment on the economy. The monitoring will also include the closure of the construction phase, to verify if there are any debts left by the Contractors and subcontrators and their workers.

- Monitor health indicators in the area of influence of the project, through a quarterly survey to be carried out during construction at health facilities (consider those closest to the TLs' route and to the camp sites among those described in **Table 7.3.8.1.a** of **Section 7.3.8.1**), to identify an increase in cases of diseases that may be related to the project (due to the presence of workers), whether they are vector-borne diseases

or sexually transmitted diseases. The possible increase in cases of teenage pregnancy will also be monitored.

The number of cases of traffic accidents attended by health centres will also be surveyed.

In the interviews with the community leaders, the issue of accidents and effectiveness of measures implemented (such as control of velocity of vehicles in areas where the population lives) will be included. The indicators will also include an analysis of the grievances presented on these issues.

- Monitoring of violence indicators in the area of influence of the project, through quarterly surveys during construction at police stations and police posts, especially those located in villages or wards closest to where the camp sites will be located, to identify an increase in cases of violence, harassment, assault, robbery or theft, traffic accidents with victims, fights, among others.

- Monitoring of implementation of environmental measures. This will include the gathering of opinions and analysis of grievances related to dust emissions, noise, vibrations, and others, to verify if the measures implemented effectively control the impact on the population or not and identify if corrective measures are required.

- Fulfilment of commitments. TANESCO will keep a record of the commitments agreed with each community and will track its implementation. This will include the management of the grievance mechanisms, the implementation of the Resettlement Action Plan and other commitments. Quarterly, in the interviews with community leaders, their opinions on their satisfaction with these commitments will be gathered and explained (if they are totally satisfied, partially, not satisfied and why).

<u>Monitoring of Gender-Based Violence (GBV) Risks and Effectiveness of the GBV Action Plan</u>

TANESCO Management Team will monitor the effectiveness of the GBV mitigation measures as outlined in the **GBV Action Plan** (**Annex 16 – P.15**). This will include:

- Tracking the number of awareness sessions held with workers and communities.
- Reviewing reports from the Grievance Redress Mechanism (GRM) on SEA/SH incidents.
- Verifying the implementation of Codes of Conduct and related trainings.
- Engaging with local GBV service providers to monitor referrals and survivor support.
- Conducting interviews with community focal points and local stakeholders to detect perception of changes in community safety and trust.

Monitoring Community Conflicts and Social Cohesion

TANESCO will include semi-structured interviews and perception-based assessments with local leaders and community members to monitor whether project-related tensions have contributed to increased intra- or inter-community conflict. Focus areas will include competition for jobs, pressure on local services, and land access disputes.

Monitoring the Implementation of the Stakeholder Engagement Plan (SEP)

The effectiveness of SEP (**Annex 14 – P.12**) implementation will be monitored based on:

- Number and type of engagement events held.
- Community participation rates disaggregated by gender and vulnerability.
- Grievances submitted, resolved, and satisfaction levels of complainants.
- Timely disclosure of information and consultation follow-up.
- Record of commitments made during consultations and their fulfilment status.

Key Social Monitoring Indicators

The following indicators will be tracked and analyzed quarterly:

- % of local hires vs. total workforce (**P.13**)
- Number of health cases reported related to Sexual Transmitted Infections - STIs, vector diseases, and teenage pregnancies.
- Number and type of grievances submitted through the SEP's GRM.
- GBV-related grievances received and appropriately managed.
- Number of stakeholder engagement events and % female participation.
- Number of confirmed project-related community conflicts or disputes.
- Number of commitments tracked and % implemented on time.
- Number of reported traffic incidents and environmental complaints (e.g., dust, noise).
- % of surveyed community members reporting satisfaction with mitigation and engagement measures.

Reporting and Documentation

TANESCO Social Monitoring Team will compile the results of all monitoring activities into a quarterly monitoring report, which will include:

- Quantitative and qualitative analysis of key social indicators, disaggregated where relevant by gender, vulnerability, and geographic area.
- Evaluation of the effectiveness of mitigation measures implemented under the ESMP, including those related to local hiring, health, stakeholder engagement, and GBV.
- Detailed records of grievances, including the nature of the complaints, response times, outcomes, and any lessons learned.

- Stakeholder feedback, gathered through consultations, interviews, and grievance mechanisms, reflecting community perceptions and levels of satisfaction.
- Recommendations for adaptive management, including corrective actions, capacity-building needs, or institutional adjustments to improve the social performance of the Project.

12.0
Resource Evaluation or Cost Benefit Analysis

12.1
Introduction

The Governments of the East Africa Community Member States agreed to interconnect their power systems by implementing the 400 kV Uganda-Tanzania Interconnector Power (UTIP) Project, which consists of the construction of a high voltage transmission line system.

Uganda and Tanzania are currently implementing various programs to increase their generation resources and transmission networks. In addition, potential sites for power generation in the region will open up opportunities for power trade between the two countries and other neighboring countries in the region. Therefore, the need for an interconnector between the two countries is of paramount importance in sharing the produced electricity.

The following is a cost-benefit analysis of the project, as required by local legislation. The costs and benefits of the UTIP project can be summarised in its negative (costs) and positive (benefits) impacts, which are described in **Chapter 8**. This section makes a high-level analysis to assess the costs and benefits of the project based on the following information:

Project Costs:

- Project investment
- Environment
- Socio-economic

Project Benefits:

- Environment
- Socio-economic

12.2
Main Project Benefits

The Project´s Feasibility Study as well as this ESIA identify the following **main Project benefits** of implementing the UTIP project:

- *Increased Energy Stability:* The interconnection allows for greater stability and reliability in energy supply, by linking regional energy generation capacity to load centres, thus reducing dependence on a single energy source and mitigating the risks of blackouts.

- *Increased Resilience to Climate Events:* The project enhances the resilience of the power supply to climate-related events such as droughts, floods, and seasonal fluctuations. This is achieved by diversifying energy sources and improving the stability of the grid.

