Detailed Initial Environmental Examination Report

December 2025

400 kV D/C East-West Transmission Line Project

Prepared by Bhutan Power Corporation Limited.

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Abbreviations

µm	Micrometer
^{0}C	Degree Celsius
ADB	Asian Development Bank
AoI	Area of Influence
Avg.	Average
BPC	Bhutan Power Corporation
CAP	Corrective Action Plan
CEMP	Contractor's Environmental Management Plan
CF	Community Forest
CFU	Colony Forming Unit
COD	Chemical Oxygen Demand
CSER	Centre for Science and Environmental Research
dB	Decibels
DECC	Department of Environment and Climate change
DGPC	Druk Green Power Corporation
DHI	Druk Holding and Investments Limited
DI	Deionized Water
DO	Dissolved Oxygen
DoE	Department of Energy
DoFPS	Department of Forest and Park Services
E	Easting
EA	Executing Agency
EAP	Environmental Action Plan
EC	Electrical Conductivity
EHS	Environmental, Health and safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMRs	Environmental Monitoring Reports
ERA	Electricity Regulatory Authority
EWTLP	East-West Transmission Line project

GHG	Greenhouse Gas
GOI	Government of India
HDPE	High Density Polyethylene
IEE	Initial Environment Examination
IUCN	International Union for the Conservation of Nature
K_F&F	Khorlochu Flora & Fauna
Km	Kilometre
KW	Khorlochu Water
M	Meter
Mg/L	Milligram per litre
mL	Milliliter
MoENR	Ministry of Energy and Natural Resources
N	Northing
NAAQS	National Ambient Air Quality Standard
NEC	National Environment Commission
NECS	National Environment Commission Secretariat
NIT	Notice Inviting Tender
NMDS	Non-metric Multidimensional Scaling
NOC	No Objection Certificate
NTU	Nephelometric Turbidity Unit
NWFPs	Non-Wood Forest Products
O&M	Operation and maintenance
PAPs	Project Affected Persons
PCR	Project Completion Report
PH	Power House
PPE	Personal Protective Equipment
PS	Pooling Station
RECOP	Regulation for Environmental Clearance of Projects
RGoB	Royal Government of Bhutan
RoW	Right of Way
S&A	Sound & Air

Sp.	Species
SPS	Safeguard Policy Statement
SRFL	State Reserved Forest Land
SS	Switching Station
STDEV	Standard deviation
TDS	Total Dissolved Solids
Temp	Temperature
TH	Total Hardness
TSS	Total Suspended Solids
U.S. EPA	Unites States Environmental Protection Agency
WHO	World Health Organization
WUA	Water Users Association

Measures and Weights

µm-Micrometre

°C- Degree Celsus

µg/m^3- micrograms per cubic meter

dB- Decibels

D/C- Double Circuit

GW- Gigawatts

GWH- Gigawatt Hours

Mg/L- milligrams per liter

MW- Megawatts

NTU- Nephelometric Turbidity Unit

Executive Summary

The Bhutan Power Corporation Limited is entrusted by the Royal Government of Bhutan, to initiate the development of a 400 kV transmission line extending from Corlung Power House (PH) to Goling Switching Station (SS), routed via the Durungri Pooling Station (PS). The project aims to evacuate power from the upcoming 600 MW Khorlochhu Hydropower Project in Trashiyangtse, improving east–west connectivity and enhance the reliability, efficiency, and resilience of power supply across the central and eastern regions of Bhutan. The DoE has sought financial assistance from the Government of India (GOI) for implementing the proposed transmission line project. From an environmental perspective, the project has been classified as Category B, necessitating the preparation and public disclosure of an Initial Environmental Examination (IEE) and an accompanying Environmental Management Plan (EMP) that comprehensively address potential environmental impacts of all project components.

The IEE was undertaken to assess the environmental and social implications of the project. The project is a critical infrastructure initiative designed to evacuate power from the upcoming 600 MW Khorlochhu Hydropower Project. It also aims to strengthen Bhutan's east–west grid connectivity, improve power reliability, and contribute to national energy security and economic development. The transmission line will span across five Dzongkhags namely Trashiyangtse, Trashigang, Mongar, Pemagatshel, and Zhemgang, and crossing mostly state reserved and community forest land while minimizing impacts on private and agricultural lands. The alignment has been carefully chosen to avoid settlements, critical habitats, and protected areas. The total project length is approximately 124.5 km, comprising 228 towers and associated structures, with an implementation period of tentatively 40 months.

Baseline environmental studies were conducted during both wet and dry seasons at 44 sampling sites along the project corridor. The results show that the air, water, and noise quality within the area are within the National Environment Commission (NEC) Class A standards. While the transmission route does not intersect any protected area, with the nearest being Jigme Singye Wangchuck and Royal Manas National Parks, it traverses Biological Corridor No. 4 near Goling, Zhemgang. Surveys revealed that the existing ecological condition remains stable, and no flora or fauna of critical conservation concern were identified within the Right-of-Way (RoW).

The anticipated environmental impacts are mostly temporary, localized, and manageable. During the construction phase, key impacts include vegetation clearance, tree felling, soil erosion, increased dust and noise from machinery, and generation of construction waste. There are also potential occupational health and safety risks to workers. During the operation phase, possible impacts include corona noise, visual intrusion, and occasional bird collisions with transmission lines, though these are expected to be minor.

To mitigate these impacts, a comprehensive Environmental Management Plan (EMP) has been developed. The plan outlines measures such as obtaining environmental and forestry clearances prior to construction, limiting tree felling within the approved RoW, and implementing compensatory afforestation in collaboration with the Department of Forest and Park Services (DoFPS). Erosion control practices like silt traps, retaining walls, and vegetation restoration will be adopted to stabilize disturbed areas. Waste will be managed according to the Waste Prevention and Management Act 2009 and its regulations, while construction work will be limited to daytime hours to minimize disturbance. Occupational safety protocols will be enforced, including the mandatory use of Personal Protective Equipment (PPE) and worker safety training. Environmental monitoring will be conducted periodically for air, water, and noise quality, and a Grievance Redress Mechanism (GRM) will be established to address community concerns effectively.

The project complies fully with Bhutan's environmental and social regulatory framework, including the Environmental Assessment Act 2000, National Environment Protection Act 2007, Regulation for Environmental Clearance of Projects 2016, Electricity Act 2001, Forest and Nature Conservation Rules and Regulations 2023, Waste Prevention and Management Act 2009, and Water Act 2011. Furthermore, it aligns with the Environmental Assessment Guideline for Power Transmission Line Projects (2012) issued by the NEC.

In conclusion, the IEE confirms that the 400 kV East–West Transmission Line Project is environmentally feasible and socially acceptable. With proper implementation of the proposed mitigation and monitoring measures, the project's impacts can be effectively managed. The design minimizes ecological disturbance, promotes community participation, and ensures compliance with national and international environmental standards. Overall, the project is a key step toward strengthening Bhutan's power

transmission infrastructure, supporting renewable energy expansion, and advancing the country's long-term vision of sustainable, low-carbon development.

1. Introduction

1.1 Project Background and Objectives

Bhutan has one of the largest repositories of hydropower in Asia with an estimated hydropower potential of 36.9 GW as per the Power System Master Plan 2040 (PSMP). This potential is assessed from some 155 sites which are largely located outside of the national parks and the biological corridors. Separate assessments of solar and wind potentials were also carried out based on geospatial data and irradiance. The solar and wind potentials are estimated at 12,000 MW and 760 MW respectively.

Bhutan has harnessed about 2450 MW of hydropower or 7.5% of its potential in almost 5 decades of hydropower development according to the Renewable Energy Roadmap 2024. This installed capacity is however falling far short of the fast-growing demand, especially during the winter months when the generation dwindles to 17% of installed capacity given the inherent characteristics of hydrology that is dependent on the summer monsoons. In December 2023, the peak demand touched 956 MW while the firm power availability was only 415 MW from then existing plants with demand outpacing supply by over 130%. The increase in overall base demand observed over the years is attributable mainly due to the high voltage industries. The much smaller residential/commercial loads contribute to the peak demand. Prior to 2022, the industrial loads were at 316 MW while residential/commercial loads were 140 MW. In 2022, the industrial loads increased to 409 MW and this further grew exponentially in 2023. At current trends of 12% annual increases experienced in the national peak demand, the domestic demand is expected to double by 2029.

The country imported 240MU in 2022, 682MU in 2023 and 1,213MU in 2024 (till May 20th) with corresponding costs of Nu. 798 million, Nu. 2,973 million and Nu. 5,143 million at average tariffs of Nu. 3.32, Nu. 4.36 & Nu. 4.24 per kWh as against weighted average export tariff of Nu. 3.04 per kWh. With the demand expected to grow and supply remaining constant, the demand supply gap is projected to significantly widen further for which the imports are required to be arranged concurrently. These imports and dwindling exports also have a huge impact on the balance of payment. In future, the power demand will essentially come from the various activities or loads like new HV

industries, FDIs, Gelephu Mindfulness City (GMC) and increased residential/commercial consumptions from transitioning to a developed nation status by 2034.

The existing transmission voltage level in the country is 400kV, 220kV, 132kV and 66kV. The entire 220kV and 400kV transmission system networks are in the western part, and it was largely developed as Associated Transmission Systems for Chukha and Tala HPs. Major quantum of electricity generated from these power plants are exported to India after meeting domestic demand. In the eastern part of Bhutan, Kurichhu (60MW) HP and its 132kV evacuation system caters to the local consumer and industrial load and the surplus power is transmitted to India through 132kV lines. Eastern Bhutan currently has only 132kV system connecting different substations from KHP.

To respond to these challenges while pursuing a low-carbon development pathway, the Royal Government of Bhutan (RGoB) has adopted several forward-looking policies and strategies:

- National Strategy and Action Plan for Low Carbon Development (2012): Identifies hydropower as a key mitigation measure to reduce emissions.
- Economic Development Policy (2016): Positions the energy sector as a key driver of growth and calls for faster development of hydropower and alternative renewables.
- Bhutan Sustainable Hydropower Development Policy (2021): Emphasizes sustainable hydropower for energy access and national security.
- National Comprehensive Development Plan 2030 and Power Sector Master Plan 2040: Prioritize large- and small-scale hydropower development.
- 13th Five-Year Plan (2023–2028): Stresses reliable domestic electricity supply with a strong focus on small hydropower projects.
- As part of these initiatives, the Ministry of Energy and Natural Resources (MoENR), through its Department of Energy (DoE), has prioritized the development of small and medium-sized hydropower projects. Goals are to achieve a total installed capacity of 25,000 MW by 2040, in alignment with the national vision of building a High-Income GNH Economy by 2034 and ensuring long-term energy security. This target will be pursued through the development of 15,000 MW from hydropower, complemented by a transformative addition of 5,000 MW from solar energy, along with meaningful contributions from wind, geothermal, biomass, and other renewable sources (MOENR , June 2025). The Khorlochhu project aligns with Bhutan's strategic vision of achieving

an additional 15,000 MW of hydropower and 5,000 MW of solar power generation capacity by 2040.

- The Druk Green Power Corporation Limited (DGPC), Bhutan's main hydropower generation agency, is spearheading the implementation of these projects. The Bhutan Power Corporation (BPC), responsible for power transmission and distribution, is working in close coordination with DGPC to develop the necessary infrastructure.
- To evacuate power from the upcoming 600 megawatts (MW) Khorlochhu Hydropower Project in Trashiyangtse, BPC will construct a 400 kV double-circuit (D/C) transmission line grid. After assessing multiple route alternatives for their social, economic, and environmental impacts, the proposed line has been finalized to span approximately 124.5 kilometers, crossing multiple Dzongkhag and gewogs.

1.2 Purpose of the Report

The Initial Environmental Examination (IEE) was prepared in line with the Terms of Reference (ToR) approved by the Department of Environment and Climate Change (DECC), as required under the Environmental Assessment Act 2000.

1.3 Extent and Scope of the Study

Bhutanese law require that the environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce the impacts to acceptable levels. This is done through the environmental assessment process which has become an integral part of lending operations and project development and implementation worldwide.

This report discusses the existing environment within the project's area of influence, environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works that will be covered by the associated transmission line.

As required by the Environmental Assessment Act 2000 and its Regulation 2002, a ToR providing the scope and framework for conducting the IEE of the 124.5 km 400 kV D/C East-West (E-W) transmission line was submitted to the DECC and was subsequently approved. The TL will start from Chorlung PH in Trashiyangtse Dzongkhag to Goling SS in Zhemgang Dzongkhag via Durungri PS in Pemagatshel Dzongkhag.

Based on the approved ToR from the DECC, the IEE was prepared. The level of detail and analysis in the report reflects the potential environmental, economic and social impacts of the proposed project and recommends mitigation and management plans for the likely adverse environmental impacts. Along with the IEE, other documentation and clearances required include the following:

(i) Community Forest Clearance from Community Forest Management Groups for vegetation clearing along the 48 m right-of-way (RoW);
(ii) Reports on separate consultations held with affected people along with their signatures of 'No Objection' for the TL; and,
(iii) Clearance from the Local District Authorities for executing the project.

1.4 IEE Methodology

1.4.1 Scoping

The specific details required according to the endorsed ToR for this IEE comprise:

The level of detail and analysis in the report should reflect the potential environmental, economic and social impacts of the proposed project and recommend mitigation and management plan for the likely adverse environmental impacts. Further, the assessment should also consider measures to enhance the potential socio-economic benefits of the proposed project.

Detailed information as below is provided in the IEE:

(i) Baseline data concerning the project's physical environment, including air quality, noise levels, water quality, land use, hydrology, climate conditions, geology, biological environment (wet & post-monsoon seasons), and socio-economic.
(ii) Review of relevant policies, laws, rules and guidelines.
(iii) Analysis and comparison of alternatives.
(iv) Identification, assessment, and quantification of impacts for both the construction and operation phases.
(v) Formulation of mitigation measures for both the construction and operation phases; and
(vi) Development of an environmental management plan for both construction and operation phases.

1.4.2 Summary of the Scoping Results for the 400 kV E-W TL

The evaluation of various impact items related to the construction and operation phases of 124.5km 400kV D/C E-W TL project has been conducted, considering factors such as pollution control, natural environment, social environment, and other relevant aspects.

During the construction phase, it is anticipated that there will be temporary air quality issues due to dust generated from civil engineering works and emissions from heavy equipment and trucks. However, during the operational phase, no air pollution is expected. Water quality is likely to be affected during both construction and operational phases due to soil runoff from exposed areas and construction activities. Waste generation is foreseen during construction, but not during operation. Soil quality may suffer during construction due to potential contamination from construction activities, though no such issues are expected during operation.

Noise and vibration are expected during construction due to machinery and construction activities, but not during operation. Subsidence is not expected to occur in either phase. Similarly, no odors or sedimentation issues are anticipated.

In terms of the natural environment, impacts on protected areas and biodiversity are expected during both construction and operation, particularly due to the transmission line's crossing of the Multiuse zone of Royal Manas Nation Park (RMNP). Hydrology, topography, and geology are not expected to be significantly impacted.

In terms of social aspects, resettlement is not foreseen in the transmission line project. However, land acquisition may take place during the pre-construction phase, with no such activity expected during operation. Vulnerable groups and ethnic minorities may be affected during both phases, necessitating verification and consideration. Employment opportunities are expected during construction and operation, potentially affecting local economies. Land and resource use may be impacted, particularly if residents engage in activities near the project site. Social infrastructure may experience temporary disruptions during construction but may benefit during operation.

Labor environment considerations are important during both phases, ensuring the safety and well-being of workers. Sanitation and security issues may arise during construction due to increased worker influx, but no significant impact is expected during operation. Cultural heritage and scenery may be impacted, particularly by landscape degradation

from construction activities. Gender perspectives need to be addressed throughout the project lifecycle.

Finally, accident risks are present during construction, including potential traffic accidents, whereas the operation phase requires further evaluation. Trans-boundary impacts and climate change considerations indicate temporary CO2 emissions during construction, but no ongoing emissions during operation.

1.4.3 Environmental Assessment

Field investigations were conducted during August and October 2025 across 44 strategic sites within the transmission corridor. The sampling network comprised twelve surface water monitoring points on key tributaries, seven air quality and noise stations near construction zones and sensitive receptors, nineteen ecological survey plots for flora and fauna, and six fish sampling locations. These sites, illustrated in **Figure 1**, were georeferenced using a Garmin GPSMAP 64s handheld unit. Detailed coordinates and site descriptions are provided in **Table 1**.

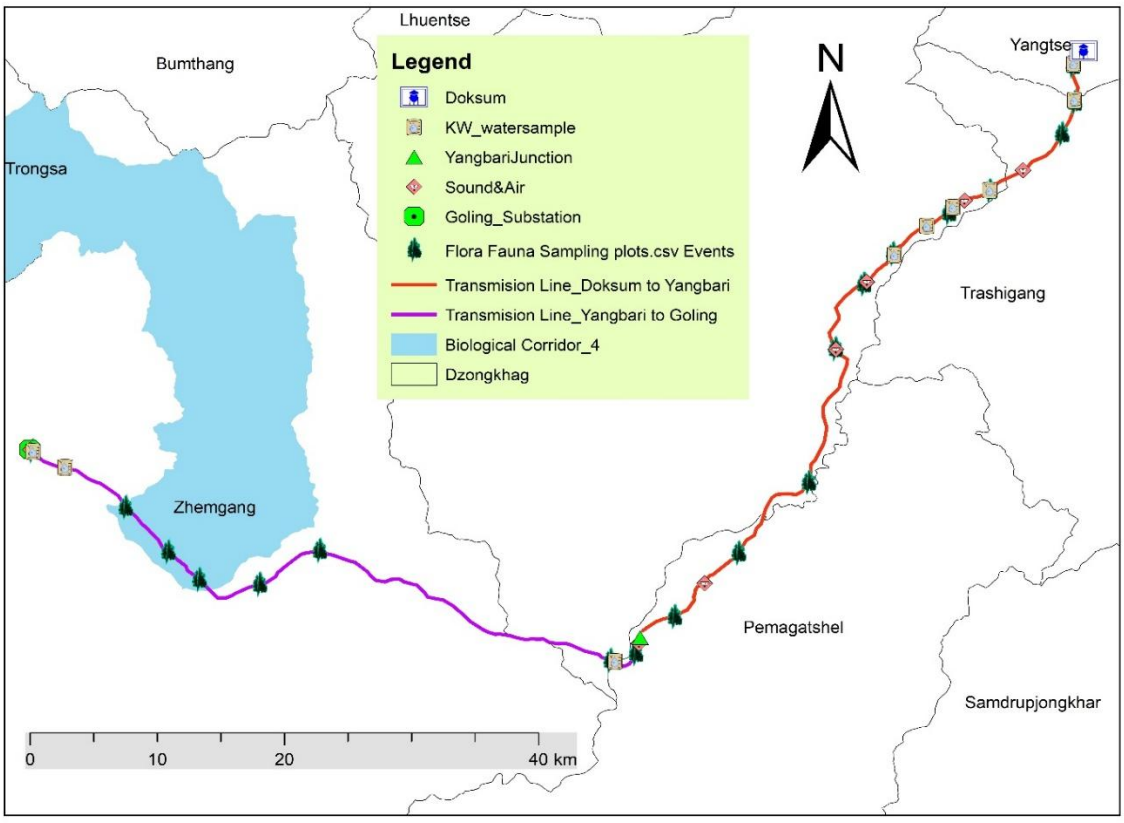


Figure 1. Sampling points along the 400 kV D/C East-West Transmission Line Project (EWTLP)

Table 1. Sites for water sample collection, Air quality & Noise level, and Flora and Fauna.

Sampling types	Location	Latitude (N)	Longitude (E)	Altitude (m)
Surface Water	KW_1 (Dangmechu Upstream)	27°24'51.48''	91°52'24.60''	811
	KW_2 (Dangmechu Downstream)	27°24'16.02''	91°33'15.07''	792
	KW_3 (Tshergom Tributary)	27°24'00.98''	91°33'02.17''	810
	KW_4 (Jamkhardrang chu Upstream)	27°22'52.22''	91°32'52.22''	930
	KW_5 (Jamkhardrang chu Downstream)	27°22'36.51''	91°33'14.96''	790
	KW_6 (Rolong Tributary)	27°19'14.61''	91°29'49.44''	775
	KW_7 (Sherichu Downstream)	27°15'56.24''	91°24'08.15''	623
	KW_8 (Sherichu Upstream)	27°15'29.19''	91°24'27.52''	598
	KW_9 (Manas Upstream (Yangbari))	27°57'55.16''	91°11'01.40''	239
	KW_10 (Manas Downstream (Yangbari))	27°57'35.92''	91°10'33.87''	237
	KW_11 (Mangdechu Upstream)	27°07'09.53''	90°42'57.56''	478
	KW_12 (Mangdechu Downstream)	27°07'26.53''	90°43'26.31''	469
Air Quality & Noise Level	Dremtse (Waichur)	27.1737	91.2720	989
	Chaskar (Yetnas)	27.1517	91.2328	1289
	Chanskar (Thangrong)	27.1137	91.2191	1456
	Murung (Khengkhar)	27.6420	91.2019	974
	Yangbari	26.5756	91.1044	338
	Digala (Pantang)	27.1301	90.5358	1187
	Goleng	27.7280	90.4330	560
Flora & Fauna	Tshergom-K_F&F_1	27.3992433	91.549663	850
	Jamkhardrang-K_F&F_2	27.372142	91.550778	907
	Lungzor-K_F&F_3	27.349063	91.540368	1150
	Rolong-K_F&F_4	27.307772	91.482513	705
	Waichur-K_F&F_5	27.291735	91.449715	995
	Sherichu-K_F&F_6	27.261988	91.404881	590
	Lungbaktang-K_F&F_7	27.24004	91.381465	1457
	Walaktang-K_F&F_8	27.19236	91.358345	1552
	Munma-K_F&F_9	27.094116	91.335863	609
	Chimong-K_F&F_10	27.042411	91.279795	1099
	Zhemgang-K_F&F_11	26.996015	91.228471	990
	Tshobalay Top-K_F&F_12	26.969055	91.197338	283
	Zhemgang-K_F&F_13	26.964045	91.177345	244
	Zhemgang-K_F&F_14	27.046911	90.94747	1421
	Digala Top-K_F&F_15	27.022335	90.899621	1291
	Baytsaling-K_F&F_16	27.026192	90.851808	803
	Kamjong-K_F&F_17	27.046876	90.827373	1226
	Zhemgang-K_F&F_18	27.079683	90.793645	1140
	Goleng-K_F&F_19	27.121741	90.719938	456

1.4.3.1 Water sample collection

All sampling containers were pretreated via an overnight soak in deionized (DI) water, followed by five successive DI rinses and air drying, with a final triple-rinse using source water performed at each site immediately prior to collection to ensure sample representativeness. Samples designated for total hardness (TH), turbidity, total suspended solids (TSS), and total dissolved solids (TDS) were collected in pre-cleaned 1000 mL high-density polyethylene (HDPE) bottles.

For the determination of geochemical parameters and chemical oxygen demand (COD), water was filtered on-site using 47-mm Millipore glass-fiber filters (1.0 µm pore size) and secured in duplicate 125 mL HDPE bottles, adhering to the filtration and preservation protocols established by Wilson et al. (2016). This methodology isolates dissolved fractions and minimizes interference from suspended particulates during laboratory analysis. To prevent biochemical degradation, all specimens were stabilized in portable cold storage units, transported to the CSER Water Chemistry Laboratory at Sherubtse College, and archived at 4°C until analysis.

1.4.3.2 Air quality and noise level

Ambient air quality and noise monitoring for the 400 kV East-West Transmission Line Project (EWTLP) were conducted concurrently with water sampling during the monsoon and post-monsoon seasons. Monitoring stations were established within settlements adjacent to the proposed alignment, targeting areas with high population density and sensitive receptors such as schools and hospitals. Fine particulate matter ($PM_{2.5}$) was quantified using TS BlueSky sensors deployed for 24-hour continuous monitoring to determine average daily concentrations. Gaseous pollutants, including nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and carbon monoxide (CO), were measured using an S318 multi-gas detector. Manual sampling for these parameters was performed during daytime hours (08:00–18:00), with data logged at 5-minute intervals to characterize daily variations.

Ambient noise levels were monitored during the same daytime window (08:00–18:00) using a calibrated EN300 Environmental Meter. These measurements were synchronized with periods of peak human activity to assess the existing acoustic environment. This integrated monitoring framework provides the baseline data necessary to evaluate project-related impacts on local air quality and soundscapes, specifically regarding the

health and well-being of the surrounding community. All equipment was calibrated according to manufacturer specifications prior to field deployment to ensure data accuracy and compliance with environmental assessment standards.

1.4.3.3 Floral Diversity

A floral species inventory was conducted along the transmission corridor using a systematic, plot-based methodology adapted from the Department of Forest and Park Services' National Forest Inventory protocol. Vegetation strata were assessed using a multi-scale nested circular plot design. The primary sampling unit consisted of a 12.62-meter radius plot (500 m^2) for tree enumeration. Within this area, a 3.57-meter radius subplot was established to record shrub density and regeneration. A central 0.56-meter radius subplot (1m^2) was utilized to quantify herbaceous species composition and cover. This nested configuration ensures that all vegetation layers are documented to establish a structural and compositional baseline for the project footprint.

1.4.3.4 Fauna: Mammals

A mammalian baseline inventory was conducted using a multi-methodological approach to document species distribution and presence. Primary data collection involved recording direct sightings and indirect evidence, including scat, dung, tracks, and pug marks within the sampling plots.

To detect elusive or nocturnal species, field observations were supplemented with automated monitoring via wildlife camera traps and CCTV units. Data retrieved from these systems were analyzed and integrated into the final assessment. This was further augmented by local ecological knowledge obtained through community consultations to provide historical context on species occurrence.

1.4.3.5 Fauna: Bird

Bird diversity was quantified using the MacKinnon Listing method, adhering to the standardized protocol established by the Department of Forest and Park Services (DoFPS, 2020). This methodology was utilized to determine species richness and relative abundance while minimizing observer bias.

1.4.3.6 Herpetofauna

The herpetofauna inventory was conducted primarily through opportunistic encounters and free-listing during systematic site visits. This methodology replaced the initial

protocol of pitfall traps with drift fences to eliminate the risk of specimen mortality during periods of high precipitation. To ensure a representative species record, primary field data were cross-referenced with verified secondary sources, including regional biodiversity databases, published checklists, and expert consultations.

1.4.3.7 Fish sampling

Fish were sampled systematically along a 500-meter reach, extending upstream and downstream from each designated station. Sampling was performed using a three-meter radius cast net deployed at strategic points within the transect, with technical assistance from local fishermen. All captured specimens were identified to the species level and subjected to standard morphometric measurements. Following data collection, specimens were released alive at the point of capture to minimize ecological disruption and maintain population integrity.

1.4.3.8 Fluvial discharge and hydraulic habitat assessment

Stream discharge was quantified at all fish sampling locations using the velocity-area method (Gore & Banning, 2017) to establish the hydraulic baseline for aquatic habitats. At each site, a representative channel cross-section was established perpendicular to the flow and subdivided into vertical segments. Depth and flow velocity were recorded within each segment using a cup-type current meter, cross-verified with a DVI-K20 portable velocity logger.

To ensure a representative mean velocity profile, a standardized depth-integration approach was applied (Meals & Dressing, 2008). For water columns with depths less than 0.8 m, velocity was measured at 0.6 of the total depth from the surface. In columns exceeding 0.8 m, measurements were taken at 0.2 and 0.8 of the depth to account for the vertical velocity gradient. Total discharge (Q) was calculated using the formula $Q = A \times V$, where A represents the cross-sectional area and V the mean velocity. These data provide the hydraulic context necessary to link physical flow conditions with aquatic habitat suitability across the surveyed reaches.

1.4.4 Field and Laboratory Water Quality Analysis

1.4.4.1 In-situ measurements

Key physicochemical parameters, including electrical conductivity (EC), pH, turbidity, temperature, and dissolved oxygen (DO), were measured in situ to establish real-time

baseline conditions. A Thermo Scientific Eutech handheld meter was utilized for EC and pH, while a Thermo Scientific Eutech TN-100 meter was used for turbidity. Temperature was recorded with an Accro-tech AT-272 thermometer, and DO concentrations were quantified using a Hach HQ40D portable multimeter. All instruments were calibrated prior to deployment in accordance with manufacturer specifications and standard protocols to ensure data accuracy and inter-site comparability.

1.4.4.2 Laboratory Analysis

Water samples were transported under stable preservation conditions to the Water Chemistry Laboratory at the Centre for Science and Environmental Research (CSER), Sherubtse College. Analytical procedures were conducted in accordance with the *Standard Methods for the Examination of Water and Wastewater, 23rd Edition* (Baird et al., 2017).

The analytical suite comprised physical, chemical, and nutrient indicators to establish a comprehensive hydrochemical baseline. Physical and aggregate parameters included Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Hardness (TH), and Chemical Oxygen Demand (COD). Major ion analysis quantified cations (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}) and anions (Cl^{-}, F^{-}, SO_4^{2-}). Nutrient concentrations were determined for nitrate-nitrogen (NO_3^{-}-N), ammonium-nitrogen (NH_3-N), and phosphate (PO_4^{3-}), alongside trace metal analysis for Manganese (Mn).

1.4.4.3 Analytical methods

Total Dissolved Solids (TDS) and Total Suspended Solids (TSS) were quantified gravimetrically using pre-dried Whatman GF/C filter paper (1.5 µm pore size). Procedures followed Standard Methods 2540C for TDS (dried at 180°C) and 2540D for TSS (dried at 103–105°C). Total hardness, calcium, and magnesium were analyzed as $CaCO_3$ equivalents via the Calmagite Colorimetric Method (HACH Method 8030) using a DR6000 UV-Vis spectrophotometer. Concentrations were derived using programs 255 and 220 in accordance with APHA (2005) protocols.

Nutrient and chemical parameters were analyzed using HACH colorimetric methods on the DR6000 spectrophotometer. Nitrate-Nitrogen (NO_3^{-}-N) was determined via the cadmium reduction method (Method 8039) using NitraVer 5 reagents. Phosphate (PO_4^{3-}) was measured by the Amino Acid Method (Method 8178), while Ammonium-Nitrogen

(NH_3-N) used Ammonia Salicylate and Cyanurate reagents. Manganese (Mn) was analyzed using the PAN colorimetric method (Method 8149) at 590 nm. Chemical Oxygen Demand (COD) was determined via the HACH Digestion Method 8000 using a DRB200 reactor for the ultra-low range (0.7–40 mg/L).

Sodium (Na^+) concentrations were measured at 589 nm using a Systronics μ Controller-Based Flame photometer (Type: 128), calibrated with NaCl standards. Potassium (K^+) was analyzed using specific reagent pillows under Program 905. Sample integrity was maintained by adhering to preservation and transport protocols from Standard Methods (2017) and U.S. EPA 40 CFR Part 136. All specimens were stored in the dark at < 6°C prior to analysis. Analytical methods, holding times, and storage conditions are summarized in **Table 2**, consistent with U.S. EPA (2017) guidelines.

Table 2.Summary of analytical parameters, maximum holding times, and storage requirements for water quality analysis.

Sl. No.	Parameters	Analysis	Maximum Holding time	Storage/ Transport
1	pH	Field/ In-situ	-	-
2	Temperature	Field/ In-situ	-	-
3	Turbidity	Field/ In-situ	-	-
4	EC	Field/ In-situ	-	-
5	Hardness	Within a week	7 Days	<6°C in dark
6	Chloride (Cl^-)	Within a week	28 Days	<6°C in dark
7	Fluoride (F^-)	Within two weeks	28 Days	<6°C in dark
8	Nitrate (NO_3^-)	ASAP upon arrival	48 Hrs	<6°C in dark
9	Sulfate (SO_4^{2-})	Within a week	28 Days	<6°C in dark
10	Sodium (Na^+)	Within a week	7 Days	<6°C in dark
11	Potassium (K^+)	Within a week	7 Days	<6°C in dark
12	Iron (Fe^{2+})	Within two weeks	7 Days	<6°C in dark
13	Ammonium (NH_4^+)	Within a week	7 Days	<6°C in dark
14	Calcium (Ca^{2+})	Within a week	7 Days	<6°C in dark
15	Magnesium (Mg^{2+})	Within a week	7 Days	<6°C in dark
16	Manganese (Mn)	Within two weeks	7 Days	<6°C in dark
17	Orthophosphate (PO_4^{3-})	ASAP upon arrival	48 Hrs	<6°C in dark
18	DO	Field/In-situ	-	-
19	COD	Within two weeks	7 Days	<6°C in dark
20	TDS	Within a week	7 Days	<6°C in dark
21	TSS	Within a week	7 Days	<6°C in dark

Microbiological water quality

Thermotolerant coliforms were quantified using the membrane filtration and colony count technique to evaluate fecal contamination (Bartram & Ballance, 1996; RCDC, 2019). A 100 mL water sample was passed through a sterile 0.45 µm cellulose acetate membrane, which was then transferred to mFC agar and incubated at 44.5°C for 24 hours. Blue colonies were enumerated and reported as colony-forming units (CFU) per 100 mL (St-Pierre et al., 2009). Biological and physicochemical results were evaluated against the National Environment Commission Secretariat ambient water quality standards (NECS, 2020) and the World Health Organization Guidelines for Drinking-water Quality (WHO, 2017).

1.4.5 Socio-economic Assessment

The methodologies employed in gathering the baseline information on gathering demographic information and socio-economic status involved:

1. Gathering of secondary information through available reports and websites.
2. Meetings, Discussions and Interviews using structured questionnaire.
3. Public and Stakeholders consultation meetings at the Gewogs; and
4. Survey of Project Affected Population in the affected areas.

Table 3. Socio-economic assessment methodology

SN	Date	Purpose	Site Visited	Survey team members
1	17th September - 16th October 2024	Walk-on Survey	124.5 Km along the Transmission route.	**Team I** Tenzin Zepa Yeshi Wangchuk Kamal Bahan Jigme Sonam **Team II** Jaku Gap Ugyen Dorji Kinga Tenzin Susmita Subba
2	14th July- 13 August 2025	Public Consultation, Clearances for Project and IEE data survey	Team I- 1. Chaskhar 2. Chimung 3. Dremetse 4. Dungmaed 5. Jamkhar 6. Kengkhar 7. Narang 8. Ramjar	**Team I** Yeshi Wangchuk Kamal Bahan Sonam Tshering **Team II** Jaku Gap Susmita Subba Ganga Devi Monger

			9. Thangrong 10. Tongmigangsa Team II- **1.** Bardo **2.** Bjoka **3.** Dungmaed **4.** Gongdue **5.** Nangkor **6.** Trong	

2. Policy, Legal, and Administrative Framework

This section of the IEE reviews the policies, acts, regulations, guidelines, and standards relevant to the proposed construction of the 124.5 km, 400 kV D/C TL from the planned 600 MW Khorlochhu Hydropower Project in Trashiyangtse, routed via Chorlung PH – Durungri PS – Goling SS. The purpose of this review is to ensure full compliance with applicable policies and regulatory requirements during the planning and execution of the project.

Bhutan has established a comprehensive policy and regulatory framework that prioritizes the protection of its pristine environment while promoting sustainable economic development. These frameworks are aimed at achieving a balanced integration of environmental conservation and developmental objectives. A detailed review of the relevant policy and legal instruments applicable to the proposed project is provided below.

Table 4. List of Applicable Policies, Acts and Regulations for the Project.

SN	Name	Objectives	Applicability
1	The Constitution of the Kingdom of Bhutan 2008	Article 5 Environment- defines the responsibilities of both the Government and citizens in protecting and conserving the country's pristine environment, while ensuring the safeguarding of Bhutan's rich biodiversity and wildlife.	It is relevant, as the construction of the transmission line will inevitably pose environmental impacts and risks that must be carefully assessed and mitigated to ensure effective protection and conservation of the environment.
2	The National Environment Protection Act 2007	The Act defines the roles and responsibilities of the National Environment Commission (NEC) and other competent authorities, including Dzongkhag-level offices, in regulating environmental matters. It mandates the NEC to monitor ambient air and water quality, as well as land-use changes, and establishes procedures for environmental inspections, verification, enforcement, and the imposition of penalties to ensure compliance.	The construction and operation phases of the TL construction are expected to have potential impacts on air, water, and soil quality. Accordingly, the project will be required to comply with the Department of Environment and Climate Change (DECC) environmental standards for air, water, and noise to minimize and manage these impacts effectively.
3	Electricity Act of Bhutan 2001	Part 5 of Electricity Act of Bhutan; Right to acquire- states that where land held under private ownership is required for the establishment of a project, such land may be acquired in accordance with the applicable provisions of the Land Act, subject to the approval of the Minister. This acquisition shall be regarded as being for a public or national purpose.	This act is relevant since the TL and right of way (RoW) passes through private land. TL projects often require land to install towers, substations, and cables across various privately owned properties. The Act provides the legal basis for acquiring such privately owned land when setting up the transmission line.
4	Environment Assessment Act 2000	Based on this act, the Environmental Clearance (EC) is required prior to the execution of any project that may entail adverse impacts on the environment.	

5	Regulation for Environmental Clearance of Projects 2016	This regulation outlines procedures for environmental assessments and clearance, requiring applicants to submit Initial Environmental Examination (IEE) forms to relevant Competent Authorities. The regulation establishes guidelines for reviewing applications, conducting site visits, and determining whether a more comprehensives Environmental Impact Assessment (EIA) is needed before an EC can be issued or renewed.	EC is required for the construction of the 400 kV DC East-West Transmission Line, taking into account the potential impacts on the surrounding environment. The Act and RECOP 2016 provide guidance on the submission of the necessary forms and reports.
6	Environmental Assessment Guideline for Power Transmission Line Projects (2012)	This assessment provides guidance and assistance to various stakeholders involved in the EA process and inform the regulatory agency and EIA practitioners about the best environmental management practices in the transmission line sector.	This is relevant since for construction of TL requires social and environmental survey to get the baseline data of the project area.
7	Forest and Nature Conservation Rules and Regulation 2023	Requires obtaining forestry clearance before the clearing and felling of trees as well as requirements for protection of wildlife.	Since there will be clearing of trees during construction of TL, the project requires obtaining of forestry clearance prior to the clearing and felling of trees and marking of trees to be cut in conjunction with Department of Forest and Park Services (DoFPS) on site.
8	Waste Prevention and Management Act of Bhutan 2009	Provides institutional framework on waste management to reduce generation at source, promotes segregation, reuse, and recycling, storage, transportation, environmentally- sound treatment and disposal of waste, and monitoring procedures and coordination at every organizational level	For the construction of TL, it will potentially generate solid wastes during construction and operation phases. The project will comply with this Act and ensure waste segregation, collection, storage and disposal as per requirements.
9	Waste Prevention and Management Regulation 2012 (amended 2016)	This regulation establishes procedures and requirements to implement the Waste Prevention and Management Act 2009.	The Project is a potential generator of solid wastes during construction and operation phases. The project will comply with the Regulations of this Act to ensure waste

			segregation, collection, storage and disposal as per requirements.
10	Water Act of Bhutan 2011	Ensures that water resources are protected, conserved and /or managed in an economically efficient, socially equitable and environmentally sustainable manner.	No specific permit required, but any development project needs to comply with the provisions of this Act and Regulation. The proposed project involves overhead construction, with tower installations and worker camps planned at a safe distance from watercourses. As a result, the project is expected to have minimal impact on water resources.
11	Water Regulation of Bhutan 2014	Chapter 5 of the Water Regulation, under the section on Temporary Water Users, outlines provisions relevant to this project. It states that any new user intending to draw water from an existing facility whether for temporary or extended use must first consult with and obtain consent from the relevant Water Users Association (WUA) or the existing water users. In cases where the proposed water source is not governed by any WUA or group of users, the necessary permit must be secured from the respective Gewog Administration.	The Project will ensure compliance with the requirements of this Act.
12	Land Act of Bhutan 2007)	Provides the basis for land tenure in Bhutan. According to this act, the government has the right to acquire land if it is important for the country. In this case, the affected individual, family, or community will be entitled to full compensation in the form of substitution or cash compensation depending on the type of land.	The construction of TL will involve the acquiring State reserved forest land (SRFL) and private land. Hence the applicability of this act.
13	Regulations on Occupational Health, safety and Welfare 2022	Regulation mandate that employers ensure a safe and healthy working environment, including providing Personal Protective Equipment (PPE) and conducting medical examinations for workers in hazardous industries. The regulations require the	Relevant during construction and operation phases of the project because the workers will be exposed to different occupational hazards.

		appointment of Safety Officers and Construction Safety Supervisors, and enterprises must develop policies to prevent sexual harassment.	
14	Environmental Standards 2020	These standards specify guidelines for 11 areas, including ambient air and water quality, industrial and vehicular emissions, noise limits, and standards for waste incineration ash disposal.	During construction phase dust pollution, noise pollution and waste are expected to generate, hence the project will compliance with the standards.
15	Guideline for plot boundary realignment/reconfiguration	It states that: Plots affected by electric structures such as high-tension cable pylons; transmission towers and electric substations have development restrictions as per safety regulations of Bhutan Electricity Authority. However, there is no provision for exchange or satshab for such plots. Since these electric structures are for public use/benefit, adjustment from state-land through plot boundary reconfiguration shall be considered if there is adjacent vacant state land.	The TL and RoW crosses in private land and Community Forest (CF). Hence this guideline is applicable for the project.
16	BPC- Community Gender Based Violence Harassment Policy- AND Community grievance redressal mechanism for General Grievances	The GBVH GRM is confined to all community members, local organizations, and stakeholders affected by the BPC operations through various project executions. Both complainants and witnesses shall have access to the channels of reporting GBVH through the easiest means.	There is a potential risk of gender-based violence and harassment at the project site. The policy provides guidance on addressing such issues through the GRM. So, it is applicable to the project site.

2.1 Applicable Guidelines and Standards

Several guidelines and standards have been notified or issued by line ministries and departments in Bhutan to ensure compliance. The guidelines and standards relevant to the current project are noted below.

2.1.1 Environmental Discharge Standard 2010

National ambient air quality standards establish upper limits on the concentration of air pollutants in outdoor air, for the protection of human health, agriculture, natural vegetation and ecosystems, and the environment in general.

Parameter	Industrial Area	Mixed Area*	Sensitive Area**
Total Suspended Particulate Matter			
24 Hour Average	500	200	100
Yearly Average	360	140	70
Respirable Particulate Matter (PM 10)			
24 Hour Average	200	100	75
Yearly Average	(World Bank/WHO = 150)	60	50
	(World Bank/WHO = 70)		
Sulfur Dioxide			
24 Hour Average	120***	80	30
Yearly Average	80	60	15
Nitrogen Oxides			
24 Hour Average	120	80	30
Yearly Average	80	60	15
	(World Bank/WHO = 40)		
Carbon Monoxide			
8 Hour Average	5,000	2,000	1,000
1 hour Average	10,000	4,000	2,000

* Mixed Area means an area where residential, commercial, or both activities take place.
*Sensitive Area means an area where sensitive targets are in place, like hospitals, schools, sensitive ecosystems.
*Exceeds (better than) WHO/World Bank guidelines.

