Environmental and Social Impact Assessment Report

132kv Jomori - Phuntshothang Transmission Line Project (2024)

June, 2024

Proponent: Bhutan Power Corporation Limited

Prepared by: Center for Environment and Development (CED)

This ESIA contains suggestions and revisions made by the JICA survey team, Tokyo Electric Power Service Company (TEPSCO) and OPMAC Corporation, for "Preparatory survey for hydropower development project in Bhutan".

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ABBREVIATIONS / ACRONYMS

ACSR	Aluminum Conductor Steel Reinforced
AH/AP	Affected Household/Affected People
BAP	Biodiversity Action Plan
BC	Biological Corridor
BHU	Basic Health Unit
BIS	Bureau of Indian Standards
BPC	Bhutan Power Corporation Limited
BS	Bhutan Standards
BSB	Bhutan Standards Bureau
CA	Competent Authority
CD	Construction Division
CEMP	Contractor Environmental Management Plan
CEO	Chief Executive Officer
CMS	Contract Management Section
CPO	Construction Project Office
CS	Construction Section
CSP	Corporate Strategic Plan
D/C	Double Circuit
DECC	Department of Environment & Climate Change
DEM	Digital Elevation Model
DGPC	Druk Green Power Corporation
DHyE	Druk Hydro Energy Limited

DoE	Department of Energy
DoFPS	Department of Forest and Park Services
DoHPS	Department of Hydro Power & Power Systems
DPR	Detailed Project Report
DSMP	Distribution System Master Plan
DTM	Digital Terrain Model
EA	Environmental Assessment
EC	Environmental Clearance
EHS	Environment, Health, and Safety
EIA	Environmental Impact Assessment
EM&MP	Environmental Management & Monitoring Plan
EMP	Environmental Management Plan
ESMP	Environmental & Social Management Plan
ERA	Electricity Regulatory Authority
ESIA	Environment & Social Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
FNCA	Forest and Nature Conservation Act
FSR	Feasibility Study Report
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Geographical Positioning System
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HH	Household
HPP	Hydropower plant
ICNRP	International Commission on Non-Ionizing Radiation Protection
IEE	Initial Environment Examination
INR	Indian Rupee
IS	Indian Standards
IUCN	International Union for Conservation of Nature
JAXA	Japan Aerospace Exploration Agency
JICA	Japan International Cooperation Agency
JMHP	Jomori Hydropower Plant
JMTL	Jomori Transmission Line
JP	Jomori to Phuntshothang Points
JWS	Jomotshangkha Wildlife Sanctuary
LDC	Least Developed Country
LULC	Land Use Land Cover
MoAF	Ministry of Agriculture & Forest
MoENR	Ministry of Energy and Natural Resources
NCHM	National Center for Hydrology & Metrology

NECS	National Environment Commission Secretariat
NEPA	National Environment Protection Act
NES	National Environment Strategy
NIEHS	National Institute of Environmental Health Sciences
NLC	National Land Commission
NOC	No Objection Certificate
NTGMP	National Transmission Grid Master Plan
NTT	Nippon Telegraph and Telephone Public Corporation
O&M	Operation & Maintenance
OHS	Occupational, Health and Safety
OPGW	Optical Ground Wire
ORC	Out Reach Clinics
PAP	Project Affected People
PAVA	Property Assessment and Valuation Agency
PCC	Plain Cement Concrete
PJ	Phuntshothang to Jomori Points
PM	Particulate Matter
PPE	Personal Protective Equipment
PSMP	Power Sector Master Plan
PTL	Power Transmission Line
RCC	Reinforced Cement Concrete
RDS	Respirable Dust Sampler
RESTEC	Remote Sensing Technology Center of Japan
RGoB	Royal Government of Bhutan
RoW	Right-of-Way
RPM	Respirable Particulate Matter
RSPM	Respirable Suspended Particulate Matter
S/C	Single Circuit
SNC	Second National Communication
SRFL	State Reserved Forest Land
SS	Substation
STDs	Sexually Transmitted Diseases
TDS	Total Dissolved Solids
TEPSCO	Tokyo Electric Power Services Co., Ltd
TL	Transmission Line
TOMS	Transmission Operation & Maintenance Section
TOMU	Transmission Operation & Maintenance Unit
ToR	Terms of Reference
TraMCA	Transboundary Manas Conservation Area
TSPM	Total Suspended Particulate Matter
TSS	Total Suspended Solids

UNESCO	United Nations Educational, Scientific and Cultural Organization
WCD	Wildlife Conservation Division
WHO	World Health Organization
WUA	Water Users' Association
WWF	World Wildlife Fund

WEIGHTS AND MEASURES

°C	degree Celsius	kVA	Kilo-volt-amperes
µg	micro gram	kWh	kilowatt hour
cm	centimeter	m	meter
dB	Decibel	masl	meter above sea level
GW	Giga-Watt	mG	milliGauss
GWh	Giga-Watt hour	mm	millimeter
kg	Kilogram	MVA	megavolt-amperes
km	kilometer	MW	megawatt
kV	kilovolt (1,000 volts)	µT	microteslas

EXECUTIVE SUMMARY

The Power System Master Plan 2040 has identified about 155 technical hydropower potential sites with a total potential of 37 GW. Several stages of assessment were conducted from May 2022 to February 2023 to enable selection of most techno-economically and socio-environmentally promising projects from an initial list of 190 projects. One of the projects identified for feasibility study is 90 MW Jomori Hydropower Project (JHPP) located under Lauri and Serthig Gewogs under Jomotshangkha Dungkhag, Samdrup Jongkhar Dzongkhag.

Bhutan Power Corporation Limited (BPC), the responsible agency for transmission and distribution of electricity in the country, is working in tandem with DGPC for evacuation of hydropower electricity generated from the proposed 90MW Jomori hydropower project. The proposed transmission line project comprises of approximately 63km long 132 KV double circuit (D/C) transmission line that is proposed to pass through five Gewogs i.e., Serthig, Langchenphug, Samrang, Pemathang, and Phuntshothang under Samdrup Jongkhar district. A total of 152 towers are planned over the 63km stretch.

As mandated by Environmental Assessment Act 2000 and Regulation of Environmental Clearance of Projects 2016, a full-fledged Environmental and Social Impact Assessment (ESIA) has been undertaken based on the Terms of Reference endorsed by the Department of Environment & Climate Change (DECC) in January 2024.

There are three options available for the line route. The first alternative route, spanning 43km, was initially favored by BPC. The second alternative route, covering 38.6 km, was proposed to avoid traversing the protected area (Jomotsangkha Wildlife Sanctuary) to mitigate environmental and social impacts, although it still passes through a biological corridor. This route traverses dense forest with no existing access roads. On the other hand, the third alternative route, totaling 63km in length, also recommended by BPC to avoid the CORE Zone of the protected area, features mild terrain and benefits from the proximity of a public road along the line route. Considering various factors, the third alternative route emerges as the most feasible option. Therefore, the Environmental and Social Impact Assessment (ESIA) study has been carried out for the third alternative route, which is the proposed 63km 132kV D/C Jomori Power Transmission line project.

In the preliminary stages of our investigation, baseline data regarding the physical, biological, and socio-economic landscape was collected through field surveys conducted in collaboration with relevant agencies. Supplementary information was also gathered from secondary sources to enrich our understanding. The proposed power evacuation line from the Jomori HPP to the existing Phuntshothang substation traverses

the multiple-use and buffer zone of the Jomotshangkha Wildlife Sanctuary (JWS). Given this circumstance, BPC has initiated a thorough Environmental & Social Impact Assessment (ESIA) for the transmission line, with support from both local and international environmental and social consultants.

This ESIA addresses a range of environmental and social impacts associated with the pre-construction and construction phases of the project. Land acquisition is identified as a significant concern due to its potential to drastically alter the landscape. The influx of laborers during these phases is expected to contribute to noticeable impacts, requiring strict adherence to occupational health and safety (OHS) measures. Construction activities may temporarily affect aesthetics, while waste disposal, air quality, and noise levels are also anticipated to be affected, although to varying extents. The demands of construction are likely to place pressure on resources, and disturbances to flora and fauna are expected, particularly during tower installation. Additionally, the risk of poaching may increase during these phases. During the operational phase, concerns shift towards electromagnetic fields and the potential electrocution of birds, primarily associated with power transmission. Surface water quality may see some impact during construction but is projected to be less affected during operation. In summary, while certain project activities are expected to have significant impacts throughout the project lifecycle, others may have minimal to no visible effect.

This ESIA is designed to thoroughly examine the environmental, social, and economic consequences of the project before any decisions are made. Its primary objective is to anticipate environmental impacts during the early stages of project planning and design, seeking ways to mitigate adverse effects, tailor projects to fit the local environment, and present decision-makers with various options.

Rather than solely using as a means to obtain environmental clearance, BPC aims to utilize this ESIA as a vital management tool. Its objective is to facilitate the efficient planning of the transmission line project, minimizing environmental disruption, and maximizing overall economic benefits for both the people and the entire country.

The Royal Government of Bhutan (RGOB) has formally asked the Japanese government for financial support to develop hydropower Projects in Bhutan. This time the hydropower projects under consideration include the 90 MW Jomori hydropower plant and the Druk Bindu hydropower plants (comprising 2 units with capacities of 18MW and 8MW). Additionally, the plan involves constructing transmission lines to support these projects. These initiatives are part of the Bhutan government's efforts to promote relatively smaller hydropower developments, which are deemed crucial given the current supply and demand dynamics and project economics. Implementing these projects is anticipated to enhance power stability in Bhutan during dry seasons and meet the escalating power requirements, thereby fostering the expansion of a reliable

and sustainable power infrastructure in the country. These initiatives are recognized as pivotal within the power sector. In evaluating these projects for potential support, the Japan International Cooperation Agency (JICA) has initiated a preparatory study encompassing both the development of the hydropower facilities and the construction of transmission lines for Jomori and Druk Bindu.

The estimated cost for constructing the 63km 132kV D/C Jomori transmission line is **Nu. 954.4 million or 1717.8 million Japanese Yen**, which also includes the Environmental Management Plan (EMP) expenses. A comprehensive assessment of the environmental and social impacts was conducted, focusing on their direction, magnitude, extent, duration, and frequency to the best possible extent. Following this assessment, mitigation measures were formulated as integral components of the EMP. The projected cost for implementing the EMP, covering expenses such as land substitute/compensation, crop damages compensation, and leasing, is approximately **Nu. 12.215 million** for the 132kV Jomori Transmission line project.

1. INTRODUCTION

1.1. Project Background and objectives

The Kingdom of Bhutan is one of the few net-carbon sink economies that is committed to remaining carbon neutral. Apart from the large proportion of forest cover that serves as a carbon sink, the pursuit of run-of-river hydropower projects have enabled the country to meet its growing domestic energy needs as well as to earn Indian Rupees (INR) from export of electricity. Of the estimated 30GW hydropower potential, the country has harnessed only about 1.6 GW of hydropower with support from India and other countries. Although the domestic annual electricity demand of only 2,459 GWh in 2021 allowed for 77% of its annual energy generation to be exported to India, the country is faced with increasing domestic demand for hydroelectricity. In 2021, earnings from export of electricity to India accounted for 40% of country's total annual export. This share of hydroelectricity in country's export earnings is expected to decrease as more of its energy generation is consumed by its energy intensive industries and businesses. This is further aggravated by the lean winter season during which hydropower generation decreases sharply to 20-40% of its peak monsoon season generation. As the country graduates from its LDC status to developing country category, its need for economic development will further translate to increasing domestic demand for electricity. It is for this reason that the country has embarked on a number of policies and plans to bridge the energy gaps while living up to its commitments for a carbon neutral economy. In the wake of the economic downturn with the Covid-19 pandemic, it has become even more urgent to harness the hydropower potential to help stimulate economic activities at the grass root levels and to generate employment.

In view of the above, the Royal Government of Bhutan (RGOB) has opted to pursue a low carbon development pathway. Towards this objective, a number of policies, strategies, and action plans have been developed. The National Strategy and Action Plan for Low Carbon Development, 2012 recommends several potential interventions and mitigation actions including hydropower development. The Economic Development Policy, 2016 recognizes the energy sector as the main driver of the country's economy and calls for accelerated development hydropower and alternative renewable energy sectors to improve domestic energy supply. Climate Change Policy of the Kingdom of Bhutan, 2020 states that Bhutan will pursue transformative actions and approaches to decouple GHG emissions from industrial sectors through improved efficiency and diversification of energy sources. The Bhutan Sustainable Hydropower Development Policy 2021 reinforces the strategic importance of hydropower in providing sustainable energy access and ensuring energy security. The National Comprehensive Development Plan 2030, the Power Sector Master Plan 2040 (PSMP 2040), all prioritize development of large as well as small hydropower

projects. The concept note for the 13th Five-Year Plan (2023-2028) identifies the need for consistent and adequate electricity from source within the country. In order to meet the growing domestic demand for energy, the government is prioritizing development of small hydropower projects.

Among many other small hydropower projects currently under different stages of development, the Department of Energy (DoE), Ministry of Energy and Natural Resources (MoENR) has prioritized development of small and medium hydropower projects. Jomori and Druk Bindu hydropower projects are among the six small hydropower projects that have been approved by Department of Energy as techno-economically viable and considered for feasibility study and up-gradation of existing FSR and DPR. The Druk Green Power Corporation (DGPC), as the agency responsible for hydropower generation is expediting the development of 26MW Druk Bindu (18MW and 8MW) and 90 MW Jomori Hydropower projects. Bhutan Power Corporation (BPC) as the implementing agency for transmission and distribution of electricity in the country, is working closely with DGPC to plan and implement the transmission lines for evacuation of power from the above two projects.

The environmental clearance process for this project was initiated in December 2023 when BPC applied for endorsement of terms of reference (TOR) for conducting Environment and Social Impact Assessment (ESIA) for construction of the 63 kilometers 132 kV D/C power transmission line. The DECC, vide letter no. CD/BPC/C&PD/2023/VOL-1/68 dated December 18, 2023 issued the endorsed TOR for ESIA of the proposed project (Appendix 1)

1.2. ESIA Objectives and Scope

This ESIA report pertains to the proposed project to evacuate electricity from the proposed 90MW Jomori Hydropower Plant to Phuntshothang Substation in Samdrup Jongkhar Dzongkhag.

The ESIA

The ESIA exercise was carried out with the dual purpose of meeting i) RGOB requirements for environmental and social considerations of development projects and ii) the financing requirements of funding agency. National Environment Protection Act (NEPA 2007) requires all development projects to secure development consent prior to implementation and that environmental clearance is a pre-requisite to development consent. Any person who seeks to carry out a project that requires a development consent must apply for environmental clearance. The Regulations on Environment Clearance of Projects (RECOP 2016) further require the applicant to adhere to the relevant environmental assessment guidelines and EIA/ IEE form issued by the National Environment Commission.

The RGoB has requested the Japanese government for financial assistance to develop the Jomori – Phuntshothang transmission line project. In addition to meeting the above RGOB requirement, this ESIA also addresses the requirements of funding agency. Projects proposed for financing under Japanese Official Development Assistance (ODA) are subject the meeting the requirements of JICA Guidelines for environmental and social considerations.

i. Objectives:

This ESIA has prepared based on the TOR for Conducting Environmental & Social Impact Assessment for The Construction of 132 Kv Power Transmission Line Project issued by DoECC in line with the environmental assessment procedure under the Environmental Assessment Act 2000 and its Regulation 2016 the objectives of the assessment are to:

Establish the environmental and social baseline status of the project area through biodiversity and social surveys.

To identify potential impacts of the project activities on the natural environment and socio-economic condition of the area

To propose mitigation measures to address the negative impacts of project activities before, during and after construction operational phases.

ii. Scope of the study

The ESIA covers the area through which the 132 KV transmission line is proposed to pass. The study area covers five Gewogs of Serthig, Langchenphug, Samrang, Pemathang, and Phuntshothang under Samdrupjongkhar Dzongkhag. The area of investigation are broadly divided into environmental and social components. The environmental considerations are derived on the basis of biodiversity surveys conducted during wet and dry seasons. Social considerations are derived from the social surveys focused on communities, households, and individuals affected by the project activities.

1.3. ESIA Methodology

1.3.1. Scoping

The specific details required according to the endorsed ToR for this ESIA 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 bellow should be provided in ESIA;

i. Baseline data concerning to the project's physical environment, including air quality, noise levels, water quality, land use, hydrology, climate conditions, geology, biological environment (wet & dry 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;
vi. Development of an environmental management plan for both construction and operation phases;
vii. Preparation of a Land Acquisition Plan; and
viii. Presentation of the findings derived from the assessment process.

On the other hand, in the JICA Guideline, "Scoping" requires the determination of methodologies and the scope of significant or potentially significant environmental and social impacts to be assessed, along with the analysis of alternatives. The guideline highlights the importance of project proponents disclosing relevant information and engaging in consultations with local stakeholders based on stakeholder analysis to mitigate environmental and social impacts for Category A projects, and if necessary, Category B projects during the scoping process.

The proposed 132kV Jomori transmission line is a Category A project due to a substantial portion of the line passing through a protected area. Consequently, BPC and JICA consultants conducted numerous consultations with local stakeholders, including public consultation meetings, local stakeholder consultations, and a national consultation meeting for stakeholders at the national level.

While the JICA Guidelines offer a comprehensive list of impacts to be assessed under the "Impacts to be assessed" section concerning environmental and social considerations, the scoping process for this transmission line project has narrowed down the elements to be addressed. In essence, the scope of work covers the environmental and social assessment of all components of the Jomori transmission line, including

the installation of transmission line towers, access roads, ropeways, temporary and permanent camps, and muck disposal sites, as well as the construction camp.

For baseline survey, scoping item are proposed, reviewing on ESIA TOR approved by DoECC and also suggested scoping items in JICA guideline.

Table 1-1: Scoping Items of the proposed Project

Impact	**Pre-Construction & Construction**			**Operation**
Items ***Italic letter items are required in ESIA TOR approved by DoECC to describe overview as baseline status, regardless its potential impacts.***	**Casting and Foundation works**	**Tower Installation**	**Stringing**	**Power Transmission**
Air quality	✓	✓		
Noise and Vibration Level	✓	✓	✓	
Water quality	✓			✓
Pressure on resources (water resource)	✓	✓	✓	
Soil Quality	✓			
Waste disposal	✓	✓		
Protected Area (Land use)	✓	✓	✓	✓
Biological environment (Biodiversity: Flora and Fauna)	✓	✓	✓	✓
Poaching	✓	✓	✓	-
Electrocution of Birds	-	-	-	✓
Hydrology	-	-	-	-
Geology & Topography	-	-	-	-
Electromagnetic fields	-	-	-	-
Climate conditions	-	-	-	-
Land acquisition	✓	✓	-	-
Livelihood (Damages to Crop, etc.)	✓	✓	✓	-
Labour Environment (Influx of laborers, Occupational Health and Safety, etc.)	✓	✓	✓	✓
Cultural Heritage	✓	✓	✓	
Scenery (Aesthetics)	-	-	-	✓
✓ : Impact is Expected Blank: No impact is expected				

1.3.1.1. Summary of Scoping Results for the 132kV Jomori Transmission Line

The evaluation of various impact items related to the construction and operation phases of 63km 132kV D/C Jomori Transmission line 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 operation 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 Jomotsangkha Wildlife Sanctuary (JWS). 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 CO_2 emissions during construction, but no ongoing emissions during operation.

1.3.2. Environmental Assessment

The methodologies employed in gathering the baseline information on different environmental components and quality parameters are described below. The ambient air and water quality measurements were taken to establish the pre-project ambient environmental baseline. As required, biodiversity assessments were carried out over two seasons to capture seasonal variations in plant and animal species. The biodiversity surveys for the wet season were conducted in September 2023 with support from Park management, Jomotshangkha Wildlife Sanctuary. The biodiversity survey for dry season was conducted in December 2023.

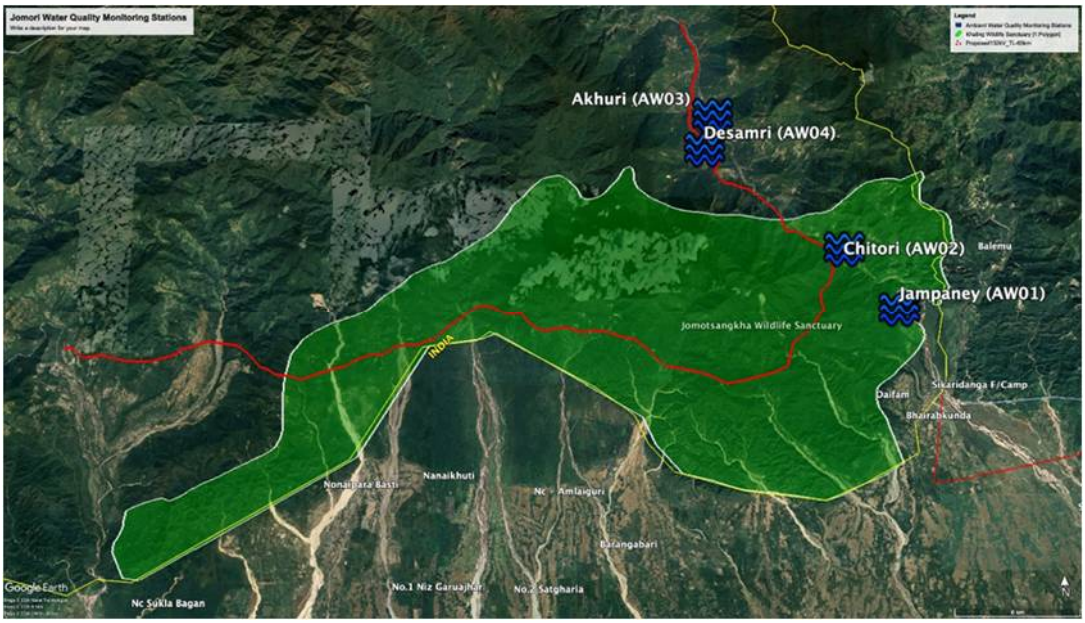
1.3.2.1. Ambient Water Quality

Considering that the transmission line project activities neither require water as an input nor involve water and water bodies, the ambient water quality measurements were taken to obtain the baseline water quality. Ambient water quality tests were carried out across four sampling sites (Table 1-2).

The physiochemical parameters measured include pH levels, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Ammonia (NH_3), Turbidity, Chloride, and Total Hardness (TH), salinity, Ammonium (NH_4), Nitrate (NO_3), Chlorine, Calcium Hardness (Ca), Magnesium Hardness (Mg), and Total Suspended Solids (TSS).

Table 1-2: Ambient water quality monitoring stations

		Coordinates		
Plot ID	**Locality**	**Northing**	**Easting**	**Elev (m asl)**
JM AW 01	Jampaney	26.9219444	92.0952778	412
JM AW 02	Chitori	26.949222	92.0690954	376
JM AW 03	Akhuri	26.9846617	92.0246446	507
JM AW 04	Desamri	26.9943736	92.0002465	719



(Source: JICA Survey Team)

Map 1-1: Locations of Ambient Water Quality measurement sites

1.3.2.2. Ambient Air and Noise Quality

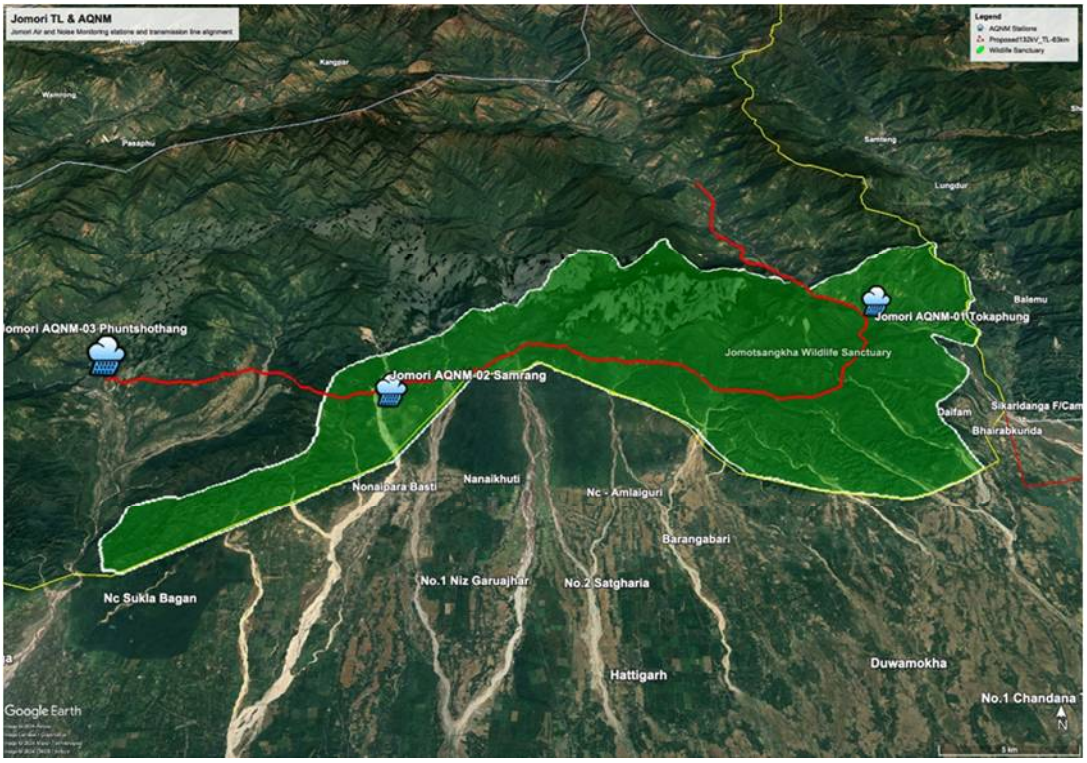
As in the case of Ambient water quality, the monitoring of air quality was also carried out to establish the baseline for air quality in the project area. AQM-09 Oceanus make & AQM-370 Envirotech make were used in monitoring noise and air quality of the project area. This equipment are real time sampling devices capable of detecting both particulates & gaseous pollutants along with auxiliary parameters such as ambient temperature, relative humidity, atmospheric pressure, Wind Direction, Wind Speed and heat Index. The AQM-09 is integrated with noise meter that can measure the sound in decibel simultaneously with the air quality parameters. Since the AQM-370 has no sound & wind speed detectors incorporated in the device, separate sound level meter SLM-100 was used to capture the sound along with the device. The device is equipped with light scattering diodes that are capable of detecting particulate matters of PM-2.5, PM-10 & TSP and pre-calibrated sensors for gaseous pollutants such as Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) and Carbon Monoxide (CO).

For noise level was monitored using a sound level meter. This device is capable of measuring noise at different ranges.

The two samples each comprising of 24 hours sampling duration were collected from three sampling stations details of which are given in Table 1-3.

Table 1-3: Ambient Noise and Air quality sampling station location details

SN.	Name of monitoring site	Date of Monitoring	Geo-coordinates	Altitude (m)
1	Phuntshothang area	22nd to 23rd Feb 2024	26.911113, 91.68212	311
2	Tokaphung area		26.950780, 92.07103	405
3	Samrang Area		26.893740, 91.823556	390



(Source: JICA Survey Team)

Map 1-2: Locations of Ambient Air Quality measurement site

1.3.2.3. Vegetation

To optimize findings from the survey, a purposive sampling method was employed within the proposed project. This sampling approach considered factors such as accessibility, geographical suitability, and operational efficiency. The identified sites encompassed crucial elements including access roads, intake structures, power house, dump yard, and designated camp sites.

The Biodiversity Monitoring and Social Survey Protocol of Bhutan recommends a 20 × 20 m, 5 × 5 m, and 2 × 2 m quadrant for national level tree, shrub and herb diversity assessment, respectively (DoFPS, 2020). However, for general purpose vegetation analysis, a quadrant or transect of 200 m^2 also proves appropriate (Gillison, 2006). To enhance sampling efficiency within the relatively small area and to make easy laying of plots along rugged topography of the project site, this study adopted 15 × 15 m quadrat plots for trees, 4 × 4 m for shrubs and 1 × 1 m for herbs (Figure 1-1). The shrub and herb plots were placed at the lower right hand corner of the 15 × 15 m plot. Using the standard protocol (DoFPS, 2020), heights, counts and diameter at breast height (DBH) (≥ 10 cm at 1.3 m DBH) of tree species, counts of shrub and herb species, were recorded for each plot.

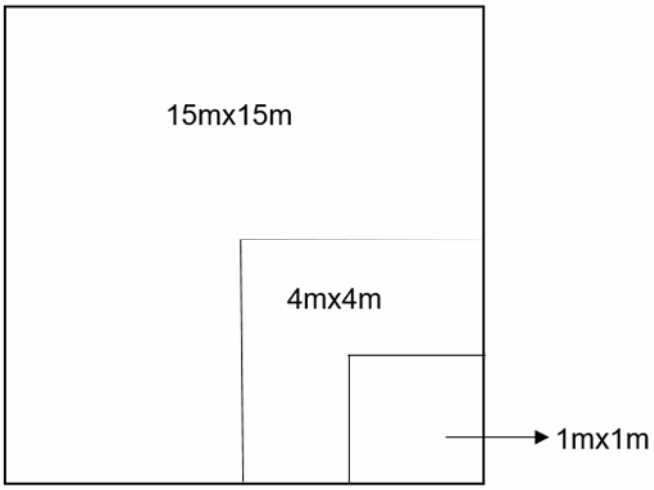


Figure 1-1: Dimensions of plots employed in vegetation survey

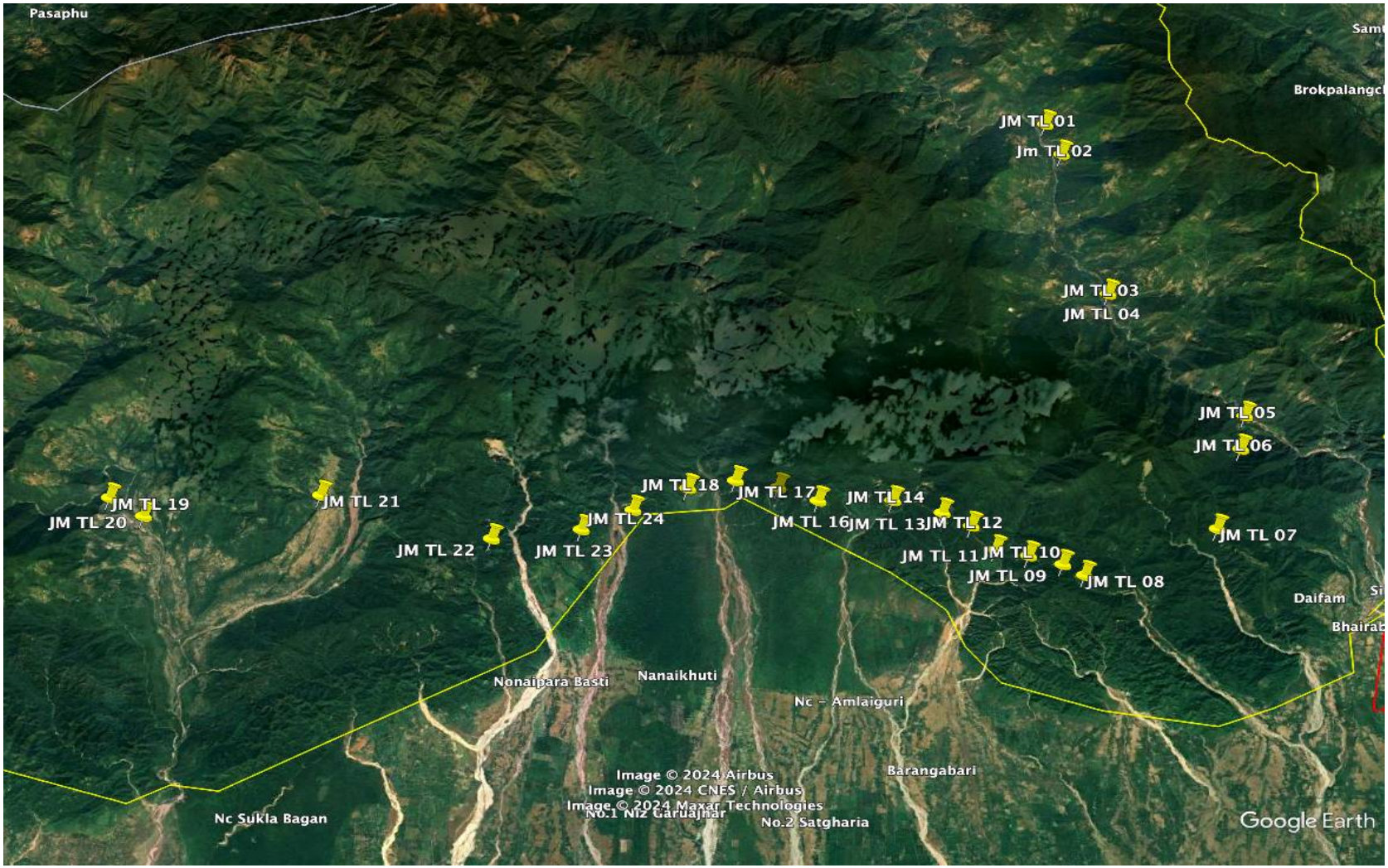
A total of 24 plots were laid across the transmission line site covering areas designated for critical project infrastructures. The plots surveyed were identified with serially numbered codes. For example, JMTL01 is the identity of the plot no.1 of Jomori Transmission Line. The details of the plot IDs and location coordinates is given in Table 1-4 below. Map 1-1 is the map showing the distribution of the forest plots in the project area.

Table 1-4: Jomori TL – Vegetation Plots Coordinates (Decimal Degrees)

	Decimal Degrees (DD)	
Plot ID	**Latitude**	**Longitude**
JMTL 01	27.05695	91.99157
JMTL 02	27.04620	91.99747
JMTL 03	26.99645	92.01442
JMTL 04	26.99670	92.01467
JM TL 05	26.95523	92.06199
JMTL 06	26.94363	92.06073
JMTL 07	26.91555	92.05315
JM TL 08	26.89783	92.00875
JMTL 09	26.90130	92.00128
JMTL 10	26.90386	91.98974
JMTL 11	26.90555	91.97860
JMTL 12	26.91335	91.97015

	Decimal Degrees (DD)	
Plot ID	**Latitude**	**Longitude**
JM TL 13	26.91755	91.96020
JMTL 14	26.92115	91.94339
JMTL 15	26.92410	91.90462
JMTL 16	26.92007	91.91827
JMTL 17	26.92592	91.89015
JMTL 18	26.92263	91.87425
JMTL 19	26.91167	91.68064
JMTL 20	26.90578	91.69260
JMTL 21	26.91535	91.75133
JMTL 22	26.90272	91.80942
JMTL 23	26.90702	91.83928
JMTL 24	26.91444	91.85623

Map 1-3: Map showing distribution of the vegetation plots in the project area



1.3.2.4. Vegetation data analysis

a) Diversity

The plot-wise and overall floristic diversity was computed using the Shannon-Wiener index, employing the following formula:

$$H' = -\sum_{i=1}^{n} pi * l\ npi$$

Where H' = Shannon diversity

p_i = The proportion of individuals belonging to the i^{th} species

ln = Natural logarithm function Tree

b) Tree density

Tree density was computed by dividing the total number of trees counted within the plot by the plot area in hectares, employing the following formula:

$$Tr\ eedens\ i\ tpye rHa = \frac{\text{Number of trees in each plot}}{Ar\ e a i\ nHa}$$

c) Tree volume

The true volume formula was used for the estimation of tree volume

$$Tr\ uevol\ ume = \pi \times r^2 \times He\ i\ ght\ of\ the\ t\ r\ e\ e$$

1.3.2.5. Wildlife

a) Mammals

Camera traps were installed in forested areas based on expert recommendations and local ecological knowledge to capture the real time occurrence of mammals. Additionally, various wildlife signs such as pugmarks, hoofmarks, dropping, scats, hairs, and burrows were recorded to supplement the camera trap data.

Jomori transmission line project mainly falls in the vegetation zone defined by subtropical forest extending horizontally westwards from Serthig and Langchenphug Gewogs to Samrang, Pemathang, and Phuntshothang. A total of four camera traps were installed along the proposed transmission line route. Camera traps were placed based on the recommendations of Park officials.

b) Avifauna

Broad survey was employed to record bird species associated with forest and stream ecosystems. The avifaunal survey was conducted using amalgamated transect and point count methods. The transects were essentially along the routes followed by surveyors to get from one forest plot to another. Along these transects, observation was made from sampling points, spaced at approximately 100m intervals. Bird species were identified using binoculars, cameras with macro lenses, and based on their distinctive calls and vocalizations. All individuals observed and/or heard were recorded with species name, numbers of individuals, habitat type, elevation, geographic coordinate, and other information needed. The protection status of the species was determined based on IUCN Red List data and Bhutan's Forest and Nature Conservation Act (FNCA 2023).

c) Herpetofauna

The herpetofauna survey, focusing on reptiles and amphibians, was primarily conducted as a supplementary task during navigation to forest plots and within immediate vicinity of these plots. Opportunistic broad survey was adopted to collect and record reptiles in the sampling areas. Both transect and visual encounter methods were employed. Techniques such as 'rock rolling', 'vocalization' and 'habitat searching' were also employed. These involves careful lifting and rolling of rock to expose hidden amphibians and reptiles, listening to their call/ croaks, and exploring habitats favored by herpetofauna, especially wetlands, streams, and ponds.

Socio-economic Assessment

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

1. Gathering of secondary information through available reports and websites
2. Meetings, Discussions and Interview of Government Officials, Local Government Elected Representatives and community forest groups using open ended structured interview questions.
3. Public and Stakeholders consultation meetings at the Gewogs and at the National Level.
4. Survey of Project Affected Population in the affected areas.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This part of the ESIA reviews the policies, acts, regulations, guidelines and standards that are relevant to the proposed construction of 63km 132 kV D/C PTL from the proposed 90MW Jomori Powerhouse to the existing 132/33kV Phuntshothang substation. The reviews are intended to ensure that policies and regulations have been reviewed and to comply with the necessary regulations during the execution of the project.

The various policies and regulations ensure the protection of its pristine environmental heritage while pursuing economic development. Bhutan has strong policies and regulations to conserve its environment and maintain a balance between environment and development. The details of the review of policy and legal frameworks relevant to the proposed project are provided below:

2.1. Constitution/Acts/Policies

2.1.1. The Constitution of Bhutan

The constitution of the Kingdom of Bhutan declares itself as the "Supreme Law" of the state and was promulgated on 18th of July, 2008. Article 4 on Culture states that the state shall endeavor to preserve, protect and promote the cultural heritage of the country, including monuments, places and objects of artistic or historic interest, Dzongs, Lhakhangs, Goendeys, Ten-sum, Nyes, language, literature, music, visual arts and religion to enrich society and the cultural life of the citizens. Article 5 of the constitution is also applicable to the proposed project which states that every Bhutanese is a trustee of the Kingdom's natural resources and environment for the benefit of the present and future generations and it is the fundamental duty of every citizen to contribute to the protection of the natural environment, conservation of the rich biodiversity and prevention of all forms of ecological degradation including noise, visual and physical pollution through the adoption of environment friendly practices and policies. The Royal Government shall:

- Protect, conserve and improve the pristine environment and safeguard the biodiversity of the country.
- Prevent pollution and environmental degradation.
- Secure ecologically balanced sustainable development while promoting justifiable economic and social development, and
- Ensure a safe and healthy environment. The Government shall ensure that, in order to conserve the country's natural resources and to prevent degradation of the fragile mountain ecosystem, a

minimum of 60% of Bhutan's total land shall be maintained under forest cover for all time.

- Parliament may, in order to ensure sustainable use of natural resources, enact environmental legislation and implement environmental standards and instruments based on the precautionary principle, polluter pay principle, maintenance of intergenerational equity, and reaffirm the sovereign rights of the State over its own biological resources.
- Parliament may, by law, declare any part of the country to be a National Park, Wildlife Reserve, nature reserve, protected forest, biosphere reserve, critical watershed and such other categories meriting protection.

2.1.2. Environmental Assessment Act 2000

This Act mandates that the government integrate environmental considerations into the formulation, renewal, modification, and implementation of all policies, plans, or programs. It stipulates that obtaining environmental clearance is a prerequisite for granting any development permit.

2.1.3. National Environment Protection Act 2007

The National Environment Protection Act of 2007 of Bhutan delineates fundamental principles and establishes a legal framework with significant ramifications for forest governance and management. It mandates that individuals extracting natural resources from the environment, or profiting economically from it, must prioritize sustainable utilization and stewardship of both the resources and ecosystems.

2.1.4. Mines and Minerals Management Act, 1995

The significance of this Act for a transmission Line (TL) project arises when the project necessitates quarries for materials like sand or stone; in such cases, adherence to this legislation is imperative to obtain site clearance. However, as the current TL project does not entail any quarrying activities, seeking clearance from the Department of Geology and Mines, which serves as the Competent Authority overseeing all Mines and Minerals in the Country, is unnecessary.

2.1.5. Electricity Act of Bhutan 2001

The Electricity Act of Bhutan was enacted by the National Assembly and the objectives of this act are as follows:

i. To promote a safe and reliable supply of electricity throughout the country;
ii. To enhance revenue generation through export of electricity;

iii. To develop socio-economic welfare of the people;
iv. To promote economic self-reliance of the country through the development of a financially viable and reliable electricity industry;
v. To promote development of renewable energy resources;
vi. To take environmental considerations into account when developing the electricity supply industry; and
vii. To promote efficiency in management and service delivery.

Few clauses from Part 5 of this Act regarding the power to acquire land and water is relevant to the proposed project. It states that;

- Where any land under private ownership is required to be acquired for setting up a project under license pursuant to Part 3, the land may be acquired under the prevailing Land Act on approval of the Minister and such acquisition shall be deemed for a public or national interest. (Section 51.1)
- Where the minister is satisfied that the land under subsection 51.1 is required for the purpose of providing or maintaining electricity supply services to the public, and that it is required in the public or national interest, regardless whether the Licensee is a public or private entity, the Minister shall pursue the acquisition of the land on behalf of the Licensee in accordance with the Land Act. (Section 51.2)
- Once a right of way has been granted to a Licensee by the Authority, no person shall build any structures or do any activity on land within the proximity of the area covered under the right of way without the prior approval of the Authority. (Section 51.5)

2.1.6. Forest & Nature Conservation Act (2023)

This Act repeals the Forest and Nature Conservation Act 1995 and the objective of this Act is to establish provisions for safeguarding and responsibly utilizing Bhutan's forests, wildlife, and associated natural resources for the welfare of both current and future generations. According to this act, State Reserved Forest Land (SRFL) shall constitute any land in Bhutan which is not State Land or private registered Land. Any activity carried out in the SRFL shall require forestry clearance, issued by the DoFPS.

Protected Areas are regulated under this act, with mammals, birds, plants, fish, insects, reptiles, amphibians, tortoises, and turtles categorized as Schedule I, II, or III, and accordingly protected. Within the core zone of the protected area, developmental activity shall be prohibited, although it may be permitted in other areas of the protected zone. The Government reserves the right to implement and execute any developmental activity deemed of national importance in the Community Forest.

Any forest produce discovered within the road right-of-way or transmission line corridor shall be the property of the State. The Department will allot such forest produce to authorized agencies or communities prior to any developmental activities.

According to Section 70 of the Act, compensatory plantation in State Reserved Forest Land must be carried out by the agency responsible for deforestation or damage caused to the forest produce for taking up any developmental activity.

2.1.7. The Biodiversity Act 2022

This Act repeals the Biodiversity Act of Bhutan 2003 and subsidiary legislations framed and adopted thereunder, and section 73 of the NEPA 2007. The chapter 7 of the Act on Fair and Equitable Sharing of Benefits discusses on the economic, social, technical, scientific, environmental or any other benefits that are intended or may be likely to be accrued to the country and an indication of the types of short, medium- and long-term benefits to be shared with the RGoB and other relevant stakeholders as well as the proposed mechanisms and arrangements for benefit sharing.

2.1.8. Land Act of Bhutan 2007

Land Act 2007 is the latest and revised version of the previous Land Act 1979. The Act intends to manage, regulate and administer the ownership and effective use of land resources and conservation of ecosystem. Some of the clauses from *Chapter 7 (Acquisition of Registered Land)* and *Chapter 12 (Easement)* of this Act are relevant to the proposed transmission line project where it states that;

- The landowner of a piece of land is bound, subject to reasonable compensation being paid to him, to allow the laying through his land of water pipes or irrigation channel, drainage pipes, telecommunication structures, electricity poles and sub-stations or other similar installations by a government agency or for the use of the adjoining or neighboring land if, without making use of his land, they could not be laid or could be laid only at an excessive cost. The landowner may require that his interests be taken into consideration.
- The Government may acquire a registered land for public interests.
- The Government may provide substitute land or cash payment, or both, as compensation.
- Acquisition of land shall entail a fair compensation.
- For rural areas, the landowner shall have the discretion to opt for substitute land or cash compensation offered by the government. In the case of a Thromde, the landowner shall be provided cash compensation. If the land is the only plot owned by the landowner in the Thromde,

the government shall consider a substitute land in the same Thromde. If the value of substitute land is inadequate, additional cash compensation shall be provided subject to the value of land.

- Compensation shall be provided for the immovable property on the acquired land.
- Upon acquisition, if the remaining land parcel is less than 10 decimals, such land both in Thromde and rural areas shall also be acquired.
- The location of substitute land to be allotted in rural areas shall be in the order of preference of same village, Gewog, and Dzongkhag.
- The land under acquisition shall be taken over only after registering the substitute land in the name of the affected landowner or the cash compensation has been made to the landowner.

The proposed project is bound to affect few private lands and the provisions contained in the Act shall govern all the issues related to land acquisitions and compensation schemes.

2.1.9. Water Act of Bhutan 2011

The Water Act of Bhutan was promulgated by the Parliament of Bhutan in 2011. The main purposes of this act is to;

i. To ensure that the water resources are protected, conserved and/or managed in an economically efficient, socially equitable and environmentally sustainable manner.

ii. To establish suitable institutions.

iii. To grant water resources right to every individual to have access to safe, affordable and sufficient water for basic human needs.

The Chapter 8 of the Act which might be relevant to this project states that;

i. Except as otherwise provided in this Act, a person may not discharge any effluent directly or indirectly to any water resource unless the discharge is in compliance with the Effluent Discharge Standard.

ii. Effluents must be treated using best available technology before discharging into the environment.

iii. Notwithstanding any other provisions, it shall be unlawful to discharge any chemical, radiological, radioactive, medical or any other hazardous waste into water bodies.

iv. Any person discharging effluent shall be liable to pay a charge as prescribed in the regulations under this Act.

v. Any person who acts in breach of the provisions of this section shall be guilty of an offence under this Act.

The proposed project is an over-head project and tower installations and workers camp sites will be located at a safe distance from watercourses. Therefore, the project will have least possible impacts on water resources.

2.1.10. The Waste Prevention & Management Act 2009

The Waste prevention and Management Act of Bhutan was enacted in 2009 with main purposes to protect, sustain human health through protection of environment by:

i. Reducing the generation of waste at source

ii. Promoting the segregation, reuse and recycling of wastes

iii. Disposal of waste in an environmentally sound manner and

iv. Effective functioning and coordination among implementing agencies.

It states that: All developmental activities that generate waste shall be planned and executed in harmony with the carrying capacity of the country's fragile ecological settings and geographical terrains. A person polluting the environment or causing ecological harm shall be responsible for the costs of avoidance, containment, abatement, medical compensation, mitigation, remediation and restoration.

2.1.11. Distribution System Master Plan (DSMP 2020-2030).

The primary objectives of the DSMP (2020-2030) include conducting a comprehensive study of the current distribution network to formulate a strategic distribution plan covering the next ten years. This plan aims to ensure the provision of affordable and sufficient electricity while minimizing losses, enhancing power quality and reliability, optimizing resources, and prioritizing excellent customer service. Additionally, the DSMP aims to develop annual investment plans to support the implementation of the strategic distribution plan, thereby facilitating continuous improvement and development in the distribution network.

The DSMP for Samdrup Jongkhar Dzongkhag acknowledges the commissioning of the Phuentshothang substation, which facilitates power distribution to the Jomotsangkha Drungkhag through the Samrang feeder, leading to an improvement in power quality to some extent, although reliability issues persist. Challenges, such as a 29km line passing through a forest inhabited by wild elephants and swollen rivers during monsoon season, impede restoration efforts and maintenance. To address these challenges, the BPC has proposed long-term solutions, including constructing 33 kV lines from Phuentshothang to Jomotsangkha and installing

a 1500 kVA Diesel Generator at Jomotsangkha. Until these plans are executed, interim measures such as increasing RoW clearing frequency, ensuring functional ARCBs, and installing FPIs for easier fault location are recommended. Therefore, the implementation of this transmission line project may potentially resolve these issues.

2.1.12. National Transmission Grid Master Plan (NTGMP) of Bhutan 2018

The NTGMP of Bhutan 2018 developed by Department of Hydropower and Power System, Ministry of Economic Affairs, RGoB is the updated version of the NTGMP 2012 that was developed by Central Electricity Authority (CEA), India. The NTGMP 2018 was developed in close consultation with all relevant stakeholders of Bhutan. The study looks into the national transmission grid master plan by 2025 and also describes exhaustively about the grid scenario up to the year 2030. Bhutan has total installed generating capacity of 1,606MW (excluding embedded generations, solar and wind) comprising of Tala (1,020MW), Chukha (336MW), Kurichhu (60MW), Basochhu-U/S (24MW) & L/S (40MW) and Dagachhu (126MW) HPs. The updated NTGMP considered the realistic hydropower development timeframe as 2020, 2025, 2030, 2035, 2040 and beyond 2040. By 2025, all the under-construction hydropower projects are expected to get commissioned. The timeframe in beyond 2040 is indicative of how the transmission systems would appear if all the techno-economically viable projects (greater than 10 MW) with total capacity of 23,833 MW are developed.

The proposed construction of one number of 132kV D/C PTL is in line with the NTGMP of Bhutan to evacuate the power generated from proposed Jomori I & II HPPs.

2.1.13. Bhutan Sustainable Hydropower Development Policy 2021

Clause 16 of this policy indicates that transmission and associated systems for hydropower projects must align with the National Transmission Grid Master Plan (NTGMP). The RGoB will provide necessary support to BPC to facilitate power transmission with importing countries' entities.

Clause 17, concerning social considerations, stipulates that project components should be situated in state reserve forest land whenever possible. If this is not feasible, private land will be acquired, and affected parties will be duly compensated in accordance with relevant laws.

In Clause 18, addressing environmental considerations, the policy outlines that the RGoB will coordinate with relevant agencies to obtain blanket forestry and environmental clearances for projects.

2.2. Rules and Regulations

2.2.1. Regulation on the Environmental Clearance of Projects (RECOP) 2016

This regulation defines responsibilities and procedures for the implementation of the EA Act 2000 concerning environmental assessment process and the issuance and enforcement of EC for projects.

The EC application procedure is described in this regulation and specific guidance is given in Environmental Assessment Guideline for Power Transmission Line Projects and IEE form issued by the Commission. For any developmental activity, the applicant is required to submit an EC application, containing information of the applicant, the project, funding agency, the affected environment, potential impacts, mitigation, monitoring and public consultation and when the project is subjected to ESIA/EIA, the applicant shall;

- Develop a ToR for ESIA as per guidelines issued by DECC, for approval by DECC and prepare one application inclusive of all sub-activities for EC.
- Inform and consult the concerned people and organizations prior to submission of EC application. Public consultation records, authenticated by concerned local authorities should be attached with EC application. Chapter VI of the regulation details public consultation requirements.
- All significant projects shall establish an environmental unit responsible to ensure compliance with the EC terms and conditions.
- The EC holder shall be responsible for chance find property during project implementation and report immediately to DECC or the CA of such finding.
- Non-compliance with environmental terms and conditions specified in the EC and any other provision of the Act, regulations or rules under it makes the offender liable to penalties that may include compensation for environmental damages, fines, sanctions, and suspension or revocation of EC in part or full.
- The time limits specified are dependent upon the submission of accurate and comprehensive information in accordance with relevant government regulations and guidelines. The table below outlines the applicable time frame required for environmental clearance.

In addition, during its 50th Meeting on December 23, 2019, the National Environment Commission (NEC) – now the Department of Environment and Climate Change (DECC) – amended certain sections within Chapter II of the the RECOP 2016. Notably, Sections 12 and 13 of this amendment, which previously mandated specific clearances for project approval, have been revoked. Originally, Section 12 required

applicants to secure approval from the Dzongkhag or Thromde administration, as well as clearances from relevant agencies, for environmental clearance submissions. Similarly, Section 13 stipulated official clearances from concerned agencies if the proposed project location fell within 50 meters of public parks, hospitals, schools, sacred landscapes, or sites. However, the Secretariat or Competent Authority reserved the discretion to extend this requirement beyond 50 meters depending on the nature of the project.

Table 2-1: Applicable Time limit for environmental clearance (EC)

Action	Time Limit
Registration and acknowledgement of an application by Secretariat/Competent Authority (CA).	Within 2 days from the receipt of an application
CA forwards application to Secretariat for non-listed projects	Within 7 days from the date of completion of assessment of adequacy of the application
Screening of a project to determine the level of environmental assessment required.	Within 1 month
Decision making • Whether Environmental & Social Impact Assessment (ESIA) is required or not • Additional information required or not • Issuance or denial of Environmental Clearance if ESIA is not required	Within 2 months after completion of screening
If screening determines that an ESIA is required, the level and time frame for the assessment will be determined through negotiations between the relevant parties and approved by the Secretariat	Time frame to be negotiated
Submission of an additional information sought for projects requiring ESIA	Within 1 year from the date of request for additional information
Submission of an additional information sought for projects not requiring ESIA	Within 3 months from the date of request for additional information
On approval of the clearance, a legal undertaking with the proponent of new projects to comply with the EA Act, 2000	Within 7days from the date of decision
Response on the environmental clearance decision	Within 7days from the date of decision
Public notification on the decision by the Secretariat/CA	Within one month from the date of decision
Appeal on the decision	Within 10 days from the date of publication of public notification
Preparation of monitoring program by Secretariat and CA	Quarterly
Preparation of monitoring program (along with detail Implementation Plan) by Holder	Within 3 months from the issuance of EC
Submission of application for renewal of Environmental Clearance (EC)	Before 3 months of its expiry date

Renewal of EC	Prior to expiry of EC
Report on the implementation of the EA Act, 2000 and its regulation to the NEC/ DECC by the Secretariat and Report on the implementation of the EA act, 2000 and its regulation to the Secretariat by the Competent Authorities	Annually

2.2.2. Forest &Nature Conservation Rules & Regulations (2023).

The Regulation states that the DoFPS shall delegate the authority to issue forestry clearance to the Division and Park Office as follows:

i. Any activity up to 3 acres of the area or 3 Km length by the Range Office;
ii. Any activity more than 3 acres of area up to 7 acres or more than 3 Km up to 7 Km length by the Division or Park Office; or
iii. Any activity more than 7 acres of area or more than 7 Km of length by the Head of Department.

The Road Right of Way and Transmission Line section of this regulation specifies that, as outlined in Section 42 of the Act (FNCA 2023), the Division or Park Office is tasked with marking trees for felling based on forestry clearance. Following this, the authorized agency or community is permitted to extract timber or forest produce before the commencement of the activity, provided they pay royalty at commercial rates and meet permit requirements.

The Department or authorized agency may should also carry out plantation, reforestation, afforestation, voluntary plantation, and compensatory plantation as per the technical guidelines issued by the Department in accordance with Section 67 to 70 of the FNCA Act. Further, the prevailing norms also states funding shall be for double the area taken up by the project. The fund shall be made available prior to project commissioning, based on DPR or DoFPS's financial estimate. The compensatory plantation program may also extend to other potential SRF areas.

2.2.3. Land Acquisition & Compensation Rules & Regulations 2022.

In exercise of the power granted by the Land Act of Bhutan 2007, the National Land Commission (NLC) has framed the Land Acquisition and Compensation Rules and Regulations 2022. These rules and regulations aim to ensure fair provision of land substitutes or cash compensation at the appropriate time when government institutions acquire private land for public interest purposes.

Some of the provisions of this Rules & Regulations that are relevant to the proposed project are as discussed below;

- The private registered land shall be acquired only under unavoidable circumstances.
- The private registered land under acquisition shall be taken over only after registering the land substitute or payment of cash compensation to the landowner.
- If the remaining land parcel after the acquisition is less than 10 deci mal, such land shall be acquired or may be consolidated with the available State land adjoining the registered land of the same landowner.
- The acquisition of land less than 10 decimals prevalent before the enactment of the Act shall be eligible for a proportionate land substitute.
- Allotment of a land substitute shall not enclose any patch of State land inside its boundary.
- If the land substitution process is delayed, the project may choose to lease the proposed land until the substitution is complete. This can be done through a formal agreement between parties. However, this option is restricted to National strategic projects.
- The private registered land acquisition and the land substitute for power transmission and distribution structures shall be in accordance with the Rules and Regulations or Guidelines of the agencies concerned. In the event of any inconsistency or unavailability, these LACRR shall prevail.
- The private registered land acquisition shall entail a fair compensation.
- The compensation for the acquired land shall be as per the land type recorded in *Thram*.
- The valuation and fixation of the land value and any other collateral property shall be in accordance with the rate determined by the PAVA and Bhutan Schedule Rate.
- The compensation rates for crops and trees shall be as prescribed by PAVA.
- The acquiring agency shall utilize or develop the land within three years from the date of approval. However, non-utilization of the acquired land within the stipulated time or for the intended purpose shall be reverted to State land.

2.2.4. The Water Regulation of Bhutan 2014

The Water Regulation of Bhutan was adopted and promulgated by the National Environment Commission Secretariat (NECS) in 2014 for the effective enforcement of the objectives and purposes of the Water Act of Bhutan 2011.

The chapter 5 of this Water Regulation under Temporary Water Users topic which might be relevant to this project states that, any new water users from an existing water facility, whether it is for temporary use or for

a length of duration, will first consult and obtain consent from the concerned Water Users' Association (WUA) or water users. If the proposed water source for abstraction does not fall under any WUA of water users, the permit for such water use will be obtained from the concerned Gewog Administration.

2.2.5. The Waste Prevention & Management Regulation 2016

The Waste Prevention and Management Regulation, 2012 shall be called as Waste Prevention and Management (Amendment) Regulation, 2016. It came into effect on 8th November, 2016 and shall extend to whole of Bhutan. The relevant points of the Regulations are:

- Establish procedures to implement the purpose of the Waste Prevention and Management Act, 2009;
- Identify roles and areas of implementation of the implementing and collaborating agencies for the purpose of establishing a sound waste management system including monitoring procedures at every organization level, through efficient collection, segregation, treatment, storage, transportation, reduction, reuse, recycling and safe disposal of solid, liquid and gaseous wastes.
- Assign costs in proportion to the waste volume generated from the point source or by degree of their hazardousness by levying fees, charges and fines for non-compliance;
- Control and prohibit illegal dumping or releasing of waste into the environment;
- Establish strategy and procedure to achieve zero waste;

Introduce a system of incentives for waste prevention and management on the principle that waste is an asset.

2.2.6. Regulation on Occupational Health, Safety, & Welfare 2022

The purpose of this Regulation is to establish standards on occupational health, safety and welfare on premises, instruments, equipment, appliances, apparatus, tools, devices, electrical safety and other hazardous conditions. It is to ensure health, safety and welfare for employees as well as other persons at the work places from work related risks as provided in Chapter IX of the Labour and Employment Act of Bhutan 2007.