- *Economic Efficiency:* Integrating the grids can lead to reduced operational and maintenance costs, as well as optimizing the use of available energy resources in both countries.

- *Enhanced Energy Efficiency:* The interconnection allows for more efficient use of energy resources, reducing waste and improving overall energy efficiency.

- *Regional Economic Development:* Improved energy infrastructure can boost economic development, attracting investments and promoting industrialization and economic growth in the interconnected regions.

- *Access to Cleaner and Low Carbon Energy:* The interconnection facilitates the integration of external renewable energy sources, such as solar and wind, into the Tanzania national grid, promoting a more sustainable energy matrix and reducing greenhouse gas emissions.

- *Promotion of Sustainable Development:* By providing a reliable and clean energy supply, the project supports sustainable development goals, contributing to environmental conservation and the well-being of communities.

- *Reduction in Deforestation:* With improved access to electricity, there is less dependence on biomass (like wood and charcoal) for cooking and heating, which can help reduce deforestation and preserve natural habitats.

- *Strengthening Regional Cooperation:* By enhancing cross-border regional electricity trade, the UTIP project will strengthen cooperation between countries in the region, promoting economic and political integration and contributing to regional stability.

- *Job Creation:* The construction and maintenance of the interconnector will create numerous job opportunities, both directly and indirectly, boosting local employment and income levels. The estimated amount of direct labour required to implement the project will be up to 1,350 workers at the peak of construction. These workers will be mobilized at construction sites or work fronts. Of the total workforce, it is estimated that between 20% and 30% will be local workers. The involvement of approximately 650 indirect workers is also estimated.

- *Improved Quality of Life:* Reliable electricity access can improve living standards by enabling better healthcare, education, and access to information and communication technologies.

- *Poverty Reduction:* By providing stable and affordable energy, the project can help reduce poverty levels, especially in rural areas, by supporting small businesses and improving agricultural productivity.

- *Enhanced Public Services:* Stable energy supply can improve the efficiency and reliability of public services, such as water supply, sanitation, and transportation, benefiting communities and businesses alike.

Interconnection between countries provides the opportunity to balance electricity demand and supply on a larger scale. By sharing electricity resources, countries can optimize their power generation to match demand patterns more effectively. This flexibility reduces the reliance on fossil fuel power plants that often operate at steady outputs. Instead, countries can tap into cleaner and more flexible energy sources, such as hydropower or natural gas plants, to meet varying demand levels. This results in lower CO_2 emissions by minimizing the use of carbon-intensive power plants.

In addition to the aforementioned benefits, directly related to Uganda and Tanzania, with a regional perspective, it can be highlighted that the Uganda-Tanzania Interconnection also allows to increase the transfer capacity usable by other countries for power exchanges. On a regional perspective, Uganda and Tanzania are part of the Eastern Africa Power Pool (EAPP), with other countries interested in power trading. There is also an interest in interconnecting the EAPP with the Southern African Power Pool (SAPP), with interconnections between Tanzania and Zambia, Mozambique and Malawi.

12.3
Project Costs

12.3.1
Capital Costs

The total investment planned for implementation of the project will be **USD 372,254,927** (Tshs. 1,009,555,362,024), with the costs broken down by component as shown below:

- 400 kV Mutukula – Kyaka TL: USD 23,478,650
- 400 kV Kyaka – Nyakanazi TL: USD 148,252,000
- 400 kV Nyakanazi – Ibadakuli TL: USD 138,922,777
- Kyaka SS expansion: USD 33,432,000
- Nyakanazi SS expansion: USD 18,774,000
- Ibadakuli SS expansion: USD 9,397,500

These costs relate to supply of equipment and materials as well as construction services, all of which will be part of the EPC contract. They do not include the costs of implementing the Plans and Programs in the ESMP, except for the Construction Environmental Plan (CEP) which will be implemented by the EPC and whose costs for implementing the established measures should be part of the costs of carrying out the works.

The monetary estimates provided in this section must be considered preliminary and reflect the current level of development of the project.

12.3.2 Environmental and Social Costs

The environmental and social risks and impacts that will result from the Project´s construction and operation will be mitigated / compensated by a diverse set of E&S management plans and programs that have been specified in this ESIA. These are detailed in **Chapters 9 and 10** and aim to prevent, mitigate and/or offset the identified negative impacts, while also maximizing the positive outcomes.

The estimated costs of these E&S plans and programs are presented herein. Construction and operation phase costs are estimated separately where applicable. Construction costs have assumed a 36-month construction schedule. Some plans and programs are continuous and other are based on periodic monitoring campaigns. Where this is the case, the assumed periodicity is being indicated.

It is assumed that costs of the construction phase E&S plans and programs listed below will be borne by the EPC Contractor and should be included in its contractual price, including the Construction Environmental Plan (CEP), the Construction Occupational Health and Safety Management Plan, the Construction Emergency Preparedness and Response Plan, the (construction) Labour Management Procedures (LMP), and the Local Hiring Program.

With the exception of the above, it is assumed that other construction phase E&S plans and programs will be a TANESCO cost.