Figure 2. Ambient air quality standards (maximum permissible limits in µg/m3) NECS Bhutan (2010)

Fuel Type	Vehicle registered prior to Jan 1, 2005	Vehicle registered after Jan 1, 2005	Type Approval
Petrol (%CO)	4.5	4	
Diesel (%HSC)	75	70	Euro-II

Figure 3. Motor vehicle emission standards

Land Use Category	Maximum Level	
	Day	Night
Industrial Area	75 dB	65 dB
Mixed Area	65 dB	55 dB
Sensitive Area	55 dB	45 dB

Figure 4. Environmental standards for noise

Noise standard as per land use Category 2. World Bank noise guidelines are 70 dB day and night for industrial areas, and the same as Bhutan guidelines for sensitive areas.

2.2 International Agreements and Conventions

RGoB is well represented in the international and regional environmental arena as part of its commitment to environmental conservation and protection. The National Environment Commission Secretariat, as a key environmental policy making body/nodal agency of the country, participates in various international meetings relating to conventions and agreements that Bhutan has signed or ratified. Bhutan is party to Multilateral Environmental Agreements as given in **Table 5**.

Table 5. International commitments and dates of ratification

No.	International Commitments	Instrument of Ratification
1	UN Framework Convention on Climate Change	1995
2	UN Convention on Biological Diversity	1995
3	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	2004
4	Kyoto Protocol to the United Nations Framework Convention on Climate Change	2005
5	Cartagena Protocol on Biosafety (the Convention on Biological Diversity)	
6	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Bhutan became a party in 2004.	2002
7	UNESCO World Heritage Convention	2001
8	International Plant Protection Convention (Adherence)	1994
9	The Final Act and the Law of Sea Convention	1982
10	Statute of the Centre for Science and Technology of the Movement of Nonaligned Countries and other Developing Countries	1985
11	Statutes of the International Centre for Genetic Engineering and Biotechnology	1985
12	Vienna Convention for the Protection of the Ozone Layer	2004
13	United Nations Convention to Combat Desertification (UNCCD)	2004

3. Description of the Project

3.1 Project Overview

Bhutan Power Corporation Limited (BPC), a state-owned company under the Druk Holding and Investments Limited (DHI), is responsible for the country's power transmission and distribution and provides telecommunications services. BPC was launched as a public utility on 1st July 2002, with the goal of distributing electricity throughout Bhutan, providing transmission access for generating stations for domestic use and export, and ensuring the electricity is affordable, adequate, and reliable for all consumers. In accordance with this mandate, BPC is responsible for the planning, construction, and operation of the transmission infrastructure necessary to evacuate power from the Khorlochhu Hydropower Project.

Khorlochhu Hydropower project has a generation capacity of 600 MW, and the electricity will be transmitted via a 400 kV D/C transmission line mounted on double-circuit towers.

The primary objectives of the proposed transmission line are to:

- ✓ Facilitate the evacuation of power generated by the 600 MW Khorlochhu Hydropower Project.
- ✓ Enhance connectivity between the eastern and western regional transmission networks.
- ✓ Improve the resilience and reliability of electricity supply in the eastern regions; and
- ✓ Support development through east-west grid connectivity.

3.2 Location and Route

The proposed transmission line route passes through state reserved forests, community forests, small streams, roads, and diverse terrain. It will begin at the Corlung PH in Trashiyangtse Dzongkhag and terminate at the Goling Switching Station SS in Zhemgang Dzongkhag via Durungri PS in Pemagatshel Dzongkhag.

The alignment spans five Dzongkhags; Trashiyangtse, Trashigang, Pemagatshel, Mongar, and Zhemgang covering a total distance of approximately 124.5 kilometers and involving the construction of 228 transmission towers.

Specifically, within Trashiyangtse, the route passes through Tongmijangsa, Jamkhar and Ramjar Gewogs; in Trashigang, it transverse Yangneer Gewog; in Mongar, it crosses Drametse, Narang, Chaskhar, Thangrong, Khenkhar and Gongdue Gewogs; in Pemagatshel, it traverses Chhimoong and Dungmaed Gewogs; and in Zhemgang, the alignment includes Nangkor, Trong, Bardo, and Bjoka Gewogs. The site location and the detailed transmission line route is illustrated in the **Figure 5** below.

Figure 5. The proposed 400 kV East-West TL Route alignment

A detailed breakdown of alignment length across Dzongkhags and Gewogs is presented in the table below.

Table 6. Alignment length across Dzongkhags and Gewogs

SN	Dzongkhag	Gewogs	Approx. Line Length (Km)	No. of towers in SRFL	No. of Towers in Private Land	Approx. Line Length over the Private Land (Km)
1	Trashiyangste	Tongmijangsa	0.175	0	0	0.09
		Ramjar	1.3	1	0	0
		Jamkhar	2.65	5	1	0.324
2	Trashigang	Yangner	9.34	16	1	0.742
3	Mongar	Drametse	9.48	14	2	0.23
		Narang	1.68	2	0	0
		Chaskhar	7.14	18	0	0.099
		Thangrong	7.53	17	0	0.186
		Khenkhar	12.4	18	4	2.005

		Gongdue	8.61	9	1	0.316
4	Pemagatshel	Chimong	6.6	14	0	0.088
		Dungmaed	7.44	18	0	0.103
		Dungmaed	3.70	8	0	0.127
5	Zhemgang	Bardo	16.42	26	0	0
		Bjoka	10.90	24	1	0
		Nangkor	15.97	23	0	0.41
		Trong	3	5	0	0
		Total	**124.5**	**218**	**10**	**4.72**

The towers are located at various elevations ranging from 314 m to as high as 2129 m. The geographical coordinates of tower angle points and its type are annexed.

3.3 Project Components

The 400 kV D/C transmission line project will comprise several critical components to support its effective implementation and reliable operation. The construction of each transmission tower will involve the following key stages: Source: (Comprehensive Guide to Transmission Line Construction, n.d).

3.3.1 Planning and Design

The initial phase involves comprehensive planning and detailed design. This includes the identification of the optimal transmission route, considering factors such as land use, environmental sensitivity, population proximity, and existing infrastructure. Engineers conduct topographical and geotechnical surveys to gather essential data on terrain, soil conditions, and potential obstructions. Based on these assessments, detailed engineering designs are developed, specifying tower types, conductor materials, foundation requirements, and other essential components.

3.3.2 Securing Permits and Approvals

Before physical work commences, all necessary permits and regulatory approvals must be obtained from relevant local, regional, and national authorities. This ensures compliance with land use policies, environmental regulations, and safety standards. EIA may be conducted to evaluate the project's effect on ecosystems, water resources, and communities. Public consultations and stakeholder engagement are also undertaken to build local support and address any concerns.

3.3.3 Site Preparation

Following approval, the site is prepared for construction. This includes clearing vegetation, removing debris, and ensuring that the transmission corridor is free of obstructions. Temporary access roads may be constructed to facilitate the transportation of materials, machinery, and personnel. Where necessary, temporary structures such as bridges may be installed to overcome natural barriers. This phase lays the groundwork for a safe and efficient construction process.

3.3.4 Foundation Installation

Foundations provide the structural base for transmission towers or poles. The foundation type and design are determined by soil conditions, tower load, and environmental factors such as wind loads and seismic activity. Depending on site requirements, foundations may be constructed using reinforced concrete, steel, or a combination of materials. Precision during this phase is critical to ensure long-term structural stability.

3.3.5 Tower and Pole Erection

Once the foundations have been cured and validated, tower or pole erection begins. Steel lattice towers are typically assembled at ground level and then lifted into place using cranes. For monopoles, holes are drilled, and the poles are positioned and secured. Accurate alignment is vital to maintain correct conductor tension and ensure structural integrity throughout the transmission line.

3.3.6 Conductor Stringing

This stage involves the installation of conductors between the erected towers or poles. Specialized tensioning and pulling equipment are used to string the conductors, maintaining precise tension to prevent sagging or overstressing. Conductors, typically composed of aluminum or aluminum alloy, are installed along with associated hardware such as insulators, spacers, and clamps to ensure reliable electrical performance and mechanical stability.

3.3.7 Installation of Ground Wires and Accessories

Ground (shield) wires are installed above the conductors to protect the transmission line from lightning strikes by directing surges safely to the ground. Additional accessories

such as vibration dampers, bird diverters, and warning markers may also be installed to improve system safety, environmental compliance, and long-term performance.

3.3.8 Testing and Commissioning

Upon completion of construction, the transmission line undergoes a comprehensive testing and commissioning process. This includes electrical tests to verify insulation integrity, continuity, and conductor performance, as well as mechanical inspections to ensure proper alignment and stability of the structures. Any defects are rectified prior to energizing the line. Final commissioning is carried out in coordination with the grid operator to integrate the line into the existing power network.

3.4 Salient Features of the Transmission Line

The following table outlines the key features of the transmission line, including tower, conductor specifications, foundation details, required clearances, line crossings, provisions for telecommunication lines, and RoW considerations. These elements are essential to ensure the transmission line operates safely, reliably, and efficiently.

Table 7. Salient Features of Transmission Line

Sl. No.	Feature	Description
	Tower	
1	Nos. of tower	228
2	DE tower	2
3	Type of tower	Tension Tower
4	Tower Height	57.321m - 82.2m
5	Foundation depth	3.05m
6	Foundation type	NDS/DFR
	Conductor	
1	Type of conductor	ACSR Moose & AACSR Moose
2	stranding wire	AL:54/3.53mm & St.:7/3.53mm
3	Ambient temperature	32 degrees
4	Max. operating temperature	85 degrees
5	Current Carrying capacity at 75 degree C	836 Amps
	Clearance	
1	Ground clearance	req. :9.5m / min.:9.35m
2	Clearance to building	
i	Vertical	7.4m

ii	Horizontal	5.7m
3	Line crossing clearance	
i	11kV	5.49m
ii	33kV	5.49m
iii	66kV	5.49m
iv	132kV	5.49m
v	220kV	5.49m
vi	400kV	5.49m
4	Telecommunication Line	4.48m
5	Row	23m on either side from CL of tower

3.5 Implementation Schedule

The proposed transmission line route has been carefully selected to avoid densely populated areas, settlements, national parks, and regions with high forest cover. The alignment will originate from the 400 kV Corlung PH and extend to the Goling SS, passing through the Durungri PS.

The project entails the construction of approximately 124.5 km of new transmission line, which includes survey and investigation works, forest clearance, detailed design and engineering, tendering for procurement, civil works along the 124.5 km corridor, tower erection, stringing of conductors, and subsequent testing and commissioning.

The entire scope of work is expected to be completed within 43 months (Corlung PH-Durungri PS within 43 months and Durungri PS- Goling SS within 38 Months). The total estimated project cost is Nu. 2,729,690,926.33 for Khorlochu PH to Durungri PS and Nu. 2,130,749,960.45 for Durungri PS to Goling SS. The project is to officially commence on December 1st, 2026, marked by the publication of the Notice Inviting Tender (NIT), and is scheduled for completion within 43 months from the date of contract award.

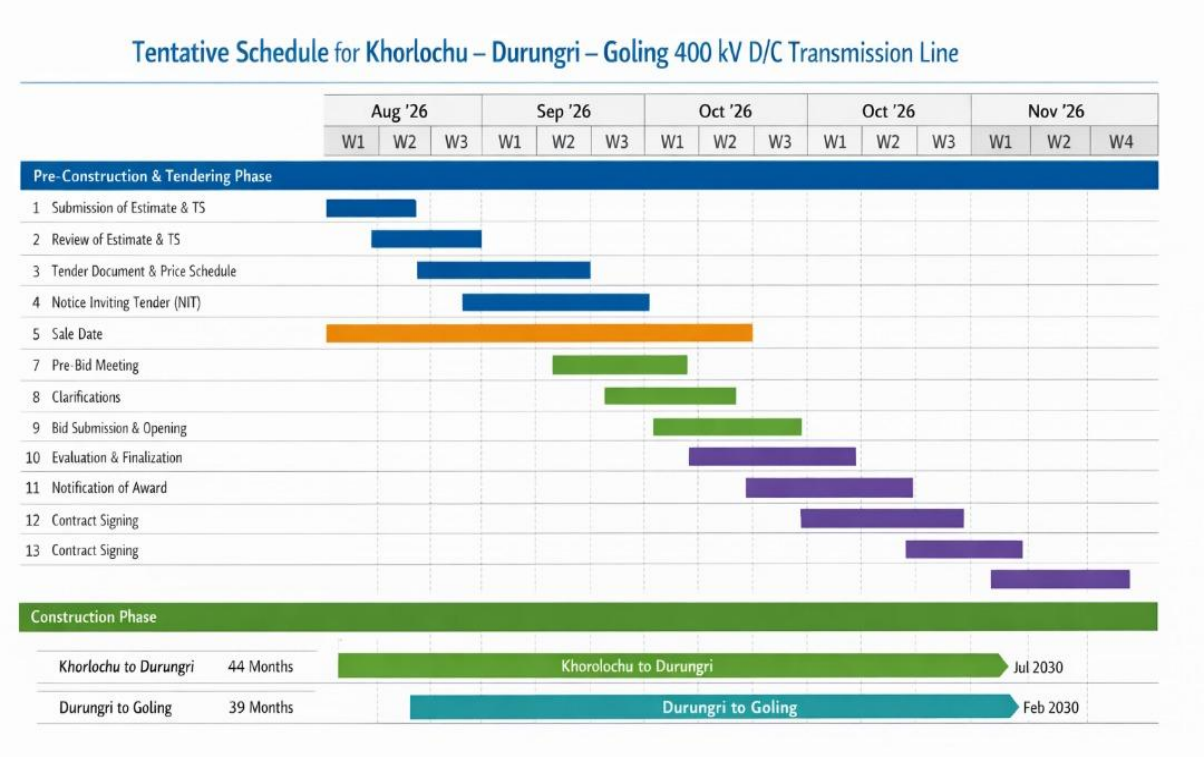


Figure 6. Implementation Schedule

4. Analysis of Alternatives

The preliminary assessment of the project included an analysis of alternatives for two sections: (i) KHEL Port head to Durungri and (ii) Durungri to Goling, addressing the optimal match between required technical specifications and site conditions, as well as addressing any concerns for environmental, social, and economic features in each location.

A walk on survey of the 400 kV line was carried out in two sections: (i) KHEL Port head to Durungri and (ii) Durungri to Goling by BPC technical staff, from 17th September to 16th October, 2024. Two options under each section were considered.

The 1st option of Section one from CD 78 to CD 86 (Khengkhar area) was chosen due to the following reasons:

(i) Social impact on private land: In the 2nd option, an additional 3 towers fall in the Khengkhar village compared to the 1st option where the 25 towers are within drylands resulting in lesser number of affected parties.

(ii) Technical reasons: The terrain along the 1st option was found to be comparatively moderate compared to the 2nd option.

The 2nd option of Section two from DG68 to DG105 (RMNP core zone) was considered due to following reasons:

(i) Environmental impacts of the length of the TL: The 1st option is approximately 61.4 km which is 2.4 km longer than the 2nd option (approximately 59 km).

(ii) Environmental impacts of the tower footings: 16 towers fall in community forest which is 9 more than the 2nd option (7 numbers).

(iii) Environmental impact of the line and tower: 7 towers fall in the core zone of RMNP for 1st option while, only 6 falls in multiuse zone of RMNP for 2nd option.

The "Do Nothing" Alternative

The "do nothing" or "without the project" option is not viable as the associated transmission line is an essential component of power evacuation from KHEP to the national grid.

4.1 Route Selection

The most cost-effective approach for constructing transmission lines is to maintain a straight alignment. However, due to the presence of residential areas, natural obstacles, and other infrastructure along the route, deviations are sometimes necessary. Therefore, the selected alignment follows the most direct and practical route between the start and end points while avoiding these constraints. Considering these factors, no alternative alignment would be less intrusive or more economical. To identify the most suitable route, assessment was applied against key technical, environmental, and social criteria. These included terrain stability, overall line length, number of road and river crossings, forest coverage, accessibility, and the presence of permanent structures. The findings are summarized in the table below.

Table 8. Route Selection

SN	Evaluation Item	Route
1	Length (Km)	124.5
2	Number of Towers	228
3	No. of River/Stream Crossings	21
4	Geological Stability	Stable
5	No. of Road/Highway Crossings	10

6	Permanent Structures	None
7	Marshy/Unstable/Rocky Ares	Avoided
8	132/220/400kV Crossings	132/220/400 kV crossing
9	SRF Length (Km)	103.2
10	CF Length (Km)	13.6
11	Private Land (Km)	4.72
12	Cultivable Land (ha)	None

5. Description of the Environment

5.1 Physical Resources

5.1.1 Physiography

The project area is situated within the rugged, high-altitude terrain of the Eastern Himalayas, characterized by steep mountains, deep river valleys, and fast-flowing rivers forming part of the Drangme Chhu river system. The project area begins at the confluence point of the Corlung PH and Khorlongchhu Hydropower Project, with elevation gradually decreasing southwards toward the Pooling Station at Durungri and the Goling switching station. The elevation across the project area ranges from approximately 812 meters at Corlung PH to around 551 meters at Goling SS and 528 meters at Durungri PS.

5.1.2 Location

a. Trashiyangtse Dzongkhag

Trashiyangtse Dzongkhag is in northeastern Bhutan and covers an area of 1,437.9 sq. km at an elevation of 1,750 to 1,880 meters. It is historically significant, featuring a 15th-century fortress built by Terton Pema Lingpa, who named the district "the fortress of auspicious fortune." The population is culturally diverse, including Yangtseps, Tshanglas, Bramis, Khengpas, and Kurtoeps.

The administrative center is Trashiyangtse town, hosting government offices, schools, and healthcare facilities. The district is renowned for its rich cultural heritage, including sacred sites like Gom Kora temple and Chorten Kora, traditional festivals, and intricate wood carvings.

Agriculture, focusing on crops like rice, maize, barley, and potatoes, alongside livestock farming, forms the backbone of the local economy. Tourism is growing, driven by natural beauty, cultural landmarks, and proximity to Sakteng Wildlife Sanctuary. While accessible by road, transportation infrastructure is still developing in some areas.

b. Trashigang Dzongkhag

Trashigang Dzongkhag, located 551 km east of Thimphu, is one of Bhutan's largest districts, covering an area of 3,066 sq. km. It shares borders with Mongar, Samdrup Jongkhar, Pemagatshel, Trashiyangtse, and the Indian state of Arunachal Pradesh. The Dzongkhag spans elevations from 600 m to over 4,500 m, with settlements ranging from Deno in Lumang Gewog (550 m) to Merak (4,600 m). The climate is predominantly temperate, with annual rainfall between 1,000 mm and 2,000 mm.

As of the 2017 PHCB, the Dzongkhag has a population of 45,518 across 10,720 households, with a population density of 20.64 per sq. km. Forests cover 77.87% of the land, while only 3.64% is arable. The Dzongkhag is administratively divided into 15 Gewogs, 3 Dungkhags, 79 Chiwogs, and one Thromde, with all Gewogs connected by motorable roads.

The administrative center and main town are located at Mithidrang in Samkhar Gewog. The historic Trashigang Dzong serves as both the Dzongkhag administration headquarters and the seat of the Dzongkhag Rabdey. The Dzongkhag is traversed by the Dangmechu River, one of Bhutan's largest river systems.

c. Mongar Dzongkhag

Mongar Dzongkhag, located approximately 460 km east of Thimphu, spans an area of 1,940.26 sq. km with elevations ranging from 400 to 4,000 meters. The district experiences a subtropical climate in the south and a temperate climate in the north. It shares borders with six Dzongkhags: Bumthang, Lhuentse, Trashigang, Pemagatshel, Samdrup Jongkhar, and Zhemgang. Major rivers such as Kuri-Chhu, Sheri-Chhu, and Drangme-Chhu flow through its valleys.

Administratively, Mongar is divided into 17 Gewogs, 88 Chiwogs, and three constituencies. As of the 2022 projection, the population stands at 36,383, with 10,084 in urban centers and 26,299 in rural areas. The economy is supported by citrus, vegetables,

dairy, poultry, and the production of beaten maize (Tengma), particularly from Chhaling and Saling.

All Gewogs are connected by 364.85 km of blacktopped roads, 1,413.11 km of farm roads, and supported by 40 bridges. Basic infrastructure such as electricity, safe drinking water, mobile networks, and some irrigation channels are accessible to all households.

Mongar serves as a key regional hub in eastern Bhutan, hosting numerous government offices and the Mongar Regional Hospital. Future developments, including the Gyalsung project, Mother and Child Care Unit, Pongchela airport, and urban expansion from Gyalpoizhing to Yadi, are expected to stimulate economic growth and population increase.

d. Pemagatshel Dzongkhag

Pemagatshel, meaning "Blissful Land of the Lotus," is in southeastern Bhutan, covering approximately 1,023 sq. km with elevations ranging from 1,000 to 3,500 meters. Bordered by five Dzongkhags and the Indian state of Assam, 87.65% of the Dzongkhag is forested. It experiences hot, humid summers and moderately cold winters, with annual rainfall between 1,500 and 3,000 mm.

The Dzongkhag comprises 11 gewogs with a population of about 25,000 across 4,486 households. Most land holdings are dryland (kamzhing), and all gewog centers are connected by road. Public services are delivered by 772 civil servants and several corporate agencies. Health services include one district hospital, 12 BHUs, 5 sub-posts, and 35 ORCs. Education is supported through a network of 35 schools, 8 ECRs, and 36 NFE centers, with a literacy rate of 56.1%.

Significant progress was made during the 10th Five-Year Plan in areas such as road connectivity, mobile network (98%), rural electrification (99%), and water supply coverage (96%). Economic activity is supported by 1,055 operational industrial licenses and 635 businesses, but poverty remains high at 29.9%, second only to Lhuentse. Contributing factors include land fragmentation, labor shortages, wildlife conflict, and poor terrain. To address landlessness and poverty, the National Rehabilitation Programme resettled 95 households at Khenadang and Borangma with support from His Majesty's Kidu.

e. Zhemgang Dzongkhag

Zhemgang Dzongkhag, located in south-central Bhutan, borders Bumthang, Trongsa, Sarpang, Mongar, Pemagatshel, and Assam (India). It forms part of a key wildlife corridor with three national parks, including the Royal Manas National Park. The Dzongkhag consists of eight Gewogs; Trong, Nangkor, Shingkhar, Bardo, Phangkhar, Goshing, Ngangla and Bjoka and is supported administratively by Panbang Drungkhag.

With a population of 17,763, Zhemgang is one of Bhutan's most remote districts. The economy is primarily agricultural, with maize as the staple crop and oranges as a major cash crop in the southern and central Gewogs. The northern Gewogs rely on livestock products. Traditionally known as Khengrig-Nam-Sum, the Dzongkhag is divided into Upper, Middle, and Lower Kheng based on altitude. It is rich in biodiversity and cultural heritage, preserving both ancient Bon practices and Buddhist traditions. Locals are known for bamboo crafts and pottery.

Zhemgang Dzong was founded in the 12th century by Lama Zhang Dorje Drakpa and later fortified in 1655. The region remains notable for its natural, cultural, and historical significance.

5.1.2.1 Communities along the Proposed TL

a. Tongmijangsa Gewog

Tongmijangsa Gewog, located in the eastern part of Bhutan, spans an area of 84 square kilometers at an elevation of 3,650 meters above sea level. The gewog comprises five chiwogs and sixteen villages, with a total population of 4,016 people (2,054 females and 1,962 males) across 367 households. However, the gewog faces development challenges due to 149 vacant households (gungtong), rural-urban migration, and recurring road blockages during heavy monsoon rains.

The economy is primarily agrarian, with residents cultivating maize, cereals, vegetables, oranges, chilies, hazelnuts, and paddy, supported by an RNR extension center. With 83% of its land under forest cover, the gewog also plays an important ecological role. Education services are supported by four schools, including the Kunzangling Higher Secondary School, along with three ECCD centers and one NFE center. Health care is delivered through a Primary Health Center and three outreach clinics, though the gewog lacks a hospital. Infrastructure is relatively well developed, with 13.5 kilometers of GC road and 59.5 kilometers of farm roads, though blacktopping delays linked to the Kholongchhu

Project continue to affect connectivity. All chiwogs are fully electrified and enjoy complete telecommunication coverage, supported by one community center at the gewog.

b. Jamkhar Gewog

Jamkhar Gewog, situated in Trashiyangtse District, eastern Bhutan, spans 31.4 sq. km at an altitude of 1,250 meters. It comprises 12 villages under five chiwogs, with a population of 3,197 across 395 households, including 100 gungtongs. The majority of residents are Tshangla and Khengpa, practicing Buddhism with rich cultural traditions.

Agriculture and livestock rearing are the primary livelihoods, complemented by cottage industries such as weaving and handicrafts. A farmer cooperative supports local economic activities. The gewog enjoys full electricity and telecommunication coverage and has essential infrastructure including one community center, one RNR center, five community forests (covering 85.62% of the area), and five community lhakhangs.

Social services include one Basic Health Unit, two Outreach Clinics, two primary schools, and two ECCD centers serving 119 students. Connectivity is supported by 5.5 km of Gewog Center Road and 72 km of farm roads.

c. Ramjar Gewog

Ramjar Gewog, located in Trashiyangtse District, eastern Bhutan, covers 22 sq. km at an altitude of 2,358 meters. It consists of 33 villages across five chiwogs and has a population of 2,494 (1,254 males, 1,240 females) living in 324 households, including 113 gungtongs (empty households).

The local economy is primarily based on agriculture and allied activities, supported by one RNR Extension Center and three farmer cooperatives. The gewog is 84% forest-covered, providing rich natural landscapes of valleys, waterfalls, and mountain peaks.

Public services include one middle secondary school and one ECCD center, with no lower-level or NFE centers. Health facilities comprise of one primary health center and three outreach clinics, but no hospital. Infrastructure is well-established, with 100% electricity and mobile network coverage. The transportation network includes 16 km of GC road and 14.1 km of farm roads. Culturally, Ramjar is home to six lhakhangs and has one community center at the Gewog headquarters.

d. Yangneer Gewog

Yangneer Gewog is situated in the northwest of the Trashigang Dzongkhag. It covers an area of 72.3 square kilometers. Gewog comprises five chiwogs with 12 major villages and 21 minor villages, housing a population of 3,499 across 557 households. The gewog has a temperate and favorable climate, with livelihoods primarily dependent on agriculture and livestock farming. Vegetable cultivation is the main source of income, and potatoes are the principal cash crop.

Connectivity is ensured through the GC road from Chazam, and most villages have access to safe drinking water and electricity. Key services include two primary schools, one middle secondary school, one RNR Extension Center, one Grade II BHU, five NFE centers, and four community lhakhangs.

The gewog also has active community groups, including one dairy cooperative, four vegetable groups, four community groups, and one forest management group. The vegetable and dairy groups are linked with three local schools to supply organic vegetables and dairy products, strengthening local economic activities.

e. Drametse Gewog

Drametse Gewog in Monggar Dzongkhag spans 72 sq. km with a population of 3,788 across 428 households. Renowned for the UNESCO-listed Drametse Ngacham mask dance, it is a spiritual and cultural hub anchored by the Drametse Dratshang and other lhakhangs. The gewog prioritizes sustainable agriculture, community forestry, and waste management, while addressing water scarcity and infrastructure needs. It has three schools with 890 students, one BHU II, and three outreach clinics, ensuring basic education and health services. Connectivity is supported by over 118 km of highway, feeder, GC, and farm roads, with 100% electricity and telecom coverage. The economy is driven by crops, livestock, and community groups, complemented by hazelnut plantations, a lemongrass cooperative, and two community forest groups, supported by the RNR Center's extension services.

f. Narang Gewog

Narang Gewog, located in Monggar Dzongkhag, covers 49.91 sq. km with a population of 2,272 (1,170 males and 1,102 females) across 225 households. Governance is led by the

Gup, Mangmi, and seven Tshogpas, supported by civil servants including an agriculture and livestock extension officer, health assistant, and school staff. The gewog has one primary school with 12 teachers serving 229 students, and health services are provided through one BHU II and two outreach clinics. Culturally, it is home to Khalong and Narang Sherimtshukpu lhakhangs, both important community religious centers. Connectivity is facilitated by a network of 16 km of feeder road, 31 km of GC road, and 23 km of farm roads, with 100% electricity and mobile coverage. The economy is largely based on potato and maize cultivation, livestock including two poultry farms, and a hazelnut plantation spanning 50.1 acres with 21,411 trees, along with one community forest group. Extension services are supported by the RNR Center, strengthening agriculture, forestry, and livestock development.

g. Chaskhar Gewog

Chaskhar Gewog in Monggar Dzongkhag spans 53 sq. km and has a population of 3,311 (1,849 males and 1,462 females) across 501 households. The gewog is primarily dependent on maize, potato, and vegetable farming, supported by two vegetable groups, a primary cooperative, poultry farming, biogas use, and a hazel nut plantation covering 35.8 acres with 17,011 trees. It also has two community forest groups, with agricultural, livestock, and forestry services provided by the RNR center. Governance is led by the Gup, Mangmi, and seven Tshogpas, supported by civil servants including agriculture, livestock, forestry, and health staff. Education is served by Chaskhar Central School (35 teachers, 577 students) and Pam ECR (3 teachers, 35 students), while health facilities include one BHU II and five outreach clinics. The gewog is culturally vibrant, with five lhakhangs—notably Ugyen Donag Shedrup Choekhorling and Yadhu Goenpa—hosting annual tshechus and housing significant relics. Infrastructure includes an extensive road network of GC and farm roads, with full electricity and mobile network coverage. Despite challenges such as crop damage and limited healthcare access, the gewog continues to improve infrastructure, services, and community resilience to enhance livelihoods.

h. Thang-Rong Gewog

Thangrong Gewog in Monggar Dzongkhag covers 69 sq. km and has a population of 2,813 (1,433 males and 1,380 females) across 327 households. Known for the Kadam Goenpa monastery and vibrant farming communities, the gewog emphasizes climate-smart

agriculture, sustainable land management, and environmental conservation while improving infrastructure and livelihoods. Governance is led by the Gup, Mangmi, and seven Tshogpas, supported by civil servants including agriculture, livestock, and health officers. Education is provided by Thangrong PS (13 teachers, 253 students) and Lingkhar PS (3 teachers, 36 students), while health services include one BHU II and four outreach clinics. Cultural heritage is preserved through Larjab Dakar Zangtopelri, Lingkhar Kadam Lhakhang, Kadam Nagtshang Lhakhang, and Ngarpangthang Lhakhang, which host annual tshechus and house sacred relics. The gewog is connected via highway, feeder, GC, and farm roads, and has 100% electricity and mobile network coverage. Its economy is driven by potato, maize, and beans, livestock including poultry and piggery, a hazelnut plantation of 16.3 acres (7,319 trees), and one community forest group, supported by RNR Center extension services.

i. Khenkhar Gewog

Kengkhar Gewog in Monggar Dzongkhag covers 100 sq. km and has a population of 3,886 (2,001 males and 1,885 females) across 437 households. The gewog focuses on infrastructure development, public health advocacy, and community-based livelihood improvement despite a 13.5% poverty gap. Governance is led by the Gup, Mangmi, and seven Tshogpas, supported by civil servants including agriculture, livestock, forestry, and health officers. Education is provided by Kengkhar Middle Secondary School (30 teachers, 458 students) and Yuldari Primary School (5 teachers, 62 students). Health services include one BHU II, a sub-post at Tongla, and six outreach clinics. Cultural heritage is maintained through Dungkhar and Nugphu lhakhangs, hosting religious festivals and housing important relics. The gewog is connected via highway, GC, feeder, and farm roads, with 100% telecommunication coverage and electricity in most chewogs. Its economy is driven by mandarin, mango, potato, ginger, beans, 30 poultry farms, a hazelnut plantation covering 45 acres (20,684 trees), art and crafts supported by Tarayana Foundation, and two community forests, with extension services provided by the RNR Center.

j. Chhimoong Gewog

Chhimoong Gewog in the western part of Pemagatshel Dzongkhag covers 52.8 sq. km and has a population of 1,763 (158 males and 135 females currently residing) across 208 households. The gewog experiences moderate climate, with low-altitude areas facing

extremely hot summers, and borders Yurung and Dungmaed Gewogs. Agriculture is the main livelihood, with maize as the primary cereal crop, supplemented by banana and ginger as cash crops, and tseri and dryland cultivation predominates. Governance is led by the Gup, Mangmi, and five Tshogpas, supported by civil servants including agriculture and livestock extension officers and a health assistant. Education is provided by Chhimoong PS with 4 teachers serving 35 students, and health services are available at Chhimoong PHC and a sub-post at Nyasikhar. Cultural heritage is preserved through five community lhakhangs and 50 chortens, with two pilgrimage sites. Connectivity is strong, with 52 km of blacktopped Gewog Center Road and multiple farm roads totaling over 54 km, ensuring access to villages. The gewog hosts six licensed shops, with cottage industries and contractors currently absent.

k. Dungmaed Gewog

Dungmead Gewog, in the southern part of Pemagatshel Dzongkhag, covers 112.5 sq. km and has a population of 2,830 across 358 households. The gewog comprises five chiwogs—Dungmead-Zimzor, Bangyul, La-Nyiri, Serduwa, and Woongborang—bordering Chhimoong, Khar, Chongshing, Dechheling, and Choekhorling. The climate is moderately warm in summer and cool in winter. Agriculture is the primary livelihood, with maize as the main crop and cardamom and ginger as cash crops, while the area is also home to wildlife such as the Great Hornbill. Governance is led by the Gup, Mangmi, Gewog Administration Officer, and five Tshogpas. Basic infrastructure includes electricity, telecommunication, safe drinking water, an RNR center, two primary health units, one sub-unit, three outreach clinics, an indigenous unit, and two ECCD facilities. Education is provided by two primary schools at Dungmead and Mekuri serving 153 students. Connectivity is ensured via a 35 km farm road from the Dzongkhag Administration to the Gewog center.

l. Gongdue Gewog

Gongdue Gewog in Monggar Dzongkhag covers 187 sq. km and has a population of 3,513 (1,801 males and 1,712 females) across 335 households. The gewog is recognized for its rich cultural heritage and natural beauty, with a focus on rural development, sustainable agriculture, and enhanced service delivery to improve community well-being. Governance is led by the Gup, Mangmi, and seven Tshogpas, supported by civil servants

including agriculture, livestock, and health officers. Education is provided by Daksa PS (6 teachers, 80 students), Pangthang PS (3 teachers, 27 students), and Yangbari PS (7 teachers, 44 students). Health services include two BHU IIs, one health sub-post, and four outreach clinics. Cultural heritage is maintained through Tshokoling and Toenpa lhakhangs, which are community-run and house sacred relics. The gewog is connected via GC and farm roads totaling over 39 km, with 100% electricity and mobile network coverage (except for some remote villages). Economic activities include mandarin cultivation, 19 poultry farms, 5 piggery farms, and 5 fishery farms, supported by the RNR Center for agriculture, forestry, and livestock extension services.

m. Nangkor Gewog

The gewog covers 543 sq. km and has a population of 4,973 (2,318 males and 2,655 females) across 400 households, including 15 gungtong (empty households). The gewog is fully connected with 100% electricity and mobile network coverage (B-Mobile and T-Cell), and agricultural, forestry, and livestock extension services are provided through the RNRC at the Gewog Centre. Key infrastructure, including education, health, lhakhangs, chortens, road networks, irrigation channels, electrical fencing, and business activities, support local livelihoods. Economic activities and destitute support programs are in place, ensuring community well-being.

n. Trong Gewog

The gewog covers 358 sq. km and has a population of 3,371 across 380 households, including 39 gungtong (empty households). The gewog benefits from 100% electricity and mobile network coverage (B-Mobile and T-Cell), with agriculture, forestry, and livestock extension services provided through the RNRC at the Gewog Centre. Key infrastructure details such as education, health, road network, lhakhangs, chortens, irrigation channels, electrical fencing, economic activities, Gyalpoi Tozay, and business activities contribute to the overall well-being and livelihood support of the community.

o. Bardo Gewog

The gewog covers 210.48 sq. km and has a population of 1,115 distributed across 343 households, including 13 gungtong (empty households). Population distribution by chiwog is as follows: Bardo (196), Digala (175), Langdhurbi (345), Khomshar (362), and Phulabi (37). Household distribution mirrors these figures, with Bardo (70), Digala (52),

Langdhurbi (66), Khomshar (137), and Phulabi (18). The gewog has 100% electricity and telecommunication coverage (B-Mobile and T-Cell). Agriculture, forestry, and livestock extension services are provided by the RNRC at the Gewog Centre. Key infrastructure—including education, health services, road networks, lhakhangs, chortens, irrigation channels, electrical fencing, economic activities, business activities, and destitute support contributes to the overall socio-economic development and well-being of the community.

p. Bjoka Gewog

The gewog spans 196 sq. km with a total population of 809 people (400 male and 409 female) living in 191 households. As per records, 2 gungtong (empty households) are reported. The gewog has achieved 100% rural electrification, and telecommunication services cover most chiwogs, with 99% B-Mobile coverage and 40% T-Cell coverage reaching areas such as Namergang, Chapdempa, Dongdempa, Warmphu, Aungkhar, Dalabi, and Kamalung. Agriculture, forestry, and livestock extension services are delivered from the RNR Centre at the Gewog Office.

5.1.3 Climate

The project area experiences significant climatic variation due to its diverse topography. The southern foothills are characterized by tropical conditions, marked by high temperatures and humidity. Mid-elevation zones exhibit a temperate climate, while the higher northern mountainous regions experience cold, alpine conditions. The area typically undergoes hot and humid summers with substantial precipitation, while spring and autumn are generally warm and pleasant. Winters are cold across much of the region. Due to the rugged and varied terrain, temperature fluctuations occur over relatively short distances.

5.1.4 Protected Areas

2.68 km (5 tower numbers) of the project line fall in the multi-use zone of the Royal Manas National Park while 9.77 km (14 numbers of tower) of the line length fall in the Biological Corridor no.4.

5.1.5 Plant Diversity

A seasonal biodiversity assessment was conducted across 19 permanent sampling plots (*K_F&F_1 to K_F&F_19*) within the project's Area of Influence (AoI). The inventory

identified 247 unique plant species, with 218 occurring in both seasons, 4 exclusives to the monsoon, and 25 exclusives to the post-monsoon (**Figure 7**). Ecological indicators, including Species Richness (*S*), the Shannon Diversity Index (*H'*), and Pielou's Evenness Index (*J'*), were calculated to quantify community structure and stability.

During the monsoon, *H'* values ranged from 1.12 (*K_F&F_2*) to 3.52 (*K_F&F_18*). Plots with *H'* > 2.0, such as *K_F&F_18* and *K_F&F_13*, indicate high diversity and ecological stability. Conversely, lower values in K_F&F_2 and K_F&F_17 reflect dominance by specific taxa, primarily *Pinus roxburghii* (Chirpine). Evenness (*J'*) mirrored these trends, ranging from 0.40 to 0.97, with higher values signifying equitable species distribution and lower values indicating a community dominated by a few abundant species.

In the post-monsoon season, species richness varied between 17 (*K_F&F_1*) and 53 (*K_F&F_11*). *H'* values ranged from 1.23 to 2.47, while *J'* values were recorded between 0.43 and 0.69. Site *K_F&F_13* consistently exhibited the highest diversity and evenness, suggesting a robust and balanced community structure.

Analysis of growth forms revealed a community dominated by the herbaceous layer, comprising 173 species (70% of the total), followed by 51 shrub and 48 tree species. The high proportion of herbs and the presence of 17 sapling species suggest an active successional stage or an open-canopy environment characteristic of areas adjacent to linear infrastructure. Shrub density remained consistent across sites (8–25 individuals), while tree density showed higher variance (3–34 individuals).

Conservation profiling based on the IUCN Red List (**Figure 8**) categorized 118 species (47.8%) as Least Concern (LC). Of these, three are identified as invasive species. A significant portion of the inventory remains unclassified, with 121 species (49.0%) Not Evaluated (NE) and 8 species (3.2%) returning no taxonomic match during the assessment. This high percentage of NE species highlights a baseline requirement for ongoing monitoring during the project lifecycle.

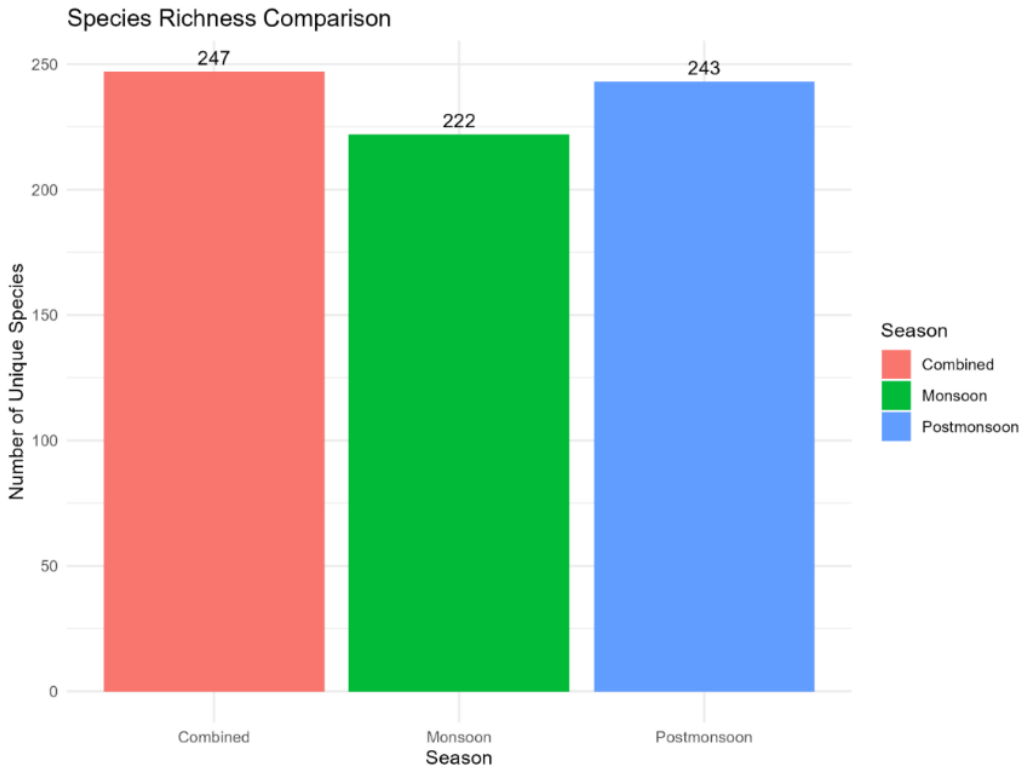


Figure 7. Plant species richness for the two seasons and combined.