Chapter 8 of this regulation concerning electrical safety mandates that all electrical supply lines, switches, conductors, and apparatus must possess adequate ratings for power, insulation, and estimated fault current. Furthermore, they must be constructed, installed, protected, operated, and maintained in a manner that guarantees the safety of all employees. Additionally, it stipulates that overhead electrical conductors must maintain a minimum clearance above ground level at all times, as per the safety code issued by the Bhutan Electricity Authority.

2.3. Applicable Guidelines and Standards

2.3.1. Environmental Assessment Guideline for Power Transmission Line Projects (2012)

The first environmental assessment guideline was published in 1999 by the NECS for six sectors namely, mining, industries, hydropower, roads, forestry and power transmission lines. It was later revised in 2003 to make it more relevant to our Bhutanese context and in line with the EA Act 2000 and its regulation 2002. However, in 2012 it was proposed for revision and was revised and updated with financial assistance from Asian Development Bank (ADB). The guideline is mainly intended to:

i. Provide guidance and assistance to various stakeholders involved in the EA process;
ii. Assist the regulatory agency and EIA practitioners to understand the main areas of concern and use that understanding to enhance the quality of the EIA study and report;
iii. Inform the regulatory agency and EIA practitioners about the best environmental management practices in the transmission line sector;
iv. Assist the regulatory agency to better access the EIA report and arrive at a sound decision.

Therefore, BPC has carried out this ESIA in accordance with the ToR and guidelines from DoECC.

2.3.2. Environmental Standards 2020

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

Table 2-2: Ambient air quality standards (maximum permissible limits in μg/m^3)

Parameter	Industrial Area	Mixed Area*	Sensitive Area**
Total Suspended Particulate Matter			
24 Hour Average	500	200	100
Yearly Average	360	140	70
$PM_{2.5}$[12]			
24 Hour Average	60	60	60
Yearly Average	40	40	40
PM_{10}			
24 Hour Average	200	100	75
Yearly Average	120	60	50
Sulfur Dioxide (SO_2)			
24 Hour Average	120	80	30
Yearly Average	80	60	15
Nitrogen Oxides (NO_X)			
24 Hour Average	120	80	30
Yearly Average	80	60	15
Carbon Monoxide			
8 Hour Average	5000	2000	1000
1 hour Average	10000	4000	2000
Ozone[13]			
8 Hour Average	100	100	100
1 hour Average	180	180	180

*Mixed Area means area where residential, commercial or both activities take place

**Sensitive Area means area where sensitive targets are in place like hospitals, schools, sensitive ecosystems.

Table 2-3: Vehicle Emission standards

Fuel Type	Vehicles registered prior 01/2005	Vehicles registered after 01/2005	Vehicles registered prior 01/2021	Vehicles registered after 01/2021 [Approval type: Euro 6/BSVI]
Petrol/ Gasoline (%CO)	4.5%	4.0%	4.0%	0.5%
Diesel (%HSC)	75.0%	70.0%	70.0%	50.0%

Table 2-4: Noise level standards (maximum permissible limits in dB)

Parameter	Day*	Night**
Industrial Area	75	65
Mixed Area	65	55
Sensitive Area	55	45

*Day time is from 6:00 hours to 22:00 hours (human activities)

**Night time is from 22:00 hours to 6:00 hours (limited human activities)

Maximum value allowed in workplace at any point of time is 75 dB(A)

Table 2-5: Checklist of Public Clearances sought for the Project

SN.	Gewog/Community Forest	Consultation date	Approved Clearance date
1	Serthi	22-Jan-24	22-Jan-24
2	Khanduphung Gayjung Norbuling Community Forest	22-Jan-24	22-Jan-24
3	Langchenphu	23-Jan-24	Not applicable
4	Samrang	23-Jan-24	Not applicable
5	Pemathang	24-Jan-24	Not applicable
6	Raling Community Forest	24-Jan-24	24-Jan-24
7	Pemathangka Community Forest	24-Jan-24	24-Jan-24
8	Phuntshothang	25-Jan-24	Not applicable

NOTE: Sections 12 and 13 of the RECOP 2016 which mandated specific clearances for project approval, have been revoked in the amendment dated 23rd December 2019.

2.4. Environmental Requirement of JICA

The JICA Guideline for Environment and Social Consideration, categorizes projects into four distinct categories based on the magnitude of their environmental and social impacts, taking into consideration various factors such as project characteristics, scale, and site conditions.

1. **Category A**: Projects falling under Category A are those expected to have significant adverse impacts on the environment and society. This includes projects with complex or unprecedented impacts that are challenging to evaluate, as well as those with a wide range of impacts or irreversible consequences. Such impacts may extend beyond the immediate construction sites or facilities. Category A typically encompasses projects in sensitive sectors, those with characteristics likely to cause adverse impacts, and those situated in or near sensitive areas. Appendix 4 provides an illustrative list of these sensitive sectors, characteristics, and areas.

2. **Category B**: Projects categorized as Category B have potential adverse impacts on the environment and society that are less severe than those of Category A projects. Generally, these projects are site-specific, with limited irreversible impacts, and can usually be mitigated using general mitigation measures.

3. **Category C**: Projects classified as Category C are expected to have minimal or negligible adverse impacts on the environment and society.

4. **Category FI**: Projects designated as Category FI meet the following conditions: JICA provides funding to a financial intermediary or executing agency; the financial intermediary or executing agency primarily handles the selection and appraisal of sub-projects under the funded projects, only after JICA's approval of the funding, preventing specification of the sub-projects prior to JICA's approval or appraisal; and these sub-projects are anticipated to have potential impacts on the environment and society.

The proposed 132kV Jomori transmission line is a Category A project due to a substantial portion of the line passing through a Jomotsangkha Wildlife Sanctuary.

3. ANALYSIS OF ALTERNATIVES

3.1. Project Overview

The BPC, the responsible agency for transmission and distribution of electricity in the country, is working in tandem with DGPC for evacuation of hydropower electricity from the proposed 90MW Jomori hydropower project. Power generated at the Jomori hydro power station, totaling 106 MVA, will be evacuated via a 63 km long, 132 kV double-circuit overhead transmission line to connect with the existing 132/33 kV Phuntshothang substation in Samdrup Jongkhar. The primary objective is to facilitate power transmission from the 90MW Jomori HPP, destined for export to India (Rangia) through the existing 132kV D/C Transmission Line from Phuntshothang to Motanga Substation. Additionally, the project will enhance and ensure the reliability of power supply for various developmental activities in the Eastern regions.

Table 3-1: Scope of the Project (Jomori)

Voltage	From - To	Capacity	No. of circuit	Length
132 kV	Jomori HPP – Phuntshothang SS	106 MVA (*1)	2	Approx. 63km
Note: *1: Power factor = 0.85				

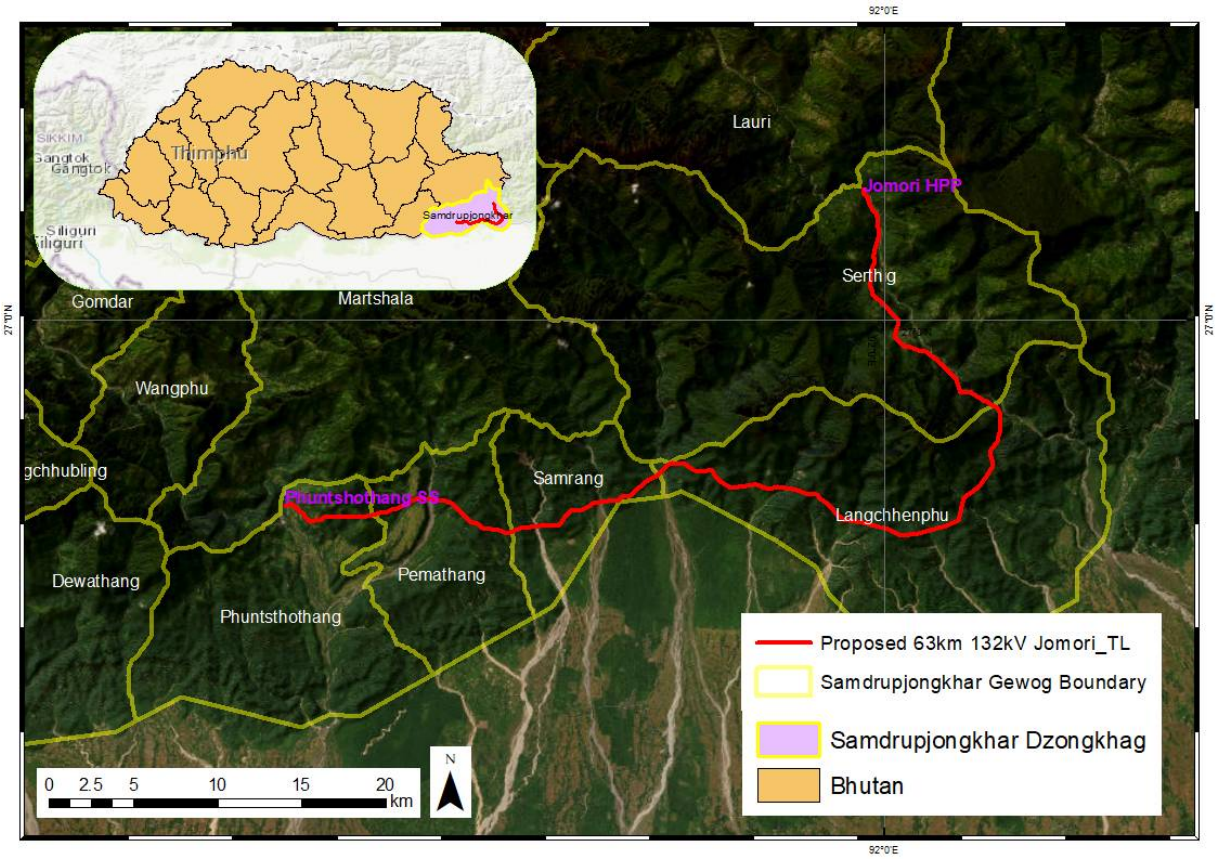
3.2. Location and Route

The proposed transmission line is proposed to pass through five Gewogs i.e., Serthi, Langchenphug, Samrang, Pemathang, and Phuntshothang under Samdrup Jongkhar district. A total of 152 towers are planned over the 63km stretch. The length and distribution of the transmission towers across Gewogs and land ownership are provided in Table 3-2 below.

Table 3-2: Transmission Line Route Details

SN.	Dzongkhag	Gewogs	Transmission line Length (km)	No. of towers
1	Samdrup Jongkhar	Serthi	15.5	44
2		Langchenphu	24.3	47
3		Samrang	9	22
4		Pemathang	8.3	20
5		Phuntshothang	5.6	19
TOTAL			**62.7 km**	**152 Towers**

Starting at an elevation of about 800 m.a.s.l where the 90MW powerhouse is located, the transmission line comprising of 152 towers will be located at various elevations ranging from 330 m.a.s.l to as high as over 1000 m.a.s.l. The TL passes through the Jomotshangkha Wildlife Sanctuary (JWS) which requires the project employ safeguards and standards necessary to uphold the conservation objective of the protected area. In order to reduce its impact on the protected area, the alignment follows the buffer around the Phuntshothang-Jomotshangkha highway, which existed prior to the establishment and application of the management zones (see Map 3-1).

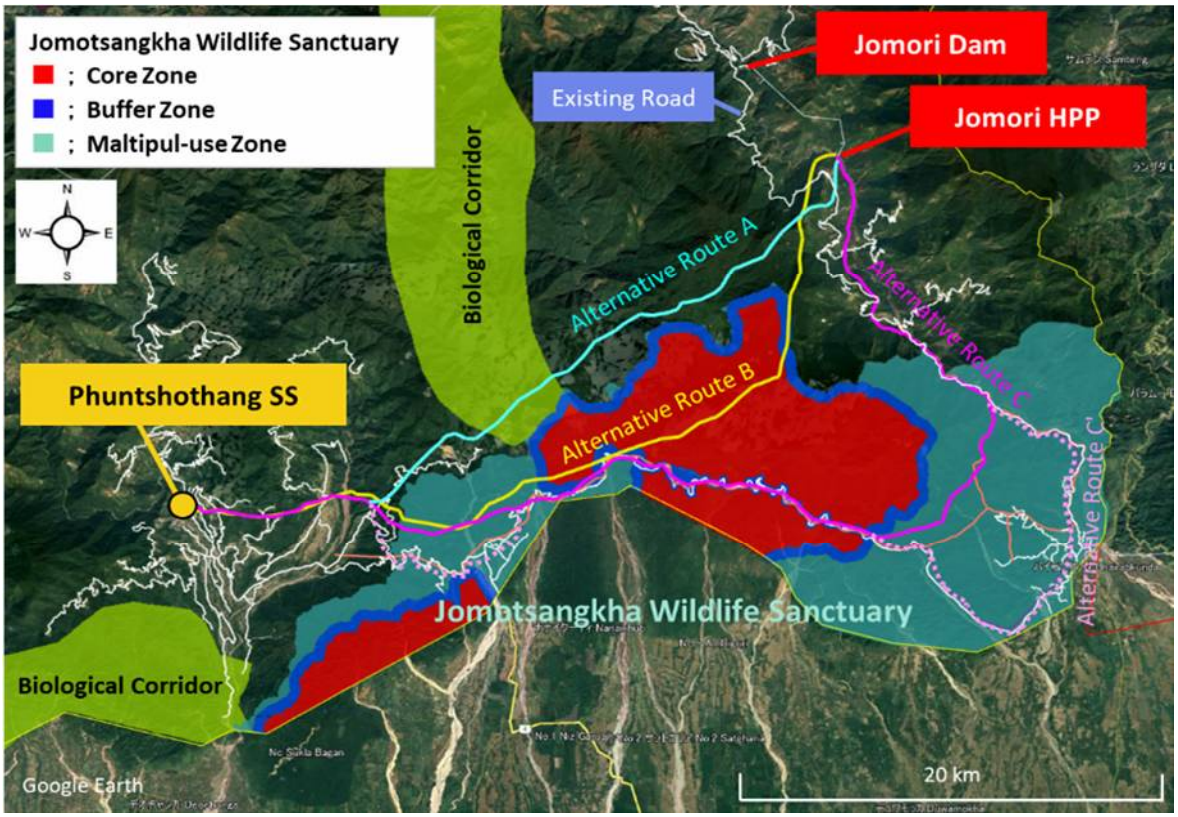


Map 3-1: Map of the proposed 132kv transmission line alignment

3.3. Analysis of Alternatives

3.3.1. Selection of evaluation items and results of evaluation of alternatives

For the proposed route to transmit power from the power house to the Puntsotan substation, which is approximately 78 km away (the largest proposal), four alternatives were considered from the viewpoint of feasibility, with the natural environment, social environment, economic feasibility, and constructability (degree of difficulty) as evaluation items. In addition, a comparison was made with these four alternatives, including the case where the project is not implemented.



(Source: JICA Survey Team)

Map 3-2: Map showing TL Alternative route proposals

Route A plan: A plan that completely avoids passing through the Jomotsangkha Wildlife Sanctuary. However, it passes through biological corridors.

Route B plan: A plan that passes over a short distance through an area where construction is relatively easy. However, it crosses the core zone of the Jomotsangkha Wildlife Sanctuary.

Route C plan: A plan that passes along existing roads in areas where construction is relatively easy. However, it will pass through the buffer zone and multiple use zone of the Jomotsangkha Wildlife Sanctuary.

Route C' Plan: A subdivision plan of Route C plan, in which all areas within the protected area are routed along roads.

3.3.2. Evaluation indicators for considering alternative route plans

The evaluation method for alternative routes is to give equal weight to the following evaluation items: "natural environment", "social environment", "economic efficiency", and "ease of construction". The evaluation indicators and score for each indicator are shown in the table below. Evaluation points within each item are distributed based on the importance and impact within the item.

Regarding the natural environment, considering that all proposal routes require passing through protected areas, it is more important to avoid impact on untouched virgin forests than to consider the importance and distance of protected areas. For this reason, the evaluation score for the tree cutting area of untouched virgin forest is set at 15 points. Regarding the social environment, considering that it is expected that relocation of residents can be avoided in either plan, it is important to minimize the impact on the area of privately owned land that is affected by the passage of the power transmission line. For this reason, the evaluation score for the area of private land expected to be affected is 15 points.

Table 3-3: Evaluation indicators

Items	Evaluation indicators	Evaluation points distribution
Natural environment (25 points)	Importance and distance of protected areas passed through	5
	Tree cutting area of untouched virgin forest	15
	Tree cutting area of natural forest around living space	5
Social environment (25 points)	Number of residents relocated	5
	Area of private land expected to be affected	15
	Tree cutting area of artificial forest	5
Economic efficiency (25 points)	Construction cost of transmission line (Includes costs for temporary roads and equipment transportation.)	25
Ease of construction (25 points)	Ease of access from existing roads (Considering construction implementation and O&M aspects)	15
	Topography of the tower installation site (flat or steep, etc.)	10

If the project crosses the core zone of a protected area where development is prohibited by domestic law, the project should be abandoned even if the project scores well in other items.

3.3.3. Comparative evaluation of each route plan

3.3.3.1. Natural environment

When constructing power transmission lines, possible impacts on the natural environment include passage through protected areas, tree cutting, degrading the landscape, impacting wild animals and plants, and impacting the ecosystem. Among these, it is thought that there are no major differences among the options except for passing through protected areas and tree cutting. Therefore, a comparative evaluation has been conducted based on two items: passage through protected areas and tree cutting.

(1) Passage through protected areas

The passage through protected areas in each route plan is as follows. If no protected area is passed, the total score is 5 (full mark), but since all plans pass through protected areas, points are set taking into consideration the importance of protected areas as a comparative evaluation. Passing through the core zone is given a score of 0, passing through the buffer zone and multiple use zone is given a score of 1 to 4 based on distance, and passing through a biological corridor is given a score of 4.

Table 3-4: Evaluation of passage through protected areas

Route plan	Evaluation details	Score
A	It passes through biological corridor.	4.0
B	It passes through the core zone of the protected area.	0.0
C	It passes through the buffer zone and multiple use zone of the protected area. (approx. 39km)	2.0
C'	It passes through the buffer zone and multiple use zone of the protected area. (approx. 54km)	1.5

Route A Plan passes through the virgin forests adjacent to the protected area and these virgin forests were judged at the year of 1988, and 1989 from The Food and Agriculture Organization of the United Nations (FAO) that these forests are forests worthy of protection because they have the same value as the virgin forest in the protected area from the viewpoint of biodiversity. In response to this view, the Ministry of Agriculture (now DoFPS) prepared a draft of the protected areas to be incorporated into the area in 1993 based on the Bhutan Five-Year Master Plan for Forests and Wildlife Sanctuary Designation Criteria (Category IV) of the International Union for Conservation of Nature (IUCN).

However, it is out of the protected area because the consent of the local province (Dzongkhag) and the county / village (Gewog) could not be obtained about a draft. (Based on interviews with the Jomotsangkha Wildlife Conservation Office and the Forestry Office January, 2024)

Route B plan, which crosses the core zone of the protected area, should be abandoned as a plan, even if it scores well in other items.

(2) Tree cutting

All proposed routes require large areas of tree cutting, as they pass through dense mountain forests over long distances. Even if the same tree is cut, the impact on the natural environment is thought to be different between a completely untouched virgin forest and a natural forest that is located near living spaces and easily accessed by people and livestock.

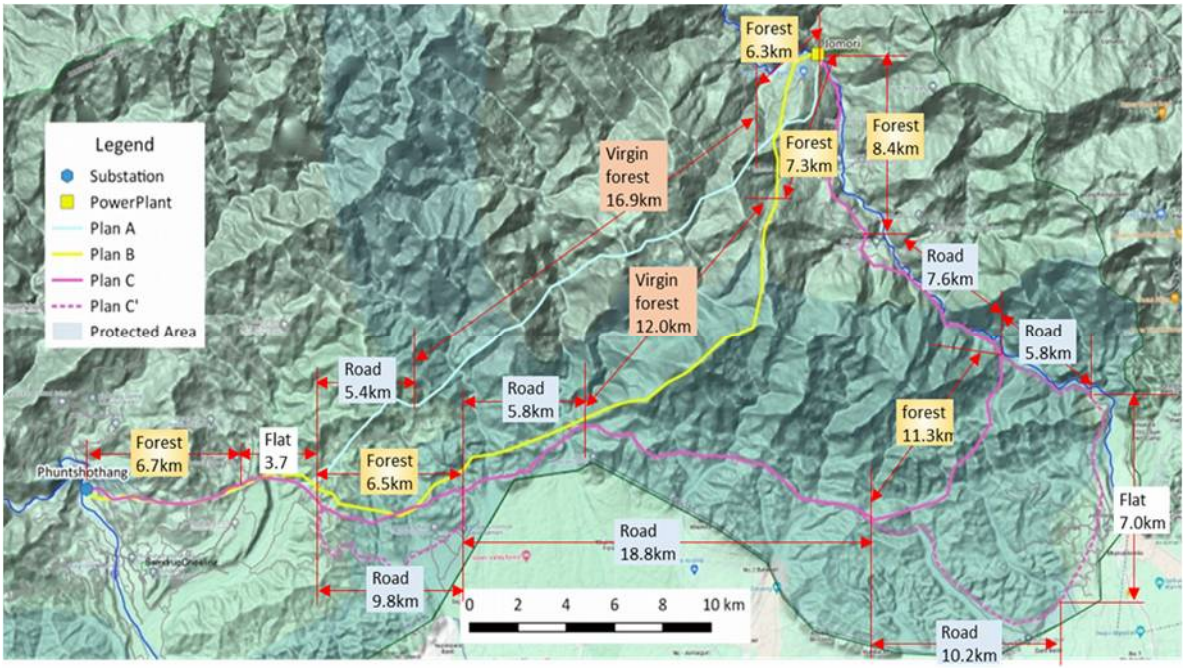
Originally, it would be accurate to calculate the required area of tree cutting after determining the location of the tower, determining whether the terrain is a valley or flat, and examining the method of constructing a temporary road. However, in order to carry out this study, it is necessary to conduct detailed route surveys for all route proposals and then determine the tower locations. Since the main purpose of this study is to comparatively evaluate the tree cutting area, a detailed study has not been conducted. In this document, as a simple method, the tree cutting area is calculated by multiplying the power transmission length and temporary road distance in each section by the tree cutting rate for each category (the ratio of the tree cutting area to the total area). The tree cutting rates for each category for each route are shown below. The width under the line (ROW) of the 132kV transmission line is 27m, and the width of the temporary road is 4m.

Table 3-5: Tree cutting rates for each category

Classification (category)	Tree cutting rates	Basis for setting
Flat area (artificial forest)	20%	Flat with low density of trees
Along the road	60%	Some of the trees have already been cut during road construction.
Natural forest, virgin forest	80%	No cutting is required when crossing a valley.
Temporary road	100%	However, the flat area is 20%

Artificial forests (especially community forests) are basically forests that are intended to be cut down and used by neighboring residents. However, it is expected that this will have an impact on the social environment as the tree cutting will take place at a different time than originally required. Therefore, the evaluation is based on the social environment.

A map showing the length of each route for each category is shown below.



Map 3-3: Map showing Length of each route for each category

(Source: JICA Survey Team)

Table 3-6: Length of each route for each category

(Unit: km)

Classification (category)	A	B	C	C'
Natural forests (some are artificial forests)	6.7	6.7	6.7	6.7
Flat area (artificial forest)	3.7	3.7	3.7	3.7
Along the road (Natural forest)	5.4			
Natural forest		6.5	6.5	
Along the road (Natural forest)				9.8
Along the road (Natural forest)		5.8	18.8	18.8
Untouched virgin forest	16.9	12.0		
Along the 33kV line (Natural forest)			11.3	
Along the road (Natural forest)				10.2
Flat area (artificial forest)				7.0
Along the road (Natural forest)				5.8
Along the road (Natural forest)			7.6	7.6
Natural forests (some are artificial forests)	6.3	7.3		
Natural forest			8.4	8.4
Total	39.0km	43.0km	63.0km	78.0km
Virgin forest	16.9	12.0	0.0	0.0
Natural forest	13.5	21.2	57.1	65.1
Artificial forest	8.6	8.8	5.9	12.9

The cost for temporary roads is calculated using the following method. During actual construction, it is envisaged that construction of temporary roads will be avoided by constructing cableways or using people and livestock to transport materials.

+ In case of along the road, temporary roads will be constructed from the road at each tower location. The average distance between towers will be 400m, and the average construction distance of temporary roads will be 100m.
+ In the forestry area, temporary roads will be constructed between towers. The cutting area can be reduced by laying within the width of the line (ROW) as much as possible. However, if the slope between the towers is steep, a winding road will be constructed with the steepest vertical gradient of 15%, and the portion outside the ROW will be cut down.

As a result, the calculated area of tree cutting is as follows.

Table 3-7: Area of tree cutting

(Unit: ha)

Classification (category)		A	B	C	C'
Untouched virgin forest	ROW	36.5	25.9	0.0	0.0
	Temporary road	9.3	3.8	0.0	0.0
	Total	45.8	29.7	0.0	0.0
Natural forest around the living space	ROW	26.2	42.7	109.1	112.4
	Temporary road	3.2	6.3	12.3	8.6
	Total	29.5	49.0	121.4	121.0
Artificial forest	ROW	12.6	13.0	6.8	10.5
	Temporary road	1.6	1.6	0.6	0.8
	Total	14.2	14.6	7.4	11.3

For evaluation of tree cutting, full point is given if there is no cutting at all, and 0 point is given if there is the largest area.

Table 3-8: Evaluation of tree cutting[1]

Evaluation items	A	B	C	C'
Untouched virgin forest	45.8ha	29.7ha	0.0ha	0.0ha
Score (full mark: 15 points)	0.0	5.3	15.0	15.0
Natural forest around the living space	29.5ha	49.0ha	121.4ha	121.0ha
Score (full mark: 5 points)	3.8	3.0	0.0	0.0

[1] Score = (1 – (cutting area) / (largest cutting area)) × (full mark)

3.3.3.2. Social environment

(1) Number of residents relocated

According to the current survey results, it is expected that the relocation of residents will be avoidable for all plans, so all plans are evaluated with a maximum of 5 points.

(2) Area of private land expected to be affected

If the land for the tower and the land under the lines are on privately owned land, it is necessary to acquire or compensate for the privately owned land, which will have an impact on the social environment, so it is desirable to avoid this as much as possible. However, it is difficult to avoid it if most of the route passes through private land. Taking this into consideration, the impact on the social environment is evaluated based on the area of private land that is expected to be affected. Full point is given if the area of private land expected to be affected is zero, and 0 point if it is 20 ha.

Table 3-9: Evaluation of the area of private land expected to be affected[2]

Evaluation items	A	B	C	C'
Area of private land expected to be affected	1.9ha	1.4ha	7.9ha	15.9ha
Score (full mark: 15 points)	13.6	14.0	9.1	3.1

(3) Tree cutting area of artificial forest

For evaluation of tree cutting area of artificial forest, full point is given if there is no cutting at all, and 0 point is given if there is the largest area.

Table 3-10: Evaluation of tree cutting area of artificial forest[3]

Evaluation items	A	B	C	C'
Tree cutting area of artificial forest	14.2ha	14.6ha	7.4ha	11.3ha
Score (full mark: 15 points)	0.2	0.0	2.5	1.1

3.3.3.3. Economic efficiency

Economic efficiency is evaluated based on the construction cost of the transmission line. The construction cost also includes the cost of temporary roads and equipment transportation. A full score of 25 points is

[2] Score = (1 – (private land expected to be affected) / 20) × (full mark)

[3] Score = (1 – (cutting area) / (largest cutting area)) × (full mark)

given to the cheapest construction cost, and if the cost is more than twice the cheapest construction cost, it will be given 0 point.

Table 3-11: Evaluation of economic efficiency[4]

Evaluation items	A	B	C	C'
Construction cost (USD million)	4.140	4.581	6.590	8.071
Score (full mark: 25 points)	25.0	22.3	10.2	1.3

3.3.3.4. Ease of construction

(1) Ease of access from existing roads

For construction along roads and on flat areas, access is expected to be easy as roads are already in place around the tower installation locations. On the other hand, if a tower is installed in a forest area, it is assumed that access will be difficult as there are no roads for access. From this point of view, the ratio of the length of the route along the road and through flat areas to the total length is evaluated. If this percentage is 100%, it is given a full score, and if this percentage is 0%, it is given 0 point.

Table 3-12: Evaluation of ease of access from existing roads[5]

Evaluation items	A	B	C	C'
Easy access length ratio	23.3%	22.6%	47.8%	80.6%
Score (full mark: 15 points)	3.5	3.4	7.2	12.1

(2) Topography of the tower installation site

It is difficult to evaluate the topography of the tower installation site unless the specific tower installation location is determined. However, as a preliminary evaluation method, it is expected that the greater the difference in elevation along the route, the more steep the terrain will need to be constructed. The altitude of the Jomori power station is approximately 800m, and the altitude of Phuntshothang substation is approximately 330m. Since the difference in elevation between the two ends is approximately 470m, full point is given if the difference in elevation between the highest point on the route and the Phuntshothang substation is 500m, and 0 point is given if the difference in elevation is more than 2,000m.

Table 3-13: Evaluation of topography of the tower installation site[6]

Evaluation items	A	B	C	C'

[4] Score = (1 – ((construction cost) – (cheapest construction cost)) / (cheapest construction cost) × (full mark)

[5] Score = (Easy access length ratio) × (full mark)

[6] Score = (1 – (highest altitude on route – 830) / 1500) × (full mark), However, the minimum is 0 points.

Highest altitude on route	2,369m	2,199m	1,014m	1,014m
Score (full mark: 10 points)	0.0	0.9	8.8	8.8

3.3.4. Conclusion

The overall evaluation results, which are the sum of the evaluations for each item, are shown below. The plan that received the highest overall score is Route C.

Table 3-14: Overall evaluation

Evaluation items	Full	A	B	C	C'
Natural environment	25	7.8	8.3	17.0	16.5
Importance and distance of protected areas passed through	5	4.0	0.0	2.0	1.5
Tree cutting area of untouched virgin forest	15	0.0	5.3	15.0	15.0
Tree cutting area of natural forest around living space	5	3.8	3.0	0.0	0.0
Social environment	25	18.8	19.0	16.6	9.2
Number of residents relocated	5	5.0	5.0	5.0	5.0
Area of private land expected to be affected	15	13.6	14.0	9.1	3.1
Tree cutting area of artificial forest	5	0.2	0.0	2.5	1.1
Economic efficiency	25	25.0	22.3	10.2	1.3
Construction cost of transmission line	25	25.0	22.3	10.2	1.3
Ease of construction	25	3.5	4.3	16.0	20.9
Ease of access from existing roads	15	3.5	3.4	7.2	12.1
Topography of the tower installation site	10	0.0	0.9	8.8	8.8
Total		**55.1**	**53.9**	**59.8**	**47.9**

Route A plan has a high evaluation of economic efficiency because of its shortest distance, but it has a low evaluation from the viewpoints of the natural environment and ease of construction. In terms of overall evaluation, it ranks second after Route C plan.

Route B plan crosses the core zone, which is the core of the protected area, so the plan should be abandoned. Furthermore, the overall evaluation rank is not very high.

Route C plan has a longer distance, so it has a lower evaluation of economic efficiency, but it has a higher evaluation from the viewpoints of the natural environment and ease of construction, giving it the highest overall evaluation.

Route C' plan, which is a subdivision of Route C plan, has a longer distance than Route C plan, resulting in a worse economic efficiency and lower overall evaluation.

4. PROJECT DESCRIPTION

4.1. Project Components

4.1.1. Transmission Line Tower Compositions & Design

Table 4-1 presents the basic design of the Jomori line, featuring a total of two circuits. Using a standard tower design, BPC opts for a configuration suited for general purposes. The selected standard tower, conforming to 132kV specifications, integrates vertical phase conductors comprised of Aluminum Conductor Steel Reinforced (ACSR), a common choice within Bhutan. Atop the tower, a single ground wire is positioned, serving dual roles for grounding and communication, utilizing Optical Ground Wire (OPGW) technology. In an effort to streamline construction and maintenance, the project adopts Composite Insulators, renowned for their lightweight nature, over traditional disk insulators. Additionally, arcing horns are strategically installed to safeguard against insulator damage during lightning strikes. To mitigate wind-induced vibration damage, stock bridge vibration dampers are affixed to both phase and ground wires.

Table 4-1: Basic facility design of the TL (Jomori)

Design voltage	132 kV	
Reliability levels	1 (50 years)	
Tower type	Steel lattice tower	
Nos of circuit	2	
Configuration of circuit	Vertical	
Nos of conductor in phase	1	ACSR
Nos of ground wire	1	OPGW
Insulator type	Composite	
Arcing horn	Yes	
Vibration damper	Yes	

The total estimated towers to be installed along the proposed 63km transmission line route is 152 towers after maintaining the average span of 335 m for 132 kV PTL. However, the minimum and maximum span between any two towers for the project may vary depending on the topography of the terrain and towers shall be spotted within the tower design parameters (tower spotting data) of the 132 kV towers.

The right-of-way (ROW) width for the 132kV transmission line is 27m detailed in Table 4-2. Notably, the necessity for clearing of vegetation within the ROW during construction is not compulsory but may be required depending on the ground realities during construction. Vegetation clearance, if required, is conducted selectively, addressing only those instances where it directly impedes construction activities.

Transmission line crossings over valleys and deep gorges would require only about 4m clearing to accommodate space for laying of cables.

Table 4-2: ROW width for the 132 kV TL (Jomori)

Voltage	ROW width	Tree cutting for construction
132 kV	27 m (13.5m from center line)	Not mandatory

Basically, four categories of towers are used in Bhutan (hilly terrain) which are classified depending on;

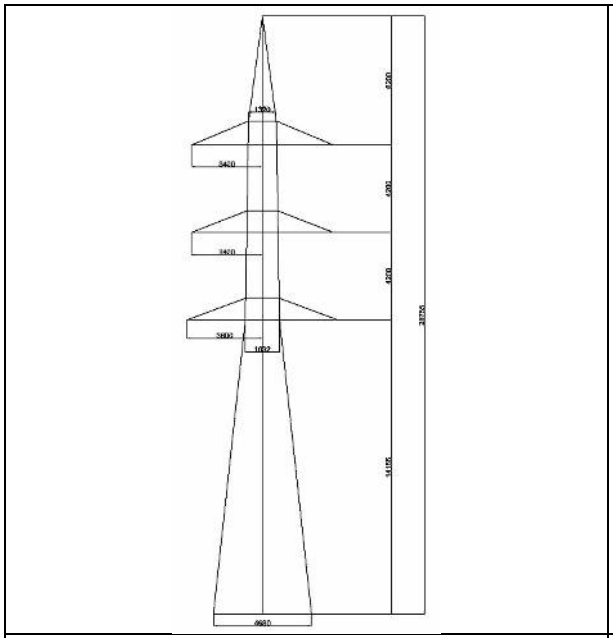
1) The angle of deviation of the line.
2) Vertical load limitation on single span on both spans.
3) Permissible sum of adjacent spans for various deviation angles.

Special towers for deep valley and river crossings.

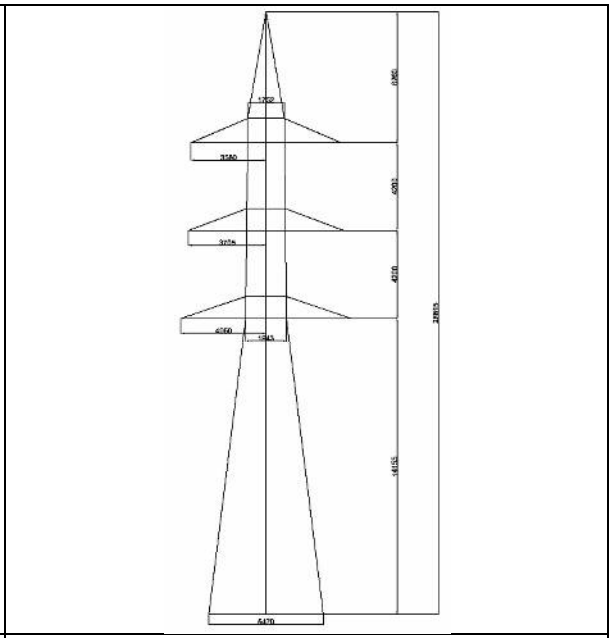
Table 4-3: Tower Type to be used for the project

Tower Type	Tower Description	Average Tower Height (m)	Typical use
Small Angle Tower (0 -15°)	B	28.04	To be used for line deviation up to 15° with normal span and also for longer span with smaller angles.
Medium Angle Tower (15° - 30°)	C	28.2	To be used for line deviation for more than 15° and up to 30° with normal span and also for longer span with smaller angles.
Large Angle & Dead End Tower (30° - 60°)	D	29.05	To be used for line deviation for more than 30° and up to 60° with normal span and also for longer span with smaller angles. These towers will also be used as Terminal Dead End Towers.
Special Towers	SP	47.05	These may be required for major river/valley crossing & under specific conditions where normal towers are not suitable.

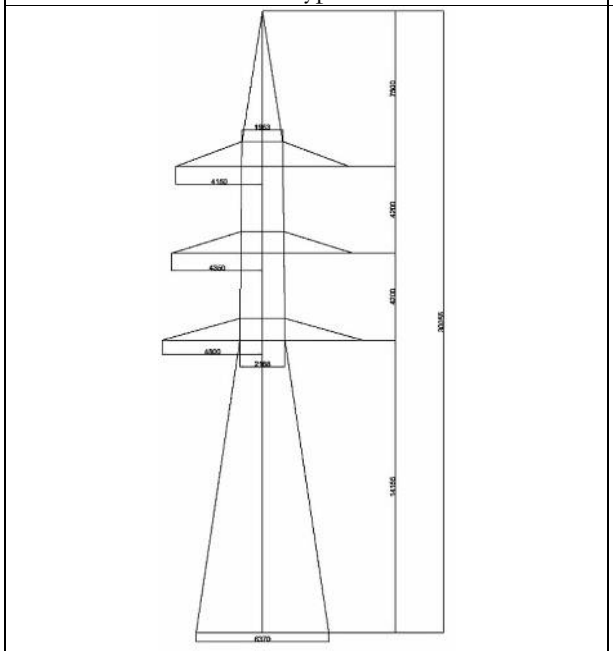
The design, manufacturing, fabrication, galvanizing, testing, installation procedures and materials to be used for manufacturing line materials, construction of foundations and installation of towers, etc. will conform to the latest revisions of the Indian standards (IS), as amended up to date and provisions.



B type



C type



D type

Figure 4-1: Outline of 132kV standard tower

4.1.2. Pre-Construction Phase Activities

4.1.2.1. Desktop & Field Investigations

During pre-construction phase, BPC carried out desktop survey and walk-on survey to ascertain and finalize the transmission line route. Subsequently, several walk-on joint site visits were carried out involving concerned local government officials, local people and Forestry people for project site verifications and to obtain necessary approvals to go ahead with the detailed survey. All the necessary approvals and No Objection Certificates (NOC) for the proposed project were obtained after joint site verifications and consultations. Pre-construction activities also includes site preparation, setting up project offices, contractors offices and workers camps which will be completed prior to the beginning of the construction activities.

4.1.2.2. Land Acquisition

The permanent land acquisition will be only for the land affected by the tower base and the land acquisition processes will be completed before construction work. There will be temporary use of some land for the work areas of the contractors, their camps, and other facilities. These will be identified by the Project Management; the Dzongkhag and Gewog Authorities and it will be allocated according to;

i. Proximity to the project site,
ii. Minimal forest clearance required, and
iii. Accessibility to the roads as well as drinking water and electricity.

4.1.3. Construction Phase Activities

4.1.3.1. Construction of Access Road and ropeway

The proposed TL project primarily follows the route of the Samrang to Jomotsangkha to Serthi Highway. Numerous tower sites along this route, extending from the current Phuntshothang substation to Samrang, can be easily reached via existing farm roads. However, for tower placements in remote areas, BPC intends to build 16 temporary access roads and 8 ropeways. All these access roads and ropeways will be constructed within the State Reserved Forest Land (SRFL) to minimize any impact on private properties. Further details regarding these proposed access roads and ropeways can be found in the Project Ancillaries section.

4.1.3.2. Benching

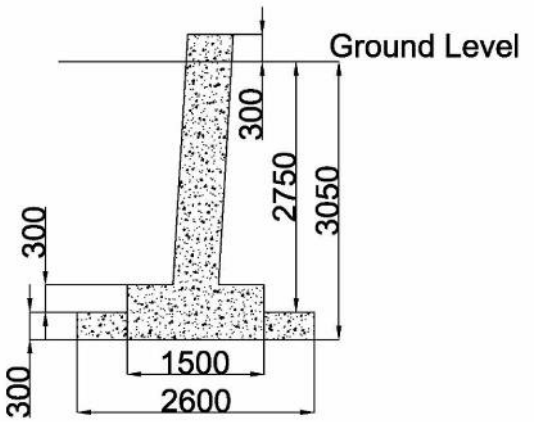
In regions characterized by steep slopes or uneven terrain, it may be necessary to bench transmission towers. Benching entails the flattening or terracing of the ground to establish a solid base for the tower structure. This method ensures the tower's stability and vertical alignment despite the natural contours of the land. Typically, benching involves creating horizontal levels or steps with nearly vertical surfaces in between, serving to safeguard workers within the excavation from potential soil or rock slides. For this Jomori TL project a total of 19 tower locations necessitates benching to secure them due to their placement in geologically unstable or steep terrain. The anticipated volume of excavated material resulting from benching these tower sites is detailed in Table 4-4.

Table 4-4: Benching volume for the 132kV D/C Jomori Transmission line

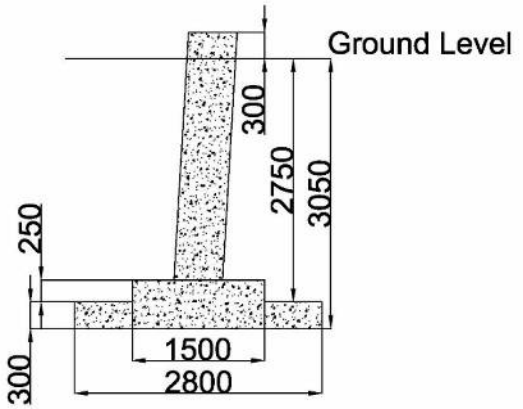
SN	Tower types	Structure Height (m)	Base Width (m)	Structure Base Area in sq.m at Ground Level	Benching Area in sq.m at foundation level	Average Benching Area in sq.m	Benching Vol. (m^3) for 19 nos of towers in unstable area
1	B	31.60	4.60	21.16	57.76	83.21	**1,581**
2	C	31.94	5.40	29.16	70.56		
3	D	32.84	6.60	43.56	92.16		
4	SP	41.30	7.60	57.76	112.36		

4.1.3.3. Excavation & Installation of Tower Foundation

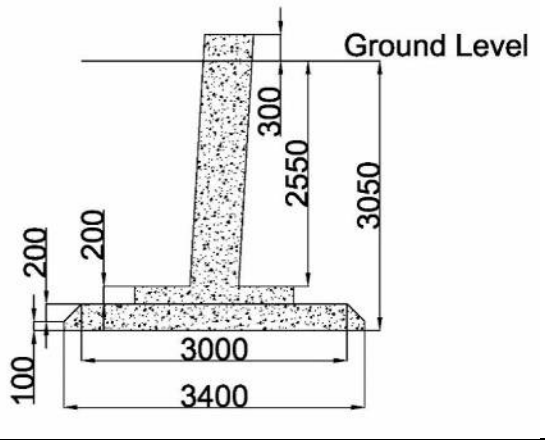
BPC uses standard foundation designs in conjunction with standard towers, utilizing pad and chimney RCC (Reinforced Concrete Cement) foundations. The specific shape of these foundations is illustrated in Figure 4-2. Notably, these foundations feature a concrete cover thickness of 50 mm, allowing for the use of steel panel or wood panel formwork during construction.



B type



C type



D type

Figure 4-2: Outline of 132kV foundation

Pit foundation digging will be done for the 4 legs of the tower. Tower foundation area may vary depending on tower type used and the terrain of the tower location. Most of the tower locations are accessible by existing roads. Thus, excavation in such locations will be done using excavators. Moreover, the construction work involved for the proposed TL is small in scale (involving the excavation of small pits for the tower foundations and installation of towers and stringing of conductors) and the works will be conducted by small teams of workers manually as far as possible without the use of heavy vehicles and machinery.

The estimated soil to be generated as a result of tower foundation excavation is worked out in the Table 4-5.

Table 4-5: Expected volume of soil from the tower foundation excavation

Tower Type	**B**	**C**	**D**	**SP**
Foundation width **(m)** of one Leg of a Tower	4.6	5.4	6.6	7.6
Depth of Foundation/Height **(m)**	3.05	3.05	3.05	3.05
Total Foundation Area **(width×width) × 4 legs (m²)**	84.64	116.64	174.24	231.04
Volume of Excavated Soil (**Area × Height) (m³)**	258.152	355.752	531.432	704.672
No. of Tower Type to be used from (152 TOWERS)	77	35	28	12
Total Volume of Excavated Soil (m³)	**19,877.704**	**12,451.32**	**14,880.096**	**8,456.064**
Total Excavated Soil from The Project (m³)	**55,665**			

The foundation concrete must adhere to M20 grade specifications, signifying a cube compression strength of 20 N/mm² at the conclusion of 28 days. For the chimney and slab sections, 20 mm downgraded stone metal is utilized, while the pyramid sections employ 40 mm downgraded stone metal.

Uniformity is maintained in the footings across all four legs of a tower, regardless of down-thrust or uplift forces. The duration for casting and foundation work at each tower site typically ranges from 15 to 20 days, involving 15 to 25 workers depending upon terrain characteristics and accessibility.

Daily construction necessitates approximately 60 liters of water per cubic meter, sourced locally through tanker deliveries and rainwater collection stored in on-site tanks. Each tower requires an average of 40 to 100 cubic meters of concrete for construction purposes.

4.1.3.4. Backfilling

To the extent available, the selected surplus soils from the excavated materials shall be used for backfilling the finished foundation concrete pit. As soon as the work of foundations has been accepted and measured, the space around the foundation shall be cleared of all debris, and filled with earth in layers not exceeding 15 cm, each layer being watered rammed and properly consolidated before the succeeding layer is laid. Each layer of earth shall be consolidated by ramming with approved mechanical compaction machines. Special care shall be taken to prevent any wedging action against the footing. The backfill shall be compacted to 95% of the maximum dry density obtainable in the standard Procter density test as specified in relevant standards. The excavation and placing operations shall be such that material when compacted will be blended sufficiently to secure best practicable degree of compaction, impermeability and stability. The stub setting template shall be opened only after the completion of backfilling.

4.1.3.5. Revetment

At locations, for instance on slopes, where there are chances of soil erosion due to rainwater, a retaining wall shall be provided around tower foundation as revetment. The wall shall consist of broken stone pieces cemented with the help of 1:5 cement mortar and weep holes and filters. The revetment walls shall be finally pointed with 1:4 cement mortar. The empty space between revetment and foundation shall be filled by earth. Alternatively, RCC retaining wall, based on standard civil engineering practices, shall also be permitted. The design of the revetment and foundation shall be developed by the Contractor and approved by the BPC.

4.1.3.6. Tower material delivery

The materials for the construction of towers will be delivered from the storage yard directly to the site. The materials will be brought to the construction site by trucks or manually (head loading) depending on the accessibility. The contractor can lease private space/house and built storage yards at Phuntshothang and Jomotsangkha area or use BPC's substation area for the storage of construction materials.

4.1.3.7. Installation of Tower and Line Materials

Towers shall be installed by assembling the prefabricated components of the lattice structure, not earlier than 14 days after concreting and after such time that the concrete has acquired its full strength. After initial installation all tower bolts shall be checked to ascertain that all nuts are fully tight. Installation of each tower and line materials takes 15 days with 15 – 20 workers. All the tower installations will be done manually by assembling prefabricated components of the lattice structure.

4.1.3.8. Stringing of Conductors and Optical Ground Wire (OPGW)

The entire stringing work of the conductors and OPGW shall be carried out by tension stringing technique manually or by using puller machines as shown in the figure below.

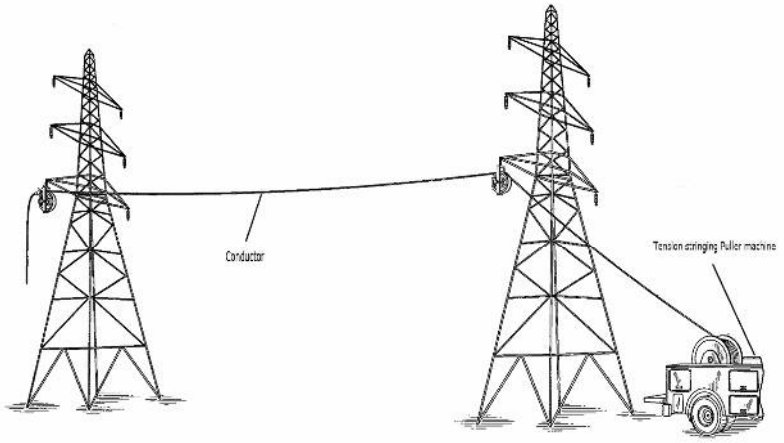
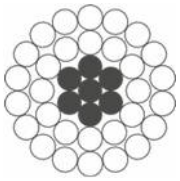


Figure 4-3: Puller machine for stringining of TL conductors

In the hilly terrain and thick forested area with space constraints, where deployment of tension stringing machine is not possible, manual stringing may be adopted. The stringing works between two towers normally takes 3 – 7 days.

The conductor used for the 132 kV project will be Aluminium Conductor Steel Reinforced (ACCSR PANTHER) with 30/3.00 mm diameter of Aluminium wire and 7/3.00 mm diameter of steel wire inside (detailed specification shown in table 3-9). The stringing work will require 50 workers when the work is carried out manually, but use of puller machine wherever possible might reduce the number of workers required.

Table 4-6: Specification of TL Conductor (Jomori)

Designation	212-AL1/49-ST1A (Panther)
Type	ACSR
Stranding (Nos / diameter)	Al: 30 / 3.00 St: 7 / 3.00
Creep period of conductor to be considered (years)	10
Overall diameter (mm)	21.0
Cross sectional area Al (mm^2)	212.1
Minimum ultimate tensile strength (kN)	92.46
Weight (kg/km)	973.1
Direction of external lay	Right hand
Maximum DC Resistance at 20 degC (ohm/km)	0.13630
Grease	Required (Shell Ensis 356 or equivalent)*
Cross section	
Note: * Grease was used in the 220kV Chukkha-Jamjee transmission line project.	

4.1.3.9. Testing & Commissioning

After completion of works, final checking of the line will be carried out to ensure that all the foundation works, tower installation, stringing etc. have been done with strict adherence to the technical requirements and specifications.

Insulation and continuity test of the transmission line, as well as earth resistance of each tower will be carried out before final commissioning.

4.1.3.10. Safety Measures for Operations

All towers will be fitted with a galvanized barbed wire type anti climbing device on all faces of the tower at a suitable height in a suitable manner.

Climbing step-bolts will be provided on one corner leg starting immediately above the anti-climbing device and continuing to the top for future maintenance purposes.

The Danger Plate will be attached to each tower approximately 2 m above ground with the inscription of bone and skull symbol and the voltage of the line. The single red word "DANGER" will be also written in Bhutanese translation on the plate.

Finally, before the activation of the transmission line, a public announcement regarding the operations of the line will be made to the inhabitants in the vicinity through media and public awareness programs.

4.1.3.11. Major Equipment & Materials required during Construction

Equipment and materials necessary for the construction of the transmission line and their source are listed in the table below;

Table 4-7: List of Construction materials and their source for TL project

SN.	Activity	Requirements	Source
1.	Tower Foundation Excavation and Casting	Stubs of towers	India
		Stub setting templates	India
		Stub setting jacks	India
		Form boxes for concreting/wooden planks for shuttering	India
		Concrete mixer machines, vibrator, dewatering pumps	India
		Sand, cement and stone chips	Locally available
		Metal screens/sand screens, etc. and other related tools/tackles for excavation/concreting and backfilling	Locally available
2.	Tower installation	Tower steel members with nuts and bolts and various tower accessories	India
		Derrick poles for lifting of tower members	India
		Poly propylene ropes for guying purposes	India
		Various single sheave pulleys and other related tools/tackles for tower erection	India
3.	Stringing of conductor and earth wire	Conductor and earth wire drums	Kolkata, India
		OPGW	China
		Insulator discs, hardware fittings and accessories	India
		Tensioner and puller machine for stringing purposes	India
		Turn table and drum mounting jacks	India
		Pilot wires for "paying off" conductor and earth wire	India
		Hydraulic compressor machine for making joints of conductor and earth wire	Italy
		Various four sheave pulleys, rollers, clamps, wire ropes, etc. and other related tools and tackles for stringing purposes	India

4.1.3.12. Manpower requirement during Construction

The average number of workers and the duration needed for constructing a tower for the proposed 132kV TL are outlined in Table 4-8. However, the workforce requirements at each site may fluctuate based on terrain characteristics.

Table 4-8: Summary of average workers & duration required for 132kV TL Project

Tower installation Phase	Duration (days)	No. of Workers Required
Foundation Casting	20	15-20
Assembly of Tower members/Installation of Towers	15	15-20
Stringing of Conductors & OPGW	7	50

4.1.4. Operation Phase Activities

4.1.4.1. Operation & Maintenance (O&M)

The project will be operated and maintained by BPC following completion of the construction works. Activities undertaken during the project operations phase are minimal which will include clearing of overgrown vegetation and repairs of any defect that can be detected along the transmission line. BPC will undertake a regular maintenance and monitoring programme for the transmission line which comprises of preventive measures and measures for breakdown.

The following preventive checks are planned to be carried out periodically along the transmission line:

i. Trimming of tree branches along the corridor/right of way i.e. 27 m for maintaining adequate electrical clearances.
ii. Visual inspections (through binoculars) and using Drones.
    a. Insulators & hardware fittings
    b. Conductor and ground wire, and their accessories such as vibration dampers, compression joints, repairs sleeves etc.
iii. Missing tower members (if any), nuts, bolts, etc.
iv. Measurement of earth footing resistance for all towers periodically & taking necessary action by improving earthing arrangements as per site conditions in case of earth footing resistance is more than 10 ohms;
v. Checking anti-climbing device, phase plate, number plate, circuit plate, danger plate;

vi. Checking of corrosion on tower members, tower earthing, etc. and taking necessary actions for Aluminium oxide painting;
vii. Checking of foundation chimneys, coping etc.
viii. Checking of adequate conductor clearances at important crossings, conductor creep, etc.

4.1.4.2. Implementing Drone Technology to Enhance O&M of TL

The JICA survey team suggested that BPC use drones to improve the efficiency of transmission line Operation and Maintenance (O&M). Drones are already used in various utilities, including in Japan, especially in the O&M sector of transmission lines, to enhance work efficiency. Table 4-9 & Figure 4-4 provide an overview and sample pictures of drone usage in Japan's transmission line O&M domain. BPC plans to enhance transmission line O&M work by introducing drone technology to two Transmission O&M Units (TOMUs) in the project: TOMU Samtse (Druk Bindu TL) and TOMU Phuntshothang (Jomori TL). This project will serve as a trial to evaluate the effectiveness of drones in Bhutan's operations.

Table 4-9: Drone usages in Japanese utility (Sample)

Area	Usages
Patrol	■ Special patrol (Earthquake, Heavy rain etc.) ■ After fault patrol (e.g. lightning fault) ■ Hilly area patrol (to reduce injury of staffs)
Inspection	■ Tower visual inspection ■ Conductor and accesory inspection ■ Line enviroment inspection (erosion, embarkment, land cutting etc.) ■ Vegetation management ■ Outageless pre-inspection ■ Climbless pre-inspection (to improve effeiciency)
Facility diagnosis	■ Tower diagnosis (corrosion management)

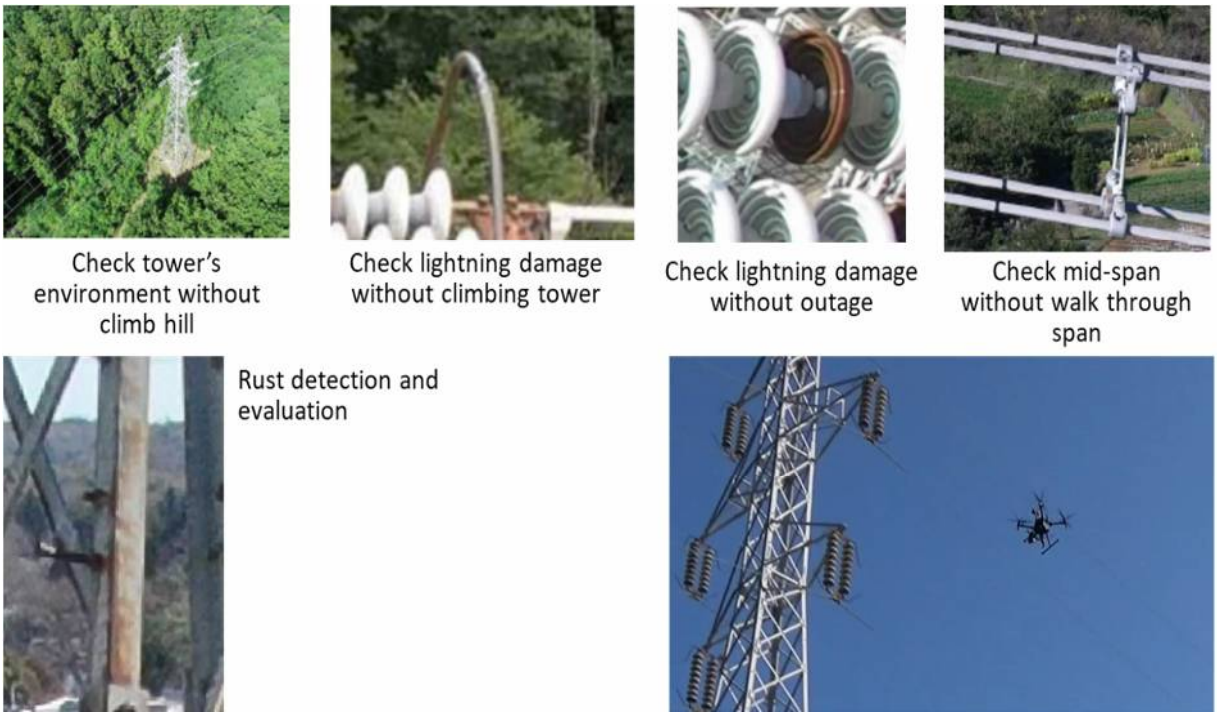


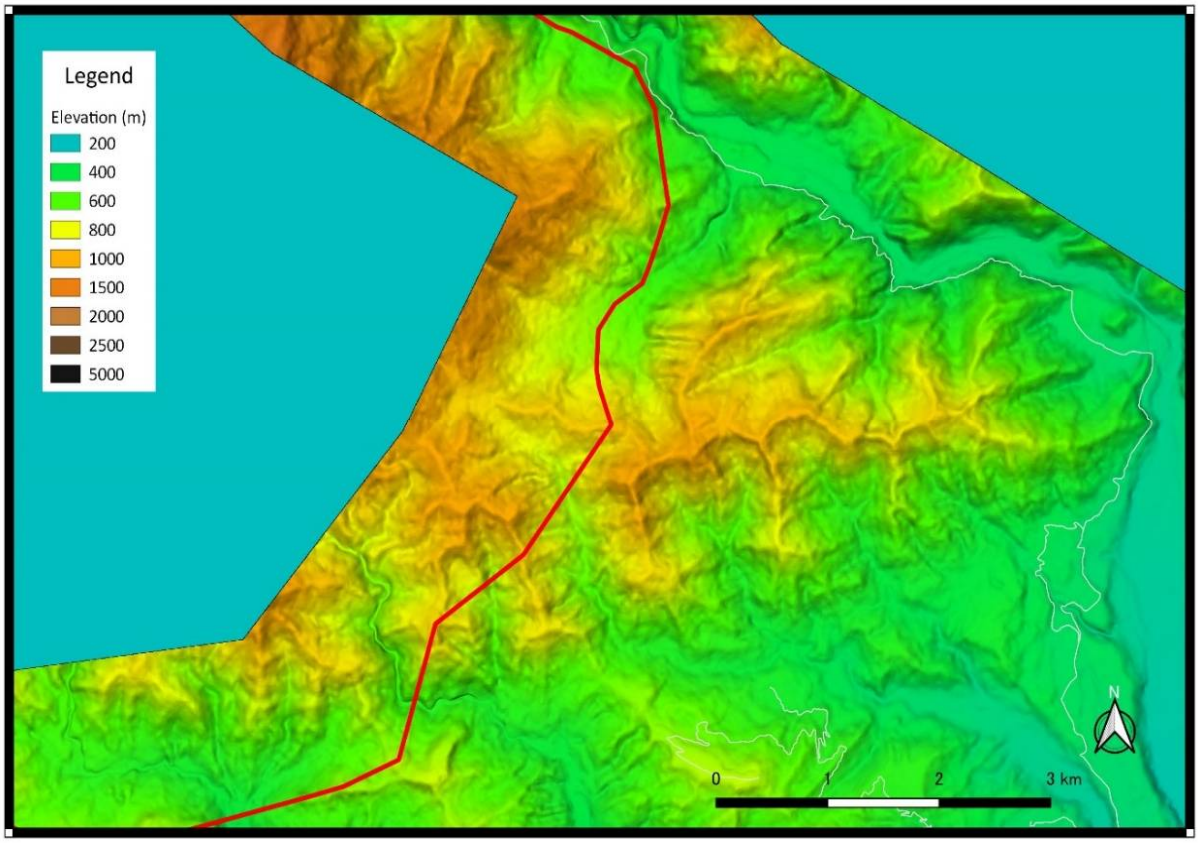
Figure 4-4: Drone usage in transmission line O&M

4.1.4.3. Utilizing High-Resolution Digital Terrain Models (DTM/DEM) for Enhanced TL Design & O&M

In 2019, the BPC initiated its Digital Strategy aimed at enhancing digitalization efforts. This strategy encompasses GIS mapping and the construction of network topology within the BPC's operational domain. As part of a project study, a high-resolution (2.5m resolution) Digital Terrain Model (DTM) was developed for each transmission line site, leveraging advanced Japanese technology. These DTMs were sourced from the Japan Aerospace Exploration Agency (JAXA), the Remote Sensing Technology Center of Japan (RESTEC), and NTT DATA. An illustrative terrain map featuring the Jomotsangkha area, including the line route derived from the high-resolution DTM, is presented in Map 4-1.