Construction Environmental Plan (CEP)

- Erosion Prevention and Control
- Control Procedures for Construction in Flooded Areas
- Prevention and Control of Soil Contamination
- Water and Effluent Management
- Atmospheric Emissions and Noise and Vibration Control
- Vegetation Clearing
- Construction Sites and Workforce Housing Management
- Waste Management
- Hazardous Materials Management
- Construction Traffic Control
- Decommissioning and Environmental Recovery
- GHG Emission Measurement and Mitigation
- Environmental Monitoring: (i) Noise monitoring; (ii) Treated effluents monitoring; (iii) Drinking water quality monitoring
- Demining of the Direct Area of Influence (DAA)
- Indemnification for unintended damage to crops and rural improvements during

works
- Indemnification of economic impacts to local businesses or economic activities due to temporary access restrictions

Construction Occupational H&S Plan

- Development of Occupational Health and Safety Management Procedures
- Minimum Requirements for Safe Work Procedures – SWP
- Health and Safety Management Staffing
- Occupational Safety Training
- Health and Safety Supervision
- Worker Health Management
- Worker Participation

Construction Emergency Preparedness and Response Plan

- Risk Assessment
- Emergency Preparedness and Response Procedures (EPR)
- Training and Drills

Labour Management Procedures (LMP)

- Human Resources Policy
- Workers' Code of Conduct
- Recruitment and Labour Training
- Management of Working Conditions
- Internal Stakeholder Grievance Mechanism
- Environmental and Social Education for Workers

Local Hiring Program

- Local Disclosure of Vacancies, Profiles and Requirements
- Interaction with Stakeholders
- CV Database Formation
- Training Programme for Local Labour
- Workforce Composition Targets

Biodiversity Programs

Regarding biodiversity values, the region is home to threatened and endemic species of flora and fauna, as well as other important attributes for the congregation of fauna species and the maintenance of the region's ecological processes, in addition to priority ecosystem services for the population. These values triggered critical habitat for criteria (a), (b), (c) and (e) in accordance with paragraph 23 of the World Bank ESS6.

The implementation of the project will cause negative impacts on these attributes, including the conversion of critical natural habitats, which will lead to the loss of individuals of flora, degradation of the remaining vegetation, and reduction of habitats for fauna, among others. As demonstrated throughout the study, impacts on critical habitat and other biodiversity values cannot be avoided.

However, following the mitigation hierarchy, the Project's Biodiversity Management Plan (BMP) includes measures to both minimize and compensate these impacts. Among the measures envisaged, the reduction of vegetation linear clearing along the transmission line´s easement to only a 6-meter-wide strip made it possible to reduce total clearing by 88%. Other measures to minimise impacts during construction include the rescue and relocation of fauna and flora during vegetation clearing, control of invasive exotic species and fauna monitoring.

As there will still be residual impacts, the BMP and the associated Biodiversity Offset Plan include afforestation measures, with a focus on achieving biodiversity gains, not only for critical habitat triggers but for impacts on natural habitats and ecosystem services in general. In total, 691.89 hectares of habitat restoration have been considered, based on a 3:1 replacement ratio in the case of natural critical habitats and a 1:1 ratio in the case of critical modified habitats, as well as a 2:1 ratio in non-critical natural habitats and 1:1 ratio in modified critical habitats.

Thus, although there will be residual negative impacts from the implementation and operation of the project, this will make it possible to achieve biodiversity gains that will contribute, in the long term, to the maintenance of ecological processes and ecosystem services in the region and assure that the Project results in no-net-loss (NNL) of biodiversity in the case of converted natural habitats and net-positive-impact (NPI) in the case of critical habitats.

Biodiversity Offset Plan Supplementary Measures:

The cost of implementation of the reforestation described herein is estimated at **US$ 6,227,010** (Tshs. 7,679,244,960) considering an average per-hectare cost of US$ 9,000, not including post-planting monitoring that is included as an operation phase activity.

A comprehensive set of supplementary plans and programs will assure the biodiversity objectives specified above are met and are consolidated into the **Biodiversity Management Plan (BMP)**. These are listed below with the corresponding cost estimations.

- Total area to be restored (to be confirmed after the end of the vegetation clearing): 691.89 ha (cost already included above).
- Carrying out specific consultations with project stakeholders, mainly protected area managers and representatives of wards and villages to identify the best areas to be restored.
- Drawing up specific restoration projects for each group of areas.

- Monitoring of the habitat restoration (this cost is in the Sub-program of native vegetation restoration below).
- Ecosystem Services Impact Mitigation Plan.

Total cost estimate for the supplementary measures: **US$ 350,000** (Tshs. 949,200,000) (part of this cost to be incurred during the first 3 years of the Project´s operation).

Fauna and Flora Rescue and Relocation Plan:

- Fauna rescue and relocation activities:
    - Installation of Temporary Fauna Rescue Bases.
    - Team of biologists and veterinarians to rescue and relocate the animals before/during vegetation clearing estimated to last up to 10 months.
- Flora rescue and relocation activities:
    - Team of biologists or forestry engineers to rescue and relocate the germplasm before vegetation clearing (for use in afforestation areas).

Total cost estimate: **US$ 145,000** (Tshs. 393,240,000)

Invasive Species Control Programme:

- Training for workers on the identification of invasive alien species and eradication methods.
- Monitoring: to be carried out minimally in the stretch along the Burigi-Chato National Park and in new open accesses in areas of native vegetation.
- Frequency: every 6 months, for 3 years.

Total cost estimate: **US$ 90,000** (Tshs. 244,080,000)

Landscape Protection Program:

- Identification of priority areas for monitoring, minimally the stretch of the Burigi-Chato National Park and in new open accesses in areas of native vegetation
- Carry out drone overflights of these stretches. The drone to be used must be suitable for monitoring large areas, with ample flight autonomy, equipped with RGB sensors and high-resolution cameras.
- Frequency: every three months, during the 1st year of operation.

Total cost estimate: **US$ 80,000** (Tshs. 216,960,000)

<u>Operation Phase:</u>

Operation Phase Biodiversity Management:

- Subprogram of bird collision monitoring
  Frequency: every three months, during the 1st 3 years

- Subprogram of fauna monitoring during operation
  Frequency: every four months, during the 1st 5 years

- Subprogram of native vegetation restoration: monitoring of compensatory plantings (Biodiversity Offset)
  i. Frequency: every three months, during the first year, and every 6 months in subsequent years, for a total period of 5 years.