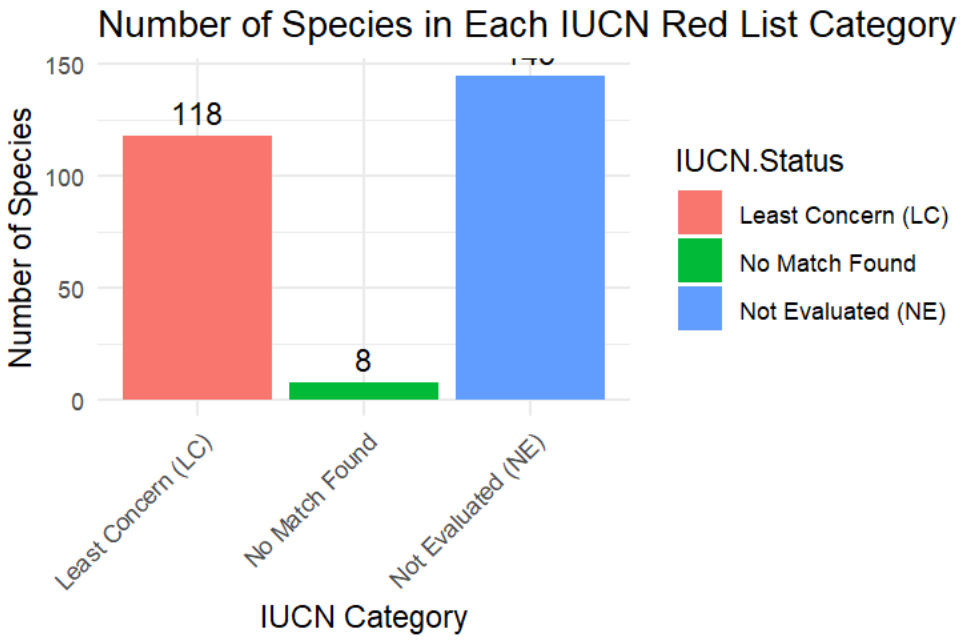


Figure 8. Number of plant species by IUCN category for the two seasons.

Table 9. Plant species diversity across all the sampling plots for two seasons.

Plot	Herb		Shrub		Tree		Richness		Shannon		Evenness	
	Mon	*P-M*	*Mon*	*P-M*	*Mon*	*P-M*	*Mon*	*P-M*	*Mon*	*P-M*	*Mon*	*P-M*
K_F&F_1	1	2	12	12	3	3	16	17	1.7878	1.8548	0.6448	0.6547
K_F&F_2	0	1	13	14	3	3	16	18	1.1168	1.2310	0.4028	0.4259
K_F&F_3	1	2	10	10	1	24	12	36	1.2064	1.2528	0.4855	0.4884
K_F&F_4	2	3	10	10	4	7	16	20	1.2557	1.2961	0.4529	0.4575
K_F&F_5	8	10	11	12	2	24	21	46	1.9948	2.0763	0.6552	0.6533
K_F&F_6	1	1	8	10	9	15	18	26	1.7046	1.7603	0.5898	0.5876
K_F&F_7	1	2	7	8	2	17	10	27	1.3454	1.4549	0.5843	0.5855
K_F&F_8	3	3	14	15	2	34	19	52	2.0347	2.0515	0.6910	0.6738
K_F&F_9	4	4	17	19	4	15	25	38	1.4580	1.5477	0.4530	0.4551
K_F&F_10	0		10	14	5	12	15	26	1.5320	1.6376	0.5657	0.5467
K_F&F_11	4	5	14	17	9	31	27	53	1.8960	1.9857	0.5753	0.5729
K_F&F_12	0	1	13	14	13	27	26	42	1.8990	1.9441	0.5829	0.5774
K_F&F_13	4	7	22	22	4	8	30	37	2.4744	2.4727	0.7275	0.6900
K_F&F_14	1	2	22	22	9	17	32	41	2.1916	2.1916	0.6324	0.6164
K_F&F_15	3	6	13	14	14	21	30	41	2.0366	2.1303	0.5988	0.5945
K_F&F_16	3	5	17	19	13	18	33	43	1.7823	2.1856	0.5098	0.6053
K_F&F_17	4	5	12	12	4	6	20	23	1.2179	1.8754	0.4066	0.6067
K_F&F_18	2	2	23	25	12	16	37	43	3.5229	2.3607	0.9756	0.6276
K_F&F_19	1	2	14	14	8	16	23	32	1.7326	1.7590	0.5526	0.5076

5.1.6 Tree Diversity, Structure, and Conservation Status

The census of tree individuals across the 19 sampling plots remained stable between the monsoon and post-monsoon seasons (**Figure 9**). Median tree abundance showed no significant seasonal deviation, a trend consistent with the perennial nature of woody taxa (Condit et al., 1995). While tree diversity is moderately rich across the corridor, significant inter-site variation was observed; plots K_F&F_11 and K_F&F_8 exhibited the highest species richness, whereas others showed reduced diversity.

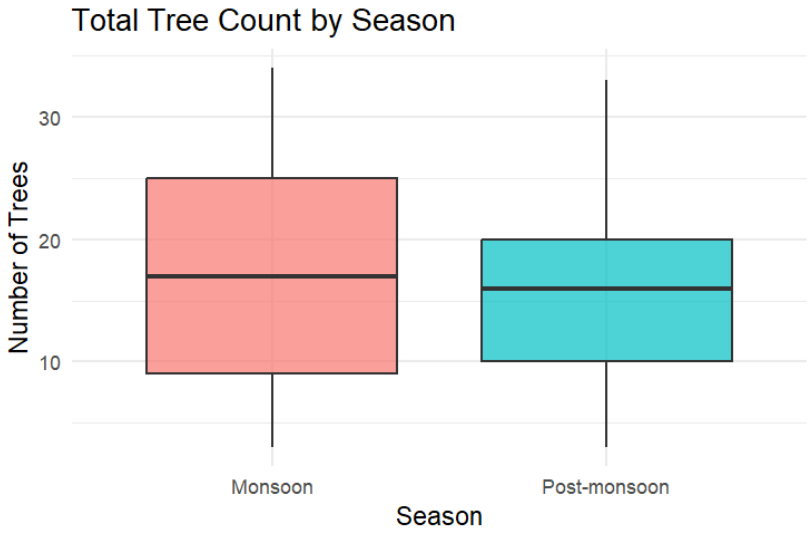


Figure 9. Tree species variation between two seasons.

The community structure is characterized by a transition between pioneer and climax species. *Pinus roxburghii* (Chir Pine) is the dominant taxon across multiple sites, reflecting historical disturbance regimes or specific edaphic conditions. This coniferous component is interspersed with a diverse broadleaf assemblage, primarily from the families Moraceae (*Ficus* spp.), Fagaceae (*Quercus* and *Castanopsis* spp.), and Meliaceae. The co-occurrence of light-demanding pioneers and shade-tolerant canopy species indicates a complex successional dynamic within the forest stands.

Forest structure, quantified through density, Diameter at Breast Height (DBH), and basal area, indicates varied developmental stages. The dataset reveals a broad DBH distribution, ranging from understory individuals (12–14 cm) to emergent specimens such as *Duabanga grandiflora* (67.4 cm) and *Schima wallichii* (75.25 cm).

Basal area—a proxy for biomass and dominance—varied significantly between plots. High basal area values in sites like K_F&F_6 and K_F&F_14 are attributed to the presence

of large-diameter trees, while lower values in other plots suggest younger successional stages or higher levels of anthropogenic disturbance. This structural diversity is a primary driver of habitat complexity, influencing microclimates and niche availability for sympatric fauna.

The majority of identified taxa, including the ecologically significant *Juglans regia*, are categorized as "Least Concern" (LC) by the IUCN Red List. However, several species within the *Litsea*, *Mallotus*, and *Albizia* genera remain "Not Evaluated" (NE). Notably, *Styrax serrulatus* is classified as "Data Deficient" (DD).

5.1.7 Analysis of Ecological Criteria

5.1.7.1 Canopy cover

Canopy density across the surveyed sites varies significantly, reflecting localized disturbance and recovery histories. High-density, multi-layered, and closed canopies characteristic of undisturbed forest systems were recorded at sites K_F&F_1 (Tshergom), K_F&F_6 (Sherichu), K_F&F_9 (Munma), and K_F&F_12 (Tshobaley top) (Korhonen, 2006).

Conversely, open or simplified canopy structures at K_F&F_2 (Jamkhardrang), K_F&F_3 (Lungzor), and K_F&F_5 (Waichur) indicate recent anthropogenic disturbance or persistent environmental stress. Sites such as K_F&F_4 (Rolong) and K_F&F_7 (Lungbaktang) exhibit partially disturbed canopies, representing intermediate successional states.

5.1.7.2 Forest structure

Vertical stratification across the majority of sampling plots, including K_F&F_4 (Rolong), K_F&F_9 (Munma), and K_F&F_14 (Langdarbi), is characterized by complex, multi-layered forest structures. In contrast, K_F&F_2 (Jamkhardrang) exhibits a uniformly simple structure, indicating lower architectural complexity. The high frequency of multi-layered scores across the study area suggests that the foundational ecosystem architecture remains largely intact, maintaining the habitat heterogeneity essential for diverse faunal assemblages.

5.1.7.3 Species composition

Species composition across the project's Area of Influence (AoI) is predominantly natural and closely correlates with the observed forest structure. Plots such as *K_F&F_3*

(Lungzor), *K_F&F_4* (Rolong), and *K_F&F_15* (Digala Top) consist almost exclusively of indigenous taxa (Scheiner, 2012). Conversely, lower scores recorded at *K_F&F_2* (Jamkhardrang) and *K_F&F_16* (Baytsaling) reflect a composite of native and non-native species. These findings, often associated with past enrichment planting or selective human intervention, indicate varying degrees of anthropogenic modification within the baseline landscape.

5.1.7.4 Human disturbance

Human disturbance levels exhibit the greatest variability across sites (Foley et al., 2005). The landscape spans minimally disturbed areas, such as *K_F&F_14* (Langdarbi), to sites with evident disturbances, including *K_F&F_3* (Lungzor) and *K_F&F_5* (Waichur). Several forests, such as *K_F&F_1* (Tshergom) and *K_F&F_10* (Chimung), display signs of historical disturbance but are undergoing regeneration. This gradient indicates pervasive human influence across nearly all areas.

5.1.7.5 Landscape context

A critical and widespread challenge is landscape fragmentation (Benitez-Malvido et al., 2008). Not a single site was located within a large, contiguous forest block. Instead, every rated plot, including K_F&F_1 (Tshergom) and K_F&F_9 (Munma), was found to be adjacent to human-altered areas.

Table 10. Criteria for modified, semi-modified and natural forest.

Criteria	Rating 0: Modified	Rating 1: Semi-Modified	Rating 2: Natural
Canopy Cover	Simplified or uniform canopy, often open (<40%).	Partially disturbed canopy with some logging gaps (40-69%). A mixed canopy with some dense areas and other areas showing signs of past disturbance.	Multi-layered, closed, undisturbed canopy (>70% canopy cover). Dense and vertically complex, with multiple layers of vegetation. Gaps are small and a result of natural events.
Forest Structure	Uniform age and size; single canopy layer; trees are planted in straight rows.	Mixed ages and sizes; some canopy layers but may lack a significant understory or emergent layer.	Multi-layered canopy (emergent, canopy, understory); a wide range of tree ages and sizes. High structural complexity.
Species Composition	Low and sparse due to recent logging, or high and uniform in a managed plantation.	A mix of native and non-native species; some evidence of	High biodiversity; composed almost exclusively of native species with few invasives.

	Gaps are large and typically a result of human activity.	enrichment planting or selective felling.	
Human Disturbance & Intervention	Ongoing or intensive disturbance. There is obvious human intervention such as clear-cutting, extensive logging roads, intensive grazing, and prescribed burning for land clearing.	Past disturbance but some regeneration. Evidence of selective logging or limited management; trails or roads may be present but are not dominant features. Evidence of controlled grazing or managed fires to reduce fuel load.	No recent logging, agriculture, or fragmentation. There is minimal to no human footprint; structure and composition are a result of natural processes like seed dispersal, natural disturbances, and wildfires.
Landscape Context	Fragmented, isolated, or embedded in a human matrix.	Adjacent to human-altered areas.	Located within large contiguous forest blocks.

5.1.8 Bird Diversity

Systematic bird surveys were carried out over two seasons: monsoon in August 2025 and post-monsoon in October 2025. This covered 19 sampling plots (*K_F&F_1 to K_F&F_19*) along the transmission line route. The MacKinnon List method was used (DoFPS, 2020; MacKinnon, 1993) to cut down on observer bias and get a solid count of species richness and abundance.

Across both seasons, 936 records were logged for 187 unique bird species. Monsoon turned up 123 species (10–40 per plot), while post-monsoon had 142 (10–56 per plot). During monsoon, 98.4% were IUCN Least Concern, but two species stood out: Near Threatened *Alexandrine Parakeet* and Vulnerable *Rufous-necked Hornbill* (Acharja et al., 2025; Sherub et al., 2022). Post-monsoon, 131 were Least Concern, including the Near Threatened River Lapwing (*Vanellus duvaucelii*) (BirdLife International, 2025; IUCN, 2025).

Table 11. Diversity Indices by Plot for monsoon and post-monsoon seasons.

Plot_ID	Forest type	No. of migratory bird		Richness (S)		Species/minute		Shannon Index (H')		Simpson Index (λ)		Pielou's Evenness (J')	
		Monsoon	*Post-mons*	*Monsoon*	*Post-mons*	*Monsoon*	*Post-mons*	*Monsoon*	*Post-mons*	*Monsoon*	*Post-mons*	*Monsoon*	*Post-mons*
K_F&F_1	CF	8	7	10	20	0.23	1.35	2.303	2.996	0.9	0.95	1	1
K_F&F_2	CF	1	7	10	21	0.16	1.48	2.303	3.045	0.9	0.952	1	1
K_F&F_3	CF	4	5	18	15	0.17	1.2	2.857	2.708	0.94	0.933	0.988	1
K_F&F_4	CF	2	6	10	12	0.15	1	2.303	2.485	0.9	0.917	1	1
K_F&F_5	CF	1	5	10	20	0.14	0.4	2.303	2.996	0.9	0.95	1	1
K_F&F_6	CF	1	9	10	21	0.16	0.33	2.303	3.045	0.9	0.952	1	1
K_F&F_7	WBF	11	14	39	42	0.15	3.31	3.654	3.738	0.974	0.976	0.997	1
K_F&F_8	CF	1	8	10	28	0.13	1.68	2.303	3.332	0.9	0.964	1	1
K_F&F_9	CF	2	11	10	37	0.14	0.57	2.303	3.611	0.9	0.973	1	1
K_F&F_10	WBF	3	28	20	42	0.27	2.29	2.996	3.738	0.95	0.976	1	1
K_F&F_11	WBF	4	29	20	49	0.24	3.06	2.996	3.892	0.95	0.98	1	1
K_F&F_12	SBF	9	12	40	27	0.19	1.86	3.689	3.283	0.975	0.962	1	0.996
K_F&F_13	SBF	2	10	20	20	0.19	2.35	2.996	2.996	0.95	0.95	1	1
K_F&F_14	WBF	3	10	20	41	0.18	2.61	2.996	3.714	0.95	0.976	1	1
K_F&F_15	WBF	1	12	20	39	0.18	1.13	2.996	3.664	0.95	0.974	1	1
K_F&F_16	WBF	1	13	10	35	0.11	3.83	2.303	3.555	0.9	0.971	1	1
K_F&F_17	WBF	1	10	20	29	0.15	1.04	2.996	3.367	0.95	0.966	1	1
K_F&F_18	WBF	8	9	20	21	0.17	0.62	2.996	3.045	0.95	0.952	1	1
K_F&F_19	WBF	9	23	40	56	0.4	1.18	3.689	4.025	0.975	0.982	1	1

5.1.9 Herpetofauna Diversity

A seasonal herpetofaunal survey covered 19 sampling plots for the proposed transmission line project's environmental impact assessment (**Table 12**). Surveys spanned monsoon and post-monsoon seasons, employing direct observation and local community reports to document amphibians and reptiles.

Monsoon surveys recorded 16 species across 10 plots: 10 snakes, 4 amphibians, and 2 lizards/skinks. Post-monsoon surveys documented four taxa across three plots: Asian Common Toad, Oriental Garden Lizard, Blue Bronzback Snake, and an unidentified Gonyosoma snake.

The majority of species, including Monocled Cobra and Indian Bull Frog, are classified as IUCN Least Concern (IUCN, 2025), indicating no major global threats. Two species have elevated IUCN status: King Cobra (*Ophiophagus hannah*), listed as Vulnerable due to habitat loss and persecution and protected under Schedule I of Bhutan's Forests and Nature Conservation Act (2023) (Royal Government of Bhutan, 2023; IUCN, 2025); and Red-necked Keelback (*Rhabdophis subminiatus*), classified as Near Threatened primarily from habitat destruction (IUCN, 2025).

Table 12. Herpetofauna diversity across sampling plots from two seasons.

Plot ID	Common name	Scientific name	Evidence	IUCN Status	Season
K_F&F_4	Monocled Cobra	*Naja kaouthia*	Observed	Least Concern	Monsoon
K_F&F_5	Eastern Trinket	*Orthriophis cantoris*	As per Locals	Least Concern	Monsoon
K_F&F_5	Green Rat Snake	*Ptyas nigromarginata*	As per Locals	Least Concern	Monsoon
K_F&F_7	Copper-headed snake	*Coelognathus radiatus*	Obsersed	Least Concern	Monsoon
K_F&F_7	Eastern Trinket	*Orthriophis cantoris*	Observed	Least Concern	Monsoon
K_F&F_7	Collared Black-headed Snake	*Sibynophis collaris*	Observed	Least Concern	Monsoon
K_F&F_8	Green Rat Snake	*Ptyas nigromarginata*	As per locals	Least Concern	Monsoon
K_F&F_8	Eastern Trinket	*Orthriophis cantoris*	As per Locals	Least Concern	Monsoon
K_F&F_8	Black Banded Trinket	*Oreocryptophis porphyraceus*	Observed	Least Concern	Monsoon
K_F&F_8	Red-necked Keelback	*Rhabdophis subminiatus*	Observed	Near Threatened	Monsoon

K_F&F_10	White-barred Kukri	*Naja kaouthia*	Observed	Least Concern	Monsoon
K_F&F_10	Oriental Garden Lizard	*Calotes versicolor*	Observed	Least Concern	Monsoon
K_F&F_10	Green Rat Snake	*Ptyas nigromarginata*	As per local	Least Concern	Monsoon
K_F&F_10		*Pterorana spp*	Observed	Least Concern	Monsoon
K_F&F_12	Monocled Cobra	*Naja kaouthia*	as per local	Least Concern	Monsoon
K_F&F_12	King Cobra	*Ophiphagus hannah*	as per local	Vulnerable	Monsoon
K_F&F_12	Indian Bull Frog	*Hoplobatrachus tigerinus*	Observed	Least Concern	Monsoon
K_F&F_12	Indian Skittering Frog	*Euphlyctis cyanophlyctis*	Observed	Least Concern	Monsoon
K_F&F_12	Asian Common Toad	*Duttaphrynus melanostictus*	Observed	Least Concern	Post-monsoon
K_F&F_12		Gyonosoma sp	Observed		Post-monsoon
K_F&F_13	Oriental Garden Lizard	Carlotes versicolor	Observed	Least Concern	Post-monsoon
K_F&F_14	Banded Trinket	*Oreocryptophis porphyraceus*	Observed	Least Concern	Monsoon
K_F&F_18	Asian Common Toad	*Duttaphrynus melanostictus*	Observed	Least Concern	Monsoon
K_F&F_18	Horn frog	*Megaphrys spp*	Observed	Least Concern	Monsoon
K_F&F_18	Spotted Litter skink	*Sphenomorphus maculatus*	Observed	Least Concern	Monsoon
K_F&F_19	Asian Common Toad	*Duttaphrynus melanostictus*	Observed	Least Concern	Monsoon
K_F&F_19	Blue Bronzback Snake	Dendrelaphis cyanochloris	Observed	Least Concern	Post-monsoon

5.1.11 Mammal Diversity

Mammal records during monsoon season derived primarily from direct sightings and local reports, with limited camera trap detections. Large and medium-sized mammals—Wild Boar (Sus scrofa), Barking Deer (Muntiacus vaginalis), Assamese Macaque (Macaca assamensis), and Sambar Deer (Rusa unicolor)—showed high direct sighting frequencies, indicating sustained activity despite adverse weather. Elusive species such as otters, civets, and smaller carnivores had lower detections, attributable to dense vegetation, limited access, and reduced movement during heavy rain—factors that reduce detection probability in tropical forests (Royle et al., 2009). Indirect signs (tracks, scats) confirmed

Sambar Deer presence when direct observations were limited, consistent with occupancy studies where such evidence offsets low detection rates (MacKenzie, 2017).

Post-monsoon season showed marked increases in observations across species and methods (**Figure 10**). Camera trap records rose substantially for elusive and nocturnal species including Yellow-throated Marten (Martes flavigula), Hoary-bellied Himalayan Squirrel (Callosciurus pygerythrus), and larger ungulates. Improved ground conditions, clearer trails, and increased post-monsoon animal movement enhanced detection efficiency, as documented in dry-season camera trap studies (Wearn et al., 2017). Direct sightings also increased, particularly for Wild Boar, Barking Deer, Assamese Macaque, and Sambar Deer, reflecting higher activity and better visibility (Hofmeester et al., 2019).

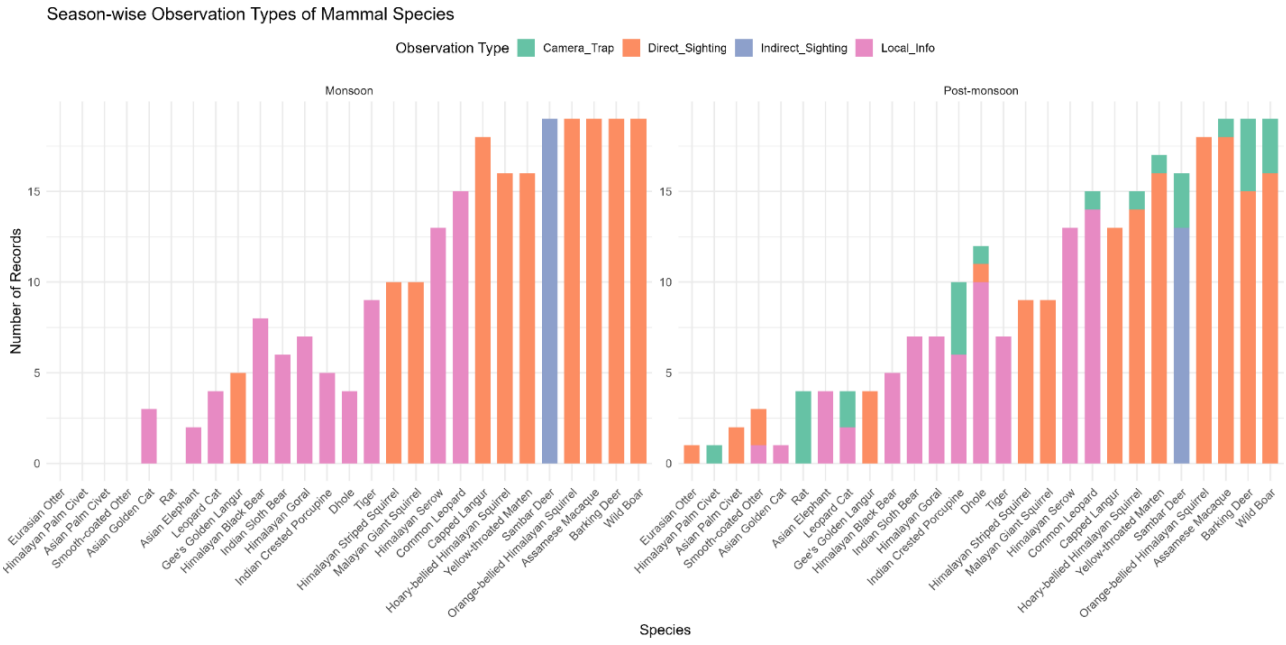


Figure 10. Evidence types for mammal species for two seasons

The study area supports significant threatened mammal diversity. Four Endangered species were recorded, facing very high extinction risk: Asian Elephant (*Elephas maximus*), Tiger (*Panthera tigris*), Dhole (*Cuon alpinus*), and Gee's Golden Langur (*Trachypithecus geei*). Nine Vulnerable species comprised a substantial proportion of records, including Common Leopard (Panthera pardus), Sambar Deer (*Rusa unicolor*), Himalayan Serow (*Capricornis sumatraensis*), Indian Sloth Bear (*Melursus ursinus*), and Smooth-coated Otter (*Lutrogale perspicillata*). Five Near Threatened species were documented: Asian Golden Cat (*Catopuma temminckii*), Assamese Macaque (*Macaca assamensis*), Eurasian Otter (*Lutra lutra*), and Malayan Giant Squirrel (*Ratufa bicolor*).

Eleven species fell under Least Concern, including Barking Deer (*Muntiacus vaginalis*), Himalayan Palm Civet (*Paguma larvata*), various squirrels, Wild Boar (*Sus scrofa*), and Leopard Cat (*Prionailurus bengalensis*) (IUCN, 2025).

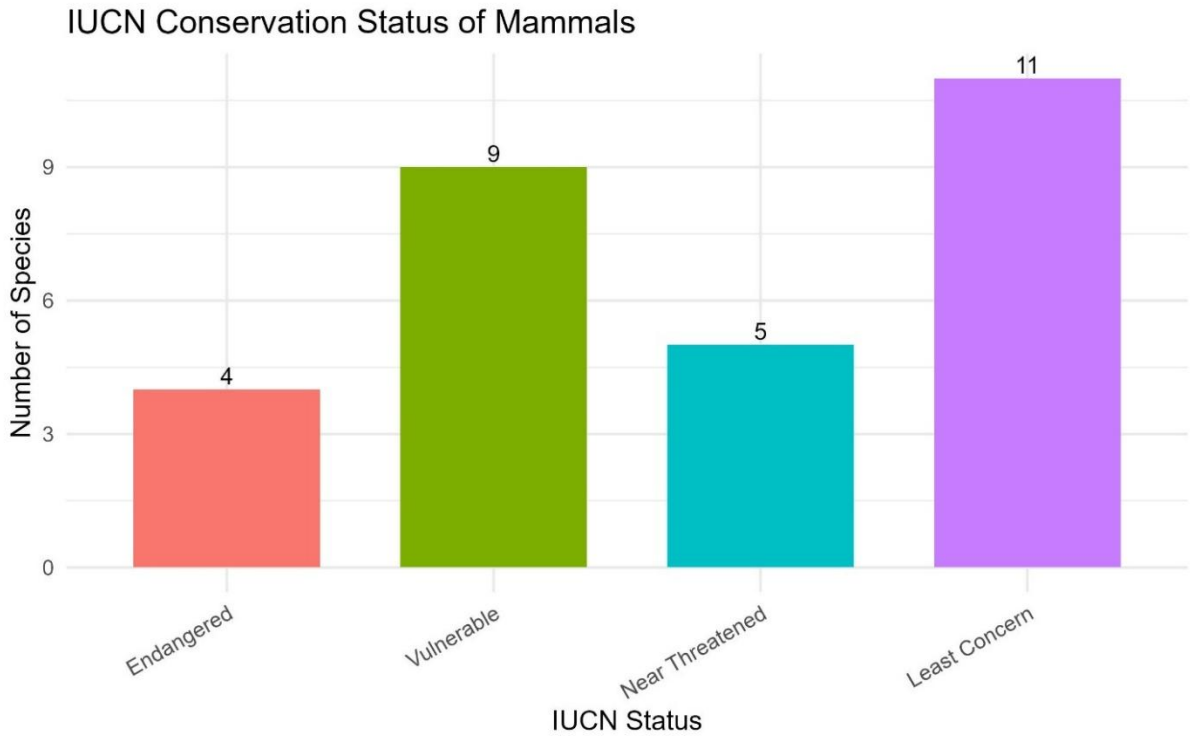


Figure 11. Number of mammal species by IUCN category.

5.1.13 Microbiological Water Quality

Comparative analysis of microbiological water quality between monsoon and post-monsoon seasons reveals a distinct seasonal pattern of fecal contamination along the transmission corridor (**Table 13**). Post-monsoon sampling detected Escherichia coli (E. coli) at all sites, with concentrations ranging from 6 CFU/100 mL at Manas (KW_6) to 101 CFU/100 mL at Jamkhardrang (KW_3). These levels exceed the 0 CFU/100 mL drinking water limit established by the National Environment Commission (NEC, 2016) and World Health Organization (WHO, 2017), confirming widespread fecal pollution across sampled water bodies.

Monsoon sampling showed variable contamination: no detectable E. coli at KW_3, with moderate levels of 10, 7, and 5 CFU/100 mL at KW_1, KW_5, and KW_6, respectively. The substantially higher post-monsoon concentrations correspond to established hydrological processes.

Table 13. Thermotolerant coliform (E. coli) levels in water samples along the water sampling sites.

Sites	Sample (mL)	Monsoon (CFU/100 mL)	Post-Monsoon (CFU/100 mL)
KW_1 *(Drangmechu Downstream)*	100	10	15
KW_2 *(Tshergom Tributary)*	100	01	10
KW_3 *(Jamkhardrang Upstream)*	100	00	101
KW_4 *(Rolong Tributary)*	100	02	30
KW_5 *(Sherichu Downstream)*	100	07	27
KW_6 *(Manas Upstream)*	100	05	06
KW_7 *(Mangdechu Upstream)*	100	01	06

5.1.15 Physio-Chemical Characteristics of Water

5.1.15.1 Physical parameters

a. Temperature

Post-monsoon season recorded mean water temperature of 18.68 ± 2.42 °C across monitored sites, with a spatial gradient from 15.3 °C at KW_1 to 23.1 °C at KW_4 (Table 13). Monsoon season measurements showed warmer conditions, averaging 22.93 ± 2.63 °C (**Table 14**).

b. Electrical Conductivity (EC) and Total Dissolved Solids (TDS)

Electrical Conductivity (EC) and Total Dissolved Solids (TDS) analysis between monsoon and post-monsoon seasons indicates stable baseline water quality with minimal anthropogenic ionic pollution across the study area. Post-monsoon measurements recorded mean EC of 71.18 ± 34.83 µS/cm and TDS of 35.88 ± 17.56 mg/L across transmission line sites (**Table 14**). Monsoon season values in the East-West transmission basin showed slightly higher means of 90.51 ± 47.40 µS/cm for EC and 41.61 ± 23.89 mg/L for TDS (**Table 14**). The modest seasonal increase during monsoon aligns with expected hydrological processes.

c. pH

pH measurements from monsoon and post-monsoon seasons confirm stable water quality across the transmission line corridor, with no evidence of acidification or alkaline

pollution. Post-monsoon values ranged from 6.87 to 7.99 (mean 7.11 ± 0.3), while monsoon measurements spanned 6.70 to 7.51 (mean 6.99 ± 0.30) (**Table 14**). This minor variation reflects natural seasonal differences in runoff, organic matter decomposition, and photosynthetic activity.

All readings from both seasons fell within the National Environment Commission Class A standard (6.5–8.5) (NEC, 2020) and the optimal physiological range (6.5–8.2) for aquatic communities (Vaishali & Punita, 2013).

d. Turbidity and Total Suspended Solids (TSS)

Turbidity and Total Suspended Solids (TSS) measurements between monsoon and post-monsoon seasons reveal persistently elevated sediment levels across the transmission corridor, with marked seasonal and spatial variability driven by hydrological processes and localized disturbance (**Table 14**). Monsoon season recorded mean turbidity of 106.21 ± 127.15 NTU (maximum 368.0 NTU) and mean TSS of 235.0 ± 167.0 mg/L. Post-monsoon values remained elevated at 45.88 ± 81.69 NTU for turbidity and 228.33 ± 254.52 mg/L for TSS. This pattern of peak monsoon sediment loading reflects surface runoff mobilization from erosional slopes and unstable terrain in dynamic river systems (Aniyikaiye et al., 2019; Dendup et al., 2022).

Table 14. Physico-chemical parameters of water samples collected during monsoon (wet) and post-monsoon seasons along the EWTLP.

Monsoon (wet) Season (early August 2025)								
ID	**pH**	**EC**	**TDS**	**Turbidity**	**Temp.**	**TSS**	**DO**	**COD**
		µS/cm	*mg/L*	*NTU*	*□C*	*mg/L*	*mg/L*	*mg/L*
KW_1	6.70	130.37	65.70	241.33	18.90	300.00	9.03	9.97
KW_2	6.79	129.83	65.40	198.33	19.10	660.00	8.78	3.10
KW_3	7.08	66.70	33.60	1.75	26.70	210.00	7.49	1.03
KW_4	6.77	104.07	52.40	0.53	26.40	290.00	7.36	4.57
KW_5	6.89	106.27	53.60	1.39	25.50	290.00	7.23	2.60
KW_6	6.76	51.67	26.00	5.31	25.50	180.00	7.57	2.70
KW_7	6.75	29.37	14.80	43.83	22.00	90.00	8.14	11.00
KW_8	6.81	27.10	13.70	35.23	22.90	120.00	7.99	17.90
KW_9	7.48	153.43	77.30	368.00	22.70	210.00	7.89	2.60
KW_10	7.51	165.23	83.30	265.67	21.80	350.00	7.84	2.83
KW_11	7.28	57.20	28.80	60.16	22.60	20.00	7.55	1.57
KW_12	7.20	64.83	32.70	52.99	21.10	100.00	7.61	2.30
Avg	**6.99**	**90.51**	**45.61**	**106.21**	**22.93**	**235.00**	**7.87**	**5.18**
STDEVA	**0.30**	**47.40**	**23.89**	**127.15**	**2.63**	**167.09**	**0.55**	**5.11**
Max	**7.51**	**165.23**	**83.30**	**368.00**	**26.70**	**660.00**	**9.03**	**17.90**
Min	**6.70**	**27.10**	**13.70**	**0.53**	**18.90**	**20.00**	**7.23**	**1.03**

Post-monsoon (early October 2025)								
ID	**pH**	**EC** *(µS/cm)*	**TDS** *mg/L*	**Turbidity** *(NTU)*	**Temp.** *(□C)*	**TSS** *(mg/L)*	**DO** *(mg/L)*	**COD** *(mg/L)*
KW_1	7.10	137.6	69.37	20.85	15.3	160	9.00	1.57
KW_2	7.16	127.1	64.06	23.49	16.3	150	8.96	0.50
KW_3	6.98	44.0	22.15	0.85	20.5	190	8.04	7.00
KW_4	6.94	54.3	27.35	0.75	23.1	90	7.52	2.60
KW_5	7.06	59.1	29.80	0.72	22.6	50	7.61	2.90

KW_6	6.92	39.0	19.64	1.78	19.0	100	8.54	2.30
KW_7	6.87	36.6	18.45	1.99	18.7	60	8.87	2.40
KW_8	6.90	36.0	18.15	1.26	17.0	400	8.84	2.53
KW_9	7.23	94.1	47.44	242.33	16.9	750	9.39	8.60
KW_10	7.12	95.2	48.00	192.00	17.5	710	9.43	8.80
KW_11	7.01	64.7	32.61	31.80	17.8	40	9.04	3.50
KW_12	7.99	66.5	33.5	32.77	19.5	40	8.90	4.50
Avg	**7.11**	**71.18**	**35.88**	**45.88**	**18.68**	**228.33**	**8.68**	**3.93**
STDEVA	**0.30**	**34.83**	**17.56**	**81.69**	**2.42**	**254.52**	**0.63**	**2.74**
Max	**7.99**	**137.60**	**69.37**	**242.33**	**23.10**	**750.00**	**9.43**	**8.80**
Min	**6.87**	**36.00**	**18.15**	**0.72**	**15.3**	**40.00**	**7.52**	**0.50**

5.1.15.2 Chemical parameters of water

a. Dissolved Oxygen (DO) and Chemical Oxygen Demand (COD)

Dissolved Oxygen (DO) and Chemical Oxygen Demand (COD) measurements between post-monsoon and monsoon seasons confirm well-oxygenated riverine systems along the transmission corridor, with low organic pollution levels (**Table 15**). Post-monsoon DO range from 7.52 to 9.43 mg/L; monsoon values spanned 7.23 to 9.03 mg/L. All readings exceeded the National Environment Commission Class A minimum of 6 mg/L (NEC, 2020), indicating pristine conditions supportive of aquatic life.

COD showed modest seasonal variation within low pollution ranges: post-monsoon 0.50–8.80 mg/L (mean 3.93 ± 2.74 mg/L); monsoon 1.03–17.90 mg/L (mean 5.18 ± 5.11 mg/L). The slight monsoon increase reflects runoff mobilization of organic matter from forested catchments (Kotti et al., 2005; Kumar et al., 2010; Li & Liu, 2019).

b. Hardness (Calcium and Magnesium)

Total hardness showed remarkable stability across seasons. Post-monsoon measurements averaged 3.844 ± 0.504 mg/L, with calcium concentrations of 0.07–0.4 mg/L and magnesium of 0.37–0.93 mg/L (**Table 15**). Monsoon season recorded average hardness of 3.33 ± 0.70 mg/L, with calcium ranging from 0–0.52 mg/L and magnesium from 0.57–1 mg/L (Table 14). The minor seasonal difference falls within measurement variability, indicating no significant hydrological or geochemical shifts.

All values remained well below the National Environment Commission Class A guideline of 200 mg/L (NEC, 2020) and WHO hardness thresholds (WHO, 2017), confirming no risk of infrastructure scaling or reduced soap efficacy (Kumar et al., 2010). Persistently low Ca^{2+} and Mg^{2+} concentrations reflect limited geochemical weathering in the catchment.

c. Sodium and Potassium

Sodium (Na^{+}) and potassium (K^{+}) concentrations between monsoon and post-monsoon seasons indicate consistently low cation levels across the transmission corridor, with defined seasonal patterns and localized anthropogenic signals (**Table 15**). Sodium showed a clear seasonal trend, with monsoon means of 4.62 ± 2.82 mg/L exceeding post-monsoon values of 2.871 ± 1.21 mg/L, consistent with enhanced wet-season runoff. All readings from both seasons remained

well below the WHO taste threshold of 200 mg/L and national standards (WHO, 2017; NEC, 2020), confirming no risk to human health or aquatic life from sodium toxicity.

d. Ammonia

Ammonia nitrogen (NH_4^+) concentrations between monsoon and post-monsoon seasons show consistently low, stable background levels across the transmission corridor (**Table 15**). Mean values were nearly identical at 0.03 ± 0.02 mg/L (monsoon) and 0.031 ± 0.036 mg/L (post-monsoon), indicating excellent water quality and a naturally low-nutrient environment.

e. Nitrate and Phosphate

Nitrate (NO_3^-) and phosphate (PO_4^-) concentrations between monsoon and post-monsoon seasons confirm consistently low nutrient levels across the transmission corridor, characteristic of oligotrophic conditions with minimal eutrophication risk (**Table 15**). Nitrate showed seasonal stability at 0.45 ± 0.09 mg/L (monsoon) and 0.821 ± 0.108 mg/L (post-monsoon). Phosphate exhibited a slight inverse pattern: 0.26 ± 0.20 mg/L (monsoon) and 0.164 ± 0.145 mg/L (post-monsoon). All values remained well below National Environment Commission Class A standards of 10 mg/L (nitrate) and 0.5 mg/L (phosphate) (NEC, 2020).

f. Chloride and Sulfate

Chloride (Cl^-) and sulfate (SO_4^{2-}) concentrations between monsoon and post-monsoon seasons demonstrate stable, low ionic levels across the transmission corridor, with variations consistent with natural hydrological and geochemical processes (**Table 15**). Chloride showed a slight monsoon increase to 1.17 ± 0.48 mg/L from 0.558 ± 0.308 mg/L post-monsoon. Sulfate remained stable at 14.78 ± 13.88 mg/L (monsoon) and 11.727 ± 13.573 mg/L (post-monsoon). All values fell well below National Environment Commission Class A standards of 50 mg/L (chloride) and 25 mg/L (sulfate) (NEC, 2020).

g. Fluoride

Fluoride concentrations showed minimal seasonal fluctuation at 0.40 ± 0.19 mg/L (monsoon) and 0.309 ± 0.127 mg/L (post-monsoon) (**Table 15**). The slight monsoon increase reflects runoff mobilization of trace ions from soils and weathered rock, but remains ecologically insignificant. All values fell well below the National Environment Commission Class A standard of 1.0 mg/L (NEC, 2020) and WHO drinking water guideline of 1.5 mg/L (WHO, 2017).

h. Iron

Iron concentrations showed remarkable seasonal stability at 0.06 ± 0.05 mg/L (monsoon) and 0.064 ± 0.04 mg/L (post-monsoon), with individual measurements ranging from 0.02 to 0.17 mg/L (**Table 15**). All values remained well below the National Environment Commission Class A guideline of 0.2 mg/L (NEC, 2020) and typical natural background ranges (0.5–50 mg/L) (WHO, 2017).

i. Manganese

Manganese concentrations showed a distinct seasonal pattern, with monsoon means of 0.015 ± 0.018 mg/L exceeding post-monsoon levels of 0.002 ± 0.002 mg/L (**Table 15**). This increase reflects enhanced runoff mobilization of trace metals from soils and weathered rock. All measurements from both seasons remained well below the National Environment Commission Class A guideline of 0.4 mg/L (NEC, 2020), indicating no risk to aquatic ecosystems or drinking water use.

Table 15. Chemical parameters (mg/L) of water samples collected during the monsoon (wet) and post-monsoon.