The utilization of high-resolution and precise DTMs facilitates the efficient detailed design of transmission lines. These DTMs play a crucial role in tasks such as line alignment survey (routing), tower positioning, and profiling (ground clearance assessment) of the lines. Beyond the project's scope, the DTMs will continue to serve in O&M activities, particularly in managing ground clearance along the transmission lines.

Map 4-1: Sample terrain map of Jomori line using high resolution DTM



(Source: JAXA, RESTEC and NTTDATA)

4.1.5. Project Ancillaries

4.1.5.1. Access Road, Ropeways & Substations

The majority of the proposed PTL follows the Samrang to Jomotsangkha to Serthi Highway Road. Many tower locations, starting from the existing Phuntshothang substation to Samrang, are easily accessible via existing farm roads. For tower site in more remote areas, BPC intends to build temporary access roads to 16 sites (total length of 106,963.5 m) and result in clearing of approximately 85,570.8 m^2 of forest and ropeways to 8 sites resulting in clearing of 2,312 m^2 of forest which counts total square of forest clearing is 87,882.9m^2. The forest density in the area is 0.053/m^2, and it is expected to result in the felling of 123 trees (2,312 m^2 × 0.053) due to ropeways and approximately 4,658 trees (85,570.8 m^2 × 0.053) are expected to be cut down due to temporary access road construction. As a result, total number of trees to be fell down is estimated about 4,781 trees.

The ratio of forest area to be cleared was 30% for ropeways and 80% for access roads is estimated based on BPC's experience.

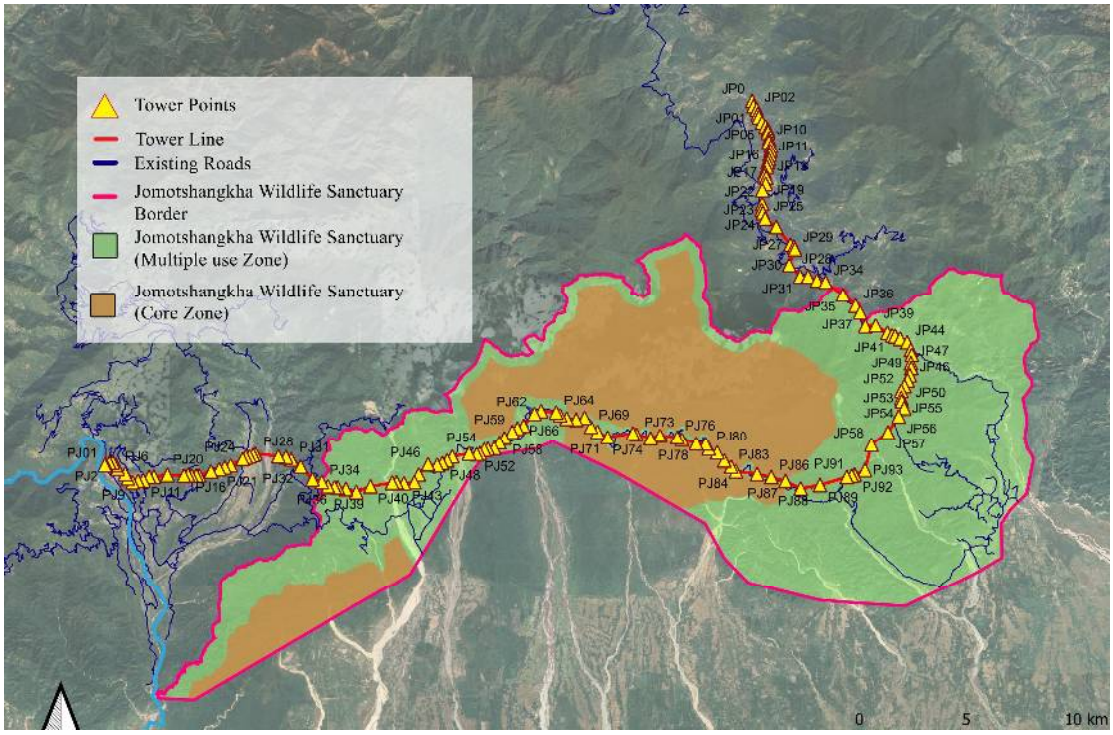
Most of the forest areas to be cut down for temporary road or ropeway are natural forests that have been naturally grow up on the site of logging due to the construction of a distribution line (33 kv), and are composed of a mixture of evergreen and deciduous broad-leaved tree species. Trees cut down is to be marked by DoFPS and handed over to Natural Resources Development Corporation Ltd (NRDCL) to carry out forest.

The details of these proposed access roads, ropeways and forest area temporarily felling down by these developments are outlined in Table 4-10 and Figure 4-5 to Figure 4-23.

Table 4-10: Ropeways and Access roads planned for the 132kV Jomori Transmission line

SN	Tower Locations	Name	Width_m	Length_m	Area_sq m	% rate of Forest m²	Applicable figure number*
1	PJ15, PJ16	Ropeways1	3.5	242	1,648.5	494.55	4-7
2	PJ18, & PJ19	Ropeway2	3.5	229			4-7
3	PJ52-PJ53	Ropeway3	3.5	273	955.5	286.65	4-11
4	PJ74	Ropeway4	3.5	134	469	140.7	4-13
5	PJ75	Ropeway5	3.5	141	493.5	148.05	4-13
6	PJ87	Ropeway6	3.5	111	388.5	116.55	4-14
7	JP57-JP58	Ropeway7	3.5	965	3,377.5	1,013.25	4-16
8	JP44	Ropeway8	3.5	107	374.5	112.35	4-17
9	PJ11-PJ14	AccessRd1	3.5	1,185	4,147.5	3,318	4-6
10	PJ20-PJ23	AccessRd2	3.5	2,896	1,0136	8,108.8	4-7
11	PJ24-PJ27	AccessRd3	3.5	505	1,767.5	1,414	4-8
12	PJ29-PJ31	AccessRd4	3.5	1,272	4,452	3,561.6	4-8
13	PJ34-PJ40	AccessRd5	3.5	3,400	11,900	9,520	4-9
14	PJ41-PJ46	AccessRd6	3.5	3,171	11,098.5	8,878.8	4-10
15	PJ50	AccessRd7	3.5	818	2,863	2,290.4	4-10
16	PJ48-PJ49	AccessRd8	3.5	800	2,800	2,240	4-10
17	PJ88-PJ89	AccessRd9	3.5	1,529	5,351.5	4,281.2	4-15
18	PJ89-PJ93	AccessRd10	3.5	2,686	9,401	7,520.8	4-15
19	JP57	AccessRd11	3.5	2,991	10,468.5	8,374.8	4-16
20	JP56	AccessRd12	3.5	857	2,999.5	2,399.6	4-16
21	JP46-JP50	AccessRd13	3.5	2,928	10,248	8,198.4	4-17
22	JP51-JP55	AccessRd14	3.5	2,759	9,656.5	7,725.2	4-17
23	JP40-JP43	AccessRd15	3.5	832	2,912	2,329.6	4-18
24	JP31-JP33	AccessRd16	3.5	1,932	6,762	5,409.6	4-19
		Total Land Area covered			**114,670.5**	**87,882.9**	

Note: ***=** Drawing number indicating the location of the access road and ropeway



Map 4-2: 132kV TL from Jomori Pothead Yard to Phuntshothang SS

1) PJ01 (Phuntshothang SS) to PJ08 (Jagartala), Phuntshothang Gewog

1.1	Type of soil	Moderately weathered and leached dry soil.
1.2	Accessibility	Jagartala and Beetar farm road, so no access road or rope way is required.
1.3	Detail of crossing	Martshala GC road, Farm Road, State reserved forest, PJ5 to PJ6, RoW may fall in private land
1.4	Places along the TL line	Phuntshothang, Koyla village.
1.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
1.6	Sq. of forest to be cut by access road	No access road and rope way not required since its near farm road.
1.7	Geological stability	Stable with no sign of geological disturbances.
1.8	Land use	State reserved forest land (SRFL)
1.9	Gewogs	Phuntshothang Gewog
	Other	-

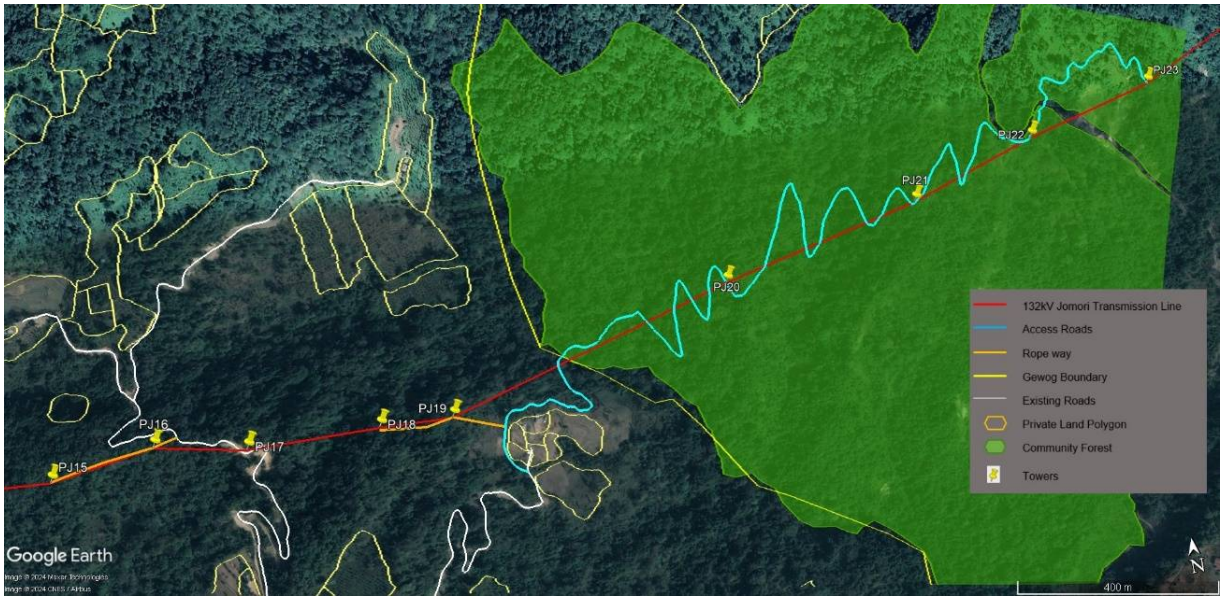
Figure 4-5: Description of each segment of the transmission line (1)

2) PJ09 (Jagartala Top) to PJ14 (Dalimpani, Kubinde), Phuntshothang Gewog

2.1	Type of soil	Moderately weathered and leached dry soil.
2.2	Accessibility (Road No:1)	Access Road: PJ11-PJ14 (1185m×3.5=4147.5m^2). Other locations are accessible by existing Kubendi and Dalimpani farm road.
2.3	Detail of crossing	SRFL and no private land, valley crossing PJ11A-PJ12.
2.4	Places along the TL line	Jagartala, Dalimpani and Beeter village
2.5	Vegetation	Sub-tropical forest and warm broadleaved forest.
2.6	Sq. of forest to be cut by access road	PJ11-PJ14 = (4147.5m^2) ×80% (rate of forest) = 3318m^2
2.7	Geological stability	Stable with gentle slope and no sign of geological disturbance, valley crossing between PJ11A-PJ12, measuring 865mts.
2.8	Land use	SRFL
2.9	Gewogs	Phuntshothang Gewog
	Other	-

Figure 4-6: Description of each segment of the transmission line (2)

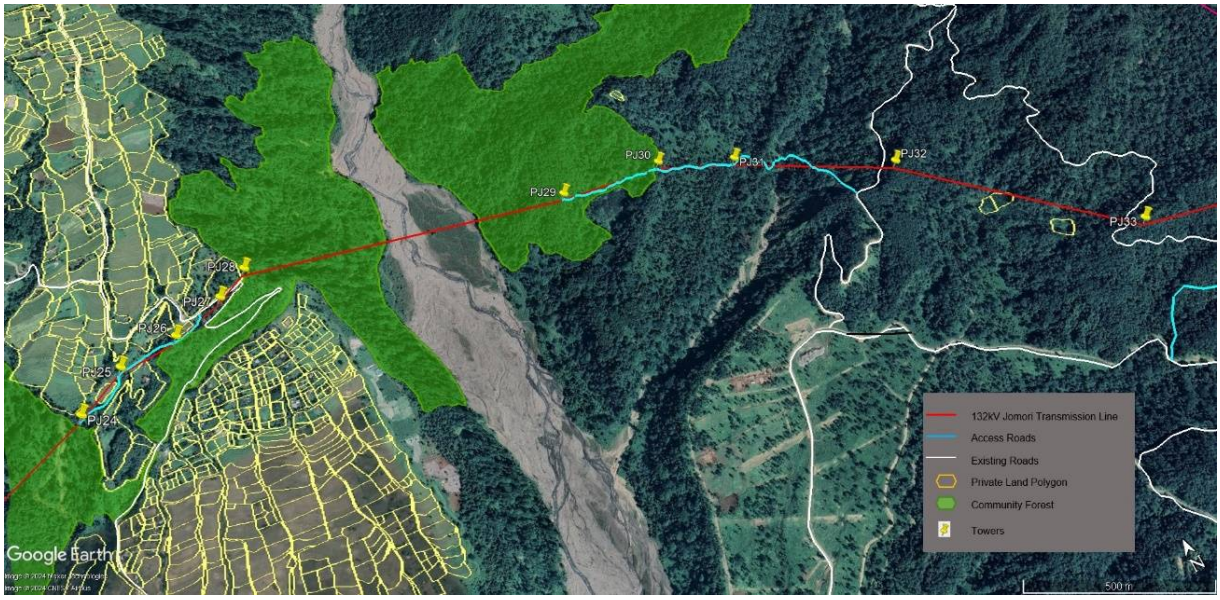
3) PJ15 – PJ23, Nainital and Phedi village, Pemathang Gewog.



3.1	Type of soil	Moderately weathered and leached dry and marshy soil.
3.2	Accessibility (Road No:2) (Rope No:1,2)	Access road: PJ20-PJ23 (2896m×3.5=10136m^2) Ropeways: PJ15, PJ16, PJ18, & PJ19 (242+229=471m×3.5=1648.5m^2)
3.3	Detail of crossing	SRFL, Pemathnagka CF and Railing CF crossing.
3.4	Places along the TL line	Nainital and Phedi village
3.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
3.6	Sq. of forest to be cut by access road	Access Road: (10136m^2) × 80% (rate of forest) = 8108.8m^2 Ropeways: (1648.5m^2) × 30% (rate of forest) = 494.55m^2
3.7	Geological stability	Slight geological disturbance observed PJ22 &PJ23.
3.8	Land use	Community forest (CF) and state reserved forest (SRFL)
3.9	Gewogs	Phuntshothang and Pemathang Gewogs.
	Other	Gentle slope and valley crossing, PJ19A-PJ20.

Figure 4-7: Description of each segment of the transmission line (3)

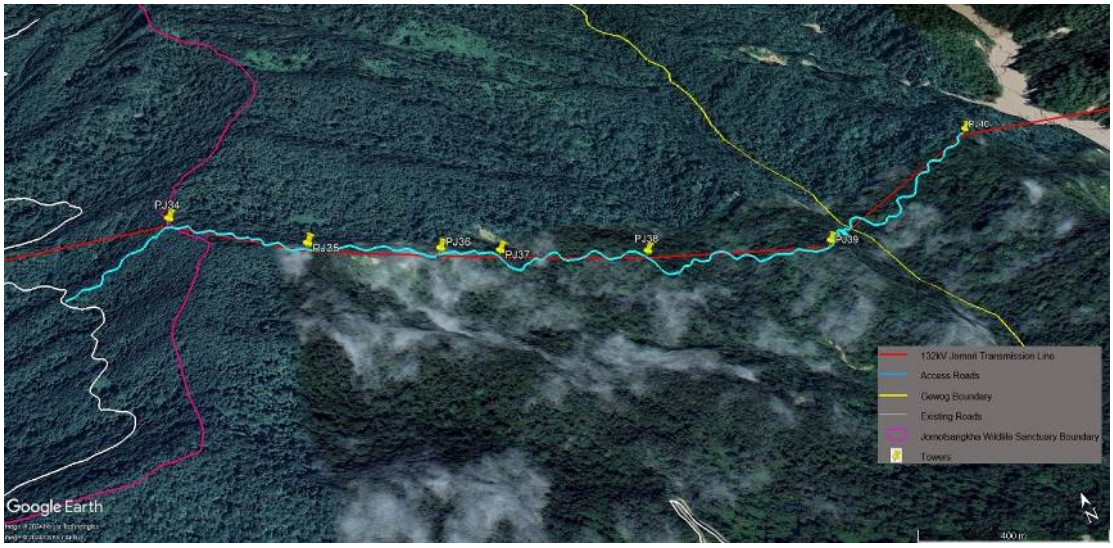
4) PJ24 – PJ33, Nanital village to Pemathang Gyelsung project top, Pemathang Gewog



4.1	Type of soil	Moderately weathered and leached dry type.
4.2	Accessibility (Road No:3,4)	Access roads: PJ24-PJ27 (505m×3.5m=1767.5m^2) PJ29-PJ31 (1272m×3.5m=4452m^2)
4.3	Detail of crossing	Two Blocks of Railing CF, Pemathang river crossing and Nanital farm road
4.4	Places along the TL line	Above Gyelsung Project, no village along the line
4.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
4.6	Sq. of forest to be cut by access road	PJ24-PJ27 (1767.5m^2) ×80% (rate of forest) =1414m^2 PJ29-PJ31 (4452m^2) ×80% (rate of forest) =3561.6m^2
4.7	Geological stability	Stable with gentle gradient and no sign of geological disturbance.
4.8	Land use	State reserved forest and CF crossing.
4.9	Gewogs	Pemathang Gewog
	Other	Two Blocks of CF and pemathang river crossing, Loc. PJ28 and PJ29, 1092mts.

Figure 4-8: Description of each segment of the transmission line (4)

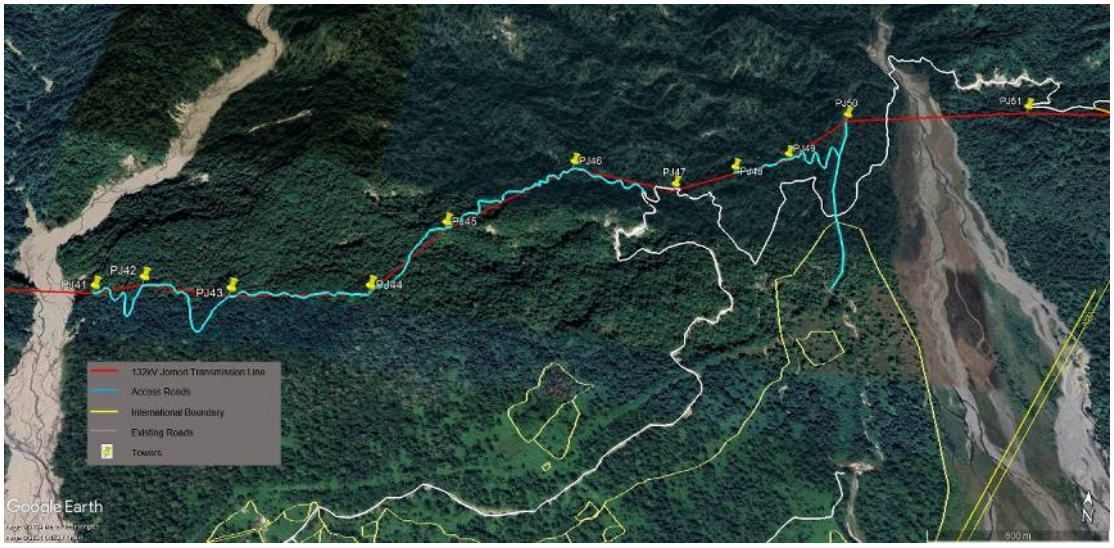
5) PJ34 – PJ40, Opposite to Dalimin, Samrang Gewog



5.1	Type of soil	Moderately weathered and leached dry and marshy soil type.
5.2	Accessibility (Road No:5)	Access road: PJ34-PJ40 (3400m×3.5m=11900m^2)
5.3	Detail of crossing	Jomotsangkha Wildlife Sanctuary (JWS), PJ40-PJ41 will cross Samrang River
5.4	Places along the TL line	No settlement along the proposed line.
5.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
5.6	Sq. of forest to be cut by access road	PJ34-PJ40 (3400m×3.5m=11900m^2) ×80% (rate of forest) =9520m^2
5.7	Geological stability	Stable with no sign of geological disturbance observed.
5.8	Land use	SRFL & Jomotsangkha Wildlife Sanctuary.
5.9	Gewogs	Samrang Gewog.
	Other	Thick vegetation/forest cover and no access road and valley crossing between PJ20 and PJ41 (1126mts)

Figure 4-9: Description of each segment of the transmission line (5)

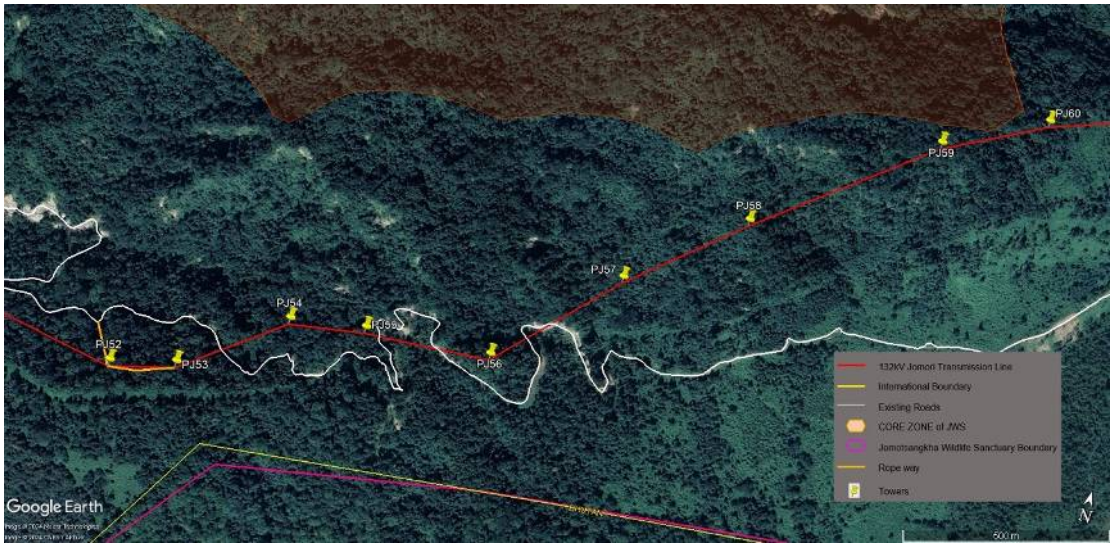
6) PJ41 – PJ51, Above Samrang village.



6.1	Type of soil	Moderately weathered and leached dry and marshy type.
6.2	Accessibility (Road No:6,7,8)	Access roads: PJ41-PJ46 (3171m×3.5m=11098.5m^2) PJ50 (818m×3.5m=2863m^2) PJ48-PJ49 (800m×3.5m=2800m^2)
6.3	Detail of crossing	Samrang_Jomotsangkha highway and 33kV line, Kalo Nadi river.
6.4	Places along the TL line	No settlement along the proposed line.
6.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
6.6	Sq. of forest to be cut by access road	PJ41-PJ46 (11098.5m^2) ×80% (rate of forest) =8878.8m^2 PJ50 (2863m^2) ×80% (rate of forest) =2290.4m^2 PJ48-PJ49 (2800m^2) ×80% (rate of forest) =2240m^2
6.7	Geological stability	Slight geological disturbance observed at PJ46 and PJ47.
6.8	Land use	Jomotsangkha Wildlife Sanctuary.
6.9	Gewogs	Samrang Gewog.
	Other	-

Figure 4-10: Description of each segment of the transmission line (6)

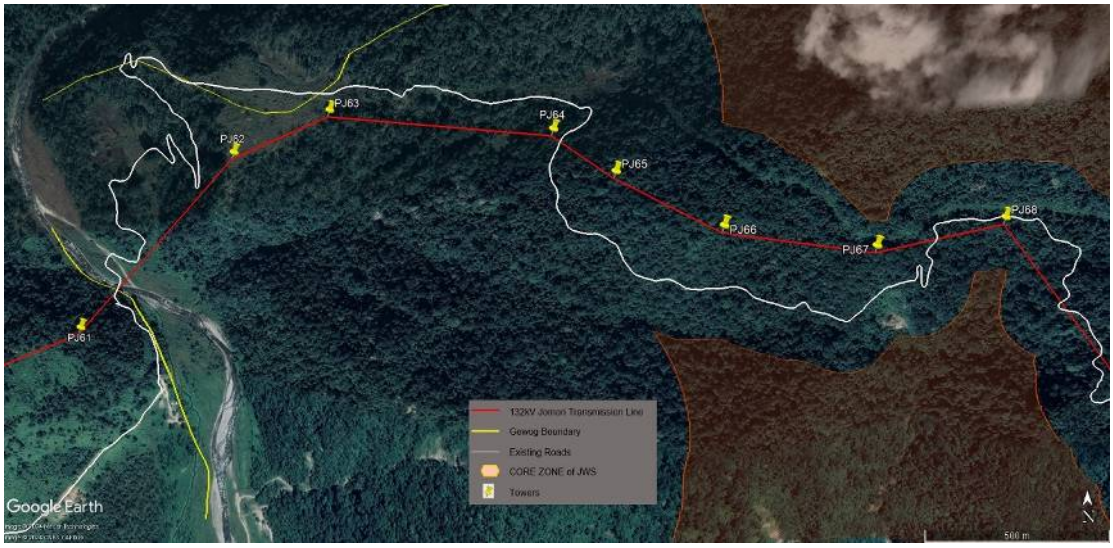
7) PJ52 – PJ60, Samrang Gewog.



7.1	Type of soil	Moderately weathered and leached dry and marshy type.
7.2	Accessibility (Rope No:3)	Accessible by existing Samrang-Jomotsangkha Highway Road Ropeway: PJ52-PJ53(273m×3.5=955.5m^2)
7.3	Detail of crossing	Samrang-Jomotsangkha highway crossing at PJ53 till PJ56, and 33kVLine crossing at PJ54 till PJ56.
7.4	Places along the TL line	No settlement along the proposed line.
7.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
7.6	Sq. of forest to be cut by access road	Ropeway (955.5m^2) ×30% (rate of forest) =286.65m^2
7.7	Geological stability	Slight geological disturbance observed in between at PJ54 and PJ55.
7.8	Land use	Jomotsangkha Wildlife Sanctuary.
7.9	Gewogs	Samrang Gewog.
	Other	Slight/ minor earth cutting required at Location PJ55.

Figure 4-11: Description of each segment of the transmission line (7)

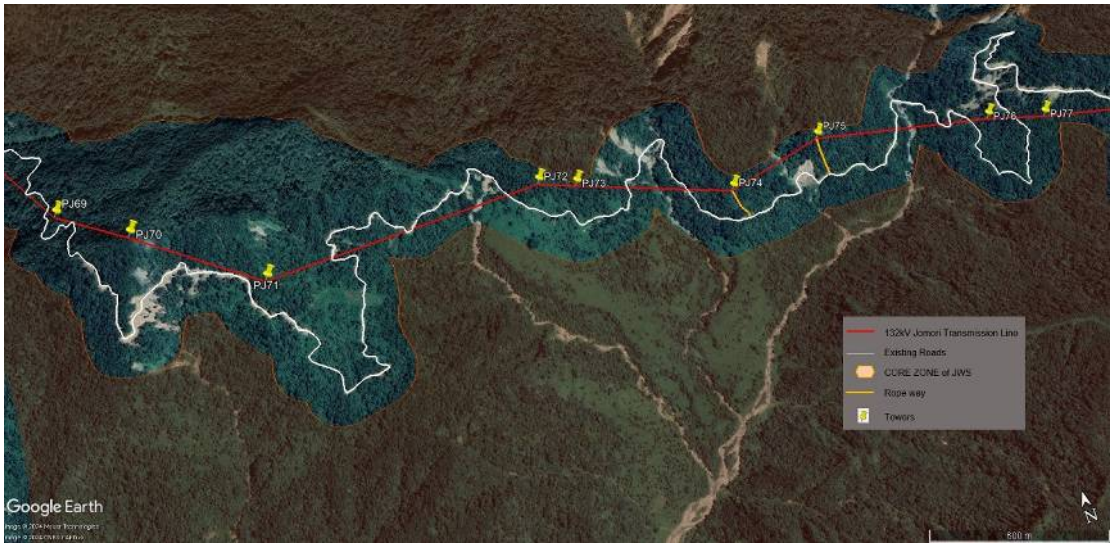
8) PJ61 – PJ68, Samrang and Langchhenphu Gewog



8.1	Type of soil	Moderately weathered and leached dry and marshy type.
8.2	Accessibility	Can be accessed by Samrang-Jomtsangkha Highway Road.
8.3	Detail of crossing	Running parallel to 33kV line, Samrang highway and Nauni River Crossing.
8.4	Places along the TL line	No settlement along the proposed line.
8.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
8.6	Sq. of forest to be cut by access road	Since the line traverse parallel to Highway, no access roads and rope way be considered.
8.7	Geological stability	Stable with gentle slope and no sign of geological disturbances.
8.8	Land use	Jomotsangkha Wildlife Sanctuary avoiding the CORE Zone.
8.9	Gewogs	Samrang and Langchhenphu Gewogs.
	Other	-

Figure 4-12: Description of each segment of the transmission line (8)

9) PJ69 – PJ77, Langchhenphu Gewog



9.1	Type of soil	Moderately weathered and leached dry and marshy type.
9.2	Accessibility (Rope No:4,5)	Ropeway: PJ74 (134m×3.5m=469m^2) Ropeway: PJ75 (141m×3.5m=493.5m^2) Other location can be accessed by Samrang Jomotsangkha Highway Road.
9.3	Detail of crossing	Samrang-Jomotsangkha highway crossing, 33kV Line, Borla river 1 crossing.
9.4	Places along the TL line	No settlement along the proposed line.
9.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
9.6	Sq. of forest to be cut by access road	Ropeway (469m^2) ×30% (rate of forest) =148.05m^2 Ropeway (493.5m^2) ×30% (rate of forest) =116.55m^2
9.7	Geological stability	Minor sign of geological disturbance observed at PJ75.
9.8	Land use	Jomotsangkha Wildlife Sanctuary.
9.9	Gewogs	Langchhenphu Gewog.
	Other	

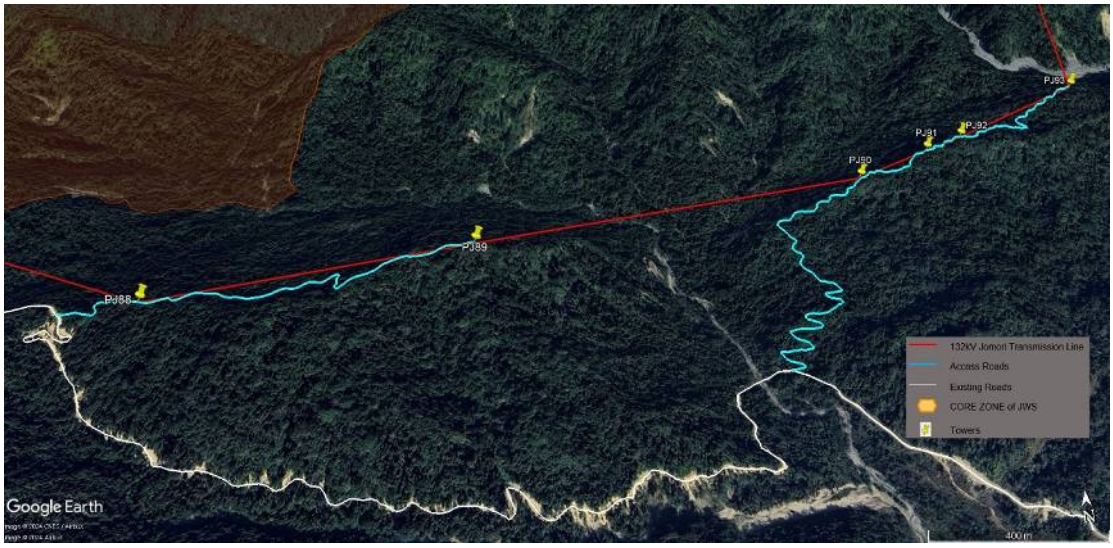
Figure 4-13: Description of each segment of the transmission line (9)

10) PJ78 – PJ87, Langchhenphu Gewog.

10.1	Type of soil	Moderately weathered and leached dry and marshy type.
10.2	Accessibility (Rope No:6)	Ropeway: PJ87(111m×3.5m=388.5m^2), also can be accessed by Samrang Jomotsangkha Highway.
10.3	Detail of crossing	Various crossing at Samrang Jomotsangkha highway road, 33kV crossing at PJ78 and PJ79.
10.4	Places along the TL line	No settlement along the proposed line.
10.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
10.6	Sq. of forest to be cut by access road	Ropeway:(388.5m^2) ×30% (rate of forest) =116.55m^2
10.7	Geological stability	Stable with no sign of geological disturbance observed.
10.8	Land use	Jomotsangkha Wildlife Sanctuary.
10.9	Gewogs	Langchhenphu Gewog.
	Other	

Figure 4-14: Description of each segment of the transmission line (10)

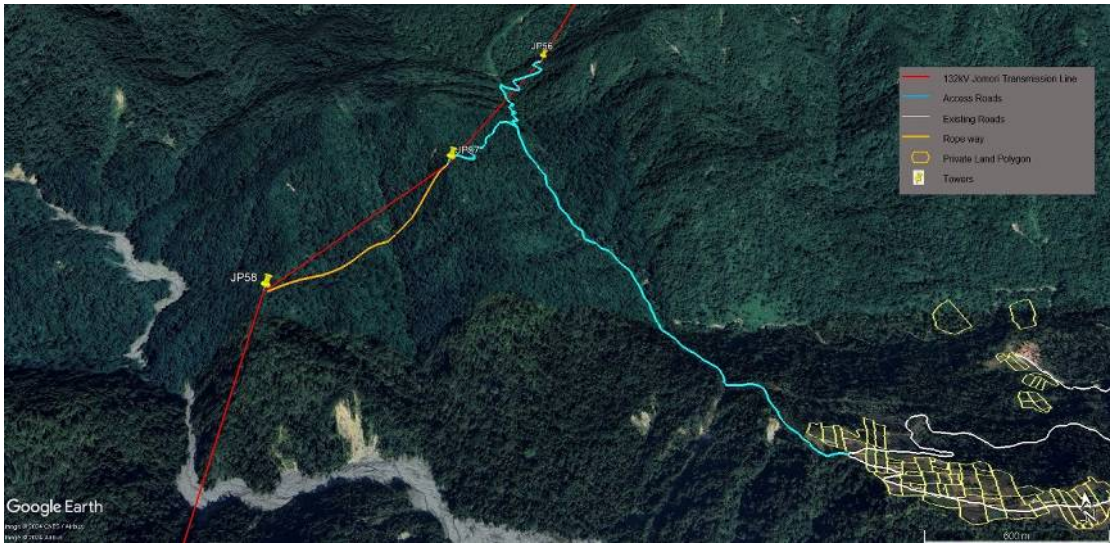
11) PJ88- PJ93, Langchhenphu Gewog



11.1	Type of soil	Moderately weathered and leached dry and marshy type.
11.2	Accessibility (Road No:9.10)	Access road: PJ88-PJ89 (1529m×3.5m=5351.5m^2) Access road: PJ89-PJ93 (2686m×3.5m=9401m^2) Other location can be accessed by Samrang Jomotsangkha Highway Road.
11.3	Detail of crossing	Laxmi river between PJ89 and PJ90, Golanti River between PJ93- JP58.
11.4	Places along the TL line	No settlement along the proposed line.
11.5	Vegetation	Sub-tropical forest and warm broad-leaved forest.
11.6	Sq. of forest to be cut by access road	Access road: (5351.5m^2) ×80% (rate of forest) =4281.2m^2 Access road: (9401m^2) ×80% (rate of forest) =7520.8m^2
11.7	Geological stability	Stable with gentle plain and no sign of geological disturbance.
11.8	Land use	Jomotsangkha Wildlife Sanctuary.
11.9	Gewogs	Langchhenphu Gewog.
	Other	

Figure 4-15: Description of each segment of the transmission line (11)

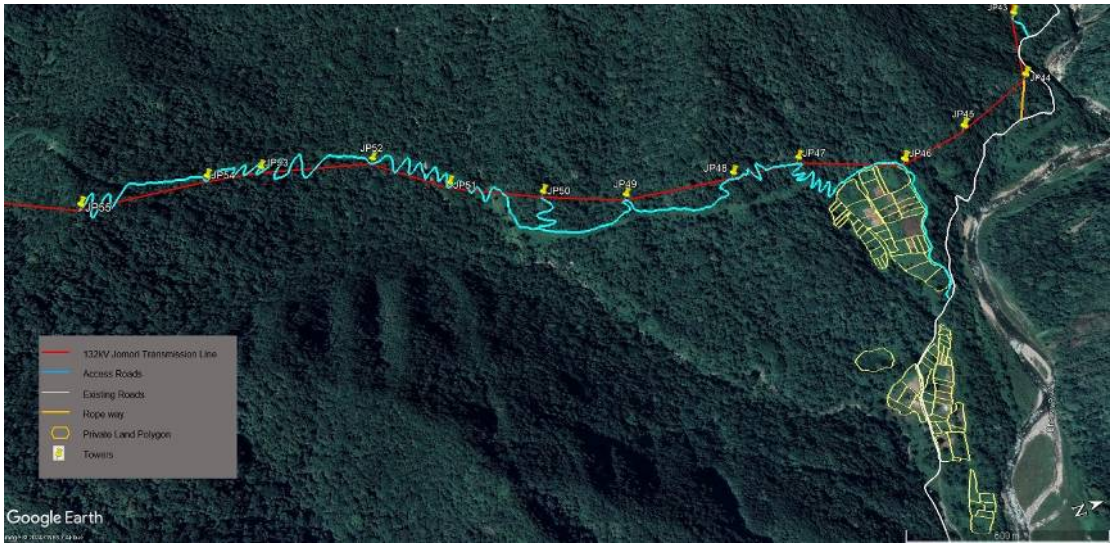
12) JP56 to JP58, Agutar Top, Langchenphu Gewog



12.1	Type of soil	Clay type soil.
12.2	Accessibility (Road No:11,12) (Rope No:7)	Access road: JP57 (2991m×3.5m=10468.5m^2) Access road: JP56 (857m×3.5m=2999.5m^2) Ropeway: JP57-JP58 (965m×3.5m=3377.5m^2)
12.3	Detail of crossing	Valley and Chukarpo river crossing b/w loc. JP57 & JP58, Golanti river and valley crossing b/w loc. JP58 & PJ93, 33kV Serthi-Lauri feeder b/w loc. JP56 & JP57.
12.4	Places along the TL line	No settlement along the proposed line
12.5	Vegetation	Subtropical with thick forest and bushes.
12.6	Sq. of forest to be cut by access road	Access road: (10468.5m^2) ×80% (rate of forest) =8374.8m^2 Access road: (2999.5m^2) ×80% (rate of forest) =2399.6m^2 Ropeway: (3377.5m^2) ×30% (rate of forest) =1013.25m^2
12.7	Geological stability	Stable with gentle plain and no sign of geological disturbance.
12.8	Land use	Jomotsangkha Wildlife Sanctuary.
12.9	Gewogs	Langchenphu Gewog
	Other	

Figure 4-16: Description of each segment of the transmission line (12)

13) JP44 to JP55 Langchenphu Gewog



13.1	Type of soil	Clay and Sandy type soil.
13.2	Accessibility (Road No:13,14) (Rope No:8)	Access road: JP46-JP50 (2759m×3.5m=10248m^2) Access road: JP51-JP55 (2928m×3.5m=9656.5m^2) Ropeway: JP44 (107m×3.5m=374.5m^2)
13.3	Detail of crossing	3 Private land under RoW of the TL JP46-JP47 (Plot ID: SER-4117, SER-2209, & SER-810)
13.4	Places along the TL line	Khritsinteng, Chiktongri, Gyenam, Tsangphurung, and Deorali Top (Ani Aunijue)
13.5	Vegetation	Subtropical with thick forest and bushes.
13.6	Sq. of forest to be cut by access road	Access road: (10248m^2) ×80% (rate of forest) =8374.8m^2 Access road: (9656.5m^2) ×80% (rate of forest) =2399.6m^2 Ropeway: (374.5m^2) ×30% (rate of forest) =1013.25m^2
13.7	Geological stability	Stable and spotted location on plain.
13.8	Land use	Jomotsangkha Wildlife Sanctuary.
13.9	Gewogs	Langchenphu Gewog
	Other	All the locations are spotted away from access road and in dense forest parallel to 33kV Serthi-Lauri feeder and home to wild animals (elephant, Guar, Leopard, bear etc.).

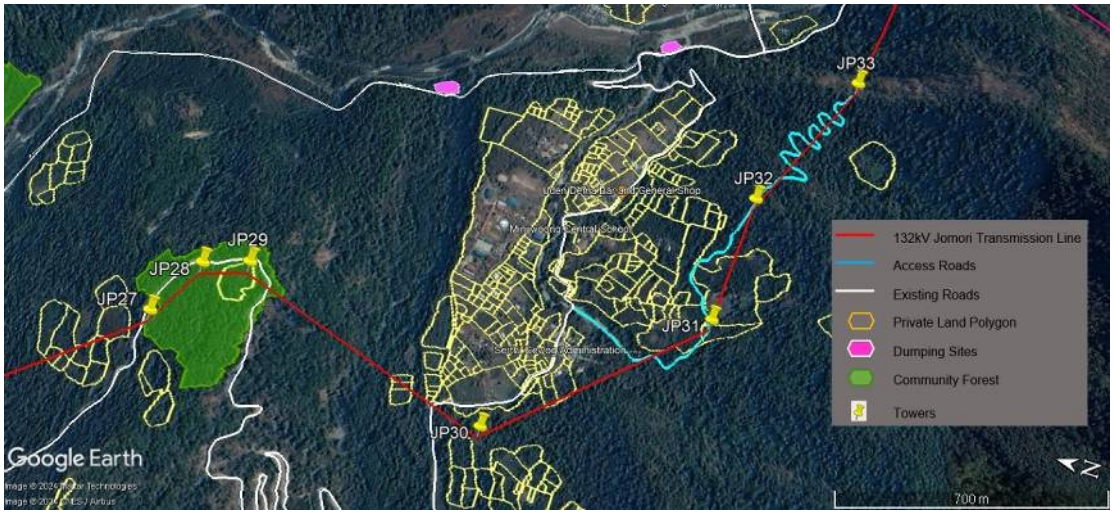
Figure 4-17: Description of each segment of the transmission line (13)

14) JP34 to JP43, Serthi Gewog

14.1	Type of soil	Dry fissured rock and loose soil.
14.2	Accessibility (Road No:15)	Access road: JP40-JP43 (832m×3.5m=2912m^2)
14.3	Detail of crossing	1 Pvt. Land (SER-228) under RoW of JP34-JP35, Akhuri river crossing b/w JP34 & JP35, Phangkiri river crossing b/w JP37 & JP38, 33kV Serthi-Lauri Feeder crossing b/w JP34 & JP35, & JP37 & JP38, GC road b/w JP34 & JP35 & JP37 & JP38, JP39 & JP40, steep terrain crossing.
14.4	Places along the TL line	Phangkiri, Inchari, Sama Domari, Zam, and Nako villages
14.5	Vegetation	Subtropical with thick forest and bushes.
14.6	Sq. of forest to be cut by access road	Access road: (2912m^2) ×80% (rate of forest) =2329.6m^2
14.7	Geological stability	Stable.
14.8	Land use	SRFL, Jomotsangkha Wildlife Sanctuary.
14.9	Gewogs	Serthi Gewog
	Other	JP38 and JP39 were spotted on a ridge and require significant benching for tower foundation base. JP37 is spotted on the roadside within the GC road, necessitating substantial earth cutting (cliff) for tower base construction and road extension due to steep terrain and conductor clearance constraints. JP38 is also situated in a steep and rocky area due to clearance issues from JP37.

Figure 4-18: Description of each segment of the transmission line (14)

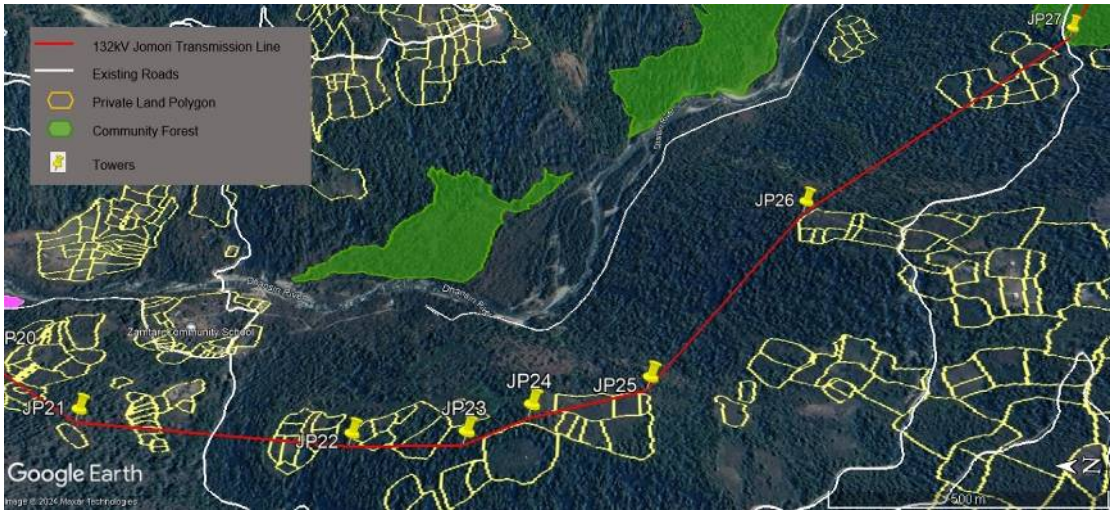
15) JP27 to JP33 (Akhuri), Serthi Gewog



15.1	Type of soil	Loose soil and dry fissured rock.
15.2	Accessibility (Road No:16)	Access road: JP31-JP33 (1932m×3.5m=6762m^2)
15.3	Detail of crossing	Disamri river, Lauri GC Road and 33kV Lauri Feeder b/w JP29 & JP30, Dungmanma stream crossing b/w JP32 & JP32, private lands and orange orchard b/w JP29-JP32, Khanduphung Gayjung Norbuling CF b/w JP27-JP29
15.4	Places along the TL line	Khandukpa, Sakari, Minjiwoong, Minjiwoong Pack and Akhuri.
15.5	Vegetation	Subtropical with thick forest, bamboos, thick bushes and barren land.
15.6	Sq. of forest to be cut by access road	Access road:(6762m^2) ×80% (rate of forest) =5409.6m^2
15.7	Geological stability	Stable and locations spotted on gentle slope and plain.
15.8	Land use	SRFL, CF, & Private lands including orange orchards under RoW.
15.9	Gewogs	Serthi Gewog
	Other	JP29 & JP31 falls in private land and 8 private lands under RoW between loc. JP29-JP32.

Figure 4-19: Description of each segment of the transmission line (15)

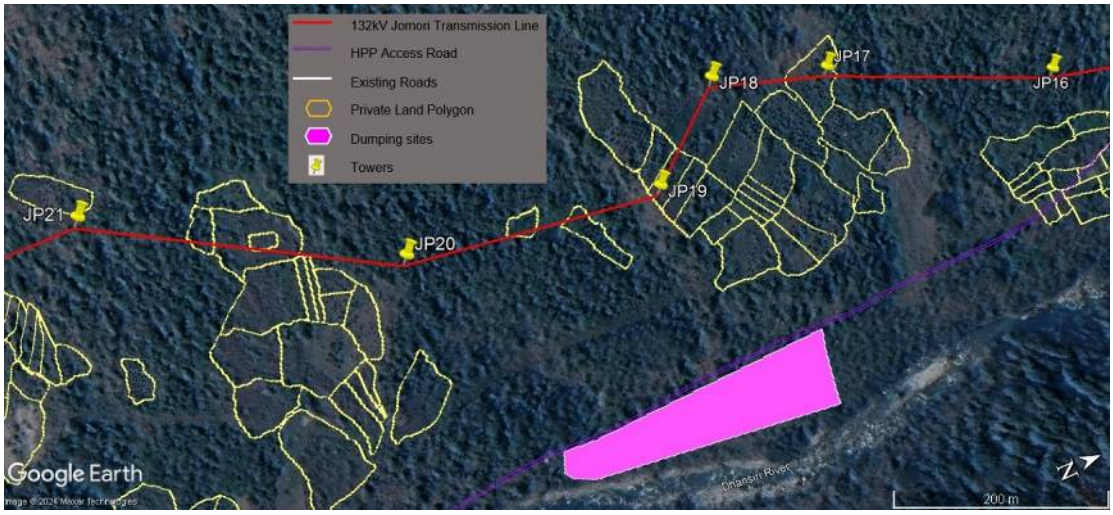
16) JP21 (Apshingzor) to JP26 (Zhukthri), Serthi



16.1	Type of soil	Clay type soil and dry fissured rock.
16.2	Accessibility	Most locations accessible by existing roads
16.3	Detail of crossing	State Reserved Forest and 33 kV line crossing. RoW b/w JP21-JP22, JP23 and JP25.
16.4	Places along the TL line	Apshingor, Dora Amari, Jomo Doksa, Lishingzor and Zhukthri village
16.5	Vegetation	Subtropical with thick forest, bamboos, thick bushes and barren land.
16.6	Sq. of forest to be cut by access road	No access roads and rope ways are considered.
16.7	Geological stability	Stable and locations spotted on gentle slope and plain.
16.8	Land use	No sign of geological disturbance observed
16.9	Gewogs	State Reserved Forest and few private lands under Tower location and RoW.
	Other	

Figure 4-20: Description of each segment of the transmission line (16)

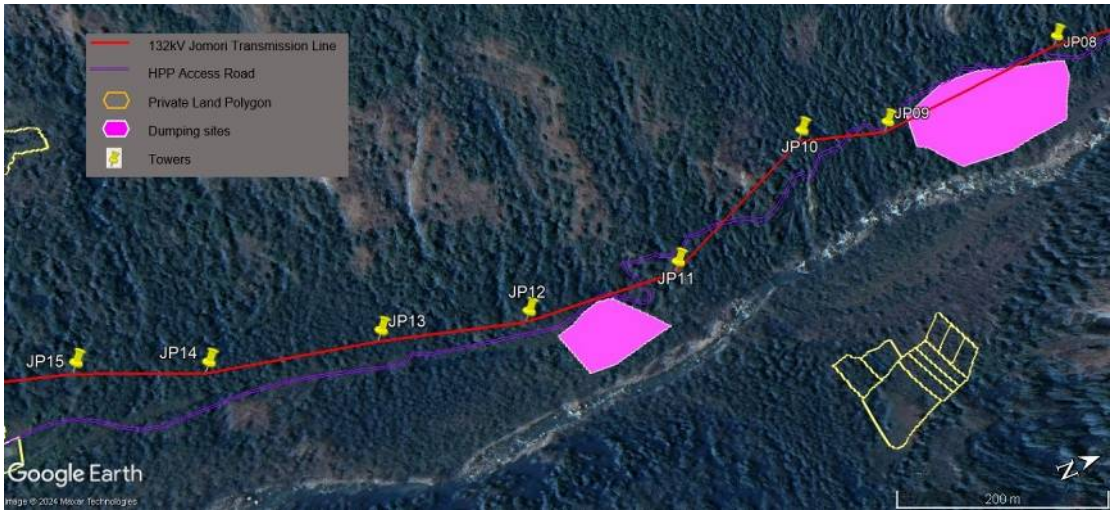
17) JP16 (Pharen Tshuren) to JP21 (Apshingzor)



17.1	Type of soil	Loose soil and dry fissured rock.
17.2	Accessibility	By walk from existing old footpath of Denphu village and existing Zamtangri farm road, and HPP Access roads.
17.3	Detail of crossing	State Reserved Forest and 33 kV line crossing. JP17, JP19 under Private land. RoW between JP17, JP18, JP19 and JP21
17.4	Places along the TL line	Pharen Tshuren, Phoskongri, Zamtari Top and Apshingor village.
17.5	Vegetation	Subtropical with thick forest and thick bushes
17.6	Sq. of forest to be cut by access road	Existing farm road and foot path to be used, so No access road & ropeway proposed.
17.7	Geological stability	Stable and locations spotted on gentle slope. Minor landslide below loc. JP17.
17.8	Land use	State Reserved Forest and few private lands under Tower location and RoW.
17.9	Gewogs	Serthi Gewog
	Other	

Figure 4-21: Description of each segment of the transmission line (17)

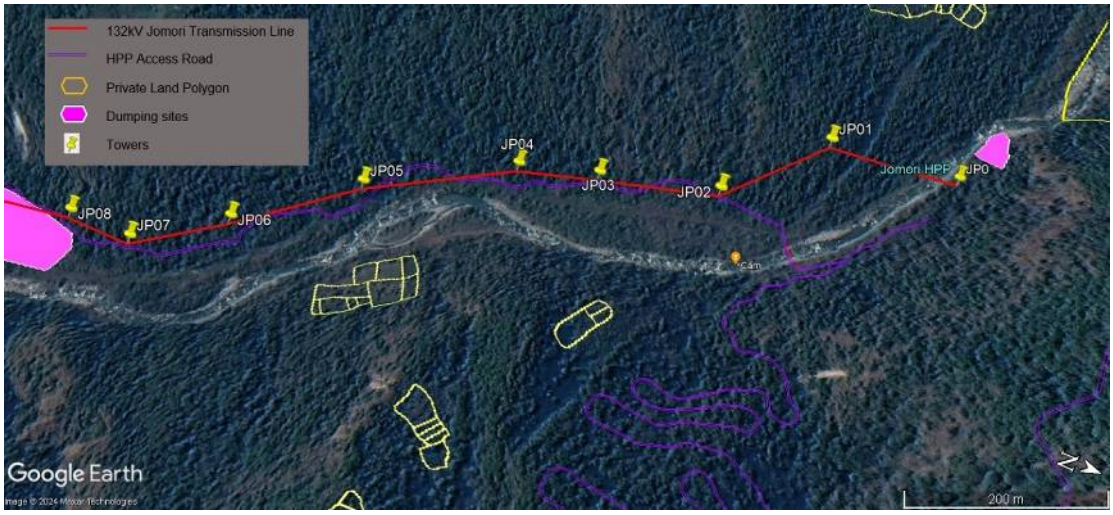
18) JP08 (Bayong Brak) to JP15 (Pharen Tshuren)



18.1	Type of soil	Loose soil and dry fissured rock.
18.2	Accessibility	All the locations can be accessed from Jomori Hydro power access road and existing foot path
18.3	Detail of crossing	DGPC access road crossing.
18.4	Places along the TL line	Pharen Tshuren village
18.5	Vegetation	Subtropical forest and thick bushes.
18.6	Sq. of forest to be cut by access road	Access road is being already constructed by DGPC, so BPC does not require to construct access road.
18.7	Geological stability	Minor sign of geological disturbance at some places along the route and earth cutting required at JP10 and JP11A due to ground clearance.
18.8	Land use	Nine private lands including orange orchards.
18.9	Gewogs	Serthi Gewog
	Other	

Figure 4-22: Description of each segment of the transmission line (18)

19) JP00-Jomori Powerhouse to JP07 (Chukarpo)



19.1	Type of soil	Loose soil and dry fissured rock.
19.2	Accessibility	All the locations can be accessed from Jomori Hydro power access road.
19.3	Detail of crossing	33 kV Lauri feeder crossing.
19.4	Places along the TL line	Depsangjue, Tshanglarijue and Chukarpo village
19.5	Vegetation	Subtropical with broadleaved and thick bushes.
19.6	Sq. of forest to be cut by access road	Access road is being already constructed by DGPC, so BPC does not require to construct access road.
19.7	Geological stability	Stable with no sign of geological disturbance.
19.8	Land use	State Reserved Forest (SRFL)
19.9	Gewogs	Serthi Gewog
	Other	

Figure 4-23: Description of each segment of the transmission line (19)

4.1.5.2. Project Site Office

The Construction Project Office (CPO, Pemathang), under the Construction Division of BPC, will oversee the proposed project. The office, located in Phuntshothang, Samdrup Jongkhar, is led by a Project Manager responsible for managing ongoing transmission realignment projects in Samdrup Jongkhar Dzongkhag. Presently, the project office operates from a rented apartment in Phuntshothang Gewog.