Total cost estimate: **US$ 780,000** (Tshs. 2,115,360,000)

Flora Active Search Programme

- Office assessment of the priority search stretches and identification of preferred habitats. In these places, search quadrants should be delimited to ensure that the entire area of potential occurrence is effectively surveyed.
- A pre-survey of the area using a drone can be carried out to identify the current state of conservation of the vegetation and optimise searches, for example by identifying recently cleared areas beforehand.
- Active search for species in the designated quadrants. The searches will be carried out by two teams, each consisting of one senior local botanist and one assistant.

Total cost estimate: **US$ 90,000** (Tshs. 216,960,000)

Environmental Programs

Construction Phase

The environmental programs for the construction phase will include a series of activities to be implemented by TANESCO, either directly or through outsourced consultancies, and operation include measures to avoid and minimise impacts related to pollution.

- Construction Supervision
- Coordination / Monitoring of Plans and Programmes of the ESMP
- Greenhouse Gas Emissions Management
- Management of Interference with Mining Permits
- Demining of resettlement areas (if applicable)

The estimated cost of the above programmes is **US$ 1,180,000** (Tshs. 3,200,160,000) considering a 36-month construction schedule. This does not include any costs for demining activities which may or may not be necessary.

Operation Phase

It is assumed that operation phase programs will mostly be executed directly by TANESCO through its existing O&M departments which will need some additional staff. The E&S programs defined in the ESIA for the operation phase are listed below:

- Supervision of Compliance with the Measures of ESMP Plans and Programmes that Extend to the Operation Phase
- Environmental Training of the Maintenance Team
- Monitoring of Afforestation Areas
- Waste Management
- Maintenance and Erosion Control
- Vegetation Management on the Wayleave Easement
- Protection of the Wayleave Easement
- Emergency Response Plan (ERP) Framework for the Operation Phase
- Audible Noise Monitoring
- Electromagnetic Field Monitoring
- Access Control Plan
- Community Health and Safety Monitoring

Costs of implementing the above E&S programs cannot be estimated on the basis of currently available information but it is not expected that they will result in a material increase in the transmission line´s overall O&M budget.

Socio-Economic Programs

Construction Phase

Establishment of the transmission line´s easement will require indemnification of affected parties as well as implementation of a comprehensive set of assistance measures that have been detailed in the project´s Resettlement Policy Framework (RPF).

The T-line will have an extension of 550.8 kilometers and the easement will be 52 meters wide, totaling around 2,854 ha along the entire length of the Project. Areas for sub-stations will add to this.

A total of 1,106 buildings located along the alignment, that will be directly affected by the project, have been identified in the ESIA. The intervention area on agricultural crops (required to wayleave easement) is estimated at 1,218.89 ha, being 80.67 ha (6.6%) to perennial crops and 1,138.23 ha (94.4%) to cyclical crops.

The RPF was developed in accordance with World Bank ESS5 and provides guidance for TANESCO to detail and subsequently implement a Resettlement Action Plan (RAP). The cost of implementing the compensation measures related to Involuntary Resettlement (i.e., buildings and assets, crops and economic displacement), as well as complementary assistance and monitoring measures, has been estimated at **USD 10,569,487** (Tshs. 28,664,448,744). These costs incorporate all the supplementary measures to comply with WB ESS5, ensuring that there is no reduction in the population's quality of life and that means of livelihood are restored.

Some temporary land-take will be necessary for construction support infrastructure outside the limits of the easement, including camp facilities, materials storage yards,

access roads with alignment outside the right-of-way, surplus soil deposits or other and this will be at the cost of the EPC Contractor. Damage to crops, constructions and improvements, such as fences or buildings, including impacts that result in business interruption (which can result in economic losses), arising from construction activities (mainly access restrictions), will be compensated by the contractor, as defined in the Construction Environmental Plan (CEP) included in the mitigation measures chapter of the ESIA.

Various prevention, control and mitigation measures have been planned in addition to the Resettlement and Livelihood Restoration Program described above, including a Stakeholder Engagement Plan (SEP), Supervision of the Local Hiring Programme (an EPC Contractor Plan), Review and Monitoring of the Labour Management Procedures (also an EPC Contractor Plan), and the Gender Based Violence (GBV) Action Plan, among others. The costs of implementing these E&S programmes over the 36 months of construction have been assumed to be a TANESCO cost are estimated as follows:

- Stakeholder Engagement Plan Implementation (SEP) – **US$ 650,000** (Tshs. 1,762,800,000)
- Supervision of the Local Hiring Program – **US$ 65,000** (Tshs. 176,280,000)
- Review and Monitoring of the Labour Management Procedures (LMP) – **US$ 80,000** (Tshs. 216,960,000)
- Sexual Exploitation and Abuse / Sexual Harassment (SEA/SH) Plan – **US$ 110.000** (Tshs. 298,320,000)

Total TANESCO cost during construction phase (excluding the Resettlement and Livelihood Restoration Program) – **US$ 905,000** (Tshs. 2,454,360,000)

Operation Phase

During the operation phase it is expected that TANESCO will continue implementing some of the social programs of the construction phase, particularly the Stakeholder Engagement Plan (SEP) and the Sexual Exploitation and Abuse / Sexual Harassment (SEA/SH) Plan. It is assumed that these programs can be handled by TANESCO´s current staff and will represent only a marginal additional cost.

Archaeological, Historical and Cultural Heritage Plans

Archaeological, historical and cultural heritage plans are proposed only for the construction phase. These will include:

- Prospecting in the Substation Expansion Areas (borehole program)
- Chance Findings Procedure (CFP) Implementation
- Monitoring during Vegetation Clearing and Earthworks
- Relocation of Graves

Costs of the plans listed above is estimated at **US$ 190,000** (Tshs. 515,280,000) excluding grave relocation.

With respect to grave relocation, the project land valuation study identified 24 grave sites and estimated indemnification costs related to grave relocation at **US$ 3,540** (Tshs. 9,600,000), based on Graves (Removal) Act, 1969.