Monsoon (wet) season (early August 2025)													
ID	**Cl^-**	**NO_3^-**	**PO_4^{3-}**	**SO_4^{2-}**	**F^-**	**Na^+**	**Fe^{2+}**	**NH_3-N**	**K^+**	**Ca^{2+}**	**Mg^{2+}**	**Mn**	**TH**
KW_1	0.90	0.40	0.17	32.00	0.13	5.24	0.13	0.07	0.60	0.06	0.68	0.022	2.953
KW_2	0.60	0.50	0.60	31.00	0.25	3.96	0.07	0.02	0.80	0.00	0.57	0.013	2.333
KW_3	1.40	0.40	0.56	9.00	0.40	8.04	0.05	0.05	1.60	0.36	1.00	0.003	5.013
KW_4	1.70	0.60	0.17	27.00	0.89	8.03	0.09	0.03	3.60	0.11	0.76	0.007	3.423
KW_5	1.70	0.60	0.17	26.00	0.38	8.04	0.05	0.01	3.90	0.04	0.68	0.001	2.863
KW_6	1.00	0.40	0.15	2.00	0.52	8.09	0.17	0.01	1.30	0.04	0.80	0.007	3.417
KW_7	2.00	0.40	0.040	0.00	0.33	1.72	0.03	0.03	0.80	0.40	0.67	0.004	3.763
KW_8	0.80	0.40	0.45	0.00	0.52	1.63	0.03	0.02	0.70	0.52	0.68	0.006	4.090
KW_9	1.00	0.30	0.07	25.00	0.45	3.20	0.02	0.01	0.50	0.01	0.75	0.046	3.050
KW_10	0.90	0.40	0.32	25.33	0.36	4.91	0.02	0.00	0.50	0.01	0.68	0.058	2.763
KW_11	0.53	0.50	0.03	0.00	0.27	1.02	0.02	0.05	0.40	0.04	0.82	0.009	3.267
KW_12	0.50	0.40	0.06	0.00	0.28	1.53	0.02	0.01	0.60	0.04	0.77	0.006	3.073
Avg	**1.17**	**0.45**	**0.26**	**14.78**	**0.40**	**4.62**	**0.06**	**0.03**	**1.28**	**0.17**	**0.74**	**0.015**	**3.334**
STDEVA	**0.48**	**0.09**	**0.20**	**13.88**	**0.19**	**2.86**	**0.05**	**0.02**	**1.21**	**0.19**	**0.11**	**0.018**	**0.704**
Max	**2.00**	**0.60**	**0.60**	**32.00**	**0.89**	**8.09**	**0.17**	**0.07**	**3.90**	**0.52**	**1.00**	**0.058**	**5.013**
Min	**0.50**	**0.30**	**0.03**	**0.00**	**0.13**	**1.02**	**0.02**	**0.00**	**0.40**	**0.00**	**0.57**	**0.001**	**2.330**
Post-monsoon (early October 2025)													
ID	**Cl^-**	**NO_3^-**	**PO_4^{3-}**	**SO_4^{2-}**	**F^-**	**Na^+**	**Fe^{2+}**	**NH_3-N**	**K^+**	**Ca^{2+}**	**Mg^{2+}**	**Mn**	**TH**
KW_1	0.87	0.90	0.07	45.0	0.35	2.21	0.03	0.010	1.30	0.25	0.56	0.001	2.93
KW_2	0.47	0.80	0.04	44.0	0.14	2.34	0.04	0.010	1.90	0.19	0.50	0.001	2.54
KW_3	0.50	0.60	0.34	5.0	0.57	2.39	0.04	0.020	2.60	0.24	0.88	0.004	4.21
KW_4	0.80	0.80	0.12	9.0	0.29	4.85	0.12	0.023	2.10	0.32	0.93	0.003	4.62
KW_5	0.50	0.80	0.14	11.0	0.43	4.71	0.11	0.020	1.40	0.23	0.77	0.001	3.75

KW_6	0.60	0.9	0.20	2.0	0.43	3.98	0.13	0.040	1.50	0.13	0.85	0.002	3.83
KW_7	0.90	0.80	0.29	4.0	0.35	1.13	0.03	0.000	1.60	0.40	0.69	0.003	3.82
KW_8	0.40	0.93	0.07	4.0	0.25	1.34	0.02	0.010	1.50	0.15	0.84	0.004	3.83
KW_9	0.27	0.67	0.04	25.0	0.16	2.73	0.07	0.010	1.20	0.07	0.86	0.000	3.70
KW_10	1.20	0.90	0.05	23.0	0.22	2.46	0.07	0.010	1.30	0.12	0.89	0.001	3.97
KW_11	0.10	0.93	0.04	1.0	0.27	2.71	0.04	0.090	1.13	0.11	0.92	0.005	4.04
KW_12	0.40	0.90	0.47	1.0	0.28	2.94	0.03	0.110	1.17	0.09	0.91	0.002	3.97
Avg.	**0.558**	**0.821**	**0.164**	**11.727**	**0.309**	**2.871**	**0.064**	**0.031**	**1.58**	**0.186**	**0.82**	**0.002**	**3.844**
STDEV	**0.308**	**0.108**	**0.145**	**13.573**	**0.127**	**1.21**	**0.04**	**0.036**	**0.45**	**0.103**	**0.128**	**0.002**	**0.504**
Max	**1.2**	**0.93**	**0.47**	**44**	**0.57**	**4.85**	**0.13**	**0.11**	**2.60**	**0.4**	**0.93**	**0.005**	**4.62**
Min	**0.1**	**0.6**	**0.04**	**1**	**0.14**	**1.13**	**0.02**	**0**	**1.130**	**0.07**	**0.50**	**0**	**2.54**

Note: Avg.- Average; STDEVA- Standard deviation; Max- Maximum; Min- Minimum

5.1.16 Air Quality and Noise Level

5.1.16.1 Air pollution

a. Particulate Matter (PM $_{2.5}$)

Across both seasons, all monitored sites recorded 24-hour average $PM_{2.5}$ concentrations well below the Bhutan National Environment Commission 24-hour standard of 60 µg/m^3 (NEC, 2020), confirming good air quality relative to national regulations.

Table 16. Concentrations of PM2.5 during the monsoon and post-monsoon seasons.

Sampling sites	Monsoon (August 2025) ($PM_{2.5}$ (µg/m^3))	Post-monsoon (October 2025) ($PM_{2.5}$ (µg/m^3))
Dremetse (Waichur)	1.85±0.93-7.82±1.06	5.17±0.54-10.71±5.09
Chaskar (Yetnas)	2.94±0.26-5.94±3.72	3.67±0.50-5.98±0.91
Chaskar (Thangrong)	2.32±0.87-9.56±2.37	4.54±0.0.72-33.3±14.9
Khengkhar (Murung)	4.65±0.73-22.6±6.04	9.28±1.26-14.4±5.11
Yangbari	8.89±1.45-14.9±1.55	3.11±0.51-5.52±0.93
Digala	1.84±0.56-19.5±5.72	14.9±2.14-20.3±3.37
Goleng	3.95±0.70-14.0±1.27	15.4±1.60-23.9±8.48

Note: Values represent 24-hour mean concentrations ± standard deviation

5.1.16.2 Noise Measurement

a. Daytime noise levels

Noise levels across the four monitored sites ranged from 32.82 to 40.68 dB (monsoon) and 33.98 to 37.36 dB (post-monsoon) (**Table 17**). The most notable seasonal decrease occurred at Goleng (40.67 dB to 36.05 dB). Overall levels remained consistently low, with a maximum of 40.68 dB, reflecting the rural acoustic environment.

Table 17. Ambient daytime noise levels during the monsoon and post-monsoon seasons.

Sampling sites	Monsoon (August 2025) Noise Level (dB)	Post-monsoon (October 2025) Noise Level (dB)
Dremetse (Waichur)	32.82	35.04
Chaskar (Etnas)	33.18	33.98
Chaskar (Thangrong)	34.36	35.35
Khengkhar (Murung)	33.99	34.73
Yangbari	35.21	37.36
Digala	40.68	36.75
Goleng	40.67	36.05

Note: Measurements represent daytime conditions (08:00-18:00)

5.2 Socio-Economic Assessment

The baseline data collection was designed considering that no secondary socioeconomic baseline information was available on the households falling within the AOI of the project (1000-m buffer). Several methods were used to collect socioeconomic baseline data to inform the Social Impact Assessment:

(i) A household survey to 284 beneficiary households (25-30% of households from each gewog falling within the AOI of the project) was conducted in the month of July and August.

(ii) A household survey of 61 directly affected people was undertaken in the month of July and August.

(iii) An inventory of community infrastructure (schools, clinics and more) was carried out during the household surveys.

5.2.1 General Information

Table below presents a breakdown by Dzongkhag and Gewog of the number of households surveyed (directly and indirectly affected households).

Table 18. No. of indirectly affected households surveyed.

Row Labels	Count of HHs Surveyed	Percentage of Surveyed HHs
Mongar	94	33.10%
Chaskhar	7	7.45%
Gungdhari	1	14.29%
Yaytong	2	28.57%
Yetong_Jarshingpogto	4	57.14%
Drametse	7	7.45%
Baging	2	28.57%
Bikhar Thungdhari	3	42.86%
Waichur	2	28.57%
Dremetse	5	5.32%
Bikhar_Thoongdari	5	100.00%
Gongdue	24	25.53%
Baagla	14	58.33%
Pikari yangbari	10	41.67%
Kengkhar	22	23.40%
Dangri	1	4.55%
Doktay-Murung	7	31.82%
Murung	5	22.73%
Phoksuthung Shinchongri	6	27.27%
Shingchoring_Phosorong	3	13.64%

Narang	7	7.45%
Ba-Ging_Shadang	1	14.29%
Dongshoom_Pangkhang	2	28.57%
Gashari	1	14.29%
Pangkang	3	42.86%
Thangrong	22	23.40%
Bowchoeling Panglem	2	9.09%
Lingkhar	7	31.82%
Ngarpangthang	6	27.27%
Ngarpontang	6	27.27%
Waklaktang	1	4.55%
Pemagatshel	39	13.73%
Chhimung	4	10.26%
Chhimung	4	100.00%
Dechhenling	7	17.95%
Doongchhilo Kholomri	7	100.00%
Dungmin	28	71.79%
Bangyuel	15	53.57%
Doongchhilo Kholomri	5	17.86%
Duenmang	2	7.14%
Dungmaed	1	3.57%
Serduwa	4	14.29%
Surdawa	1	3.57%
Trashigang	5	1.76%
Yangnyer	5	100.00%
Kharza_Leyphu	2	40.00%
Lephu	3	60.00%
Trashiyangtse	10	3.52%
Jamkhar	10	100.00%
Jamkhar	1	10.00%
Kharza_Lephu	3	30.00%
Rijoong_Yoob	6	60.00%
zhemgang	136	47.89%
Bardo	56	41.18%
Dhigala	25	44.64%
Langdhorbi	31	55.36%
Bjoka	14	10.29%
Dhali	7	50.00%
Kamati	7	50.00%
Gongdue	4	2.94%
Pikari yangbari	4	100.00%
Nangkor	53	38.97%
Duenmang	27	50.94%
Goleng	1	1.89%
Nyakhar	25	47.17%
Trong	9	6.62%

Tsanglajong_Zurphel	9	100.00%
(blank)		0.00%
(blank)		
(blank)		
Grand Total	284	100.00%

Table 19. No. of directly affected households surveyed.

Row Labels	Count of HH_ID	Count of HH_ID2
Mongar	27	44.26%
Chaskhar	2	7.41%
Doongsingma_Pam	1	50.00%
(blank)	1	50.00%
Dremetse	4	14.81%
Bikhar_Thoongdari	2	50.00%
Dargyeling_Kharthoong	2	50.00%
Gongdue	4	14.81%
Pikari yangbari	4	100.00%
Khengkhar	10	37.04%
Dangri	1	10.00%
Dogtang_mooroong	2	20.00%
Murung	1	10.00%
Phosothong_Shingchongri	6	60.00%
Narang	1	3.70%
Dongshoom_Pangkhang	1	100.00%
Thangrong	6	22.22%
Ba-Ging_Shadang	2	33.33%
Lingkhar	3	50.00%
Olokid_Tsalabi	1	16.67%
Pema Gatshel	2	3.28%
Chhimoong	2	100.00%
Chhimoong	2	100.00%
Pemagatshel	7	11.48%
Dungmin	7	100.00%
Bangyul	4	57.14%
Pikari yangbari	2	28.57%
Surduwa	1	14.29%
Trashi Yangtse	8	13.11%
Jamkhar	5	62.50%
Rijoong_Yoob	5	100.00%
Yangnyer	3	37.50%
Dargyeling_Kharthoong	3	100.00%
Trashigang	2	3.28%
Yangnyer	2	100.00%
Dargyeling_Kharthoong	2	100.00%
Zhemgang	15	24.59%

Bardo	3	20.00%
Dhigala	1	33.33%
Langdhorbi	2	66.67%
Bjoka	2	13.33%
Dhali	2	100.00%
Nangkor	5	33.33%
Duenmang	1	20.00%
Nyakhar	4	80.00%
Trong	5	33.33%
Duenmang	2	40.00%
Langdorbi	2	40.00%
Tsanglajong_Zurphel	1	20.00%
(blank)		0.00%
(blank)		
(blank)		
Grand Total	61	100.00%

The average number of inhabitants per household was 3.62 persons for the directly affected households. While residing in village was 9.4.

5.2.2 Demographics of respondents

5.2.2.1 Gender

a. Directly affected respondents' gender

In this socio-economic survey of directly affected respondents, the participation percentage of men was higher than female, out of 61 participants interviewed 34 respondents were male, while 27 were female.

Table 20. Gender of directly affected respondents

Row Labels	Count of HH_ID
Female	27
Male	34
Grand Total	61.00

b. Indirectly affected respondents' gender

In this socio-economic survey, the participation percentage of women was slightly higher than male, out of 284 participants interviewed 41.99% respondents were male, the majority of respondents were female, accounting to 57.81%.

Table 21. Gender of indirectly affected respondents.

Row Labels	Count of HH_ID
Female	57.81%
Male	41.99%
(blank)	0.20%
Grand Total	100.00%

The survey also showed that women in project areas have good awareness of the socio-economic issues and participated very actively in activities in the local community, the position of the woman has been changed and raised higher. Local women, more proactively are participating with decision making in both domestic family (expenditure and savings for their family, education and job of their children) and community social issues (discuss on technical option for proposed works).

5.2.2.2 Age

As group age of people is an important variable to represent opinions, the age of the participants surveyed is as follows:

Table 22. Age of indirectly affected respondents

Row Labels	Percentage of age
0-14	12.98%
0-15	0.20%
15-24	6.90%
25-54	47.06%
25-55	0.20%
25-56	0.20%
55-64	15.82%
55-65	0.20%
65-100	16.23%
(blank)	0.20%
Grand Total	100.00%

The survey results showed that the age of the participants surveyed is mostly from 25 to 54 years old (accounting for 47.06%); followed by 65 above years old group (16.23%), and 55-65- or 0-15-years old group accounting for only a small proportion (0.2%). This shows that participants surveyed are mostly mid-aged groups or working population and are mostly the people who are decision makers in the family on key issues of the family.

Similar finding as to the indirectly affected respondents can be found for the directly affected respondents.

Table 23. Age of directly affected respondents

Row Labels	Percentage
0-14 yrs	15.42%
15-24 yrs	9.35%
25-54 yrs	41.59%
55-64 yrs	13.08%
65 and over yrs	20.09%
(blank)	0.47%
Grand Total	100.00%

5.2.3 Education

According to the survey result, out of the total participants, the people with illiteracy accounted for the highest proportion of 64.9%; followed by primary school level people accounting for 12.74%. People with secondary school level accounted for 12.02% and 1.44% of respondents surveyed had tertiary level education.

Overall, the educational level of the people in the project area is relatively low. Because of which, during group discussions with the local people in the project area, a lower ability of the community to participate and provide comments to the project was observed. Therefore, during the dissemination of the information related to the project as well as public consultation on the proposed technical options, local dialect was preferred so that the communities understand the nature and significance of the project as well as participate and support the project.

Similar findings were observed for directly affected respondents. the people with illiteracy accounted for the highest proportion of 63.08%; followed by up to grade schooling people accounting for 20.56%. People with secondary school (G9 -12) level accounted for 10.75%.

5.2.4 Expected benefits from project

In consultations for the SIA preparation, community expressed their support to the project implementation because it will not only strengthen the power reliability (accounting to 52.48%) but also lead to clean energy (26.95%). However, 7.45% of the

surveyed participants weren't sure of the project benefit for which they did not express their support to the project.

Table 24. Expected benefits

Category	Count (No)	Percentage (%)
Yes	356	100.00
Electricity Benefit	57	16.01
Agricultural market Benefit	57	16.01
Health Benefit	37	10.39
Education Benefit	36	10.11
Business Benefit	57	16.01
Job Benefit	55	15.45
House rent Benefit	43	12.08
Land Leasing Benefit	14	3.93
No	132	100.00
Electricity Benefit	4	3.03
Agricultural market Benefit	4	3.03
Health Benefit	24	18.18
Education Benefit	25	18.94
Business Benefit	4	3.03
Job Benefit	6	4.55
House rent Benefit	18	13.64
Land Leasing Benefit	47	35.61

5.2.5 Ethnic Groups

The survey's results on ethnic groups showed that the project area is occupied mainly by the Tshangla and Kheng people.

As a result of screening (within the project's AOI –as a minimum) and consultations with local people, it was confirmed that there weren't any presence of indigenous peoples or ethnic minority communities within the project area.

5.2.6 Agriculture and occupation

The survey result showed that, 95.77% of the participants do farming with crop production and livestock rearing (46.13%) being the primary activity and 33.45% indicating no secondary activities. Of the directly affected households surveyed, 74.77% are farmers, followed by students (17.29%). Only 2.8% indicated of not having any work.

The most common crops grown among the respondents was found to be vegetables accounting to 18.54%, followed by chili (17.42%). Least grown were pulses and lentils

(0.07%). 0.21% claim of not cultivating any crop or fruit trees. The grown crops/fruit trees are mostly for household consumption, while some part of it goes to market.

5.2.7 Income

According to the survey results, 66.2% of respondents have a relatively stable income. Based on the CBN national poverty lines, which specify the food poverty line at Nu. 2,852 per person per month, the nonfood allowance between 1,247 Nu (lower bound) and 3,352 Nu (upper bound), and the resulting total poverty lines ranging from 4,099 Nu (lower bound) to 6,204 Nu (upper bound), it is evident that those earning above these thresholds are not classified as poor. Given that 66.2% of the population reportedly earn more than Nu. 70,000 per year—a figure significantly higher than the upper bound poverty line—they are considered to be above the poverty line and not poor.

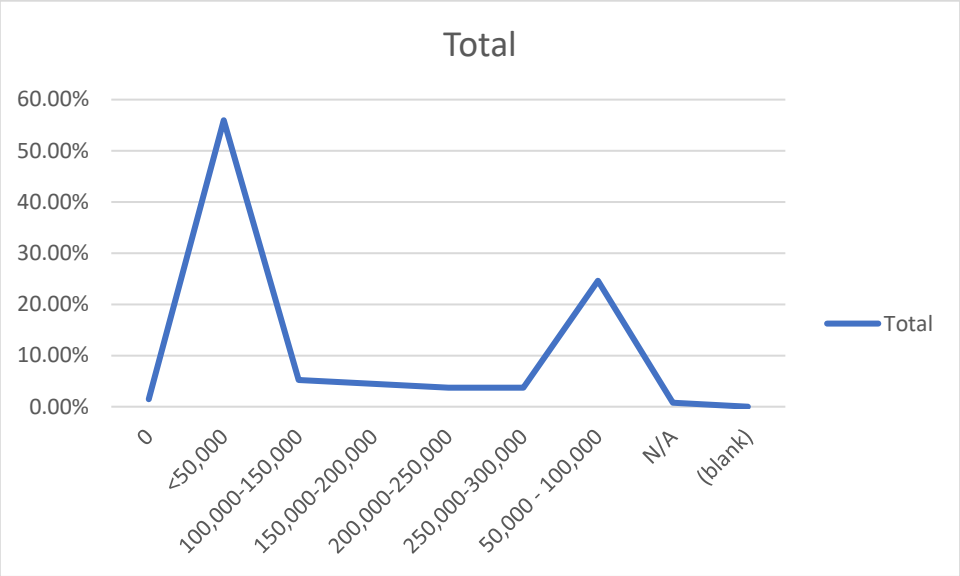


Figure 12. Income level of indirectly affected households

Directly affected respondents also had relatively stable income with only 1.49% of the respondents stating to have an income less than Nu.70,000 per year.

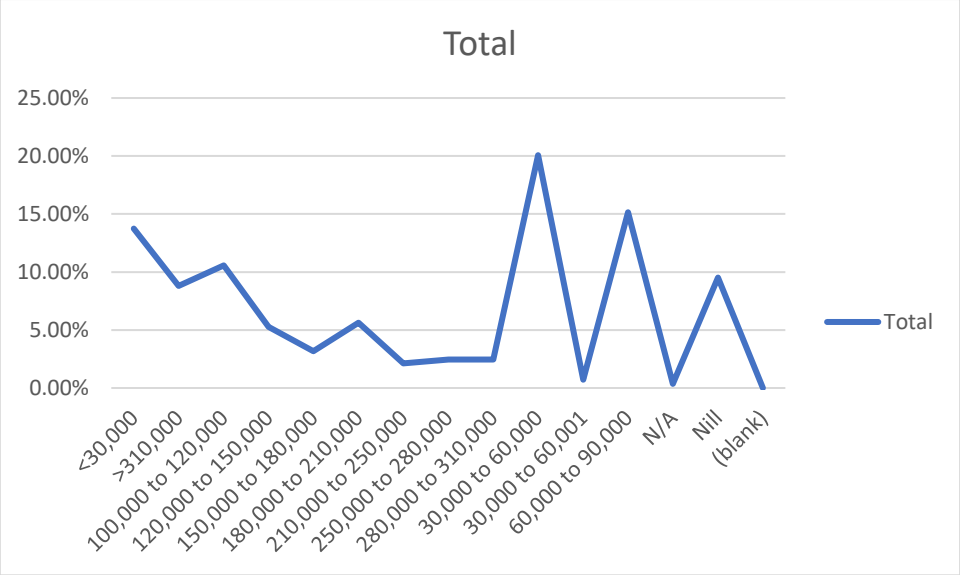


Figure 13. Income level of directly affected households.

5.2.8 Expenditure

Households were asked about their average expenditure amount per year and distribution of expenditure by detailed categories such as expense for food, health care, and children's studying. Food is the highest contributor in expenditure. Generally, a larger household spends more than smaller ones.

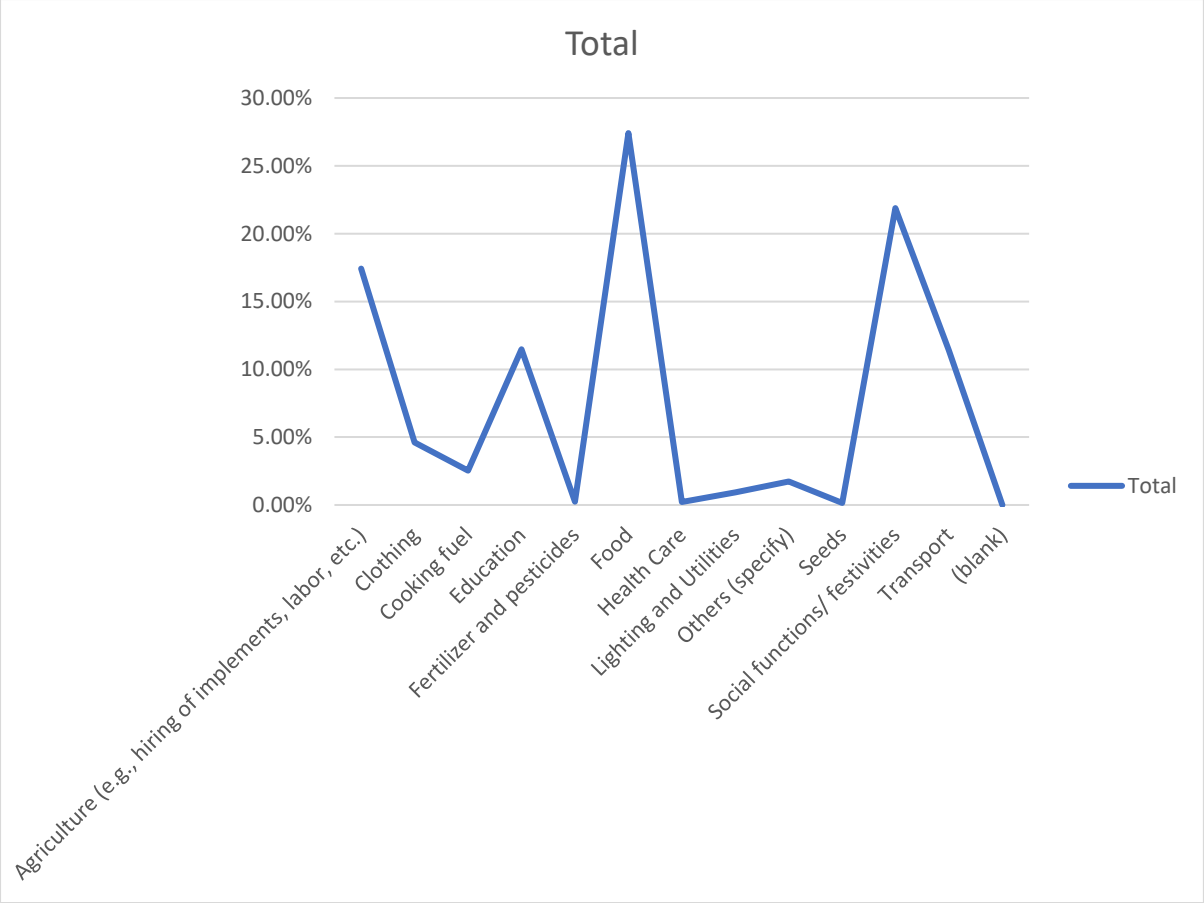


Figure 14. Household expenditure of indirectly affected households

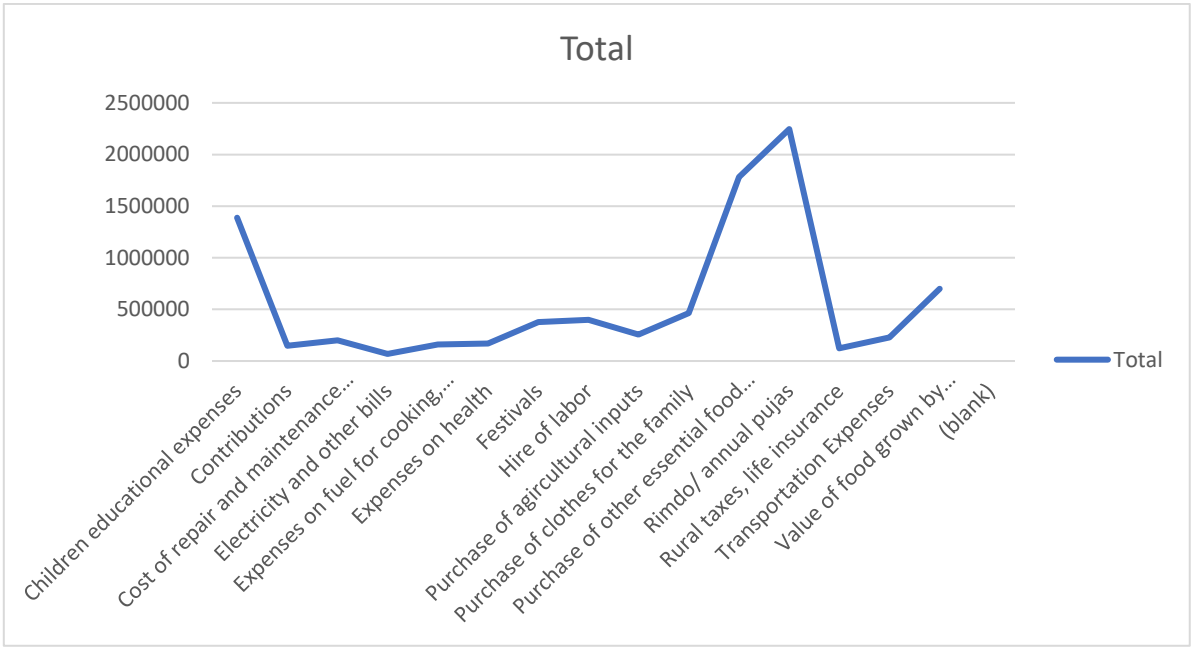


Figure 15. Household expenditure of directly affected households

5.2.9 Assets

The majority of the houses (75.35%) are built with durable materials such as mud-bonded bricks or stones, while 5.99% of the houses are constructed using wood or branches, which may suggest a more modest economic status.

61.13% of the indirectly affected respondents hold 1-5 acres of land, with only 1.06% holding 16 to 20 acres of land. 58.10% of the directly affected households own dry land followed by wet land (22.86%). 26.23% own 0-2 acres of land and 21.31% holding 4-6 acres of dry land. Other assets owned by the households are as presented in **Figure 16**.

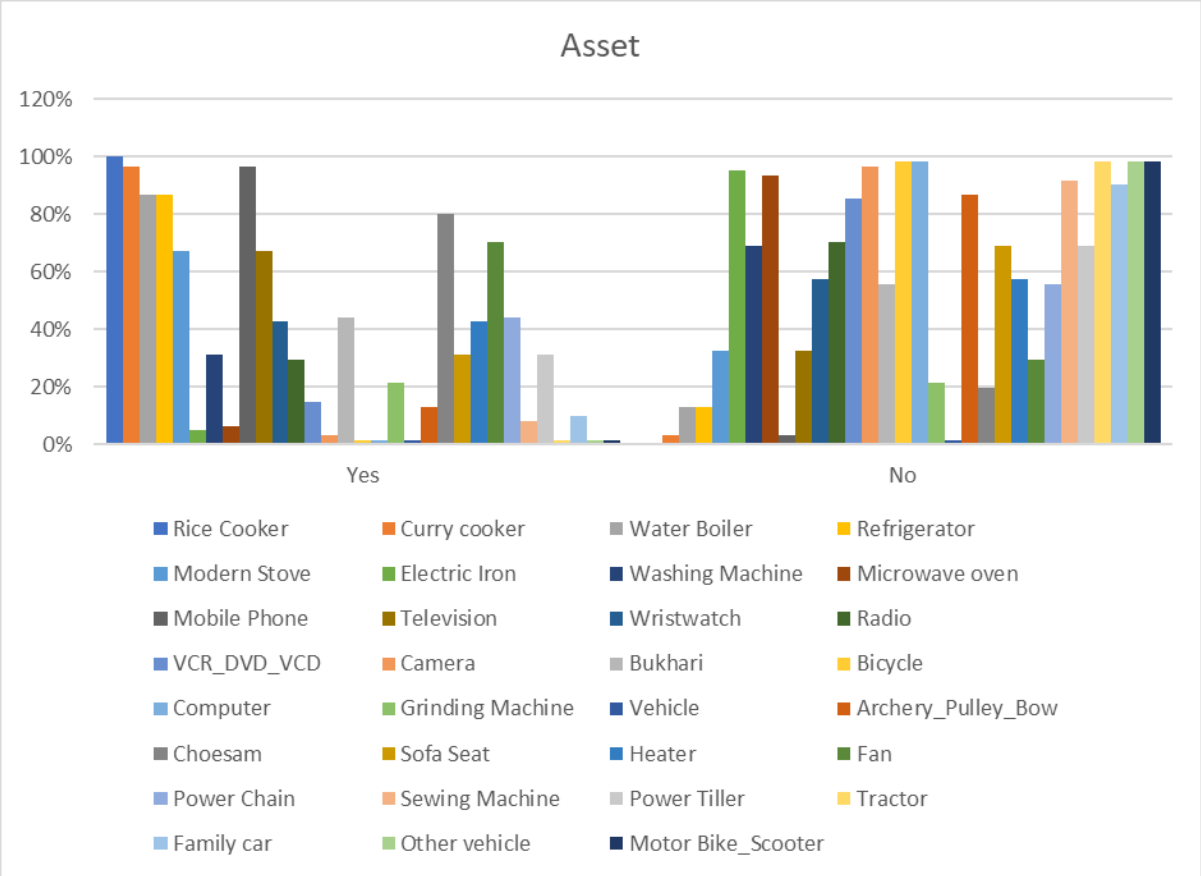


Figure 16. Asset ownership of respondents.

5.2.10 Electricity

The survey results indicate that almost all (99.65%) households have access to the national power grid, with outage frequency being more than 15 times a year (61.48%) and duration being more than 6 hours (51.24%).

6. Anticipated Project Impacts

6.1 Introduction

The Environmental, Social, and Economic Impact Assessment (ESEIA) was conducted to evaluate project viability and establish a framework for the identification and management of residual impacts through rigorous mitigation protocols. This evaluative process necessitated a comprehensive characterization of the environmental baseline, accounting for site-specific uniqueness, ecological sensitivities, and the spatial-temporal dynamics of construction and operational phases. A systematic screening matrix was utilized to analyze the interface between project components and the surrounding environmental and socioeconomic receptors within a 1km buffer zone. This methodology functioned as a technical filter to isolate high-magnitude interactions requiring intensive analysis from negligible impacts. Interactions categorized as non-significant—typically those characterized by transient durations and high receptor resilience—were excluded from further detailed modeling on the basis that baseline conditions would naturally normalize without intervention.

6.2 Determining the degree of potential impacts

The magnitude of impact associated with the proposed transmission line infrastructure is quantified based on a multi-criteria evaluation of the following technical parameters:

(i) The prevailing baseline level of anthropogenic or environmental disturbance within the project corridor. Impact significance is inversely correlated with the degree of existing land degradation or industrialization.

(ii) The ecological or cultural value of the affected area, specifically the presence of endemic species, protected habitats, or high-value landscapes. This factor assesses the sensitivity of the receiving environment to infrastructural encroachment.

(iii) The potential for the project to act as a catalyst for secondary land-use transformation or future cumulative disturbance. This involves evaluating whether the establishment of the Right-of-Way (RoW) will induce irreversible shifts in regional land-use patterns.

(iv) The temporal scale of the disturbance. Permanent impacts are characterized by the physical footprint of the transmission towers and the functional lifespan

of the line. Conversely, transient impacts are confined to the pre-construction and construction phases, or occur as episodic events during the operational phase, such as emergency repairs or periodic RoW vegetation management.

To be clear on the nature of the impacts, the following definitions of impacts that embody the concept of recovery from impact are used:

(i) **Major impacts** are characterized by high-magnitude disruptions to environmental or social receptors. In ecological terms, an impact is deemed major if it results in a decline in species abundance or an alteration in distribution that exceeds the threshold of natural recruitment, preventing the population from returning to baseline levels within several generations. Socioeconomically, major impacts constitute a long-term degradation of subsistence or commercial resources, business viability, or community well-being. Due to their scale, these impacts are often considered residual and necessitates fundamental changes to project siting or design iterations, as conventional mitigation is typically insufficient.

(ii) **Moderate impacts** involve a localized effect on a portion of a population or habitat. While these may induce changes in abundance or distribution over one or more generations, the overarching biological integrity of the species and its dependent trophic levels remains intact. Socially, moderate impacts manifest as short-term disruptions to the economic well-being of resource users, with a recovery trajectory estimated within a 3–6-month window. Such impacts are generally managed through standardized mitigation measures or may be deemed acceptable provided that environmental and social recovery is demonstrably assured.

(iii) **Minor impacts** are defined by localized, short-term disturbances affecting specific individuals or habitats within a single generation or less, without cascading effects on population dynamics or trophic structures. Socioeconomic disturbances in this category do not measurably alter resource use or community activities beyond a negligible, rapidly recoverable baseline. These impacts are frequently self-correcting or are highly responsive to routine, low-cost mitigation strategies.

Environmental parameters identified as having negligible sensitivity to construction-related stressors have been systematically excluded from the detailed impact analysis. This scoping-out process ensures that the assessment remains focused on significant environmental interactions, thereby optimizing the technical review of the construction phase. For a comprehensive inventory of these excluded receptors and the justification for their omission, refer to the screening results detailed in **Table 25**.

Table 25. Fields in which construction is not expected to have significant impacts

Field	Rationale
Climate	Short-term production of dust is the only effect on atmosphere.
Geology and seismology	Excavation will not be large enough to affect these features.
Industries	There are no major industries in any area affected by the project.
Tourism	Not a tourist hotspot.
Population and communities	Construction will not affect population numbers, location or composition.

In accordance with standard EIA methodology, the significance of an impact is contingent upon the regenerative capacity of the receptor. Receptors exhibiting high elasticity and rapid recovery trajectories following project-related disturbances are classified as having non-significant impacts. Furthermore, spatial extent serves as a critical threshold for significance; disturbances affecting a negligible fraction of a local population or habitat—typically defined as <2%—are deemed insignificant. This classification is supported by the existence of habitat continuity, which ensures the availability of adjacent refugia for displaced species. At this scale, such impacts fall within the natural range of spatial and temporal variability and do not manifest as functional barriers to ecological connectivity.

The assessment further evaluates the complexity of these interactions by categorizing them into three distinct impact types:

(i) **Direct Impacts:** Immediate causal relationships between a project activity and a receptor.

(ii) **Indirect Impacts:** Secondary effects that occur later in time or are removed in distance, often requiring intermediary drivers.

(iii) **Cumulative Impacts:** The incremental effects of the project when integrated with the impacts of other past, present, and reasonably foreseeable future developments in the 1km study area.

Regarding socioeconomic parameters, a net-benefit approach is applied. Negative impacts localized to specific socioeconomic variables are considered acceptable if they are effectively offset or superseded by broader, positive developmental outcomes, ensuring the project maintains a net-positive contribution to regional well-being.

All impacts are identified by phase and in three main categories.

(i) Economic impacts
(ii) Social impacts
(iii) Environmental impacts

6.3 Impacts during Pre-Construction

6.3.1 Economic Impacts

6.3.1.1 Impact from Temporary and Permanent Land Acquisition

Land acquisition comprises temporary and permanent components. Temporary requirements, limited to 18 months, support construction labor camps and material/machinery storage as needed. Permanent acquisition facilitates Right-of-Way (RoW) clearing for the transmission line.

The project displaces no private fruit trees, standing crops, structures (residential, commercial, industrial, or occupied premises), religious/community/cultural sites, or common property resources. Land represents the sole affected asset, with no displacement of indigenous peoples.

Table 26. Transmission line route survey and land acquisition summary

Aspect	Details
Route Survey Avoidance	Settlements, private land, wetlands, monuments, common property resources, public utilities.
Total Towers	228
Towers on Government Land	218
Towers on Private Land	10
Affected Households	10 displaced households

Land loss per household	10 decimals each
Total permanent land required	100 decimals (1 acre)
Land type	Dryland (Kamzhing)

6.3.2 Employment Opportunities

The project is expected to yield positive socioeconomic externalities through direct employment and the stimulation of local commodity markets. During the construction phase, the presence of the workforce will catalyze demand for regional agricultural and livestock products, specifically dairy, meat, and vegetables.

The labor procurement strategy adopts a tiered approach: while specialized technical roles may be sourced externally or from India, priority for unskilled labor is reserved for the local population and Project Affected Persons (PAPs). Direct employment opportunities include Right-of-Way (RoW) clearance, logistical material transport, and participation in compensatory afforestation and land management initiatives. A primary component of local engagement involves the manual portage (head-loading) of materials in areas with restricted vehicular access.

6.3.3 Mobilization of Construction Equipment and Materials

Construction logistics for the transmission line are designed to minimize heavy machinery impacts. Material transport, specifically for tower components, will be restricted to a limited fleet of trucks operating on an intermittent basis. From designated road access points, material conveyance to tower sites will be executed via manual portage (head-loading), eliminating the requirement for site-clearing for heavy vehicle access. Consequently, disturbances related to construction mobilization are categorized as marginal, as the project avoids the continuous deployment of high-volume heavy machinery.

6.3.3.1 Influx of Project Staff and Contract Workers

The Project Management Unit (PMU) will be led by a Project Manager, supported by a technical team including an Engineer, an Environmental Officer, and administrative staff. Workforce requirements will fluctuate across project phases, starting with a minimal crew for site preparation and peaking at approximately 200 personnel during the construction phase.

To optimize the socioeconomic balance and mitigate the risks associated with labor influx, a tiered hiring policy will be implemented. Technical milestones, such as foundation engineering, tower erection, and stringing, will utilize skilled labor sourced externally or internationally. Conversely, labor-intensive tasks—including benching, head-loading, and site clearance—will be reserved for the local population. This strategy prioritizes Project Affected Persons (PAPs) and minimizes the influx of foreign workers.

Potential adverse impacts associated with foreign labor influx include:

(i) **Social Dynamics:** Risks of social instability or friction between external workers and local communities.
(ii) **Resource Pressure:** Increased demand on regional housing, infrastructure, and public services.
(iii) **Public Health:** Potential transmission of communicable diseases within the local community and labor camps.
(iv) **Environmental Sanitation:** Risks of localized contamination from inadequately managed waste and sewage.
(v) **Occupational Health and Safety (OHS):** Site-specific safety hazards and camp-level health concerns, including indoor air quality.

To mitigate these risks, the Contractor is contractually mandated to conduct comprehensive inductions for all non-local personnel. These briefings will cover national legal frameworks, codes of conduct, forest and nature conservation regulations, and OHS and waste management protocols.

The overall social impact is assessed as non-significant due to the limited scale of the immigrant workforce and the strategic siting of labor camps along the Right-of-Way (RoW), distanced from existing settlements and transport arteries. While the economic externalities remain positive, temporary social risks will be managed through structured mitigation planning focused on health, sanitation, and community relations.

6.3.4 Cultural and religious sites

Baseline surveys and site reconnaissance confirm that the proposed Right-of-Way (RoW) and the broader project area are devoid of any documented cultural, religious, or heritage sites. The project alignment does not intersect with, or encroach upon, areas of spiritual

significance, sacred groves, or archaeological assets. Consequently, no impacts on cultural resources are anticipated during the construction or operational phases.

6.3.5 Environmental Impacts

6.3.5.1 Impacts on air quality

Air quality impacts remain minimal. The five dzongkhags exhibit high forest cover, low population density, and limited industry, maintaining good baseline air quality. Environmental baseline data confirm non-detectable SOx and NOx levels, consistent with sparse population, absence of heavy industry, and low traffic volumes.

Transmission line construction generates dust solely from excavation during benching and foundation works. Given the limited excavation area, dust emissions remain minimal.

6.3.5.2 Increase in demand for water resources

Approximately 200 workers will be deployed along the transmission line during peak pre-construction and construction periods. World Health Organization guidelines indicate 50–100 liters of water per person per day meets basic needs with minimal health risks (WHO). At the conservative estimate of 50 liters per worker per day—accounting for communal kitchens and pit latrines—total peak water demand reaches 10,800 liters per day.