4.1.5.3. Contractors Construction Facilities (CCFs) & Worker Camps

The contractor will occasionally employ unskilled workers from the local area whenever available and necessary. However, skilled workers will be recruited from India. These workers will either reside in rented accommodations or temporary shelters near the project sites. Additionally, the contractor will need space for constructing temporary material stores, machine parking yards, etc. Local apartments will be leased for the site office and residence for permanent employees. Consequently, there's no requirement for constructing permanent buildings for the project.

4.1.5.4. Organization, Roles and Responsibilities

The organizational structure of the transmission line construction within the BPC is shown in figure 3-5 & 3-6. Under the BPC's CEO, there are four departments, including Construction and Procurement, and the Engineering & Research division.

All the engineering and design work in the BPC is done by the Engineering & Research division. The results of their analysis are shared with the concern offices of the BPC. Procurement, tendering and contract of turnkey project are handled by the Contract Management section under Construction & Procurement Department.

All the construction sites are looked after by construction section and for each construction site, a Project office is set up to manage the work. BPC workers are sent to these Project offices. The number of people in each Project office depends on how big the construction project is. The estimated number of staff for the Jomori transmission line Project office will have around 15 people.

The Environment, GIS and Survey unit, part of the Contract Management Section, is in charge of Environmental and Social concerns, including Environment, Health, and Safety (EHS) matters related to BPC projects. As the project proponent, BPC management holds the main responsibility for ensuring

adequate resources (funds and manpower) are provided for continual improvement of EHS performance throughout the project.

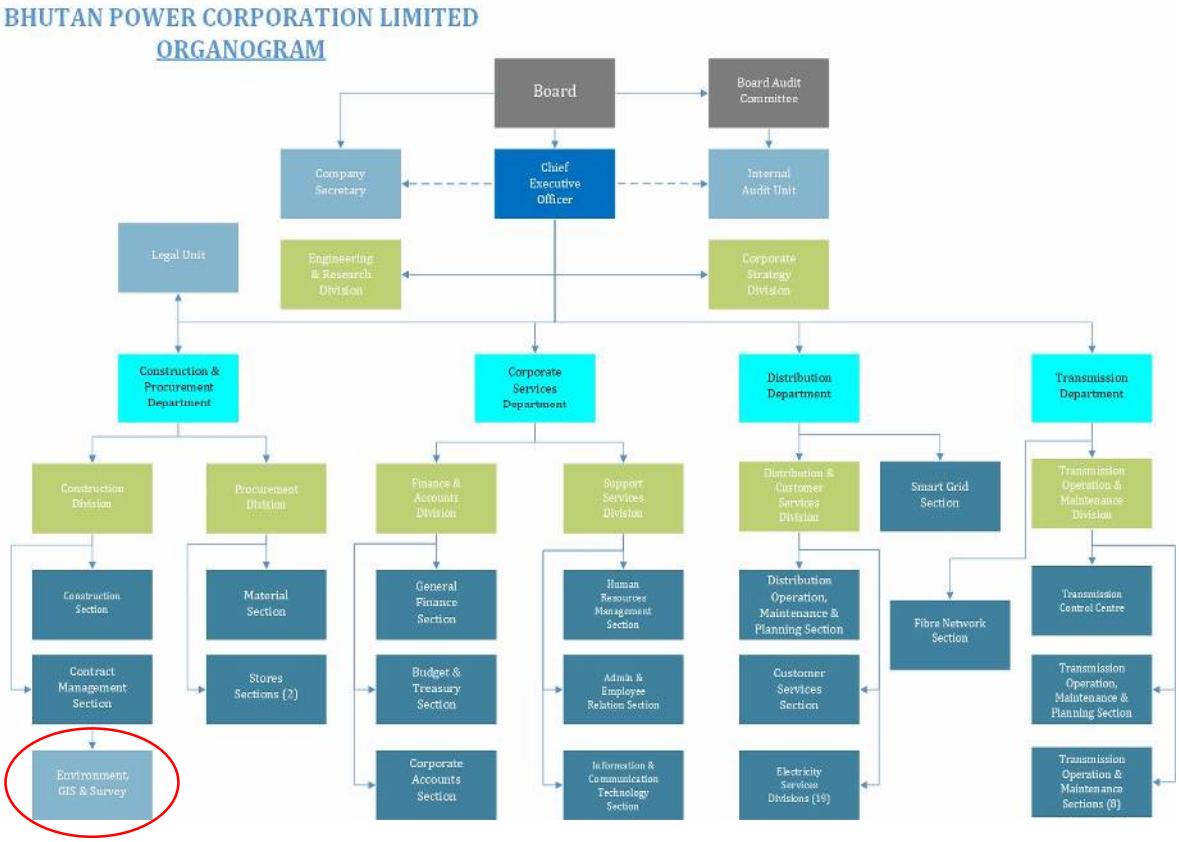


Figure 4-24: Organizational Chart of BPC

4.2. Implementation Schedule

The construction of the 132kV Jomori transmission line, spanning approximately 63 km, is expected to require **thirty-six (36) months**, accounting for a construction break during the rainy season. Transporting materials and laying foundations proves challenging during this period, which typically begins in June and concludes in the first week of September.

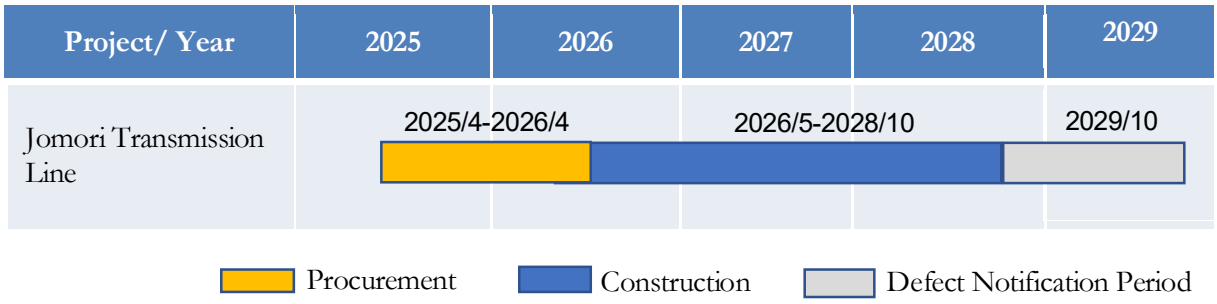


Figure 4-25: Tentative Implementation Schedule for 63km 132 kV D/C Jomori PTL project

5. ENVIRONMENTAL AND SOCIAL BASELINE STATUS

5.1. Environmental Conditions

5.1.1. Topography

The proposed PTL is located close to flat lands of Phuntshothang, Pemathang, and Samrang, langchenphu, and Serthi Gewogs of Samdrupjongkhar Dzongkhag with elevations ranging from 330 m.a.s.l to over 1000 m.a.s.l (See Map 5-2 & 5-3). The topography of the alignment is plain to gentle slope with several narrow valley crossings and few deep rugged valley crossings.

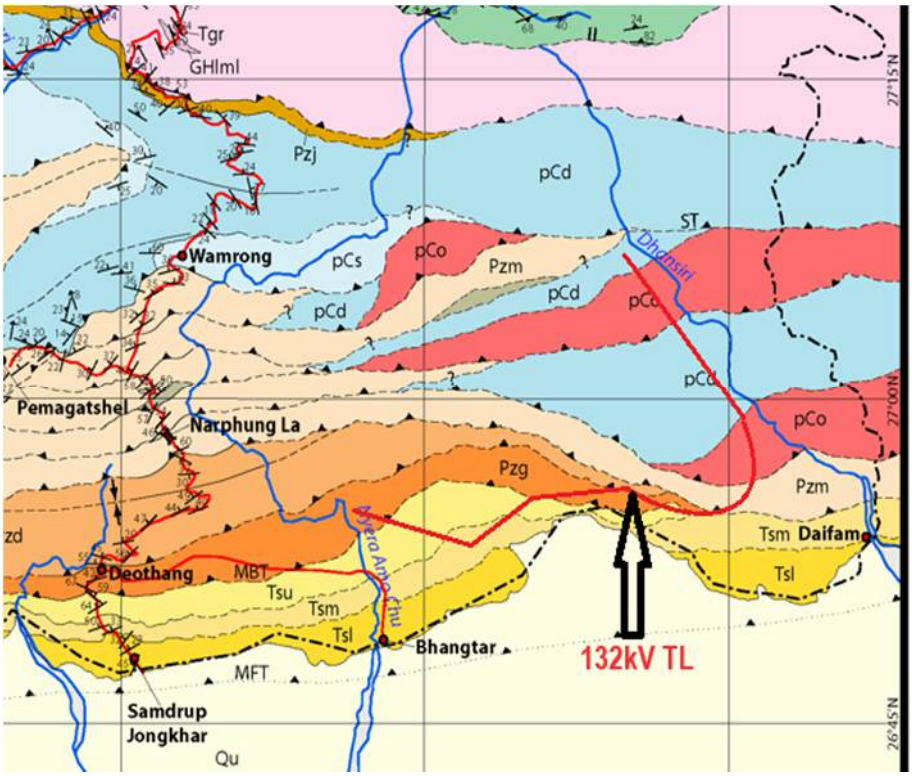
5.1.2. Geology and Seismicity

The geology and topography of Bhutan is shaped by the intense tectonic activity that resulted from the collision of the Indian and Eurasian continental plates, the closure of the intervening Tethys Ocean, and the uplift of the Himalayan range of mountains.

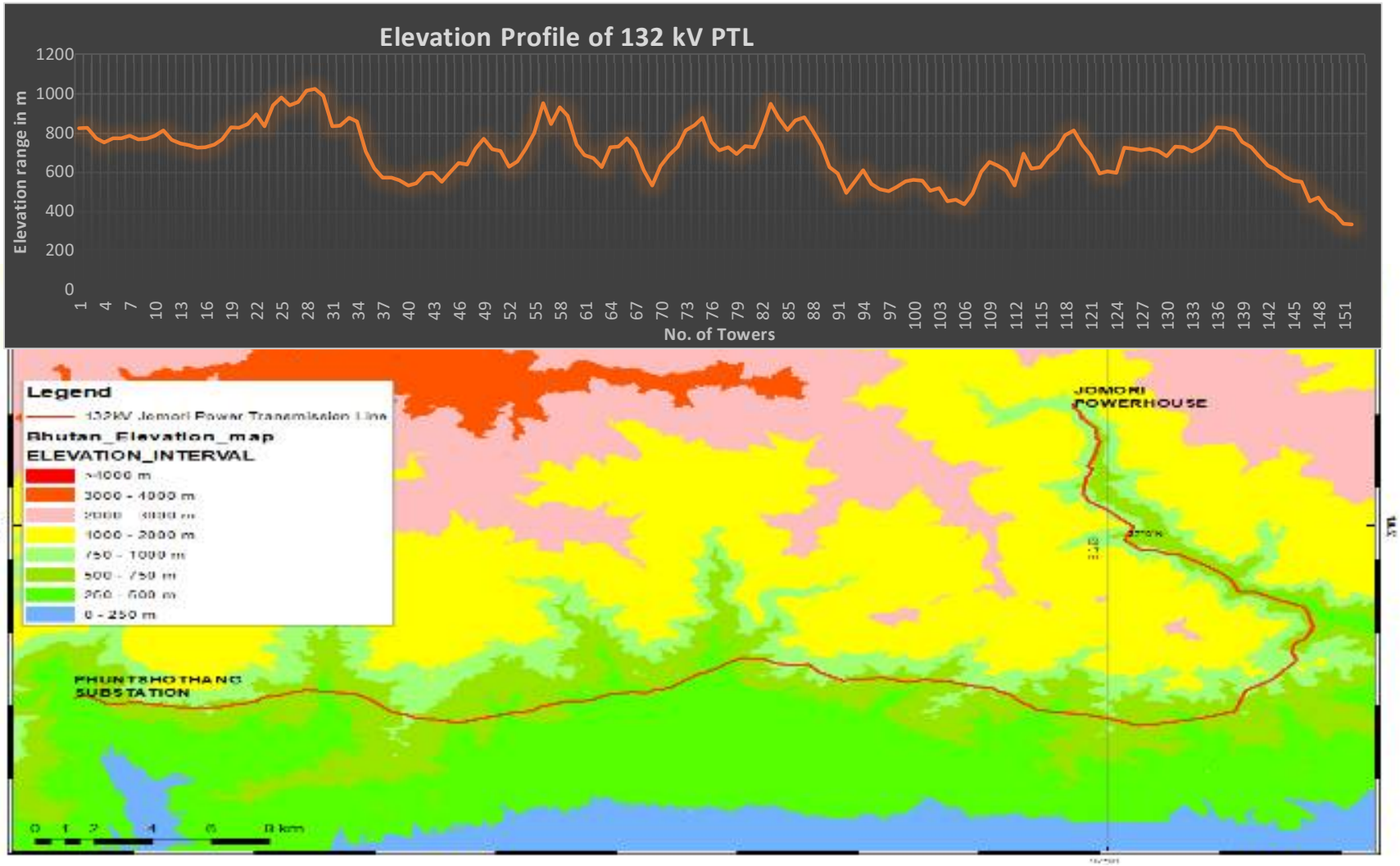
The project area encompasses the **Lesser Himalayan zone**, **sub-Himalayan zone**, and **Daling-Shumar geological groups**. Within the Lesser Himalayan zone, the geological formation comprises the (Pzg) Gondwana succession (Permian), distinguished by gray, medium-grained, feldspathic, lithic-rich sandstones interbedded with dark-gray to black, thin to medium-bedded, carbonaceous siltstone, shale, slate, and argillite, along with occasional black coal beds. Approximately 1.2 to 2.4 km of this geological layer is distributed in and around Samdrupjongkhar Dzongkhag.

Moving into the sub-Himalayan zone, the geological formations include the Siwalik Group (Miocene-Pliocene), categorized into the Tsu (Upper member), Tsm (Middle Member), and Tsl (Lower member). The upper member (Tsu) is characterized by medium to coarse-grained conglomeratic sandstone and pebble to cobble, occasionally boulder-sized conglomerates, interleaved with tan siltstone, with approximately 1.5 km thickness in the vicinity of Samdrupjongkhar Dzongkhag. The middle member (Tsm) exhibits tan to gray, medium to coarse-grained sandstone and pebble to cobble conglomeratic sandstone, with about 1.3 km thickness present in and around Samdrupjongkhar Dzongkhag. Meanwhile, the Lower member (Tsl) of the Sub-Himalayan zone features gray to green massive-weathering siltstone and shale, interspersed with tan to gray, fine-grained, lithic-rich sandstone, with an approximate thickness of 2.9 km surrounding Samdrupjongkhar Dzongkhag.

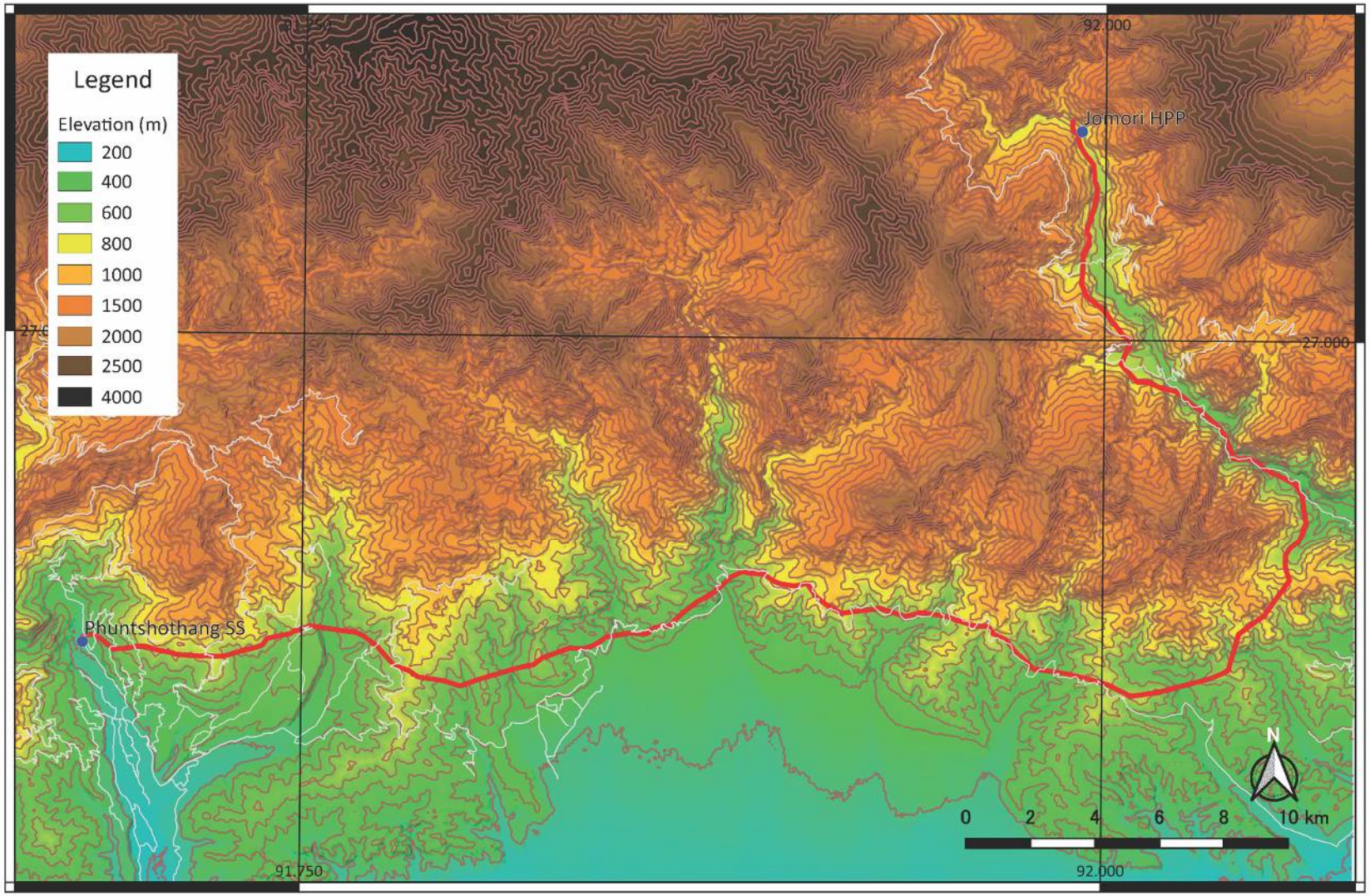
Finally, in Daling to Shumar group formation, the geologic formation includes the Daling Formation (pCd) that shares lithological similarities with the Shumar Formation, characterized by predominance of schist and phyllite, while featuring thin- to medium-bedded quartzite with rare occurrences of medium-gray limestone interbeds. Its lower contact with the Shumar Formation is gradational, spanning a thickness range between 2.3 and 3.2 km. Additionally, the Orthogneiss (pCo) comprises concordant bodies of mylonitized, granitic orthogneiss, believed to be deformed Paleoproterozoic granite plutons intruding the Daling-Shumar Group, with greater thickness observed in easternmost Bhutan and interpreted as part of the Indian crystalline basement east of Bhutan in Arunachal Pradesh. Conversely, the Shumar Formation (pCs) exhibits light-gray to white, tan-weathering, very fine-grained, medium- to thick-bedded quartzite, often accompanied by interbeds of green, muscovite-biotite schist and phyllite with characteristic sigmoidal quartz vein boudins, reaching a thickness of 1-2 km, except for a 6 km-thick section in the Kuri valley, and presenting upper greenschist facies characteristics.



Map 5-1: Map focusing project area on Geologic Map of Bhutan, 2011, DGM, MoEA



Map 5-2: Elevation profile & map for the 132kV Jomori TL



Map 5-3: Contour map for the 132kV Jomori TL

5.1.3. Physiography

The physiography of the area through which the transmission line passes is highly rugged with mountains segregated by north south flowing rivers. The project area falls in the vegetation zones characterised by tropical and subtropical warm broadleaf to cool broadleaf forest types with elevations ranging from 600m to ~1400m asl as defined by Ohsawa (1987).

5.1.4. Hydrology

Hydrology across the stretch of proposed transmission line may be described as comprising of north south flowing rivers like Jomori and its tributaries on the eastern side. As we move westwards along the lateral Jomotshangkha-Phuntshothang highway, the transmission line crosses a number of rivers and streams with highly variable flows during summer and winter.

5.1.5. Climate

Climate in the project area is defined by four seasons namely spring, summer, autumn and winter. The project area has warm winters, and hot and humid summers. Being located in the region of heavy monsoon, the project area is known for heavy rainfall causing soil erosion, landslides, and road blockages.

5.1.6. Protected area

Three protected areas, Jomotshangkha Wildlife Sanctuary (JWS), Sakteng Wildlife Sanctuary (SWS), and Biological Corridor have been designated inside and outside the project. Sakteng Wildlife Sanctuary (SWS) and Biological Corridor are located outside the project area and in fairly remote areas. The project areas therefore do not directly impact any floral and faunal diversity habitat having critical and higher conservation significance to these two project areas. The project area is partially located in the Jomotshangkha Wildlife Sanctuary (JWS) (see map 5-4), which covers an area of 362 sq.km covering whole of Samrang and Langchenphu Gewogs, and part of Serthi, Pemathang, and Phuntshothang Gewogs under Samdrupjongkhar Dzongkhag. The significance of the sanctuary may be seen in its being the home to an array of endangered species. In addition, its location at the Indo-Bhutan border makes it an important component of Transboundary Manas Conservation Area (TraMCA) providing critical habitat for survival of several threatened species (JWS, 2023). The 132kV Jomori TL is set to cut through various multi-purpose or buffer zones within the JWS, with a major section running through regions already affected by established

settlements, roads, and 33kV distribution lines. Approximately 41 km of the total line length, with a 27 m RoW, will cross the JWS area, encompassing roughly **1.107 sq. km** of land.

i) Protected Area Characteristics and Overview

An overview of the protected areas is shown in the table below.

Table 5-1: Protected Area Characteristics and Overview

Protected area name	Feature	Location, area, etc.
Protected areas through which the Project's transmission lines may pass		
Jomotsangkha Wildlife Sanctuary (JWS)	The elevation ranges from 400m to 2,200m above sea level allows a wide variety of forest vegetation to be observed, ranging from broad-leaved forests in the lowlands to mixed coniferous forests in the highlands. It is home to endangered species such as the Bengal Tiger, Common Leopard, Himalayan Black Bear, and Asiatic Elephant, which are listed in the IUCN Red Book.	It is located in the eastern part of Samdrup Jongkhar Dzongkhag, adjacent to the Indian state of Assam. The area of 334.73 km^2 is designated as protected area in 1974 and is connected by a biological corridor to two other protected areas designated on both sides of the protected area, Royal Manas National Park and Sakteng WS.
Protected area in close proximity to the proposed Jomori Power Plant site		
Sakteng Wildlife Sanctuary (SWS)	The elevation varies from 2,300m to 4,400m, and the area around 2,000m is a steep mountainous area where swift currents have violently eroded the valley floor, forming a V-shaped valley. The highlands are vast, gently sloping grasslands dominated by cold-temperate coniferous forests dominated by firs and dwarf herbaceous species. The site is home to endangered species such as the Bengal Tiger, Clouded Leopard, Himalayan Black Bear, Red Fox, and Red Panda, which are listed in the IUCN Red Book of Endangered Species.	Located in the eastern part of Trashigang Dzongkhag (Trashigang), the eastern boundary of the reserve is entirely bordered by India. Designated in 1993, it covers an area of 740.60 km^2 and is revered by the people of Bhutan not only for its biodiversity but also as a sacred mountainous area.
Biological Corridor	It is a protected area that connects both Wildlife Sanctuaries (WS) in the form of a belt, mainly for the purpose of breeding, feeding, or adaptation to the environment (climate change) of large mammals, reptiles, birds, etc. that live in Sakteng WS and Jomotsangkha WS.	Location: This corridor stretches approximately 8 km wide and 32 km north to south in a forested area in the center of Samdrup Jongkhar Dzongkhag, and extends into neighboring Trashigang Dzongkhag.

ii) Core Zone Classification and Management

In the State of Bhutan, based on the initiative of relevant government ministries, areas to be protected are designated as protected areas (FNCA, Article 36). In addition, protected areas are zoned and protected and managed according to zoning classifications with an objective to delineate Wildlife Sanctuary into different zones as per the functions of the area and accordingly prescribed regulations and management interventions. (FNCA, Article 37).

Table 5-2: Core Zone Classification and Management Objectives and Contents

Name of Zone	Related Provisions, Purpose, and Contents
Core Zone	Core zones are areas with high conservation values that provide critical services for the persistence of flora and fauna of international, national or local importance including resident or migratory fauna. Development activities are strictly prohibited in the zone (FNCA Article 46, clouse1). In Jomotsangkha Wildlife Sanctuary, two blocks totaling up to 124 sq.km, have been identified as core zones in which almost of areas are covered with truly virgin forest with precious plant and animals.
Buffer Zone	Buffer zone is classified mainly to provide cushioning function to the core zone when this zone is located in the immediate vicinity of anthropogenic disturbances both from within and outside of the Sanctuary. The buffer zone may be regarded as an area in which human interventions is less intensive than what might be found in the multiple-use zone and may accommodate activities for environmental education, tourism, traditional resource use and recreation facilities. However, it is an area where development other than the traditional use of local residents and national development projects is prohibited (FNCA Article 46, clouse6). An area of 11.43 sq.km of Jomotsangkha Wildlife Sanctuary has been identified as buffer zone.
Multiple Use Zone	Multiple use zone which is also termed as 'zone of cooperation' include settlements, built-up areas, private registered lands and resource allocation areas for the Sanctuary residents. This is a zone where stakeholders agree to work together to manage and use the area in a sustainable manner to benefit both people and wildlife. However, it is an area where development other than the traditional use of local residents and national development projects is prohibited (FNCA Article 46, clouse6). About 197 sq.km of the Jomotsangkha Wildlife Sanctuary has been mapped as the multiple use zone.
Transition zone	Transition zone means an area of interdependence between wildlife and local communities within a protected area wherein, traditional and legal rights for sustainable use of natural resources is permitted for a designated period of time in a year (FNCA Article 251, clouse78).

Adapted from Conservation Management Plan, Jomotsangkha Wildlife Sanctuary (January 2023-December 2033)

Note: In addition to the three zoning categories above, there is a "transition zone" but it is not designated in the Jomotsanker Wildlife Sanctuary.

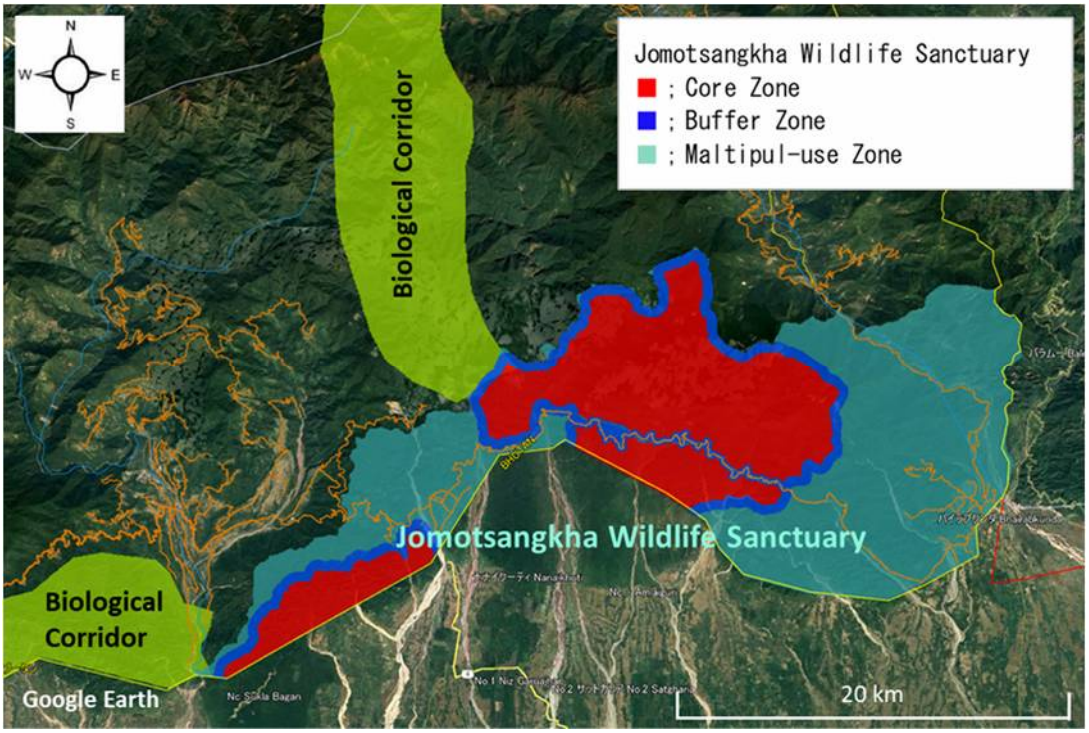


Figure 5-1: Protected Areas and Zoning Classifications

iii) Verification of the feasibility of implementing the project in the protected area

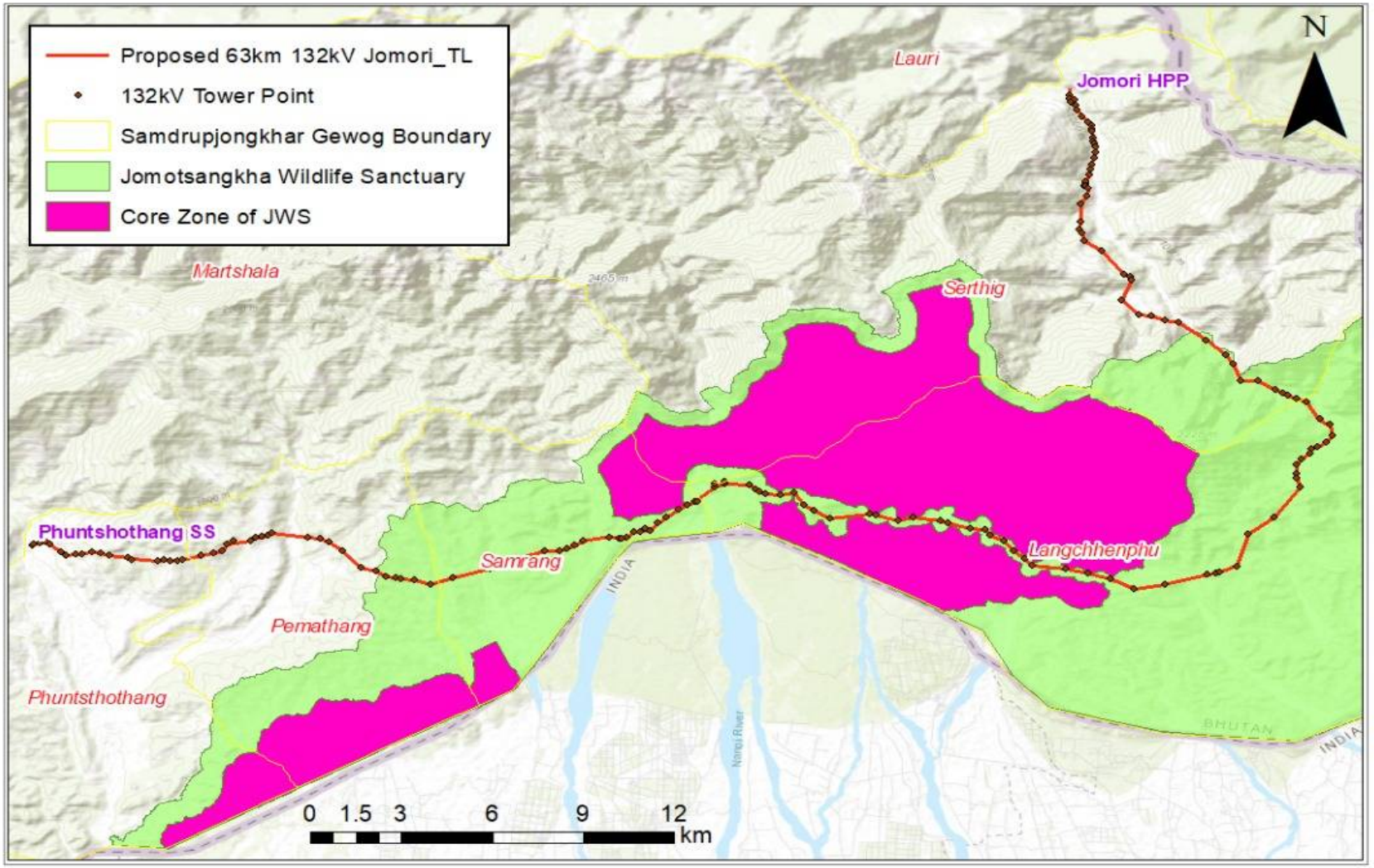
(if it is not possible to avoid the passage of the protected area)

The JICA Guideline write that "In principle Projects must be undertaken outside of areas that are specifically designated for conservation of nature or cultural heritages by the host county governments, unless the main purpose of the Projects is to promote or restore the protection of such areas." (FAQ P41, 42)

The investigation revealed that there was no viable alternative to the transmission line route outside of the protected area. In addition, it was found that all five conditions (JICA Guideline FAQ) that can be exceptionally implemented in the protected area are met (see table below).

Table 5-3: Cases where passage through protected areas for environmental and social considerations, etc. cannot be avoided (Excerpt from JICA Guidelines FAQ)

Judgment conditions	Preliminary Judgement Results ○ Meet the principle / △ To be confirmed in surveys	Confirmed Items from the Survey
(1) No feasible alternative plans shall be available in areas other than the area designated as such by the country and/or local governments by laws and/or ordinances to protect nature and cultural heritage ("the Designated Area" hereinafter):	○ Due to topographical conditions, construction conditions, and safety, it is difficult to establish an alternative route that avoids the protected area.	Based on the analysis of the field survey, it was difficult to choose a route that avoids the protected area.
(2) Development in the designated Area shall be legally acceptable by the host country's domestic laws:	○ Under Act (Forest and Nature Conservation Act of Bhutan 2023), exceptions are made for development activities related to national development projects outside the core zone.	Permitted by Act, as this project will be implemented as a national project.
(3) Project proponents, shall comply with the laws, ordinance concerning the Designated Area and management plan of the protected zones:	△ The manager of the protected area (Park management Office) has indicated his intention to agree to this project based on the zoning plan (November, 2023).	The manager of the protected area (Park management Office) has already agreed to this project based on the zoning plan (March, 2024).
(4) Project proponents, shall form a consensus about project implementation with stakeholders including organizations responsible for managing the Designated Area, local communities through consultations:	△ The project proponent (BPC) plan to consult with relevant government agencies and local residents at the EIA preparation stage to obtain agreement on the implementation of this project.	The fact of agreement from local residents for the implementation of the project was confirmed through the interviews with local residents.
(5) Project proponents, shall perform additional programs, where necessary, to ensure that the Designated Area is effectively managed for its conservation.	△ The BPC develops an environmental management plan to minimize the environmental impact on the protected area and also intend to continue monitoring in collaboration with the park manager and consider additional mitigation measures as needed.	The BPC was in close contact with the park office manager, and BPC has already agreed to the creation of additional programs (if necessary).



Map 5-4: Jomotshangkha Wildlife Sanctuary Zonation Map with 132kV Jomori TL

5.1.7. Ambient environmental quality

5.1.7.1. Ambient Water Quality

Water was sampled across four localities (Table 5-4: Ambient water quality measurements across 4 sample sites

), pH values were found to be consistently within the acceptable range of 6.0-9.0 for all categories (A, B, C), with the recorded values spanning from 7.60 in Desamri to 8.10 in Jampaney. Electrical Conductivity (EC) levels were well below the maximum limits across all categories, with Jampaney recording the highest value at 156.70 µs/cm, still significantly lower than the category A limit of 800.00 µs/cm. Total Dissolved Solids (TDS) also remained within acceptable limits, with Jampaney registering the highest value at 98.60 ppm, well below the category A limit of 500.00 ppm. Dissolved Oxygen (DO) levels were above the required minimum for category B, with Akhuri recording the highest DO level at 8.74 mg/l. Salinity levels varied, with Jampaney recording the highest at 110.40 ppm. However, there are no specified limits for salinity in Bhutan's environmental standards. Ammonia (NH_3) levels were within the acceptable range for category A, except with the highest level observed in Jampaney at 0.06 mg/l, which falls within the acceptable range for category B. Turbidity levels were within the category A limit, with Jampaney showing the highest turbidity at 1.71 NTU. Chloride levels were within the category A limit, with Jampaney recording the highest level at 49.63 mg/l. Total Hardness (TH) levels were below the category A limit, with the highest TH level observed in Jampaney at 92.00 mg/l $CaCO_3$. Chlorine levels varied across localities, and there are no specified limits for chlorine in Bhutan's environmental standards. Calcium hardness (Ca) levels were below the category A limit, with the highest Ca level recorded in Chitori at 82.00 mg/l. Magnesium hardness (Mg) levels were also below the category A limit, with the highest Mg level observed in Chitori at 30.00 mg/l. Total Suspended Solids (TSS) were within the category A limit, with the highest TSS level observed in Chitori and Akhuri at 20.00 mg/l. Ammonium (NH_4) levels varied, and there are no specified limits for NH_4 in Bhutan's environmental standards. Nitrate (NO_3) levels were below the category A limit, with the highest NO_3 level recorded in Desamri at 5.27 mg/l.

Note:

A**:** (Very good) Potable water source obtained without undergoing conventional treatment but subjected to disinfection whenever deemed necessary.

B: (Good) Potable water source subjected to conventional treatment.

C: (Moderate) Utilized for purposes such as irrigation, industrial cooling, etc

Table 5-4: Ambient water quality measurements across 4 sample sites

	Current study				Bhutan environmental standards 2020		
Plot ID	**JM AW 01**	**JM AW 02**	**JM AW 03**	**JM AW 04**	**A**	**B**	**C**
Locality	Jampaney	Chitori	Akhuri	Desamri			
N	26.92194444	26.94922199	26.98466169	26.99437358			
E	92.09527778	92.06909543	92.02464461	92.0002465			
Elev (m asl)	412.00	376.00	507.00	719.00			
Temp °C	19.50	16.90	15.00	15.30			
pH	8.10	7.80	7.70	7.60	6.5-8.5	6.0-9.0	6.0-9.0
EC (µs/cm)	156.70	125.30	98.80	96.50	800.00	1000.00	2000.00
TDS (ppm)	98.60	75.30	59.70	58.30	500.00	1500.00	2100.00
DO (mg/l)	7.15	8.19	8.74	8.11	6.00	4.00	-
Salinity (ppm)	110.40	84.50	67.10	65.50	-	-	-
NH_3 (mg/l)	0.06	0.05	0.03	0.04	0.05	0.50	-
Turbidity (NTU)	1.71	0.31	1.32	0.56	5.00	-	-
Chloride (mg/l)	49.63	24.82	19.85	19.85	50.00	200.00	-
TH (mg/l $CaCO_3$)	92.00	52.00	58.00	44.00	400.00	-	-
Chorine (mg/l)	0.11	0.22	0.21	0.28	-	-	-
Ca (mg/l)	70.00	82.00	52.00	38.00	200.00	-	-
Mg (mg/l)	22.00	30.00	6.00	6.00	200.00	-	-
TSS (mg/l)	10.00	20.00	20.00	0.00	25.00	100.00	-
NH_4 (mg/l)	2.18	0.55	0.04	0.04	-	-	-
NO_3 (mg/l)	2.45	0.93	1.80	5.27	10.00	50.00	-

5.1.7.2. Ambient Air Quality

Considering that the area is relatively undisturbed, the ambient air quality parameters are very much within the levels permissible under the national ambient air quality standards (NEC, 2020) – see Table 5-4.

Table 5-4: Ambient Air Quality at Tokaphung, Serthi Gewog during the winter season

No.	Parameters	UOM	Max. P.L (NECS Standards 2020)	Phuntshothang		Samrang		Tokaphung	
				Day 1	Day 2	Day 1	Day 2	Day 1	Day 2
1	TSPM	µg/m³	200 (24hr Avg.)	35.97	37.87	42.31	45.11	15.99	15.98
2	$PM_{2.5}$	µg/m³	60 (24hr Avg)	24.53	23.01	32.94	28.95	4.02	4.93
3	PM_{10}	µg/m³	100 (24hr Avg)	31.45	31.78	38.69	38.24	6.48	7.06
4	Conc. Of Sulphur Dioxide (SO_2)	µg/m³	80 (24 hr avg.)	0	0	0	0	0	0
5	Conc. Of Nitrogen Dioxide (NO_2)	ppm	80 (24hr avg.)	0.154	0.148	0.128	0.127	0.026	0.028
6	Conc. Of Carbon Monoxide (CO)	ppm	2000 (8hr avg.)	0	0	0	0	0	0
7	Atmospheric Pressure	mbar		975.69	975.28	968	967.3	974.36	973.9
8	Wind Speed (WS)	m/sec		0.537	1.358	0.048	0.130	---	---
9	Temperature	° C		18.62	21.81	19.01	19.92	20.04	20.03
10	Relative Humidity	%		75.41	55.19	77.47	67.78	73.48	72.07

5.1.7.3. Ambient noise levels

The noise level recorded from the three locations during the dry season also suggest the area is peaceful with little or no noise pollution. The noise levels in decibels (Db) is given in Table 5-5.

Table 5-5: Ambient Noise level in decibels (Db) at 3 sampling stations in Jomori TL area

SLM continuous recording						Max. permissible level (NEC 2020)
Phuntshothang		Samrang		Tokaphung		
Day 1	Day 2	Day 1	Day 2	Day 1	Day 2	
45.38	43.88	47.33	49.76	39.92	42.99	65 (Day)
35.46	35.90	43.35	45.71	37.83	40.90	55 (Night)

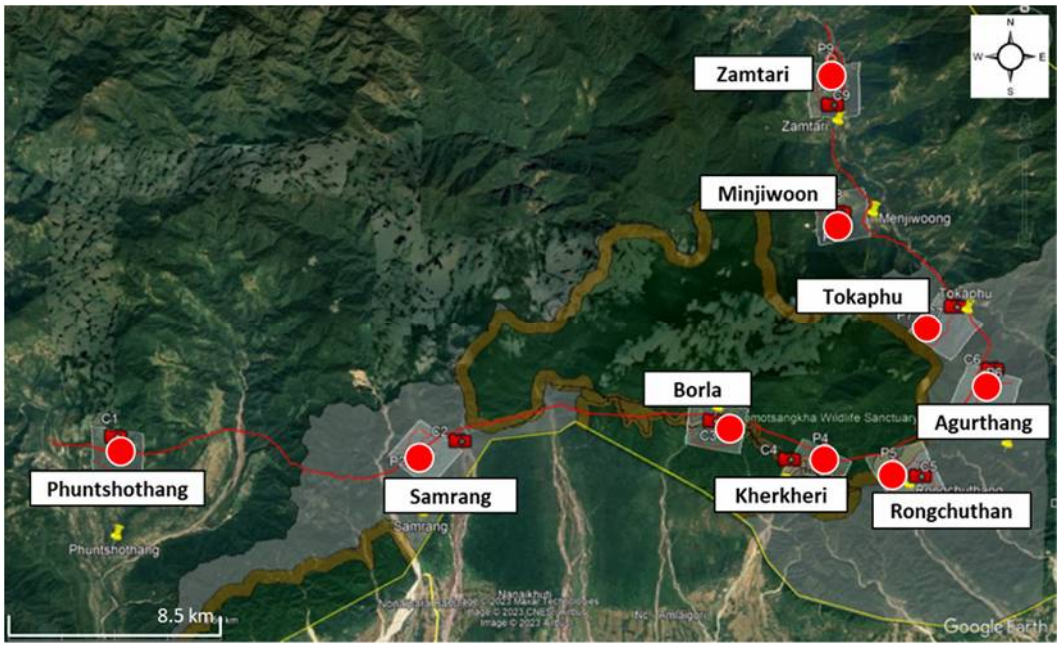
5.1.8. Ecological Resources

5.1.8.1. Terrestrial

The results of the terrestrial surveys conducted during the wet season and dry winter season generated the status of plants, mammals, birds, and reptiles and amphibians in the project area.

Vegetation

The combined results of forest plot surveys conducted during wet and dry seasons recorded a total of 432 plant species comprised of trees, shrubs, herbs and epiphytes (Appendix 3). Considering the dry winter season vegetation as the baseline for plan diversity, a total of 201 plant species was recorded. Among them, one species (Pandanus furcatus) was listed as Endangered, while another (Piper pedicellatum) was categorized as Vulnerable. Additionally, 48 species were listed as Least Concern, one was data deficient, and 69 were not listed in the IUCN Red List category. However, 81 species were identified only up to generic level



(Source: Report on biodiversity assessment of flora and fauna along existing Phuntshothang substation to proposed Jomori Powerhouse Transmission Line)

Figure 5-2: Map of survey sites and park management classifications for plants and animals along the power lines

The most dominant tree species observed were *Litsea* sp. (n = 17), followed by *Ostodes paniculata* (n = 16). *Ailanthus intefrifolia, Alangium chinense, Albizia* sp., *Boehmeria* sp., *Bridelia retusa, Bridelia sikkimensis, Capparis* sp., *Casearia graveolenus, Chukrasia* sp., *Chukrasia tabularis, Cinnamomum glaucescens, Dendrocnide sinuate*, *Falconeria insignis, Ficus* sp. *Hedychium coccineum*, *Heteropanax fragrans*, *Heynea trijuga*, *Malus sikkimensis, Monoon simiarum, Monosis volkameriifolia, Orerelthya cynthia, Persea* sp., *Picrasma* sp., *Rhus chinensis, Syzygium tetragonium, Toona ciliate, Urera* sp., *Wendladia grandis* were among the least dominant species (n = 1).

Similarly, the most dominant shrub species were Coffea benghalensis (n = 89), and *Oreocnide* sp. (n = 58) whereas, *Ziziphus* sp., Dendrocnide sp., and *Flemingia macrophylla* were some of the least abundant (n = 1). *Eranthemum* sp. was the most dominant herb (n = 55) followed by *Piper* sp. and (n = 56), while, *Hoya* sp., was the least dominant herb species (n = 1).

Floral diversity

Following an examination of the plant life within individual plots, Shannon diversity indices were computed to evaluate the overall biodiversity and tree diversity within the sample plots. The Shannon diversity index evaluates both the abundance and distribution of species, offering a comprehensive understanding of the ecological diversity present in the ecosystem under study. Typically ranging from 0 to around 4.6, it

categorizes biodiversity into three tiers: Low Diversity (0-1.5), Moderate Diversity (1.5-3.5), and High Diversity (3.5-4.6+) (Shannon & Wiener, 1949). Low diversity suggests few species with uneven distribution, moderate diversity indicates a fair range of species with relatively balanced distribution, while high diversity reflects a rich variety with a more uniform spread.

The values of Shannon index for overall floral diversity in the sampling plots ranged from 2.04 to 5.11, indicating varying degree of floral diversity across the sampled plots (Appendix 4). Furthermore, to gain a comprehensive understanding of the floral diversity within the proposed hydropower area, the overall floral diversity index was also computed. The computation of the overall floral diversity index for the proposed hydropower area revealed a value of 4.25, indicating a relatively high level of floral diversity within the entire area. This value suggests that the proposed hydropower area harbors a diverse array of plant species, with a balanced distribution among them.

Calculating tree species diversity in each plot of the proposed hydropower project area is crucial for assessing and mitigating potential environmental impacts, planning conservation efforts, and ensuring regulatory compliance. Therefore, tree species diversity was calculated for each plot as well as for the overall area.

The tree species diversity assessment conducted within each plot of the proposed hydropower project area uncovered diverse levels of biodiversity across different locations, reflecting the heterogeneous nature of the ecosystem within the project site (Appendix 5). The overall tree diversity in the study area was 3.96, indicative a relatively diverse area with even distribution of tree species.

Tree density

Tree density provides valuable information about the abundance and distribution of trees within different habitats and can help identify areas with high or low tree cover. To achieve this, tree density was calculated for individual plot as well as the overall project area.

At the plot level, tree density analysis revealed spatial variations ranging from approximately 222.22 (JM TL 05) to 800 (JM TL 04) trees per hectare (Appendix 6), which may be influenced by factors such as soil characteristics, microclimate conditions, and land use history. Similarly, evaluating tree density across the entire study area provides an understanding of the overall tree cover and landscape structure. The overall tree density across the study area was found to be 535 trees per hectare (0.053 trees/m^2). This metric provides a comprehensive measure of the abundance and distribution of trees within the project site.

Tree volume

Based on the forest mensuration data, analysis of tree volume was conducted to derive average volume per plot, per tree and overall project site (Appendix 7). The average tree volume per plot ranged from 1.48 to 357.46 cubic feet (cft). Similarly, the total tree volume in the proposed project site was 18771.55 cft with an average of 64.96 cft per tree. This measure in conjunction with the density will be handy for estimating number of trees that will be removed for development.

Table 5-6: Number of endangered species found growing and inhabiting in the proposed transmission line construction area (Rainy Season)

	Number of species (common)	Endangered species		
		CR	EN	VU
Plant	289 (283)	1 Intoxicating Yam	3 Cats tail orchid, Nepal yam, Grey Leaved Indian Raisin	2 Billygoat weed, Amchoi
Mammals	16 (8)	0	2 Asian Elephant, Wild dog	6 Clouded leopard, Leopard, Gaur, Sambar, Asiatic Golden Cat, Capped langur
Birds	274 (270)	0	0	4 Great hornbill, Rufous-necked hornbill, Beautiful nuthatch, Black Baza
Reptiles	11 (9)	0	0	2 king cobra, Burmese Python
Amphibians	12 (12)	0	0	0
Butterflies	196 (195)	0	0	1 Purple Emperor

Table 5-7: Number of endangered species found growing and inhabiting in the proposed transmission line construction area (Dry Season)

	Number of species (common)	Endangered species		
		CR	EN	VU
Plant	201 (199)	0	1 *Pandanus furcatus*	1 *Piper pedicellatum*
Mammals	11 (6)	0	1 Elephants	4 Clouded leopard, Gaur, Sambar, Capped langur
Birds	100 (98)	0	0	2 Rufous-necked hornbill Great hornbill
Reptiles	0	0	0	0
Amphibians	0	0	0	0

Wildlife

Mammals

From the camera traps, direct and indirect observations recorded during the wet and dry season surveys, a threatened species was recorded with two categorized by IUCN as endangered, 7 Vulnerable, 1 near threatened and the remaining are least concern species. (Appendix 8)

The rainy season survey alone recorded a total of 16 wild mammals. Among them, two (*Elephas maximus*, *Cuon alpinus)* was categorized as Endangered, six (*Bos gaurus, Catopuma temminck, Cervus unicolor*, *Panthera pardus, Neofelis nebulosi*, and *Trachypithecus pileatus*) was listed as vulnerable, one as Near Threatened (*Macaca assamensis*) as Least Concerned by the IUCN Red List.

Table 5-8: Mammals identified in the proposed transmission line construction area (Rainy season)

Sl. No.	Scientific Name	Common Name	IUCN Status
1	*Atherurus macrourus*	Brush tailed porcupine	LC
2	*Bos gaurus*	Guar	VU
3	*Catopuma temminck*	Asiatic Golden Cat	VU
4	*Cervus unicolor*	Sambar	VU
5	*Cuon alpinus*	Wild dog	EN
6	*Elephas maximus*	Asian Elephant	EN
7	*Felis bengalensis*	Leopard cat	LC
8	*Herpestes urva*	Crab-Eating mangoose	LC
9	*Macaca assamensis*	Assamese macaque	NT
10	*Martes flavigula*	Himalayan Yellow-throated Marten	LC
11	*Muntiacus muntjak*	Barking Deer	LC
12	*Neofelis nebulosa*	Clouded leopard	VU
13	*Panthera pardus*	Common leopard	VU
14	*Sus scrofa*	Wild boar	LC
15	*Trachypithecus pileatus*	Capped langur	VU
16	*Viverra zibetha*	Large Indian Civet	LC

(Source: BPC Report on Flora and Fauna Survey during the Rainy Season along the Transmission Line (Jomotsangkha Wildlife Sanctuary))

Note; EN=Endangered, LC=Least Concern, VU=Vulnerable, NT=Near Threatened

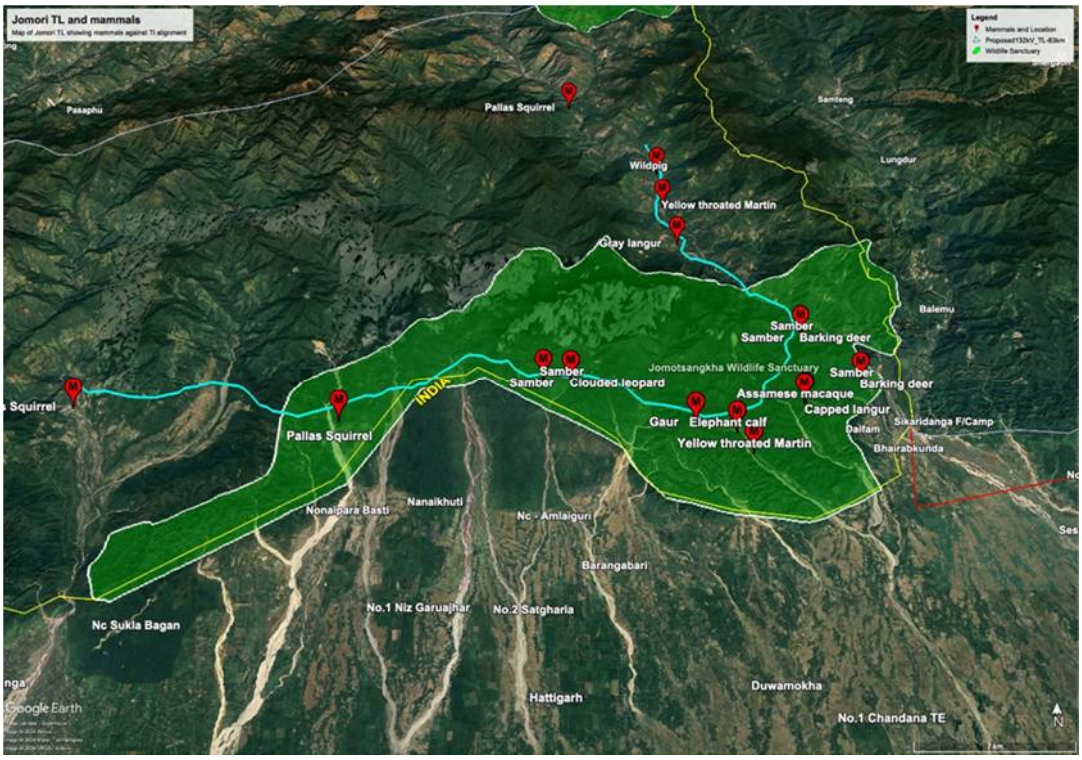
The dry season survey alone recorded a total of 11 wild mammals. Among them, one (*Elephas maximus*) was categorized as Endangered, four (*Bos gaurus, Neofelis nebulosi, Rusa unicolor, and Trachypithecus pileatus*) was listed as vulnerable, one as Near Threatened (*Macaca assamensis*) as Least Concerned by the IUCN Red List (Appendix 8).

Table 5-9: Mammals identified in the proposed Transmission Line construction area (Dry season)

Sl. No.	Scientific Name	Common Name	IUCN Status
1	*Bos gaurus*	Gaur	VU
2	*Callosciurus erythraeus*	Pallas Squirrel	LC
3	*Elephas maximus*	Asian Elephant	EN
4	*Macaca assamensis*	Assamese macaque	NT
5	*Martes flavigula*	Himalayan Yellow-throated Marten	LC
6	*Muntiacus muntjak*	Barking Deer	LC
7	*Neofelis nebulosa*	Clouded leopard	VU
8	*Rusa unicolor*	Sambar	VU
9	*Semnopithecus schistaceus*	Gray langur	LC
10	*Sus scrofa*	Wild boar	LC
11	*Trachypithecus pileatus*	Capped langur	VU

(Source: BPC Report on Flora and Fauna Survey during the Rainy Season along the Transmission Line (Jomotsangkha Wildlife Sanctuary))

Note; EN=Endangered, LC=Least Concern, VU=Vulnerable, NT=Near Threatened

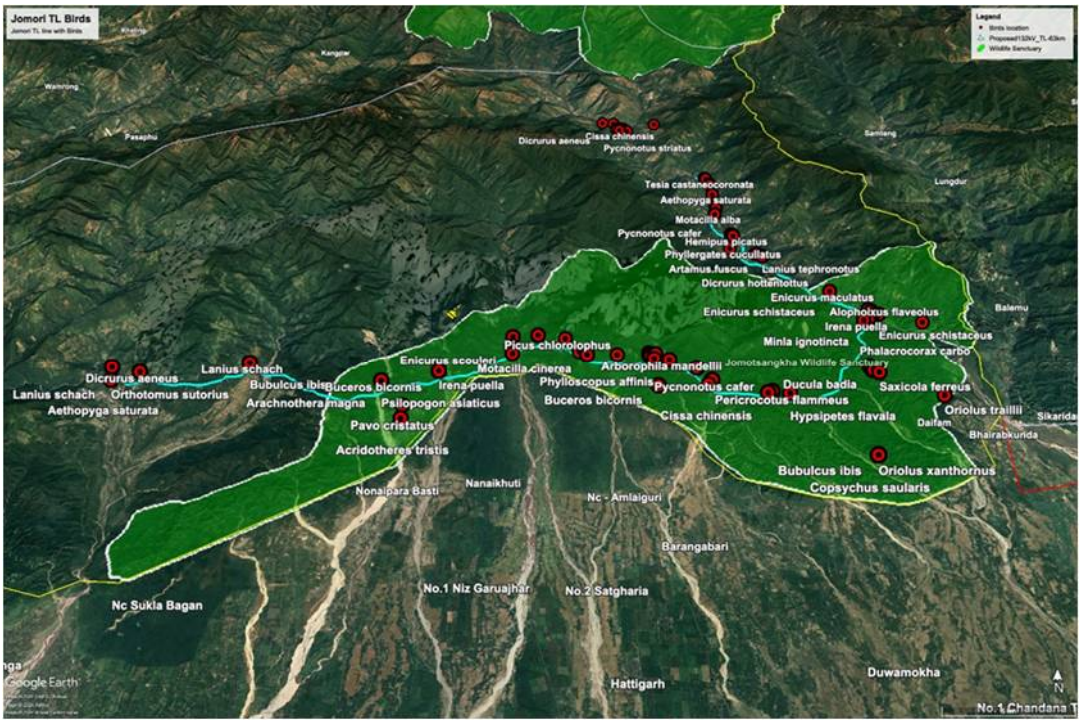


(Source: JICA Survey Team)

Figure 5-3: Locations identified mammals along Jomori Transmission Line

Avifauna

The avifauna survey, conducted using point count and transect methods, recoded 297 (rainy season; 274, dry season; 100) species of birds of which *Aceros nipalensis, Aviceda leuphotes, Buceros bicornis,* and *Sitta Formosa* are Vulnerable, *Cephalopyrus flammiceps* and *Turdus obscurus* are Threatened, *Alcedo Hercules, Harpactes wardi, Psittacula alexandri,* and *Vanellus duvaucelii* are Near threatened, and the remaining belong to least concern category (Appendix 9). The dry season survey recorded a total of 100 species under 40 families Among them, one (*Aceros nipalensis*) was listed as Vulnerable, two (*Buceros bicornis* and *Harpactes wardi*) were listed as Neat Threatened while, others were listed as Least Concern by the IUCN Red list.