12.4 Analysis

The UTIP project is a strategic initiative that aligns with sustainable development goals, promoting environmental conservation, social well-being, and economic prosperity. The comprehensive compensation measures for environmental and social impacts ensure that the benefits of the project are maximized while minimizing any adverse effects. This balanced approach underscores the project's potential to drive positive change and development in the region.

Considering the monetizable cost aspects, this project has the potential to deliver significant benefits to both Tanzania and Uganda, at national and local levels, enhancing the standard of living for many stakeholders. While there will be environmental and social costs that are challenging to quantify, the project includes management plans with mitigation measures aligned with international best practices, such as the World Bank ESS Standards, to minimize these impacts. Overall, given the relatively few and manageable residual impacts, which will be minimized as much as possible, and the project’s extensive footprint, the overall benefits, including those for the regional economy, are deemed to outweigh the costs.

13.0
Decommissioning Plan

The Decommissioning Plan presents two sections, one with the decommissioning and recovery measures to be implemented at the end of the Project's construction works, and one with the measures to be implemented in the hypothetical case of demobilising the TLs at the end of their useful life.

13.1
Decommissioning and Recovery at the End of the Construction Phase

The Contractors shall adopt the following procedures for the demobilisation of support facilities and restoration of areas:

- All temporary construction support infrastructure will be dismantled at the end of the works. This will include construction sites and other support facilities. During demobilisation, all temporary structures will be removed to restore the area to similar conditions to the original.
- All concrete plant structures shall be demolished and the debris removed and disposed of in appropriate and authorised areas.
- All areas used for the storage and handling of fuel, chemicals or other hazardous products will be inspected for contamination. If necessary, contaminated soil shall be removed and treated.
- All debris, contaminated materials and other waste such as concrete, wood, plastics, equipment and general tools shall be removed from the areas to be recovered. All waste arising from clearance and demolition activities must be sent to appropriate disposal sites with all relevant permits and authorisations.
- Machinery and equipment washing areas, as well as fuel, oil and grease traps or handling areas, shall be inspected to identify possible soil contamination problems. If necessary, contaminated soil shall be scraped and disposed of to an authorised site or company.
- For the recovery of the work fronts and wayleave easement, the land will be reshaped, which includes levelling the area and stabilising the cut and landfill slopes.
- Grooves and ravines should be recovered.
- Measures will be implemented to ensure the final geotechnical stabilisation of the tower base areas.
- Drainage systems will be reorganised, which will regulate the drainage of rainwater in a way that is suitable for watercourses. On steep slopes, the need for water energy dissipation devices will be assessed.
- Sediment soil shall be removed by manual or mechanical methods in sections where there is heavy deposition of material with compromise of watercourses and potential for damage to vegetation or obstruction of the pre-existing drainage system. Removal shall aim to return watercourses as much as possible to their natural conditions.
- Surface drainage system cleaning activities should be carried out extensively at all construction sites.

- The final inspection of septic tanks and their deactivation should be carried out by cleaning, disinfection using lime and filling with firm material for soil stabilisation.
- Areas directly affected by excavations and earthworks will receive surface protection against rain and runoff. Surface protection activities in areas without geotechnical complications may include the application of topsoil and the planting of grass and/or other herbaceous plants. The protection provided by the planted vegetation should be sufficient to protect the soil against climatic agents and minimise soil loss through erosion. Verification of the success of vegetation restoration activities shall be carried out until complete consolidation.
- In the easement, where native tree vegetation may cause interference with TLs conductors, restoration of vegetation cover will be carried out using a herbaceous cover of species native.

Restoration of vegetation cover

- After the land stabilisation, erosion control and reorganisation of the drainage system, the vegetation cover in the areas that have been subjected to the project intervention will be recovered. This recomposition may take the form of herbaceous vegetation cover or forest recomposition, in all cases using native species and avoiding the use of exotic species.
- Herbaceous vegetation cover is primarily intended to provide surface protection for slopes and areas affected by excavations and earthworks, including the tower areas. After the herbaceous vegetation has been restored, cattle may continue to transit and graze in the wayleave and in the tower areas. It is recommended that cattle be kept away from the towers only during maintenance work, for electrical safety reasons, i.e. to prevent electric shock in the event of accidental electrical discharges, induction or temporary energisation of metal parts, and also to prevent accidents during the movement of equipment such as trucks and cranes. During maintenance inspections, it should be assessed whether the constant presence of livestock near the bases of the towers is causing soil degradation, compaction or even natural excavations that could compromise the stability of the tower foundation over time.
- Forest recomposition can be done through methods of planting seedlings of native species throughout the area; planting seedlings of native species in islands of diversity (nucleation); by natural regeneration with enrichment through seedling planting or seeding; or through a consortium of all three methods. It should be noted, however, that forest recomposition is not advisable in the areas of the service strip, since the planting of large trees may pose a risk to the safety of the transmission line.

Maintenance, demobilisation or recovery of access

During the construction phase, access roads will be maintained where necessary, avoiding inconvenience to the population. The roads implemented for the works and that will not be used later for TLs maintenance will have their original conditions restored, including the implementation of compatible vegetation cover (herbaceous cover or forest restoration with native species). Access roads that will remain functional during the operation phase of the project will require some restoration or adjustment procedures.

For all these cases, the following procedures shall be considered:

- Measures will be implemented to ensure the final geotechnical stabilisation of the accesses, based on inspections;
- Erosion corrections will be made and trawled soils will be removed;
- Soil trawled to watercourses shall be removed and deposited at the access (or in a surplus deposit, if foreseen);
- Temporary drainage devices shall be removed and appropriately disposed.

The following procedures must also be observed for accesses that will be demobilised after completion of the works:

- The relief will be reconfigured to restore the land to its natural features;
- The soil shall be decompressed and the organic soil initially removed and stored for this purpose shall be spread;
- The vegetation cover (herbaceous) will be established by planting native species;
- Alternatively, in pre-defined areas, the vegetation cover can be replanted with native species by planting seedlings or seeds;
- All the signalling installed for the works will be removed.