Table 27. Total quantity of water required for domestic and construction purposes

No.	Purpose	Estimated No of staff/workers	Water requirement (liters/day)	Total water required (liters/day)
1	Project staff requirement	10	50	500
2	Contractor facility and workers	200	50	10,000
3	Construction works		300	300
	Total water required			10,800

Water requirements during peak construction remain limited to domestic use in labor camps and specific activities. Concreting demands approximately 300 liters per day, confined to tower foundation works. Dust suppression via sprinkling during excavation at tower footprints requires about 50 liters per day.

Net impacts on water resources prove minimal and transient. Usage supports domestic needs and limited construction only, with multiple streams available in the project area.

Estimates reflect peak demands and may decrease substantially based on actual worker numbers per site.

6.3.5.3 Risk of Poaching by workers

Poaching risk increases substantially from worker influx into remote locations. Project sites, distant from towns with limited meat availability in rural areas, receive infrequent Forestry Personnel monitoring. These areas support documented threatened species including Endangered Asian Elephant, Tiger, Dhole, and Gee's Golden Langur.

Poaching impacts, though transient, pose significant threat to biodiversity without intervention. Mitigation requires immediate implementation of worker awareness programs, site-specific monitoring protocols, and coordinated Forestry Personnel patrols from project commencement.

6.4 Impacts during Construction Phase

6.4.1 Economic Impacts

The project generates employment and supplier opportunities during construction through expanded income sources. Priority hiring of affected persons by the Project and Contractors for unskilled tasks—including Right-of-Way (RoW) forest clearance, road repair/maintenance, water supply works, afforestation, seed planting, nursery operations, fencing, and retaining wall construction—maximizes local benefits. These activities require minimal expertise and suit local capabilities.

Additional income derives from increased sales of fresh vegetables, dairy products, and food to workers and travelers via roadside stalls or outlets near labor camps.

6.4.2 Social Impacts

6.4.2.1 Impacts from influx of more workers

Social impacts from the pre-construction phase intensify during construction due to increased worker numbers, expanded work sites, and more frequent material transportation as additional personnel mobilize to accelerate completion. Risks of social conflict, communicable disease transmission, health and safety incidents, waste/sewage generation, and resource pressure all escalate proportionally with workforce expansion.

6.4.2.2 Mobilization of more construction equipment and vehicles

No heavy vehicles deploy regularly during transmission line construction. Material transport occurs as-needed for limited quantities of tower components (steel lattice, insulators, conductors, accessories), eliminating anticipated societal impacts. On-site delivery employs manual head loading, further minimizing disturbance while generating local employment opportunities.

6.4.2.3 Potential damage to the highway due to heavy equipment and truck traffic

Highway damage from additional vehicle burden remains marginal. Regular transportation requirements absent from transmission line construction limit impacts exclusively to as-needed material delivery, minimizing road deterioration attributable to the project.

6.4.2.4 Noise, dust and access issues during vegetation clearing

Vegetation clearing for the Right-of-Way (RoW) generates localized noise, dust, and temporary access impediments for workers and wildlife. Impacts remain minor due to confined spatial extent along the RoW corridor. Mitigation measures further reduce these effects.

6.4.2.5 Loss of visual aesthetics

Visual impacts prove minor due to limited receptor exposure. Transmission line structures remain screened from highways by existing forest cover. Construction-phase effects—vegetation clearing, site works, and temporary equipment presence—generate localized aesthetic disruption but affect few viewers given low population density and tourist traffic.

6.4.2.6 Occupational health and safety

Health and safety risks primarily affect construction workers, with secondary exposure to nearby communities. Right-of-Way (RoW) clearance presents significant hazards during tree felling, tower foundation work, and conductor stringing, compounded by working at height. Labor camps introduce additional risks including communicable disease transmission and poor air quality.

These impacts remain manageable through implementation of a comprehensive Occupational Health and Safety (OHS) Plan. Contractor compliance eliminates risks post-construction phase completion.

6.4.3 Environmental Impacts

6.4.3.1 Loss of forest cover and habitat for wildlife

The primary impact of the transmission line involves forest cover loss and wildlife habitat destruction. For 400 kV transmission line, minimum ground clearance requires 8.84 m from the lowest conductor, permitting shrubs exceeding 3 m to regenerate. Total forest clearance encompasses approximately 1415 acres within the project area.

Despite the size of the forest area requiring clearance, the net impacts on forest cover are not considered significant for the following reasons:

(i) Some of the sections of the proposed TL will be aligned parallel to the existing transmission lines so the actual area that will be cleared is less than 1414 acres, especially where the TL runs through scrub forest and agricultural land.

(ii) Where the TL spans gullies and valleys, it is not necessary to clear the 46 m RoW but rather clearing a smaller RoW of 4 m is practiced by BPC (to allow for operation and maintenance works).

(iii) The project site is not unique in terms of biodiversity or located in a protected area. The only Park involved is the Royal Manas National Park (RMNP).

Tree removal and vegetation clearance along the transmission line Right-of-Way (RoW) destroys forest habitat and displaces resident wildlife species, including large/small mammals, birds, reptiles, amphibians, insects, and invertebrates. Some species relocate to adjacent areas; others sustain injury or mortality during clearing operations. Baseline biodiversity surveys document pre-existing high disturbance levels from grazing, tree lopping, and fodder collection by local communities.

Habitat losses require compensatory measures: enhancement of adjacent areas and replanting at double the cleared area through Compensatory Afforestation using suitable local tree species in degraded sites.

6.4.3.2 Impacts on air quality

The five dzongkhags maintain good baseline air quality due to high forest cover, low population density, and minimal industry. Baseline analysis detected no SOx or NOx, consistent with sparse population, absence of heavy industry, and low traffic volumes.

6.4.3.3 Risk of poaching by workers

Worker influx into remote project sites elevates poaching risk due to distance from towns, limited meat availability in rural areas, and infrequent Forestry Personnel patrols. These locations support documented threatened species including Endangered Asian Elephant, Tiger, Dhole, and Gee's Golden Langur.

6.4.3.4 Impacts from excavation works and muck disposal

Excavation works for 228 towers along the 124.5 km transmission line generate approximately 48,000 m^3 of material. Dispersed tower locations produce ~700 m^3 per site, with 50% reused for foundation backfill. Key concerns encompass slope stability, stockpiling containment, and prevention of sediment ingress into drainage paths, creeks, and rivers.

Net impacts from excavation and muck generation remain small and temporary due to: (i) not all sites located on steep slopes or near streams, limiting rainfall-induced siltation; (ii) 400 m minimum spacing between dispersed tower footprints.

6.4.3.5 Risk of slope instability

Slope stability concerns arise solely from localized excavation at tower sites. Transmission line design incorporates detailed geotechnical investigations of soil conditions and hazards at each tower footing to eliminate foundation stability risks. Site reconnaissance surveys confirm absence of geological disturbances across the alignment.

Net slope stability impacts remain minimal, integrated into tower foundation design and planning based on site-specific ground conditions.

6.4.3.5 Impacts on community forest

Transmission line route traverses Community Forest (CF) areas, requiring mitigation to prevent losses to Community Forest Management Groups (CFMGs). Compensation follows national regulations to minimize CF impacts.

6.4.3.6 Impact on surface waters

Surface water impacts link directly to slope instability risks, remaining negligible when towers maintain minimum 30 m setbacks from water sources. Additional impacts stem from improper waste disposal, sewage from worker camps, unregulated water sourcing, and streamside washing activities.

Net water quality impacts remain minor with mitigation enforcing tower and camp setbacks from rivers/streams, alongside strict prohibitions and enforcement against surface water pollution.

6.4.3.7 Impacts from improper storage of fuel

Material requirements arrive pre-construction to enable foundation, erection, and stringing works, eliminating ongoing fuel demands. Fuel storage and spillage risks—potentially contaminating groundwater and surface water—do not exist due to absence of large quantities or extended storage periods.

6.4.3.8 Impacts from improper closure of project work sites

Contractors must ensure proper closure of pre-construction and construction facilities, including worker camps and storage sites along the transmission line, to eliminate future risks to human health and the environment.

6.5 Impacts during Operation Phase

6.5.1 Economic Impacts: Decrease in income opportunities

Routine Right-of-Way (RoW) maintenance generates no economic impacts, avoiding agricultural areas and local farm roads used for produce transport. Tower repositioning following line failure requires no additional land acquisition; new foundations locate adjacent to existing ones, enabling land exchange with current owners and restoration of previously occupied areas.

Local economies experience reduced demand for agricultural products (vegetables, dairy) post-construction as contractors and migrant workers depart. Nationally, East-West transmission line power evacuation substantially increases revenue from electricity exports to India.

6.5.2 Social Impacts

6.5.2.1 Reduced pressure for local resources

Operation phase generates no negative social impacts. Local district authorities benefit from reduced pressure on health services, water resources, LPG, kerosene, diesel, and fuelwood supplies, alongside decreased poaching and anti-social activities.

6.5.2.2 Risk of electrocution and accidents during maintenance work

Operation and maintenance of the 400 kV transmission line over grazing areas necessitates stringent safety measures for local populations and livestock. Individuals under power lines face electrocution risks during maintenance, with exposure extending to workers repairing towers, lines, and components.

Electrocution hazards encompass fatal electrocution, electric shock, burns, and falls from electrical contact. Locals remain particularly vulnerable due to limited awareness of risks. Mitigation requires maintaining minimum 15-17 feet clearance between personnel, objects, and energized lines.

Risks diminish substantially through Bhutan Power Corporation Limited (BPCL) shutdown procedures prior to maintenance and adherence to BPC Occupational Health and Safety Guidelines for transmission line operations nationwide.

6.5.2.3 Electromagnetic field (EMF)

Extensive research since the 1970s examines electromagnetic field (EMF) health and environmental impacts from transmission lines. Laboratory studies and epidemiological investigations demonstrate no strong associations between EMF exposure and adverse health effects. Scientific panels convened by national/international health agencies and U.S. Congress reviewed evidence and concluded insufficient data exist to establish causal links (Minnesota State Interagency Working Group, 2002). These panels similarly note insufficient evidence confirming EMF exposure safety.

6.5.3 Environmental Impacts

Operations and maintenance of the right-of-way (RoW) for the transmission line impose minimal ecological impacts, as no new towers will be constructed. Maintenance activities remain small-scale and infrequent, preserving the existing landscape with limited disturbances.

Selective vegetation re-growth within the RoW supports ecological recovery by enabling plant and animal recolonization. The opened forest canopy fosters habitat shifts, introducing different species that enhance overall biodiversity.

6.5.4 Electrocution of raptors and other large birds

Transmission lines pose electrocution risks to large birds, which use pylons for hunting and roosting, especially in areas lacking natural perches. Electrocution happens when birds contact two wires simultaneously or perch on conductive structures touching energized lines; collisions also occur if lines are hard to detect visually.

No documented bird electrocutions exist from Bhutan's existing lines in the project area, minimizing concern. Pylon designs include conductor cage boxes to deter perching and nesting, with additional mitigative measures proposed for any unforeseen impacts.

Net impacts remain insignificant due to these factors and local ecological context.

7. Environmental Mitigation and Management Plan

This chapter discusses the mitigation and management plan for the impacts associated with the transmission line and the required management plans. Specific details associated with each proposed mitigation measure, including the institutional requirements to ensure proper implementation, accountability and monitoring are also detailed out. The identification of impacts covers both the immediate project area as well as adjoining areas within 1 km in the immediate vicinity of the Project.

7.1 Management Plan for Loss of Private Land and Livelihood

The transmission line project requires no forest land purchase since all designated forests are state-owned, with only 1 acre of private dryland (Kamzhing) needed for 10 towers, displacing 10 households by 10 decimals each.

Land acquisition follows the Land Acquisition and Compensation Rules and Regulations (LACRR), 2022, while right-of-way (RoW) alignments adhere to the Guideline for plot boundary realignment/reconfiguration, 2021. Temporary leases (up to 18 months) mandate full rehabilitation and revegetation post-construction, enhancing land utility for communities.

Grievances over compensation or substitution route through the Grievance Redressal Mechanism to the dedicated Committee; minimal income impacts expected due to land substitution or realignment.

Table 28. Land Impact Summary

Aspect	Details
Total Private Land	1 acre (Dryland/Kamzhing)
Affected Households	10 (10 decimals each for 1 tower)
Guiding Policies	LACRR 2022; RoW Guideline 2021
Temporary Land	Rehabilitated post-18 months max
Income Effect	Not significant; full substitution

No significant livelihood disruptions anticipated from this limited acquisition.

7.2 Employment Opportunities

The transmission line project creates employment opportunities for local communities, prioritizing affected households based on skills and qualifications. Roles span contractor support, right-of-way (RoW) clearing, material transport, compensatory forestation, and land management initiatives.

Locals gain additional income streams through sales of vegetables, milk, and meat products to project personnel. Further benefits include renting accommodations, office spaces, vehicles, equipment, or leasing private land to contractors.

Table 29. Economic Benefits

Opportunity Type	Examples
Direct Employment	RoW clearing, transport, forestation labor
Skill-Based Jobs	Contractor roles for qualified locals
Indirect Income	Produce sales, rentals (housing/vehicles/land)

These measures enhance local livelihoods without significant disruptions.

7.3 Management of Impacts from Mobilization of Equipment, Construction Materials and their Storage

Construction of the transmission line requires moderate quantities of aggregate, sand, cement, and steel lattice structures for 228 towers. Materials transport uses hired trucks on an as-needed basis, with no regular deployment of heavy vehicles or machinery.

Storage occurs near access roads, followed by head-loading to sites at least 15 days prior to activities, synchronized with construction progress to prevent site congestion. Highway impacts remain minimal due to limited vehicle requirements.

Table 30. Material Logistics

Aspect	Details
Key Materials	Aggregate, sand, cement, steel lattices
Transport Method	Hired trucks (as-needed)
Storage & Delivery	Roadside storage; head-loaded 15+ days ahead
Vehicle Impact	Low; no heavy machinery routine use

These practices ensure efficient supply without overburdening local infrastructure.

7.4 Management of Social Impacts

The transmission line project will draw both local and external laborers to sites, establishing worker camps that boost employment opportunities for nearby communities. While this influx offers positive economic gains, it risks generating solid and liquid waste accumulation, littering, water body pollution, and disruptions to village life.

Proper waste management and site hygiene remain essential to mitigate these issues. Construction sites, material stores, temporary/permanent structures, and cooking facilities require meticulous maintenance under strict supervision to prevent environmental contamination.

Table 31.Labor Camp Management

Aspect	Key Measures
Waste Handling	Organized disposal; no littering near water bodies
Site Maintenance	Supervised cleaning of camps, stores, and utensils
Community Impact	Controlled access to minimize village intrusions

These protocols ensure positive employment benefits outweigh potential negative effects through disciplined oversight.

7.5 Management of Workers/Worker Camps

Worker influx impacts commence during pre-construction and intensify in the construction phase, with increased personnel density at sites and heightened transport of materials and equipment. Pre-construction planning and experience establish foundational mitigation strategies that scale effectively into full construction activities.

Impact Timeline

- Pre-Construction: Initial worker arrival, site setup, and baseline planning to preempt risks.
- Construction: Expanded scale with frequent movements and higher worker concentrations.

Strategic early-phase measures ensure smooth transitions and controlled impacts throughout project execution.

The main concerns with an influx of workers include:

(i) Risk of communicable diseases spreading in the local community.
(ii) Waste and sewage entering the local environment.
(iii) Safety issues at the work sites.
(iv) Possible social instability; and
(v) Health concerns in the camps (communicable diseases, poor air quality).

7.5.1 Risk of communicable diseases spreading in the local community

To minimize communicable disease spread from worker influx to local communities, rigorous screening and health protocols apply across pre-construction and construction phases.

Contractors must conduct medical tests for all prospective workers—especially foreign hires—prior to employment, in line with hiring procedures that screen for diseases, sicknesses, and criminal records. Regular checkups continue at sites, coordinated with Dzongkhag Health Officers and local hospitals to detect issues early.

Health Screening Measures

- Pre-Employment: Mandatory medical tests at source for diseases and fitness.
- Ongoing Monitoring: Site-based checkups with health authority consultation.
- Accountability: Contractors ensure compliance; no unfit or criminal workers employed.

These steps safeguard community health while supporting project workforce needs.

7.5.2 Increased pressure on housing, infrastructure, and services

(i) Ensure minimal land clearing and removal of vegetation for housing

Worker camp siting avoids land conversion by utilizing degraded or semi-cleared forest areas, selected in consultation with Dzongkhag authorities.

(ii) Housing and sanitation for workers

Worker camp mitigation relies on strategic siting in isolated, degraded forest areas (consulted with Dzongkhag authorities) and rapid construction for 50+ worker capacity. Camp isolation from communities minimizes social conflicts, cultural disruptions, and communicable disease transmission risks.

Pre-construction layout planning designates locations for essential structures. Communal kitchens and toilets centralize fuel/water use, pollution control, and waste/wastewater management.

(iii) Provision of drinking water

Labor camps locate adjacent to streams with water supplied via PVC pipes through gravity-fed systems. Each camp provides individual shelters, communal kitchens, and pit latrines for workers.

Water extraction taps nearest streams into a header tank, sequences through rapid sand filtration, then storage tank. Distribution mains connect storage to secondary pipes serving camps, kitchens, and common taps.

(iv) Waste and sewage entering the local environment

Waste from labor colonies and construction sites includes PET bottles, paper, plastics, glass, organics, metals, and batteries. Improper segregation and dumping degrade visual aesthetics, pollute streams, and attract disease vectors.

Compliance with Waste Prevention and Management Act 2009 mandates environmentally sound reduction, reuse, recycling, and disposal of non-hazardous waste by implementing agencies.

Project measures comprise waste reduction via electricity substitution for firewood; reuse of plastic containers, jars, and bags in camps; recycling of organics into compost or livestock feed for nearby households. Sites equip with separate bins for degradable and non-biodegradable waste; only non-recyclable residuals dispose at designated landfills distant from settlements and water sources.

(v) Safety issues at work sites

Occupational Health and Safety (OHS) apply to all project personnel, complying with General Rules and Regulations on OHS in Construction, Manufacturing and Mining and Service Industries, 2006 (RGOB), and Chapter IX of the Labor and Employment Act of Bhutan (2007).

The OHS program identifies workplace hazards and risks, defines prevention procedures and responsibilities, establishes emergency plans, and mandates worker consultation, training, and information dissemination. Contractors appoint a site-specific Health and Safety Focal Person to maintain accident records (including causes, actions, and remedies), serve as worker-contractor liaison for grievances and directives, and enforce Personal Protective Equipment (PPE) usage including gloves, helmets, and mufflers.

Additional measures include hazard signboards, secure material stacking to prevent collapse, progressive waste/scrap removal with excavated earth stockpiled 2 feet from pits, trained personnel for electrical works, fire extinguishers at sites, and quarterly incident reviews by Project Management analyzing reports on incident details to recommend corrective actions.

(vi) Possible social instability

Worker influx risks social instability from poor integration of external (district or foreign) workers with local communities and communicable disease transmission, despite Bhutan's experience managing such influxes.

Mitigation enforces worker Code of Conduct awareness via posters, talks, and contractor meetings covering local interactions (including HIV/AIDS risks), worksite health/safety, and emergency procedures through focal health persons. Contractors instruct site supervisors on ethics; per Department of Labour Regulations 2012, foreign workers must respect Bhutanese values, traditions, culture, laws, and restrictions—no access to prohibited areas without permits.

(vii) Management of health concerns in the camps

Temporary labor camps expose workers to health risks including communicable diseases and poor air quality from cooking emissions. Communal kitchens centralize operations to

minimize individual exposure; contractors must establish emergency procedures for illnesses and accidents.

First aid kits remain available throughout construction, critical due to remote sites distant from Basic Health Units (BHUs). Additional requirements include standby or hireable vehicles for transporting injured/sick workers to nearest BHUs, site radios/mobile communications for emergency coordination, and posted contact numbers for focal health persons familiar with local medical facilities.

7.6 Management of Impacts on Cultural and Religious Sites

Transmission line design avoids impacts on cultural and religious sites through survey-stage precautions ensuring no towers near temples, shrines, or meeting places and no conductors overhead. BPC implements additional measures including pre-work community consultations detailing project purpose, activities, timelines, and schedules; coordination with monastery/nunnery custodians to sidestep religious festivals or key dates; and strict prohibition of towers or lines over heritage structures.

7.7 Air Quality Management

The following measures shall be taken to mitigate the impact on air quality during construction phase:

(i) The fugitive dust generation at each excavation sites shall be suppressed by sprinkling water periodically.
(ii) Those trucks carrying construction materials shall be covered while transported. This shall help prevent the dust particles being blown away by the wind.
(iii) Risks to the health and safety of workers can be prevented by provision of PPEs to all workers.
(iv) Leave a covering of grass and/or other naturally occurring low-growing vegetation where possible along the RoW to reduce dust; and
(v) Avoid burning waste vegetation and instead leave this material in situ after cutting to rot down gradually, and discourage re-growth whilst it is decomposing.

7.8 Management of Noise Generation

Transmission line construction mandates contractor compliance with National Environment Commission noise standards to minimize community disturbance. Project

sites' remoteness from villages and settlements, buffered by forest cover, ensures negligible adverse noise impacts on ambient levels.

Workers must wear PPE including earmuffs at sites to prevent occupational hearing loss, with strict adherence to Ministry of Labour and Human Resources (MoLHR) noise exposure limits.

7.9 Management of Aesthetics

Excavated material dumping during transmission line construction risks aesthetic degradation if released downslope. Muck management follows dedicated Muck Management Plan protocols, including controlled stockpiling, erosion prevention via retaining structures, layer-wise compaction, and post-disposal revegetation to stabilize slopes and restore site conditions.

7.10 Occupational Health and Safety

Occupational Health and Safety program ensures workplace safety by identifying hazards, defining prevention procedures and responsibilities, establishing emergency plans, and mandating worker training and consultation. Mitigation follows earlier protocols compliant with Occupational Health Safety and Welfare Regulations 2012 and Ministry of Labour and Human Resources construction guidelines.

Contractors must secure employee and site personnel health, rectify hazardous conditions, supply/maintain PPE with usage enforcement, and deliver supervision/instruction. First aid boxes locate at each workplace under trained First Aider oversight.

7.11 Forest Conservation

Contractors limit right-of-way (RoW) forest clearance to trees precisely marked by Forestry staff, maintaining 8.84 m ground clearance from the lowest 400 kV conductor to preserve undisturbed vegetation.

Tree loss compensates per Bhutanese guidelines through twice-area afforestation, accommodating 40% mortality allowance under Forest and Nature Conservation Rules and Regulations.

7.12 Biodiversity Conservation

Transmission line project anticipates no significant irreversible biodiversity changes, as alignment avoids unique wildlife habitats and creates no barriers to animal or bird movements. Temporary disruptions occur solely during pre-construction and construction phases; no net species loss expected.

Mitigation targets rare, endangered, or threatened species via minimal vegetation clearance confined to Forestry Department-marked trees; biodiversity surveys and monitoring plots established with input from Dzongkhag Forestry Officers, UWICE, and National Biodiversity Centre; RoW vegetation regrowth permitted to 2 m height for wildlife cover.

Poaching risks from worker intrusion addressed through mandatory Forest and Nature Conservation Act awareness for contractors and workers (emphasizing fines, penalties, job termination); enhanced patrolling by forestry staff supported by project resources; deployment of risups (village forest guards) for illegal activity alerts at camps and sites.

7.13 Muck Management

Excavation and muck disposal impacts confine to tower foundation sites, with maximum generation during 2 m benching clearance and minor volumes from pit excavations for footings. Approximately 50% of muck reuses in backfilling to minimize total volume and disposal needs.

7.14 Managing Risk of Slope Instability and Impact on Surface Waters

Tower footing excavations on steep slopes risk slope instability and landslides, with potential siltation impacts on aquatic ecology from rainfall runoff. Preconstruction siting prohibits towers near public streams, rivers, or water bodies, maintaining 30 m buffers to preserve drainage paths and minimize turbidity.

Excavated soil requires immediate backfilling or site removal, with loose material protected by mulch or tarpaulins against rainy season erosion. Excess soil dumps locate nearby, leveled without obstructing surface runoff or stream flows.

7.15 Closure Plans

(i) All buildings and service infrastructure will be de-constructed and recycled or disposed of as solid waste.

(ii) All equipment, debris, residual waste, etc. will be cleared from the site and disposed of according to the project solid waste management plan.

(iii) The remaining area, once cleared as described above, will be graded and prepared for re-vegetation (a target for compensatory Afforestation).

(iv) All camp sites will then be inspected, documented, and photographed as evidence of full camp closure; and

(v) Any material left after excavation and erection of the towers will be removed and low growing vegetation will be allowed to flourish for slope stabilization.

7.16 Mitigating Risk of Electrocution and Accidents during Maintenance Works

Operational Health and Safety measures from construction phase extend to operations, mandating workplace securing, PPE usage, and defined emergency/compensation procedures. BPC applies established OHS safeguards and compensation protocols across all transmission line sites.

7.17 Electromagnetic Field (EMF)

No significant environmental or human health effects anticipated from 400 kV line EMF exposure. Line routing maintains distance from settlements; 46-48 m RoW adheres to national and international standards.

7.18 Mitigating Risk and Hazard Associated with TL

i. During the design and Survey stage, selection of tower foundation areas is based on the soil conditions, topography and geological features along each of the sections of the transmission corridor and areas of potential slope instability, potential seismic risk, debris flows, and rock fall hazards are avoided at this stage to prevent mishaps in Operation and Maintenance.

ii. On the upper slopes of the TL, it may be necessary to cut down trees that may fall outside the range of required corridors. In such area(s), all trees/obstacles that may hit the conductor and or the transmission tower shall be felled. This will mitigate any risks of Trees or their branches from upper slopes falling on the TL during an earthquake or landslide.

iii. BPC must enforce appropriate building codes and infrastructure design to increase the ability of physical structure to withstand the impact of catastrophes.

iv. Raise public awareness of disasters, their risks and ways to cope with them.

v. Developing emergency protocols to be followed during emergencies cause by disasters/catastrophes; and

vi. Conduct regular check and maintenance. BPC conducts regular Operation and Maintenance of all TL lines to check on the conditions of all Tower locations and along the TL to ensure that towers are in good condition and wherever needed, retaining structures are constructed to stabilize these. Routine checks must also include removing overhanging trees and branches from upper slope likely to fall on the Conductors and removing these to prevent damaging the power line.

7.19 Mitigating Electrocution of Raptors and Other Large Birds

Mitigation measures to minimize the risk of electrocution include:

(i) Construction of cage boxes on conductors to prevent birds from sitting or making nests on the towers.

(ii) Placing colorful/fluorescent tape on the towers to make them conspicuous enough to enable birds to see them and avoid these while flying overhead or using marking devices of various shapes that can be attached to phase conductors.

(iii) Sufficient phase-to-phase and phase-to ground wire spacing is critical for large, winged birds. Jumper wires on all electrical equipment should be insulated, including at tap and dead-end locations.

(iv) Silhouette/Predator scaring method. Use of silhouettes of predators (falcon/hawk) as scary devices for repelling birds has been used in Netherlands, and proved to result in significant decrease in collision frequency; and

(v) Work closely with the Department of Forest to collect information on any reports of bird collisions/accidents due to the TL, to assess sensitive areas so that specific mitigation measures for high-risk areas can be undertaken. Also, the project can fund studies to be conducted on distribution of birds and density, seasonal patterns and migration corridors will help better design future mitigation measures.

8. Environmental Monitoring Program and Institutional Responsibilities

8.1 The Environmental Monitoring Program

The main objectives of environmental monitoring program are:

i. To assess the changes in environmental conditions.
ii. To monitor the effective implementation of mitigation measures; and
iii. To warn about significant deteriorations in environmental quality so that further prevention action can be undertaken.

BPCL Environmental Units will be responsible for ensuring the implementation of the environmental management plan (EMP). Table 41 shows the proposed EMP which specifies the various monitoring activities to be conducted during all phases, while Table 42 presents the environmental monitoring plan. Some of the measures have been consolidated to avoid repetition, and there has been some reordering to present together those measures that relate to the same activity or site. The EMP describes:

i. Impact.
ii. Mitigation measures.
iii. Responsibility for mitigation.
iv. Location.
v. Monitoring method.
vi. Frequency of monitoring; and
vii. Responsibility for monitoring

Table 32. Environmental impacts, significance, duration, and their mitigation

(Sign= Significance; S: Significant Impact, M: Medium Impact; NS: Impact Not Significant) (Dur=Duration; P: Permanent, T: Temporary)

	Activity	Potential Negative Impacts	Sign	Dur	Mitigation Activities and Method	Responsibility
PRECONSTRUCTION PHASE						
1	Acquisition of private land	1 acre of dryland required permanently for tower footings from 8 households	M	P	Selection of chosen TL alignment to avoid wetland; Substitution as per LACRR 2022; Follow Grievance Redress Mechanism.	BPC and Dzongkhag, NLC
PRECONSTRUCTION PHASE and CONSTRUCTION PHASE						
ECONOMIC IMPACTS						
2	Recruitment of local workers by Contractors	Positive increase in income and livelihood source	S	T	Project must employ as many locals as possible	BPC
SOCIAL IMPACTS						
3	Influx of construction workers	Risk of Communicable Diseases	M	T	Contractors should be encouraged to recruit locals; Initial screening of workers for HIV/STD; Provide camp clinics and regular screening for infection.	Contractor
		increased pressure on housing, infrastructure, services	S	T	Provision of adequate housing Provision of communal kitchen and sewerage facilities	Contractor
		increased pressure for water and fuelwood and LPG			Provision of drinking water, Request of quota for LPG, Fuel	Contractor, BPC
		Health and safety issues Workers at risk from accidents on site			Nomination of a Health and Safety Focal Person Follow Occupational Health and Safety Plan and BPC prescribed work safety measures; Provide PPE to all workers; Workers must be informed of risks at workplace Minimize hazards at the workplace Use signage and barricades at risky sites Ensure proper transportation, storage of hazardous materials Provision of vehicles on standby, communication and	Contractor, BPC

					emergency procedures Maintain record of accidents Provide compensation for injuries and accidents	
		Possible social instability	M	T	Locate Worker camps away from villages Workers briefed on required behavior towards host community and Codes of Conduct to be followed; Penalty for irresponsible behavior may result in unemployment	BPC, Contractor
4	Mobilization of Construction Equipment and Materials	Congestion and risk of accidents due to increase in vehicles and machines, and traffic	M	T	Stage delivery of required materials and equipment Store all construction equipment and materials at "off road" sites Post signs along the National Highway and use flag persons Move heavy machines only early mornings and late evenings	Contractor
		Workers exposed to air and noise pollution	M	T	Provide PPE for workers	BPC, Contractor
5	Impact on Cultural and Religious sites	Encroachment or disturbance to nearby religious and cultural sites	S	T	Consult all affected communities Consult the custodians of all social and cultural facilities	BPC, Contractor
6	Construction of TL	Reduction in visual aesthetics	NS	P	Green belt plantation	BPC, DoFPS, Local Forestry staff
7	Forest clearance activities	Work may create noise, dust & impede access	M	T	Work only during daytime, retain ground vegetation in RoW to reduce dust	Contractor
		Loss of visual aesthetics	NS	T	Green belt development	BPC, DoFPS, Local Forestry staff
ENVIRONMENTAL IMPACTS						
8	Influx of construction workers	Impact on forest if land is required to be cleared for worker camps	M	T	Locate worker camps in degraded sites where no clearing will be required	Contractor, BPC
		Increase in demand for firewood			Liaise with the DoFPS to utilize felled unusable trees as fuelwood	Contractor, BPC
		Emissions from stoves in worker camps	M	T	Provide electricity for cooking if possible; Use centralized kitchen to reduce use of fuelwood Air quality monitoring	BPC, Contractor

		Water Pollution and Waste Generation from construction camps	M	T	Follow Solid waste management system Provide sanitation facilities and sewerage collection and disposal.	Contractor
		Increase in demand for Water	M	T	Water sourcing and provision for all worker camps	Contractor
		Increase in risk of poaching by workers	M	T	Prohibit workers from hunting, fishing and enforce strictly; Brief workers on Forest and Nature Conservation Rules and penalties through awareness meetings/programs	Contractor, BPC
9	Mobilization of Construction Equipment and Materials	Air emissions and increased air pollution	M	T	Permit only those vehicles passing emission control tests by RSTA	BPC, Contractor
		Noise pollution from increase in traffic	M	T	Use of mufflers and emission control	BPC, Contractor
		Risk of landslides and erosion	M	T	Construct retaining walls and implementing land management plan	BPC, DoFPS, Local Forestry staff
		Potential disturbance to wildlife	M	T	Use noisy equipment only during daytime	Contractor
10	Forest clearance for Row	Reduction of forest cover	M	P	Implement Compensatory Afforestation plan,	BPC, DoFPS, Local Forestry staff
		Impacts on wildlife and bird habitat and distribution	M	P	Avoid felling of trees beyond RoW; Fell only trees marked by Forestry Field staff; Dispose of cut trees as required/instructed by Forestry Officials; Collaborate with DoFPS on a) strengthening research on wildlife/bird species distribution, habitat use; b) strengthen antipoaching and patrolling; c) ensure minimal clearing and disturbance of forest; d) revegetation of cleared areas on project completion	BPC, DoFPS, Local Forestry staff
		Impacts on air quality Dust may blow from areas cleared of vegetation in RoW	M	T	Retain short trees, shrubs and ground vegetation in RoW Allow cut materials to rot down in situ and do not burn Air quality monitoring	BPC, DoFPS, Local Forestry staff

		Workers could damage species & habitats outside RoW	M	T	Mark the boundaries of the RoW with tape and prohibit trespass outside	BPC, DoFPS, Local Forestry staff
11	Tower Foundation	Increase in demand for water for construction and curing works	M	T	Source water from nearby streams/rivers for construction activities	
		Muck generation from excavation works	M	T	Muck disposal and revegetation at all tower sites; Construct retaining walls and bioengineering if required	BPC, DoFPS, Local Forestry staff
		Risk of erosion and sedimentation of nearby streams	M	T	Keep all machines, fuel storage 30m from streams Water quality monitoring	Contractor
		Risk of slope instability	S	P	All towers must be located at least 30m from the nearest water source Tower footings will be located at stable locations; Site preparation must ensure that sediments are not mobilized. Implement tree cutting during dry season or before monsoon Allow ground vegetation shrubs to grow	BPC and Contractor
12	Stringing of Transmission lines	Possible obstruction and disturbance to wildlife from materials stored along the Length of TL	M	T	Remove all stored materials as soon as work is completed; Inform locals in advance of work schedule	Contractor
13	Construction of TL	EMF impacts			Phase cancellation Conductor separation Vertical Double-circuiting Conductor and OPGW spacing and Clearance Selection of conductors and OPGW. Maintain minimum distances and clearances as per standard norms	
14	Post Construction	Improper closure of project site sites	M	P	Follow closure plan for all worker camps, Contractor and storage sites, muck sites	Contractor, BPC
OPERATION PHASE						
ECONOMIC IMPACTS						

15	Removal of workers from site	Reduction in income from sale outlets	S	P	Local must be brief on project period and schedule	BPC
		Reduction in employment opportunities	S	P	Make locals aware from outset about temporary nature of employment	BPC
SOCIAL IMPACTS						
16	Removal of workers from site	No anticipated impacts		T		
17	Regular clearing of RoW	Risk of electrocution of Maintenance workers	M	T	Provide PPE to workers Follow OHS and emergency procedures in case of emergencies	BPC, Contractor
18	Operation and Maintenance of TL	Risk of electrocution of Maintenance workers and locals	M	T	Follow OHS and emergency procedures in case of emergencies Secure the workplace and shut down Power Use of PPE Inform locals in advance of maintenance work being carried out Educate Public and locals on risks of TL	BPC
ENVIRONMENTAL IMPACTS						
19	Regular clearing of RoW for maintenance	Permanent openings within Forest		P	Compensatory Afforestation	BPC, DoFPS, Local Forestry staff
		Visual impacts		P	green belt plantation	BPC, DoFPS, Local Forestry staff
20	Incomplete removal of project materials	Risk of soil, water, waste impacts from residuals left after project completion	M	P	Clean up of all worksites/work camps after project completion; Revegetation of all sites and hand over to Dzongkhag	BPC, Contractor
21	Electrocution of birds	Birds accidently hitting the TL leading to injuries and death			Construction of cage box on conductors Placing colorful/fluorescent tape on the Towers Sufficient phase-to-phase and phase-to ground wire spacing Silhouette/Predator scaring method. Collect information on bird collisions/accidents	BPC, Contractor
22	Disasters	Risks and hazards from catastrophes			selection of tower foundation areas based on detailed geological studies	BPC

					cut trees that may fall on TL from upper slopes enforce appropriate building codes and infrastructure design public awareness of disasters, developing emergency conduct regular checks and maintenance	

Table 33. Environmental Monitoring Plan

Impact	Mitigation Measure	Responsibility	Location	Monitoring	Monitoring Frequency	Monitoring Responsibility
	ECONOMIC					
Land compensation	LACRR 2022	BPC	Villages	Substitution/Compensation report	As needed	BPC
Local employment	Project must employ as many locals as possible	BPC	Villages	Contractor's meeting, public consultation	every 6 months	BPC
	Local must be aware of project period	BPC	Villages	Public consultation, Surveys	every 6 months	BPC
	Make locals aware from outset about temporary nature of employment	BPC	Villages	Public consultation, Surveys	every 6 months	BPC
	SOCIAL					
Employment	Project must employ as many locals as possible	BPC	Villages	Contractor's meeting, public consultation	every quarter	BPC
Worker camps	locate Worker camps away from villages	BPC, Contractor	Villages	Field observations	every quarter	BPC
Housing and sanitation	Provision of adequate housing and sanitation facilities	Contractor	Worker camps	Field observations	every quarter	BPC
Drinking water	Water sourcing and provision for all worker camps	Contractor	Worker camp	Field observations	Every quarter	BPC

Pressure on resources	Provide electricity for cooking if possible; Use centralized kitchen to reduce use of fuel wood	BPC, Contractor	Worker camp	Field observations	Every quarter	BPC
Waste generation	Follow Solid waste management system	Contractor	Worker camp	Field observations	Every quarter	BPC
Sewerage	Provide sanitation facilities and sewerage collection and disposal	Contractor	Worker camp	Field observations	Every quarter	BPC
Social conflict	Only locate worker camps in already cleared, disturbed areas	BPC, Contractor	Worker camp	Field observations	Every quarter	BPC
Poaching	Prohibit workers from hunting, fishing and enforce strictly	Contractor	Worker camp	Field observations	Every quarter	BPC
	Brief workers on Forest and Nature Conservation Rules and penalties	Contractor	Worker camp	Field observations	Every quarter	BPC
Worker health risks	Initial screening of workers for HIV/STD	Contractor	Worker camp	Field observations	Every quarter	BPC
	Provide camp clinics and regular screening for infection	Contractor	Worker camp	Field observations	Every quarter	BPC
Worker safety	Provide PPE (masks, gloves, boots) for workers	BPC, Contractor	Work site	Observations, reports	Every quarter	BPC
	Workers must be informed of risks at workplace	Contractor	Work site	Observations, reports	Every quarter	BPC
	Use signage and barricades at risky sites	Contractor	Work site	Observations, reports	Every quarter	BPC
	Ensure proper storage, transportation of materials	Contractor	Work site	Observations, reports	Every quarter	BPC

	Encourage project workers and Contractors to minimize travel and drop off for all construction materials	BPC, Contractor	Highway	Observations, reports	Every quarter	BPC
Impact on Religious sites	No Towers will be located nearby Such sites	BPC, Contractor	Villages	Public consultation, Field observations	During construction of towers	BPC
	Discuss with custodians/In-charge of Nunnery to inform about project activities	BPC, Contractor	Villages	Public consultation, Field observations	During construction of towers	BPC
	ENVIRONMENTAL					
Air pollution	Sprinkle water during excavation at tower footings	Contractor	Each tower foot	Field Observation	daily	BPC
Water sourcing and impacts on streams	Source water from nearby streams/rivers for construction activities		Work sites	Field Observation	Every quarter	BPC
	Keep all machines and fuel stored 30m from streams	Contractor	Work sites	Field Observation	Every quarter	BPC
	Muck disposal and revegetation plan	BPC, DoFPS, Local Forestry staff	Tower foundation site	Field Observation	Every quarter	BPC
Impact on Forest cover	Compensatory Afforestation	BPC, DoFPS, Local Forestry staff	Entire project area	Field Observation	Every quarter	BPC
Disturbance to wildlife and Biodiversity	Reduce RoW on valleys where this does not increase shorting risk	BPC, DoFPS, Local Forestry staff	RoW	Field Observation	every quarter	BPC
	Retain short trees, shrubs and ground vegetation in RoW	BPC, DoFPS, Local Forestry staff	RoW	Field Observation	every quarter	BPC

	Allow cut materials to rot down in situ and do not burn	BPC, DoFPS, Local Forestry staff	RoW	Field Observation	every quarter	BPC
	Avoid felling of trees beyond RoW	BPC, DoFPS, Local Forestry staff	RoW	Field Observation	every quarter	BPC
	Fell only trees marked by Forestry Field staff	BPC, DoFPS, Local Forestry staff	RoW	Field Observation	every quarter	BPC
	Dispose of cut trees as required/instructed by Forestry Officials	BPC, DoFPS, Local Forestry staff	RoW	Field Observation	every quarter	BPC
	Work only during daytime, Retain ground vegetation in RoW	Contractor	RoW	Field Observation	every quarter	BPC
Project Completion and Closure	Remove all stored materials as soon as work is completed	Contractor	All work sites	Field Observation	On completion of work	BPC
	Clean up of all worksites/work camps after project completion	BPC, Contractor	All work sites	Field Observation	On completion of work	BPC
EMF mitigation	Phase cancellation Conductor separation Vertical double-circuiting Conductor and OPGW spacing and clearance Selection of conductors and OPGW Maintain minimum distances and clearances as per standard norms	BPC	All towers	Field observation	During construction	BPC
Disasters	selection of tower sites	BPC	Tower foundation	Field observation	Pre-construction	BPC

	cut overhanging trees	BPC	RoW	Field observation	Pre-construction	BPC
	enforce appropriate building codes	BPC	Tower sites	Field observation	Construction	BPC
	public awareness	BPC	Local community	No. of meetings	Construction	BPC
	regular check and maintenance	BPC	Entire site	Field report	Operation	BPC
Operation & Maintenance	Follow OHS and emergency procedures in case of emergencies	BPC	Work site	Observations, reports	Every quarter	BPC

8.2 Institutional Responsibilities

The implementation of the TL will be managed within the institutional framework that already exists in BPC.

The roles and responsibilities are as follows:

(i) BPC is the Implementing Agency (IA), responsible for the successful construction and subsequent operation of this project. Implementation will be managed centrally by the Transmission Department, located in the BPC head office in Thimphu, who will appoint a Project Manager and other senior and junior staff from the existing personnel who will be responsible for local implementation of the project.