(Source: JICA Survey Team)

Figure 5-4: Locations identified Main Birds along Jomori Transmission Line

Herpetofauna

During the dry season survey, no reptiles or amphibians were encountered and/or sighted. This is likely due to hibernation. However, wet season survey recorded 11 species of reptiles and 12 amphibian species. Except for King Cobra and Burmese Python, which are categorized by IUCN as 'vulnerable', all other reptiles and amphibians belong to the 'least concern' category (Appendix 10).

Table 5-10: Reptile identified in the proposed Transmission Line construction area (Rainy season)

Sl. No.	Scientific Name	Common Name	IUCN Status
1	*Ophiophagus hannah*	King Cobra	VU
2	*Bungarus niger*	Greater Black Krait	LC
3	*Rhabdophis subminiatus*	Red Necked Keelback	LC
4	*Oligodon albocinctus*	White Barred Kukri	LC
5	*Oreocryptophis porphyraceus*	Black Banded Trinket	LC
6	*Rhadinophis prasina*	Green Trinket	LC
7	*Dendrelaphis tristis*	Bronzeback Tree Snake	LC
8	*Lycodon aulicus*	Common Wolf Snake	LC
9	*Elaphe cantoris*	Easterner Trinket	LC
10	*Oviphis monticola*	Mountain Pit viper	LC
11	*Python bivittatus*	Burmese Python	VU

(Source: BPC Report on Flora and Fauna Survey during the Rainy Season along the Transmission Line (Jomotsangkha Wildlife Sanctuary))

Note; LC=Least Concern, VU=Vulnerable

Table 5-11: Amphibians identified in the proposed Transmission Line construction area (Rainy season)

Sl. No.	Scientific Name	Common Name	IUCN Status
1	*Fejervarya pierrei*	Pierre's Cricket Frog	LC
2	*Hoplobatrachus tigerinus*	Indian Bull Frog	LC
3	*Euphlyctis cyanophlyctis*	Skittering Frog	LC
4	*Polypedates leucomystax*	Common Tree Frog	LC
5	*Uperodon globulosus*	Indian Ballon Frog	LC
6	*Duttaphrynus melanostictus*	Asian Common Toad	LC
7	*Microhylla berdmorei*	Large Pygmy Frog	LC
8	*Polypedates maculatus*	Common Indian Tree Frog	LC
9	*Kurixalus naso*	Annandale's high-altitude frog	LC
10	*Hylarana leptoglossa*	Assam Forest Frog	LC
11	*Duttaphrynus stomaticus*	Marbled Toad	LC
12	*Kurixalus bisacculus*	Loei frilled tree Frog	LC

(Source: BPC Report on Flora and Fauna Survey during the Rainy Season along the Transmission Line (Jomotsangkha Wildlife Sanctuary))

Note; LC=Least Concern

5.2. Socio-economic conditions

5.2.1. Dzongkhag Profile

Samdrup Jongkhar is situated in the southeastern corner of Bhutan, sharing borders with India to the south and north. Its strategic location provides access to the Indian market, making it a potential gateway to Assam and other northeastern states. However, the presence of cheaper products across the border poses a significant economic challenge for local businesses. The Dzongkhag experiences a sub-tropical climate, with elevations ranging from 200 to 3600 meters above sea level. Temperature extremes range from 14 to 36 degrees Celsius during peak summer. More than three-quarters of the area is covered by forests, mainly comprising broad-leaved sub-tropical evergreen forests. According to the Population and Housing Census of Bhutan 2017 (PHCB 2017), Samdrup Jongkhar had a population of 35,079, with approximately 48% being female. The rural population constituted around 65% of the total population, with a high dependency ratio indicating a significant portion of the population comprising children and the elderly. Migration patterns within the district show a mix of rural-rural, rural-urban, and urban-rural movements. The overall literacy rate in Samdrup Jongkhar is 65.9%, with males having a higher literacy rate than females (73.7%:57.2%). The district has a total of 34 schools, including higher secondary, middle secondary, lower secondary, and primary schools. Healthcare facilities include two hospitals located in Samdrup Jongkhar town and Dewathang urban settlement. Samdrup Jongkhar Dzongkhag is divided into two Dungkhags – Jomotsangkha and Samdrupchoeling – and 11 Gewogs. Additionally, there is one Thromde (urban municipality) in Samdrupjongkhar. The Jomori project affects three Gewogs: Langchenphu, Serthi, and Lauri, all falling under the Jomotsangkha Dungkhag.

5.2.2. Communities along proposed transmission line

Serthi Gewog

Serthi gewog covers an area of about 306.163 sq.km. There are 5 chiwogs comprised of 14 villages. The gewog has two primary schools and one central school, one Early Childhood and Care Development (ECCD) two outreach clinics and a Primary Health Care Centre. The gewog experiences sub-tropical climate and altitude ranges from 600 to 2200 meters above the sea level.

Langchenphu Gewog

Covering an area of 222.43 sq.km, Langchenphu gewog is located at the eastern most part of Samtse. The Gewog comprises of 5 chiwgos and bifurcated in 15 villages. The gewog experiences a sub tropical climate

and experience hot and humid weather during the summer and receives rainfall in the period June – September. The Gewog has 1 Middle Secondary School, 8 Non-Formal Education Centres, 1 Primary Health Care centre and 1 ORC.

Phuntshothang Gewog

Phuntshothang Gewog, popularly referred to as Bangtar, is situated approximately three hours' drive to the west of the Samdrup Jongkhar Dzongkhag headquarters. This Gewog shares its southern border with Assam, India. Covering an area of 130.2 square kilometres, it comprises 969.61 acres of wetland and 1548.75 acres of dry land. The gewog is comprised of 6 Chiwogs encompassing 25 villages. The Gewog experiences a subtropical climate characterized by wet and humid summers and cool, dry winters. Altitude in the area ranges from 350 to 450 meters above sea level, with heavy rainfall occurring during the summer months. Under Phuntshothang, there is a BHU in Samdrupcholing and 3 ORCs. There is also a higher secondary school and a middle secondary school, 2 ECRs and one NFE. Data shows that there the gewog has 99% coverage of electricity.

Pemathang Gewog

Pemathang Gewog is situated in the remote valleys of the southeastern foothills under Samdrup Choling Drungkhag, within Samdrup Jongkhar Dzongkhag. It is located 78 kilometres away from the main district headquarters and covers an area of 76.54 square kilometres. It comprises of five chiwogs, all of which are connected by stable farm roads, reaching out to all 14 villages within the gewog. Health services are provided through the Primary Health Care facility based in Pemathang chiwog. Educational services are facilitated by the only 1 lower secondary school in the gewog. Reliable and safe water supply is guaranteed at all times, as are irrigation channels for the paddy fields, ensuring agricultural productivity. All villages within the gewog are connected with reliable network coverage, enabling communication and access to information.

Samrang Gewog

Covering an area of 51.25 square kilometres, Samrang Gewog, is the smallest among the eleven gewogs in Samdrup Jongkhar. Falling under the jurisdiction of Samdrup Choling Drungkhag, the gewog is approximately 24.15 kilometers away from the Drungkhag Administration, requiring about an hour's drive to reach. There is one Primary Health Care Centre and one Early Child Care Development center. The sparsely located houses in Samrang are provided with electricity.

5.2.3. Population

The table below shows the population, area, and population density of the gewogs where the power plant and transmission line projects are located. The number of people per household where the project is located, varies from 3.4 to 5.6, and the population density varies from 6.3 to 23.3 persons/km^2.

Table 5-12: Population details of the Impacted Gewogs by the TL project

Gewog	Population	No. of HHs	Average family member per HH	Area (km^2)	Population Density (persons/km^2)
Serthi	2,090	439	4.7	306.2	6.8
Langchenphu	968	243	4.0	222.4	4.4
Samrang	310	55	5.6	51.3	6.0
Pemathang	1,468	380	3.8	76.5	19.2
Phuntshothang	3,028	701	4.3	130.2	23.3

(Source: National Statistics Bureau of Bhutan "2017 Population &Housing Census of Bhutan Samdrup Jongkhar Dzongkhag", Area size is URL: http://www.samdrupjongkhar.gov.bt/gewogs, accessed on December 18 2023)

Note: Average number of persons per household is calculated from the number of households and families living in a normal house.

The table below gives a chiwog wise breakdown of the population in the impacted gewogs. The chiwogs in italics and bold are the chiwogs which will be impacted by the Transmission Line.

Table 5-13: Demographics in the Impacted Chiwogs of the TL Project

		POPULATION		
Gewog	**Chiwog**	**Male**	**Female**	**Total**
Phuntshothang	***Minjigang***	159	142	301
	Samdrupchholing	218	134	352
	Phuentshogthang	370	375	745
	Baylamsharang	245	239	484
	Khameadthang	220	210	430
	Doongkarling	345	371	716
	Total	1,557	1,471	3,028
Langchenphu	Rongchuthang	41	34	75
	Agoorthang	86	91	177
	Jampani	67	39	106
	Langchenphu	195	185	380
	Jangsa	125	105	203
	Total	514	454	968
Pemathang	***Uesarna_Warong***	156	126	282
	Raling	118	149	267
	Pemathang	259	276	535

	Chirtshosa_Loongminang	90	99	189
	Khatoobdang_Shiling Gye	95	100	195
	Total	718	750	1,468
Samrang	***Ngangtshothang Toed***	155	85	240
	Ngangtshothang Maed	54	16	70
	Total	209	101	310
Serthi	***Khandophu_Minjiwoong***	555	516	1,071
	Drenphu	136	143	279
	Phagchog_Suskar	154	95	249
	Dangtsho_serthig	85	97	182
	Monmola_Tashithang Gyed	169	140	309
	Total	1,099	991	2,090

(Source: National Statistics Bureau of Bhutan "2017 Population &Housing Census of Bhutan Samdrup Jongkhar Dzongkhag")

5.2.4. Livelihood and economic activities

Serthi Gewog consists of mainly dry land in terms of land use pattern and maize is the main staple food of the gewog. Farming and livestock provide the main livelihood for the people in Seerthi and most of them derive their income from the sale of non-wood forest products (NWFP). With accessibility of farm road, the farmers now have the opportunity to sell their farm products to schools and nearby markets.

In Langchenphu, Agriculture and livestock are the main sources of livelihood as the gewog falls in a sub-tropical climatic zone and is covered with wetland which is conducive for most of agricultural activities. Paddy is the dominant food crop grown by the farmers and cash crops consists of orange, betel nut, ginger. The gewog has initiated the integrated farming practices of fishery and piggery on large scale which is also expected to raise the local economy. As the Gewog also has an Immigration entry and exit point. The gewog centre has considerable economic activity, acting as a hub and transit point for people of Lauri and Serthi gewog to sell their produce or procure their necessities. Quite a number of shops can be found including restaurants and a hotel.

Land in Phuntshothang is mostly used to cultivate Paddy, including the popular Khamti variety, which serves as the staple crop, while ginger, citrus fruits, and areca nuts are cultivated as main cash crops. Phuntshohang is also close to the urban centre of Samdrup Jongkhar and within the confines of its gewog, the state through the State Minig Corporation Ltd., also operates coal mines. The gewog centre also is very active with many small businesses registered and acts as a locus for the nearby rural communities to sell their produce and buy their necessities.

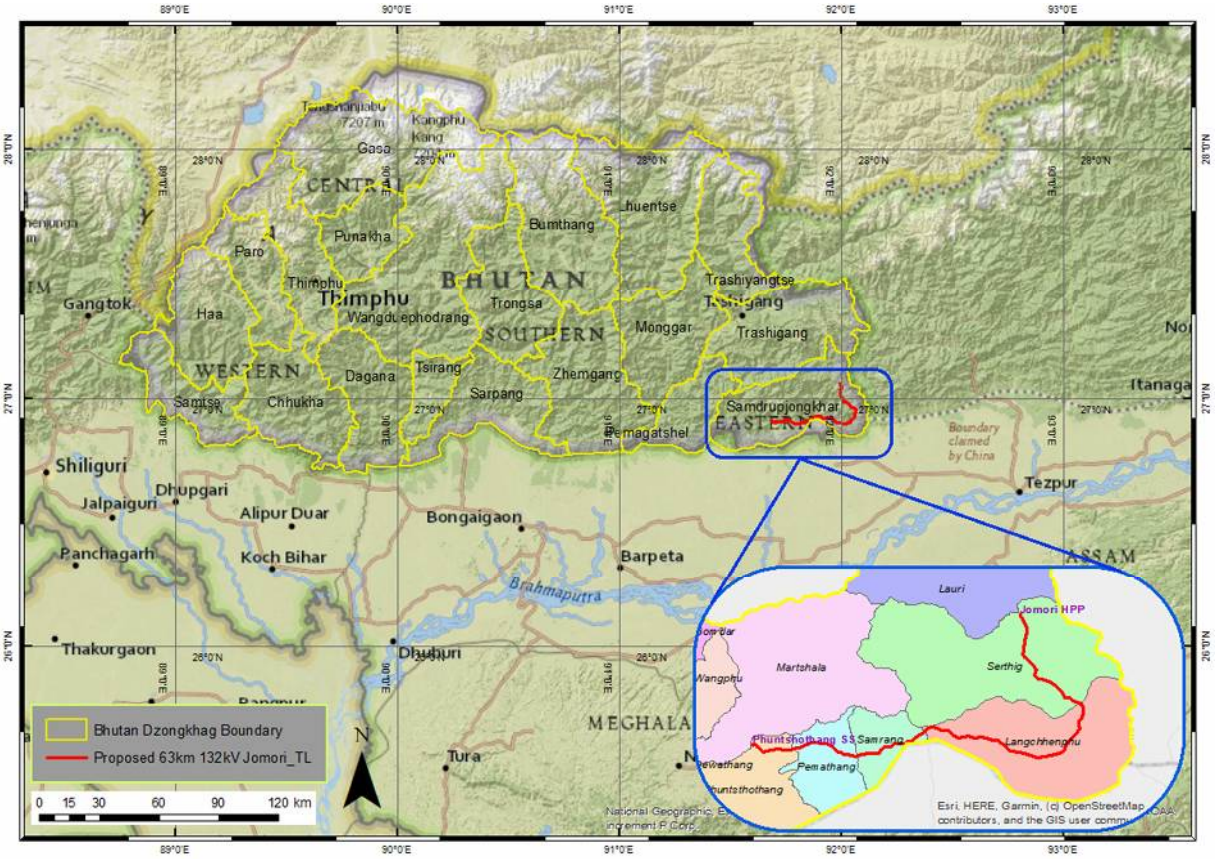
Pemathang Gewog is renowned for the production of the famous local rice variety, Khamti, which serves as a significant source of income alongside areca nut cultivation, supported by the dedicated services of the RNR (Renewable Natural Resources) sector under the Ministry of Agriculture and Forests.

In Samrang, Agriculture serves as the main source of income for households. Residents cultivate crops such as paddy, maize, and vegetables, and engage in livestock rearing. However, due to the limited population, there is a shortage of manpower for agricultural work. Despite their isolated location, farmers strive to bring their produce to nearby markets, with ginger being a primary source of income.

5.2.5. Land Environment

The proposed 63km of 132 kV D/C PTL is located in Samdrupjongkhar Dzongkhag and will traverse Serthi, Langchenphug, Samrang, Pemathang, and Phuntshothang Gewogs. Samdrupjongkhar is situated in the southeastern corner of the country (26º47' to 27º15' latitude and 91º23' to 92º07' longitude), sharing its southern and eastern borders with the Indian states of Assam and Arunachal Pradesh respectively. To its west lies Pemagatshel Dzongkhag and to its north Trashigang Dzongkhag.

The Dzongkhag is located in the subtropical climate zone with elevation ranging from 200 m to 4300 m above sea level, with majority of the land ranging from 600 m to 1200 m. The flattest areas are in the south along the Assam border.

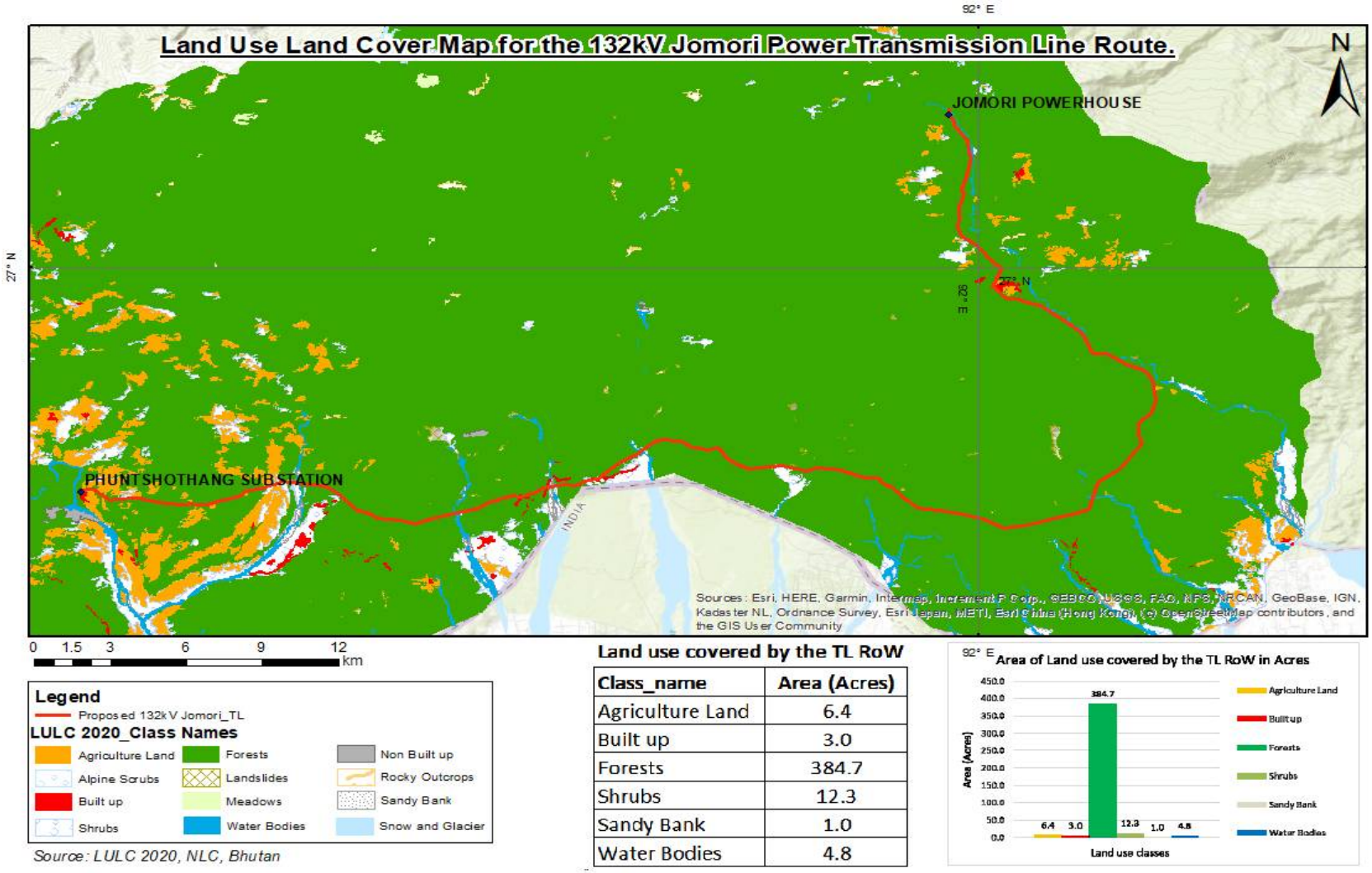


Map 5-5: Location map of Project area

5.2.6. Land use

90.60% of Samdrupjongkhar Dzongkhag's area is under forest cover and mostly the subtropical broadleaf forest type. Agricultural activities occupy roughly 4.17% of the Dzongkhag's area, with the primary land uses being Kamzhing (dry land) and Chuzhing (wet land). The staple crops cultivated annually include maize, rice, millet, buckwheat, potatoes, mustard, chili, beans, ginger, and various green vegetables. Notably, oranges stand out as the principal perennial crop in the region.

The planned transmission line, spanning 63 km with a right-of-way width of 27 m, will traverse an overall area of 1,701,000 sq. m (equivalent to approximately 420 acres). Nearly 92% of the transmission line route, accounting for 384.7 acres, will cut through forested regions. On the other hand, only 6.4 acres of agricultural land fall within the proposed alignment of the transmission line, as indicated by the Land Use Land Cover map (see Map 5-6).



Map 5-6: Land use Land cover map of the 132kV Jomori Transmission line

5.2.7. Project Affected People (PAP)

The total land area covered by the proposed 63km PTL with 27 m RoW is estimated to be **420 acres.** However, the actual area required for the tower base for whole line length will be less and is expected to be **3.192 acres (i.e., avg. tower base area 0.021 acres × 152 towers).** Out of which only **0.084 acres** of private land will be directly affected by tower base installation. The RoW for the PTL will also impact on 15.459 acres of forest in 3 Community Forest Groups 1 in Serthi Gewog and 2 under Pemthang Gewog. These groups have user rights/ certificates over these lands.

The following tables shows the details of tower locations and Projected Affected People (PAP) of the proposed project:

Table 5-14: Land type and Land use type of tower locations

SN	Place Name	Tower No.	Land Type (SRFL / Pvt. Land)	Land Use Type
1	Jomori PowerHouse	JP00	SRFL	State Reserve Forest
2	Tshanglarijue	JP01 and JP02		
3	Deptsangjue	JP03 and JP04		
4	Chukarpo	JP05 and JP06		
5	Bayong Brak	JP07 and JP08		
6	Pharen Tshuren	JP09, JP10, JP11, JP12, JP13, JP14, JP15 and JP16		
7	Phoskongri	JP17	Pvt. Land	Kamzhing (dryland for agriculture)
8		JP18	SRFL	State Forest
9	Zamtangri Top	JP19	Pvt. Land	Oranges (Orchard)
10		JP20	SRFL	State Reserve Forest
11	Apshingzor	JP21		
12	Dora Amari	JP22		
13	Jomo Doksa	JP23 and JP24		
14	Lishingzor	JP25		
15	Zhukthri	JP26		
16	Khandukpa	JP27 and JP28		
17		JP29	Pvt. Land	Oranges (Orchard)
18	Sakari	JP30	SRFL	State Reserve Forest
19	Minjiwoong Pack	JP31	Pvt. Land	Kamzhing (dryland for agriculture)
20		JP32	SRFL	State Reserve Forest
21	Akhuri	JP33, JP34 and JP35		
22	Korlam Tomang	JP36		

23	Phangkiri	JP37, JP38 and JP39		
24	Inchari	JP40 and JP41		
25	Sama Domari	JP42		
26	Zam Nako	JP43 and JP44		
27	Khritsinteng	JP45 and JP46		
28	Gyenam	JP47, JP48, JP49 and JP50		
29	Tsangphurung	JP51, JP52, JP53 and JP54		
30	Deorali Top	JP55 and JP56		
31	Tespangzor	JP57		
32	Wangleyzor	JP58, PJ51 to PJ93		
33	Nauni	PJ48 - PJ50		
34	Above Samrang	PJ31 - PJ47		
35	Nainital	PJ18 to PJ30		
36	Phedi	PJ15 to PJ17		
37	Dalimpani, Kubinde	PJ14		
38	Jagartala Top	PJ13		
39	Jagartala	PJ8 to PJ12		
40	Phuntshothang	PJ3 to PJ7		
41	Phuntshothang Substation	PJ1 and PJ2		

Private Land

Table 5-15: Details of Project Affected People by the tower installation of 132kV Jomori TL

SN.	Name of the Affected People	CID	Affected Tower Location no.	PlotID	Thram no	Village/ Gewog	Type of Land	Land Area Affected (Acres)
1	Dorji	11111001312	JP31	SER-4348	163	Serthi	Kamzhing	**0.021**
2	Pema Ugyen Namdrol	11103000548	JP29	SER-179	125	Serthi	Oranges	**0.021**
3	Pema Wangzom	11111000453	JP19	SER-2185	382	Serthi	Oranges	**0.021**
4	Tashi Peljor	11111000333	JP17	SER-548	40	Serthi	Kamzhing	**0.021**
					Total Pvt. Land Affected			**0.084 Acres**

Table 5-16: Details of Private land falling within the 27m RoW of the 132kV Jomori TL

SN	Plot ID	Gewog	Thram No	Land Owner	CID	Land_Type	Land Area Affected (Acres)
1	SER-1505	Serthi	161	Lumpo	11111001298	Kamzhing	0.856
2	SER-2181	Serthi	381	Dorji Tshering	11111000454	Oranges	0.003
3	SER-1233	Serthi	114	Sompo	11111001755	Kamzhing	0.233
4	SER-3947	Serthi	929	Norbu Zangmo	11111000211	Kamzhing	0.238
5	SER-2185	Serthi	382	Pema Wangzom	11111000453	Oranges	0.278
6	SER-4430	Serthi	23	Drakpa	11111000399	Oranges	0.123
7	SER-4348	Serthi	163	Dorji	11111001312	Kamzhing	0.229
8	SER-1518	Serthi	163	Dorji	11111001312	Kamzhing	1.370
9	SER-4527	Serthi	882	Jomo Wangdi	11111002563	Kamzhing	0.007
10	SER-555	Serthi	1011	Jangchuk	11111000332	Oranges	0.024
11	SER-554	Serthi	40	Tashi Peljor	11111000333	Oranges	0.031
12	SER-1112	Serthi	940	Thinley Wangdi	11111001748	Kamzhing	0.865
13	SER-3859	Serthi	895	Thinley Dorji	11111001757	Kamzhing	0.016
14	SER-4429	Serthi	32	Tshering Phuntsho	11111000368	Oranges	0.163
15	SER-548	Serthi	40	Tashi Peljor	11111000333	Kamzhing	0.401

16	SER-1547	Serthi	168	Kelzang Dorji	11111000237	Kamzhing	0.042
17	SER-809	Serthi	63	Yonten	11111000423	Kamzhing	0.004
18	SER-565	Serthi	41	Cheki Zangmo	11111000452	Oranges	0.086
19	SER-96	Serthi	29	Lobzang Tshering	11111000456	Oranges	0.001
20	SER-485	Serthi	33	Tendel Wangchuk	11111000408	Oranges	0.025
21	SER-179	Serthi	125	Pema Ugyen Namdrol	11103000548	Oranges	0.555
22	SER-3809	Serthi	870	Nidup Tshering	11111002612	Kamzhing	0.638
23	SER-4436	Serthi	40	Tashi Peljor	11111000333	Kamzhing	0.045
24	SER-3704	Serthi	834	Dawa Norbu	11111001856	Cardamom	0.112
25	SER-817	Serthi	63	Yonten	11111000423	Oranges	0.117
26	SER-4431	Serthi	63	Yonten	11111000423	Kamzhing	0.450
27	SER-3709	Serthi	835	Yangdon	11111000443	Cardamom	0.028
28	SER-3700	Serthi	319	Karma Rinchen	11111000539	Cardamom	0.164
29	SER-1029	Serthi	90	Cheten Tshering	11111001732	Kamzhing	0.092
30	SER-3703	Serthi	467	Ugyen Lhamo	11111001859	Cardamom	0.019
31	SER-228	Serthi	125	Pema Ugyen Namdrol	11103000548	Oranges	1.448
32	SER-1125	Serthi	885	Kinzang Dorji	11111001041	Kamzhing	0.182
33	SER-3980	Serthi	945	Tenzin Dorji	11111001221	Kamzhing	0.032
34	SER-3954	Serthi	920	Tashi Phuntsho	11111001003	Kamzhing	0.248
35	SER-1807	Serthi	1085	Darmo	11111001021	Kamzhing	0.331
36	SER-4943	Serthi	1084	Sonam Chegyel	11111001020	Kamzhing	0.254
37	SER-1083	Serthi	94	Kezang Tshering	11111001714	Kamzhing	0.509
38	SER-4972	Serthi	1129	Dorji Wangchuk	11111001811	Kamzhing	0.119
39	SER-1526	Serthi	956	Ngedrup Dorji	11111001807	Kamzhing	0.007
40	SER-5017	Serthi	1154	Norbu Wangdi	11111002508	Kamzhing	0.036
41	SER-4382	Serthi	102	Norbu Gyeltshen	11111002509	Kamzhing	0.072
42	SER-5016	Serthi	1156	Tashi	11111001322	Kamzhing	0.087
43	SER-3949	Serthi	930	Tshering Zangmo	11111002512	Kamzhing	0.152
44	SER-3783	Serthi	857	Pema Chedon	11111001064	Kamzhing	0.020
45	SER-5095	Serthi	1208	Ugyen Namdrup	11111001065	Kamzhing	0.215

46	SER-1131	Serthi	858	Pema Chezom	11111001191	Kamzhing	0.260
47	SER-1242	Serthi	948	Tashi Lhamo	11111001217	Kamzhing	0.082
48	SER-1581	Serthi	174	Sonam Tenzin	11111001403	Kamzhing	0.332
49	SER-1260	Serthi	1205	Norbu Gyeltshen	11111001061	Kamzhing	0.249
50	SER-5097	Serthi	1206	Chesung Wangdi	11111001062	Kamzhing	0.256
51	SER-1635	Serthi	890	Yangjay	11111002525	Kamzhing	0.112
52	SER-4361	Serthi	168	Kelzang Dorji	11111000237	Kamzhing	0.002
53	SER-1589	Serthi	873	Nungney Lhamo	11111000254	Kamzhing	0.280
54	SER-4117	Langchenphu	1010	Namgay Dema	11103001579	Kamzhing	0.191
55	SER-2209	Langchenphu	1124	Tshewang Tenzin	11111000429	Kamzhing	0.074
56	SER-810	Langchenphu	63	Yonten	11111000423	Kamzhing	0.405
57	PMT-958	Pemathang	264	Mananda Regmi	11108001188	Chhuzhing	0.400
58	PMT-959	Pemathang	264	Mananda Regmi	11108001188	Kamzhing	0.077
59	PMT-372	Pemathang	56	Damber Kumar Nirola	11108000666	Kamzhing	0.169
60	PMT-2113	Pemathang	823	Pema Khandu Rai	11108003097	Kamzhing	0.282
61	PMT-852	Pemathang	439	Mon Bdr. Rai	11108000738	Oranges	0.266
62	PMT-822	Pemathang	219	Santa Bir Rai	11108000733	Oranges	0.211
63	PMT-2639	Pemathang	439	Mon Bdr. Rai	11108000738	Kamzhing	0.069
64	PHT-973	Phuentshothang	595	Mon Bdr. Shangdan	11109002095	Chhuzhing	0.762
65	PHT-1139	Phuentshothang	630	Dawa Dorji Tamang	11109002049	Chhuzhing	0.244
66	PHT-3889	Phuentshothang	213	Chakra Bdr. Kami	11109001487	Residential Land	0.128
67	PHT-66	Phuentshothang	10	Harka Bdr. Yonjan Tamang	11109002138	Kamzhing	0.110
					TOTAL Private Land Impacted by PTL (Acres)		**15.887**

Table 5-17: Details of Community Forest land falling within the 27m RoW of the 132kV Jomori TL

SN.	Community Forest Group	Gewog	ROW_m	Line Length in CF_m	Area_Acres
1	Khandophung Gayjung Kuenphen Norbuling	Serthi	27	438	2.922
2	Raling CF	Pemathang	27	1829	12.203
3	Pemathangka CF	Pemathang	27	50	0.334
	Total CF land				15.459

6. ENVIRONMENTAL AND SOCIAL IMPACTS ASSESSMENT

6.1. Summary of Impact Assessment of the Proposed Project

As result of baseline survey, impact items and result are summarized as table in the below.
Following section from 6.2 to 6.4 will further explained on impact assessment of each item with additional survey results.

Table 6-1： Impact Assessment on Jomori Transmission Line

Item	Impact item		Rating (Scoping)		Rating (After Study)		Results
			Pre/ construction phase	Operation phase	Pre/ construction phase	Operation phase	
Pollution Control	1	Air Quality	✓	-	B-	N/A	**Construction phase:** Dust is foreseen to be generated during civil engineering works such as land development, and Dust and Air pollutant emissions such as NO_X and SO_X caused by construction of temporary access road is foreseen but the impact is temporary. In addition, emissions from heavy equipment and trucks are possible, but the extent of impact associated with emissions is limited to the vicinity of the construction area. **Operation phase:** No air pollution will occur.
	2	Water Quality	✓	✓	D	D	**Construction phase:** Since there are no plans to construct towers in the river channel, the impact is expected to be minor. In addition, water pollution from chemicals is not expected as there are no plans to use ground improvement chemicals in the construction of the towers.**Operation phase:** No Water pollution occurs as the slope is covered with vegetation.
	3	Waste	✓	-	B-	N/A	**Construction phase:** General and hazardous waste such as plastic, PET bottles, empty cement bags and admixture barrels are generated during construction from construction site. **Operation phase:** No work involving construction occurs, so there is no risk of waste generation.
	4	Soil Quality	✓	-	B-	N/A	**Construction phase:** Possible soil contamination due to leakage of lubricating oil and fuel oil from construction equipment, etc. **Operation phase:** No soil contamination occurs because no work involving construction.

Item		Impact item	Rating (Scoping)		Rating (After Study)		Results
			Pre/ construction phase	Operation phase	Pre/ construction phase	Operation phase	
	5	Noise and Vibration	レ	-	B-	N/A	**Construction phase:** Noise and vibration impact is expected due to the operation of heavy machinery and trucks, and construction of temporary access road but the impact area is limited to the vicinity of the construction area. **Operation phase:** No noise and vibration will be generated because no work involving construction.
	6	Subsidence	-	-	N/A	N/A	**Construction phase:** There are no plans to use ground improvement chemicals and no impact on bottom sediment is anticipated. **Operation phase:** No impact on bottom sediments is expected from the transmission facilities.
	7	Odor	-	-	B-	N/A	**Construction phase:** Odors are expected if waste materials are not properly disposed. **Operation phase:** No odor is expected to be generated.
	8	Sediment	-	-	N/A	N/A	**Construction phase and Operation phase:** No special impact is expected since there is no continuous drainage to rivers, etc.
Natural Environment	9	Protected Areas	レ	レ	A-	A-	**Construction phase:** The transmission line (recommended proposal) will cross the Jomotsangkha Wildlife Sanctuary (JWS), and therefore, impacts to the natural physical environment in the project area due to tree cutting, digging, air pollution, noise generated by construction activities and construction of temporary access road are expected. **Operation phase:** Impact of landscape degradation due to steel towers is expected.
	10	Biodiversity	レ	レ	A-	A-	**Construction phase:** Construction work including (access road) involves clearing and rooting, resulting in loss of vegetation and fragmentation and loss of animal habitat on a certain scale, as well as air pollution and noise due to the operation of heavy machinery and deep excavation at the location of the tower, which is expected to have an impact on animals in the Jomotsangkha Wildlife Sanctuary (JWS). **Operation phase:** Impacts on behavior of large mammals such as elephants, bird strikes, etc. are expected. In forested areas, the impact is expected to be the felling of trees to maintain separation distances under the line at regular intervals and the fragmentation and loss of animal habitats.
	11	Hydrology	-	-	N/A	N/A	**Construction phase and Operation phase:** No particular impact is expected since the project does not involve any construction work on the water vein.
	12	Topography and Geology	-	-	N/A	N/A	**Construction phase and Operation phase:** No significant topographic change is expected, so no particular impact is anticipated.

Item	Impact item		Rating (Scoping)		Rating (After Study)		Results
			Pre/ construction phase	Operation phase	Pre/ construction phase	Operation phase	
Social environment	13	Land acquisition and Resettlement	✓	-	B-	N/A	**Pre-construction**: As a result of field survey and hearing from local government and residents, 0.08 acres private land acquisition of 3 HHs are planned. No local residents live in the project site, thus residential resettlement is not required. **Operation phase:** No additional resettlement or land acquisition is anticipated.
	14	Socially Vulnerable Groups	✓	✓	D	D	As a result of field survey and hearing from local government and residents, no socially vulnerable groups (the poor, disability, hhs without civil registration, etc.) are identified among project affected persons.
	15	Ethnic Minorities and Indigenous Peoples	✓	✓	D	D	As a result of field survey and hearing from local government and residents, no indigenous peoples are confirmed in the project site.
	16	Local economy, including employment and means of livelihood	✓	✓	B+/-	B+	**Pre-Construction Phase:** Cardamon and orchard products will be lost by permanent land acquisition. **Construction phase**: Employment opportunities arise as construction workers. **Operation phase:** Local residents could be employed to assist in the operation and maintenance of the transmission line.
	17	Land use and local resource use	✓	✓	D	D	As a result of field survey and hearing from local government and residents, although transmission line pass through a part of community forest areas near Phuntshothang substation, it is predicted that no impact on livelihood of local people.
	18	Existing social infrastructure and social services	✓	✓	B-	D	**Construction phase**: Traffic volume of trucks is predicted to be increased during the construction. **Operation phase**: No impacts are predicted since there are no public facilities or private houses within near transmission line.
	19	Labor Environment	✓	✓	B-	C	**Construction phase**: A number of workers will be temporarily staying at the construction site, accordingly, appropriate considerations are required to be planned and implemented in terms of employment conditions and safety for various workers, including domestic and foreign workers, gender-wise considerations, etc. **Operation phase:** BPC is required to manage their staff in charge of transmission line in accordance with the Labour and Employment Act 2007 and also the Occupational Safety and Health Policy (OSPH).
	20	Sanitation, Safety and security in local society	✓	-	B-	N/A	**Construction phase**: The inflow of many workers at the construction site may result in infectious disease outbreaks, deterioration of public safety, etc.

Item	Impact item		Rating (Scoping)		Rating (After Study)		Results
			Pre/ construction phase	Operation phase	Pre/ construction phase	Operation phase	
	21	Cultural heritage	✓	✓	D	D	According to GIS data of cultural heritage information and also hearing from the local government and residents, there will be no impacts on local historical, cultural, or archaeological properties, land features near the transmission line.
	22	Scenery	✓	✓	D	D	As a result of hearing from the local government and residents, the potential for negative impacts on the landscape is not confirmed.
	23	Gender	✓	✓	D	D	As a result of hearing from the local government and residents, implementing agency, any particular gender-wise considerations are not confirmed.
Other	24	Accident	✓	✓	B-	B-	**Construction phase**: There is a possibility of accidents due to construction activities. Also, traffic accidents can be happened due to increased traffic. Also, elephants attack to local people are reported in the project site area, therefore, it should be noted during construction work. **Operation phase**: Accident may occur during maintenance work of transmission tower and line.
	25	Transboundary impacts, and climate change	-	-	D	D	Transmission lines do not cross the border. **Construction phase:** Construction activities will generate CO_2, but it is temporary and have a very negligible impact on climate change. **Operation phase**: no CO_2 is generated.
	26	Poaching	✓	-	B-	D	**Construction phase:** Illegal hunting may be expected by workers. **Operation phase:** Illegal hunting may not be expected by workers, as they will not be stationed at the site after the construction work is completed.

レ : Impact is expected or unknown (further examination is needed, and the impact may be clarified as the study progresses)
— : No impact is expected.
A+/- : Significant positive/negative impact is expected.
B+/- : Positive/negative impact is expected to some extent.
C : Extent of positive/negative impact is unknown (further examination is needed, and the impact may be clarified as the study progresses).
D : No impact is expected.
N/A : Impact assessment was not performed due to a D in the scoping phase.

(Source: JICA Survey Team)

6.2. Environmental Impacts

6.2.1. Environmental Impacts pre-construction phase

During pre-construction period, not so many impacts are foreseen and preparatory work for starting project implementation would have some impacts. Except for field surveys, public consultations, and material procurements there are no pre-construction activities involving damage or disturbance to natural environment.

Table 6-2: Environmental Impacts during Pre-Construction Phase

Env. Quality component	Impacts
Air Quality	- Air pollutant emissions resulting from pre-construction activities such as route selection surveys, geotechnical investigation, and material procurements are anticipated to occur, but their impact is expected to be negligible.
Noise and vibration	- Noise and vibration caused by the implementation of pre-construction activities such as route selection surveys, geotechnical investigation, and material procurements are anticipated to occur, but their impact is expected to be negligible.

6.2.2. Environmental Impacts during Construction Phase

The erection of towers, installation of high-tension cables, and the construction of access roads, particularly in forested regions where many transmission towers are situated, necessitates construction of access roads & rope ways for transporting construction materials. This process involves clearing vegetation, excavating along steep slopes, blasting in rocky terrain, and depositing excavated material at excavation sites. Therefore, the likely environmental impacts of these activities are detailed in the table below.

Table 6-3: Impacts during Construction Phase

Env. Quality component	Impacts
Air Quality	- Dust is expected to arise during civil engineering activities like land development and access road construction, but its effect is temporary. Moreover, emissions from heavy machinery and trucks may occur, yet their impact is confined primarily to the construction site's vicinity.
Noise and vibration	- Anticipated noise and vibration effects stem from the operation of heavy machinery, trucks, and access road construction. However, these impacts are localized primarily within the vicinity of the construction area. Additionally, heightened human activity in the vicinity could contribute to noise levels.

Pressure on resources (water resource)	- During peak construction, approximately 200 workers will be stationed at various labor camps along the TL route. This influx of workers will demand a significant amount of water, with each individual needing 50 to 100 liters daily, totaling around 14,000 liters per day during construction. The water at these labor camps will serve multiple purposes, including household tasks, latrines, drinking, and foundation casting at the construction site. - To alleviate strain on existing community water supplies, separate water sources will be utilized for construction activities.
Soil Quality	- Removal and exposure of topsoil leading to erosion from wind and rain; - The project is expected to produce approximately **57,246 m^3** of excavated soil, mainly from benching and foundation activities for tower footing. Concerns include potential slope instability and obstruction of drainage paths due to excavated materials. However, the impact is projected to be minimal as over 95% of the excavated soil will be reused in backfilling for tower footing reinforcement. Additionally, most tower locations are positioned remotely from water bodies, mitigating the risk of significant soil runoff into rivers. Therefore, the environmental impact of excavation work is site-specific and temporary. - Possible soil contamination due to leakage of lubricating oil and fuel oil from vehicles, machinery and equipment maintenance.
Waste	- Solid wastes are expected to be generated from construction activities, worker camps, and offices. - According to national waste data, the average individual generates approximately 0.23 kg of waste per day. Therefore, each camp is projected to produce a total estimated residential solid waste of 9.2 kg per day (0.23 × 40 workers in each camp) or less, considering their remote location. - However, it's important to note that waste estimation is based on the maximum anticipated number of workers, and these risks can be effectively controlled and mitigated through proper measures outlined in the EM&MP. - Littering and open-air dumping have the potential to contaminate the soil, while improper disposal of waste materials may also result in odors.
Protected Area	- The transmission line passes through the JWS, leading to expected impacts on the natural physical environment of the project area. These impacts encompass tree cutting, excavation, air pollution, and noise from construction activities, along with the construction of access roads. However, it's important to note that disturbance and potential damage to protected species and habitats are confined to the multiple-use and buffer zones, excluding the core zone.
Biodiversity	- Construction activities, particularly the development of access roads, involve the clearance of vegetation, resulting in habitat loss and fragmentation for

	wildlife. Moreover, the operation of heavy machinery and deep excavation near tower locations can introduce air pollution and noise, potentially impacting the animals residing within the Jomotsangkha Wildlife Sanctuary (JWS). Furthermore, disturbances to wildlife and their habitat are expected from activities such as blasting, rolling rocks, and burial of vegetation under excavated soil alongside the access road. There is also a notable risk of birds colliding with power lines installed during construction. Additionally, concerns arise regarding the illegal fishing and hunting of wildlife by construction workers, posing a direct threat to the fauna within the sanctuary.
Loss of Forest/vegetation cover	- Construction activities, including the creation of access roads, can significantly impact vegetation. This involves the cutting or removal of all vegetation, including trees, with an estimated total of 39,273 trees to be cut for access road construction, ropeway installation, and right-of-way clearing for transmission line activities. However, due to the deep valley crossings along the transmission line route, clearing a 27m RoW for the entire route is not required. Instead, for valley crossings, a 4m ROW clearance for conductor spanning is deemed sufficient. Additionally, an 80% removal rate is considered, recognizing that many electric lines will traverse deep ravines and valleys where vegetation removal may not be as extensive as initially estimated.
Poaching Threats	- The remote tower locations and labor camps, situated far from towns, face a significant threat of poaching due to the large number of workers gathering in these areas. The lack of easy access to meat increases the temptation for poachers. Additionally, the scattered nature of labor camps along the TL route through the jungle presents a challenge for Forest Officials to maintain constant vigilance. However, the heightened risk is deemed temporary and manageable through measures such as increased awareness, clear guidelines for workers, and consistent monitoring by both contractors and the BPC.
Accident	- Accidents are a potential risk during construction activities, particularly during foundation casting, tower installation, and stringing. These tasks involve working in hazardous environments, such as the risk of falling boulders during foundation works, working at heights during tower installation and stringing, and felling trees to clear the RoW. Additionally, increased traffic may lead to traffic accidents, and there have been reports of elephant attacks on local people in the project site area, necessitating caution during construction. Despite the heightened risk levels during construction, these impacts are typically temporary and can be effectively mitigated through the implementation of proper health and safety measures.

6.2.3. Environmental Impacts Operations phase

It is expected that most of the assessed impacts are taken care of during the period of construction activities. However, considering that the project infrastructure and associated operations and maintenance activities

will take place during the operational phase, there would be likely impacts if appropriate mitigation measures are not undertaken. Likely environmental impacts post construction operational phase are given in the table below;

Table 6-4: Impacts post construction operational phase

Env. Quality Component	Impacts
Air Quality	- Air pollutant emissions from the implementation of pre-construction work
Noise and vibration	- Noise and vibration caused by the implementation of pre-construction work
Biodiversity (Electrocution of Birds)	- Collision and electrocution of birds: Electric lines coming in the way of flight paths of avian species may lead to collision and electrocution of high-flying birds especially the near threatened Great Hornbills.
Improper closure of project work sites	- In order to safeguard human health and the environment from potential threats posed by project components in the future, it is imperative for the BPC to oversee the meticulous closure of pre-construction and construction project activities, including worker camps and storage sites along the TL.

6.3. Social Impacts before and during construction phase

For assessing the impacts on the social environment, the survey team conducted interviews and discussions with Dzongkhag Administration Officials, Local Government functionaries during the month of November 2023. Gewog level public consultations, interviews with affected groups and local government functionaries were held in January 2024 and a National Stakehoder meetings was organized in February 2024 for seeking comments and feedback. A project affected population survey was conducted from the 20th February to 2nd March 2024. Additional interviews with the Tshogpas of affected chiwogs were held. The objective of the survey was to identify the project affected persons (PAPs) and take stock of the socio-economic situation of the affected households, the nature and level of impacts and identifying the level of vulnerability that exists among the population.

Using structured questionnaire and trained enumerators ensured consistency and reliability in data collection. Pre-appointments were made with affected households through the local representatives and all households available for survey during the period were surveyed. Cleaning, organizing, and analyzing the data in Excel spreadsheets was a crucial step in making sense of the information gathered. It allowed for the identification of trends, patterns, and key findings that will inform the development of a Resettlement/ Land Acquisition Plan aimed at ensuring fair compensation for those affected. The Table below provides a snapshot of the Survey respondents:

Table 6-5: Details of Survey Respondents

	Total HH	Those affected by tower (TL)	Those affected by ROW (TL)	Remarks
HHs affected	57	4	57	All Tower Land for Acquisition is under Serthi Gewog
HHs surveyed	37	4	37	
% Surveyed	65	100	65	

13 out of the 37 respondents were females and 24 out of the 37 were male headed households. 32 of the 37 respondents were illiterate and the other 5 had some degree of education either western or monastic.

6.3.1. Land Acquisition and Resettlement

During the preliminary walk-on surveys of the TL, the involvement of the Tshogpas for route identification ensured minimization/ avoidance of settlements, private land, wetland, culturally significant sites and other properties. Land acquisition can be of two types, temporary and permanent. Land acquired to set up labor camps and stores are temporary whereas, permanent land acquisition is required for tower construction.

For the proposed 63km of PTL project, there are 152 towers to be constructed and only 4 numbers of towers fall in private land. Approximately **8.4 decimals** of land need to be acquired permanently from the 4 affected land owners, since each tower base occupies around **2.1 decimals** of land.

Its is to be noted that in the case of Power Transmission Lines, the BPC doesnot have to aquire or pay lease payments to the Government for the land that is impacted by the Project. This is mainly, as per discussions with BPC officials from the Environment Section, to ensure that the BPC is able to keep it mandate of social service by keeping electricity costs at affordable prices.

The permanent land acquired by the project is minimal; hence, there will be no impact on the income of the individual households due to land acquisition. Also, as assessment of impacted land viz a viz total land holdings was carried out to determine if any of the affeced households meet the threshold for being classified as "Adversely Affected Family(ies)" to determine if the additional safeguard measures under the Sustainable Hydro Power Policy 2020 area applicable. It was concluded that none of the affected population can be classified as Adversely Affected Family(ies) as none of the affected population lose more than 25% of their land nor their homastead. Similar assessment was carried out for RoW, although, not for permanent acquisition, to determine the degree of impact and it can be concluded that it does not have a significant impact. The total Land Holdings of the PAPs are attached as Appendix 11.

All the 4 households affected by Land acquisition for construction of Tower stand to lose only less than 1% of their total land holdings. However, during the survey, all the 4 households responded that they would opt to go for a land replacement or realignment. Hence, based on the information it can be concluded that the acquisition will not have major bearing on their livelihood. Further during the survey, all 4 households confirmed that they do not reside in the affected land.

Similarly, the RoW impacts the land of 57 households across the 4 gewogs. However, a comparison of their land holdings viz a viz the impacted land, 44 of the households are impacted on less than 5% of their total land holdings, 8 households less than 10% but more than 5% and 4 households more than 10% but less than 20%.

Only 1 household has the RoW impacting residential land in Phuntshothang Gewog. However, during the Survey, it was found that he is currently living on the Land and already has a concrete, single story cottage and the proposed line runs over the edge of his land and does not disrupt or cause any need to move the house. Considering, RoW implications are principally for infrastructure construction and 56 of the households are impacted over dry land or orchards, minimal impacts on livelihood is expected.

6.3.2 Socially Vulnerable Groups

The 37 respondents reported income ranging from Nu. 40,000 to Nu. 700, 000 in the households. However, these are to be noted as additional cash income, as most of the households are subsistence farmers and grow most of their food requirements. It is to be noted that all households report some income. 26 out of the 37 households reported having a family living away and out of these 26, 9 households reported receiving remittances from them.

All 37 respondents reported having access to piped drinking water connections, electricity and owning mobile phones. 34 households reported being connected to the road and 3 households reported having to walk less than 30 minutes to the road.

Of the 37 respondents 31 were living single story cottages, 5 in structures which were 2 floors and 1 reported living in a structure taller than 2 floors. 28 of these houses were permanent structures and 9 semi-permanent.

28 of these are owned and built the respondents, 6 inherited their family homes and 3 respondents live rented houses.

For the purpose of this Assessment, as the respondent group are primarily farmers, to determine vulnerability on income is complex and unclear. Hence, in addition to income level, status of food insecurity, all female

households, senior citizen households and households with disabled family members were used to determine if any of the respondents are considered socially vulnerable.

All 37 households reported not facing food insecurity, and many reported as sharing their paddy harvest with their relatives who live outside of the Dzongkhag.

None of the households interviewed were comprised of all females, or composed of only senior citizens (65 and above) and none of the respondents had family members who were Person with Disability.

Based on these findings, it can be concluded that there are no socially vulnerable groups in the affected population)

6.3.3 Ethnic Minorities and Indigenous Groups

The Project area is not located in areas where there are groups which have been identified as Ethnic Minority or Indigenous groups by National Laws. However, during interviews and meetings with Dzongkhag officials and elected representatives from the communities, it was confirmed that there are no ethic minority or indigenous groups in the affected areas in the 4 gewogs.

During the survey, the respondents were asked if the households identified either as a minority or indigenous group and all respondents confirmed the households do not belong to any specific group or consider themselves a minority. Further, they were also asked if they know or area aware of any minorities/ groups in the project area and their responses confirmed the absence of any minority or indigenous group, as stated by officials.

6.3.4 Local Economy, including employment and means of livelihood

35 out of the 37 respondents are engaged in farming for self-consumption and cash income. 1 reported being employed in the private sector and 1 household being engaged in spiritual and religious activity. However, of the 35 households engaged in farming, 9 reported also being engaged in livestock rearing, 3 reported also carrying out small business activities, 3 reported pension income as well, 2 employed as private sector employees and 2 reported working as a seasonal farm worker for other people.

The project will have some impact livelihood means as the impacted land is agriculture land. However, considering the acquisition component is only 0.21 acres of land from each of the 4 impacted households, and their total land holdings, the anticipated impact on livelihood is very low.

During Construction of the PTL, the areas under RoW might also cause some damages to crops and lead to the destruction of some trees (in orchards), however, these are minimized during construction and can only be determined during the actual construction and stringing of the lines. However, these damages are also assessed jointly with the relevant competent authority and compensated based on the rates prescribed by the Property Assessment Valuation and Agency (updated every three years). The latest rates from the Agency are the Compensation Rates 2022.

All of the respondents expressed hope and aspirations that the project would entail the opportunities for them to sell their agriculture produce, set up small businesses and also employment opportunities for the residents during time of construction and during the operational phase.

The Business Owners interview in the 4 gewogs expect the project to increase the local population and create some increased transactions in the local economy. However, some apprehension was also shared by some respondents on more people opening businesses and diluting the gains for individual business owners.

6.3.5 Land Use and Local Resource Use

The PTL RoW will also lead to the clearing of trees in the CF and a total area of 15.459 acres of belonging to 3 Community Forest Groups will be acquired. The CF is based on user rights and it is stipulated under the regulations that the Government shall exercise right to implement and execute any developmental activity of national importance in the Community Forest. In the event the Community Forest is taken over by the government, a fair compensation determined by the Department may be paid to the Community Forest Management Group. This compensation is calculated based on a minimum royalty fee determined by the Department) for each tree cut in their community forest. A joint tree enumeration and verification is conducted by Forest officials, CF management, and BPC and concern contractor/s during the construction phase and paid by the BPC.

These Community Forests are primarily used for collection of Non-Wood Forest Products and the trees are used by the community members for meeting their building needs and other communal needs. However, considering that the affected are composes 12% of the CF in Serth and less than 3% in Pemathang Gewog, it can be concluded it will not have a major bearing on activities of the communities in accessing local resources from the forest. However, it should also be noted that foraging activities for non wood forest products is not limited to only the CF, but the residents also access other parts of state reserve forests to harvest these products under the rules and regulations of the Department of Forest and Park Services.

6.3.6 Water Use

Through interviews with local government officials and the Tshogpas of the affected chiwogs, it was validated that the project would not have any impact on water sources for drinking or irrigation.

During the survey, all respondents confirmed that the project wouldn't impact any water sources. Further, it was also found that all of the respondents have piped waster connection to their homes and enjoy access to safe drinking water.

6.3.7 Exisiting Social Infrastructure and Social Services

Through Interviews with Dzongkhag and Local Government Officials it was validated that project and its path would not have any impact on any existing social infrastructure and social services. However, during the survey, most of the respondents expressed hope for improved road infrastructure in the area due to the project.

6.3.8 Labour Environment

The BPC in its operations ensures compliance with the Labour and Employment Act. Similarly, contractors operating in Bhutan have to adhere to the Labour and Employment Act 2007, Regulation on Occupational Health, Safety and Welfare 2002, Regulations on working conditions 2022 and also the Regulation on Occupational Health and Safety for Construction Industry 2002. Additionally, as migrant workers will be hired, the contractor will be required to comply with the Regulation on Foreign Workers Management 2022.

6.3.9 Sanitation, Safety and Security in Local Area

9 of the respondents of the 37 households interviewed had Toilets inside their homes and the rest had it outside their homes. 28 of the homes were outfitted with pour flush toilets and the 9 homes were fitted with latrines with closed pit and water seal.

The gewogs of Serthi, Langchenphu and Samrang are serviced by the Police Station at Jomotsangkhag Dungkhag and Phuntshothang and Pemathang by the Police Station at Samdrupchholing Dungkhag. In Samrang, there is an additional police outpost, due to the border crossing into India from the gewog. Additionally, Langchenphu is also homebase to a wing of the Royal Bhutan Army and another Army base is set up in Dewathang, which neighbors Phuntshothang.

6.3.10 Cultural Heritage

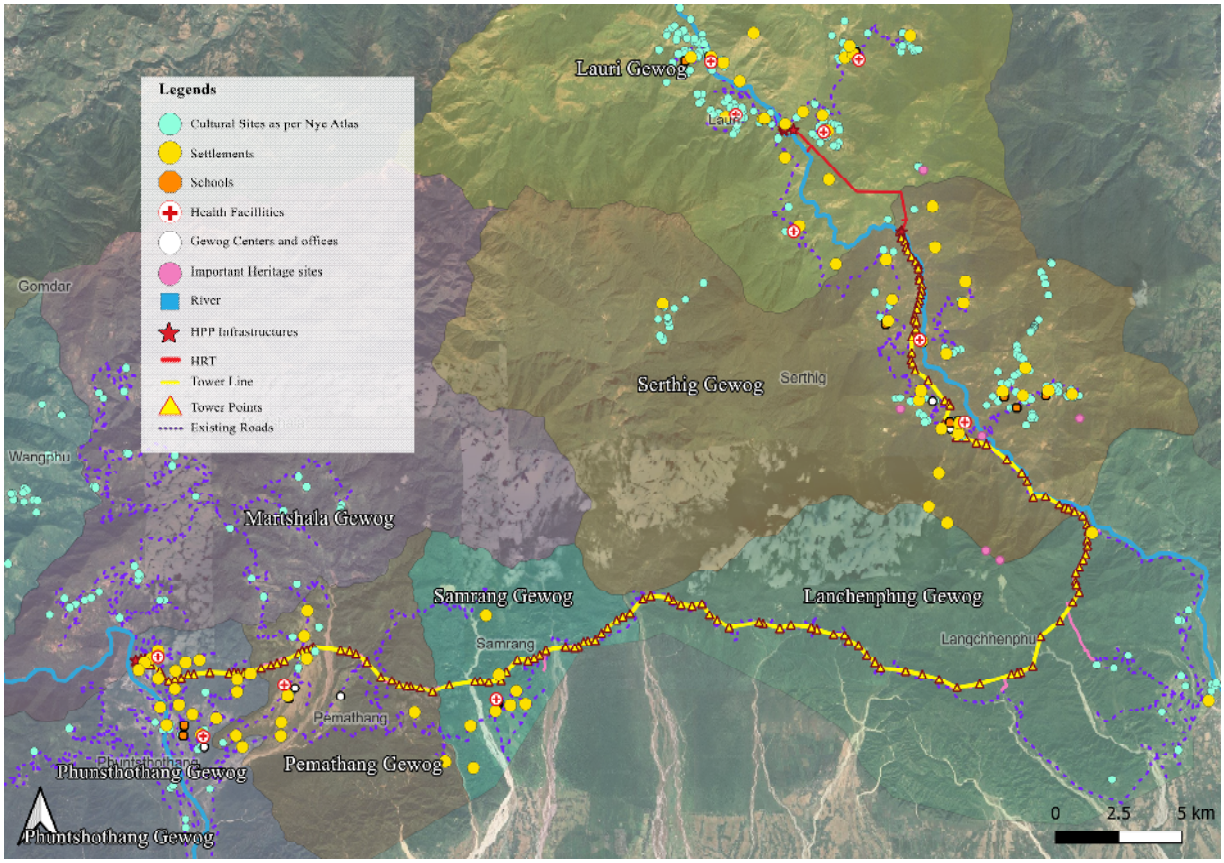
Based on interviews with local government officials and Tshogpas of the affected chiwogs, it was confirmed that the project would not have any impact on any cultural or heritage site. This was further validated by all 37 respondents to the survey confirming that there are no such sites located in the affected land.