For accesses that will remain functional during the operation phase of the project, the following shall also be considered:

- The access surface will be re-compressed and the flow orientation will be adjusted in a manner consistent with the drainage design;
- Low spots where water accumulation may favour insect proliferation shall be eliminated;
- Final drainage devices must be cleaned and repaired;
- Herbaceous cover will be implemented on slopes by planting native species;
- The blocking signage shall be removed.

In addition, existing road sections damaged by the works will be restored. These sections will be returned to normal conditions, compatible with their situation before the start of the works. Construction signage will be removed, reinstalling or restoring normal signage where appropriate.

Monitoring of recovered areas

The recovered areas will be monitored. For each work front, compliance with at least the following aspects will be observed and monitored during recovering:

- Demobilisation, demolition and clearance of support areas;
- Recovery of erosion;
- Surface protection of areas directly affected by excavations and earthworks;
- Removal of temporary drainage components, except those considered useful for continued erosion control;

- Recovery of sections of local roads damaged by the works;
- Consolidation of the processes of restoration of vegetation cover and forest restoration;
- Compliance with other specific requirements that TANESCO and/or the environmental authority have included in the decommissioning and recovery procedure.

The demobilisation of the work fronts and the recovery of degraded areas will be supervised by TANESCO's Supervision Team (see P.02).

13.2
Abandonment Plan for the Operation Phase

The Abandonment Plan for the Operation Phase considers the total dismantling of the facilities of the Project's TLs, either when it has completed its useful life, when TANESCO decides to close operations, or also in the event that the equipment is reconditioned and modernised or dismantled to make room for new technology equipment. Whatever the situation, the decision will be taken in a timely manner and the authorities will be informed and the current regulations will be complied with.

The plan includes the following activities:

- Disconnection and de-energisation of TLs;
- Removal of conductors, insulators and other accessories;
- Dismantling and removal of structures;
- Demolition of foundations down to ground level (if they exceed this level);
- Rearrangement of disturbed surfaces and areas;
- Blocking and decommissioning of access roads, if not used by the community.

The Abandonment Plan for the Operation Phase will start with the reconnaissance of all areas occupied by the Project and assessment of the works to be abandoned, in order to prepare or plan for closure.

Through the collection and analysis of information, the activities necessary for the decommissioning of the facilities will be determined, protecting the environment, human health and safety during the works.

Printed notices should be distributed to the neighboring population, as well as other forms of communication, e.g. using cars with loudspeakers, to communicate the actions and precautions to be taken by the population during and after the removal of the installations.

Before the transformers and conductors are removed, the circuits must be de-energised and grounded. Grounding is an additional safety measure that protects workers against possible residual voltages or atmospheric discharges that may occur while the TL is being dismantled. In the period between de-energisation and removal of conductors, control, command and protection equipment, and transformers, TANESCO must maintain vigilance on the physical integrity of the equipment as it may be stolen.

After de-energisation, the transformers must be dismantled and removed by adopting the following measures: disconnecting and removing the transformer from the structure; loading and anchoring the transformer in the transport vehicle; transporting the transformer to a TANESCO storage deposit or for relocation to another facility. In case the part remains stored in a warehouse, it must be placed in a covered, contained and waterproofed room, to avoid contamination of the ground by possible oil spills.

As for the conductors, the measures to be adopted in their removal are the following: installation of pulleys for the recovery of conductors; untying of conductors; recovery of conductors on wooden reels; loading and anchoring of the reels in the transport vehicle; transport of conductors to a TANESCO storage deposit or for relocation to another facility; dismantling of insulators.

For the removal of the structures, the following shall be carried out: dismantling of accessories and equipment; first anchoring of the structures; excavation of the base of the tower to free it from its support; hoisting of the tower, transfer and installation on the transport vehicle; reconditioning of the areas, returning the soil properties to their original natural condition or to a level suitable for the desired future use; transport of the parts of the structures to a TANESCO storage deposit or for relocation to another facility.

If parts stored in TANESCO deposits cannot be reused in another facility, the materials should be disassembled, separating scrap, electrical and other items. Marketable metallic materials can be sold, and contaminated elements should be encapsulated and disposed of in hazardous waste safety landfill.

In case the blocks built for tower foundations exceed the ground level, they will be demolished to that level. These areas will then be covered by a layer of organic horizon with a minimum thickness of 40 cm in order to be reused, in the case of the stretches of the TLs that intersect areas occupied by agricultural crops.

In the stretches of the TLs close to remnants of native vegetation, the choice is to favour the spontaneous regeneration of vegetation in the areas previously occupied by the towers, as well as in the stretches of the easement where the vegetation has been suppressed. In these areas, due to the proximity to the forest areas, there is the possibility of propagules dispersed by the wind or, mainly, carried by native fauna, reaching the areas to be recovered. In these areas, the need for soil decompaction will be assessed.

The spreading of the organic horizon coverage in the areas to be reclaimed should only be done after the completion of any land mobilisation in function of the Project dismantling activities, machinery and human traffic, stabilisation of erosive processes and surface flow dynamics, removal of debris and contaminating materials, and other factors that may compromise the reclamation of the areas.

14.0
Summary and Conclusions

This chapter presents a general conclusion of the main impacts and risks identified during the ESIA exercise and the environmental and social viability of the project at the selected site, to demonstrate that these impacts and risks have been adequately avoided, mitigated or compensated for so that the environmental and socio-economic benefits outweigh the adverse impacts.

As detailed in **Section 8.1**, a careful assessment was carried out to identify the best technical and locational alternative for the Project. The aim of this assessment was to prevent potential impacts already in the planning phase, as well as optimizing the benefits of the Project. The analysis of alternatives took into account several socio-environmental restriction criteria, including aspects associated with the need of vegetation clearing, interference with representative habitats for fauna, interference with inhabited areas, the need to cross watercourses, among other factors. In addition to the qualitative assessment, a quantitative analysis of the interferences was carried out, enabling a numerical comparison between the alternatives and the choice of the one with the best technical and locational viability.