(ii) BPC, DoFPS, Land Record Officers, and the Gup will be responsible for executing all Land Compensation Measures, transfer of Thram (land title) as well as assisting farmers in developing the newly exchanged land into agriculturally productive parcels of land. All grievances will also be dealt with by these offices.

(iii) BPC and selected contractors will be responsible for the following:

- Proper sitting of all project offices, labor camps.
- Provision of water, fuel, wood, gas, electricity for all temporary offices and worker camps.
- Sewerage and sanitation of all sites.
- Waste management.
- Staging and movement of machines and vehicles and construction materials to project sites.
- Development of muck disposal sites.
- Fuel storage.
- Operational Health and Safety of all workers; and
- Closure of all work sites, staff quarters, temporary storage sites.

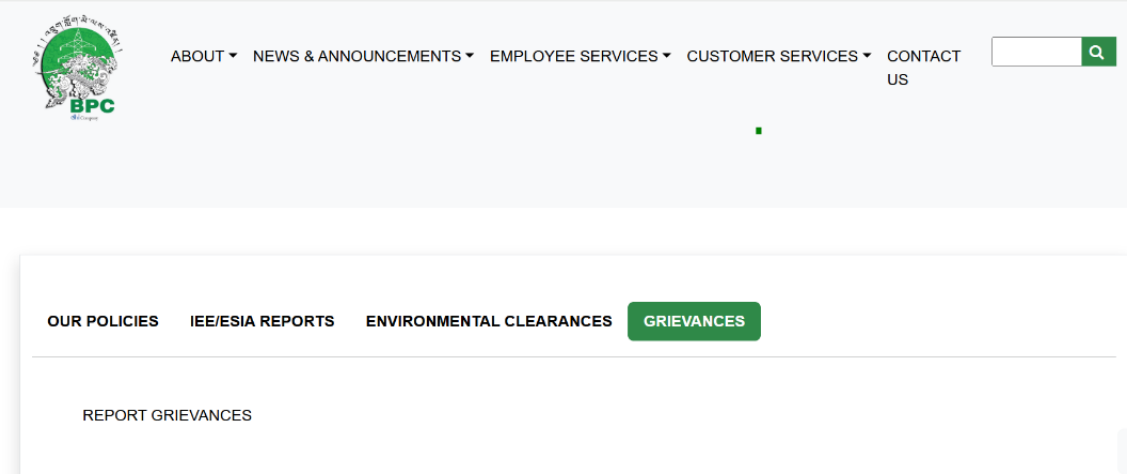
(iv) Contractors will be held responsible by the BPC for the following:

- Screening of all workers prior to being employed.
- Provision of PPE for workers and availability of first aid, emergency health care; and
- Prohibiting workers from a) social instability and mingling with locals, poaching and fishing restrictions, health risks and safety issues.

9. Grievance Redress Mechanism

A project-specific GRM will be established and managed by the Construction Project Office (CPO) to ensure accessible, transparent, and timely resolution of grievances. The Project Manager (PM) holds overall responsibility for implementation and operation of the GRM. The mechanism is designed to receive, address, and resolve complaints from affected people regarding land acquisition, compensation, resettlement, and any other project-related concerns, aiming to resolve issues at the project level and prevent escalation to national courts.

Grievances may be submitted orally or in writing, including via an online platform accessible through the BPC website (https://www.bpc.bt/environmental). Additionally, a pamphlet in Dzongkha will be distributed to stakeholders, which contains detailed GRM process, contact information for the CPO Grievance Focal Points, and the project's objectives will be distributed in Dzongkha during construction consultations.



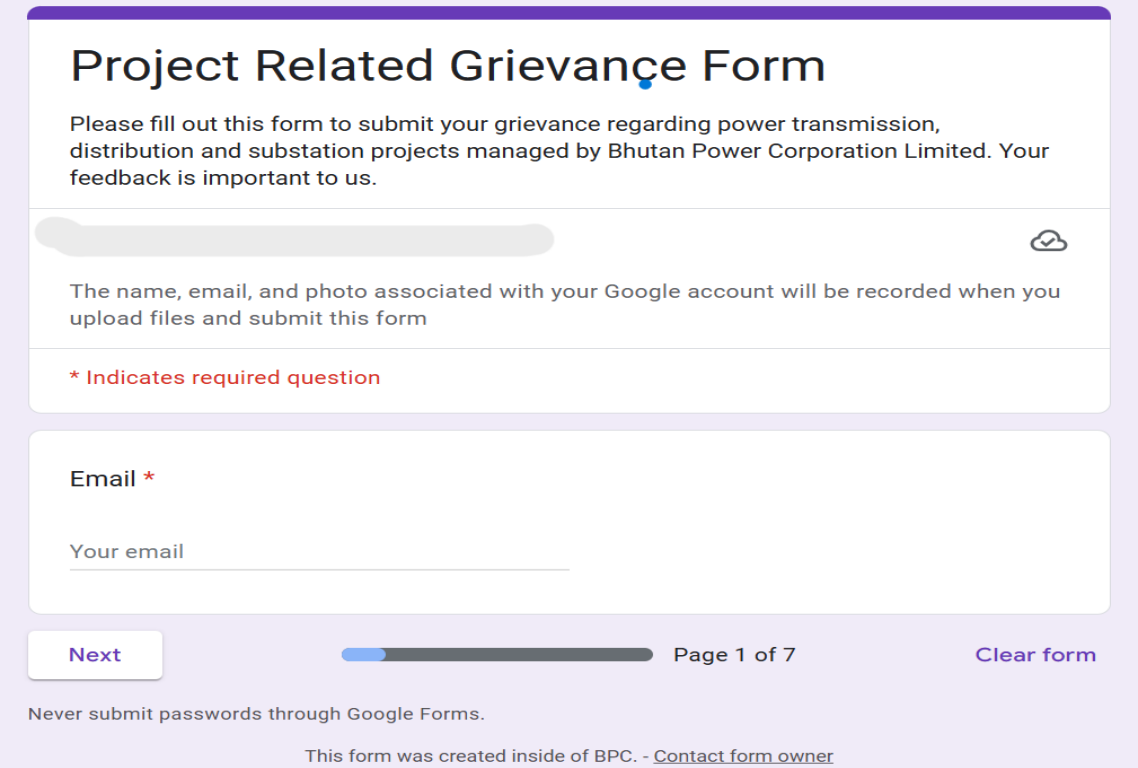


Figure 17. Online GRM Form

9.1 Grievance Redress Process and Timeframe

The GRM operates through multiple redressal levels:

Step 1: Informal Resolution

i. Community members should first attempt to resolve grievances informally with the company's local field staff or community liaison officer (CLO).
ii. If unresolved within five working days, the grievance proceeds to formal submission.

Step 2: Formal Grievance Submission

i. Community members can submit grievances through:
   a) Written forms (available at local offices and online, in local languages and pictorial formats for accessibility)
   b) Dedicated email address or hotline (with assistance for those with limited literacy)
   c) Grievance boxes placed in accessible community centers and public spaces
ii. The grievance should include:
   a) Name and identification of the parties to the dispute.

b) The identity of the complainant or the victim shall be optional (for anonymity).
c) The place where the dispute exists.
d) Subject matter of the dispute.
e) Description of the issue with relevant details (dates, incidents, witnesses, etc.).
f) Desired resolution or outcome.

Step 3: Acknowledgment

i. The Grievance Redressal Officer (GRO) or CLO shall acknowledge receipt within 48 hours and provide a resolution timeline.

Step 4: Investigation

i. The Grievance Redressal Committee (GRC), comprising the GRO, CLO (as permanent members), and additional members as needed (ensuring gender and social diversity), conducts a thorough and impartial investigation.
ii. For complex cases, a small investigation sub-committee (1–2 permanent members, with additional ad hoc members as needed) may be formed to ensure impartiality and practicality.
iii. Investigation methods include site visits, interviews, and document review.
iv. Investigations are completed within 7–14 days, depending on complexity.

Step 5: Resolution

i. Based on investigation findings, the GRC proposes a resolution, which may include:
a) Corrective actions (for instance repairing equipment, resolving billing errors, infrastructure repairs)
b) Compensation for damages or losses
c) Policy changes or community engagement initiatives
d) Referral to external authorities if necessary
ii. Resolution actions are aligned with the specific types of grievances reported (for instance power supply, construction impacts, environmental or social issues).
iii. Resolution is communicated in writing to the complainant and, if applicable, the community.

Step 6: Appeal

i. If the complainant is dissatisfied with the resolution, they may appeal to a higher authority (e.g., a senior GRC panel or regulatory body) within 7 days of receiving the decision.

ii. The appeal shall be reviewed, and a final decision shall be communicated within 14 days from the receipt of appeal.

Step 7: Closure

i. The appellate body's decision shall be final and the case is formally closed with confidential record-keeping.

The complainant, without prejudice and discrimination, shall have the right to withdraw the complaint after submission of a written application at any stage of dispute resolution.

9.2 GRM Records and Documentation

- ✓ All grievances and their resolutions shall be documented and stored securely.
- ✓ Records shall be maintained for at least 3 years or as per legal requirements.
- ✓ Data shall be anonymized for reporting and analysis purposes.

The CGRM process is shown below in **Figure 18**.

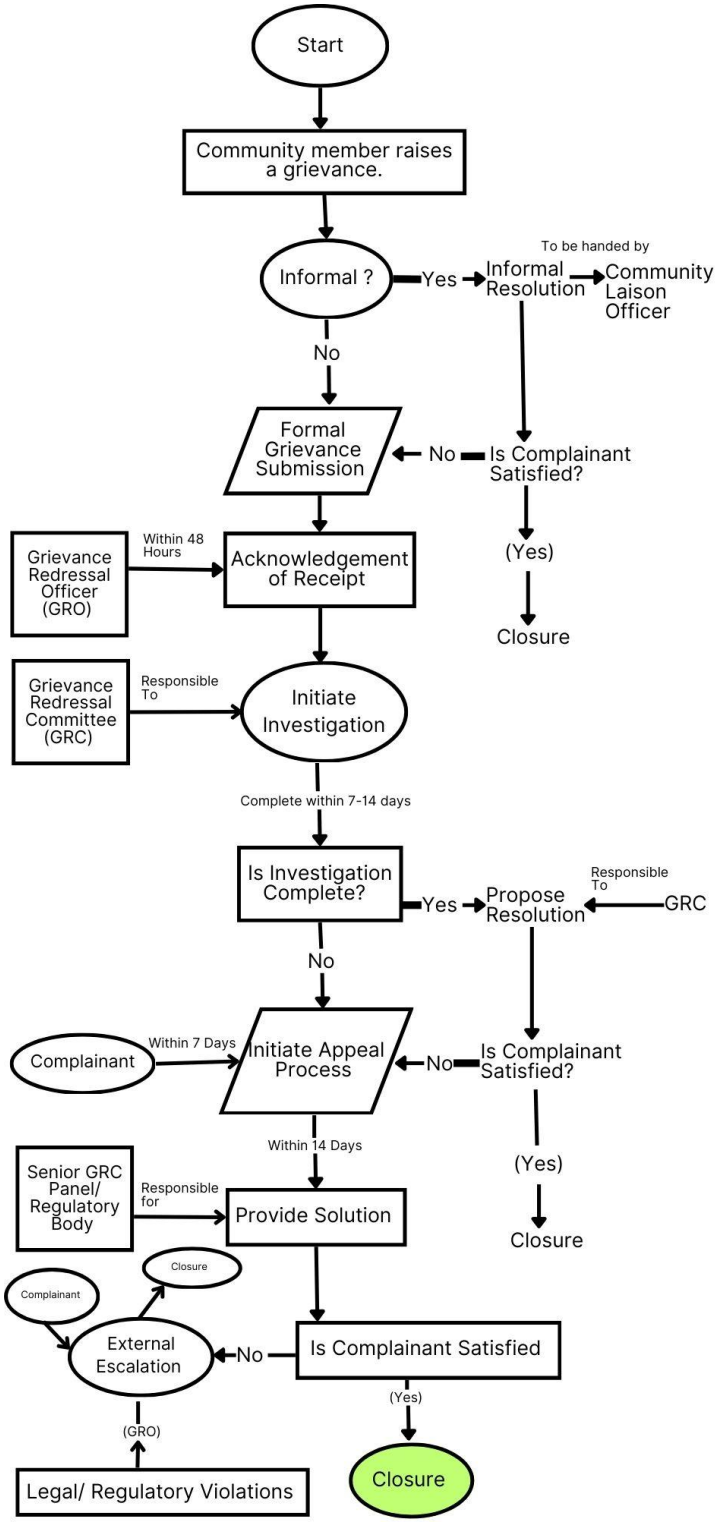


Figure 18. CGRM Process Map

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Annex-1: Gewog and CFMG Clearance and Public Consultation ROD

Thangrong Gewog Clearance.pdf	Ramjar Gewog Clearance.pdf	Narang Gewog Clearance.pdf	Kengkhar Gewog Clearance.pdf	Jamkhar Gewog Clearance.pdf	Dungmin Gewog Clearance.pdf
Dremetse Gewog Clearance.pdf	chimung Gewog Clearance.pdf	Chaskhar Gewog Clearance.pdf	Tongmijangsa Gewog Clearance.pdf	Bjoka Clearance_1.8.2025.pd	Bardo Gewog Clearance_25.7.2025.p
Trong Gewog Clearance_14.7.2025.p	Nangkor Gewog Clearance_16.7.2025.p	Kharamree_CF_Clearance.pdf	Gongdue Gewog_Clearances_8.	Dungmin_Clearances_8.8.2025.pdf	Bjoka Tsarzo_Clearance.pdf

Annex-2: Gewog and CFMG Clearance and Public Consultation ROD

Geographical coordinates of tower points and its types

1. *Tower point from Corlung PH till Durungri PS*

Tower Number	Easting	Northing	RL	Ahead Span	Angle of Deviation	Tower Type	Attachment height
SS	950953.4	3040168	813.487	534.77		DD+9MBE	66.14
CD01	950709	3039692	823.053	829.328	11.3157	DDS+25MBE	82.14
CD02	950192.7	3039043	808.567	293.802	0.3948	DD+25MBE	82.13
CD03	950008.3	3038815	962.652	408.518	-32.9762	DD+6MBE	63.13
CD03A	949966.1	3038408	873	1109.011	-31.0593	DDS+25MBE	82.14
CD04	950437.2	3037404	1078	356.145	-6.1739	DDS+18MBE	75.14
CD05	950622.3	3037100	1142.221	176.286	6.0774	DD+3MBE	60.13
CD06	950697.4	3036940	1096.296	919.992	24.8396	DD+18MBE	75.13
CD07	950703.8	3036021	966.614	319.633	22.9231	DD+18MBE	75.13
CD08	950581.3	3035725	1063.5	91.872	-1.6837	DDS+3MBE	60.13
CD09	950548.6	3035639	1088.333	125.402	6.2579	DBS+0MBE	48.32
CD10	950491.5	3035528	1111.08	408.715	12.1121	DCS+6MBE	54.95
CD11	950233.1	3035211	1204.402	821.223	-20.4454	DDS+9MBE	66.14
CD12	949968.8	3034434	1091.377	798.769	9.763	DD+9MBE	66.14
CD13	949587.3	3033732	1092.084	667.051	-1.705	DD+3MBE	60.13
CD14	949286.2	3033137	1228.62	382.907	-6.525	DBS+9MBE	57.32
CD15	949153.4	3032777	1246.162	1009.949	9.8514	DD+9MBE	66.14
CD16	948646.1	3031904	1198	364.414	17.2458	DDS+25MBE	82.14

CD17	948377.8	3031657	1336	250.453	-2.4014	DBS+0MBE	48.32
CD18	948200.7	3031480	1366	349.245	14.3543	DCS+0MBE	48.95
CD19	947900.3	3031302	1300	889.05	7.0488	DC+9MBE	57.95
CD20	947085.6	3030946	1201	818.425	-27.9557	DD+3MBE	60.13
CD21	946576.7	3030305	1299	785.769	21.3818	DC+3MBE	51.95
CD22	945897.4	3029911	1434	1421.553	2.6262	DDH+0MBE	57.36
CD23	944637	3029253	859	593.793	-6.4675	DDS+25MBE	82.14
CD24	944144.8	3028921	857	1008.106	-15.9784	DD+25MBE	82.13
CD25	943496.7	3028149	956	124.584	42.3079	DD+18MBE	75.13
CD26	943373.2	3028132	1153	598.019	-11.8768	DCS+0MBE	57.95
CD27	942809.7	3027932	1213	423.67	9.5228	DCS+0MBE	48.95
CD28	942392.5	3027858	1145	113.074	7.9853	DB+9MBE	57.32
CD29	942279.5	3027854	1231	638.196	-28.5816	DC+6MBE	54.95
CD30	941730.4	3027529	1170	435.668	1.7722	DCS+0MBE	57.95
CD31	941348.8	3027319	1047	746.468	-10.6458	DD+3MBE	60.13
CD32	940772.9	3026844	1001	493.896	-12.5854	DC+6MBE	54.95
CD33	940469.5	3026454	1167.972	253.837	23.6736	DCS+3MBE	51.95
CD34	940246.2	3026333	1217.958	288.769	0.8423	DCS+3MBE	51.95
CD35	939990.3	3026199	1208.63	764.179	-12.4812	DD+3MBE	60.13
CD36	939405.4	3025708	1094.112	1360.236	13.0619	DDH+9MBE	66.36
DC37	938193.3	3025090	1163	720.114	-12.6258	DDH+0MBE	57.36
CD38	937638.7	3024631	1043.251	987.99	-11.7541	DD+18MBE	75.13
CD39	937022	3023859	981.121	391.25	25.2388	DDS+3MBE	60.13
CD40	936670.7	3023687	889	1675.586	-31.9683	DDH+3MBE	60.36
CD41	935785.4	3022264	1022.634	157.463	40.1698	DDS+25MBE	82.14
CD42	935635.6	3022216	1092.918	490.529	-23.7858	DC+9MBE	57.95
CD43	935269.5	3021889	1187	216.772	6.125	DDS+3MBE	60.13
CD44	935093.2	3021763	1157	436.669	-10.6353	DCS+3MBE	51.95
CD45	934791.2	3021448	1079	502.294	2.7046	DB+9MBE	57.32
CD46	934427	3021102	1157	247.647	-10.2537	DC+9MBE	57.95

CD47	934280.7	3020902	1305	236.154	-1.5477	DBS+6MBE	54.32
CD48	934146.3	3020708	1535	193.144	39.8195	DD+6MBE	63.13
CD49	933960.2	3020656	1536	250.116	-12.3916	DB+3MBE	51.32
CD50	933739.2	3020539	1576	203.613	-7.1471	DD+3MBE	60.13
CD51	933572.5	3020422	1416	1333.54	-7.5744	DDH+3MBE	60.36
CD52	932591.2	3019519	1338	239.841	-9.1747	DDH+3MBE	60.36
CD53	932442.9	3019331	1473	274.752	3.1355	DD+0MBE	57.13
CD54	932261.4	3019124	1566	304.986	-5.8547	DB+9MBE	57.32
CD55	932084.4	3018876	1693	198.76	-1.0256	DBS+0MBE	48.32
CD56	931971.9	3018712	1789	146.593	-3.6611	DB+6MBE	54.32
CD57	931896.9	3018586	1854	657.558	-51.637	DD+3MBE	60.13
CD58	932130.8	3017972	2129	320.265	17.9517	DCS+6MBE	54.95
CD59	932147	3017652	2125	1345.727	36.2524	DD+9MBE	66.14
CD60	931406.9	3016528	1863.366	315.671	-47.3094	DDS+9MBE	66.14
CD61	931483	3016221	1810.538	179.753	-16.8526	DCS+3MBE	51.95
CD62	931575	3016067	1820.822	402.333	19.6504	DCS+6MBE	54.95
CD63	931652.8	3015672	1716.19	188.799	-30.1149	DDS+9MBE	66.14
CD64	931777.3	3015530	1657.706	493.531	13.3622	DD+18MBE	75.13
CD65	932008.3	3015094	1549.515	344.081	-23.8122	DC+9MBE	57.95
CD66	932278.3	3014881	1427.5	246.521	9.3033	DB+9MBE	57.32
CD67	932444.6	3014699	1329.394	368.065	-16.0684	DD+18MBE	75.13
CD68	932758.3	3014507	1040.928	192.595	10.251	DD+25MBE	82.13
CD69	932902	3014378	1089	505.863	54.102	DD+9MBE	66.14
CD70	932850.2	3013875	860.573	1159.004	15.1295	DD+9MBE	66.14
CD71	932436.1	3012792	961.468	238.115		DD+9MBE	66.14
CD72	932407.1	3012556	1088.93	190.452	4.1949	DD+3MBE	60.13
CD73	932370.1	3012369	1179.571	223.755	-11.8089	DB+6MBE	54.32
CD74	932372.5	3012146	1213.733	224.128	34.8233	DD+3MBE	60.13
CD75	932246.4	3011960	1218.675	1732.713	4.4951	DDH+3MBE	60.36
CD76	931162.8	3010608	1310.339	169.751	-8.79	DDH+3MBE	60.36

CD77	931078.1	3010461	1393.74	389.795	-30.883	DD+3MBE	60.13
CD78	931084.6	3010071	1363.449	443.939	-4.1603	DB+9MBE	57.32
CD79	931124.3	3009629	1347.635	110.72	-23.3858	DC+9MBE	57.95
CD80	931177.1	3009532	1295.285	807.316	12.6453	DD+9MBE	66.14
CD81	931397.8	3008755	1211.154	1025.781	23.0132	DDS+9MBE	66.14
CD82	931270	3007738	831.932	326.922	8.3512	DD+18MBE	75.13
CD83	931182.7	3007422	848	1316.632	9.8405	DD+9MBE	66.14
CD84	930619.1	3006233	983	126.54	18.6166	DD+9MBE	66.14
CD85	930531.3	3006141	983	374.934	23.2539	DDS+0MBE	57.13
CD86	930185.6	3005996	846	822.878	7.0912	DDS+18MBE	75.14
CD87	929393.4	3005774	702	656.674	-49.482	DD+6MBE	63.13
CD88	929117.7	3005178	695	535.493	3.1433	DD+25MBE	82.13
CD89	928866.6	3004705	950	252.175	21.6937	DD+25MBE	82.13
CD90	928674.4	3004541	1074	175.066	-11.7416	DB+3MBE	51.32
CD91	928566.8	3004403	1109	260.675	-28.7591	DDS+6MBE	63.13
CD92	928525.3	3004146	1268	492.414	22.9022	DDH+0MBE	57.36
CD93	928263.9	3003729	983	879.137	19.9013	DDS+25MBE	82.14
CD94	927571.5	3003187	626	430.34	0.1827	DDS+25MBE	82.14
CD95	927231.7	3002923	564	585.246	-23.8777	DC+3MBE	51.95
CD96	926954.5	3002407	641	464.357	-1.4425	DBS+9MBE	57.32
CD97	926745	3001993	537	1251.926	-12.1134	DD+9MBE	66.14
CD98	926427.1	3000782	336	304.007	22.9339	DD+9MBE	66.14
CD99	926241.4	3000541	320	259.236	7.1505	DD+6MBE	63.13
CD100	926058.7	3000358	548	578.934	-27.7152	DD+25MBE	82.13
CD101	925888.7	2999804	583	326.795	38.0422	DD+25MBE	82.13
CD102	925620.6	2999617	743	387.461	1.8794	DBS+9MBE	57.32
CD103	925295.6	2999406	825	750.518	-27.8319	DCS+6MBE	54.95
CD104	924929.8	2998751	1002	303.335	-4.9984	DBS+3MBE	51.32
CD105	924805.6	2998474	1065	244.382	13.4269	DB+6MBE	54.32
CD106	924656.5	2998281	1157.128	347.622	-24.1678	DC+9MBE	57.95

CD107	924575.7	2997942	1296.242	512.321	49.0463	DDS+9MBE	66.14
CD108	924121.4	2997706	1089.785	1881.551	-13.1689	DDH+9MBE	66.36
CD109	922694.7	2996479	1146	172.422	31.3554	DDH+9MBE	66.36
CD110	922524.6	2996451	1146	204.577	-32.0098	DD+3MBE	60.13
CD111	922371	2996316	1217	261.469	2.03	DB+3MBE	51.32
CD112	922168.7	2996150	1265	258.858	-28.5976	DC+3MBE	51.95
CD113	922071.4	2995910	1305	359.915	24.2061	DC+3MBE	51.95
CD114	921811.2	2995662	1340	368.763	11.3961	DBS+3MBE	51.32
CD115	921499.5	2995465	1406	248.4	-27.7295	DCS+3MBE	51.95
CD116	921375.5	2995249	1517	276.69	-26.1165	DCS+3MBE	51.95
CD117	921357	2994973	1492	348.856	14.3986	DB+3MBE	51.32
CD118	921247.7	2994642	1523	265.593	-29.6527	DC+6MBE	54.95
CD119	921300.3	2994382	1442	985.737	44.8079	DD+9MBE	66.14
CD120	920757.7	2993559	1442.209	333.742	32.2487	DD+9MBE	66.14
CD121	920453.7	2993421	1467.498	441.922	-10.4685	DCS+6MBE	54.95
CD122	920090.9	2993169	1337.708	127.658	-20.0859	DCS+6MBE	54.95
CD123	920017.5	2993064	1312.74	1188.778	41.6767	DDS+9MBE	66.14
CD124	918860.3	2992792	954.097	344.658	-13.1073	DD+9MBE	66.14
CD125	918551.4	2992639	823.333	166.517	8.9352	DDS+3MBE	60.13
CD126	918392.5	2992589	770.844	1352.105	-18.5677	DDH+6MBE	63.36
CD127	917298.2	2991795	674.934	110.752	42.3191	DDH+3MBE	60.36
CD128	917188.2	2991807	653.97			DD+9MBE	66.14

2. *Tower Point from Durungri PS till Goling SS.*

Structure Number	Station	Easting	Northing	RL	Ahead span	Angle of Deviation	Tower Type	Attachment Height
1		321476	2985552	404	789.573		DD+6MBE	63.13
2	789.573	321325	2984777	393	404.323	16.3636	DC+0MBE	48.95
3	1193.896	321139	2984418	381	395.297	-8.4956	DB+9MBE	57.32
4	1589.194	321011	2984044	377	378.058	10.9268	DB+9MBE	57.32
5	1967.252	320823	2983716	497	393.273	8.1571	DBS+9MBE	57.32
6	2360.525	320581	2983406	584	406.263	28.6761	DD+9MBE	66.14
7	2766.789	320208	2983245	515	318.981	27.8419	DD+9MBE	66.14
8	3085.77	319890	2983270	400	869.058	28.244	DDH+18MBE	75.36
9	3954.827	319159	2983740	314	351.832	-21.4293	DD+9MBE	66.14
10	4306.66	318814	2983809	383	412.331	15.193	DC+0MBE	48.95
11	4718.991	318445	2983993	579	307.278	21.399	DCS+0MBE	48.95
12	5026.269	318239	2984221	749	1186.144	-32.4011	DDH+18MBE	75.36
13	6212.413	317096	2984538	1190	1247.065	9.9546	DDH+6MBE	63.36
14	7459.479	315970	2985074	1598	441.461	-6.6922	DDH+6MBE	63.36
15	7900.94	315552	2985216	1541	541.181	-20.2457	DC+9MBE	48.95
16	8442.121	315011	2985202	1395	720.081	10.5915	DC+9MBE	48.95
17	9162.202	314300	2985316	1391	531.204	23.5937	DD+9MBE	66.14
18	9693.407	313853	2985603	1485	344.006	-33.0359	DD+6MBE	63.13
19	10037.412	313509	2985601	1475	618.634	2.9273	DB+6MBE	54.32
20	10656.046	312891	2985629	1451	387.738	-9.4076	DB+3MBE	51.32
21	11043.785	312506	2985583	1448	755.604	19.8933	DD+9MBE	66.14
22	11799.389	311770	2985754	1331	523.646	7.2585	DC+0MBE	48.95
23	12323.034	311279	2985936	1415	397.141	-8.7172	DC+6MBE	54.95

24	12720.175	310890	2986016	1454	513.858	-0.9673	DBS+0MBE	48.32
25	13234.033	310385	2986111	1341.531	307.717	-14.5671	DC+3MBE	51.95
26	13541.751	310078	2986090	1345.015	628.033	22.5789	DD+6MBE	63.13
27	14169.784	309483	2986291	1183	385.126	9.0304	DCS+0MBE	48.95
28	14554.91	309142	2986470	1003.959	1245.129	7.8575	DDH+9MBE	66.36
29	15800.039	308129	2987194	1142.619	847.977	10.5452	DDH+9MBE	66.36
30	16648.016	307541	2987805	1095.837	690.299	-3.976	DC+0MBE	48.95
31	17338.315	307029	2988268	1001.569	359.235	2.2004	DB+0MBE	48.32
32	17697.55	306772	2988519	932.22	899.65	-11.8521	DC+0MBE	48.95
33	18597.2	306013	2989002	956.989	416.941	-23.6414	DD+9MBE	66.14
34	19014.141	305601	2989066	1038.239	789.215	5.4002	DC+0MBE	48.95
35	19803.357	304836	2989260	1058.72	426.287	42.1546	DD+0MBE	57.13
36	20229.644	304600	2989615	1146.164	453.998	-10.6706	DC+0MBE	48.95
37	20683.642	304283	2989940	1403.014	405.927	2.7815	DDS+9MBE	66.14
38	21089.569	304014	2990244	1515.939	242.786	-34.9171	DD+0MBE	57.13
39	21332.355	303778	2990301	1592.44	854.005	2.8831	DD+9MBE	66.14
40	22186.361	302959	2990543	1829.747	238.757	24.9728	DD+9MBE	66.14
41	22425.118	302780	2990701	1919.659	223.949	-19.6803	DCS+0MBE	48.95
42	22649.066	302572	2990784	2000	589.574	-24.2814	DD+3MBE	60.13
43	23238.64	301983	2990758	2047	508.099	-18.5828	DD+9MBE	66.14
44	23746.739	301509	2990575	1837	728.989	31.9425	DD+6MBE	63.13
45	24475.728	300793	2990712	1826	508.768	32.0173	DDS+9MBE	66.14
46	24984.497	300420	2991058	1368	474.009	10.6433	DC+9MBE	48.95
47	25458.506	300138	2991439	1591	1266.195	-14.1333	DDH+9MBE	66.36
48	26724.701	299159	2992242	1349	347.403	-24.0031	DDH+9MBE	66.36
49	27072.104	298824	2992334	1350	1503.796	6.0559	DDH+9MBE	66.36
50	28575.9	297424	2992883	1338	310.886	-12.3438	DDH+9MBE	66.36
51	28886.786	297117	2992932	1429	450.724	22.5058	DC+0MBE	48.95

52	29337.51	296733	2993168	1478	328.495	-9.7728	DB+3MBE	51.32
53	29666.005	296428	2993290	1475	580.401	-34.1375	DD+3MBE	60.13
54	30246.405	295861	2993166	1356	532.752	4.6775	DB+3MBE	51.32
55	30779.158	295333	2993095	1293	380.548	-9.3002	DB+3MBE	51.32
56	31159.706	294969	2992984	1245	455.247	-18.0229	DC+3MBE	51.95
57	31614.953	294596	2992723	1215	795.812	-2.205	DC+9MBE	48.95
58	32410.765	293962	2992242	1035	1112.036	-2.1571	DD+9MBE	66.14
59	33522.802	293102	2991537	1031	362.035	-19.5568	DD+9MBE	66.14
60	33884.836	292915	2991227	1039	1079.182	24.9307	DD+6MBE	63.13
61	34964.018	292020	2990624	1340	447.091	32.8164	DD+9MBE	66.14
62	35411.109	291573	2990615	1356	347.576	-18.1677	DC+3MBE	51.95
63	35758.685	291245	2990500	1324	589.281	3.1621	DCS+0MBE	48.95
64	36347.966	290679	2990336	1025	578.25	-8.1455	DC+6MBE	54.95
65	36926.216	290152	2990098	929	459.971	0.8606	DB+6MBE	54.32
66	37386.186	289730	2989915	876	305.287	-8.1636	DB+3MBE	51.32
67	37691.473	289470	2989755	828	520.485	11.2576	DB+3MBE	51.32
68	38211.958	288982	2989574	874	689.088	21.2646	DD+6MBE	63.13
69	38901.046	288293	2989585	737	1532.551	46.7563	DDH+9MBE	66.36
70	40433.597	287261	2990718	723	339.438	-1.9548	DDH+9MBE	66.36
71	40773.035	287024	2990961	808	427.479	6.3148	DBS+6MBE	54.32
72	41200.514	286761	2991298	852	505	-15.1611	DC+3MBE	51.95
73	41705.514	286357	2991601	1113	470.405	0.268	DBS+3MBE	51.32
74	42175.919	285982	2991885	1086	312.083	36.8663	DD+3MBE	60.13
75	42488.002	285896	2992185	1029	1535.663	-33.1762	DDH+9MBE	66.36
76	44023.665	284734	2993189	1109	457.581	7.5385	DDH+9MBE	66.36
77	44481.246	284430	2993531	1308	462.039	-10.7525	DCS+3MBE	51.95
78	44943.285	284064	2993813	1148	701.679	25.7114	DD+9MBE	66.14
79	45644.964	283749	2994440	1048	1465.629	-15.394	DDH+9MBE	66.36

80	47110.593	282767	2995528	1479	357.095	-8.0437	DDH+9MBE	66.36
81	47467.688	282493	2995757	1300	675.873	14.8702	DD+3MBE	60.13
82	48143.561	282103	2996309	1057	1298.359	-10.5069	DDH+9MBE	66.36
83	49441.92	281173	2997215	1217	666.796	19.107	DDH+9MBE	66.36
84	50108.716	280874	2997811	1198	374.214	-4.5844	DB+3MBE	51.32
85	50482.93	280680	2998131	1222	1208.202	-22.0176	DD+9MBE	66.14
86	51691.132	279712	2998854	1156	283.219	3.2308	DD+9MBE	66.14
87	51974.351	279495	2999036	1132	237.154	-7.0339	DB+9MBE	57.32
88	52211.505	279296	2999165	1136	399.396	-14.5634	DC+3MBE	51.95
89	52610.901	278917	2999291	1101	655.623	8.449	DDS+6MBE	63.13
90	53266.523	278332	2999587	843	1086.763	11.0225	DD+9MBE	66.14
91	54353.286	277474	3000254	816	1548.352	-23.9595	DDH+9MBE	66.36
92	55901.638	275971	3000626	809	334.67	3.1256	DDH+9MBE	66.36
93	56236.308	275651	3000724	730	867.42	7.2035	DDH+18MBE	75.36
94	57103.728	274860	3001080	908	258.043	16.6836	DDH+18MBE	75.36
95	57361.77	274665	3001249	814	596.8	3.9498	DBS+6MBE	54.32
96	57958.57	274242	3001670	572	585.243	-2.1493	DB+6MBE	54.32
97	58543.813	273812	3002067	555			DD+0MBE	57.13

Annex-3: Wet Season Baseline Data

Sampling location with geographic coordinates and elevation for the 400kV D/C EWTLP.

Sample ID	Location	Latitude (N)	Longitude (E)	Elevation (m)
KW1	Dangmechu Upstream	27°24'51.48''	91°52'24.60''	811
KW2	Dangmechu Downstream	27°24'16.02''	91°33'15.07''	792
KW3	Tshergom Tributary	27°24'00.98''	91°33'02.17''	810
KW4	Jamkhardrang chu Upstream	27°22'52.22''	91°32'52.22''	930
KW5	Jamkhardrang chu Downstream	27°22'36.51'	91°33'14.96''	790
KW6	Rolong	27°19'14.61''	91°29'49.44''	775
KW7	Sherichu Downstream	27°15'56.24'	91°24'08.15''	623
KW8	Sherichu Upstream	27°15'29.19''	91°24'27.52''	598
KW9	Manas Upstream	27°57'55.16''	91°11'01.40''	239
KW10	Manas Downstream	27°57'35.92''	91°10'33.87''	237
KW11	Mangdechu Upstream	27°07'09.53''	90°42'57.56''	478
KW12	Mangdechu Downstream	27°07'26.53''	90°43'26.31''	469

Taxonomic classification and conservation status of documented plant species along the 400 kV D/EWTLP during the wet season.