Further based on the feedback from the Department of Culture from the National Stakeholder Meetings, data for cultural and heritage sites were obtained from the National Land Commission (Ney Atlas[7]) and publications on sites in Samdrup Jongkhar Dzongkhag from the Department were transplanted and their locations pinned on google maps with the help of the local government officials to ascertain the location of these sites. The data available was then plugged into GIS software and overlayed with the PTL components and buffers were generated around the PTL components to ascertain impacts.

Based on these interviews and GIS analysis of the data from National Land Commission and Department of Culture, it is concluded that there will be no impact on cultural and heritage sites that are significant nationally and locally.

The map below provides an overview of the PTL viz a viz cultural and heritage sites.

[7] Ney refers to sacred sites



Map 6-1: Overview Map of the PTL viz a viz cultural and heritage sites

6.3.11 Scenery

The TL project primarily traverses remote areas and forests, it is expected to have minor to insignificant impacts on visual aesthetics. However, during interviews with local governments, it was found that there are no tourism activities in the gewogs.

During the survey, respondents were asked how they feel about the impact of the project on the scenery and 20 of the respondents expressed that it does not make any difference as there are already other distribution lines transversing the geowgs, 16 felt positive about the changes which they associated with development and opportunities in the community and 1 shared negative feeling associated with damages caused to the environment and scenery.

However, as the proposed TL is running along the highway under construction and the existing BPC distribution line, the project is expected to have minimal impact on the scenery.

6.3.12 Gender

The Constitution of Bhutan mandates that fundamental rights are equally bestowed equally men and women, fundamental duties mandate every Bhutanese not to tolerate abuse of women, and principles of state policies intend and guide actions to eliminate discrimination against women and children. Bhutan has also ratified international treaties like Convention on the Elimination of all forms of Discrimination against Women (CEDAW). Bhutan also released its National Gender Equality Policy 2020 and provides an overarching directive for gender equality and women's empowerment.

The Labour and Employment Act of Bhutan 2007, which serves as the principal law relating to all matters of labour and employment is gender mainstreamed and includes sections which clearly establish nondiscriminatory practices in Organizations. All Organizations in the country and required to comply and is enforced by the Ministry of Industry, Commerce and Employment.

Hence, considering the above practices in Bhutan and this specific project being one which isn't targeting women empowerment specifically, it is concluded that no gender mainstreaming strategies need to be developed.

6.3.13 Accidents

Traffic Accidents concerns also were expressed as concerns by the respondents due to increased activity in the area. During the sites visit by the Survey Team, it was observed that there was minimum traffic after crossing Phuntshothang and it appears that vehicle ownership is low in communities and only 5 out of the 37 households interviewed own vehicles.

However, this may not be a major concern and can be overcome by close collaboration with the respective traffic police units under the two Dungkhags and also with the Dzongkhag Traffic unit in Samdrup Jongkhar.

6.4. Social Impacts during Operation Phase

It is expected that most of the assessed impacts are taken care of during the period of construction activities. However, considering that the project infrastructure and associated operations and maintenance activities will take place during the operational phase, there would be likely impacts if appropriate mitigation measures are not undertaken.

6.4.1. Impacts on Local Communities

The Project is expected to have positive impacts on the communities during the construction phase. Usually, BPC outsources the annual works for clearing the right of way along the PTL to the communities in the affected area and this creates seasonal jobs and employment opportunities for the residents.

As the Transmission Line will be managed under the existing BPC Phuntshothang Substation, it is not expected to create additional settlements of population influx during the operation phase. Similarly, once the construction is completed, traffic flow is also expected to normalize.

6.4.2. Impacts on workers

Workplace accidents are possible and considering the high voltage of the Transmission Line it is pertinent that Occupational Health, Safety and Welfare measures are operationalized, implemented and monitored by the BPC.

7. INFORMATION DISCLOSURE, PUBLIC CONSULTATION AND PARTICIPATION

7.1. Stakeholder Analysis

The identification of stakeholders for this analysis is done by discussing executing agencies and referring to secondary sources including stakeholder analysis done by DGPC in ESIA for JOMORI Hydropower Project. Different types of stakeholders have to be engaged in different ways from information dissemination to consultation, dialogue, working together and partnership, from the onset of project till its completion. Stakeholders are identified in various aspects in relation to the project.

Category of the group of stakeholders related to the project is summarized in table below. Local stakeholders such as residents around the project site including Project Affected Peoples (PAP), local government agencies such as Dzongkhag/Dungkhag and Gewog Administrations are critical and therefore it is necessary to obtain consensus on the project. Central government organizations such as DoFPS, DoECC, DoE, National Land Commission, etc. are categorized as regulatory stakeholders due to their power and project's reliance on these agencies for approval and co-ordination. These stakeholders need to be kept always informed regarding the social, environmental, financial and technical issues on execution of the project. These are also the agencies who will continuously monitor the project implementation. Other stakeholder group such as NGOs/CSOs in the field of environment protection or social support need to be kept aware of essential information of the project so that they can provide insights and suggestions for better environment management. Institute such as Jomotsangkha Wildlife Sanctuary Park office (under DoFPS) and also NGOs such as Royal Society for the Protection of Nature (RSPN) will be involved particularly during the construction phase to collaborate on conservation activities, if deemed necessary as an outcome of baseline data augmentation.

Table 7-1: List of Stakeholders of the Project

Implementing Agencies

No.	organization name	Roles, relationships, etc.
1	Druk Green Power Corporation Ltd (DGPC)	Power plant project planning, operation and maintenance management organization
2	Bhutan Power Corporation Ltd (BPC)	Transmission line project construction, operation and maintenance organization
3	Druk Hydro Energy Ltd (DHyE)	Power Plant Project Construction Organization

Central Government Regulatory Bodies

No.	organization name	Roles, relationships, etc.
1	Department of Environment and Climate Change, Ministry of Energy and Natural Resources	The Department is responsible for planning and activities related to environmental protection and climate change, and is the competent authority for EIA and SEA (Strategic Environmental Assessment).

2	Department of Forest and Park Services, Ministry of Energy and Natural Resources	Planning and activities related to the management of forests and protected areas in the target area.
3	Department of Energy, Ministry of Energy and Natural Resources	Energy jurisdiction, including electricity.
4	Electricity Regulatory Authority, Ministry of Energy and Natural Resources	Jurisdiction over power regulation-related matters.
5	National Land Commission Secretariat	Planning and activities related to land management, acquisition, etc.
6	Ministry of Home Affairs	Jurisdiction over the administration of indigenous peoples and nationalities in the country.
7	Ministry of Infrastructure and Transport	Jurisdiction over construction and maintenance of roads in the country.
8	Ministry of Industry, Commerce and Employment	Jurisdiction over labor regulations and employment.
9	Ministry of Education	Jurisdiction over education policy, school construction permits, etc.
10	Ministry of Health	Jurisdiction over health policy, construction permits for health posts, etc.

Local government agencies

No.	organization name	Roles, relationships, etc.
1	Dzongkhag and Dungkhag government agencies (Samdrup Jongkhar Dzongkhag and Jomotsangkha Dungkhag)	Local government agencies at the prefectural and county level in the project area.
3	National Park Office (Jomotsangkha Wildlife Sanctuary)	same as above
4	Gewog Administration (5 gewogs)	Dzongkhag-level local government agencies of the project site.

Target Area Residents

No.	Organization Title	Roles, relationships, etc.
1	Project Affected People such as land acquisition targets	Needs to be discussed as they are directly and negatively impacted by the acquisition of land by the project.
2	Agriculture Groups and Cooperatives	The organization arose from the initiative of local farmers.
3	Merchants and other business-related businesses Business Owners	Non-agricultural local business actors. Trends in electricity needs and related.

NGOs, others

No.	Organization Title	
1	Royal Society for the Protection of Nature	Planning and activities for ecosystem conservation and wildlife (especially birds) protection (established in 1987)
2	Bhutan Ecological Society	An organization of researchers and others in the environmental field.
4	World Wildlife Fund	Planning and activities for ecosystem conservation and wildlife protection (established in 1992).
5	Bhutan Trust Fund for Environmental Conservation	Financial support for nature conservation activities.

7.2. Public Consultation

In accordance with **Article 16 of the Environmental Assessment Act (EA Act) 2000** and **Chapter VI of the Regulations for the Environmental Clearance of Projects 2016**, a public consultation meeting was conducted involving affected individuals, Gewog administration, and the community. During this meeting BPC presented detailed information regarding the project, including its duration, objectives, and both positive and negative impacts. Public consultation meetings were held in all affected Gewogs, including the affected community forests, with specific objectives:

a) Raising awareness about the proposed project.

b) Consulting with and gathering recommendations from the Dungkhag and Gewog administration.

c) Providing an opportunity for communities in areas where the proposed transmission line is expected to pass to voice their concerns and issues.

d) Gathering feedback from affected individuals on anticipated problems and potential solutions.

The public consultation meeting consisted of two parts: first, presentations by BPC on project details, aims, objectives, analysis of alternatives, pros and cons, and explanations of relevant rules and regulations on land substitution and compensation. The second part included a presentation by the JICA consultant on ESIA aspects.

Feedback from consultations revealed that residents of affected Gewogs had no prior knowledge of the proposed project but showed a positive attitude towards it, expressing approval. The local population demonstrated unwavering support, willing to offer their land in exchange for compensation or land substitution as per government rules. Concerns raised during the meeting included minimizing impacts on land and the environment, employment opportunities for locals, accurate measurement of affected land for tower construction, design routes to avoid inhabited areas, and ensuring adequate awareness during the construction period to prevent accidents.

(1) The First Public Consultation for the Jomori Transmission Line (from the 22nd -24th January 2024)

The First Local Consultation meetings for the Jomori Transmission Line was organized at the Gewog level. Over the course of three days, project affected population including members of the affected community forestry groups and gewog officials from the Forest, Agriculture and Health were also present and the Land Registrar, Agriculture and Environment Officers from the Dzongkhag Administration also attended the consultations.

During the consultation, the project overview, its potential positive and negative impacts including private land acquisition were presented by the BPC and JICA Survey Team and the floor was open to questions.

<Serthi Gewog>

The Consultation meeting for Serthi Gewog was held on the 22nd of January 2024 (Community Hall, Serthi Gewog Administration, 11 am to 2 pm). 53 (41 males, 12 females) participants were present for the consultation.

Table 7-2: Main Comments and Responses for JOMORI Transmission Line Consultation in Serthi Gewog

Comments/ Questions from participants	Response/ Explanation
Some residents shared concerns that falling under ROW requirements imposes restriction on construction but does not provide compensation.	The Land Registrar of Samdrup Jongkhar Dzongkhag, informed the participants, that under special circumstance, if that is the only plot available to the person to construct their home, the affected person can be provided with land substitute. He also informed the group, that in case of any damages caused by the project, the affected people are eligible for compensation, and such cases should be submitted to the Gewog Administration or Dzongkhag Administration for verification and compensation.

Mr. Yeshey Wangchuk, BPC invited the affected landowners for detailed review of how the proposed TL alignment will affect the identified plots. He thanked all stakeholders, representatives, and landowners for their participation. This was followed by review of the TL alignment maps with each member after which members present signed the no-objection form.

<Lanchenphu Gewog>

The Consultation meeting for Langchenphu Gewog was held on the 23rd of January 2024 (Conference Hall, Jomotsangkha Wildlife Sancturary Office, 10 am to 1 pm). 17 (11 males, 6 females) participants were present for the consultation. There were no comments and clarifications sought during the consultation by the participants. Mr. Yeshey Wangchuk, BPC invited the affected landowners for detailed review of how the proposed TL alignment will affect the identified plots. He thanked all stakeholders, representatives, and landowners for their participation. This was followed by review of the TL alignment maps with each member after which members present signed the no-objection form.

<Samrang Gewog>

The Consultation meeting for Samrang Gewog was held on the 23rd of January 2024 (Community Hall, Samrang Gewog Administration, 5 pm to 6:30 pm, 23rd January 2024). 7 (all males) participants were present for the consultation. Since there were no landowners affected by the TL in the Gewog, Mr Yeshey Wangchuk

of BPC briefed the Gup, Mangmi, and the Tshogpa on the transmission line project. During the review of the proposed alignment the Gewog Officials led by the Gup shared concerns of the alignment and proposed changes which are listed below:

Table 7-3: Main Comments and Responses for JOMORI Transmission Line Consultation in Samrang Gewog

Comments/ Questions from participants	Response/ Explanation
Local residents commented that realignment of towers between PJ37 and PJ 48. The proposed realignment will not only help protect the Ngangtsho lake, which is the source of water supply for the Gewog office and the town but also reduce distance (and may be cost). This information flagged the need for cautious approaches to construction of towers to avoid disturbance to geology, soil and ecological stability of the lake.	BPC clarified that these consultations are to bring these considerations in design. It was agreed that the BPC Official would make a site visit with the gewog officials and make the necessary changes (if possible, based on the site visit). Post the consultation, Mr. Yeshey Wangchuk, BPC officer, visited the site and was able to change the design to incorporate the proposed changes to avoid the concerns raised the Gewog Officials.
Local residents asked the realignment of towers PJ31 to PJ36 which pass above Tsho Dhuen (7 ponds) area.	
Local residents asked realignment of towers PJ56, PJ57, and PJ58: The three towers pass through the area that was previously inhabited. The previous inhabitants were resettled in Dungkarling under Phuntshothang Gewog. In the interest of saving this land for future settlements, the above towers could be realigned.	

Post consultation, Mr. Yeshey Wangchuk, BPC visited the site and was able to change the design to incorporate the proposed changes to avoid the concerns raised the Gewog Officials. In Samrang Gewog, this resulted in realigning the tower between PJ37 and PJ48, re- alignment of tower PJ31 to PJ36 and of towers PJ56 to PJ58. These changes have been incorporated into the TL design. The realignment of these towers falls in SRF land and did not result in any private land being affected. As there are no affected households there was no need for No Objection Clearances.

<Pemathang Gewog>

The Consultation meeting for Pemathang Gewog was held on the 24th of January 2024 (Community Hall, Pemathang Gewog Administration, 10 am to 12:30 pm). 17 (16 males, 1 female) participants were present for the consultation.

Table 7-4: Main Comments and Responses for JOMORI Transmission Line Consultation in Pemathang Gewog

Comments/ Questions from participants	Response/ Explanation
Will compensation be calculated on the basis of tree species? Since there are teak plantations in the CF, how will teak be compensated?	BPC Clarified that the compensation will be based on tree species and also on the age of the trees. This will be paid and calculated based on the Royalty rates determined by the Department of Forest and Park services and assessments will be carried out by the competent authority with the CF and compensation paid into the account of the CF as practiced in other TL Projects.

Mr. Yeshey Wangchuk, BPC invited the affected landowners for detailed review of how the proposed TL alignment will affect the identified plots. He thanked all stakeholders, representatives, and landowners for their participation. This was followed by review of the TL alignment maps with each member after which members present signed the no-objection form.

< Phuntshothang Gewog>

The Consultation meeting for Phuntshothang Gewog was held on the 24th of January 2024 (Local Tshongkhag, Minjigang Chiwog, Phuntshothang Gewog, 1 pm to 4 pm). 13 (12 males, 1 female) participants were present for the consultation.

Table 7-5: Main Comments and Responses for JOMORI Transmission Line Consultation in Phuntshothang Gewog

Comments/ Questions from participants	Response/ Explanation
One member conveyed that Ms. Sancha Maya who is based in Thimphu has expressed unwillingness to accept the TL alignment over her land. (over telephone)	BPC clarified that these designs were made with minimal impact however this would mean carry out other alignments to avoid that and it was agreed that Mr. Yeshey Wangchuk would make site visits with the Gewog Officials to explore realignment solutions.

Post consultation, Mr. Yeshey Wangchuk, BPC made site visits with the Tshogpa, re-alignment was carried out to avoid the private plot for acquisition (who did not agree to acquisition over telephone) and this resulted in reduction of PAPs for Land Acquisition to 3 hhs and the realignment also resulted in avoidance of ROW impacts over Minijigang Community Forest and impacts from the realignment fall within SRF Land.

Mr. Yeshey Wangchuk obtained No Objection Certificates from the project affected peoples.

The Record of Discussion and Participant list are attached at Appendix 12.

(2) The Second Public Consultation for the Jomori Transmission Line (from the 8th -11th April 2024)

< Samdrup Jongkhar Dzongkhag >

On the 8th of April, Public Consultation was convened by the Dzongkhag Administration for Dzongkhag Level Stakeholders at the Conference Hall, Dzongkhag Administration, 10 am to 1 pm. The meeting was attended by 11 (8 males, 3 females) participants and represented various governmental agencies at the Dzongkhag Level. The JICA Survey team made detailed presentation on the results from the scoping exercise, impact assessment, proposed mitigation measures and monitoring plan. Some of the concerns and comments raised during the meeting are as under:

Table 7-6: Main Comments and Responses for JOMORI Transmission Line Consultation in Samdrup Jongkhar Dzongkhag

Comments/ Questions from participants	Response/ Explanation
One participant made reference to the elephant passage along the road in Raidak area, which could be adopted as mitigation measures for elephant passage route in relevant parts of JWS. It was also pointed out that the project needs to collaborate with Dantak (Border Road Organization), which is currently building the Phuntshothang to Jomotsangkha road. Information Board and signages should be placed in appropriate places along the road.	Clarification was provided by the JICA Survey team that the team is coordinating with the Jomotsangkha Wildlife Sanctuary to identify the known crossings and have signages go up as mitigation measure.
It was recommended that a component to build stepdown transformer be integrated in the project to resolve the issues of frequent, extended outages in the Jomori Area.	Clarification was provided by the JICA Survey team that this is part of the DGPC proposal and was raised and addressed by the MD, DGPC during the Public Consultation hearing.

The District Agriculture Officer, who was filling in for Dasho Dzongrab, thanked for the presentations and wished the project success.

<Samdrupchong Dungkhag: Phuntshothang, Pemathang and Samrang Gewogs>

On the 9th of April, Public Consultations was convened by the Samdrupchholing Dungkhag Administration for Gewog Level Stakeholders at the Community Hall, Phuntshothang Gewog Administration, 10:30 am to 1 pm. The three affected gewogs of Phuntshothang, Pemathang and Samrang fall under the Dungkhag. The meeting was attended by 20 (18 males, 2 females) participants comprising mostly of elected gewog officials and other government agencies. The meeting was held at the Community Hall, Phuntshothang Gewog Centre. The JICA Survey team made detailed presentation on the results from the scoping exercise, impact

assessment, proposed mitigation measures and monitoring plan. Concern(s) raised during the meeting are as under:

Table 7-7: Main Comments and Responses for JOMORI Transmission Line Consultation in Samdrupchong Dungkhag

Comments/ Questions from participants	Response/ Explanation
The Samrang Gup expressed concern over potential impact of construction workers on natural environment and wildlife - illegal hunting for example. To minimize the impacts, he suggested that the project involve the Gewog Administration in identification and allocation of worker camps and to monitor them against illegal activities.	BPC representative clarified that, during the start of the project, it is usual practice for the project to work with the Gewog Office to identify the sites and also obtain approval of these workers campsites. The gewog finally has to approve the location before setting up camp. Similarly, the project office works closely with the Forest Officials and the Royal Bhutan Police to be vigilant to curb illegal activities including illegal hunting/poaching and trafficking of wildlife.
The Samrang Gup shared the potential expansion of Samrang town and development of industrial area. For this, he requested that the project consider integrating options for sourcing the increased energy needs from the proposed TL.	It was clarified that this would be beyond the scope of this project and be taken up during discussions with Dzongkhag Administration for integration into the Dzongkhag Development Plans.

The meeting concluded with No Objections against the Project and consensus that the project would immensely benefit the area.

< Jomotsangkha Dungkhag: Langchenphu and Serthi Gewogs>

On the 11th of April, Public Consultations was convened by the Jomotsangkhag Dungkhag Administration for Gewog Level Stakeholders at the Community Hall, Langchenphu Gewog Administration, 10:00 am to 1 pm. The two affected gewogs of Langchenphu and Serthi fall under the Dungkhag. The meeting was attended by 10 (all males) participants comprising mostly of elected gewog officials and other government agencies. The JICA Survey team made detailed presentation on the results from the scoping exercise, impact assessment, proposed mitigation measures and monitoring plan. Some of the concerns raised during the meeting are as under:

Table 7-8: Main Comments and Responses for JOMORI Transmission Line Consultation in Jomotsangkha Dungkhag

Comments/ Questions from participants	Response/ Explanation
The participants pointed out the importance of the upcoming hydropower and TL projects in addressing the inconsistent and unreliable electricity supply in Jomotsangkha Dungkhag. For this, there was consensus among stakeholders that a 132kv / 33kv interconnection transformer (substation) is crucial in enabling connectivity from the Jomori hydropower for reliable electricity supply in Serthi and Langchenphug Gewogs. The participants urged BPC and DGPC to ensure the facility is provided for in the proposed project.	Clarification was provided by the JICA Survey team that this was already addressed by the MD of DGPC and a step down would be integrated into the Project to address the reliability issues in the area.
Dasho Dungpa, Jomotsangkha Dungkhag expressed concern over the lack of proper waste disposal site in Langchenphu and Samrang Gewogs. Given the lack of budget as well as capacity to provide a designated waste disposal site, he felt it appropriate for the project to support provision of waste disposal facilities.	The JICA Survey team noted the concern and agreed to discuss with the BPC officials and include the support of construction of waste disposal sites in partnership with the Dungkhag/ Gewogs and incorporate the same as part of the EMP.

The meeting concluded with No Objections against the Project and consensus that the project would immensely benefit the area.

The Record of Discussion and Participant list are attached at Appendix 13.

7.3. National Stakeholder Meeting

(1) The 1st National Stakeholder Meeting

The 1st National Stakeholder Consultation was held in English since all participants can understand it, at the Conference Le Meridien Hotel, Thimphu on the 1st of February 2024, attended by 29 (23 males, 6 females) participants from various Governmental agencies and non-governmental agencies from 9: 30 am to 1 pm. During the consultation, the DGPC and BPC made detailed presentations of the Projects, its design, costs, potential impacts. The JICA Survey Team also made a presentation on the scoping list and the items under consideration for the assessment and the plan moving forward. The stakeholders were informed that a second consultation would be held in April to share the findings and conclusions of the assessment and sought their participation for continuity.

The representative from the Department of Surface Transport asked if the impacts to the existing roads and bridges will be assessed as it can be assumed the movement of heavy trucks and machinery could have a

detrimental impact on the road and also increase likelihood of accidents. DGPC clarified that they have already started the study on carrying capacity of the existing roads and bridges in collaboration with the relevant Ministries and are in discussion to improve the carrying capacity of the existing infrastructure.

The representative from the Bhutan Ecological Society sought clarity on how PAPs have they been consulted and how will the compensation be carried out. The team from DGPC and BPC informed the audience that public consultations have been organized and the no objection clearances from PAPs have been obtained. It was also informed that a PAP survey would also be carried out in the coming month to better understand the impact of land acquisition on the lives and livelihood.

The official from the Department of Forest and Park Services expressed her hope that the study would cover both flora and fauna aspect of bio-diversity and appropriate mitigation measures are proposed.

The representative from the Department of Culture asked for the inclusion of Heritage Site Impact Assessment based on information with the National Land Commission and additional information available from the Department. It was agreed that the data sets and publication would be shared for both the Dzongkhags and would be included in the ESIA.

The Representative from the Department of Law and Order, shared his views and concerns over the proximity of the Transmission Line with the Indian border and reminded the BPC team to ensure that at least 10 meter buffer should be maintained with the International Border at all times. This was noted and the BPC team ensured that the Design provides more than 10 meter buffer from the International Border along the whole line.

The Record of Discussion and Participant list are attached at Appendix 14.

(2) The 2nd National Stakeholder Meeting

The 2nd National Stakeholder Consultation was held in English since all participants can understand it, at the Conference Hall, Hotel Tashi Yidwong, Thimphu on the17th of April and attended by 31 (26 males, 5 females) participants from various Governmental agencies and non-governmental agencies from 9:30 am to 1 pm. The Meeting was chaired by the CEO, DHyE and the JICA survey Team made detailed presentation on the results of the Scoping and Impact Assessment, Proposed Mitigation measures, monitoring format and the budget outlay for the said measures for all the Projects.

The Official from the Department of Law and Order, inquired about the permanency of access roads and BPC acquisition of necessary approvals. He suggested that in cases which are close to the border areas for access road construction, it would be prudent, if permissions and approvals are also sought beforehand from the Department. BPC responded that all required approvals for access roads and ropeways will be included in the ESIA report.

The meeting was called to an end and the CEO, DHyE highlighted the importance of being mindful of budgetary constraints, noting that the projects are primarily aimed at serving domestic consumers and would eventually result in higher tariffs if costs are not managed.

The Record of Discussion and Participant list are attached at Appendix 14.

Serthig Public Consucltation

Langchenphu Public Consucltation

Pemathang Public Consucltation

Samrang Public Consucltation

Phuntshothang Public Consucltation

Figure 7-1: Glimpses of Public Consultation Meeting held for 132kV Jomori Transmission Line

8. GRIEVANCE REDRESS MECHANISM

The overall structure of the GRM for the project shall be suited to redress the grievances through a single GRM with a Grievance Redress Committee (GRC). To address any complaints from an individual, a group or an institution about environmental and social issues among others associated with the implementation of the project, a Grievance Redress Committee (GRC) will be established.

The GRC will be constituted of representatives from Samdrup Jongkhar Dzongkhag Administration, Serthi, Langchenphug, Samrang, Pemathang, and Phuntshothang Gewog Administration and Project Management Units of the Projects. Once, the GRC is constituted at the start of the project, the contact information and procedure for GRM will be conveyed to the residents through the respective elected officials (Gup/ Tshogpa).

Table 8-1: Composition of the Grievance Redress Committee

SN	Designation	Organization	Role
1	Project Manager	BPC	‣ Coordinate the functioning of the GRC ‣ Compilation of Grievance Redress Reports
2	Land Registrar/ Representative	Survey Division, Dzongkhag Administration	‣ Member Secretary, Dzongkhag Land Acquisition and Compensation Committee ‣ Coordinate in Grievance resolution with other sectors (Competent Authorities)
3	Gup/ Tshogpa*	Gewog Administrations	‣ Receive complaints and submit to GRC for resolution from respective gewogs.

* Gup is the elected head of the Gewog and Tshogpa is the elected representative of the Chiwog (cluster of villages).

(Source; JICA Survey Team)

Types of anticipated grievances are, but not limited to the following:

- Land acquisition and compensation related grievances.
- Construction activities related grievances such as:
  - ✓ Blasting/vibration/damage to properties.
  - ✓ Physical environment related nuisance such as noise and dust.
- Traffic related complaints.
- Social related grievances such as conflict between project workers and local community, crime, etc.

Some of the roles of GRC are, but not limited to the following:

- Address project level grievances received.

- Consult relevant agencies and/or stakeholders as required by the nature of grievance to address it.
- Decide on compensation for AH/AP in line with relevant prevailing rates.
- Act as a link between project management, Dzongkhag/Gewog Administration, Contractors and the AHs/APs in relation to addressing the grievances.
- Monitor the grievance resolution process.
- Maintain database of all grievances.

The grievance redress mechanism for the Projects will follow the process described in Table below:

Table 8-2: Grievance Redress Process

Step 1: The aggrieved PAP/ Resident submits grievance in writing or orally in Dzongkha (national language) or English, to the respective Gewog Representative/ Contractors/ Project Director (Manager). These officials shall maintain a Grievance Record Register at the Gewog Administration Office, the Project Office and the Contractors Office for recording grievances submitted by PAPs/ Residents. **Step 2:** GRC is convened by the Project Director (Manager) within 21 days to acknowledge receipt of Grievance and hold consultations on grievance redressal. The complainant is then notified through the respective Gup/ Tshogpa of the decisions/ actions taken by the Committee to address the grievance. The time frame to resolve grievances will be subject to the nature of complaint and scale of investigation that would be needed. The GRC shall thereafter carry out necessary assessment and provide solutions. During this period, the Project Director/ Manager and/or Gup/Tshogpa shall provide updates and provide clarification to the aggrieved party whenever sought by aggrieved parties. In the case of Land and Compensation associated grievances, the matter will be forwarded to the DLACC and in the event the scope of the grievance is wide-ranging based on the nature of complaints received, relevant Competent Authorities (CAs) will be involved. **Step 3:** The aggrieved parties are not satisfied with the decision rendered by the GRC or, if he/she does not receive a response within 21 days; he/she can approach the Executives of DHyE/ BPC, and appeal existing local governments such as the Gewog Tshogde (local government assembly) and the Dzongkhag Administration or file a legal suit in the Dzongkhag Courts.

9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

9.1. Environmental Mitigation measures

The effectiveness of mitigation measures is maximized when they are:

i) Appropriately identified,
ii) Implemented promptly in accordance with required standards, and
iii) Monitored to ensure compliance with applicable standards.

The environmental sustainability of the project is highly dependent on the extent to mitigation measures for ambient environmental quality and biodiversity conservation are implemented in a timely manner and that the resulting environmental quality is within the prescribed limits. This is ensured through the following:

a) Preparation of an overall Environment Management Plan (EMP) for the proponent

b) Integration of environmental management requirements in contract documents for various work packages awarded to contractors.

c) Based on the overall EMP, contractors prepare the Contractor Environmental Management Plan (CEMP) containing:

    i) Outline of environmental impacts and mitigation measures for the construction activities under the contract work packages.
    ii) Methods and schedule for periodical monitoring of ambient air, noise, and water quality, and terrestrial and aquatic biodiversity.
    iii) Schedule of monthly, semi-annual, and annual environmental monitoring reports demonstrating project compliance to environmental standards.

9.2. Social Mitigation Measures

The Project is expected to have impacts of Land Acquisition and resettlement of livelihood, loss of community forest resources, and labour environment for workers and accidents risks from increased traffic flow during the construction time.

The Project will not entail any displacement of households but will require some acquisition of private and some resettlement of livelihoods as the acquired land are used for agricultural cultivation. It will also impact 3 community forest and result in the de registration of the land from the CF group and owned by the

Government. The determination of market prices of land is difficult and speculative. Rural lands in Bhutan are hardly sold in open market and accessibility to land transaction records for analysis is not possible.

During meetings with the Officials at the National Land Commission and the Land Registrars at the Dzongkhag Administration, it was shared that the transaction prices reflected during ownership transfers are usually under invoiced for tax avoidance purposes and does not reflect actual market prices. The Dzongkhags do not maintain any data base or track land transaction prices. The officials also expressed that there are very minimal land transactions in the rural areas and hence prices tend be based on the speculative, emotional and familial (relationship) values rather. DGPC also wrote to the National Land Commission seeking data from their repository for Land Transactions, however, it was not received.

On the policy front, the Environmental Assessment Guideline for Hydropower Projects, 2012, does suggest compensation to be paid at current market prices, the National Land Act 2007 and the Land Acquisition and Compensation Rules and Regulations (LACRR) 2022, clearly state that land shall be acquired based on the Property Assessment and Valuations Agency rates, which are updated every three years., under the Ministry of Finance. The valuation form used by the DLACC for land compensation is attached as Appendix 15.

The following are expected impacts from the Project on Land and associated livelihood:

1. Acquisition of Private Land

The Project requires the acquisition of 0.084 acres of land for Tower Construction belonging to 4 households in Serthi Gewog. The estimated cost for the acquisition of the Private Land is as under:

Table 9-1: Estimated cost for the acquisition of the Affected Privates land of the TL

SN	Tower Nos.	Plot ID	Gewog	Thram_No	Owner	CID	Land_Type	Land Area Affected (Acres)	Land Class (PAVA 2022)	Compensation PAVA RATE (Nu)
1	JP31	SER-4348	Serthi	163	Dorji	11111001312	Kamzhing	**0.021**	D (Nu.2955.48)	6,206.508
2	JP29	SER-179	Serthi	125	Pema Ugyen Namdrol	11103000548	Oranges	**0.021**	D (Nu.3358.25)	7,052.325
3	JP19	SER-2185	Serthi	382	Pema Wangzom	11111000453	Oranges	**0.021**	D (Nu.3358.25)	7,052.325
4	JP17	SER-548	Serthi	40	Tashi Peljor	11111000333	Kamzhing	**0.021**	D (Nu.2955.48)	6,206.508
TOTAL										**26,517.67**

The private land acquired are of dry land and orchard category. Considering the small size of the acquisition the associated damages to the crops and fruit trees will be compensated as per the PAVA Compensation rates 2022 and calculated during site verification jointly with the Agriculture Official (existing practice of BPC). These compensations will be provided by the BPC through its internal funds.

2. Impact by RoW

There are two impacts expected from the PTL project by RoW. 15.887 Acres of Land belonging to 57 households in 4 gewogs are affected by the RoW of the project. However, in the case of RoW, it is expected that there will be no damages to crops, and efforts are made to minimize damages. However, in the case of unforeseen damages, the BPC Project office shall consult the affected household and carry out joint verification to assess the damages and be compensated as per national laws and practices.

The RoW will also have an impact on 3 Community Forest Groups, 1 in Serthi and 2 in Pemathang Gewogs. However, the impact on livelihood from collection of non-wood forest products are expected to be minimal as the households are also allowed to collect the same from State Reserve Forest Land. However, this will have an impact on the timber that the CF Group can use from the CF. In this regard, the Forest and Nature Conservation Act 2023, state that the CF will receive a minimum royalty payment determined by the Department may be paid to the Community Forest Management Group (CFMG) for each tree cut in their community forest. A joint tree enumeration and verification is conducted by Forest officials, CF management, and BPC and concern contractor/s during the construction phase.

9.3. Mitigation measures for Pre-Construction phase

Table 9-2: Mitigation measures for Pre-Construction phase

No	Items (impacts)	Sources of Potential Impact	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost
1	Air Quality	‣ Air pollutant emissions from the implementation of pre-construction work such as clearing the land, cutting down trees, and transporting equipment for surveying.	‣ Appropriately maintain the equipment and vehicles used and reduce the generation of air pollutants. ‣ During pre-construction work, water will be sprayed as necessary to prevent dust generation. ‣ Reduce speed on existing unpaved access roads to prevent dust generation.	‣ BPC	‣ BPC	Included in the Consultant Cost
2	Noise and Vibration	‣ Noise and vibration caused by the implementation of pre-construction work.	‣ Appropriately maintain and manage the equipment and vehicles used to reduce noise and vibration.	‣ BPC	‣ BPC	Ditto
3	Land acquisition and Resettlement	‣ Land Acquisition for Tower Construction and associated damages to agricultural produce	‣ Provide Compensation / Replacement for land acquisition and compensation for resettlement of livelihood from damages to agriculture	‣ BPC	‣ BPC	Estimated as Nu. 26,517.67

9.4. Mitigation measures for construction and operational phase

Mitigation measures for the impacts identified in the preceding section must be geared towards i) maintaining the ambient air, noise, and water within the prescribed national limits as per NEC's national Environmental Standards 2020 (NEC, 2020) and ii) minimizing impacts on biodiversity especially those species with special global and national protection status as per IUCN Red list and Bhutan's FNCA, 2020. Keeping these requirements in minds, the mitigation measures for construction and operational phase of the project are identified in the table below.

Table 9-3: Proposed mitigation measures for assessed impacts of project activities on environmental quality during construction

No	Items (impacts)	Sources of Potential Impact	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost
1	Air Quality	‣ Due to the operation of construction equipment and transport vehicles, the generation of exhaust gases and dust will affect the atmosphere around the site.	‣ Ensure proper maintenance of equipment and vehicles used and reduce emissions of air pollutants. ‣ During construction works, water will be sprayed as necessary to prevent dust generation. ‣ Reduce speed on existing unpaved access roads to prevent dust generation. ‣ When transporting earth, sand, etc., do not fill the load fully, but cover it with plenty of room. ‣ Effectively educate and train relevant personnel such as operators of equipment and drivers of vehicles.	‣ BPC ‣ Contractor	‣ BPC	Estimated of Nu. 227,000 as Air Quality management cost including Monitoring Cost
2	Wastes	‣ Cutting and de-rooting result in plant bodies becoming waste. ‣ Waste is generated in the workers' camp. ‣ Solid waste generated if not managed well could potentially pollute the land and water environment impacting the animals.	‣ Plants are not discarded, but used for soil retention and surface cover to prevent soil erosion and also encourage regeneration where possible. ‣ The non-biodegradeble waste is to be further segregated into recyclable and non-recyclable waste. ‣ The recyclable waste such as plastics and bottles is to be encouraged to be sold to scrap dealer who is a professional contractors with a scrap collection permit. ‣ The non-recyclable waste is to be disposed to the identified landfills by Gewog. ‣ Train workers on storage methods, waste handling, prevention of leakage/disposal and what to do in the event of a leak, and provide them with the	‣ BPC ‣ Contractor	‣ BPC	Estimated of Nu. 227,000 as Waste management cost including Monitoring Cost

No	Items (impacts)	Sources of Potential Impact	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost
			personal protective equipment necessary for handling hazardous waste.			
3	Soil Quality	‣ Spills of lubricating oil, fuel oil, etc. from heavy machinery	‣ Ensure that lubricants and fuel oils are properly managed to secure the facility of stocked oil to prevent it from tipping over and that a receptacle is available in case of spillages when refilling.	‣ BPC ‣ Contractor	‣ BPC	Included in the Consultant Cost
4	Noise and Vibration	‣ Use of construction machineries, excavations and blasting activities generate noise and vibration which might disturb wild animals and communities nearby.	‣ Appropriately maintain and manage the equipment and vehicles used to reduce noise and vibration. ‣ If the noise levels within the project area exceed permissible limits, increased noise levels will be managed not to exceed the appropriate level based on National Noise Standard level through Noise Management Plan. ‣ Construction activities, especially noisy ones, should be limited to daytime only and avoided at night and on weekends.	‣ BPC ‣ Contractor	‣ BPC	Estimated of Nu. 227,000 as Noise Level management cost including Monitoring Cost
5	Odor	‣ Generation of odor due to improper waste management.	‣ Proper transport of waste and dumping of waste into designated disposal facilities by licensed contractors to avoid the accumulation of odor, pest control problems, general litter and other nuisance sources of waste on the site.	‣ BPC ‣ Contractor	‣ BPC	Included in the Consultant Cost
6	Protected Areas	‣ Loss of outstanding landscapes of protected area due to towers	‣ Adopt designs and colors that harmonize with the surrounding landscape	‣ BPC ‣ Contractor	‣ BPC	Included in the Consultant Cost
7	Biodiversity	‣ Deterioration of ecosystem by cutting trees, clearing and de-rooting by carrying out for tower construction work including access road.	‣ Proper wildlife or alien plants management which prevents the invasion of non-native plant and animal species that do not normally inhabit the site by creating a detailed inventory.	‣ BPC ‣ Contractor	‣ BPC	Estimated of Nu. 1,843,000 as Biodiversity management cost

No	Items (impacts)	Sources of Potential Impact	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost
		‣ Fragmentation and loss of fauna habitats. ‣Fragmentation and loss of bird habitat ‣ Post-vegetation clearing and rooting of vegetation ‣ Destruction of ecosystems due to feeding to wild animals by workers.	‣ Make a new detour for migratory animals (beast trail) such as elephant by cutting lianas and shrubs. ‣ Animals and plants (endangered species) that are expected to be directly affected by during construction work is be moved and transplanted to suitable habitats. ‣ Animals that have been injured by the development act are protected and returned to a safe place after healing. ‣ Restrict the movement of machinery and vehicles to the work area. ‣ Prevent unnecessary destruction of trees (e.g. dead trees with hollow) as a nesting place for endangered species of hornbill and habitat for geckos, snakes, bats. ‣ Establish speed limits for vehicles to prevent roadkill on animals. ‣ Train workers not to interfere with animals unnecessarily. ‣ To preserve nesting sites, expert surveys are carried out prior to constructing work. ‣ Hunting in and around the project area is prohibited. ‣ Backfilling of surface soil. ‣ Restrict the movement of machinery and vehicles into the work zone. Mainly in multiple use zone. ‣ For the most affected areas (e.g. temporary access routes, construction sites), develop and implement various short- to long-term vegetation restoration plans, including removal/relocation of protected species and afforestation/reforestation.			including Monitoring Cost

No	Items (impacts)	Sources of Potential Impact	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost
			‣ Strictly prohibit the collection of trees and hunting by workers. ‣ All leftovers should be taken out of the project area. ‣ Prohibit feeding animals.			
8	Land acquisition and Resettlement	‣ Land Acquisition for Tower Construction and associated damages to agricultural produce ‣ Damages to crop during laying and stringing of transmission line	‣ Provide Compensation / Replacement for land acquisition and compensation for resettlement of livelihood from damages to agriculture ‣ Provide compensation for the damages for livelihood resettlement	‣ BPC (Project Office) ‣ Contractor	‣ BPC	Estimated as Nu. 26,517.67
9	Labour Environment (including sanitation and safety)	‣ Accidents by construction work ‣ Access to Toilet ‣ Access to Water	‣ Plan and ensure implementation of the Occupational Health and Safety (OHS) Standards in OHS regulations for the construction industry, such as prepare the health and safety policy, appointment of safety officer, use of protective equipment, instruction of establishment of toilet and water facility, etc..	‣ BPC ‣ Contractor	‣ BPC ‣ Ministry of Industry, Commerce and Employment	Measures can be taken through standard, and special cost is not required / Contractor Cost
10	Accidents	‣ Accident due to increased traffic	‣ Work with local traffic police for traffic management	‣ BPC ‣ Contractor	‣ BPC	Covered by operational cost of Royal Bhutan Police/ Contractor Cost
11	Poaching	‣ Workers' hunting acts of disregard for the law	‣ Train workers not to interfere with animals unnecessarily.	‣ BPC ‣ Contractor	‣ BPC	Measures can be taken through standard, and special cost is not required / Contractor Cost

Table 9-4: Mitigation measures of Operational Phase

No	Items (impacts)	Sources of Potential Impact	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost
1	Protected Areas	‣ Reduction in the value of protected areas due to tree cutting	‣ Trees clearance should be as little as possible and limited to strictly necessary areas. ‣ In places where planting is possible, planting is carried out using the same tree species as the surrounding trees.	‣ BPC	‣ BPC	Part of operational cost of project office of BPC
2	Biodiversity	‣ Inhibition of the migration pathways of large mammals such as elephants by newly build towers ‣ Bird strike caused by Transmission line or towers ‣ Contact between trees and overhead transmission line in the right of Way (ROW).	‣ Make a new detour for migratory animals (beast trail) such as elephant by cutting lianas and shrubs. ‣ To reduce accidents from collisions, placing fluttering banners and brightly-colored (orange, yellow, white, etc.) spirals on power lines. ‣ Regular tree pruning in the Right of Way (ROW).	‣ BPC	‣ BPC	Part of operational cost of project office of BPC
3	Accidents	‣ Accidents to workers in O&M of facilities	‣ Conduct safety management training including periodic safety awareness program and use of protective equipment (footwear, helmets, goggles, eye-shields, safety belts, etc.)	‣ BPC	‣ BPC	Estimated at Nu. 46,000

9.5. Environmental Monitoring measures

The Environmental Monitoring Form is attached as Appendix 2.

9.5.1. Monitoring during Pre- Construction Phase

Table 9-5: Monitoring measures during Pre-Construction phase

No	Items (impacts)	Mitigation Measures	Monitoring Items	Standard	Monitoring Sites	Implementing Organization	Term/ Frequency	Cost
1-1	Air Quality	‣ Appropriately maintain the equipment and vehicles used and reduce the generation of air pollutants.	‣ $PM_{2.5}$, PM_{10}, NO_X, SO_X, CO	$PM_{2.5}$ 40 (1-year) 60 (24-hour) PM_{10} 60 (1-year) 100 (24-hour) NO_X 80 (24-hour) 60 (1-year) SO_X 80 (1-year) 60 (1-year) [$\mu g/m^3$] (National standard for ambient air quality, NEC, 2020)	‣ Boundaries of dwellings of Phuntshothang, Tokaphung, Samrang (Coordinates of sampling location, see *2 Notice (Monitoring Sites) listed at the end of the table)	‣ BPC	‣ One time every Monsoon and Post-Monsoon	Included in the Contractor's contract
1-2		‣ During pre-construction work, water will be sprayed as necessary to prevent dust generation.	‣ Number of times of water spray	N/A	‣ Project area and its surrounding area		‣ At any time	
		‣ Reduce speed on existing unpaved access roads to prevent dust generation	‣ Speed level	‣ Speed of compliance	‣ Project area and its surrounding area			

2	Noise and Vibration	‣ Appropriately maintain and manage the equipment and vehicles used to reduce noise and vibration.	‣ Noise level	‣ Daytime: 55 dBA* ‣ Nighttime: 45 dBA* (‣ Wark place 75 dBA**) *=Sensitive area **=Maximum value allowed in workplace at any point of time is 75 dB(A) (National standard for ambient air quality, NEC, 2020)	‣ Boundaries of dwellings of Phuntshothang, Tokaphung, Samrang (Coordinates of sampling location, see *2 Notice (Monitoring Sites) listed at the end of the table)	‣ BPC	‣ One time every Monsoon and Post-Monsoon	Ditto
3	Land acquisition and Resettlement	‣ Provide Compensation for land acquisition and resettlement of livelihood	‣ Number of Households ‣ Provided with Land Replacement ‣ Provided with cash compensation ‣ Provided with Crop Compensation	N/A	‣ Chiwog, Gewog and Dzongkhag	‣ Project Management/ BPC ‣ Dzongkhag Administration, Dungkhag Administration and Gewog Administration	Monthly	Part of operational cost of project office of BPC

9.5.2. Monitoring during Construction & Operational Phase

Table 9-6: Monitoring measures during Construction phase

No	Items (impacts)	Mitigation Measures	Monitoring Items	Standard	Monitoring Sites	Implementing Organization	Term/ Frequency	Cost
1-1	Air Quality	‣ Ensure proper maintenance of equipment and vehicles used and reduce emissions of air pollutants	‣ $PM_{2.5}$, PM_{10}, NO_X, SO_X, CO	$PM_{2.5}$ 40 (1-year) 60 (24-hour) PM_{10} 60 (1-year) 100 (24-hour) NO_X 80 (24-hour) 60 (1-year) SO_X 80 (1-year) 60 (1-year) [$\mu g/m^3$]	‣ Boundaries of dwellings of Phuntshothang, Tokaphung, Samrang (Coordinates of sampling location, see *2 Notice (Monitoring	‣ BPC ‣ Contractor/ Project Office	‣ One time every Quater	Estimated of Nu. 227,000 as Air Quality management cost including Planning Cost

				(National standard for ambient air quality, NEC, 2020)	Sites) listed at the end of the table)			
1-2		‣ During construction works, water will be sprayed as necessary to prevent dust generation.	‣ Records of water sprinkling.	N/A	‣ Project area and its surrounding area		‣ At any time	
1-3		‣ Reduce speed on existing unpaved access roads to prevent dust generation.	‣ Speed level	‣ Speed of compliance	‣ Project area and its surrounding area		‣ At any time	
		‣ When transporting earth, sand, etc., do not fill the load fully, but cover it with plenty of room.	‣ Loading capacity and protective netting	N/A	‣ Project area and its surrounding area		‣ At any time	
		‣ Effectively educate and train relevant personnel such as operators of equipment and drivers of vehicles.	‣ Holding workshops	N/A	‣ Project office	‣ BPC ‣ Contractor/ Project Office	‣ Once every 3 months	
2-1	Wastes	‣ Plants are not discarded, but used for soil retention and surface cover to prevent soil erosion and encourage regeneration where possible.	‣ Confirmation of the status of vegetation recovery by checking the taking root rate and soil erosion by checking stability of soil.	N/A	‣ Project area	‣ BPC ‣ Contractor/ Project Office	‣ One time every Monsoon and Post-Monsoon	Estimated of Nu. 227,000 as waste management cost including Planning Cost
2-2		‣ Train workers on storage methods, waste handling, prevention of leakage/disposal and what to do in the event of a leak, and provide them with the personal protective equipment necessary for handling hazardous waste.	‣ Holding training workshops	N/A	‣ Project office ‣ Workers' camp (Mini camp with 2 tents for 10 workers and 1 tent for buffet and removes to another place after 7 days staying.)	‣ BPC ‣ Contractor/ Project Office	‣ Once every 1 week	

3	Soil Quality	‣ Ensure that lubricants and fuel oils are properly managed to secure the facility stocked oil to prevent it from tipping over and that a receptacle is available in case of spillages when refilling.	‣ Checking of tipping prevention devices such as oil storage tanks and emergency equipment in the event of a leak.	N/A	‣ Project area	‣ BPC ‣ Contractor/ Project Office	‣ At any time	Included in the Contractor's contract
4-1	Noise and Vibration	‣ Appropriately maintain and manage the equipment and vehicles used to reduce noise and vibration.	‣ Noise level	‣ Daytime: 55 dBA* ‣ Nighttime: 45 dBA* (‣ Wark place 75 dBA**) *=Sensitive area **=Maximum value allowed in workplace at any point of time is 75 dB(A) (National standard for ambient air quality, NEC, 2020)	‣ Boundaries of dwellings of Phuntshothang, Tokaphung, Samrang (Coordinates of sampling location, see *2 Notice (Monitoring Sites) listed at the end of the table)	‣ BPC ‣ Contractor/ Project Office	‣ One time every Quater	Estimated of Nu. 227,000 as Noise Level management cost including Planning Cost
4-2		‣ If the noise levels within the project area exceed permissible limits, increased noise levels will be managed not to exceed the appropriate level based on National Noise Standard level through Noise Management Plan.	‣ Noise level			‣ BPC ‣ Contractor/ Project Office	‣ At any time	
4-3		‣ Construction activities, especially noisy ones, should be limited to daytime only and avoided at night and on weekends.	‣ Noise and Vibration level			‣ BPC ‣ Contractor/ Project Office	‣ At any time	
5	Odor	‣ Proper transport of waste and dumping of waste into designated disposal facilities by licensed contractors to avoid the accumulation of odor, pest control problems, general litter and other nuisance	‣ Odor index ‣ Complaint record	Odor index, see *1 Notice (Monitoring Sites) listed at the end of the table	‣ Workers' camp (Mini camp with 2 tents for 10 workers and 1 tent for buffet and removes to another place after 7 days staying.)	‣ BPC ‣ Contractor/ Project Office	‣ Once a week	Included in the Contractor's contract

		sources of waste on the site.						
6	Protected Areas	‣ Adopt designs and colors that harmonize with the surrounding landscape	‣ Landscape	Low: Not bother Minor: A little bother Moderate: Tolerance (No standard, but above criteria is usually used)	‣ Viewpoints from the main road in protected are	‣ BPC ‣ Contractor/ Project Office	‣ At any time	Included in the Contractor's contract
7-1	Biodiversity	‣ Proper wildlife or alien plants management.	‣ Monitor and record the number and distribution of plant and main animal specie	N/A	‣ Project area (500m on one side (1,000m on both sides) across the center of the T/L, covering from the starting point (SS) to the end point (HPP))	‣ BPC ‣ Contractor/ Project Office	‣ At any time	Nu. 184,300 per monitoring. (10% of the total cost of making sign markers and sign poles)
7-2		‣ Restrict the movement of machinery and vehicles to the work area.	‣ Holding training workshops	N/A	‣ Project office	‣ Contractor	‣ At any time	‣ Included in the Contractor's contract
7-3		‣ Prevent unnecessary destruction of trees (e.g. dead trees with hollow) as a nesting place for endangered species of hornbill and habitat for geckos, snakes, bats	‣ Holding training workshops	N/A	‣ Project office	‣ Contractor	‣ At any time	
7-4		‣ Establish speed limits for vehicles to prevent roadkill on animals.	‣ Holding training workshops	N/A	‣ Project office	‣ Contractor	‣ At any time	
7-5		‣ Train workers not to interfere with animals unnecessarily.	‣ Holding training workshops	N/A	‣ Project office	‣ Contractor	‣ At any time	
7-6		‣ Make a new detour for migratory animals (beast trail) such as elephant by cutting lianas and shrubs.	‣ Monitor and record the behavior of animal such as ‣ Breeding action, ‣ Nidification action,	N/A	‣ Visual survey (500m on one side (1,000m on both sides) across the center of the T/L, covering from the	‣ BPC ‣ Contractor	‣ Monthly	‣ Nu. 120,000 for 1 times of monitoring (2 experts)

		‣ Animals and plants (endangered species) that are expected to be directly affected by during construction work is be moved and transplanted to suitable habitats. ‣ Animals that have been injured by the development act are protected and returned to a safe place after healing.	‣ Predation (fellow species) action, ‣ Territorial dispute) ‣ Breeding behavior ‣ Record the number on animals or plants which are removed other place from the construction site for protection.		starting point (SS) to the end point (HPP))			
7-7		‣ Hunting in and around the project area is prohibited.	‣ Holding training workshops ‣ Installation of gates to prevent non-related persons from entering the access road	N/A	‣ Project area and its surrounding area ‣ Project office	‣ BPC ‣ Contractor	‣ At any time	‣ Included in the Contractor's contract
7-8		‣ Backfilling of surface soil.	‣ Temporary storage status of surface soil	N/A	‣ Project area and its surrounding area	‣ Contractor	‣ At any time	
7-9		‣ Restrict the movement of machinery and vehicles into the work zone. Mainly in multiple use zone.	‣ Holding training workshops	N/A	‣ Project office	‣ Contractor	‣ At any time	
7-10		‣ For the most affected areas (e.g. temporary access routes, construction sites), develop and implement various short- to long-term vegetation restoration plans, including removal/ relocation of protected species and afforestation/	‣ Survival (rooting) rate of plants of relocated protected species and afforestation/reforesta tion.	N/A	‣ Project area (Planting site after restoration of the access road)	‣ BPC ‣ Contractor	‣ At any time after planting	Nu. 184,300 per monitoring. (10% of the total cost of making sign markers and sign poles)

		reforestation.						
7-11		‣ Strictly prohibit the collection of trees and hunting by workers.	‣ Holding training workshops	N/A	‣ Project office ‣ Workers' camp (Mini camp with 2 tents for 10 workers and 1 tent for buffet and removes to another place after 7 days staying.)	‣ Contractor	‣ At any time	Included in the Contractor's contract
7-12		‣ All leftovers should be taken out of the project area.	‣ Holding training workshops	N/A	‣ Project office ‣ Workers' camp (Mini camp with 2 tents for 10 workers and 1 tent for buffet and removes to another place after 7 days staying.)	‣ Contractor	‣ At any time	
7-13		‣ Prohibit feeding animals.	‣ Holding training workshops	N/A	‣ Project office ‣ Workers' camp (Mini camp with 2 tents for 10 workers and 1 tent for buffet and removes to another place after 7 days staying.)	‣ Contractor	‣ At any time	
8	Land acquisition and Resettlement	‣ Provide Compensation for land acquisition and resettlement of livelihood	‣ Number of Households ‣ Provided with Land Replacement ‣ Provided with cash compensation ‣ Provided with Crop Compensation	N/A	‣ Chiwog, Gewog and Dzongkhag	‣ Project Management/ BPC ‣ Dzongkhag Administration, Dungkhag Administration and Gewog Administration	Monthly	Part of operational cost of project office of BPC

9	Labour Environment (including sanitation and safety)	‣ Plan and ensure implementation of the Occupational Health and Safety (OHS) Standards in OHS regulations for the construction company.	‣ Number of workplace accident ‣ Access to toilets with managed waste for the workers ‣ Access to potable water to the workers	N/A	‣ Project Site	‣ BPC ‣ Contractor/ Project Office	Monthly	Part of operational cost of project office of BPC/ Contractor Cost
10	Accidents	‣ Work with local traffic police for traffic management	‣ Accident due to increased traffic	N/A	‣ Project Site, Traffic Police Unit, Samdrup Jongkhar	‣ BPC ‣ Contractor/ Project Office	Monthly	Covered by operational cost of Royal Bhutan Police/ Contractor

Table 9-7: Monitoring measures during Operational phase

No	Items (impacts)	Mitigation Measures	Monitoring Items	Standard	Monitoring Sites	Implementing Organization	Term/ Frequency	Cost
1	Protected Areas	‣ Trees clearance should be as little as possible and limited to strictly necessary areas.	‣ Numbers of cutting trees	N/A	‣ Project area	‣ BPC	‣ One time every year	Nu. 329,900 per monitoring.
		‣ In places where planting is possible, planting is carried out using the same tree species as the surrounding trees.	‣ Numbers and species name of planting trees					
2-1	Biodiversity	‣ Construct a new detour for migratory animals such as elephant. ‣ Fragmentation and loss of animal habitats.	‣ Numbers and species name of dead or injured animals. ‣ Numbers and species name of using of new detour mitigation route.	N/A	‣ Project area and its surrounding area (500m on one side (1,000m on both sides) across the center of the T/L, covering from the starting point (SS) to the end point (HPP))	‣ BPC	‣One time every three years in Monsoon and Post-Monsoon	Nu.142,500 per monitoring. (10% of the total cost of making sign poles)

2-2		‣ To reduce accidents from collisions, placing fluttering banners and brightly-colored (orange, yellow, white, etc.) spirals on power lines.	‣ Numbers and species name of dead or injured birds.	N/A	‣ Project area and its surrounding area (500m on one side (1,000m on both sides) across the center of the T/L, covering from the starting point (SS) to the end point (HPP))	‣ BPC	‣ At any time	Nu. 41,800 per monitoring. (10% of the total cost of making sign makers)
2-3		‣ Planting bare land and protecting animals that are unable to adapt to altered habitats.	‣ Monitor and record the number of plant species and distribution, ‣ Monitor and record the behavior of animal such as ‣ Breeding action, ‣ Nidification action, ‣ Predation (fellow species) action, ‣ Territorial dispute)	N/A	‣ Project area and its surrounding area (500m on one side (1,000m on both sides) across the center of the T/L, covering from the starting point (SS) to the end point (HPP))	‣ BPC	‣ At any time	Nu. 329,900 per monitoring. (10% of the total cost of planting)
2-4		‣ Regular tree pruning in the Right of Way (ROW).	‣ Numbers of trees cut down	N/A	‣ Inside of ROW	‣ BPC	‣ One time every three yeas	Part of operational cost of project office of BPC
3	Accidents	‣ Conduct Safety management training	‣ Number of accidents by type and their causes	N/A	‣ Along the Transmission line	‣ BPC	‣ Annually	Estimated at Nu.183,000

Notice: [Monitoring Sites]

*1; Odor index

	Indications for judgment
0	Odorless
1	Odors that can finally be detected (detection threshold)
2	Weak smell that tells you what it smells like (cognitive threshold)
3	Smells that can be easily detected
4	Strong odor
5	Intense smell

(offensive odor control law, 1971, Japan)

*2; Coordinates of sampling location

Site		Latitude	Longitude
1	Phuntshothang	26.911113	91.68212
2	Tokaphung	26.950780	92.07103
3	Samrang	26.893740	91.823556

9.6. Tentative Costs for Implementation of the ESMP

Based on discussions with the Environment and Social Unit officials in the BPC, it was ascertained that the BPC has been practicing allocating 3% of total project costs towards Environmental & Social Management Plans (ESMP). However, for the current project, the ESMP costs are calculated based on specific activities. The estimated budget for implementing the ESMP and environmental monitoring plan for the proposed Jomori 132kV transmission line project is outlined in the table below.