In terms of social aspects, it is important to note that the Project intersects three regions of the country (Kagera, Geita and Shinyanga), 13 districts, 47 wards and 105 villages. Most of them are rural communities and their main activities are agriculture and livestock keeping. The Direct Area of Influence (DAI) is constituted by the villages where the T-line will be located, and the Indirect Area of Influence (IAI) by the wards, districts and regions to which these villages belong. In total, the DAI has a population of 572,062 persons, of which 50.7% are women and 49.7% men. The average houseold size is 5.6 persons per household, varying in a range from 2.97 persons per household (in Missenyi, Kagera region) to 9.79 (in Shinyanga DC). Most villages have less than 10,000.

An extensive consultation process was carried out during baseline studies. A total of 93 consultation meetings with the villages of the Direct Area of Influence were held. 5,250 persons participated, of which 1773 (33.8%) were women and 3477 (66.2%) were men. They, and the other stakeholders (local and regional authorities, different institutions) showed their support to the project because electricity is perceived as necessary for development and economic/productive projects; there is a need to improve the quality of electricity (tension, permanent); they expect more energy will reduce its cost and they expect that the Project will create direct and indirect jobs. They also expressed concern regarding the impact on land, agriculture and livestock keeping. Members of the villages also demanded to get connected to the electricity grid.

In terms of labor-related risks, the Project presents a range of potential concerns, particularly during the construction phase, which is expected to employ up to 1,350 direct workers and approximately 650 indirect workers. Key risks include occupational health and safety hazards such as exposure to noise, handling of hazardous materials, and risks related to machinery use and works in flooded or unstable areas. Labor influx may also generate social tensions or increased pressure on local services if not properly managed.

To address these risks, the Project adopts the requirements of the World Bank ESS2 on Labor and Working Conditions, and a comprehensive Labor Management Procedure (LMP) has been prepared. It outlines measures to ensure fair treatment, non-discrimination, safe working conditions, grievance mechanisms, and provisions to prevent child labor, forced labor, and gender-based violence (GBV/SEA/SH). Contractors will be contractually obligated to adhere to these provisions, and TANESCO's supervision team will monitor compliance as part of the ESMP implementation.

Regarding poverty, the Human Development Index (PNUD, based on the 2012 census) report that the three regions are below the national average. Life expectancy in Kagera was of 57.8 years, in Shinyanga 59.8 and 63.3 in Geita. Years of education completed are 7.27 in Geita, 8.8 in Kagera and 7.47 in Shinyanga. The incidence of poverty is of 52.9% in Kagera, 62% in Geita and 63.8% in Shinyanga, while population in severe poverty were 25% in Geita, 19.8% in Kagera and 28.4%.in Shinyanga. Hence, the districts that make up the area of influence are among the ones which face the most difficult economic conditions in the country. The presence of foreign workers could lead to social conflicts over natural resources and public services, as well as cultural conflicts. The possibility of the proliferation of contagious and transmissible diseases is not ruled out.

Agriculture is the main economic activity and the main source of employment both in the DAI and IAI. The main food crops are maize, paddy, bananas, cassava, beans, among others. The cash crops include sugarcane, paddy, coffee, sunflower. Most agriculture is produced in small scale areas that go from 2ha to 10 ha. The intervention area on agricultural crops (required to wayleave easement) is estimated at 1,218.89 ha, being 80.67 ha (6.6%) to perennial crops and 1,138.23 ha (94.4%) to cyclical crops. The greatest impact on crops, especially cyclical crops, is on the 400 kV Nyakanazi - Ibadakuli TL, confirming the greater degree of anthropisation in the region crossed by this TL compared to the other TLs which run in a N-S direction.

Mining activities take place in 30 villages of the DAI, that belong to 10 districts. 8 are in Shinyanga, 8 in Geita, and 14 in Kagera. Most of them have artisanal mining, with the exception only of the two villages located in Kaniha ward (Biharamulo DC), where only largescale mining takes place. The presence of mining activities will make the resettlement and compensation process more complex, as this livelihood maybe difficult to restore, even more if it is informally done.

A total of 1106 buildings located in the area of the alignment, that will be directly affected by the project, have been identified. Of them, 513 are in Kagera; 326 are located in Shinyanga Region, and 267 in Geita. The districts of Biharamulo and Shinyanga DC concentrate 43% of the affectation. The buildings include houses, public and private institutions. They also include businesses. One of the main concerns and demands expressed in the consultations, both in the villages and with other stakeholders, was if the land and assets would be paid fairly, on time (prior to leaving the land) and respecting human rights. During Scoping Study phase, a Resettlement Policy Framework (RPF) was developed in accordance with the World bank ESS 5 to guide TANESCO to implement a Resettlement Action Plan (RAP).

Communities and isolated houses closer to work fronts will be susceptible to discomfort from increased noise and vibration levels due to the operation of machinery and from dust caused by the excavation of trenches for tower foundations and earthworks at the SS expansion sites, especially during construction in the dry season. The Project's construction phase may lead to labour influx impacts such as tensions with local communities, transmission of communicable diseases, and risks of GBV/SEA/SH, in addition to increased traffic safety concerns due to the circulation of heavy vehicles. These risks are addressed through the Labor Management Procedures, GBV Action Plan, and Community Health and Safety Plan. In the operation phase, community health and safety risks persist, including potential accidents during line maintenance, unauthorized access to the wayleave, and continued traffic risks, which will be mitigated through safety protocols, community awareness, and enforcement of exclusion zones.

Various prevention, control and mitigation measures have been planned for this set of impacts, including a Resettlement Policy Framework (RPF), Stakeholder Engagement Plan (SEP), Local Hiring Programme, Labour Management Procedures (LMP), Gender Based Violence Action Plan, among others.