Sl. No	Class	Order	Family	Species	IUCN Status
1	Liliopsida	Alismatales	Araceae	*Amorphophallus bulbifer*	NE
2	Liliopsida	Alismatales	Araceae	*Arisaema echinatum*	NE
3	Liliopsida	Alismatales	Araceae	*Pothos cathcartii*	NE
4	Liliopsida	Alismatales	Araceae	*Raphidophora hookeri*	NE
5	Liliopsida	Alismatales	Araceae	*Remusatia hookeriana*	NE
6	Liliopsida	Alismatales	Alismataceae	*Sagittaria sp*	NE
7	Liliopsida	Asparagales	Asparagaceae	*Asparagus racemosus*	LC
8	Liliopsida	Asparagales	Hypoxidaceae	*Hypoxis aurea*	NE
9	Liliopsida	Asparagales	Hypoxidaceae	*Molineria capitulata*	NE
10	Liliopsida	Asparagales	Orchidaceae	*Cymbidium lancifolium*	LC
11	Liliopsida	Commelinales	Commelinaceae	*Murdannia sp*	NE
12	Liliopsida	Dioscoreales	Dioscoreaceae	*Dioscorea bulbifera*	LC
13	Liliopsida	Dioscoreales	Dioscoreaceae	*Dioscorea hispida*	NE
14	Liliopsida	Dioscoreales	Dioscoreaceae	*Dioscorea pentaphylla*	NE
15	Liliopsida	Liliales	Smilacaceae	*Smilax lanceolata*	NE
16	Liliopsida	Pandanales	Pandanaceae	*Pandanus unguifer*	NE
17	Liliopsida	Poales	Poaceae	*Cymbopogon bhutanicus*	NE

18	Liliopsida	Poales	Poaceae	*Cymbopogon flexuosus*	LC
19	Liliopsida	Poales	Poaceae	*Oplismenus compositus*	NE
20	Liliopsida	Poales	Poaceae	*Oplismenus sp*	NE
21	Liliopsida	Poales	Poaceae	*Thysanolaena latifolia*	NE
22	Liliopsida	Zingiberales	Costaceae	*Costus speciosus*	LC
23	Liliopsida	Zingiberales	Zingiberaceae	*Globba clarkei*	NE
24	Liliopsida	Zingiberales	Zingiberaceae	*Hedychium gardnerianum*	LC (Invasive)
25	Liliopsida	Zingiberales	Zingiberaceae	*Hedychium thyrsiformis*	NE
26	Lycopodiopsida	Selaginellales	Selaginellaceae	*Selaginella bryopteris*	NE
27	Lycopodiopsida	Selaginellales	Selaginellaceae	*Selaginella sp*	NE
28	Magnoliopsida	Apiales	Araliaceae	*Brassaiopsis hainla*	NE
29	Magnoliopsida	Apiales	Araliaceae	*Heteropanax fragrans*	NE
30	Magnoliopsida	Aquifoliales	Aquifoliaceae	*Ilex kingiana*	NE
31	Magnoliopsida	Asterales	Asteraceae	*Ageratina adenophora*	LC (Invasive)
32	Magnoliopsida	Asterales	Asteraceae	*Ageratum conyzoides*	LC
33	Magnoliopsida	Asterales	Asteraceae	*Artemisia vulgaris*	LC
34	Magnoliopsida	Asterales	Asteraceae	*Bidens pilosa*	LC
35	Magnoliopsida	Asterales	Asteraceae	*Blumea aromatica*	NE
36	Magnoliopsida	Asterales	Asteraceae	*Chromolaena odorata*	LC (Invasive)
37	Magnoliopsida	Asterales	Asteraceae	*Crassocephalum crepidioides*	LC
38	Magnoliopsida	Asterales	Asteraceae	*Inula cappa*	NE

39	Magnoliopsida	Asterales	Asteraceae	*Mikania micrantha*	LC
40	Magnoliopsida	Boraginales	Boraginaceae	*Cordia obliqua*	LC
41	Magnoliopsida	Boraginales	Boraginaceae	*Cynoglossum furcatum*	NE
42	Magnoliopsida	Brassicales	Capparaceae	*Capparis acuminata*	NE
43	Magnoliopsida	Caryophyllales	Amaranthaceae	*Achyranthes aspera*	NE
44	Magnoliopsida	Caryophyllales	Amaranthaceae	*Achyranthes bidentata*	NE
45	Magnoliopsida	Caryophyllales	Polygonaceae	*Persicaria chinensis*	NE
46	Magnoliopsida	Chloranthales	Chloranthaceae	*Chloranthus elatior*	NE
47	Magnoliopsida	Cornales	Hydrangeaceae	*Dichroa febrifuga*	NE
48	Magnoliopsida	Cucurbitales	Coriariaceae	*Coriaria nepalensis*	NE
49	Magnoliopsida	Dipsacales	Adoxaceae	*Viburnum cylindricum*	NE
50	Magnoliopsida	Ericales	Pentaphylacaceae	*Eurya acuminata*	NE
51	Magnoliopsida	Ericales	Primulaceae	*Embelia floribunda*	NE
52	Magnoliopsida	Ericales	Primulaceae	*Maesa chisia*	NE
53	Magnoliopsida	Ericales	Styracaceae	*Styrax serrulatus*	NE
54	Magnoliopsida	Ericales	Theaceae	*Schima wallichii*	LC
55	Magnoliopsida	Fabales	Fabaceae	*Acacia pennata*	LC
56	Magnoliopsida	Fabales	Fabaceae	*Albizia chinensis*	NE
57	Magnoliopsida	Fabales	Fabaceae	*Albizia lebbeck*	LC
58	Magnoliopsida	Fabales	Fabaceae	*Albizia odoratissima*	NE
59	Magnoliopsida	Fabales	Fabaceae	*Bauhinia purpurea*	LC

60	Magnoliopsida	Fabales	Fabaceae	*Butea buteiformis*	NE
61	Magnoliopsida	Fabales	Fabaceae	*Cajanus scarabaeoides*	LC
62	Magnoliopsida	Fabales	Fabaceae	*Cassia occidentalis*	LC
63	Magnoliopsida	Fabales	Fabaceae	*Cladrastis sinensis*	NE
64	Magnoliopsida	Fabales	Fabaceae	*Dalbergia sericea*	NE
65	Magnoliopsida	Fabales	Fabaceae	*Dalbergia sp*	NE
66	Magnoliopsida	Fabales	Fabaceae	*Dalbergia stipulacea*	NE
67	Magnoliopsida	Fabales	Fabaceae	*Desmodium confertum*	NE
68	Magnoliopsida	Fabales	Fabaceae	*Desmodium elegans*	NE
69	Magnoliopsida	Fabales	Fabaceae	*Desmodium oblongum*	NE
70	Magnoliopsida	Fabales	Fabaceae	*Flemingia macrophylla*	NE
71	Magnoliopsida	Fabales	Fabaceae	*Flemingia strobilifera*	NE
72	Magnoliopsida	Fabales	Fabaceae	*Indigofera dosua*	NE
73	Magnoliopsida	Fabales	Fabaceae	*Lespedeza gerardiana*	NE
74	Magnoliopsida	Fabales	Fabaceae	*Leucaena leucocephala*	LC
75	Magnoliopsida	Fabales	Fabaceae	*Macrotyloma uniflorum*	NE
76	Magnoliopsida	Fabales	Fabaceae	*Mucuna pruriens*	NE
77	Magnoliopsida	Fabales	Fabaceae	*Pueraria peduncularis*	NE
78	Magnoliopsida	Fabales	Fabaceae	*Tamarindus indica*	LC
79	Magnoliopsida	Fagales	Betulaceae	*Betula alnoides*	LC
80	Magnoliopsida	Fagales	Fagaceae	*Castanopsis hystrix*	NE

81	Magnoliopsida	Fagales	Fagaceae	*Castanopsis tribuloides*	NE
82	Magnoliopsida	Fagales	Fagaceae	*Lithocarpus sp*	NE
83	Magnoliopsida	Fagales	Fagaceae	*Quercus glauca*	LC
84	Magnoliopsida	Fagales	Fagaceae	*Quercus griffithii*	NE
85	Magnoliopsida	Fagales	Juglandaceae	*Engelhardia spicata*	NE
86	Magnoliopsida	Fagales	Juglandaceae	*Juglans regia*	NE
87	Magnoliopsida	Fagales	Myricaceae	*Myrica esculenta*	NE
88	Magnoliopsida	Gentianales	Apocynaceae	*Chonemorpha fragrans*	NE
89	Magnoliopsida	Gentianales	Apocynaceae	*Cryptolepis buchananii*	NE
90	Magnoliopsida	Gentianales	Apocynaceae	*Tabernaemontana divaricata*	NE
91	Magnoliopsida	Gentianales	Apocynaceae	*Wrightia arborea*	NE
92	Magnoliopsida	Gentianales	Rubiaceae	*Canthium glabrum*	NE
93	Magnoliopsida	Gentianales	Rubiaceae	*Hedyotis scandens*	NE
94	Magnoliopsida	Gentianales	Rubiaceae	*Hyptianthera stricta*	NE
95	Magnoliopsida	Gentianales	Rubiaceae	*Paederia cruddasiana*	NE
96	Magnoliopsida	Gentianales	Rubiaceae	*Paederia foetida*	LC
97	Magnoliopsida	Gentianales	Rubiaceae	*Psilanthus bengalensis*	NE
98	Magnoliopsida	Gentianales	Rubiaceae	*Rubia cordifolia*	LC
99	Magnoliopsida	Gentianales	Rubiaceae	*Rubia sikkimensis*	NE
100	Magnoliopsida	Gentianales	Rubiaceae	*Spermacoce latifolia*	NE
101	Magnoliopsida	Gentianales	Rubiaceae	*Spermadictyon suaveolens*	NE

102	Magnoliopsida	Gentianales	Rubiaceae	*Uncaria scandens*	NE
103	Magnoliopsida	Icacinales	Icacinaceae	*Natsiatum herpeticum*	NE
104	Magnoliopsida	Lamiales	Acanthaceae	*Justicia adhatoda*	LC
105	Magnoliopsida	Lamiales	Acanthaceae	*Phlogacanthus thyrsiformis*	NE
106	Magnoliopsida	Lamiales	Acanthaceae	*Strobilanthes sp*	NE
107	Magnoliopsida	Lamiales	Acanthaceae	*Thunbergia fragrans*	NE
108	Magnoliopsida	Lamiales	Acanthaceae	*Thunbergia grandiflora*	LC
109	Magnoliopsida	Lamiales	Bignoniaceae	*Radermachera sinica*	NE
110	Magnoliopsida	Lamiales	Bignoniaceae	*Stereospermum colais*	NE
111	Magnoliopsida	Lamiales	Gesneriaceae	*Chirita bifolia*	NE
112	Magnoliopsida	Lamiales	Lamiaceae	*Callicarpa arborea*	LC
113	Magnoliopsida	Lamiales	Lamiaceae	*Clerodendrum colebrookianum*	NE
114	Magnoliopsida	Lamiales	Lamiaceae	*Clerodendrum serratum*	NE
115	Magnoliopsida	Lamiales	Lamiaceae	*Clerodendrum viscosum*	NE
116	Magnoliopsida	Lamiales	Lamiaceae	*Elsholtzia fruticosa*	NE
117	Magnoliopsida	Lamiales	Lamiaceae	*Gmelina arborea*	LC
118	Magnoliopsida	Lamiales	Lamiaceae	*Holmskioldia sanguinea*	LC
119	Magnoliopsida	Lamiales	Lamiaceae	*Isodon coetsa*	NE
120	Magnoliopsida	Lamiales	Lamiaceae	*Premna bengalensis*	NE
121	Magnoliopsida	Lamiales	Lamiaceae	*Scutellaria discolor*	NE
122	Magnoliopsida	Lamiales	Oleaceae	*Jasminum elongatum*	NE

123	Magnoliopsida	Lamiales	Oleaceae	*Jasminum grandiflorum*	NE
124	Magnoliopsida	Lamiales	Oleaceae	*Jasminum laurifolium*	NE
125	Magnoliopsida	Lamiales	Oleaceae	*Jasminum nitidum*	NE
126	Magnoliopsida	Laurales	Lauraceae	*Actinodaphne obovata*	NE
127	Magnoliopsida	Laurales	Lauraceae	*Beilschmiedia sp*	NE
128	Magnoliopsida	Laurales	Lauraceae	*Litsea cubeba*	NE
129	Magnoliopsida	Laurales	Lauraceae	*Litsea glutinosa*	LC
130	Magnoliopsida	Laurales	Lauraceae	*Litsea sp*	NE
131	Magnoliopsida	Laurales	Lauraceae	*Parasassafras confertiflora*	NE
132	Magnoliopsida	Laurales	Lauraceae	*Phoebe sp*	NE
133	Magnoliopsida	Magnoliales	Annonaceae	*Desmos sp*	NE
134	Magnoliopsida	Magnoliales	Annonaceae	*Polyalthia simiarum*	NE
135	Magnoliopsida	Magnoliales	Magnoliaceae	*Taulama hodgsonii*	NE
136	Magnoliopsida	Magnoliales	Myristicaceae	*Knema tenuinervia*	NE
137	Magnoliopsida	Malpighiales	Euphorbiaceae	*Croton caudatus*	NE
138	Magnoliopsida	Malpighiales	Euphorbiaceae	*Croton sp*	NE
139	Magnoliopsida	Malpighiales	Euphorbiaceae	*Macaranga denticulata*	NE
140	Magnoliopsida	Malpighiales	Euphorbiaceae	*Macaranga peltata*	LC
141	Magnoliopsida	Malpighiales	Euphorbiaceae	*Mallotus nepalensis*	NE
142	Magnoliopsida	Malpighiales	Euphorbiaceae	*Mallotus philippensis*	LC
143	Magnoliopsida	Malpighiales	Euphorbiaceae	*Mallotus tetracoccus*	NE

144	Magnoliopsida	Malpighiales	Euphorbiaceae	*Ostodes paniculata*	NE
145	Magnoliopsida	Malpighiales	Euphorbiaceae	*Sapium insigne*	NE
146	Magnoliopsida	Malpighiales	Phyllanthaceae	*Breynia retusa*	NE
147	Magnoliopsida	Malpighiales	Phyllanthaceae	*Emblica officinalis*	LC
148	Magnoliopsida	Malpighiales	Phyllanthaceae	*Flueggea virosa*	LC
149	Magnoliopsida	Malpighiales	Phyllanthaceae	*Glochidion sp*	NE
150	Magnoliopsida	Malpighiales	Salicaceae	*Casearia graveolens*	NE
151	Magnoliopsida	Malvales	Malvaceae	*Grewia eriocarpa*	NE
152	Magnoliopsida	Malvales	Malvaceae	*Grewia sepiaria*	NE
153	Magnoliopsida	Malvales	Malvaceae	*Kydia calycina*	NE
154	Magnoliopsida	Malvales	Malvaceae	*Pterospermum acerifolium*	LC
155	Magnoliopsida	Malvales	Malvaceae	*Sterculia villosa*	NE
156	Magnoliopsida	Malvales	Malvaceae	*Urena lobata*	NE
157	Magnoliopsida	Myrtales	Lythraceae	*Duabanga grandiflora*	NE
158	Magnoliopsida	Myrtales	Lythraceae	*Lagerstroemia parviflora*	NE
159	Magnoliopsida	Myrtales	Lythraceae	*Woodfordia fruticosa*	NE
160	Magnoliopsida	Myrtales	Melastomataceae	*Melastoma normale*	NE
161	Magnoliopsida	Myrtales	Myrtaceae	*Syzygium cumini*	LC
162	Magnoliopsida	Piperales	Piperaceae	*Piper mulesua*	NE
163	Magnoliopsida	Piperales	Piperaceae	*Piper pedicellatum*	NE
164	Magnoliopsida	Piperales	Piperaceae	*Piper sp*	NE

165	Magnoliopsida	Proteales	Proteaceae	*Helicia nilagirica*	NE
166	Magnoliopsida	Ranunculales	Ranunculaceae	*Clematis buchananiana*	NE
167	Magnoliopsida	Ranunculales	Menispermaceae	*Stephania glabra*	NE
168	Magnoliopsida	Ranunculales	Menispermaceae	*Stephania japonica*	NE
169	Magnoliopsida	Ranunculales	Menispermaceae	*Tinospora sinensis*	LC
170	Magnoliopsida	Rosales	Cannabaceae	*Celtis tetrandra*	NE
171	Magnoliopsida	Rosales	Cannabaceae	*Trema orientalis*	LC
172	Magnoliopsida	Rosales	Moraceae	*Ficus heteropleura*	NE
173	Magnoliopsida	Rosales	Moraceae	*Ficus semicordata*	LC
174	Magnoliopsida	Rosales	Moraceae	*Morus australis*	NE
175	Magnoliopsida	Rosales	Moraceae	*Morus macroura*	NE
176	Magnoliopsida	Rosales	Rhamnaceae	*Rhamnus nepalensis*	NE
177	Magnoliopsida	Rosales	Rhamnaceae	*Ziziphus mauritiana*	LC
178	Magnoliopsida	Rosales	Rosaceae	*Rubus biflorus*	NE
179	Magnoliopsida	Rosales	Rosaceae	*Rubus ellipticus*	LC
180	Magnoliopsida	Rosales	Rosaceae	*Rubus treutleri*	NE
181	Magnoliopsida	Rosales	Rosaceae	*Spiraea bella*	NE
182	Magnoliopsida	Rosales	Ulmaceae	*Ulmus lanceifolia*	NE
183	Magnoliopsida	Rosales	Urticaceae	*Boehmeria clidemioides*	NE
184	Magnoliopsida	Rosales	Urticaceae	*Boehmeria platyphylla*	NE
185	Magnoliopsida	Rosales	Urticaceae	*Boehmeria rugulosa*	NE

186	Magnoliopsida	Rosales	Urticaceae	*Boehmeria sp*	NE
187	Magnoliopsida	Rosales	Urticaceae	*Oreocnide frutescens*	NE
188	Magnoliopsida	Rosales	Urticaceae	*Pouzolzia sanguinea*	NE
189	Magnoliopsida	Rosales	Urticaceae	*Urtica dioica*	LC
190	Magnoliopsida	Santalales	Santalaceae	*Osyris lanceolata*	LC
191	Magnoliopsida	Sapindales	Anacardiaceae	*Drimycarpus racemosus*	NE
192	Magnoliopsida	Sapindales	Anacardiaceae	*Pegia nitida*	NE
193	Magnoliopsida	Sapindales	Anacardiaceae	*Rhus chinensis*	LC
194	Magnoliopsida	Sapindales	Anacardiaceae	*Rhus paniculata*	NE
195	Magnoliopsida	Sapindales	Burseraceae	*Garuga pinnata*	LC
196	Magnoliopsida	Sapindales	Meliaceae	*Aphanamixis polystachya*	NE
197	Magnoliopsida	Sapindales	Meliaceae	*Chukrasia tabularis*	LC
198	Magnoliopsida	Sapindales	Rutaceae	*Citrus medica*	NE
199	Magnoliopsida	Sapindales	Rutaceae	*Murraya koenigii*	NE
200	Magnoliopsida	Sapindales	Rutaceae	*Murraya paniculata*	NE
201	Magnoliopsida	Sapindales	Rutaceae	*Toddalia asiatica*	NE
202	Magnoliopsida	Sapindales	Rutaceae	*Zanthoxylum armatum*	LC
203	Magnoliopsida	Sapindales	Simaroubaceae	*Brucea mollis*	NE
204	Magnoliopsida	Saxifragales	Altingiaceae	*Altingia excelsa*	NE
205	Magnoliopsida	Saxifragales	Crassulaceae	*Kalanchoe integra*	NE
206	Magnoliopsida	Solanales	Convolvulaceae	*Argyreia venusta*	NE

207	Magnoliopsida	Solanales	Solanaceae	*Solanum erianthum*	NE
208	Magnoliopsida	Solanales	Solanaceae	*Solanum viarum*	NE
209	Magnoliopsida	Vitales	Vitaceae	*Ampelocissus rugosa*	NE
210	Magnoliopsida	Vitales	Vitaceae	*Tetrastigma leucostaphylum*	NE
211	Magnoliopsida	Vitales	Vitaceae	*Tetrastigma rumicispermum*	NE
212	Magnoliopsida	Vitales	Vitaceae	*Tetrastigma sp*	NE
213	Pinopsida	Pinales	Pinaceae	*Pinus roxburghii*	LC
214	Polypodiopsida	Polypodiales	Dennstaedtiaceae	*Pteridium revolutum*	LC
215	Polypodiopsida	Polypodiales	Pteridaceae	*Adiantum caudatum*	NE
216	Polypodiopsida	Polypodiales	Pteridaceae	*Adiantum incisum*	NE
217	Polypodiopsida	Polypodiales	Pteridaceae	*Adiantum philippense*	LC
218	Polypodiopsida	Polypodiales	Pteridaceae	*Adiantum sp*	NE
219	Polypodiopsida	Polypodiales	Pteridaceae	*Pteris cretica*	LC
220	Unknonw 1				
221	Unknown 2				
222	Unknown 3				

Tree species diversity recorded along the 400 kV D/C EWTLP during the wet season

Plot ID	Tree species	No. of Tree	Sampling count (DBH:5cm-10cm)	Avg. DBH (cm)	Avg. Height ()	Density (trees/m2)	Basal Area (m^2/ha)	IUCN status
K_F&F_1	Grewia eriocarpa	1	6			19.99		NE
K_F&F_1	Litsea glutinosa	1	2			19.99		NE
K_F&F_1	Pinus roxburghii	1		14.50	7.00	19.99	0.33	LC
K_F&F_2	Albizia odoratissima	1			58.00	19.99		NE
K_F&F_2	Ulmus lanceifolia	1			7.00	19.99		NE
K_F&F_2	Ziziphus mauritiana	1	2			19.99		LC
K_F&F_3	Pinus roxburghii	24		28.83	14.04	479.67	31.30	LC
K_F&F_4	Bauhinia purpurea	1	1		48.00	19.99		LC
K_F&F_4	Ficus semicordata	4	2	20.70	8.00	79.95	2.69	LC
K_F&F_4	Grewia eriocarpa	1	2			19.99		NE
K_F&F_4	Mallotus philippensis	1	4			19.99		LC
K_F&F_5	Pinus roxburghii	22	3	24.56	11.71	439.70	20.83	LC
K_F&F_5	Sapium insigne	1	1			19.99		LC
K_F&F_6	Daubanga grandiflora	1		67.40	15.00	19.99	7.13	NE
K_F&F_6	Ficus semicordata	1		36.00	10.00	19.99	2.03	LC
K_F&F_6	Grewia eriocarpa	3	3	15.45	7.50	59.96	1.12	NE
K_F&F_6	Leucaena leucocephala	1	15		7.00	19.99	0.00	LC
K_F&F_6	Leucaena leucocephala	2		51.40	13.00	39.97	8.29	LC
K_F&F_6	Mallotus philippensis	1	8			19.99		LC
K_F&F_6	Premna bengalensis	2	1	14.70	7.00	39.97	0.68	NE
K_F&F_6	Tamarindus indica	1	4			19.99		LC

K_F&F_6	Tamarindus indica	2		19.15	8.50	39.97	1.15	LC
K_F&F_7	Myrica esculenta	1	2			19.99		LC
K_F&F_7	Pinus roxburghii	16	6	34.24	17.33	319.78	29.44	LC
K_F&F_8	Pinus roxburghii	33	3	27.79	14.66	659.55	40.01	LC
K_F&F_8	Quercus griffithii	1	2			19.99		LC
K_F&F_9	Albizia odoratissima	3	1	21.80	12.50	59.96	2.24	NE
K_F&F_9	Lagerstroemia parviflora	7	1	21.63	9.67	139.90	5.14	NE
K_F&F_9	Pinus roxburghii	1		14.10	8.00	19.99	0.31	LC
K_F&F_9	Stereospermum colais	1		18.00	9.00	19.99	0.51	LC
K_F&F_10	Lithocarpus sp	4	30	12.80	25.33	79.95	1.03	NE
K_F&F_10	Litsea sp	1	5			19.99		NE
K_F&F_10	Mallotus tetracoccus	3		17.80	11.00	59.96	1.49	NE
K_F&F_10	Quercus griffithii	1	2			19.99	0.00	LC
K_F&F_10	Radermachera sinica	2		17.80	13.00	39.97	0.99	NE
K_F&F_11	Aphanamixis polystachya	1	3			19.99		NE
K_F&F_11	Canthium glabrum	1	1		97.00	19.99		NE
K_F&F_11	Drimycarpus racemosus	1		13.60	8.00	19.99	0.29	NE
K_F&F_11	Juglans regia	1		37.60	25.00	19.99	2.22	LC
K_F&F_11	Phoebe sp	4	1	43.10	21.67	79.95	11.66	NE
K_F&F_11	Taulama hodgsonii	2		41.65	15.50	39.97	5.45	NE
K_F&F_11	Taulama hodgsonii	3		34.07	19.33	59.96	5.47	NE
K_F&F_11	UK tree 1	13		22.48	14.31	259.82	10.32	
K_F&F_11	UK tree 2	3		36.20	19.33	59.96	6.17	
K_F&F_12	Actinodaphne obovata	1		23.50	15.00	19.99	0.87	NE
K_F&F_12	Altingia excelsa	1	1			19.99		NE
K_F&F_12	Aphanamixis polystachya	1	4			19.99		NE
K_F&F_12	Beilschmiedia sp	1		24.10	13.00	19.99	0.91	NE

K_F&F_12	Garuga pinnata	1		18.60	12.00	19.99	0.54	NE
K_F&F_12	Garuga pinnata	2		62.10	26.00	39.97	12.11	NE
K_F&F_12	Knema tenuinervia	1	5			19.99		NE
K_F&F_12	Knema tenuinervia	1		36.50	14.00	19.99	2.09	NE
K_F&F_12	Mallotus nepalensis	1	3			19.99		NE
K_F&F_12	Polyalthia simiarum	8	7	21.50	27.14	159.89	5.80	NE
K_F&F_12	Pterospermum acerifolium	1	1			19.99		NE
K_F&F_12	Pterospermum acerifolium	5		29.44	16.80	99.93	6.80	NE
K_F&F_12	Unknown	2		31.50	17.50	39.97	3.12	
K_F&F_13	Callicarpa arborea	1		13.20	9.00	19.99	0.27	NE
K_F&F_13	Chukrasia tabularis	1		68.60	15.00	19.99	7.39	LC
K_F&F_13	Garuga pinnata	2		31.00	13.50	39.97	3.02	NE
K_F&F_13	Mallotus tetracoccus	1		15.30	10.00	19.99	0.37	NE
K_F&F_14	Castanopsis tribuloides	3	2	13.65	10.50	59.96	0.88	NE
K_F&F_14	Engelhardia spicata	1	1			19.99		LC
K_F&F_14	Eurya acuminata	2	6	17.40	14.00	39.97	0.95	NE
K_F&F_14	Glochidion sp	1		13.40	10.00	19.99	0.28	NE
K_F&F_14	Litsea cubeba	3	2	14.10	14.00	59.96	0.94	NE
K_F&F_14	Litsea sp	1		16.90	14.00	19.99	0.45	NE
K_F&F_14	Macaranga peltata	1	1			19.99		NE
K_F&F_14	Murdannia sp	1			7.00	19.99		NE
K_F&F_14	Rhus chinensis	1		15.70	15.00	19.99	0.39	LC
K_F&F_14	Schima wallichii	2		75.25	14.00	39.97	17.78	LC
K_F&F_15	Actinodaphne obovata	1	1		120.00	19.99		NE
K_F&F_15	Betula alnoides	1		47.40	20.00	19.99	3.53	NE
K_F&F_15	Callicarpa arborea	1		15.40	13.00	19.99	0.37	NE
K_F&F_15	Castanopsis hystrix	1		14.20	9.00	19.99	0.32	NE

K_F&F_15	Castanopsis tribuloides	2	5	17.50	12.00	39.97	0.96	NE
K_F&F_15	Helicia nilagirica	1		13.50	8.00	19.99	0.29	NE
K_F&F_15	Ilex kingiana	1	3			19.99		NE
K_F&F_15	Ilex kingiana	2		14.60	13.50	39.97	0.67	NE
K_F&F_15	Lithocarpus sp	2	3	13.20	7.00	39.97	0.55	NE
K_F&F_15	Macaranga denticulata	2		14.60	14.00	39.97	0.67	NE
K_F&F_15	Parasassafras confertiflora	1		13.20	14.00	19.99	0.27	NE
K_F&F_15	Quercus glauca	1	1			19.99		LC
K_F&F_15	Schima wallichii	2	2	37.40	18.00	39.97	4.39	LC
K_F&F_15	Styrax serrulatus	1		23.30	13.00	19.99	0.85	NE
K_F&F_16	Albizia chinensis	1		50.00	20.00	19.99	3.92	NE
K_F&F_16	Bauhinia purpurea	1	1			19.99		LC
K_F&F_16	Callicarpa arborea	2	1	81.00	19.00	39.97	20.60	NE
K_F&F_16	Dalbergia sericea	1		17.00	14.00	19.99	0.45	LC
K_F&F_16	Gmelina arborea	3		41.67	20.33	59.96	8.18	LC
K_F&F_16	Heteropanax fragrans	1	1			19.99		NE
K_F&F_16	Hyptianthera stricta	1	2			19.99		NE
K_F&F_16	Kydia calycina	1		51.00	23.00	19.99	4.08	NE
K_F&F_16	Mallotus tetracoccus	1	2			19.99		NE
K_F&F_16	Ostodes paniculata	4	3	12.33	10.50	79.95	0.96	NE
K_F&F_16	Radermachera sinica	1	1			19.99		NE
K_F&F_16	Solanum erianthum	1	1			19.99		NE
K_F&F_16	Trema orientalis	1	1			19.99		LC
K_F&F_17	Callicarpa arborea	1		35.30	14.00	19.99	1.96	NE
K_F&F_17	Kydia calycina	2		19.25	8.00	39.97	1.16	NE
K_F&F_17	Morus macroura	1		23.20	10.00	19.99	0.84	NE

K_F&F_17	Quercus glauca	1		26.70	13.00	19.99	1.12	LC
K_F&F_18	Castanopsis tribuloides	1		23.40	18.00	19.99	0.86	NE
K_F&F_18	Cordia obliqua	1		15.60	17.00	19.99	0.38	NE
K_F&F_18	Dalbergia sericea	1	1			19.99		LC
K_F&F_18	Engelhardia spicata	1	1			19.99		LC
K_F&F_18	Ficus semicordata	1		65.40	13.00	19.99	6.71	LC
K_F&F_18	Hyptianthera stricta	1	3			19.99		NE
K_F&F_18	Pinus roxburghii	1		18.60	15.00	19.99	0.54	LC
K_F&F_18	Quercus griffithii	4	2	35.43	16.00	79.95	7.88	LC
K_F&F_18	Rhus chinensis	1	1			19.99		LC
K_F&F_18	Schima wallichii	2	4	67.50	18.00	39.97	14.30	LC
K_F&F_18	Sterculia villosa	1	1		35.00	19.99		LC
K_F&F_18	Syzygium cuminii	1	1			19.99		LC
K_F&F_19	Albizia lebbeck	1		52.00	18.00	19.99	4.24	LC
K_F&F_19	Albizia lebbeck	1		23.40	13.00	19.99	0.86	LC
K_F&F_19	Callicarpa arborea	1		61.90	18.00	19.99	6.01	NE
K_F&F_19	Celtis tetrandra	1		27.20	15.00	19.99	1.16	NE
K_F&F_19	Dalbergia sericea	1	1			19.99		LC
K_F&F_19	Lagerstroemia parviflora	6		22.78	13.00	119.92	4.89	NE
K_F&F_19	Pterospermum acerifolium	2		76.55	20.00	39.97	18.40	NE
K_F&F_19	Schima wallichii	2	2	11.70	7.00	39.97	0.43	LC

Plant species list with IUCN category along the 400 kV D/C EWTLP during wet season.

Sl. NO	Common Name	Species	IUCN status
1	Alexandrine Parakeet	Psittacula eupatria	Near Threatened
2	Ashy Bulbul	Hemixos flavala	Least Concern
3	Ashy Drongo	Dicrurus leucophaeus	Least Concern
4	Asian Emerald Dove	Chalcophaps indica	Least Concern
5	Asian Green Bee-Eater	Merops orientalis	Least Concern
6	Barred Buttonquail	Turnix suscitator	Least Concern
7	Barred Cuckoo-Dove	Macropygia unchall	Least Concern
8	Black Bulbul	Hypsipetes leucocephalus	Least Concern
9	Black Drongo	Dicrurus macrocercus	Least Concern
10	Black Eagle	Ictinaetus malaiensis	Least Concern
11	Black-Chinned Yuhina	Yuhina nigrimenta	Least Concern
12	Black-Crested Bulbul	Rubigula flaviventris	Least Concern
13	Black-Naped Monarch	Hypothymis azurea	Least Concern
14	Black-Throated Sunbird	Aethopyga saturata	Least Concern
15	Black-Throated Tit	Aegithalos concinnus	Least Concern
16	Blue-Capped Rock Thrush	Monticola cinclorhyncha	Least Concern
17	Blue-Throated Barbet	Psilopogon asiaticus	Least Concern
18	Blue-Throated Flycatcher	Cyornis rubeculoides	Least Concern
19	Blue-Whistling Thrush	Myophonus caeruleus	Least Concern
20	Bronzed Drongo	Dicrurus aeneus	Least Concern
21	Brown Dipper	Cinclus pallasii	Least Concern
22	Brownish-Flanked Bush Warbler	Horornis fortipes	Least Concern
23	Chestnut-Bellied Nuthatch	Sitta cinnamoventris	Least Concern
24	Chestnut-Tailed Starling	Sturnia malabarica	Least Concern
25	Chestnut-Winged Cuckoo	Clamator coromandus	Least Concern

26	Collared Owlet	Glaucidium brodiei	Least Concern
27	Common Hoopoe	Upupa epops	Least Concern
28	Common Iora	Aegithina tiphia	Least Concern
29	Common Kingfisher	Alcedo atthis	Least Concern
30	Common Myna	Acridotheres tristis	Least Concern
31	Common Rock Pigeon	Columba livia	Least Concern
32	Common Tailorbird	Orthotomus sutorius	Least Concern
33	Crested Bunting	Emberiza lathami	Least Concern
34	Crested Goshawk	Accipiter trivirgatus	Least Concern
35	Crested Kingfisher	Megaceryle lugubris	Least Concern
36	Crested Serpent-Eagle	Spilornis cheela	Least Concern
37	Crimson Sunbird	Aethopyga siparaja	Least Concern
38	Eurasian Red-Rumped Swallow	Cecropis daurica	Least Concern
39	Eurasian Tree Sparrow	Passer montanus	Least Concern
40	Fulvous-Breasted Woodpecker	Dendrocopos macei	Least Concern
41	Golden-Throated Barbet	Psilopogon franklinii	Least Concern
42	Gray Bushchat	Saxicola ferreus	Least Concern
43	Gray Treepie	Dendrocitta formosae	Least Concern
44	Gray-Bellied Tesia	Tesia cyaniventer	Least Concern
45	Gray-Headed Canary-Flycatcher	Culicicapa ceylonensis	Least Concern
46	Gray-Headed Woodpecker	Picus canus	Least Concern
47	Gray-Hooded Warbler	Phylloscopus xanthoschistos	Least Concern
48	Gray-Sided Laughingthrush	Pterorhinus caerulatus	Least Concern
49	Great Barbet	Psilopogon virens	Least Concern
50	Great Hornbill	Buceros bicornis	Least Concern
51	Great Myna	Acridotheres grandis	Least Concern
52	Greater Flameback	Chrysocolaptes guttacristatus	Least Concern

53	Greater Racket-Tailed Drongo	Dicrurus paradiseus	Least Concern
54	Greater Yellownape	Chrysophlegma flavinucha	Least Concern
55	Green Magpie	Cissa chinensis	Least Concern
56	Green-Backed Tit	Parus monticolus	Least Concern
57	Green-Billed Malkoha	Phaenicophaeus tristis	Least Concern
58	Hair-Crested Drongo	Dicrurus hottentottus	Least Concern
59	Hill Partridge	Arborophila torqueola	Least Concern
60	Himalayan Bulbul	Pycnonotus leucogenys	Least Concern
61	Himalayan Prinia	Prinia crinigera	Least Concern
62	House Sparrow	Passer domesticus	Least Concern
63	Indian Cuckoo	Cuculus micropterus	Least Concern
64	Indian White-Eye	Zosterops palpebrosus	Least Concern
65	Kalij Pheasant	Lophura leucomelanos	Least Concern
66	Large Woodshrike	Tephrodornis virgatus	Least Concern
67	Large-Billed Crow	Corvus macrorhynchos	Least Concern
68	Large-Hawk Cuckoo	Hierococcyx sparverioides	Least Concern
69	Lesser Coucal	Centropus bengalensis	Least Concern
70	Lesser Laughingthrush	Trochalopteron lineatum	Least Concern
71	Lesser Yellownape	Picus chlorolophus	Least Concern
72	Long-Tailed Minivet	Pericrocotus ethologus	Least Concern
73	Maroon Oriole	Oriolus traillii	Least Concern
74	Mountain Bulbul	Ixos mcclellandii	Least Concern
75	Mountain Scops Owl	Otus spilocephalus	Least Concern
76	Nepal Fulvetta	Alcippe nipalensis	Least Concern
77	Orange-Bellied Leafbird	Chloropsis hardwickii	Least Concern
78	Orange-Headed Thrush	Geokichla citrina	Least Concern
79	Oriental Magpie-Robin	Copsychus saularis	Least Concern

80	Oriental Turtle-Dove	Streptopelia orientalis	Least Concern
81	Pied Cuckoo	Clamator jacobinus	Least Concern
82	Pin-Tailed Green Pigeon	Treron apicauda	Least Concern
83	Plaintive Cuckoo	Cacomantis merulinus	Least Concern
84	Plum-Headed Parakeet	Psittacula cyanocephala	Least Concern
85	Puff-Throated Babbler	Pellorneum ruficeps	Least Concern
86	Red Junglefowl	Gallus gallus	Least Concern
87	Red-Vented Bulbul	Pycnonotus cafer	Least Concern
88	Red-Whiskered Bulbul	Pycnonotus jocosus	Least Concern
89	Rose-Ringed Parakeet	Psittacula krameri	Least Concern
90	Rufescent Prinia	Prinia rufescens	Least Concern
91	Rufous Woodpecker	Micropternus brachyurus	Least Concern
92	Rufous-Capped Babbler	Cyanoderma ruficeps	Least Concern
93	Rufous-Necked Hornbill	Aceros nipalensis	Vulnerable
94	Rufous-Necked Laughingthrush	Pterorhinus ruficollis	Least Concern
95	Russet Sparrow	Passer cinnamomeus	Least Concern
96	Rusty-Cheeked Scimitar Babbler	Erythrogenys erythrogenys	Least Concern
97	Scaly-Breasted Munia	Lonchura punctulata	Least Concern
98	Scarlet Minivet	Pericrocotus speciosus	Least Concern
99	Shikra	Accipiter badius	Least Concern
100	Slaty-Backed Forktail	Enicurus schistaceus	Least Concern
101	Slender-Billed Oriole	Oriolus tenuirostris	Least Concern
102	Spot-Bellied Eagle-Owl	Bubo nipalensis	Least Concern
103	Spotted Dove	Spilopelia chinensis	Least Concern
104	Square-Tailed Drongo-Cuckoo	Surniculus lugubris	Least Concern
105	Streak-Breasted Scimitar Babbler	Pomatorhinus ruficollis	Least Concern
106	Streaked Spiderhunter	Arachnothera magna	Least Concern

107	Striated Laughingthrush	Grammatoptila striata	Least Concern
108	Striated Yuhina	Staphida castaniceps	Least Concern
109	Striped Yuhina	Yuhina castaniceps	Least Concern
110	Sultan Tit	Melanochlora sultanea	Least Concern
111	Wedge-Tailed Green Pigeon	Treron sphenurus	Least Concern
112	Whiskered Yuhina	Yuhina flavicollis	Least Concern
113	White Wagtail	Motacilla alba	Least Concern
114	White-Bellied Heron	Ardea insignis	Critically Endangered
115	White-Breasted Waterhen	Amaurornis phoenicurus	Least Concern
116	White-Browed Scimitar Babbler	Pomatorhinus schisticeps	Least Concern
117	White-Browed Wagtail	Motacilla maderaspatensis	Least Concern
118	White-Crested Laughingthrush	Garrulax leucolophus	Least Concern
119	White-Rumped Munia	Lonchura striata	Least Concern
120	White-Throated Bulbul	Alophoixus flaveolus	Least Concern
121	White-Throated Fantail	Rhipidura albicollis	Least Concern
122	White-Throated Kingfisher	Halcyon smyrnensis	Least Concern
123	Yellow-Vented Warbler	Phylloscopus cantator	Least Concern

Annex-4: Post Monsoon Season Baseline Data

Sampling location with geographic coordinates and elevation for the 400kV D/C EWTLP.

Sample ID	Location	Latitude (N)	Longitude (E)	Elevation (m)
KW_1	Dangmechu Upstream	27°24'51.48''	91°52'24.60''	811
KW_2	Dangmechu Downstream	27°24'16.02''	91°33'15.07''	792
KW_3	Tshergom Tributary	27°24'00.98''	91°33'02.17''	810
KW_4	Jamkhardrang chu Upstream	27°22'52.22''	91°32'52.22''	930
KW_5	Jamkhardrang chu Downstream	27°22'36.51'	91°33'14.96''	790
KW_6	Rolong	27°19'14.61''	91°29'49.44''	775
KW_7	Sherichu Downstream	27°15'56.24'	91°24'08.15''	623
KW_8	Sherichu Upstream	27°15'29.19''	91°24'27.52''	598
KW_9	Manas Upstream	27°57'55.16''	91°11'01.40''	239
KW_10	Manas Downstream	27°57'35.92''	91°10'33.87''	237
KW_11	Mangdechu Upstream	27°07'09.53''	90°42'57.56''	478
KW_12	Mangdechu Downstream	27°07'26.53''	90°43'26.31''	469

Systematic classification and conservation status of plant species documented during the post-monsoon biodiversity assessment.

Sl. No	Class	Order	Family	Corrected Species Name	IUCN Status
1	Liliopsida	Asparagales	Asparagaceae	Asparagus racemosus	Least Concern
2	Liliopsida	Commelinales	Commelinaceae	Commelina benghalensis	Least Concern
3	Liliopsida	Zingiberales	Costaceae	Costus speciosus	Least Concern
4	Liliopsida	Asparagales	Orchidaceae	Cymbidium lancifolium	Least Concern
5	Liliopsida	Poales	Poaceae	Cymbopogon flexuosus	Least Concern
6	Liliopsida	Dioscoreales	Dioscoreaceae	Dioscorea bulbifera	Least Concern
7	Liliopsida	Dioscoreales	Dioscoreaceae	Dioscorea hispida	Least Concern
8	Liliopsida	Dioscoreales	Dioscoreaceae	Dioscorea pentaphylla	Least Concern
9	Liliopsida	Asparagales	Hypoxidaceae	Hypoxis aurea	Least Concern
10	Liliopsida	Asparagales	Hypoxidaceae	Molineria capitulata	Least Concern
11	Liliopsida	Poales	Poaceae	Oplismenus compositus	Least Concern
12	Liliopsida	Poales	Poaceae	Thysanolaena latifolia	Least Concern
13	Liliopsida	Alismatales	Araceae	Amorphophallus bulbifer	Not Evaluated
14	Liliopsida	Poales	Cyperaceae	Carex sp	Not Evaluated
15	Liliopsida	Commelinales	Commelinaceae	Commelina sp	Not Evaluated
16	Liliopsida	Poales	Poaceae	Cymbopogon bhutanicus	Not Evaluated
17	Liliopsida	Zingiberales	Zingiberaceae	Globba clarkei	Not Evaluated
18	Liliopsida	Zingiberales	Zingiberaceae	Hedychium sp.	Not Evaluated
19	Liliopsida	Zingiberales	Zingiberaceae	Hedychium thyrsiforme	Not Evaluated
20	Liliopsida	Commelinales	Commelinaceae	Murdannia sp	Not Evaluated
21	Liliopsida	Pandanales	Pandanaceae	Pandanus unguifer	Not Evaluated
22	Liliopsida	Alismatales	Araceae	Pothos cathcartii	Not Evaluated
23	Liliopsida	Alismatales	Araceae	Raphidophora hookeri	Not Evaluated
24	Liliopsida	Alismatales	Araceae	Remusatia hookeriana	Not Evaluated
25	Liliopsida	Alismatales	Alismataceae	Sagittaria sp	Not Evaluated

26	Liliopsida	Liliales	Smilacaceae	Smilax lanceifolia	Not Evaluated
27	Lycopodiopsida	Selaginellales	Selaginellaceae	Selaginella bryopteris	Not Evaluated
28	Lycopodiopsida	Selaginellales	Selaginellaceae	Selaginella sp	Not Evaluated
29	Magnoliopsida	Caryophyllales	Amaranthaceae	Achyranthes aspera	Least Concern
30	Magnoliopsida	Asterales	Asteraceae	Ageratina adenophora	Least Concern
31	Magnoliopsida	Asterales	Asteraceae	Ageratum conyzoides	Least Concern
32	Magnoliopsida	Fabales	Fabaceae	Albizia lebbeck	Least Concern
33	Magnoliopsida	Saxifragales	Altingiaceae	Altingia excelsa	Least Concern
34	Magnoliopsida	Sapindales	Meliaceae	Aphanamixis polystachya	Least Concern
35	Magnoliopsida	Asterales	Asteraceae	Artemisia vulgaris	Least Concern
36	Magnoliopsida	Fabales	Fabaceae	Bauhinia purpurea	Least Concern
37	Magnoliopsida	Fagales	Betulaceae	Betula alnoides	Least Concern
38	Magnoliopsida	Asterales	Asteraceae	Bidens pilosa	Least Concern
39	Magnoliopsida	Fabales	Fabaceae	Cajanus scarabaeoides	Least Concern
40	Magnoliopsida	Lamiales	Lamiaceae	Callicarpa arborea	Least Concern
41	Magnoliopsida	Malpighiales	Salicaceae	Casearia graveolens	Least Concern
42	Magnoliopsida	Fabales	Fabaceae	Senna occidentalis	**Not Evaluated**
43	Magnoliopsida	Fagales	Fagaceae	Castanopsis hystrix	Least Concern
44	Magnoliopsida	Fagales	Fagaceae	Castanopsis tribuloides	Least Concern
45	Magnoliopsida	Rosales	Cannabaceae	Celtis tetrandra	Least Concern
46	Magnoliopsida	Asterales	Asteraceae	Chromolaena odorata	Least Concern
47	Magnoliopsida	Sapindales	Meliaceae	Chukrasia tabularis	Least Concern
48	Magnoliopsida	Lamiales	Lamiaceae	Clerodendrum serratum	Least Concern
49	Magnoliopsida	Lamiales	Lamiaceae	Clerodendrum viscosum	Least Concern
50	Magnoliopsida	Asterales	Asteraceae	Crassocephalum crepidioides	Least Concern
51	Magnoliopsida	Myrtales	Lythraceae	Duabanga grandiflora	Least Concern
52	Magnoliopsida	Sapindales	Sapindaceae	Dodonaea viscosa	Least Concern
53	Magnoliopsida	Caryophyllales	Caryophyllaceae	Drymaria cordata	Least Concern
54	Magnoliopsida	Malpighiales	Phyllanthaceae	Phyllanthus emblica	Least Concern
55	Magnoliopsida	Fagales	Juglandaceae	Engelhardia spicata	Least Concern