Table 9-8: Tentative budget for ESMP and Environmental Monitoring

SN.	ITEM & ACTIVITIES	Unit	Cost (Nu. In million)
A. Construction Phase			
1	Cash Compensation for 4 Affected Land owners.	As per the existing PAVA rates	0.027
2	Cash Compensation for 2 Affected orange orchard and direct damages to standing crops under RoW during construction phase.	Lump sum	0.500
3	Royalty for Tree cut in the 3 Affected Community Forests	Royalty fee for Special class and class A trees in CF	3.909
4	Compliance Monitoring by BPC: Includes Quarterly testing of Ambient Air Quality, Noise Level, and water quality test in the project area. Quarterly Monitoring of OHS and compliance to terms & conditions of ESIA document & Environmental Clearance of the project.	Nu.1500 TADA of 2 Officials × 4 times × 15 days for 3 years (36months) + Hiring vehicle charges	0.680
5	Community Awareness Campaigns on Environmental, Health and Safety for workers of Power transmission line	Nu.1500 TADA of 2 Officials × 1 time × 15 days for 3 years (36months) + Hiring vehicle charges	0.275
6	Compensatory Afforestation/Plantation Program	Nu. 84/ sapling including 3 years maintenance cost × No. of trees clearing in TL RoW, Access road, and Ropeway.	3.299
7	Installations of Power line bird diverters (Marker balls) in Jomotsangkha Wildlife Sanctuary (JWS)	50 numbers of Markers balls × Nu. 8365 (including Freight charges from India)	0.418
8	Elephant bypass signages in JWS	19 sinages × Nu. 75,000/sinages (including installation charges)	1.425
9	Developing and preparing a waste disposal facilities of affected gewogs in JWS (Langchenphu & Samrang Gewogs)	750,000 for each gewog	1.500

B. Operation Phase			
1	Community Awareness Campaigns on Environmental, Health and Safety of Power transmission line	Nu.1500 TADA of 2 Officials × 2 time × 15 days + Hiring vehicle charges	0.183
Total (Nu. In millions)			**12.215**

10. ESMP IMPLEMENTATION ARRANGEMENTS

10.1. Implementation Structure

The implementation system of the environment management plan and environment monitoring plan for the project is shown below during Pre-construction, during construction and operation phases. BPC will be the Executing Agency (EA) responsible for management, coordination and execution of all activities. Therefore, BPC will take the lead in the environmental management structure and will be responsible for leading the implementation of the EMP.

BPC will then enter into a construction contract with a contractor, and mitigation measures and environmental monitoring during construction will be performed by the contractor who is awarded the contract. This will be monitored and enforced by the BPC Project Office which will be located at the site.

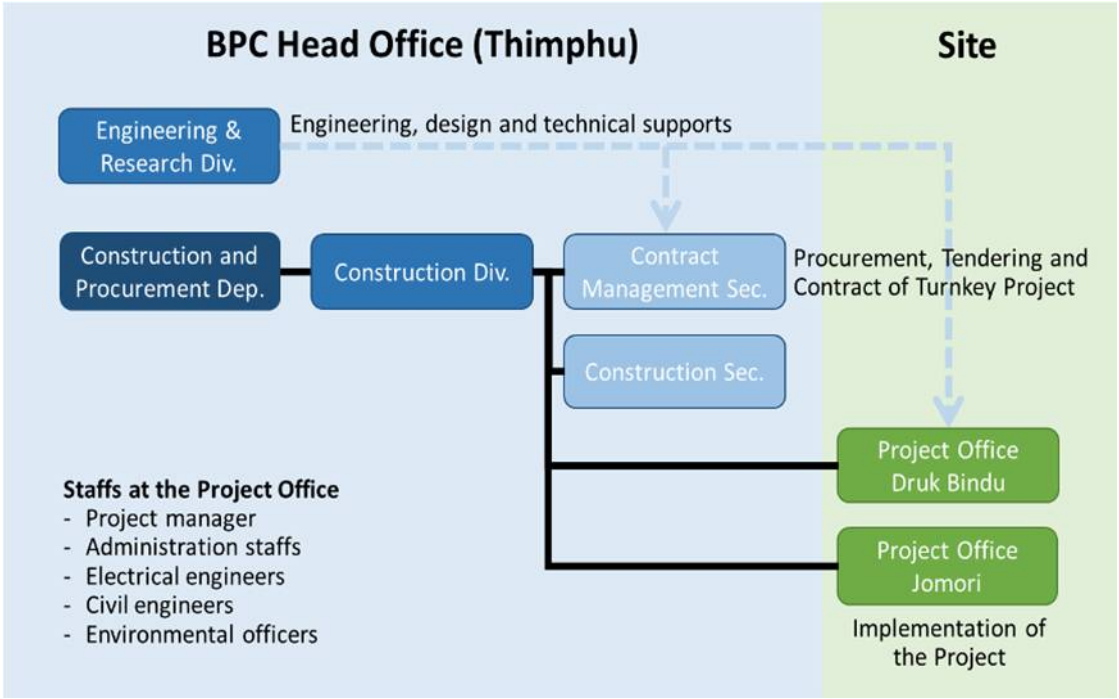


Figure 10-1: Implementation Structure of transmission line construction in BPC

11. CONCLUSION AND RECOMMENDATIONS

In conclusion, the comprehensive survey conducted within the proposed transmission line area revealed a rich diversity of flora and fauna. The vegetation assessment highlighted the presence of numerous plant species, with occurrences of endangered and vulnerable species, underscoring the ecological significance of the area. The Shannon diversity indices indicated varying degrees of floral diversity across sampled plots, with an overall high floral diversity index for the entire area. Similarly, tree species diversity assessments showcased heterogeneous biodiversity levels, emphasizing the need for tailored conservation efforts. Moreover, analyses of tree density and volume provided insights into the distribution and abundance of trees, crucial for informed decision-making regarding land use and development.

In terms of wildlife, the survey recorded a diverse array of species, including mammals, birds, amphibians, and fish, with several species categorized under conservation concern by the IUCN Red List. The findings underscore the importance of preserving habitat integrity to support the diverse wildlife populations inhabiting the area. Overall, the survey outcomes provide evidence that the project will have minimal impact from a social consideration perspective and it also provides valuable baseline data essential for effective environmental management and conservation planning within the proposed site, ensuring sustainable development practices and biodiversity conservation efforts are harmonized for the benefit of both human communities and the natural environment.

From the Social Consideration perspective, the PAP survey provided evidence that, none of the affected households are socially vulnerable, no ethnic minorities or indigenous group will be impacted, there will be no resettlement of households and impact on land will be limited to only 57 households, of which only 4 will be affected by permanent land acquisition (0.084 acres) and the rest are impacted by RoW, which is expected not impact on livelihoods as it would only restrict construction of infrastructure in the demarcated area. The Project is much more likely to have beneficial impacts of improved electricity, improved road connectivity, potential for employment and business opportunities for the whole community in the affected gewogs.

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Department of Environment and Climate Change
Ministry of Energy and Natural Resources
Royal Government of Bhutan
Thimphu

BHUTAN
Believe

DECC/EACD/ToR/2024/ 95 **January 25, 2024**

Chief Executive Officer
Bhutan Power Corporation Limited
Thimphu

Subject: Endorsed Terms of Reference

Sir,

This has reference to the letter no. CD/BPC/C&PD/2023/VOL-1/68 dated December 18, 2023 regarding application for endorsement of draft Terms of Reference (ToR) for conducting Environment and Social Impact Assessment (ESIA) study for the construction of 63 kilometers 132 kV D/C power transmission line connecting the proposed 90 MW Jomori Hydropower Plant to Phuntshothang Substation in Samdrup Jongkhar Dzongkhag.

In this regard, the Department of Environment and Climate Change (DECC) is pleased to endorse the ToR as attached herewith. Kindly ensure that the ESIA study is conducted as per the endorsed ToR and accordingly submit the ESIA report.

The endorsed ToR is valid for two (02) years from the date of issue of this endorsement letter. Please note that the submission of the ESIA report does not guarantee the issuance of environmental clearance.

For any clarification, kindly contact the Environment Assessment and Compliance Division, DECC at 02-323384.

Sincerely,

(Choki Wangmo)
Chief Environment Officer

Copy to:

1. Guard file (ToR), EACD, DECC for record.

TERMS OF REFERENCE (TOR) FOR CONDUCTING ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE CONSTRUCTION OF 132KV POWER TRANSMISSION LINE PROJECT

This ToR provides a framework for conducting environmental and social impact assessment (ESIA) for the construction of 132 kV D/C Power Transmission Line from the proposed 90 MW Jomori Hydropower Plant to Phuntshothang Substation in Samdrup Jongkhar Dzongkhag, in line with the environmental assessment procedure under the Environmental Assessment Act 2000 and its Regulation 2016. 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.

This ToR is developed subsequent to the draft ToR submitted to the Department of Environment and Climate (DECC) December 18, 2023. The report prepared as per this ToR should be submitted to the DECC along with relevant written consents from affected public and stakeholder agencies, and records of public consultation signed by the member(s) of the concerned local authority present during the public consultation for granting environmental clearance for the proposed hydropower project.

1. **Title Page:** The name and location of the project, the name of the applicant, company's name and address. Name, qualification, and address of the ESIA consulting firm.

2. **Table of Contents:** The title and page number of all sections, maps, plans, tables, figures and annexes of the Environmental Assessment Report.

3. **Executive Summary:** A brief description of the project in clear and non-technical language including the following:

a. The name and location of the project
b. Objective and need for the project
c. Summary of the project area to be acquired for transmission line and ancillary activities and land use pattern.
d. Summary of key findings and recommendations of the assessment, including the details of the main environmental impacts and social issues, project footprint of the main project and ancillary/associated facilities, economic benefits, significant environmental challenges, and impacts covering cumulative impacts and proposed mitigation measures.
e. A brief description on how the public was consulted and stating the issues raised, resolved, and pending
f. A brief description on an assessment of alternatives to the project, its main components and ancillary components with respect to the location, technical design and other environmental and social components.
g. Project financial statement including project cost, funding source and the project activity schedule.
h. Project benefits: The local, regional and national benefits of the project should be explained.
i. A declaration stating that the information disclosed in the ESIA report is correct.

4. Essential maps for ESIA of transmission line projects:

a) A map with appropriate scale showing the proposed transmission line along with alternative alignments, the location of towers, substations, project access (rope/ropeways), water supply, muck disposal site, site offices, labour camps and other existing infrastructures along the length of new route/alignment. This should also be plotted in Google Earth and soft copy needs to be submitted to DECC.
b) A map specifying the existing land use patterns of the proposed transmission line RoW.
c) A map specifying the forest cover along the right of way (RoW) of the transmission line, showing, if applicable, zonation of biological corridors, national parks, and sanctuaries.
d) A contour map (*with appropriate scale*) of the proposed transmission line RoW.
e) **Topography -** Plot the transmission line layout on an appropriate scale; topographical map with a map scale and geographical North. Geology, seismicity, and stability characteristics of the project area.

5. Policy and Legal Frameworks

Provide description on the review of existing legislations and policies governing the implementation of the proposed activity and environmental assessment requirements.

6. Project Details

- Type and nature of the project:

a) Source(s) and designation(s) of power
b) Capacity, Voltage level
c) Number of substations and capacity
d) Project duration
e) Total environmental management cost

- Describe the route details of proposed alignment including administrative location as mentioned in *Table 1: Transmission line route details.*

Table 1. Transmission line route details

Dzongkhag	Gewog	Village	Distance (Km)
Total Distance (Km)			

- **Design and Engineering features,** such as:

a) Voltage level.....KV
b) Tapping Point.....
c) Termination Point.....
d) Length of line.....km
e) Right of Way (RoW) width.....m
f) Conductors: Number of lines and circuits, composition and diameter, minimum height over ground level for overhead lines, depth and trench and fill specifications for underground lines.
g) Number, type, and composition of towers (number of towers on private land), manholes (if any).
h) Number and designs of substations to be constructed or modified or operated in conjunction with the transmission lines.

i) Points of interconnection with the existing grid.
j) Load Flow Analysis.

- Design drawings for towers, manholes, trenches, substations, and other facilities.
- Access roads for transmission lines, substations, and other facilities:

a) Means of access for each stretch of the route.
b) Detailed information on any roads to be constructed. If roads are being constructed mention whether they are 'Temporary' or 'Permanent'. Descriptions on the consideration of alternative means of transportation such as 'cableway' were considered or not. (Note: All information required for applications for environmental clearances for the consideration of road/cableways should be included).

- Construction phase:

a) Identify and provide schedule for each phase of construction and operation for all project and ancillary facilities including the environmental issues associated with such ancillary activity, wherever possible:

I. Mobilisation of work including resources and labours
II. Road construction and improvements
III. Land clearing
IV. Blasting, if required
V. Borrow and spoil disposal
VI. Excavation and sub-grade preparation
VII. Foundation preparation
VIII. Concrete work
IX. Stockyard for construction materials
X. Construction and installation of each project facility
XI. Stabilisation of disturbed areas

b) Construction camps (if applicable):

I. Location of the camp. Land acquisition and compensation and study on the existing environment
II. Water supply and distribution
III. Waste generation, handling, and disposal
IV. Fuel supply

c) Handling and disposal of mucks: Provide the total quantity of excavated material likely to be generated during the construction period (in m^3), along with a management and disposal plan including identification of dump sites, dumping methods and restoration/reclamation plan.

7. Requirement of Resources

- Land: Provide details of the land requirements for different project activities such as transmission line RoW, substations, roads, labour camps, stockyards, and offices.
- Raw materials: A complete list of the raw material requirements for the construction and erection of transmission line with quantities, sources, an inventory of chemical, toxic or hazardous substances and storage means etc., in case of sub-stations.
- Description on water requirement
- Details of workforce to be employed – skilled, semi-skilled, and unskilled labour both during construction and operational phases of the project with specific attention to employment opportunities

for local population with assessment of skills available and training needs to make them employable for such projects.

- Equipment: equipment and machinery required for the proposed project along with type and quantity of fuels required for their operations.
- The project should also explore the availability of environment friendly technologies for the type of project proposed and the feasibility of adopting such technologies in the country.

8. Description of Existing Environment of the Project Area (Baseline Data)

The ESIA report must present two seasons' baseline information pertaining to the geo-physical, biological, socio-economic and cultural situation of the area under study, including any changes anticipated prior to project implementation. Baseline information should be provided within the 200 m on both sides of the RoW. The study area should be defined as the area of influence, including direct impact area, indirect impact area and cumulative impact area.

This section should provide detailed description and analysis of the type of baseline data and information collected, methodology used for data collection and explain how they were used, and the time and frequency of data collection. Based on the data collected, describe the existing baseline environmental and socio-economic conditions in quantitative and qualitative terms including comparison/analysis of the previous baseline data with the recent data.

a) Land Environment

- Provide details of topography, geology, stability, and type of soil in the project area.
- Provide information on the existence of any transmission lines (of different voltage levels) in the proposed area and the status of their environmental impacts such as visual aesthetics due to such infrastructures.
- Describe land use types of all lands required by the project such as transmission line alignment, substations, labour camps, stockyards, offices, etc.
- Discuss the characteristics of topsoil, its thickness and estimate the total quantity of topsoil to be generated during clearance of land along the RoW, construction of the transmission towers, sub-stations, access roads, labour camps, site offices, etc.

b) Air Environment

- Provide data on ambient air quality including parameters such as PM10, gaseous pollutants, and information on existing meteorological conditions such as temperature, humidity, rainfall and wind speed and direction, wherever applicable.
- Describe the source of emissions.

c) Water Environment

- Data on surface and sub-surface water characteristics including inventory of rivers, streams, springs, water crossings falling along the RoW of the transmission line.
- Information on the existence of any water sources along the route should be spelled out in the report.
- Detailed information on existing natural drainage/run-off patterns along the length of the proposed alignment.
- If any changes are likely in the drainage pattern due to the proposed activity, provide details of such changes including the identification of areas vulnerable to erosion and landslide.

d) Biodiversity

- Obtain a list on the type of vegetation and wildlife including birds along the RoW of transmission line and approach roads/cableways and proposed substation location from the nearest forest area.
- Collect primary data through biodiversity surveys on the occurrence of forest type and wildlife including avi-fauna in the project area and document the findings.
- Conduct public interviews to collect information on biodiversity.
- Compare the findings of the survey and interview with the list provided by the forest office.
- Existence of any restricted areas from a biodiversity perspective, if applicable.
- Give details on the type of forest being diverted for non-forest use and status of forest cover in the length of new alignment proposed.
- Inventories of species of trees and plants along the RoW and 200 metres on both sides of the RoW of the alternative as well as the final proposed alignment of the transmission route in every 10 KM stretch, access road/cableways and other project infrastructure's locations which will be permanently affected.
- Provide information on endemic, endangered and threatened species and their geographical distribution as per Forest and Nature Conservation Act (FNCA) of Bhutan 2023 and IUCN Red List.
- Documentation of economically important plants, medicinal as well as timber, fuel wood, non-wood timber products, etc.
- Obtain authentication and verification of the wildlife corridor by the competent authority.
- Provide information on the existence of any community forests and their significance.
- Provide information on the existence of biological corridors, national parks, sanctuaries, and their significance in terms of occurrence of any endangered/threatened flora and fauna species and their habitats. In case of biological corridors, state the type/species of fauna which uses it.
- In case of transmission passing through Protected Areas, provide the following:

Table 2. Protected area details for transmission line.

Name of the Protected area	**Length of transmission line in different zones within the protected area (km)**						**Total Length (km)**
	Enclave zone	**Buffer zone**	**Core zone**	**Seasonal grazing zone**	**Administrative zone**	**Multiple use zone**	

- If Substations fall within the Protected Areas, provide the following information.

Table 3. Protected area details for substations

Name of the Protected area	**Length of transmission line in different zones within the protected area (km)**	**Total Length (km)**

	Enclave zone	Buffer zone	Core zone	Seasonal grazing zone	Administrative zone	Multiple use zone	

- Provide the zonation map of the protected areas through which the transmission line passes.

e) Socio-economic and Cultural Aspect

- Cultural and heritage sites- Existence of any significant cultural, historical, archaeological, or environmentally sensitive sites along and 200 m on both sides of the RoW of the transmission line, access road/cableways alignment and other project infrastructures. List these sites as per Table 4 below.
- Provide inventory of cultural heritage (both tangible and intangible) that may be affected directly or indirectly by the proposed project including from its ancillary facilities in consultation with the Department of Culture (DoC), Ministry of Home Affairs (MoHA) and Local Government.

Table 4. Cultural and heritage site details:

Name of cultural heritage	Location Easting	Coordinates Northing	Describe the significance of the site. Is the site listed with Department of Culture

- Describe with the help of maps the number of villages likely to be affected by the proposed project. Provide details of the land use type likely to be affected in the villages.
- Study the socio-economic and livelihood benefits obtained by local communities from the forests likely to be affected by the transmission project and its ancillary facilities.

9. Public Consultation:

Public consultation is mandatory as per Article 16 of the EA Act 2000, and Public consultation needs to be carried out as per **Article 16** of the **Environment Assessment (EA) Act 2000**, and **Section 41** of the **Regulation for Environmental Clearance of Projects (RECOP) 2016**. The proponent must explain the expected impacts (both positive and negative) of the proposed project to the public and stakeholder agencies, listen to the concerns raised, provide clarifications and maintain record as follows:

- Description of issues raised and resolved during the consultation. List out pending issues and the proponent's views on the pending issues and how it will be addressed by the project.
- Provide evidence of public meeting and participation duly authenticated by the Local Government and Dzongkhag.
- Provide records of public consultation signed by the member(s) of the concerned local authority present during the public consultation.

10. Assessment of Potential Environmental Impacts

Assessment of potential environmental impacts should consider both negative and positive impacts of the construction of transmission line, its allied activities and alternatives. The ESIA report shall assess (in quantitative terms, to the maximum extent practicable) the direct and indirect potential environmental impacts from all aspects of the construction of transmission including short-term as well as long-term impacts for all the phases of the project (e.g acquisition, construction, operation and decommissioning) and cumulative impacts of the project.

Predictions of impacts should be accompanied by commonly used quantitative and qualitative methods and models available.

The ESIA report should contain a list of both adverse and beneficial impacts anticipated as consequences of the proposed Project activities at different stages of the project cycle.

a) Land Environment

Provide the assessment of the following:

- Impact due to land acquisition for the proposed project and corresponding land use changes the project would cause.
- Provide detailed assessment of the area of land required for the transmission line RoW. In areas of steep topography not all the forest within the RoW needs to be cleared. For a particular transmission line project, the total area of forest to be cleared should be calculated based on the length of transmission line and RoW for corresponding voltage level. However, the areas which are not required to be cleared should be estimated depending on the topography, type of land, and ground clearance requirement and should be subtracted from the total area to obtain the actual forest area to be cleared. *Refer Table 5: Areas of land use along transmission line RoW.*

Table 5. Areas of land use along transmission line RoW

Facility	Chushing (km^2)	Kamshing (km^2)	Tseri (km^2)	Tsamdo (km^2)	Sokshing (km^2)	Broadleaf (km^2)	Conifer forest (km^2)	Scrubland (km^2)	Total (km^2)
Transmission line RoW									
Actual Corridor clearing required									

- Substations – Detailed information on the land use required for the substation and type of vegetation existing in the proposed area should be provided as per *Table 6.*

Table 6. Areas of land use required for substations (m^2)

Facility	Chushing (km^2)	Kamshing (km^2)	Tseri (km^2)	Tsamdo (km^2)	Sokshing (km^2)	Broadleaf (km^2)	Conifer forest (km^2)	Scrubland (km^2)	Total (km^2)
Substation 1									
Substation 1									
Total area requiring clearance (m^2)									

Note: Scrubland also includes disturbed areas of BroadLeaf and Coniferous Forest that have been logged and are now regenerating

- Impact to the surrounding environment due to waste generation from labour camps and site offices.
- Impacts due to earth excavations. Provide the quantity of mucks likely to be generated surplus mucks likely to be generated from the proposed project.
- Impacts from extraction and production of construction materials such as aggregates, if applicable;
- Impact of project on the hilly terrain due to slope destabilisation caused by site preparation, civil works, construction of access roads and other activities, if applicable such as landslides, soil erosions and sedimentations due to surface run-offs;
- Aesthetics – Mention whether the location of the transmission line will significantly impair visual aesthetics. Explain in detail.
- Details of the quantity and characteristics of solid/hazardous wastes likely to be generated including from utilities, if applicable.
- Complete information on the use of hazardous materials such as insulating oils/gases [e.g. Polychlorinated Biphenyls (PCB) and Sulphur Hexafluoride (SF_6)] used in transformers used during the construction and vegetation maintenance of RoW should be enumerated in the ESIA, if any.

b) Air Environment

- Details about the potential sources of fugitive emissions and list of activities that may generate fugitive dust.
- Impact of fugitive emissions on ambient air quality and on workers during the construction phase of the project.
- Details about the potential sources of noise generating equipment and activities that may cause noise pollution. Level of noise likely to be generated from such sources.

c) Water Environment

- List of potential project activities which can cause contamination of water resources.
- Impacts of the project on local hydrology along the length of the new alignment including impact on surface and ground water resources.
- Impact of project and its auxiliary activities on land and water contamination.
- Impacts on water bodies due to discharge of effluents from labour camps, colonies and offices.

d) Biodiversity

Describe and provide assessment of:

- Impact of transmission line project on biodiversity
- Likely illegal hunting and poaching
- Impact on wildlife habitats
- Loss of species: Address the concern of possible extinction of such species

e) Socio-economic and Cultural Aspect

- Impact of land acquisition including a list of all affected families including names of family members, educational qualification, source of income, land holdings, house/land to be acquired and house/land

left after acquisition, details of any other property in possession and getting affected, animal possession, type of house, etc., number of houses, huts and other infrastructure that will be lost as a result of construction of various project components.

- Impact on the local economy including demographic changes.
- Impact due to immigration of the labour population.
- Impact on human health, hygiene and communicable disease risks.
- Impact due to increase in traffic.
- Impact and risks on gender and vulnerable groups
- Impact on cultural heritage (both tangible and intangible) such as archaeological, paleontological, historical, religious, pilgrims' properties, sacred sites, traditions and customs among others. Any cultural heritage present in the project area and study area should be verified by the DoC, MoHA and Local Government. Further, views of DoC, MoHA must be sought and submitted to DECC.
- The extent and nature of land and immovable property to be acquired from affected persons; including a list of public utilities and government buildings which are affected or likely to be affected. *For providing information refer Table 8: Losses of houses and other infrastructures.*
- Land ownership of the acquired land; provide information as described in Table 7.

Table 7. Land ownership and affected household details (m^2 or acres or decimal)

Facility	Chushing		Kamshing		Tseri		Tsamdo		Sokshing		Forest		Scrubland	Wet land	Total
	Ownership (O) / Households (HH)	Total Area Affected (TAA)	O / HH	TAA	O / HH	TAA	O / HH	TAA	O / HH	TAA	O / HH	TAA			
Sub-Station 1															
Sub-Station 2															
Transmission Line															
Total affected households (no.)															

Where HH= Households, O=Owner, Total Affected Area= TAA

Table 8. Losses of houses and other infrastructure

Facility	Houses (no.)	Other infrastructure, describe
Sub-Station 1		
Sub-Station 2		
Sub-Station 3		
Transmission Line		
Total (no.)		

Note: Other infrastructure losses could include shops, hotels, offices, health posts, schools, etc.

- Provide assessment of displacement of communities/people, if required.
- Describe the possibility of human-wildlife conflict due to the proposed project.
- Provide assessments of risk and hazard associated with transmission line, substation, and other allied activities both during construction and operation.

In addition to above, wherever applicable, following information should also be provided:

a) Electromagnetic Field (EMF): If EMF levels are confirmed or expected to be above the recommended exposure limits then:

- Evaluate potential exposure on workers, people living in existing residences, schools, other occupied buildings, and populated areas along the transmission corridor.
- Evaluate effects of EMF on wildlife and vegetation (if applicable).

b) Landslides, earthquakes, and snow avalanches – Based on the soil conditions, topography, and geological features along each of the sections of the transmission corridor, evaluate areas of potential slope instability, potential seismic risk, debris flows, and rock fall hazards.

c) Substation failure: Identify potential effects due to accidents and malfunctions associated with mechanical failures of project-related substation and capacitor station equipment.

d) Occupational health and safety: Assess the potential occupational health and safety issues that may arise out of:

- Live power lines (electrical hazards)
- Electric and magnetic fields
- Working at height
- Fire/explosions from transformers
- Exposure to chemicals

11. Assessment of Alternatives

A description and analysis of alternatives to the project and its alignment including:

a) the alternative of not undertaking the project (i.e., the no-build alternative) for the purpose of establishing a future baseline in relation to which the project and its alternatives can be described and analysed, and its potential environmental impacts and mitigation measures can be assessed;
b) an analysis of the feasible alternatives for both project and alignments;
c) an analysis of principal differences among the feasible alternatives under consideration, particularly regarding potential environmental impacts;
d) a brief discussion of any alternatives no longer under consideration including the reason for no longer considering these alternatives.

12. Mitigation and Environmental Management Plan (EMP)

A description and assessment of site specific physical, biological, and management measures designed to limit negative environmental impacts or to enhance positive environmental impacts during development of the project should be provided. The ESIA report shall specify in detail, the measures to be taken by the proponent to avoid, minimize, and mitigate potential adverse environmental impacts. Provide implementation schedule for the mitigation measures. The ESIA report shall also discuss alternatives to the proposed mitigation measures considered by the proponent, noting the relative benefits and costs of these alternative mitigation measures.

The EMP should discuss the mitigation measures against each impact, the timeline for completion, the responsible departments for implementation, the budget for the EMP, post monitoring provisions and reporting to the concerned regulatory authority. The EMP should essentially include but not be limited to the following:

- Resettlement and Rehabilitation plan (R&R) if displacement is involved. The plan should include details of the compensation provided/to be provided, including land-for-land compensation, employment, or money; provisions at the resettlement colony (such as basic amenities including housing, educational facilities, infrastructure, and alternate livelihood potential); a clear timeline for implementation, responsibility, budgets, grievance mechanism, etc.
- Detailed management plan to reduce landslides and ensure slope stabilization during transmission line construction, wherever applicable.
- Options for alternative or any substitute to avoid or minimize land acquisition with appropriate justification.
- Detail waste management plan: waste generated from the worksite, site offices, labour camps, and stockyard, if any must be managed and must prevent open dumping in the surrounding environment;
- Public safety strategy and plan: risk of circuit failure and electric shock must be addressed in the ESIA report. Proper awareness program and plan must be adopted for general public awareness;
- Mitigation measures for control of erosion and run-off from the area where construction is to take place, especially if there is a river or agricultural land adjoining the project site.
- If the transmission line project passes through sensitive areas, a Biodiversity Action Plan must be prepared. Detailed mitigation and management measures must be planned for protecting endangered species.
- Mitigation measures for noise abatement and control, wherever applicable.
- Management plan for topsoil utilisation and conservation.
- Management plan to reduce fugitive emissions during land clearing, civil works, handling/transporting of construction material, construction of access roads, quarry operations, etc., if applicable.
- Mitigation plan to reduce, avoid or minimise spills and leaks from transformers, substations, etc.
- Restoration and reclamation plan for all debris/spoil/muck disposal sites and other project affected areas.
- Management plan to minimise or avoid electrocution of raptors and other large birds.
- Mitigation measures against extreme weather events and natural catastrophes such as landslides, earthquakes, and avalanches.
- Afforestation and reforestation plan.
- Mitigation plan to minimise or avoid hazardous materials spills and leakages.
- A management plan for occupational health and safety of the workers and local community in the proposed transmission line RoW.
- A detailed management plan and EMP for improving and enhancing socio-economic conditions.
- Decommissioning Plan: Provide detailed plan to be implemented during decommissioning of the project.
- Rescue plan for flora and fauna species and habitats.
- Measures to manage and combat Human-Wildlife conflict, if caused by the proposed project.
- Slope stabilisation plan.

17. Environment Monitoring Plan

This section of the ToR must provide a comprehensive and detailed plan covering the environmental and social parameters/variables to be monitored. Clearly state the agencies responsible for the monitoring plan during construction and operation.

18. Environment Budget Outlay

Provide the activity breakdown and budget for the implementation of EMP and environmental monitoring both during construction and operation.

19. Response to Comments: A response to each comment received on the environmental assessment should be included in a separate appendix, unless this section clearly explains the location and response to each comment.

20. Annexures:

Provide the following annexure:

- Applications for environmental clearances for all the ancillary facilities such as construction of access roads, ropeway etc. should be submitted with duly filled separate Initial Environmental Examination form which is available on DECC web www.nec.gov.bt.
- A presentation of detailed technical data to the extent necessary to keep the main text of the ESIA Report clear and readable. The main text of the ESIA shall refer to and summarise any information contained in any annexure.
- A copy of the terms of reference duly approved by the DECC.
- Curriculum vitae of the ESIA consulting team members.
- Records of public consultation meetings signed by the member (s) of the concerned local authority present during public consultation.
- List of written consents from affected public and stakeholder agencies.
- Copy of minutes of all consultation meetings including public consultation records.
- Power evacuation study report prepared by Bhutan Power Corporation Limited.

NOTE:

- *The proponent should maintain consistency and accuracy in the report and no subjective statements shall be accepted.*
- *The proponent shall be responsible for undertaking any other related study desired by the DECC during the process of environmental clearance.*
- *Consistency and accuracy of information should be ensured in the report and no subjective statements shall be accepted.*
- *The ESIA report shall include all other necessary documents such as written consents and records of public consultation signed by the member(s) of the concerned local authority present during the public consultation for granting environmental clearance for the proposed project, etc.*
- *A soft copy of the report including all the annexes, maps including Google Earth images/maps, GIS data, etc. needs to be submitted along with the hard copy of the report.*
- *The proponent may refer to the 'Environmental Assessment Guideline for Power Transmission Line Projects, 2012' available at www.nec.gov.bt for practical guidance while preparing the ESIA report.*

Appendix 2 : Environmental monitoring form for Jomori Transmission Line

<Pre-construction Phase>

(a) Air pollution

- Monitoring item: PM_{10}, $PM_{2.5}$, SO_X, NO_X, CO
- Record: measurements are taken One time every Monsoon and Post-Monsoon before and after felling and clearing, at the boundaries of neighboring dwellings

(Date)
(Location)

(Data) Item (Unit.)	Baseline value	Measured value (Average value)	Measured value (Max. value)	Local standard*	Referred to international standards**	Remarks (e.g. location, frequency and method of measurement)
PM_{10} ($\mu g/m^3$)				60 (1-year) 100 (24-hour)	20 (1-year) 50 (24-hour)	Measured by PM meter for 30 minutes
$PM_{2.5}$ ($\mu g/m^3$)				40 (1-year) 60 (24-hour)	10 (1-year) 25 (24-hour)	Measured by PM meter for 30 minutes
SO_X ($\mu g/m^3$)				80 (24-hour)	20 (24-hour) 500 (10 minute)	
NO_X ($\mu g/m^3$)				80 (24-hour)	40 (1-year) 200 (1-year)	
CO ($\mu g/m^3$)				2000 (24-hour)	-	

*Note: * = National standard for ambient air quality (NEC,2020)*
*Note: ** = WHO Air Quality Guideline, 2021 (WHO, 2021)*

(b) Noise and vibration

Noise levels

- Monitoring item: noise levels
- Record: measurements are taken One time every Pre-Monsoon and Post-Monsoon before and after felling and clearing at the boundaries of neighboring dwellings

(Date)
(Location)

(Data) Item (Unit.)	Baseline value	Measured value (Average value)	Measured value (Max. value)	Local standard*	Referred to international standards**	Remarks (e.g. location, frequency and method of measurement)
Noise level (dB A)				[Sensitive Area] Daytime: 55 dBA Nighttime: 45 dBA [Mixed Area] Daytime: 65 dBA Nighttime: 55 dBA Maximum value allowed in workplace at any point of time is 75 dB(A)	[Sensitive Zone] Daytime: 55 dBA Nighttime: 45 dBA [Industrial zone] Daytime:70 dBA	

*Note: * = National standard for ambient air quality (NEC,2020)*
*Note: ** = IFC/WB Guideline*

(c) Land acquisition and resettlement

Land Compensation and Replacement

- Monitoring item: Land Compensation, Replacement and Crop Compensation
- Record: PAPs provided with Land Replacement, Land Compensation and Crop Compensation.

SN	Progress Indicator	Frequency
1	Number of affected HHs losing land been compensated (cash) for Land	monthly
2	Number of affected HHs provided land replacement	monthly
3	Number of affected HHs provided with Crop Compensation (cash)	monthly

(d) Complaints

i) Natural Environment

- Monitoring item and record: complaints from local government and residents

Date	Item	Complaint by	Complaint details	Action	Remarks (resolution status)

ii) Land Acquisition

- Monitoring item and record: complaints from local government and residents including PAPs on Land Acquisition

Date	Complaint by	Details of Complaint	Action	Remarks (resolution status)

<Construction Phase>

(a) Air pollution

- Monitoring item: PM_{10}, $PM_{2.5}$, SO_X, NO_X, CO
- Record: measurements are taken One time every Quater before and during the construction of the towers, at 144 tower locations and at the boundaries of neighboring dwellings.

(Date)
(Location)

(Data) Item (Unit.)	Baseline value	Measured value (Average value)	Measured value (Max. value)	Local standard*	Referred to international standards**	Remarks (e.g. location, frequency and method of measurement)
PM_{10} ($\mu g/m^3$)				60 (1-year) 100 (24-hour)	20 (1-year) 50 (24-hour)	Measured by PM meter for 30 minutes
$PM_{2.5}$ ($\mu g/m^3$)				40 (1-year) 60 (24-hour)	10 (1-year) 25 (24-hour)	Measured by PM meter for 30 minutes
SO_X ($\mu g/m^3$)				80 (24-hour)	20 (24-hour) 500 (10 minute)	
NO_X ($\mu g/m^3$)				80 (24-hour)	40 (1-year) 200 (1-year)	
CO ($\mu g/m^3$)				2000 (24-hour)	-	

*Note: * = National standard for ambient air quality (NEC,2020)*
*Note: ** = WHO Air Quality Guideline, 2021 (WHO, 2021)*

(b) Waste

- Monitoring item: waste storage and transport conditions
- Record: once a week, at the workers' camp and construction site, the amount of waste collected and disposed of by item by the waste collection and disposal contractor
- Check contractor's record ledgers

Date	Point	Monitoring item	Status during the reporting period.
		Amount of waste collected	

(c) Soil pollution

- Monitoring item: fuel, lubricating oil and other leaks
- Record: record at any time at the construction site and at the workers' camp
- Check the operator's record ledger

Date	Point	Monitoring item	Status during the reporting period.
		Fuel, lubricating oil and other leaks	

(d) Noise and vibration

Noise levels

- Monitoring item: noise levels
- Record: measurements are taken One time every Quater before and during the construction of the towers, at 144 tower locations and at the boundaries of neighboring dwellings.

(Date)
(Location)

(Data) Item (Unit.)	Baseline value	Measured value (Average value)	Measured value (Max. value)	Local standard*	Referred to international standards**	Remarks (e.g. location, frequency and method of measurement)
Noise level (dB A)				[Sensitive Area] Daytime: 55 dBA Nighttime: 45 dBA [Mixed Area] Daytime: 65 dBA Nighttime: 55 dBA Maximum value allowed in workplace at any point of time is 75 dB(A)	[Sensitive Zone] Daytime: 55 dBA Nighttime: 45 dBA [Industrial zone] Daytime:70 dBA	

*Note: * = National standard for ambient air quality (NEC,2020)*
*Note: ** = IFC/WB Guideline*

(e) Odors

- Monitoring item: presence or absence of odors by sensory examination
- Record: once a week at the workers' camp

Date	Point	Monitoring item	Referred to international standards	Status during the reporting period.
		Odors (sensory No.)	Sensory Indicator See page.165 *1; Odor index	

(f) Protected Area

- Monitoring item: towers harmony between artificial structure and natural landscapes
- Record: record One time every Quater, visual fixed-point observations and photography are conducted and documented.

Date	Point	Monitoring item	Status during the reporting period.
		Degree of harmony between the tower and the surrounding environment -Low level impact -Minor impact -Moderate impact	

Degree*: Low=Not bother, Minor=A little bother, Moderate=Tolerance
(No standard, but above criteria is usually used)

(g) Biodiversity

i) Flora and fauna

- Monitoring item: Plant species and distribution before and during construction of the Tower, and animal occurrence species in the vicinity
- Record: At any time after the start of construction, the occurrence of plant and animal species will be observed at project area and its surrounding area (500m on one side (1,000m on both sides) across the center of the T/L, covering from the starting point (SS) to the end point (HPP)).

Date	Point	Monitoring item	Status during the reporting period.
	Dotting the confirmation position at a map with 1/5000	Number of Plant species and distribution	
	Dotting the confirmation position at a map with 1/5000	Behavior of Animal species -Breeding action, -Nidification action, -Predation (fellow species) action, -Territorial dispute)	

ii) Flora and fauna which are removed or rescued at construction site

Date	Point	Monitoring item	Status during the reporting period.
		・Number of Animals and plants moved and transplanted to suitable habitats. ・Number of Animals that have been injured by the development act are protected and returned to a safe place after healing.	

(h) Land acquisition and resettlement

Land Compensation and Replacement

- Monitoring item: Land Compensation, Replacement and Crop Compensation
- Record: PAPs provided with Land Replacement, Land Compensation and Crop Compensation.

SN	Progress Indicator	Frequency
1	Number of affected HHs losing land been compensated (cash) for Land	monthly
2	Number of affected HHs provided land replacement	monthly
3	Number of affected HHs provided with Crop Compensation (cash)	monthly

(i) Labour Environment

- Monitoring item: Workplace Accident, Functional Toilets and Water Accessibility.

Date	Point	Monitoring item	Status during the reporting period.
		Workplace Accident	Number of Accidents / Type of Accident / Action Taken
		Are there toilets which are in working condition?	
		Do the workers have access to potable water and enough water for their use?	

(j) Accident

- Monitoring item: Traffic Accidents of vehicles associated with Project

Date	Monitoring item	Where and How did it occur	Damages caused by accident	Action Taken
	Traffic Accident			

(k) Complaints

i) Natural Environment

- Monitoring item and record: complaints from local government and residents

Date	Item	Complaint by	Complaint details	Action	Remarks (resolution status)

ii) Land Acquisition

- Monitoring item and record: complaints from local government and residents including PAPs on Land Acquisition

Date	Complaint by	Details of Complaint	Action	Remarks (resolution status)

<Operation Phase>

(a) Protected Area

- Monitoring item: Numbers of cutting trees, Numbers and species name of planting trees.
- Record: One time every year record, at project area and its surrounding area (500m on one side (1,000m on both sides) across the center of the T/L, covering from the starting point (SS) to the end point (HPP)).

Date	Point	Monitoring item	Status during the reporting period.
		Numbers of cutting trees	
		Numbers and species name of planting trees	

(b) Biodiversity

Flora and fauna

- Monitoring item: ① Plant species which was withered after construction of the Tower and behavior of animal species. ② Number of bird strike and its dead species
- Record: At any time after the completion of construction, the occurrence of withered plants and animal species will be observed at project area and its surrounding area (500m on one side (1,000m on both sides) across the center of the T/L, covering from the starting point (SS) to the end point (HPP)).

Date	Point	Monitoring item	Status during the reporting period.
	Dotting the confirmation position at a map with 1/5000	Number of Plant species and distribution	
	Dotting the confirmation position at a map with 1/5000	Behavior of Animal species -Breeding action, -Nidification action, -Predation (fellow species) action, -Territorial dispute)	
	Dotting the confirmation position at a map with 1/5000	Dead bird species and number by bird strike	

(c) Accident

- Monitoring item: Traffic Accidents of vehicles associated with Project

Date	Monitoring item	Where and How did it occur	Damages caused by accident	Action Taken
	Traffic Accident			

(d) Complaints

i) Natural Environment

- Monitoring item and record: complaints from local government and residents

Date	Item	Complaint by	Complaint details	Action	Remarks (resolution status)

Appendix 3 : List of flora species recorded in the project site

LC = Least Concern; EN = Endangered; VU = Vulnerable; NT = Near Threatened ; NL = Not Listed ; NC = Not Confirmed S1 = Schedule I ; S2 = Schedule II ; S3 = Schedule III				List Of Conservation			Survey Period	
No.	**Scientific name**	**English name**	**Data source**	**IUCN (2023)**	**FNCA**	**Sampling Point**	**1ST Survey (Rainy Season)**	**2ND Survey (Dry Season)**
1	*Abroma augusta*	Devils cotton	Direct Observation	NA	NA	1	○	
2	*Acacia catechu*	Black cutch	Direct Observation	LC	S2	1,2,5	○	
3	*Acacia pennata*	Rusty mimosa	Direct Observation	LC	NA	2, 5	○	
4	*Acacia rugata*	Soap-pod	Direct Observation	NA	NA	1	○	
5	*Acacia* sp.		Direct Observation					○
6	*Acanthus leucostachyus*	Prickly acanthus	Direct Observation	NA	NA	1,3,5	○	
7	*Acer oblongum*	Himalayan maple	Direct Observation	LC	NA	8, 9	○	
8	*Achyranthes aspera*	Chaff-Flower	Direct Observation	NA	NA	2,4,5,6	○	○
9	*Achyrospermum* sp.		Direct Observation					○
10	*Achyrospermum wallichianum*		Direct Observation	NL	NL		○	○
11	*Acmella uliginosa*	Para Cress	Direct Observation	LC	NA	6,8	○	
12	*Aconogono molle*	Thrumbula	Direct Observation	NA	NA	3,4,6,7	○	
13	Acronomelis sp		Direct Observation					○
14	*Actinodaphne obovata*	NA	Direct Observation	NA	NA	8	○	○
15	*Adiantum philippensis*	Maidenhair fern	Direct Observation	NA	NA	3,4,6,7	○	
16	*Adina cordifolia*	Indian Walnut	Direct Observation	NA	NA	6,7	○	
17	*Aerides multiflora*	Fox Tail Orchid	Direct Observation	NA	NA	6	○	
18	*Aerides odorata*	Cats tail orchid	Direct Observation	EN	NA	3	○	
19	*Aeschynanthus gracilis*	Lipstick vine	Direct Observation	NA	NA	3,7	○	
20	*Aeschynanthus micranthus*	small-flowered blushwort	Direct Observation	NA	NA	3,4,6	○	
21	*Aeschynanthus parviflorus*	Sikkim Blushwort	Direct Observation	NA	NA	6	○	
22	*Agapetes bhutanica*	Bhutanese Blueberry	Direct Observation	NA	NA	7	○	

23	*Agave angustifolia*	Narrow Century plant	Direct Observation	LC	NA	1,2,4,5	○	
24	*Ageratina adenophora*	Crofton weed	Direct Observation	NA	NA	1,2,4,5,6,8,9	○	○
25	*Ageratum conyzoides*	Billygoat -weed	Direct Observation	LC	NA	1,2,5,8,9	○	○
26	*Aglaia spectabilis*	Toothache Tree	Direct Observation	LC	NA	1, 2	○	
27	*Agrostophyllum callosum*	Himalayan grass leaf Orchid	Direct Observation	NA	NA	3,4,6,7	○	
28	*Agrostophyllum planicaule*	Flat-stem eria	Direct Observation	NA	NA	6,7,8	○	
29	*Ailanthus integrifolia*	White Siris	Direct Observation	LC	S3	2,3,4	○	○
30	*Alangium alpinum*	Mountain Alangium	Direct Observation	NA	NA	3,4	○	○
31	*Alangium chinense*	Chinese Stone Alangium	Direct Observation	NA	NA	6,7	○	
32	*Albiza lebbek*	Indian siris	Direct Observation	LC	S2	1,3,5	○	
33	*Albizia chinensis*	Indian siris	Direct Observation	NA	NA	2,5,6	○	
34	*Albizia julibrissin*		Direct Observation	NL	NL			○
35	*Albizia lucidior*	Shiney-leaved Albizia	Direct Observation	NL	NL	6,7	○	○
36	*Albizia procera*	White Siris	Direct Observation	LC	NA	2,4	○	
37	*Albizia* sp.		Direct Observation					○
38	*Alchornea mollis*	Badiki	Direct Observation	NA	NA	5,7	○	
39	*Alnus nepalensis*	Nepal Alder	Direct Observation	LC	S3	7,8	○	○
40	*Alocasia* sp.		Direct Observation					○
41	*Alpinia* sp.		Direct Observation					○
42	*Alstonia scholaris*	Indain Devil tree	Direct Observation	LC	NA	1	○	○
43	*Alternanthera ficoidea*	Parrot leaf	Direct Observation	NA	NA	3,4,5	○	
44	*Alternanthera sessilis*	Brazilian spinach	Direct Observation	NA	NA	4,5	○	
45	*Altingia excelsa*	Rasamala	Direct Observation	NA	S3	2,4	○	
46	*Amaranthus viridis*	Grean amaranth	Direct Observation	NA	NA	1,2,5	○	
47	*Amoora rohituka*	Amoora	Direct Observation	LC	NA	3,4	○	
48	*Anisomeles indica*	Indian Catmint	Direct Observation	NA	NA	6	○	
49	*Anthogonium gracile*	Slender Anthogonium	Direct Observation	NA	NA	6,7	○	

50	*Antidesma acidum*	Sour Currant Shrub	Direct Observation	LC	NA	3	○	
51	*Antidesma nigricans*	Tassel Berry	Direct Observation	NA	NA	3	○	
52	*Aphanamixis polystachya*	Rohituka tree	Direct Observation	LC	S3			○
53	*Apios carnea*	Groundnut or Indian Potato	Direct Observation	NA	NA	8	○	
54	*Aralia foliolosa*	Many-leaf craze	Direct Observation	NA	NA	5,6	○	
55	*Ardisia solanacea*	Shoebutton ardisia	Direct Observation	NA	NA	3,4	○	
56	*Ardisia* sp.		Direct Observation					○
57	*Argostemma sarmentosum*	Variable-Leaf Argostema	Direct Observation	NA	NA	5	○	
58	*Argyreia venusta*	Elephant creeper	Direct Observation	NA	NA	1	○	
59	*Artemisia myriantha*	Tite pali	Direct Observation	NL	NL	1,2,5,9	○	○
60	*Artocarpus* sp.		Direct Observation	NL				○
61	*Arundina graminifolia*	Bamboo orchid	Direct Observation	NA	NA	4	○	
62	*Asclepias* sp.		Direct Observation					○
63	*Asplenium nidus*	Bird next fern	Direct Observation	NA	NA	6	○	
64	*Baccaurea ramiflora*	Kusum (Lh)	Direct Observation	LC	NA	3,4	○	
65	*Baliospermum monanthum*	Red physic nut	Direct Observation	NA	NA	4	○	
66	*Baliospermum* sp.		Direct Observation					○
67	*Bauhinia purpurea*	Butterfly tree/ Orchid tree	Direct Observation	LC	NA	6, 7	○	
68	*Beaumontia grandiflora*	Easter Lily Vine	Direct Observation	NL	NL			○
69	*Begonia hatacoa*	Red-vein	Direct Observation	NA	NA	7	○	
70	*Beilschmiedia assamica*	Amchoi	Direct Observation	VU	NA	5,8	○	
71	*Beilschmiedia dalzellii*	Kosterm	Direct Observation	LC	NA	3	○	
72	*Berchemia nepalensis*		Direct Observation	NL	NL			○
73	*Betula alnoides*	Himalayan birch	Direct Observation	LC	S2	8,9	○	
74	*Bidens pilosa*	Beggars Tick	Direct Observation	NL	NL	7,8,9	○	○
75	*Bischofia javanica*	Bishopwood	Direct Observation	LC	S3	8	○	
76	*Blumea aromatica*	Ngai camphor	Direct Observation	NA	NA	9	○	

77	*Boehmeria hamiltonia*	False nettles	Direct Observation	NA	NA	7,8	○	
78	*Boehmeria macrophylla*	False nettles	Direct Observation	NA	NA	7	○	
79	*Boehmeria rugulosa*	Daar,Githa(Lh)	Direct Observation	NA	S3	8	○	○
80	*Boehmeria* sp.		Direct Observation					○
81	*Boerhavia coccinea*	Scarlet spiderling	Direct Observation	NA	NA	4	○	
82	*Bombex ceiba*	Red silk-cotton tree	Direct Observation	LC	S3	1,2,3,4	○	
83	*Brassaiopsis sp*	Drumstick	Direct Observation	NA	NA	3,6,7	○	○
84	*Brassaiopsis* sp.	Drumstick	Direct Observation	NA	NA		○	○
85	*Breynia retusa*	Cupped Coral-Berry	Direct Observation	LC	NA	5	○	
86	*Breynia* sp.		Direct Observation					○
87	*Bridelia retusa*	Spinous Kino tree	Direct Observation	LC	NA	5	○	○
88	*Bridelia sikkimensis*		Direct Observation	NL	NL			○
89	*Brucea mollis*	Soft-leaf Brucea	Direct Observation	NA	NA	3	○	
90	*Buddleja asiatica*	Asian Butterfly Bush	Direct Observation	NA	NA	3	○	
91	*Bulbophyllum affine*	Single Flowered Bulf-Leaf Orchid	Direct Observation	NA	NA	4,6	○	
92	*Bulbophyllum leptanthum*	Narrow flowered Orchid	Direct Observation	NA	NA	4	○	
93	*Bulbophyllum* sp.		Direct Observation					○
94	*Byttneria grandiflora*		Direct Observation	NL	NL			○
95	*Calamus erectus*	Viagra Palm	Direct Observation	NL	NL			○
96	*Calamus erectus var. schizospathus*	Viagra plam	Direct Observation	LC	NA	4,6	○	
97	*Calamus* sp.		Direct Observation					○
98	*Callostylis rigida*	Rigid Eria orchid	Direct Observation	NA	NA	5,7	○	
99	*Calophyllum sp*	Mastwood	Direct Observation	NA	NA	7	○	
100	*Canarium sikkmimensis*	NA	Direct Observation	NA	NA	1	○	
101	*Canarium strictum*		Direct Observation	NL	NL			○
102	*Canthium*sp.		Direct Observation					○
103	*Capparis acutifolia subsp.*	Chinese Caper	Direct Observation	NA	NA	8	○	

	viminea							
104	*Capparis*sp.		Direct Observation					○
105	*Carex* sp.		Direct Observation					○
106	*Caryota urens*		Direct Observation	LC	NL			○
107	*Casearia graveolenus*	Chilla	Direct Observation	NA	NA	5	○	○
108	*Cassia fistula*	Golden shower tree	Direct Observation	LC	S3	2	○	
109	*Castanopsis indica*		Direct Observation	LC				○
110	*Celtis tetrandra*	Nilgiri elm	Direct Observation	LC				○
111	*Celtis*sp.		Direct Observation					○
112	*Chloranthus elatior*	Larimas	Direct Observation	NA	NA	6,7	○	
113	*Choerospondias axillaris*	Nepali hog plum	Direct Observation	LC	NA	6	○	
114	*Chonemorpha fragrans*	Frangipani Vine	Direct Observation	NA	NA	7	○	
115	*Chromolaena odorata*	Devil Weed	Direct Observation	NA	NA	1,2,5,8,9	○	○
116	*Chukrasia* sp.		Direct Observation					○
117	*Chukrasia tabularis*	India Mahogany	Direct Observation	LC	NL			○
118	*Cinnamomum bejolghota*	Wild cassia	Direct Observation	LC	NL		○	○
119	*Cinnamomum glaucescens*		Direct Observation	LC	NL			○
120	*Cinnamomum tamala*	Tejpat	Direct Observation	LC	S3			○
121	*Cissampelos pareira*	Velvetleaf	Direct Observation	NA	NA	3,4,6,7,8	○	
122	*Clematis buchananiana*	Lemon Clematis	Direct Observation	NL	NL			○
123	*Cleome rutidosperma*	Fringed Spiderflower	Direct Observation	NA	NA	5	○	
124	*Clerodendrum colebrookianum*	East indian Glory bower	Direct Observation	NA	NA	2, 5	○	
125	*Clerodendrum hastatum*		Direct Observation	NL	NL			○
126	*Clerodendrum infortunatum*	Bagawak Na Puti	Direct Observation	NL	NL			○
127	*Clerodendrum serratum*	Blue Flowered Glory tree	Direct Observation	NA	NA	8	○	
128	*Coffea benghalensis*		Direct Observation	LC	NL			○
129	*Colocasia* sp.		Direct Observation					○
130	*Combretum sp.*	NA	Direct Observation	LC	NA	1	○	○

131	*Commelina benghalensis*	Benghal dayflower	Direct Observation	LC	NA	7	○	○
132	*Commelina paludosa*	Swamp Dayflower	Direct Observation	NL	NL			○
133	*Conyza bonariensis*	Flaxleaf Fleabane	Direct Observation	NA	NA	1,2	○	
134	*Crotalaria alata*	Winged-Stem Rattlepod	Direct Observation	NA	NA	8	○	
135	*Croton joufra*	Physic nut	Direct Observation	NA	NA	6,7	○	○
136	*Cuphea carthagenensis*	Colombian Waxweed	Direct Observation	NA	NA	3	○	
137	*Cuphea* sp.		Direct Observation					○
138	*Curcumorpha longiflora*	Orchid ginger	Direct Observation	NA	NA	3,4	○	
139	*Cuscata reflexa*	Giant dodder	Direct Observation	NA	NA	2	○	
140	*Cyanthillium cinereum*	Little Ironweed	Direct Observation	NA	NA	4	○	
141	*Dalbergia assamica*		Direct Observation	LC	NL			○
142	*Dalbergia pinnata*	Laleng- Chali	Direct Observation	LC	NA	2,5	○	
143	*Dalbergia sericea*	Silky Dalbergia	Direct Observation	LC	NA	5	○	
144	*Dalbergia*sp.		Direct Observation					○
145	*Debregeasia longifolia*	Orange Wild Rhea	Direct Observation	NA	NA	4	○	
146	*Dendrobium densiflorum*	Pineapple Orchid	Direct Observation	NA	NA	4	○	○
147	*Dendrobium jenkinsii*	Jenkinsii's dendrobium	Direct Observation	NA	NA	7	○	
148	*Dendrocalamus hamiltonii*	Hamilton's bamboo	Direct Observation	NL	NL			○
149	*Dendrocalamus* sp.		Direct Observation					○
150	*Dendrocnide sinuata*	Pulutus	Direct Observation	LC	NL			○
151	*Dendrocnide* sp.		Direct Observation					○
152	*Derris polystachya*	Red-leaf Derris	Direct Observation	NA	NA	9	○	
153	*Desmodium triflorum*	Creeping Tickfoil	Direct Observation	NA	NA	3,4,6,8,9	○	
154	*Desmodium*sp.		Direct Observation					○
155	*Desmos chinensis*	Chinese Demos	Direct Observation	NA	NA	2	○	
156	*Dicliptera bupleuroides*	Thorowax Foldwing	Direct Observation	NA	NA	7,8	○	○
157	*Dicranopteris sp*	NA	Direct Observation	NA	NA	6,7	○	
158	*Dillenia indica*	Elephant Apple	Direct Observation	LC	NA	2	○	