The potential of the Project's implementation area in relation to the Historical, Cultural and Archaeological Heritage is high. The field surveys carried out identified 6 (six) archaeological sites outside the DAA, but close to it, resulting in 71 recovered artefacts from the seven areas prospected. As measures to safeguard archaeological heritage, the P.16 - Archaeological, Historical and Cultural Heritage Protection Plan includes prior prospecting to be carried out in the areas where the SSs are being extended, and archaeological monitoring to be carried out by a specialist during land clearing and earthmoving activities along the TLs and any new accesses. A Chance Findings Procedure will also be prepared and implemented during the works.

In addition, it is understood that there is also a risk of landmine accidents involving population and workers. This is because some districts in the Kagera region, specifically Missenyi, Kyerwa, Bukoba, Muleba and Karagwe, were affected by the conflicts of the Tanzania-Uganda War, also known as the Kagera, which took place in 1978 and 1979. And landmines may still be buried in these areas, what demands demining measures throughout the DAA to ensure that there are no accidents involving workers and population.

Regarding biodiversity aspects, the project is located in the Guinea-Congolia/ Zambezia regional transition zone and in the Lake Victoria regional mosaic. The predominant ecosystems is Miombo woodland. Although this ecosystem is not threatened with extinction, the region is under intense pressure from the conversion of natural habitats, mainly for the establishment of agricultural crops, the use of savannas as grazing land for cattle and the (sometimes indiscriminate) use of fire to renew pastures, and the extraction of timber and other plant products.

The anthropized areas are mostly located along the TL Ibadakuli-Nyakanazi. This region is more intensely anthropized, with the remaining natural habitats basically inside the protected areas and in specific places where the terrain is steeper. Along the Kyaka-Nyakanazi segment, there is a more significant presence of preserved natural habitats,

mainly within the Burigi-Chato National Park. There project intercepts 3 protected areas the Burigi-Chato National Park (also an IBA), the Biharamulo Forest Reserve and the Uyovu Forest Reserve.

Regarding biodiversity values, the region is home to threatened and endemic species of flora and fauna, as well as other important attributes for the congregation of fauna species and the maintenance of the region's ecological processes, in addition to priority ecosystem services for the population. These values triggered the critical habitat for criteria (a), (b), (c) and (e) in accordance with paragraph 23 of the ESS6.

The implementation of the project will cause negative impacts on these attributes, including the conversion of critical natural habitats, which will lead to the loss of individuals of flora, degradation of the remaining vegetation, and reduction of habitats for fauna, among others. As demonstrated throughout the study, impacts on critical habitat and other biodiversity values cannot be avoided.

However, the project's mitigation hierarchy includes measures to minimise these impacts. Among the measures envisaged, the reduction in the vegetation clearing range from 52 to a 14 meters-wide strip made it possible to reduce the need to suppress native vegetation by 88%. Other measures to minimise impacts during construction include the rescue and relocation of fauna and flora during vegetation clearing, control of invasive exotic species and fauna monitoring. In addition, the environmental programmes for construction and operation include measures to avoid and minimise impacts related to pollution.

As there will still be residual impacts, the Biodiversity Management Plan and the Biodiversity Offset Plan include offset measures, with a focus on achieving biodiversity gains, not only for critical habitat triggers but for impacts on natural habitats and ecosystem services in general. Thus, although there will be residual negative impacts from the implementation and operation of the project, it is possible to achieve biodiversity gains that will contribute, in the long term, to the maintenance of ecological processes and ecosystem services in the region.

With regard to the resulting impacts on the physical environment, it can be seen that the most significant will occur during the construction phase, notably related to the establishment of specific erosion processes, with possible indirect consequences in terms of siltation and increased turbidity of downstream watercourses. However, no major earth movements are expected for the installation of the towers, and they will be occasional, with small amounts of material resulting from the excavations. In addition, it should be noted that any impacts resulting from these earth movements will cease immediately after the work is finished, and there is no risk of them persisting during the operation of the TL. In any case, attention must be paid to the correct and complete adoption of the erosion and siltation control measures to be provided for in the Construction Environmental Plan (CEP), with special attention to the interventions to be carried out along the N-S section of the route, which intersects the steeper slopes to the north of Nyakanazi.

Impacts were also identified for the construction and operation phase corresponding to the risk of contamination of the soil and watercourses, due to accidental events involving

fuel or lubricant leaks from the vehicles and equipment used to build and maintain the TL. The Construction Environmental Plan provides for preventive maintenance actions for this equipment. In any case, it is considered that, should these leaks occur, they should be of small proportions and their effects will be promptly remedied by adopting the corrective measures for containing, removing and disposing of the contaminants that have also been planned.

The impact on air quality during construction and operation will be restricted to emissions from mobile sources and the suspension of dust. This is a one-off impact of low intensity, especially considering the good air quality and the ability to disperse pollutants in the area where the TL is being installed, which does not present critical pollution situations. If they do occur, these impacts will be more intense during the austral winter, when rainfall is lower along the entire route, especially in its western end in the Shinyanga region. During the summer, until mid-April and May, the concentration of rainfall favours the conditions for dispersing pollutants.

Last but not least, it is worth noting that the impacts on the speleological and paleontological component were considered to have a very low probability of occurrence, given the geological characteristics of the intercepted area, as well as the results obtained during the baseline, which did not indicate any records of these features along the TL.

Based on the information provided in this chapter and the findings from this Environmental and Social Impact Assessment (ESIA), the key potential impacts of the Project have been identified. A comprehensive set of social and environmental measures has been suggested to address these impacts. These measures are designed to be implemented at every stage of the project, from planning to operation. The Environmental Programs aim to prevent, mitigate and offset the identified negative impacts, while also maximizing the positive outcomes, such as strengthening the country's transmission systems and energy availability. If executed, this could potentially bolster the economic and social development of northwest Tanzania and improve living standards for the local population. In conclusion, the Project is deemed technically and environmentally feasible, with the condition that all impact prevention, mitigation, and compensation measures are properly carried out.

15.0
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