56	Magnoliopsida	Ericales	Pentaphylacaceae	Eurya acuminata	Least Concern
57	Magnoliopsida	Rosales	Moraceae	Ficus semicordata	Least Concern
58	Magnoliopsida	Fabales	Fabaceae	Flemingia macrophylla	Least Concern
59	Magnoliopsida	Fabales	Fabaceae	Flemingia strobilifera	Least Concern
60	Magnoliopsida	Malpighiales	Phyllanthaceae	Flueggea virosa	Least Concern
61	Magnoliopsida	Sapindales	Burseraceae	Garuga pinnata	Least Concern
62	Magnoliopsida	Asterales	Asteraceae	Gerbera piloselloides	Least Concern
63	Magnoliopsida	Lamiales	Lamiaceae	Gmelina arborea	Least Concern
64	Magnoliopsida	Malvales	Malvaceae	Grewia eriocarpa	Least Concern
65	Magnoliopsida	Proteales	Proteaceae	Helicia nilagirica	Least Concern
66	Magnoliopsida	Asterales	Asteraceae	Inula cappa	Least Concern
67	Magnoliopsida	Lamiales	Acanthaceae	Justicia adhatoda	Least Concern
68	Magnoliopsida	Malvales	Malvaceae	Kydia calycina	Least Concern
69	Magnoliopsida	Myrtales	Lythraceae	Lagerstroemia parviflora	Least Concern
70	Magnoliopsida	Fabales	Fabaceae	Leucaena leucocephala	Least Concern
71	Magnoliopsida	Laurales	Lauraceae	Litsea glutinosa	Least Concern
72	Magnoliopsida	Malpighiales	Euphorbiaceae	Macaranga denticulata	Least Concern
73	Magnoliopsida	Malpighiales	Euphorbiaceae	Macaranga peltata	Least Concern
74	Magnoliopsida	Fabales	Fabaceae	Macrotyloma uniflorum	Least Concern
75	Magnoliopsida	Malpighiales	Euphorbiaceae	Mallotus philippensis	Least Concern
76	Magnoliopsida	Myrtales	Melastomataceae	Melastoma normale	Least Concern
77	Magnoliopsida	Asterales	Asteraceae	Mikania micrantha	Least Concern
78	Magnoliopsida	Rosales	Moraceae	Morus macroura	Least Concern
79	Magnoliopsida	Sapindales	Rutaceae	Murraya koenigii	Least Concern
80	Magnoliopsida	Sapindales	Rutaceae	Murraya paniculata	Least Concern
81	Magnoliopsida	Santalales	Santalaceae	Osyris lanceolata	Least Concern
82	Magnoliopsida	Oxalidales	Oxalidaceae	Oxalis corniculata	Least Concern
83	Magnoliopsida	Gentianales	Rubiaceae	Paederia foetida	Least Concern
84	Magnoliopsida	Caryophyllales	Polygonaceae	Persicaria chinensis	Least Concern
85	Magnoliopsida	Caryophyllales	Polygonaceae	Persicaria runcinata	Least Concern

86	Magnoliopsida	Malvales	Malvaceae	Pterospermum acerifolium	Least Concern
87	Magnoliopsida	Fagales	Fagaceae	Quercus glauca	Least Concern
88	Magnoliopsida	Fagales	Fagaceae	Quercus griffithii	Least Concern
89	Magnoliopsida	Sapindales	Anacardiaceae	Rhus chinensis	Least Concern
90	Magnoliopsida	Gentianales	Rubiaceae	Rubia cordifolia	Least Concern
91	Magnoliopsida	Rosales	Rosaceae	Rubus ellipticus	Least Concern
92	Magnoliopsida	Malpighiales	Euphorbiaceae	Sapium insigne	Least Concern
93	Magnoliopsida	Ericales	Theaceae	Schima wallichii	Least Concern
94	Magnoliopsida	Solanales	Solanaceae	Solanum erianthum	Least Concern
95	Magnoliopsida	Gentianales	Rubiaceae	Spermacoce latifolia	Least Concern
96	Magnoliopsida	Ranunculales	Menispermaceae	Stephania japonica	Least Concern
97	Magnoliopsida	Lamiales	Bignoniaceae	Stereospermum colais	Least Concern
98	Magnoliopsida	Myrtales	Myrtaceae	Syzygium cumini	Least Concern
99	Magnoliopsida	Fabales	Fabaceae	Tamarindus indica	Least Concern
100	Magnoliopsida	Magnoliales	Magnoliaceae	Magnolia hodgsonii	Least Concern
101	Magnoliopsida	Lamiales	Acanthaceae	Thunbergia grandiflora	Least Concern
102	Magnoliopsida	Ranunculales	Menispermaceae	Tinospora sinensis	Least Concern
103	Magnoliopsida	Sapindales	Rutaceae	Toddalia asiatica	Least Concern
104	Magnoliopsida	Rosales	Cannabaceae	Trema orientalis	Least Concern
105	Magnoliopsida	Malvales	Malvaceae	Triumfetta rhomboidea	Least Concern
106	Magnoliopsida	Malvales	Malvaceae	Urena lobata	Least Concern
107	Magnoliopsida	Rosales	Urticaceae	Urtica dioica	Least Concern
108	Magnoliopsida	Dipsacales	Adoxaceae	Viburnum cylindricum	Least Concern
109	Magnoliopsida	Myrtales	Lythraceae	Woodfordia fruticosa	Least Concern
110	Magnoliopsida	Gentianales	Apocynaceae	Wrightia arborea	Least Concern
111	Magnoliopsida	Sapindales	Rutaceae	Zanthoxylum armatum	Least Concern
112	Magnoliopsida	Rosales	Rhamnaceae	Ziziphus mauritiana	Least Concern
113	Magnoliopsida	Rosales	Ulmaceae	Ulmus lanceifolia	Least Concern
114	Magnoliopsida	Fagales	Juglandaceae	Juglans regia	**Least Concern**
115	Magnoliopsida	Fabales	Fabaceae	Acacia pennata	Not Evaluated

116	Magnoliopsida	Caryophyllales	Amaranthaceae	Achyranthes bidentata	Not Evaluated
117	Magnoliopsida	Laurales	Lauraceae	Actinodaphne obovata	Not Evaluated
118	Magnoliopsida	Fabales	Fabaceae	Albizia chinensis	Not Evaluated
119	Magnoliopsida	Fabales	Fabaceae	Albizia odoratissima	Not Evaluated
120	Magnoliopsida	Vitales	Vitaceae	Ampelocissus rugosa	Not Evaluated
121	Magnoliopsida	Solanales	Convolvulaceae	Argyreia venusta	Not Evaluated
122	Magnoliopsida	Laurales	Lauraceae	Beilschmiedia sp	Not Evaluated
123	Magnoliopsida	Asterales	Asteraceae	Blumea aromatica	Not Evaluated
124	Magnoliopsida	Rosales	Urticaceae	Boehmeria clidemioides	Not Evaluated
125	Magnoliopsida	Rosales	Urticaceae	Boehmeria platyphylla	Not Evaluated
126	Magnoliopsida	Rosales	Urticaceae	Boehmeria rugulosa	Not Evaluated
127	Magnoliopsida	Rosales	Urticaceae	Boehmeria sp	Not Evaluated
128	Magnoliopsida	Apiales	Araliaceae	Brassaiopsis hainla	Not Evaluated
129	Magnoliopsida	Malpighiales	Phyllanthaceae	Breynia retusa	Not Evaluated
130	Magnoliopsida	Sapindales	Simaroubaceae	Brucea mollis	Not Evaluated
131	Magnoliopsida	Fabales	Fabaceae	Butea monoptera	Not Evaluated
132	Magnoliopsida	Brassicales	Capparaceae	Capparis acuminata	Not Evaluated
133	Magnoliopsida	Brassicales	Capparaceae	Capparis acutifolia	Not Evaluated
134	Magnoliopsida	Lamiales	Gesneriaceae	Henckelia bifolia	Not Evaluated
135	Magnoliopsida	Chloranthales	Chloranthaceae	Chloranthus elatior	Not Evaluated
136	Magnoliopsida	Gentianales	Apocynaceae	Chonemorpha fragrans	Not Evaluated
137	Magnoliopsida	Sapindales	Rutaceae	Citrus medica	Not Evaluated
138	Magnoliopsida	Fabales	Fabaceae	Cladrastis sinensis	Not Evaluated
139	Magnoliopsida	Ranunculales	Ranunculaceae	Clematis buchananiana	Not Evaluated
140	Magnoliopsida	Lamiales	Lamiaceae	Clerodendrum colebrookianum	Not Evaluated
141	Magnoliopsida	Lamiales	Lamiaceae	Clerodendrum wallichii	Not Evaluated
142	Magnoliopsida	Boraginales	Boraginaceae	Cordia obliqua	Not Evaluated
143	Magnoliopsida	Cucurbitales	Coriariaceae	Coriaria nepalensis	Not Evaluated
144	Magnoliopsida	Fabales	Fabaceae	Crotalaria calycina	Not Evaluated
145	Magnoliopsida	Malpighiales	Euphorbiaceae	Croton caudatus	Not Evaluated

146	Magnoliopsida	Malpighiales	Euphorbiaceae	Croton sp	Not Evaluated
147	Magnoliopsida	Gentianales	Apocynaceae	Cryptolepis buchananii	Not Evaluated
148	Magnoliopsida	Boraginales	Boraginaceae	Cynoglossum furcatum	Not Evaluated
149	Magnoliopsida	Fabales	Fabaceae	Dalbergia sericea	Not Evaluated
150	Magnoliopsida	Fabales	Fabaceae	Dalbergia sp	Not Evaluated
151	Magnoliopsida	Fabales	Fabaceae	Dalbergia stipulacea	Not Evaluated
152	Magnoliopsida	Fabales	Fabaceae	Desmodium confertum	Not Evaluated
153	Magnoliopsida	Fabales	Fabaceae	Desmodium elegans	Not Evaluated
154	Magnoliopsida	Fabales	Fabaceae	Desmodium oblongum	Not Evaluated
155	Magnoliopsida	Magnoliales	Annonaceae	Desmos sp	Not Evaluated
156	Magnoliopsida	Cornales	Hydrangeaceae	Dichroa febrifuga	Not Evaluated
157	Magnoliopsida	Sapindales	Anacardiaceae	Drimycarpus racemosus	Not Evaluated
158	Magnoliopsida	Lamiales	Lamiaceae	Elsholtzia fruticosa	Not Evaluated
159	Magnoliopsida	Ericales	Primulaceae	Embelia floribunda	Not Evaluated
160	Magnoliopsida	Rosales	Moraceae	Ficus heteropleura	Not Evaluated
161	Magnoliopsida	Rosales	Moraceae	Ficus subincisa	Not Evaluated
162	Magnoliopsida	Malpighiales	Phyllanthaceae	Glochidion sp	Not Evaluated
163	Magnoliopsida	Malvales	Malvaceae	Grewia sepiaria	Not Evaluated
164	Magnoliopsida	Gentianales	Rubiaceae	Hedyotis scandens	Not Evaluated
165	Magnoliopsida	Apiales	Araliaceae	Heteropanax fragrans	Not Evaluated
166	Magnoliopsida	Lamiales	Lamiaceae	Holmskioldia sanguinea	Not Evaluated
167	Magnoliopsida	Gentianales	Rubiaceae	Hyptianthera stricta	Not Evaluated
168	Magnoliopsida	Aquifoliales	Aquifoliaceae	Ilex kingiana	Not Evaluated
169	Magnoliopsida	Fabales	Fabaceae	Indigofera dosua	Not Evaluated
170	Magnoliopsida	Brassicales	Brassicaceae	Ischnocarpus frutescens	Not Evaluated
171	Magnoliopsida	Lamiales	Lamiaceae	Isodon coetsa	Not Evaluated
172	Magnoliopsida	Lamiales	Oleaceae	Jasminum elongatum	Not Evaluated
173	Magnoliopsida	Lamiales	Oleaceae	Jasminum grandiflorum	Not Evaluated
174	Magnoliopsida	Lamiales	Oleaceae	Jasminum laurifolium	Not Evaluated
175	Magnoliopsida	Lamiales	Oleaceae	Jasminum nitidum	Not Evaluated

176	Magnoliopsida	Saxifragales	Crassulaceae	Kalanchoe integra	Not Evaluated
177	Magnoliopsida	Fabales	Fabaceae	Lespedeza gerardiana	Not Evaluated
178	Magnoliopsida	Lamiales	Linderniaceae	Lindernia ruellioides	Not Evaluated
179	Magnoliopsida	Fagales	Fagaceae	Lithocarpus sp.	Not Evaluated
180	Magnoliopsida	Laurales	Lauraceae	Litsea cubeba	Not Evaluated
181	Magnoliopsida	Laurales	Lauraceae	Litsea sp	Not Evaluated
182	Magnoliopsida	Ericales	Primulaceae	Maesa chisia	Not Evaluated
183	Magnoliopsida	Malpighiales	Euphorbiaceae	Mallotus nepalensis	Not Evaluated
184	Magnoliopsida	Malpighiales	Euphorbiaceae	Mallotus tetracoccus	Not Evaluated
185	Magnoliopsida	Gentianales	Rubiaceae	Mitracarpus hirtus	Not Evaluated
186	Magnoliopsida	Rosales	Moraceae	Morus australis	Not Evaluated
187	Magnoliopsida	Fagales	Myricaceae	Myrica esculenta	Not Evaluated
188	Magnoliopsida	Icacinales	Icacinaceae	Natsiatum herpeticum	Not Evaluated
189	Magnoliopsida	Rosales	Urticaceae	Oreocnide frutescens	Not Evaluated
190	Magnoliopsida	Malpighiales	Euphorbiaceae	Ostodes paniculata	Not Evaluated
191	Magnoliopsida	Gentianales	Rubiaceae	Paederia cruddasiana	Not Evaluated
192	Magnoliopsida	Laurales	Lauraceae	Parasassafras confertiflora	Not Evaluated
193	Magnoliopsida	Sapindales	Anacardiaceae	Pegia nitida	Not Evaluated
194	Magnoliopsida	Lamiales	Acanthaceae	Phlogacanthus thyrsiflorus	Not Evaluated
195	Magnoliopsida	Laurales	Lauraceae	Phoebe sp	Not Evaluated
196	Magnoliopsida	Piperales	Piperaceae	Piper mulesua	Not Evaluated
197	Magnoliopsida	Piperales	Piperaceae	Piper pedicellatum	Not Evaluated
198	Magnoliopsida	Piperales	Piperaceae	Piper sp	Not Evaluated
199	Magnoliopsida	Piperales	Piperaceae	Piper sylvaticum	Not Evaluated
200	Magnoliopsida	Magnoliales	Annonaceae	Polyalthia simiarum	Not Evaluated
201	Magnoliopsida	Lamiales	Lamiaceae	Premna bengalensis	Not Evaluated
202	Magnoliopsida	Gentianales	Rubiaceae	Coffea benghalensis	Not Evaluated
203	Magnoliopsida	Fabales	Fabaceae	Pueraria peduncularis	Not Evaluated
204	Magnoliopsida	Fabales	Fabaceae	Pueraria sp	Not Evaluated
205	Magnoliopsida	Lamiales	Bignoniaceae	Radermachera sinica	Not Evaluated

206	Magnoliopsida	Rosales	Rhamnaceae	Rhamnus nepalensis	Not Evaluated
207	Magnoliopsida	Sapindales	Anacardiaceae	Rhus paniculata	Not Evaluated
208	Magnoliopsida	Lamiales	Gesneriaceae	Rhynchoglossum obliquum	Not Evaluated
209	Magnoliopsida	Gentianales	Rubiaceae	Rubia sikkimensis	Not Evaluated
210	Magnoliopsida	Rosales	Rosaceae	Rubus biflorus	Not Evaluated
211	Magnoliopsida	Rosales	Rosaceae	Rubus treutleri	Not Evaluated
212	Magnoliopsida	Lamiales	Lamiaceae	Scutellaria discolor	Not Evaluated
213	Magnoliopsida	Solanales	Solanaceae	Solanum viarum	Not Evaluated
214	Magnoliopsida	Gentianales	Rubiaceae	Spermadictyon suaveolens	Not Evaluated
215	Magnoliopsida	Rosales	Rosaceae	Spiraea bella	Not Evaluated
216	Magnoliopsida	Ranunculales	Menispermaceae	Stephania elegans	Not Evaluated
217	Magnoliopsida	Ranunculales	Menispermaceae	Stephania glabra	Not Evaluated
218	Magnoliopsida	Lamiales	Acanthaceae	Strobilanthes sp	Not Evaluated
219	Magnoliopsida	Ericales	Styracaceae	Styrax serrulatus	Not Evaluated
220	Magnoliopsida	Gentianales	Apocynaceae	Tabernaemontana divaricata	Not Evaluated
221	Magnoliopsida	Vitales	Vitaceae	Tetrastigma leucostaphylum	Not Evaluated
222	Magnoliopsida	Vitales	Vitaceae	Tetrastigma rumicispermum	Not Evaluated
223	Magnoliopsida	Vitales	Vitaceae	Tetrastigma sp	Not Evaluated
224	Magnoliopsida	Lamiales	Acanthaceae	Thunbergia fragrans	Not Evaluated
225	Magnoliopsida	Gentianales	Rubiaceae	Uncaria scandens	Not Evaluated
226	Magnoliopsida	Malvales	Malvaceae	Sterculia villosa	Not Evaluated
227	Magnoliopsida	Gentianales	Rubiaceae	Canthium glabrum	Not Evaluated
228	Magnoliopsida	Fagales	Fagaceae	Castanopsis sp	Not Evaluated
229	Magnoliopsida	Magnoliales	Myristicaceae	Knema tenuinervia	**Least Concern**
230	Pinopsida	Pinales	Pinaceae	Pinus roxburghii	Least Concern
231	Polypodiopsida	Polypodiales	Pteridaceae	Adiantum philippense	Least Concern
232	Polypodiopsida	Schizaeales	Lygodiaceae	Lygodium japonicum	Least Concern
233	Polypodiopsida	Polypodiales	Pteridaceae	Pteris cretica	Least Concern
234	Polypodiopsida	Polypodiales	Pteridaceae	Adiantum caudatum	Not Evaluated
235	Polypodiopsida	Polypodiales	Pteridaceae	Adiantum incisum	Not Evaluated

236	Polypodiopsida	Polypodiales	Pteridaceae	Adiantum sp	Not Evaluated
237	Polypodiopsida	Polypodiales	Aspleniaceae	Asplenium finlaysonianum	Not Evaluated
238	Polypodiopsida	Polypodiales	Aspleniaceae	Asplenium phyllitidis	Not Evaluated
239	Polypodiopsida	Polypodiales	Dennstaedtiaceae	Pteridium revolutum	Not Evaluated
240	Magnoliopsida	Unknown	Unknown	Unknown	Unknown
241	Magnoliopsida	Unknown	Unknown	Unknown	Unknown
242	Magnoliopsida	Unknown	Unknown	Unknown	Unknown

Tree species diversity recorded post-monsoon with their IUCN status.

Site No	No. of Tree	Count of Tree	Sampling count (DBH:5-10 cm)	Avg. DBH (cm)	Avg. Height (cm)	Density (trees/m²)	Basal Area (m²/ha)	IUCN status
K_F&F_1	Grewia eriocarpa	1	6			119.9178	0	Least Concern (LC)
K_F&F_1	Litsea glutinosa	1	2			39.9726	0	Least Concern (LC)
K_F&F_1	Pinus roxburghii	1	1	14.5	7	19.9863	0.330034	Least Concern (LC)
K_F&F_2	Albizia odoratissima	1	1		58	19.9863	0	Not Evaluated (NE)
K_F&F_2	Ulmus lanceifolia	1	1		7	19.9863	0	Not Evaluated (NE)
K_F&F_2	Ziziphus mauritiana	1	2			39.9726	0	Least Concern (LC)
K_F&F_3	Pinus roxburghii	7	1	28.825	14.04167	19.9863	1.304253	Least Concern (LC)
K_F&F_4	Bauhinia purpurea	1	1		48	19.9863	0	Least Concern (LC)
K_F&F_4	Ficus semicordata	4	2	20.7	8	39.9726	0.672611	Least Concern (LC)
K_F&F_4	Grewia eriocarpa	11	2			39.9726	0	Least Concern (LC)
K_F&F_4	Mallotus philippensis	1	4			79.9452	0	Least Concern (LC)
K_F&F_5	Casearia graveolens	1	1			19.9863	0	Least Concern (LC)
K_F&F_5	Pinus roxburghii	22	3	24.39	11.71429	59.9589	0.933785	Least Concern (LC)

K_F&F_5	Sapium insigne	1	1			19.9863	0	Least Concern (LC)
K_F&F_6	Daubanga grandiflora	1	1	67.4	15	19.9863	7.130879	Least Concern (LC)
K_F&F_6	Ficus semicordata	1	1	36	10	19.9863	2.034362	Least Concern (LC)
K_F&F_6	Grewia eriocarpa	3	3	15.45	7.5	59.9589	0.374697	Least Concern (LC)
K_F&F_6	Leucaena leucocephala	1	15		7	299.7945	0	Least Concern (LC)
K_F&F_6	Leucaena leucocephala	2	1	51.4	13	19.9863	4.147148	Least Concern (LC)
K_F&F_6	Mallotus philippensis	1	8			159.8904	0	Least Concern (LC)
K_F&F_6	Premna bengalensis	2	1	14.7	7	19.9863	0.339202	Not Evaluated (NE)
K_F&F_6	Tamarindus indica	2	5		6	99.9315	0	Least Concern (LC)
K_F&F_6	Tamarindus indica	2	1	19.15	8.5	19.9863	0.575653	Least Concern (LC)
K_F&F_7	Myrica esculenta	1	2			39.9726	0	Least Concern (LC)
K_F&F_7	Pinus roxburghii	16	22	34.23571	17.33333	439.6986	1.839849	Least Concern (LC)
K_F&F_8	Pinus roxburghii	32	3	27.72903	14.48387	59.9589	1.20696	Least Concern (LC)
K_F&F_8	Quercus griffithii	1	2			39.9726	0	Least Concern (LC)
K_F&F_9	Albizia odoratissima	3	1	21.8	12.5	19.9863	0.745996	Not Evaluated (NE)
K_F&F_9	Casearia graveolens	7	2			39.9726	0	Least Concern (LC)
K_F&F_9	Lagerstroemia parviflora	1	1	21.63333	9.666667	19.9863	0.734633	Least Concern (LC)

K_F&F_9	Litsea glutinosa	1	1		10	19.9863	0	Least Concern (LC)
K_F&F_9	Pinus roxburghii	1	1	14.1	8	19.9863	0.312077	Least Concern (LC)
K_F&F_9	Rhus paniculata	1	6			119.9178	0	Not Evaluated (NE)
K_F&F_9	Stereospermum colais	1	1	18	9	19.9863	0.508591	Least Concern (LC)
K_F&F_10	Lithocarpus sp	4	30	12.8	25.33333	599.589	0.257184	Not Evaluated (NE)
K_F&F_10	Litsea sp	1	5			99.9315	0	Not Evaluated (NE)
K_F&F_10	Mallotus tetracoccus	3	1	17.8	11	19.9863	0.497351	Not Evaluated (NE)
K_F&F_10	Quercus griffithii	1	2			39.9726	0	Least Concern (LC)
K_F&F_10	Radermachera sinica	2	1	17.8	13	19.9863	0.497351	Least Concern (LC)
K_F&F_10	Rhus chinensis	1	1			19.9863	0	Least Concern (LC)
K_F&F_11	Aphanamixis polystachya	1	3			59.9589	0	Least Concern (LC)
K_F&F_11	Canthium glabrum	2	2		52.5	39.9726	0	Not Evaluated (NE)
K_F&F_11	Drimycarpus racemosus	1	1	13.6	8	19.9863	0.290336	Not Evaluated (NE)
K_F&F_11	Juglans regia	1	1	37.6	25	19.9863	2.219213	Least Concern (LC)
K_F&F_11	Phoebe sp	4	1	43.1	21.66667	19.9863	2.915935	Not Evaluated (NE)
K_F&F_11	Taulama hodgsonii	2	1	41.65	15.5	19.9863	2.723036	Not Evaluated (NE)
K_F&F_11	Taulama hodgsonii	3	1	34.06667	19.33333	19.9863	1.821724	Not Evaluated (NE)

K_F&F_11	UK tree 1	13	1	22.48462	14.30769	19.9863	0.793586	Cannot Check
K_F&F_11	UK tree 2	3	1	36.2	19.33333	19.9863	2.057029	Cannot Check
K_F&F_11	Unknown	1	1			19.9863	0	Cannot Check
K_F&F_12	Actinodaphne obovata	1	1	23.5	15	19.9863	0.86688	Not Evaluated (NE)
K_F&F_12	Altingia excelsa	1	1			19.9863	0	Least Concern (LC)
K_F&F_12	Aphanamixis polystachya	1	4			79.9452	0	Least Concern (LC)
K_F&F_12	Beilschmiedia sp	1	1	24.1	13	19.9863	0.911711	Not Evaluated (NE)
K_F&F_12	Garuga pinnata	1	1	18.6	12	19.9863	0.543062	Least Concern (LC)
K_F&F_12	Garuga pinnata	2	1	62.1	26	19.9863	6.053499	Least Concern (LC)
K_F&F_12	Knema tenuinervia	1	5			99.9315	0	Least Concern (LC)
K_F&F_12	Knema tenuinervia	1	1	36.5	14	19.9863	2.091265	Least Concern (LC)
K_F&F_12	Mallotus nepalensis?	1	3			59.9589	0	Not Evaluated (NE)
K_F&F_12	Mallotus philippensis	1	1		19	19.9863	0	Least Concern (LC)
K_F&F_12	Polyalthia simiarum	8	7	21.5	27.14286	139.9041	0.725605	Least Concern (LC)
K_F&F_12	Pterospermum acerifolium	1	1			19.9863	0	Least Concern (LC)
K_F&F_12	Pterospermum acerifolium	5	1	29.44	16.8	19.9863	1.360501	Least Concern (LC)
K_F&F_12	Unknown	2	1	31.5	17.5	19.9863	1.557559	

K_F&F_13	Callicarpa arborea	1	1	13.2	9	19.9863	0.273509	Least Concern (LC)
K_F&F_13	Capparis acutifolia	1	2			39.9726	0	Not Evaluated (NE)
K_F&F_13	Chukrasia tabularis	1	1	68.6	15	19.9863	7.387058	Least Concern (LC)
K_F&F_13	Garuga pinnata	2	1	31	13.5	19.9863	1.508505	Least Concern (LC)
K_F&F_13	Maesa chisia	1	3			59.9589	0	Not Evaluated (NE)
K_F&F_13	Mallotus tetracoccus	1	1	15.3	10	19.9863	0.367457	Not Evaluated (NE)
K_F&F_13	Mallotus tetracoccus	1	1		9	19.9863	0	Not Evaluated (NE)
K_F&F_14	Castanopsis tribuloides	3	2	13.65	10.5	39.9726	0.292475	Least Concern (LC)
K_F&F_14	Engelhardia spicata	1	1			19.9863	0	Least Concern (LC)
K_F&F_14	Eurya acuminata	1	2		9	39.9726	0	Least Concern (LC)
K_F&F_14	Eurya acuminata	2	6	17.4	14	119.9178	0.47525	Least Concern (LC)
K_F&F_14	Glochidion sp	1	1	13.4	10	19.9863	0.28186	Not Evaluated (NE)
K_F&F_14	Litsea cubeba	3	2	14.1	14	39.9726	0.312077	Least Concern (LC)
K_F&F_14	Litsea sp	1	1	16.9	14	19.9863	0.448329	Not Evaluated (NE)
K_F&F_14	Macaranga peltata	1	1			19.9863	0	Least Concern (LC)
K_F&F_14	Rhus chinensis	1	1	15.7	15	19.9863	0.386921	Least Concern (LC)
K_F&F_14	Schima wallichii	1	1		5	19.9863	0	Least Concern (LC)

K_F&F_14	Schima wallichii	2	1	75.25	14	19.9863	8.88866	Least Concern (LC)
K_F&F_15	Actinodaphne obovata	1	1		120	19.9863	0	Not Evaluated (NE)
K_F&F_15	Betula alnoides	1	1	47.4	20	19.9863	3.526793	Least Concern (LC)
K_F&F_15	Callicarpa arborea	1	1	15.4	13	19.9863	0.372276	Least Concern (LC)
K_F&F_15	Castanopsis hystrix	1	1	14.2	9	19.9863	0.316519	Least Concern (LC)
K_F&F_15	Castanopsis sp	1	1		9	19.9863	0	Not Evaluated (NE)
K_F&F_15	Castanopsis tribuloides	2	5	17.5	12	99.9315	0.480728	Least Concern (LC)
K_F&F_15	Helicia nilagirica	1	1	13.5	8	19.9863	0.286082	Least Concern (LC)
K_F&F_15	Ilex kingiana	1	3			59.9589	0	Not Evaluated (NE)
K_F&F_15	Ilex kingiana	2	1	14.6	13.5	19.9863	0.334602	Not Evaluated (NE)
K_F&F_15	Lithocarpus sp	2	3	13.2	7	59.9589	0.273509	Not Evaluated (NE)
K_F&F_15	Macaranga denticulata	1	3			59.9589	0	Least Concern (LC)
K_F&F_15	Macaranga denticulata	2	1	14.6	14	19.9863	0.334602	Least Concern (LC)
K_F&F_15	Parasassafras confertiflora	1	1	13.2	14	19.9863	0.273509	Least Concern (LC)
K_F&F_15	Quercus glauca	1	1			19.9863	0	Least Concern (LC)
K_F&F_15	Schima wallichii	2	2	37.4	18	39.9726	2.195667	Least Concern (LC)
K_F&F_15	Styrax serrulatus	1	1	23.3	13	19.9863	0.852187	Data Deficient (DD)

K_F&F_16	Albizia chinensis	1	1	50	20	19.9863	3.92431	Least Concern (LC)
K_F&F_16	Bauhinia purpurea	1	1			19.9863	0	Least Concern (LC)
K_F&F_16	Callicarpa arborea	2	1	81	19	19.9863	10.29896	Least Concern (LC)
K_F&F_16	Dalbergia sericea	1	1	17	14	19.9863	0.45365	Not Evaluated (NE)
K_F&F_16	Gmelina arborea	3	1	41.66667	20.33333	19.9863	2.725215	Least Concern (LC)
K_F&F_16	Heteropanax fragrans	1	1			19.9863	0	Not Evaluated (NE)
K_F&F_16	Hyptianthera stricta	1	2			39.9726	0	Not Evaluated (NE)
K_F&F_16	Kydia calycina	1	1	51	23	19.9863	4.082852	Least Concern (LC)
K_F&F_16	Mallotus tetracoccus	1	2			39.9726	0	Not Evaluated (NE)
K_F&F_16	Ostodes paniculata	4	3	12.33333	10.5	59.9589	0.238772	Least Concern (LC)
K_F&F_16	Radermachera sinica	1	1			19.9863	0	Least Concern (LC)
K_F&F_16	Solanum erianthum	1	1			19.9863	0	Least Concern (LC)
K_F&F_16	Trema orientalis	1	1			19.9863	0	Least Concern (LC)
K_F&F_17	Callicarpa arborea	1	1	35.3	14	19.9863	1.956017	Least Concern (LC)
K_F&F_17	Kydia calycina	2	1	19.25	8	19.9863	0.581681	Least Concern (LC)
K_F&F_17	Maesa chisia	1	5			99.9315	0	Not Evaluated (NE)
K_F&F_17	Morus macroura	1	1	23.2	10	19.9863	0.844888	Least Concern (LC)

K_F&F_17	Quercus glauca	1	1	26.7	13	19.9863	1.119041	Least Concern (LC)
K_F&F_18	Castanopsis tribuloides	1	1	23.4	18	19.9863	0.859518	Least Concern (LC)
K_F&F_18	Cordia obliqua	1	1	15.6	17	19.9863	0.382008	Not Evaluated (NE)
K_F&F_18	Dalbergia sericea	1	1			19.9863	0	Not Evaluated (NE)
K_F&F_18	Engelhardia spicata	1	1			19.9863	0	Least Concern (LC)
K_F&F_18	Ficus semicordata	1	1	65.4	13	19.9863	6.713961	Least Concern (LC)
K_F&F_18	Hyptianthera stricta	1	3			59.9589	0	Not Evaluated (NE)
K_F&F_18	Pinus roxburghii	1	1	18.6	15	19.9863	0.543062	Least Concern (LC)
K_F&F_18	Quercus griffithii	4	2	35.43333	16	39.9726	1.970822	Least Concern (LC)
K_F&F_18	Rhus chinensis	1	1			19.9863	0	Least Concern (LC)
K_F&F_18	Schima wallichii	2	4	67.5	18	79.9452	7.152055	Least Concern (LC)
K_F&F_18	Sterculia villosa	1	1		35	19.9863	0	Least Concern (LC)
K_F&F_18	Syzygium cuminii	1	1			19.9863	0	Least Concern (LC)
K_F&F_19	Albizia lebbeck	1	1	52	18	19.9863	4.244534	Least Concern (LC)
K_F&F_19	Albizia lebbeck	1	1	23.4	13	19.9863	0.859518	Least Concern (LC)
K_F&F_19	Callicarpa arborea	1	1	61.9	18	19.9863	6.01457	Least Concern (LC)
K_F&F_19	Celtis tetrandra	1	1	27.2	15	19.9863	1.161345	Least Concern (LC)

K_F&F_19	Dalbergia sericea	1	1			19.9863	0	Not Evaluated (NE)
K_F&F_19	Lagerstroemia parviflora	6	1	22.78333	13	19.9863	0.814813	Least Concern (LC)
K_F&F_19	Mallotus philippensis	1	2		8	39.9726	0	Least Concern (LC)
K_F&F_19	Pterospermum acerifolium	2	1	76.55	20	19.9863	9.19843	Least Concern (LC)
K_F&F_19	Schima wallichii	2	2	11.7	7	39.9726	0.21488	Least Concern (LC)

Bird species diversity with their IUCN status documented during post-monsoon season.

Sl. No	Common Name	Scientific Name	IUCN Status
1	Ashy Bulbul	*Hemixos flavala*	LC
2	Ashy Drongo	*Dicrurus leucophaeus*	LC
3	Ashy Woodswallow	*Artamus fuscus*	LC
4	Asian Barred Owlet	*Glaucidium cuculoides*	LC
5	Barred Buttonquail	*Turnix suscitator*	LC
6	Barred Cuckoo-Dove	*Macropygia unchall*	LC
7	Bar-winged Flycatcher-Shrike	*Hemipus picatus*	LC
8	Bhutan Laughingthrush	*Trochalopteron imbricatum*	LC
9	Black Bulbul	*Hypsipetes leucocephalus*	LC
10	Black-chinned Yuhina	*Yuhina nigrimenta*	LC
11	Black-crested Bulbul	*Rubigula flaviventris*	LC
12	Black-naped Monarch	*Hypothymis azurea*	LC
13	Black-throated Parrotbill	*Suthora nipalensis*	LC
14	Black-throated Prinia	*Prinia atrogularis*	LC
15	Black-throated Sunbird	*Aethopyga saturata*	LC
16	Blue Rock Thrush	*Monticola solitarius*	LC
17	Blue Whistling Thrush	*Myophonus caeruleus*	LC
18	Blue-bearded Bee-eater	*Nyctyornis athertoni*	LC
19	Blue-capped Rock Thrush	*Monticola cinclorhyncha*	LC
20	Blue-throated Barbet	*Psilopogon asiaticus*	LC
21	Blue-throated Flycatcher	*Cyornis rubeculoides*	LC
22	Blue-winged Minla	*Siva cyanouroptera*	LC
23	Bronzed Drongo	*Dicrurus aeneus*	LC
24	Brown Dipper	*Cinclus pallasii*	LC
25	Brown Shrike	*Lanius cristatus*	LC

26	Chestnut-bellied Nuthatch	*Sitta cinnamoventris*	LC
27	Chestnut-crowned Laughingthrush	*Trochalopteron erythrocephalum*	LC
28	Chestnut-tailed Minla	*Chrysominla strigula*	LC
29	Collared Owlet	*Glaucidium brodiei*	LC
30	Common Green Magpie	*Cissa chinensis*	LC
31	Common Hawk-Cuckoo	*Hierococcyx varius*	LC
32	Common Kingfisher	*Alcedo atthis*	LC
33	Common Myna	*Acridotheres tristis*	LC
34	Common Sandpiper	*Actitis hypoleucos*	LC
35	Common Tailorbird	*Orthotomus sutorius*	LC
36	Crested Kingfisher	*Megaceryle lugubris*	LC
37	Dark-sided Flycatcher	*Muscicapa sibirica*	LC
38	Dollarbird	*Eurystomus orientalis*	LC
39	Dusky Warbler	*Phylloscopus fuscatus*	LC
40	Eurasian Hoopoe	*Upupa epops*	LC
41	Eurasian Kestrel	*Falco tinnunculus*	LC
42	Eurasian Tree Sparrow	*Passer montanus*	LC
43	Fire-breasted Flowerpecker	*Dicaeum ignipectus*	LC
44	Fire-tailed Sunbird	*Aethopyga ignicauda*	LC
45	Golden Bush Robin	*Tarsiger chrysaeus*	LC
46	Golden-throated Barbet	*Psilopogon franklinii*	LC
47	Gray Bushchat	*Saxicola ferreus*	LC
48	Gray Treepie	*Dendrocitta formosae*	LC
49	Gray Wagtail	*Motacilla cinerea*	LC
50	Gray-backed Shrike	*Lanius tephronotus*	LC
51	Gray-bellied Cuckoo	*Cacomantis passerinus*	LC
52	Gray-bellied Tesia	*Tesia cyaniventer*	LC
53	Gray-headed Canary-Flycatcher	*Culicicapa ceylonensis*	LC

54	Gray-headed Woodpecker	*Picus canus*	LC
55	Gray-hooded Warbler	*Phylloscopus xanthoschistos*	LC
56	Gray-throated Babbler	*Stachyris nigriceps*	LC
57	Great Barbet	*Psilopogon virens*	LC
58	Great Cormorant	*Phalacrocorax carbo*	LC
59	Great Myna	*Acridotheres grandis*	LC
60	Greater Yellownape	*Chrysophlegma flavinucha*	LC
61	Green-backed Tit	*Parus monticolus*	LC
62	Hair-crested Drongo	*Dicrurus hottentottus*	LC
63	Hill Partridge	*Arborophila torqueola*	LC
64	Himalayan Bulbul	*Pycnonotus leucogenys*	LC
65	Himalayan Buzzard	*Buteo refectus*	LC
66	Himalayan Prinia	*Prinia crinigera*	LC
67	Indian White-eye	*Zosterops palpebrosus*	LC
68	Kalij Pheasant	*Lophura leucomelanos*	LC
69	Large Woodshrike	*Tephrodornis virgatus*	LC
70	Large-billed Crow	*Corvus macrorhynchos*	LC
71	Lesser Necklaced Laughingthrush	*Garrulax monileger*	LC
72	Little Bunting	*Emberiza pusilla*	LC
73	Long-tailed Broadbill	*Psarisomus dalhousiae*	LC
74	Long-tailed Minivet	*Pericrocotus ethologus*	LC
75	Long-tailed Shrike	*Lanius schach*	LC
76	Maroon Oriole	*Oriolus traillii*	LC
77	Mountain Bulbul	*Ixos mcclellandii*	LC
78	Mountain Scops Owl	*Otus spilocephalus*	LC
79	Nepal Fulvetta	*Alcippe nipalensis*	LC
80	Nepal House-Martin	*Delichon nipalense*	LC
81	Olive-backed Pipit	*Anthus hodgsoni*	LC

82	Orange-bellied Leafbird	*Chloropsis hardwickii*	LC
83	Orange-headed Thrush	*Geokichla citrina*	LC
84	Oriental Magpie Robin	*Copsychus saularis*	LC
85	Oriental Turtle Dove	*Streptopelia orientalis*	LC
86	Plumbeous Redstart	*Phoenicurus fuliginosus*	LC
87	Pygmy Cupwing	*Pnoepyga pusilla*	LC
88	Red Junglefowl	*Gallus gallus*	LC
89	Red-billed Leiothrix	*Leiothrix lutea*	LC
90	Red-headed Trogon	*Harpactes erythrocephalus*	LC
91	Red-tailed Minla	*Minla ignotincta*	LC
92	Red-vented Bulbul	*Pycnonotus cafer*	LC
93	Red-whiskered Bulbul	*Pycnonotus jocosus*	LC
94	River Lapwing	*Vanellus duvaucelii*	NT
95	Rock Pigeon	*Columba livia*	LC
96	Rufescent Prinia	*Prinia rufescens*	LC
97	Rufous Sibia	*Heterophasia capistrata*	LC
98	Rufous Woodpecker	*Micropternus brachyurus*	LC
99	Rufous-capped Babbler	*Cyanoderma ruficeps*	LC
100	Rufous-chinned Laughingthrush	*Ianthocincla rufogularis*	LC
101	Rufous-headed Parrotbill	*Psittiparus bakeri*	LC
102	Rufous-necked Hornbill	*Aceros nipalensis*	VU
103	Rufous-necked Laughingthrush	*Pterorhinus ruficollis*	LC
104	Rusty-cheeked Scimitar Babbler	*Erythrogenys erythrogenys*	LC
105	Rusty-fronted Barwing	*Actinodura egertoni*	LC
106	Scaly-breasted Cupwing	*Pnoepyga albiventer*	LC
107	Scaly-breasted Munia	*Lonchura punctulata*	LC
108	Scarlet Minivet	*Pericrocotus speciosus*	LC
109	Siberian Stonechat	*Saxicola maurus*	LC

110	Slaty-backed Forktail	*Enicurus schistaceus*	LC
111	Small Niltava	*Niltava macgrigoriae*	LC
112	Speckled Piculet	*Picumnus innominatus*	LC
113	Spotted Dove	*Spilopelia chinensis*	LC
114	Spotted Elachura	*Elachura formosa*	LC
115	Spotted Nutcracker	*Nucifraga caryocatactes*	LC
116	Streak-breasted Scimitar Babbler	*Pomatorhinus ruficollis*	LC
117	Streaked Spiderhunter	*Arachnothera magna*	LC
118	Striated Laughingthrush	*Grammatoptila striata*	LC
119	Striated Yuhina	*Staphida castaniceps*	LC
120	Sultan Tit	*Melanochlora sultanea*	LC
121	Taiga Flycatcher	*Ficedula albicilla*	LC
122	Tickell's Leaf Warbler	*Phylloscopus affinis*	LC
123	Ultramarine Flycatcher	*Ficedula superciliaris*	LC
124	Verditer Flycatcher	*Eumyias thalassinus*	LC
125	Wedge-tailed Green Pigeon	*Treron sphenurus*	LC
126	Whiskered Yuhina	*Yuhina flavicollis*	LC
127	White Wagtail	*Motacilla alba*	LC
128	White-bellied Heron	*Ardea insignis*	CR
129	White-browed Scimitar Babbler	*Pomatorhinus schisticeps*	LC
130	White-browed Shrike-Babbler	*Pteruthius aeralatus*	LC
131	White-browed Wagtail	*Motacilla maderaspatensis*	LC
132	White-capped Redstart	*Phoenicurus leucocephalus*	LC
133	White-crested Laughingthrush	*Garrulax leucolophus*	LC
134	White-hooded Babbler	*Gampsorhynchus rufulus*	LC
135	White-rumped Munia	*Lonchura striata*	LC
136	White-throated Bulbul	*Alophoixus flaveolus*	LC
137	White-throated Fantail	*Rhipidura albicollis*	LC

138	White-throated Laughingthrush	*Pterorhinus albogularis*	LC
139	Yellow-bellied Warbler	*Abroscopus superciliaris*	LC
140	Yellow-browed Warbler	*Phylloscopus inornatus*	LC
141	Yellow-cheeked Tit	*Machlolophus spilonotus*	LC
142	Yellow-vented Warbler	*Phylloscopus cantator*	LC