159	*Dillenia pentagyna*	Karmal	Direct Observation	NL	NL			○
160	*Dioscorea bulbifera*		Direct Observation	NL	NL			○
161	*Dioscorea deltoidea*	Nepal yam	Direct Observation	EN	S2	3,7	○	
162	*Dioscorea hispida*	Intoxicating Yam	Direct Observation	Critically EN	NA	4	○	
163	*Diplazium* sp.		Direct Observation					○
164	*Docynia indica*	Monkey Apple	Direct Observation	NA	NA	9	○	
165	*Dracaena angustifolia*	Silhouette Plant	Direct Observation	NA	NA	1	○	
166	*Drimycarpus racemosus*	Amsia	Direct Observation	NA	NA	4	○	○
167	*Drypetes indica*	Indian Amulet Tree	Direct Observation	NA	NA	6	○	
168	*Duabanga grandiflora*	Duabanga	Direct Observation	LC	S2	5	○	○
169	*Dysoxylum gotadhora*	Cup-Calyx White Cedar	Direct Observation	NA	NA	7	○	
170	*Elaeocarpus lanceifolius*	Indian Olive	Direct Observation	NA	NA	4	○	
171	*Elaeocarpus* sp.		Direct Observation					○
172	*Elatostema lineolatum*	Lined Elatostema	Direct Observation	NA	NA	7,8,9	○	
173	*Elatostema longicaudatum*	Long-Tailed Elatostema	Direct Observation	LC	NA	6	○	
174	*Elatostema* sp.		Direct Observation					○
175	*Emilia sonchifolia*	Lilac tasselflower	Direct Observation	NA	NA	8	○	
176	*Entada rheedii*	snuff box sea bean	Direct Observation	NA	NA	5	○	
177	*Eranthemum* sp.		Direct Observation					○
178	*Erythrina arborescens*	Himalayan Coral Tree	Direct Observation	NA	NA	5	○	
179	*Erythrina* sp.		Direct Observation					○
180	*Eurya* sp.		Direct Observation					○
181	*Exbucklandia populnea*	Pipli Tree	Direct Observation	NA	NA	8	○	
182	*Falconeria insignis*		Direct Observation	NL	NL			○
183	*Ficus auriculata*	Himalaya Fig Tree	Direct Observation	LC	NA	3	○	
184	*Ficus drupacea*	Brown-wolly Tree	Direct Observation	NA	NA	6	○	
185	*Ficus elastica*		Direct Observation	LC	NL			○

186	*Ficus hirta*	Hairy fig	Direct Observation	NA	NA	5	○	
187	*Ficus hispida*	Hairy Fig	Direct Observation	LC	NA	7	○	
188	*Ficus lamponga*	Lampong Fig	Direct Observation	NA	NA	6	○	
189	*Ficus nudiflora*	Shedding Fig	Direct Observation	NA	NA	2	○	
190	*Ficus semicordata*	Red-stem Fig	Direct Observation	LC	NA	4	○	○
191	*Ficus* sp.		Direct Observation					○
192	*Flemingia macrophylla*		Direct Observation	NL	NL			○
193	*Flueggea virosa*	White Honey Shrub	Direct Observation	NA	NA	2	○	○
194	*Fraxinus floribunda*	Himalayan Ash	Direct Observation	LC	NA	5,6	○	
195	*Garuga pinnata*	Grey Nicker	Direct Observation	NA	NA	7	○	○
196	*Gaultheria trichophylla*	Himalayan Snowberry	Direct Observation	NA	NA	7	○	
197	*Glochidion sphaerogynum*	Globe-Fruited Spike Thorn	Direct Observation	NA	NA	4	○	
198	*Gomphostemma parviflorum*	Small-Flowered Gomphostemma	Direct Observation	NA	NA	4	○	
199	*Goniothalamus sesquipedalis*	Long-Pedicelled Goniothalamus	Direct Observation	NA	NA	5	○	○
200	*Gouania leptostachya*	Narrow-Spiked Rattlepod	Direct Observation	NA	NA	2	○	
201	*Grewia sepiaria*	Grey Leaved Indian Raisin	Direct Observation	EN	NA	1	○	
202	*Gynocardia odorata*	Cardamom Vine	Direct Observation	NA	NA	3,4	○	
203	*Hedychium coccineum*	Applecourt	Direct Observation	NL	NL			○
204	*Hedyotis scandens*	Climbing Hedyotis	Direct Observation	NA	NA	3	○	
205	*Heteropanax fragrans*	Fragrant Aralia	Direct Observation	NL	NL			○
206	*Heynea trijuga*	Heynea	Direct Observation	NA	NA	5	○	○
207	*Hiptage bengalensis*	Helicopter Flower	Direct Observation	NA	NA	2	○	
208	*Hodgsonia macrocarpa*	Elephant Apple	Direct Observation	NA	NA	6, 7	○	
209	*Holarrhena pubescens*	Conessi Tree	Direct Observation	NA	NA	6	○	
210	*Holarrhena* sp.		Direct Observation					○
211	*Holmskioldia sanguinea*	Chinese Hat Plant	Direct Observation	NA	NA	6	○	

212	*Hoya obcordata*	Heart-Leaf Hoya	Direct Observation	NA	NA	3	○	
213	*Hoya* sp.		Direct Observation					○
214	*Huperzia squarrosa*	Fir Clubmoss	Direct Observation	NA	NA	5	○	
215	*Hymenodictyon flaccidum*	Hymenodictyon	Direct Observation	NA	NA	2	○	
216	*Hyptianthera stricta*	Hyptianthera	Direct Observation	NA	NA	4	○	○
217	*Hyptis suaveolens*	Bushmint	Direct Observation	NA	NA	2	○	
218	*Ilex sp.*	Holly	Direct Observation	NA	NA	4	○	
219	*Ipomoea quamoclit*	cypress vine	Direct Observation	NL	NL			○
220	*Itea mycrophylla*	Littleleaf Sweetspire	Direct Observation	NA	NA	1	○	
221	*Ixora* sp.		Direct Observation					○
222	*Jasminum* sp.		Direct Observation					○
223	*Justicia adhatoda*	Malabar nut	Direct Observation	LC				○
224	*Knema* sp.		Direct Observation					○
225	*Knema tenuinervia*	Knema	Direct Observation	NA	NA	4	○	
226	*Kydia calycina*	Kydia	Direct Observation	LC	NA	4	○	○
227	*Lagerstroemia hirsuta*	Hairy Crepe Myrtle	Direct Observation	NA	NA	7	○	
228	*Lagerstroemia lanceolata*		Direct Observation	LC	S3			○
229	*Lagerstroemia parviflora*	Small-Flowered Crepe Myrtle	Direct Observation	NA	NA	5	○	
230	*Lantana camara*	Common Lantana	Direct Observation	NA	NA	1,2,4,5,8,9	○	○
231	*Laparis* sp.		Direct Observation					○
232	*Leea indica*	Bandicoot Berry	Direct Observation	NA	NA	7	○	
233	*Leea* sp.		Direct Observation					○
234	*Liquidambar excelsa*	Rasamala	Direct Observation	LC	S3			○
235	*Lithocarpus elegans*	Kohin	Direct Observation	LC	NL			○
236	*Litsea cubeba*	May Chang	Direct Observation	NA	NA	2	○	
237	*Litsea monopetala*	Litsea	Direct Observation	NA	NA	6	○	
238	*Litsea* sp.		Direct Observation					○

239	*Livistona jenkinsiana*	Major Jenkins' fan palm	Direct Observation	NL	NL			○
240	*Lonicera* sp.		Direct Observation					○
241	*Macaranga denticulata*	Macaranga	Direct Observation	NA	NA	5	○	○
242	*Macaranga peltata*	Macaranga	Direct Observation	NA	NA	4	○	
243	*Maesa chisia*	Chisia wild berry	Direct Observation	NL	NL			○
244	*Maesa indica*	Indian Plum	Direct Observation	LC	NL	3,5	○	○
245	*Maesa macrophylla*	Large-Leaved Maesa	Direct Observation	NA	NA	3	○	○
246	*Magnolia hodgsonii*	Large-leaf Magnolia	Direct Observation	LC	NL			○
247	*Mallotus philippensis*	Kamala tree	Direct Observation	LC	NL			○
248	*Mallotus roxburghianus*	Roxburgh's Kamala	Direct Observation	NA	NA	5	○	
249	*Mallotus tetracoccosus*	Kamala	Direct Observation	NA	NA	5	○	
250	*Malotus* sp.		Direct Observation					○
251	*Malus sikkimensis*	Sikkim crabapple	Direct Observation	Data Deficient	NL			○
252	*Mangifera sylvatica*	Himalayan mango	Direct Observation	LC	NL			○
253	*Melastoma normale*	Malabar Melastoma	Direct Observation	NA	NA	4	○	
254	*Melia azedarach*	Chinaberry	Direct Observation	NA	NA	5	○	
255	*Meliosma pinnata*	Meliosma	Direct Observation	NA	NA	2	○	
256	*Mentha longifolia*	Horse Mint	Direct Observation	NA	NA	3	○	
257	*Meyna spinosa*	Greenish-Yellow Flower	Direct Observation	NA	NA	6	○	
258	*Micromelum* sp.		Direct Observation					○
259	*Mikania micrantha*	Climbing hemp vine	Direct Observation	NL	NL			○
260	*Miliusa macrocarpa*	Miliusa	Direct Observation	NA	NA	5	○	
261	*Milliusa* sp.		Direct Observation					○
262	*Mimosa pudica*	Sensitive Plant	Direct Observation	NA	NA	1,2,5,8,9	○	
263	*Mimusops elengi*	Spanish Cherry	Direct Observation	LC	NA	3	○	
264	*Mitrephora harae*		Direct Observation	NL	NL			○
265	*Molineria capitulata*	India Molineria	Direct Observation	NA	NA	2	○	

266	*Momordica dioica*	Indian Balsam Pear	Direct Observation	NA	NA	7	○	
267	*Monoon simiarum*		Direct Observation	LC	NL			○
268	*Monosis volkameriifolia*	Himalayan tree vernonia	Direct Observation	LC				○
269	*Morinda angustifolia*	Morinda	Direct Observation	NA	NA	7	○	
270	*Morus macroura*	King White Mulberry	Direct Observation	LC	NL			○
271	*Mucuna macrocarpa*	Velvet Bean	Direct Observation	NA	NA	3	○	
272	*Murdannia nudiflora*	Asiatic Dewflower	Direct Observation	NA	NA	8	○	
273	*Murrya paniculata*	Orange Jasmine	Direct Observation	NL	NL			○
274	*Musa sp*	Banana	Direct Observation	NA	NA	5	○	○
275	*Musa* sp.	Banana	Direct Observation	NA	NA		○	○
276	*Mussaenda roxburghii*	Mussaenda	Direct Observation	NA	NA	3	○	
277	*Mussaenda sp*	Mussaenda	Direct Observation	NA	NA	3	○	
278	*Mycetia longifolia*	Mycetia	Direct Observation	NA	NA	2,4	○	
279	*Nasturtium officinalis*	Watercress	Direct Observation	LC	NA	5	○	
280	*Neocinnamomum caudatum*	Cinnamon	Direct Observation	NA	NA	4	○	
281	*Neocinnamomum* sp.		Direct Observation					○
282	*Neolamarckia cadamba*	Cadamba	Direct Observation	NA	NA	3	○	
283	*Neolitsea foliosa*	Neolitsea	Direct Observation	NA	NA	2	○	
284	*Nephrolepsis cordifolia*	Fishbone Fern	Direct Observation	NL	NL			○
285	*Neyraudia arundinacea*	Burr Grass	Direct Observation	NA	NA	2	○	
286	*Oplismenus burmannii*	Burmann's basketgrass	Direct Observation	NL	NL			○
287	*Oreocnide* sp.		Direct Observation					○
288	*Orerelthya cynthia*	Ailanthus silkmoth	Direct Observation					○
289	*Oroxylum indicum*	Midnight Horror	Direct Observation	NA	NA	5	○	
290	*Orthosiphon rubicundus*	Red-Stemmed Cat's Whiskers	Direct Observation	NA	NA	4	○	
291	*Osbeckia nepalensis var. nepalensis*	Nepalese Osbeckia	Direct Observation	NA	NA	7	○	
292	*Osbeckia nutans*	Nodding Osbeckia	Direct Observation	NA	NA	7	○	

293	*Ostodes paniculata*	Ostodes	Direct Observation	LC	NA	5	○	○
294	*Paederia foetida*	Skunk Vine	Direct Observation	NA	NA	3	○	○
295	*Pandanus furcatus*	Hala Tree	Direct Observation	EN	NL	6	○	○
296	*Parasassafrasconfertiflora*	Se-lung tree	Direct Observation	NA	NA	8	○	
297	*Parthenocissus* sp.		Direct Observation					○
298	*Peperomia pellucida*	Shiny Bush	Direct Observation	NA	NA	5	○	
299	*Periploca calophylla*	Pretty-Leaved Silkflower Vine	Direct Observation	NL	NL			○
300	*Persea sp.*		Direct Observation					○
301	*Persicaria* sp.		Direct Observation					○
302	*Phlogacanthus thyrsiformis*		Direct Observation	NL	NL			○
303	*Phoebe lanceolata*	Sweet Tamarind	Direct Observation	LC	NA	3	○	○
304	*Phoebe* sp.		Direct Observation					○
305	*Phoenix rupicola*	Cliff Date Palm	Direct Observation	NT	NA	6	○	
306	*Phoenix* sp.		Direct Observation					○
307	*Phrynium* sp.		Direct Observation					○
308	*Phylla nodiflora*	Frog Fruit	Direct Observation	LC	NA	6	○	
309	*Phyllanthus emblica*	Indian Gooseberry	Direct Observation	LC	NL	5	○	○
310	*Phyllanthus sp.*	NA	Direct Observation	NA	NA	5	○	
311	*Picrasma javanica*	Indonesian Quinine	Direct Observation	NA	NA	3	○	
312	*Picrasma* sp.		Direct Observation					○
313	*Pilea* sp.		Direct Observation					○
314	*Piper betleoides*	Betel Pepper	Direct Observation	NA	NA	4,5,8	○	
315	*Piper pedicellatum*		Direct Observation	VU	NL			○
316	*Piper* sp.		Direct Observation					○
317	*Plectocomia himalayana*	Himalayan Hanging Bamboo	Direct Observation	LC	NA	4	○	
318	*Podocarpus* sp.		Direct Observation					○
319	*Pogostemon benghalensis*	Bengal Pogostemon	Direct Observation	NA	NA	5	○	○

320	*Poikilospermum* sp.		Direct Observation					○
321	*Pollia hasskarlii*	East-Indian Pollia	Direct Observation	NA	NA	5	○	
322	*Pollia subumbellata*	Umbelled Pollia	Direct Observation	NA	NA	6	○	○
323	*Polyalthia* sp.		Direct Observation					○
324	*Porana paniculata*	Porana Creeper	Direct Observation	NA	NA	3	○	
325	*Pothos* sp.		Direct Observation					○
326	*Pouzolzia sanguinea*	Red-Stemmed Pouzolzia	Direct Observation	NA	NA	4,6	○	
327	*Pouzolzia* sp.		Direct Observation					○
328	*Premna* sp.		Direct Observation					○
329	*Pseudognaphalium affine*	Jersey Cudweed	Direct Observation	NA	NA	9	○	
330	*Psilanthus bengalensis*	Bengal Psilanthus	Direct Observation	LC	NA	4	○	
331	*Psychotria calocarpa*	Yellow Psychotria	Direct Observation	NA	NA	7	○	
332	*Psychotria* sp.		Direct Observation					○
333	*Pteridium aquilinum*	Bracken Fern	Direct Observation	NA	NA	6,7	○	
334	*Pteriospermum acerifolium*	Maple-leaved Bayur tree	Direct Observation	NL	NL			○
335	*Pteriospermum javonica*		Direct Observation	NL	NL			○
336	*Pteris* sp.		Direct Observation					○
337	*Rauwolfia serpentina*	Indian Snakeroot	Direct Observation	NA	S2	2	○	
338	*Remusatia hookeriana*	Hooded Dwarf Lily	Direct Observation	NA	NA	4	○	
339	*Rhamnus napalensis*	Nepalese Buckthorn	Direct Observation	NA	NA	5	○	
340	*Rhaphidophora* sp.		Direct Observation					○
341	*Rhododendron arboreum*	Rhododendron Tree	Direct Observation	NA	NA	7	○	
342	*Rhus chinensis*	Chinese Sumac	Direct Observation	LC	S3	7,9	○	○
343	*Rubia sikkimensis*	Sikkim Madder	Direct Observation	NA	NA	8	○	
344	*Rubus biflorus*	Taktse metog	Direct Observation	NA	NA	7	○	
345	*Rubus elipticus*	Yellow Himalayan Raspberry	Direct Observation	NA	NA	8,9	○	
346	*Rubus hirstus*	Blackberry	Direct Observation	NA	NA	7	○	

347	*Rubus paniculatus*	Himalayan blackberry	Direct Observation	NL	NL		○	○
348	*Rubus preptanthus*	Himalayan blackberry	Direct Observation	NL	NL	8	○	○
349	*Salvia plebeia*	Japanese Sage	Direct Observation	NA	NA	6	○	
350	*Sambucus javanica*	Java Elderberry	Direct Observation	LC	NA	7	○	
351	*Sapindus rarak*	lerak or klerek	Direct Observation	NA	NA	4	○	
352	*Sapium insigne*	Bilodar Chicada Chinese Tallow Curupi	Direct Observation	NA	NA	5	○	
353	*Saurauja armata*	Armed Saurauja	Direct Observation	NA	NA	6	○	
354	*Saurauja napaulensis*	Nepalese Saurauja	Direct Observation	NA	NA	5	○	
355	*Saurauja Sp*	NA	Direct Observation	NA	NA	5	○	
356	*Schefflera roxburghii*	Umbrella Tree	Direct Observation	LC	NA	7	○	
357	*Schima wallichii*	Wallich's Schima	Direct Observation	LC	NA	5, 8	○	○
358	*Scurrula parasitica*	Mistleto	Direct Observation	NA	NA	7	○	
359	*Setaria palmifolia*	Palmleaf Bristlegrass	Direct Observation	NA	NA	5	○	
360	*Sida acuta*	Common Wireweed	Direct Observation	NL	NL	1,2	○	○
361	*Sizigium cumini*	Java Plum	Direct Observation	LC	NA	6	○	
362	*Sizigium formosum*	Malay Apple	Direct Observation	NA	NA	5	○	
363	*Sloanea tomentosa*	Velvet Sloanea	Direct Observation	LC	NA	4	○	
364	*Smilax* sp.		Direct Observation		NL			○
365	*Solanum erianthum*	Hairy Nightshade	Direct Observation	NA	NA	7	○	
366	*Solanum viarum*		Direct Observation	LC	NL			○
367	*Solena amplexicaulis*	Clasping-Leaved Solena	Direct Observation	NA	NA	7	○	
368	*Spermacoce latifolia*	Broadleaf Buttonweed	Direct Observation	NA	NA	4	○	
369	*Sphaerosacme decandra*	Ten-Angled Blisterpod	Direct Observation	NA	NA	8,9	○	
370	*Stachytarpheta cayannensis*	Brazilian Tea	Direct Observation	NA	NA	6	○	
371	*Stephania glabra*	Hairless Tape Vine	Direct Observation	NA	NA	5	○	
372	*Stephania* sp.		Direct Observation					○
373	*Sterculia hamiltonii*		Direct Observation	NL	NL			○

374	*Sterculia villosa*	Large-leaved Sterculia	Direct Observation	LC	S3	2	○	○
375	*Stereospermum colais*	Trumpet flower	Direct Observation	NL	NL			○
376	*Streblus asper*	Hard-Leaved Rata	Direct Observation	LC	NA	3	○	
377	*Strobilanthes hamiltoniana*	Hamilton's Strobilanthes	Direct Observation	NA	NA	7	○	
378	*Strobilanthes* sp.		Direct Observation					○
379	*strobilanthus callosa*	Shaggy Strobilanthes	Direct Observation	NA	NA	3	○	
380	*Synedrella nodiflora*	Piggrass	Direct Observation	NA	NA	1	○	
381	*Syzygium formosum*		Direct Observation	NL	NL			○
382	*Syzygium* sp.		Direct Observation					○
383	*Syzygium tetragonium*		Direct Observation	NL	NL			○
384	*Tabernaemontana divaricata*	Crepe Jasmine	Direct Observation	NA	NA	5	○	○
385	*Tacca integrifolia*	White Bat Flower	Direct Observation	NA	NA	8	○	
386	*Tamarindus indica*	Tamarind	Direct Observation	NA	NA	6	○	
387	*Tectona grandis*	Teak	Direct Observation	NA	S2	5	○	
388	*Terminalia bellirica*	Belleric Myrobalan	Direct Observation	LC	S3	3	○	
389	*Terminalia myriocarpa*	East Indian almond	Direct Observation	LC	NL	4	○	○
390	*Terminilia chebula*	Chebulic Myrobalan	Direct Observation	NA	S3	4	○	
391	*Tetrameles nudiflora*	Bhend Bhendsa Chinni False Hemp Tree	Direct Observation	LC	NL	2,3	○	
392	*Tetrastigma serrulatum*	Grape Leaved Tetrastigma	Direct Observation	NA	NA	2	○	
393	*Tetrastigma* sp.		Direct Observation					○
394	*Thladiantha cordifolia*	Heartleaf Thladiantha	Direct Observation	NA	NA	4	○	
395	*Thunbergia coccinea*	Red Clock Vine	Direct Observation	NA	NA	5	○	○
396	*Thunbergia grandiflora*	Blue Trumpet Vine	Direct Observation	NA	NA	8	○	
397	*Thysanolaena latifolia*	Tiger Grass	Direct Observation	NA	S3	4	○	○
398	*Tinospora cordifolia*	Heart-Leaved Moonseed	Direct Observation	NA	NA	7	○	
399	*Toddalia asiatica*	Forest Pepper	Direct Observation	NA	NA	5	○	
400	*Toona ciliata*	Australian Red Cedar	Direct Observation	LC	S2	7,8	○	○

401	*Torenia diffusa*	Bluewings	Direct Observation	NA	NA	7	○	
402	*Torenia* sp.		Direct Observation					○
403	*Torenia violacea*	Violet Wishbone Flower	Direct Observation	NA	NA	6	○	
404	*Toricellia tiliifolia*	Toricellia	Direct Observation	NA	NA	2	○	
405	*Toxicodendron hookeri*		Direct Observation	LC	NL			○
406	*Trema tomentosa*	Poon	Direct Observation	NA	NA	3,4	○	
407	*Trevesia palmata*	Snow flake Aralia	Direct Observation	LC	NL			○
408	*Trewia nudiflora*	Shinyleaf Trewia	Direct Observation	LC	NA	5	○	
409	*Trichosanthes* sp.		Direct Observation					○
410	*Tridax procumbens*	Coat Buttons	Direct Observation	NA	NA	2	○	
411	*Triumfetta rhomboidea*	Burr Bush	Direct Observation	NL	NL	2,4,5	○	○
412	*Tropidia angulosa*		Direct Observation	NL	NL			○
413	*Tylophora belostemma*	Tylophora	Direct Observation	NA	NA	2	○	
414	*Typha elephantina*	Elephant Grass	Direct Observation	NA	NA	2	○	
415	*Uncaria sessilifructus*	Chinese Cat's Claw	Direct Observation	NA	NA	1,5	○	
416	*Uncaria* sp.		Direct Observation					○
417	*Urena lobata*	Caesarweed	Direct Observation	LC	NA	6,7,8	○	
418	*Urera* sp.		Direct Observation					○
419	*Urtica* sp.		Direct Observation					○
420	*Vernonia volkameriifolia*	Volkameria Vernonia	Direct Observation	NA	NA	8	○	
421	*Vitex negundo*	Five-Leaved Chaste Tree	Direct Observation	NA	NA	6,7	○	
422	*Wallichia densiflora*	Himalayan dwarf fishtail palm	Direct Observation	NL	NL			○
423	*Wendladia grandis*		Direct Observation	NL	NL			○
424	*Wendlandia* sp.		Direct Observation					○
425	*Woodfordia fruticosa*	Fire flame bush	Direct Observation	LC	NL			○
426	*Wrightia arborea*	Woolly Wrightia	Direct Observation	LC	NA	5	○	
427	Zanthoxylum acanthopodium	Andaliman Pepper	Direct Observation	LC	NL			○

428	*Zanthoxylum asiaticum*	Orange climber	Direct Observation	NL	NL			○
429	*Zanthoxylum myriacanthum*	Largetooth Prickly Ash	Direct Observation	NA	NA	8,9	○	
430	*Ziziphus* sp.		Direct Observation					○
431	*Zizyphus incurva*	Roundleaf Jujube	Direct Observation	NA	NA	3	○	
432	*Zizyphus mauritiana*	Indian Jujube	Direct Observation	NA	NA	6	○	

Appendix 4 : Plot wise floral diversity in the proposed

Plot ID	H'
JM TL 01	2.16
JM TL 02	2.76
JM TL 03	2.75
JM TL 04	**3.05**
JM TL 05	2.04
JM TL 06	2.81
JM TL 07	2.91
JM TL 08	2.80
JM TL 09	3.15
JM TL 10	2.98
JM TL 11	2.19
JM TL 12	2.94
JM TL 13	2.80
JM TL 14	2.83
JM TL 15	2.99
JM TL 16	**2.96**
JM TL 17	2.92
JM TL 18	2.73
JM TL 19	3.04
JM TL 20	3.16
JM TL 21	5.11
JM TL 22	3.15
JM TL 23	3.13
JM TL 24	3.09

Appendix 5 : Plot wise tree diversity in the proposed TL

Plot ID	H'
JM TL 01	2.397895
JM TL 02	1.94591
JM TL 03	1.94591
JM TL 04	2.890372
JM TL 05	1.609438
JM TL 06	2.197225
JM TL 07	2.615631
JM TL 08	2.197225
JM TL 09	2.484907
JM TL 10	2.564949
JM TL 11	2.564949
JM TL 12	2.666554
JM TL 13	2.397895
JM TL 14	2.772589
JM TL 15	2.397895
JM TL 16	2.772589
JM TL 17	2.484907
JM TL 18	2.484907
JM TL 19	2.639057
JM TL 20	2.564949
JM TL 21	2.302585
JM TL 22	**2.70805**
JM TL 23	2.484907
JM TL 24	2.397895

Appendix 6 : Plot wise tree density in the proposed TL

Plot ID	Total trees	Density (m^2)	Density (Ha)
JM TL 01	11	0.05	488.89
JM TL 02	7	0.03	311.11
JM TL 03	7	0.03	311.11
JM TL 04	18	0.08	800.00
JM TL 05	5	0.02	222.22
JM TL 06	9	0.04	400.00
JM TL 07	15	0.07	666.67
JM TL 08	9	0.04	400.00
JM TL 09	12	0.05	533.33
JM TL 10	13	0.06	577.78
JM TL 11	13	0.06	577.78
JM TL 12	**17**	0.08	755.56
JM TL 13	11	0.05	488.89
JM TL 14	16	0.07	711.11
JM TL 15	11	0.05	488.89
JM TL 16	16	0.07	711.11
JM TL 17	12	0.05	533.33
JM TL 18	12	0.05	533.33
JM TL 19	14	0.06	622.22
JM TL 20	**13**	0.06	577.78
JM TL 21	10	0.04	444.44
JM TL 22	15	0.07	666.67
JM TL 23	12	0.05	533.33
JM TL 24	11	0.05	488.89

Appendix 7 : Plot wise average and total tree volume in the proposed TL

Plot ID	Average volume	Total volume
JM TL 01	12.61	126.1491
JM Tl 02	26.71	186.9768
JM TL 03	14.91	104.379
JM TL 04	1.48	26.60484
JM TL 05	357.46	1787.29
JM TL 06	124.51	1120.627
JM TL 07	183.14	2380.805
JM TL 08	22.00	197.9911
JM TL 09	67.82	813.8394
JM TL 10	4.53	54.31163
JM TL 11	4.63	60.18649
JM TL 12	20.47	327.5844
JM TL 13	107.45	1181.955
JM TL 14	50.37	805.913
JM TL 15	77.36	850.9904
JM TL 16	28.79	460.671
JM TL 17	22.42	269.0887
JM TL 18	85.04	1020.495
JM TL 19	223.32	3126.523
JM TL 20	33.14	430.7872
JM TL 21	36.37	363.7312
JM TL 22	92.67	1390.027
JM TL 23	26.08	312.9791
JM TL 24	22.33	245.6367

Appendix 8 : Mammals recorded in the project site

LC = Least Concern; EN = Endangered; VU = Vulnerable; NT = Near Threatened ; NL = Not Listed ; NC = Not Confirmed S1 = Schedule I ; S2 = Schedule II ; S3 = Schedule III				List Of Conservation			Survey Period	
SN.	**Scientific name**	**English name**	**Data source***	**IUCN (2023)**	**FNCA**	**Sampling Point**	**1ST Survey (Rainy Season)**	**2ND Survey (Dry Season)**
1	*Atherurus macrourus*	Brush tailed porcupine	Indirect Observation	LC	S3	C2	○	
2	*Bos gaurus*	Guar	Direct, Indirect Observation, Camera traps	VU	S2	7, C4, 56, Daisam	○	○
3	*Callosciurus erythraeus*	Pallas Squirrel	Direct observation	LC	S3	Woongthi, Samrang, Phuentshothang (Near substation), Borla		○
4	*Catopuma temminck2*	Asiatic Golden Cat	Indirect Observation	VU	S2	C3	○	
5	*Cervus unicolor*	Sambar	Direct Observation	VU	S2	1, C2, 33, 77	○	
6	*Cuon alpinus*	Wild dog	Indirect Observation	EN	S3	C7, C9	○	
7	*Elephas maximus*	Asian Elephant	Direct, Indirect Observation, Camera traps	EN	S1	2, 7,14, C4,29, 41, 52, Rongchuthang	○	○
8	*Felis bengalensis*	Leopard cat	Indirect Observation	LC	S2	C4	○	
9	*Herpestes urva*	Crab-Eating mangoose	Indirect Observation	LC	S3	C3	○	
10	*Macaca assamensis*	Assamese macaque	Direct observation	NT	S3	23, Agurthang	○	○
11	*Martes flavigula*	Himalayan Yellow-throated Marten	Indirect Observation	LC	S3	C5, C9, Zamtari, Rongchuthang	○	○
12	*Muntiacus muntjak*	Barking Deer	Indirect Observation; Camera traps	LC	S3	C1, C6, Akhuri, Chitori	○	○
13	*Neofelis nebulosa*	Clouded leopard	Indirect Observation	VU	S1	C7, Borla	○	○

14	*Panthera pardus*	Common leopard	Direct Observation	VU	S2	12, 27,52	○	
15	*Rusa unicolor*	Samber	Camera traps	VU	S2	Borla, Akhuri, Chitori		○
16	*Semnopithecus schistaceus*	Gray langur	Direct observation	LC	S2	Khanduphung (serthi Gewog)		○
17	*Sus scrofa*	Wild boar	Direct Observation	LC	S3	52, 59, 66, Tsanglari	○	○
18	*Trachypithecus pileatus*	Capped langur	Direct Observation	VU	S2	37, 53, Agurthang	○	○
19	*Viverra zibetha*	Large Indian Civet	Indirect Observation	LC	S3	C2	○	

Appendix 9 : List of avifauna recorded in the project site

LC = Least Concern; EN = Endangered; VU = Vulnerable; NT = Near Threatened ; NL = Not Listed ; NC = Not Confirmed S1 = Schedule I ; S2 = Schedule II ; S3 = Schedule III				list of conservation			Survey Period	
SN	**Scientific name**	**English name**	**Data source**	**IUCN (2023)**	**FNCA**	**Sampling Point**	**Wet Season**	**Dry Season**
1	*Abroscopus superciliaris*	Yellow-bellied Warbler	Direct Observation	LC	NL	1	○	
2	*Accipiter nisus*	Eurasian Sparrowhawk	Direct Observation	LC	NL	7	○	
3	*Accipiter virgatus*	Besra	Direct Observation	LC	NL	7	○	
4	*Aceros nipalensis*	Rufous-necked Hornbill	Direct Observation	VU	S2	3,4,6; JMTL 2,3,4	○	○
5	*Aceros undulatus*	Wreathed Hornbill	Direct Observation	LC	S2	8	○	
6	*Acridotheres fuscus*	Jungle Myna	Direct Observation	LC	NL	4; JMTL 1, 1	○	○
7	*Acridotheres grandis*	Great Myna	Direct Observation	LC	NL	JMTL 5, 10		○
8	*Acridotheres tristis*	Common Myna	Direct Observation	LC	NL	1, 2,5, 8; JMTL 1, 8, 9	○	○
9	*Actinodura egertoni*	Rusty-fronted Harwing	Direct Observation	LC	NL	7	○	
10	*Actinodura nipalensis*	Hoary-throated barwing	Direct Observation	LC	NL	9	○	
11	*Actitis hypoleucos*	Common Sandpiper	Direct Observation	LC	NL	5	○	
12	*Aegithalos concinnus*	Black-throated Tit	Direct Observation	LC	NL	9; JMTL 1	○	○
13	*AegithiNL tiphia*	Common Iora	Direct Observation	LC	NL	7	○	
14	*Aerodramus brevirostris*	Himalayan Swiftlet	Direct Observation	LC	NL	10	○	
15	*Aethopyga nipalensis*	Green-tailed Sunbird	Direct Observation	LC	NL	5	○	
16	*Aethopyga saturata*	Black-throated Sunbird	Direct Observation	LC	NL	3; JMTL 1, 2, 3, 6, 8, 9	○	○
17	*Aethopyga siparaja*	Crimson Sunbird	Direct Observation	LC	NL	4, JMTL 9	○	○
18	*Alcedo atthis*	Common Kingfisher	Direct Observation	LC	S2	10; JMTL 7	○	○
19	*Alcedo Hercules*	Blyth's Kingfisher	Direct Observation	NT	S2	8	○	
20	*Alcippe nipalensis*	Nepal Fulvetta	Direct Observation	LC	NL	8	○	
21	*Alophoixus flaveolus*	White-throated Bulbul	Direct Observation	LC	NL	9; JMTL 2, 4, 8, 9	○	○
22	*Amaurornis phoenicurus*	White-breasted Waterhen	Direct Observation	LC	S3	8	○	
23	*Anthracoceros albirostris*	Oriental Pied Hornbill	Direct Observation	LC	S2	8; JMTL 4	○	○

24	*Anthus godlewskii*	Blyth's Pipit	Direct Observation	LC	NL	2	○	
25	*Anthus hodgsoni*	Olive-backed Pipit	Direct Observation	LC	NL	4	○	
26	*Anthus rufulus*	Paddyfield Pipit	Direct Observation	LC	NL	2	○	
27	*Apus acuticauda*	Dark-rumped Swift	Direct Observation	LC	NL	7	○	
28	*Arachnothera longirostra*	Little Spiderhunter	Direct Observation	LC	NL	JMTL 1		○
29	*Arachnothera magna*	Streaked Spiderhunter	Direct Observation	LC	NL	6; JMTL 1, 5, 6, 8, 9, 10	○	○
30	*Arborophila mandellii*	Chestnut-breasted Partridge	Direct Observation	LC	S2	JMTL 3, 5		○
31	*Arborophila rufogularis*	Rufous-throated Partridge	Direct Observation	LC	S3	10	○	
32	*Arborophila torqueola*	Hill Partridge	Direct Observation	LC	NL	JMTL 1		○
33	*Ardeola grayii*	Indian Pond Heron	Direct Observation	LC	NL	2	○	
34	*Artamus fuscus*	Ashy Woodswallow	Direct Observation	LC	NL	8; JMTL 2	○	○
35	*Athene brama*	Spotted Owlet	Direct Observation	LC	NL	9	○	
36	*Aviceda leuphotes*	Black Bazza	Direct Observation	VU	NL	7	○	
37	*Blythipicus pyrrhotis*	Bay Woodpecker	Direct Observation	LC	NL	JMTL 1, 6		○
38	*Bubo nipalensis*	Spot-bellied Eagle Owl	Direct Observation	LC	S3	3	○	
39	*Bubulcus ibis*	Cattle Egret	Direct Observation	LC	NL	8; JMTL 5, 10	○	○
40	*Buceros bicornis*	Great Hornbill	Direct Observation	VU	S2	3,8; JMTL 2, 3, 5, 6, 9	○	○
41	*Buteo buteo*	Common Buzzard	Direct Observation	LC	NL	1	○	
42	*Butorides striata*	Little Heron	Direct Observation	LC	NL	1	○	
43	*Cacomantis merulinus*	Plaintive Cuckoo	Direct Observation	LC	NL	8	○	
44	*Cacomantis sonneratii*	Banded Bay Cuckoo	Direct Observation	LC	NL	3; JMTL 7	○	○
45	*Caprimulgus affinis*	SavanNL Nightjar	Direct Observation	LC	NL	2	○	
46	*Caprimulgus macrurus*	Large-tailed Nightjar	Direct Observation	LC	NL	4	○	
47	*Carpodacus erythrinus*	Common Rosefinch	Direct Observation	LC	NL	3	○	
48	*Cecropis daurica*	Red -rumped Swallow	Direct Observation	LC	NL	4	○	
49	*Celeus brachyurus*	Rufous Woodpecker	Direct Observation	LC	NL	5	○	
50	*Centropus bengalensis*	Lesser Coucal	Direct Observation	LC	NL	JMTL 6		○

51	*Centropus sinensis*	Greater Coucal	Direct Observation	LC	NL	JMTL 5		○
52	*Cephalopyrus flammiceps*	Fire-capped Tit	Direct Observation	TH	NL	5	○	
53	*Cettia brunnifrons*	Grey-sided Bush Warbler	Direct Observation	LC	NL	5	○	
54	*Chalcoparia singalensis*	Ruby-cheeked Sunbird	Direct Observation	LC	NL	8	○	
55	*Chalcophaps indica*	Emerald Dove	Direct Observation	LC	NL	2; JMTL 2	○	○
56	*Charadrius dubius*	Little Ringed Plover	Direct Observation	LC	NL	6	○	
57	*Chelidorhynx hypoxantha*	Yellow-bellied Fantail	Direct Observation	LC	NL	6; JMTL 3, 7, 8, 10	○	○
58	*Chleuasicus atrosuperciliaris*	Lesser Rufous-headed parrotbill	Direct Observation	LC	NL	9	○	
59	*Chloris spinoides*	Yellow-breasted Greenfinch	Direct Observation	LC	NL	3	○	
60	*Chloropsis aurifrons*	Golden-fronted Leafbird	Direct Observation	LC	NL	4	○	
61	*Chloropsis hardwickii*	Orange-bellied Leafbird	Direct Observation	LC	NL	5; JMTL 5	○	○
62	*Chrysococcyx maculatus*	Asian emerald cuckoo	Direct Observation	LC	NL	4	○	
63	*Chrysophlegma flavinucha*	Greater Yelownape	Direct Observation	LC	NL	5; JMTL 8, 10	○	○
64	*Ciconia nigra*	Black Stork	Direct Observation	LC	NL	8	○	
65	*Cinnyris asiaicus*	Purple Sunbird	Direct Observation	LC	NL	7	○	
66	*Cissa chinensis*	Common Green Magpie	Direct Observation	LC	NL	4; JMTL 1, 2, 5	○	○
67	*Columba livia*	Rock Pigeon	Direct Observation	LC	NL	1	○	
68	*Copsychus malabaricus*	White-rumped Shama	Direct Observation	LC	NL	5	○	
69	*Copsychus saularis*	Oriental Magpie-robin	Direct Observation	LC	NL	3; JMTL 5, 6, 9, 10	○	○
70	*Coracias benghalensis*	Indian Roller	Direct Observation	LC	NL	1	○	
71	*Corvus macrorhynchos*	Large-billed Crow	Direct Observation	LC	NL	9	○	
72	*Cucukus micropterus*	Indian Cuckoo	Direct Observation	LC	NL	3	○	
73	*Culicicapa ceylonensis*	Grey-headed CaNLry Flycatcher	Direct Observation	LC	NL	1	○	
74	*Cyanoderma chrysaeum*	Golden Babbler	Direct Observation	LC	NL	3	○	
75	*Cyornis poliogenys*	Pale-chinned Flycatcher	Direct Observation	LC	NL	4	○	
76	*Cyornis rubeculoides*	Blue-throated blue flycather	Direct Observation	LC	NL	2	○	

77	*Cyornis unicolor*	Pale Blue-flycatcher	Direct Observation	LC	NL	5	○	
78	*Cypsiurus balasiensis*	Asian Palm-swift	Direct Observation	LC	NL	6	○	
79	*Delichon nipalense*	Nepal House Martin	Direct Observation	LC	NL	9	○	
80	*Dendrocitta formosae*	Grey Treepie	Direct Observation	LC	NL	6; JMTL 3, 5, 9	○	○
81	*Dendrocitta vagabunda*	Rufous Treepie	Direct Observation	LC	NL	4	○	
82	*Dendrocopos canicapillus*	Grey-capped Pygmy Woodpecker	Direct Observation	LC	NL	3	○	
83	*Dendrocopos cathpharius*	Crimson-breasted Woodpecker	Direct Observation	LC	NL	1	○	
84	*Dendrocopos macei*	Fulvous-breasted Woodpecker	Direct Observation	LC	NL	7	○	
85	*DendrocygNL javanica*	Lesser whistling duck	Direct Observation	LC	NL	3	○	
86	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker	Direct Observation	LC	NL	4	○	
87	*Dicaeum minullum*	Plain Flowerpecker	Direct Observation	LC	NL	6	○	
88	*Dicrurus aeneus*	Bronzed Drongo	Direct Observation	LC	NL	JMTL 9		○
89	*Dicrurus annectans*	Crow-billed Drongo	Direct Observation	LC	NL	3	○	
90	*Dicrurus bracteatus*	Spangled Drongo	Direct Observation	LC	NL	1	○	
91	*Dicrurus hottentonttus*	Hair-crested Drongo	Direct Observation	LC	NL	6	○	
92	*Dicrurus hottentottus*	Spangled Drongo	Direct Observation	LC	NL	JMTL 2, 5, 10		○
93	*Dicrurus leucophaeus*	Ashy Drongo	Direct Observation	LC	NL	10; JMTL 6, 8, 9	○	○
94	*Dicrurus macrocercus*	Black Drongo	Direct Observation	LC	NL	2,5	○	
95	*Dicrurus paradiseus*	Greater Racket-tailed Drongo	Direct Observation	LC	NL	JMTL 4, 6, 8, 9	○	○
96	*Dicrurus paratiseus*	Greater racket-tailed Drongo	Direct Observation	LC	NL	10	○	
97	*Dinopium benghalense*	Lesser Golden-backed woodpecker	Direct Observation	LC	NL	1	○	
98	*Ducula badia*	Mountain Imperial Pigeon	Direct Observation	LC	NL	3; JMTL 4	○	○
99	*Ducula myristicivora*	Great Imperial Pigeon	Direct Observation	LC	NL	JMTL 4		○
100	*Egretta garzetta*	Little Egret	Direct Observation	LC	NL	8	○	

101	*Elachura formosa*	Spotted Elachura	Direct Observation	LC	NL	8	○	
102	*Enicurus lescheNLalti*	White-crowned Forktail	Direct Observation	LC	NL	2	○	
103	*Enicurus maculatus*	Spotted Forktail	Direct Observation	LC	NL	JMTL 1		○
104	*Enicurus schistaceus*	Slaty-backed Forktail	Direct Observation	LC	NL	8; JMTL 1, 7, 8	○	○
105	*Enicurus scouleri*	Little Forktail	Direct Observation	LC	NL	2; JMTL 5, 7	○	○
106	*EudyNLmys scolopaceus*	Asian Koel	Direct Observation	LC	NL	1	○	
107	*Eumyias thalassinus*	Verditer Flycatcher	Direct Observation	LC	NL	5; JMTL 6	○	○
108	*Eurystomus orientalis*	Dollarbird	Direct Observation	LC	NL	7	○	
109	*Falco peregrinus*	Peregrine Falcon	Direct Observation	LC	S2	8	○	
110	*Falco tinnunculus*	Common Kestrel	Direct Observation	LC	NL	9	○	
111	*Ficedula albicilla*	Taiga Flycatcher	Direct Observation	LC	NL	1	○	
112	*Ficedula hodgsoni*	Pygmy Blue Flycatcher	Direct Observation	LC	NL	5	○	
113	*Ficedula hyperythra*	Snowy-browed Flycatcher	Direct Observation	LC	NL	6	○	
114	*Ficedula sapphira*	Sapphire Flycatcher	Direct Observation	LC	NL	2	○	
115	*Ficedula strophiata*	Rufous-gorgeted Flycatcher	Direct Observation	LC	NL	7	○	
116	*Ficedula superciliaris*	Ultramarine Flycatcher	Direct Observation	LC	NL	3	○	
117	*Ficedula westermanni*	Little-Pied Flycatcher	Direct Observation	LC	NL	6; JMTL 5, 10	○	○
118	*Fulica atra*	Common coot	Direct Observation	LC	NL	2	○	
119	*GalliNLgo galliNLgo*	Common Snipe	Direct Observation	LC	NL	8	○	
120	*Gallus gallus*	Red Junglefowl	Direct Observation	LC	S3	7; JMTL 7	○	○
121	*Garrulax albogularis*	White-throated Laughingthrush	Direct Observation	LC	NL	9	○	
122	*Garrulax caerulatus*	Grey-sided Laughingthrush	Direct Observation	LC	NL	7	○	
123	*Garrulax leucolophus*	White-crested Laughingthrush	Direct Observation	LC	NL	9; JMTL 5	○	○
124	*Garrulax monileger*	Lesser Necklaced Laughingthrush	Direct Observation	LC	NL	5	○	
125	*Garrulax pectoralis*	Greater Necklaced Laughingthrush	Direct Observation	LC	NL	7	○	

126	*Garrulax squamatus*	Blue-winged Laughingthrush	Direct Observation	LC	NL	5	○	
127	*Garrulax striatus*	Striated Laughingthrush	Direct Observation	LC	NL	5; JMTL 1	○	○
128	*Garrulus glandarius*	Eurasian Jay	Direct Observation	LC	NL	10	○	
129	*Geokichla citrina*	Orange-headed Thrush	Direct Observation	LC	NL	3	○	
130	*Glaucidium brodiei*	Collared Owlet	Direct Observation	LC	S3	8	○	
131	*Glaucidium cuculoides*	Asian Barred Owlet	Direct Observation	LC	S3	6	○	
132	*Glaucidium radiatum*	Jungle Owlet	Direct Observation	LC	S3	6	○	
133	*Gorsachius melanolophus*	Malayan Night Heron	Direct Observation	LC	NL	6	○	
134	*Gracula religiosa*	Hill MyNL	Direct Observation	LC	NL	4; JMTL 5	○	○
135	*Gracupica contra*	Asian Pied Starling	Direct Observation	LC	NL	8	○	
136	*Halcyon smyrnensis*	White-throated Kingfisher	Direct Observation	LC	NL	1, 2, 8; JMTL 6, 10	○	○
137	*Harpactes erythrocephalus*	Red-headed Trogon	Direct Observation	LC	NL	9	○	
138	*Harpactes wardi*	Ward's Trogon	Direct Observation	NT	S2	JMTL 6, 8	○	○
139	*Hemipus picatus*	Bar-winged Flycatcher-shrike	Direct Observation	LC	NL	JMTL 1		○
140	*Hemixos flavala*	Ashy Bulbul	Direct Observation	LC	NL	9	○	
141	*Heterophasia picaoides*	Long-tailed Sibia	Direct Observation	LC	NL	10 ' JMTL 2	○	○
142	*Heterophasia pulchella*	Beautiful Sibia	Direct Observation	LC	NL	10	○	
143	*Hierococcyx sparverioides*	Large Hawk Cuckoo	Direct Observation	LC	NL	3	○	
144	*Horornis fortipes*	Brown-flanked Bush Warbler	Direct Observation	LC	NL	4	○	
145	*Hypothymis azurea*	Black-NLped MoNLrch	Direct Observation	LC	NL	3; JMTL 4	○	○
146	*Hypsipetes flavala*	Ashy Bulbul	Direct Observation	LC	NL	JMTL 4, 5	○	○
147	Hypsipetes leucocephalus	Black Bulbul	Direct Observation	LC	NL	7	○	
148	*IctiNLetus malayensis*	Black Eagle	Direct Observation	LC	S3	1	○	
149	*IduNL aedon*	Thick-billed Warbler	Direct Observation	LC	NL	5	○	
150	*Irena puella*	Asian Fairy-bluebird	Direct Observation	LC	NL	1; JMTL 3, 5	○	○
151	*Ixos mcclellandii*	Mountain Bulbul	Direct Observation	LC	NL	10	○	

152	*Ketupa flavipes*	Tawny Fish Owl	Direct Observation	LC	S2	8	○	
153	*Lanius cristatus*	Brown Shrike	Direct Observation	LC	NL	9; JMTL 2, 5	○	○
154	*Lanius schach*	Long-tailed Shrike	Direct Observation	LC	NL	4; JMTL 8, 9, 10	○	○
155	*Lanius tephronotus*	Grey-backed Shrike	Direct Observation	LC	NL	5; JMTL 2, 9	○	○
156	*Leiothrix argentauris*	Silver-eared Mesia	Direct Observation	LC	NL	9; JMTL 2, 3	○	○
157	*Leiothrix lutea*	Red-billed Leiothrix	Direct Observation	LC	NL	3	○	
158	*Lewinia striata*	Slaty-breasted Rail	Direct Observation	LC	NL	9	○	
159	*Liocichla phoenicae*	Red-faced Liocichla	Direct Observation	LC	NL	10	○	
160	*Liocichla phoenicea*	Red-faced Liocichla	Direct Observation	LC	NL		○	
161	*Lonchura punctulata*	Scaly-breasted Munia	Direct Observation	LC	NL	8; JMTL 1	○	○
162	*Lonchura striata*	White-rumped Munia	Direct Observation	LC	NL	3	○	
163	*Lophura leucomelanos*	Kalij Pheasant	Direct Observation	LC	NL	8; JMTL 4	○	○
164	*Machlolophus spilonotus*	Yellow-cheeked Tit	Direct Observation	LC	NL	10	○	
165	*Macronus gularis*	Pin-tailed Tit Babbler	Direct Observation	LC	NL	JMTL 3, 6		○
166	*Macropygia unchall*	Barred Cuckoo-dove	Direct Observation	LC	NL	9	○	
167	*Megaceryle lugubris*	Crested Kingfisher	Direct Observation	LC	S2	8; JMTL 7	○	○
168	*Megalaima asiatica*	Blue-throated Barbet	Direct Observation	LC	NL	1	○	
169	*Megalaima australis*	Blue-eared Barbet	Direct Observation	LC	NL	7	○	
170	*Megalaima franklinii*	Golden-throated Barbet	Direct Observation	LC	NL	10	○	
171	*Megalaima haemacephala*	Coppersmith Barbet	Direct Observation	LC	NL	7	○	
172	*Megalaima lineata*	Lineated Barbet	Direct Observation	LC	NL	2	○	
173	*Megalaima virens*	Great Barbet	Direct Observation	LC	NL	6	○	
174	*Melanochlora sultanea*	Sultan Tit	Direct Observation	LC	NL	8; JMTL 5	○	○
175	*Mergus merganser*	Common Merganser	Direct Observation	LC	NL	8	○	
176	*Merops leschenaulti*	Chestnut-headed Bee-eater	Direct Observation	LC	NL	6; JMTL 5	○	○
177	*Merops orientalis*	Green Bee-eater	Direct Observation	LC	NL	3	○	
178	*Microhierax melanoleucos*	Pied Falconet	Direct Observation	LC	NL	1	○	
179	*Minla cyanouroptera*	Blue-winged Minla	Direct Observation	LC	NL	9	○	

180	*Minla ignotincta*	Red-tailed Minla	Direct Observation	LC	NL	8; JMTL 3	○	○
181	*Mixornis gularis*	Striped Tit Babbler	Direct Observation	LC	NL	7	○	
182	*Monticola cinclorhynchus*	Blue-capped Rock Thrush	Direct Observation	LC	NL	10	○	
183	*Monticola solitarius*	Blue Rock Thrush	Direct Observation	LC	NL	10; JMTL 6	○	○
184	*Motacilla alba*	White Wagtail	Direct Observation	LC	NL	2	○	
185	*Motacilla cinerea*	Grey Wagtail	Direct Observation	LC	NL	9; JMTL 5, 6	○	○
186	*Muscicapa ferruginea*	Ferruginous Flycatcher	Direct Observation	LC	NL	4	○	
187	*Musicicapa dauurica*	Asian Brown Flycatcher	Direct Observation	LC	NL	5	○	
188	*Myophonus caeruleus*	Blue Whistling Thrush	Direct Observation	LC	NL	6; JMTL 6, 9	○	○
189	*Niltava macgrigoriae*	Small Niltava	Direct Observation	LC	NL	5	○	
190	*Niltava sundara*	Rufous-bellied Niltava	Direct Observation	LC	NL	5	○	
191	*Nisaetus nipalensis*	Mountain Hawk Eagle	Direct Observation	LC	S3	1	○	
192	*Nyctyornis athertoni*	Blue-bearded Bee-eater	Direct Observation	LC	NL	1	○	
193	*Oriolus traillii*	Maroon Oriole	Direct Observation	LC	NL	6; JMTL 4, 6	○	○
194	*Oriolus xanthornus*	Black-hooded Oriole	Direct Observation	LC	NL	8; JMTL 5	○	○
195	*Orthotomus sutorius*	Common Tailorbird	Direct Observation	LC	NL	5; JMTL 8	○	○
196	*Otus spilocephalus*	Mountain Scops Owl	Direct Observation	LC	S3	7	○	
197	*Parus major*	Great Tit	Direct Observation	LC	NL	9	○	
198	*Parus monticolus*	Green-backed Tit	Direct Observation	LC	NL	1	○	
199	*Passer cinNLmomeus*	Russet Sparrow	Direct Observation	LC	NL	1	○	
200	*Passer domesticus*	House Sparrow	Direct Observation	LC	NL	8	○	
201	*Passer montanus*	Eurasian Tree Sparrow	Direct Observation	LC	NL	2	○	
202	*Pavo cristatus*	Indian Peafowl	Direct Observation	LC	NL	6; JMTL 8	○	○
203	*Pellorneum ruficeps*	Puff-throated Babbler	Direct Observation	LC	NL	2	○	
204	*Pericrocotus ethologus*	Long-tailed Minivet	Direct Observation	LC	NL	5	○	
205	*Pericrocotus flammeus*	Scarlet Minivet	Direct Observation	LC	NL	JMTL 3, 5	○	○
206	*Pericrocotus speciosus*	Scarlet Minivet	Direct Observation	LC	NL	1	○	
207	*Pernis ptilorhynchus*	Oriental Honey-buzzard	Direct Observation	LC	NL	7	○	

208	*Phaenicophaeus tristis*	Green-billed Malkoha	Direct Observation	LC	NL	2; JMTL 6	○	○
209	*Phalacrocorax carbo*	Great Cormorant	Direct Observation	LC	NL	8; JMTL 3	○	○
210	*Phoenicurus frontalis*	Blue-fronted Redstart	Direct Observation	LC	NL	3	○	
211	*Phoenicurus fuliginosus*	Plumbeous Water-redstart	Direct Observation	LC	NL	9; JMTL 6, 7	○	○
212	*Phoenicurus hodgsoni*	Hodgson's Redstart	Direct Observation	LC	NL	6; JMTL 7	○	○
213	*Phoenicurus leucocephalus*	White-capped Water Redstart	Direct Observation	LC	NL	1	○	
214	*Phoenicurus ochruros*	Black Redstart	Direct Observation	LC	NL	1	○	
215	*Phyllergates cucullatus*	Mountain Tailorbird	Direct Observation	LC	NL	3; JMTL 1	○	○
216	*Phylloscopus affinis*	Tickell's Leaf Warbler	Direct Observation	LC	NL	JMTL 5		○
217	*Phylloscopus caNLtator*	Yellow-vented Warbler	Direct Observation	LC	NL	1	○	
218	*Phylloscopus chloronotus*	Lemon-rumped warbler	Direct Observation	LC	NL	3	○	
219	*Phylloscopus fuscatus*	Dusky Warbler	Direct Observation	LC	NL	3	○	
220	*Phylloscopus inornatus*	Yellow-browed Warbler	Direct Observation	LC	NL	JMTL 1		○
221	*Phylloscopus intermedius*	White Spectacled Warbler	Direct Observation	LC	NL	JMTL 1		○
222	*Phylloscopus magnirostris*	Large-billed Leaf Warbler	Direct Observation	LC	NL	9	○	
223	*Phylloscopus trochiloides*	Greenish Warbler	Direct Observation	LC	NL	3	○	
224	*Phylloscopus xanthoschistos*	Grey-hooded warbler	Direct Observation	LC	NL	4	○	
225	*Picumnus innomiNLtus*	Speckled Piculet	Direct Observation	LC	NL	7	○	
226	*Picus canus*	Grey-headed Woodpecker	Direct Observation	LC	NL	6	○	
227	*Picus chlorolophus*	Lesser YellowNLpe	Direct Observation	LC	NL	6; JMTL 6, 10	○	○
228	*Pitta nipalensis*	Blue-NLped Pitta	Direct Observation	LC	NL	7	○	
229	*Pitta sordida*	Hooded pitta	Direct Observation	LC	NL	7	○	
230	*Ploceus philippinus*	Baya Weaver	Direct Observation	LC	NL	6	○	
231	*Polyplectron bicalcaratum*	GreyPeacock Pheasant	Direct Observation	LC	NL	8	○	
232	*Pomatorhinus erythrogenys*	Rusty-cheeked Scimitar Babbler	Direct Observation	LC	NL	9	○	
233	*Pomatorhinus ruficollis*	Streak-breasted Scimitar Babbler	Direct Observation	LC	NL	3	○	
234	*Prinia atrogularis*	Black-throated Prinia	Direct Observation	LC	NL	JMTL 6		○

235	*Prinia crinigera*	Striated Prinia	Direct Observation	LC	NL	2	○	
236	*Prinia rufescens*	Rufescent Prinia	Direct Observation	LC	NL	1	○	
237	*Prunella strophiata*	Rufous-breasted Accentor	Direct Observation	LC	NL	10	○	
238	*Psarisomus dalhousiae*	Long-tailed Broadbill	Direct Observation	LC	NL	9; JMTL 1, 5	○	○
239	*Psilopogon asiaticus*	Blue-throated Barbet	Direct Observation	LC	NL	JMTL 3, 5, 9	○	○
240	*Psilopogon lineatus*	Lineated Barbet	Direct Observation	LC	NL	JMTL 9		○
241	*Psilopogon virens*	Great Barbet	Direct Observation	LC	NL	JMTL 6, 7		○
242	*Psittacula alexandri*	Red-breasted Parakeet	Direct Observation	NT	S3	9	○	
243	*Psittacula himalayana*	Slaty-headed Parakeet	Direct Observation	LC	NL	8	○	
244	*Psittacula krameri*	Rose-ringed Parakeet	Direct Observation	LC	NL	7	○	
245	*Psittiparus bakeri*	Greater Rufous-headed Parrotbill	Direct Observation	LC	NL	9	○	
246	*Pteruthius melanotis*	Black-eared Shrike-Babbler	Direct Observation	LC	NL	JMTL 1, 8	○	○
247	*Pteruthius rufiventer*	Black-headed Shrike Babbler	Direct Observation	LC	NL	5	○	
248	*Pycnonotus cafer*	Red-vented Bulbul	Direct Observation	LC	NL	1; JMTL 1, 5, 9, 10	○	○
249	*Pycnonotus flaviventris*	Black-crested bulbul	Direct Observation	LC	NL	5	○	
250	*Pycnonotus jocosus*	Red-whishered Bulbul	Direct Observation	LC	NL	3; JMTL 1, 2, 5, 9	○	○
251	*Pycnonotus leucogenys*	Himalayan Bulbul	Direct Observation	LC	NL	2	○	
252	*RalliNL eurizonoides*	Slaty-legged Crake	Direct Observation	LC	NL	7	○	
253	*Rhipidura albicollis*	White-throated Fantail	Direct Observation	LC	NL	6; JMTL 1, 3, 5	○	○
254	*Rhyticeros undulatus*	Wreathed Hornbill	Direct Observation	LC	S2	JMTL 6, 8		○
255	*Rubigula flaviventris*	Black-crested Bulbul	Direct Observation	LC	NL	JMTL 4, 5, 8		○
256	*Sasia ochracea*	White-browed Piculet	Direct Observation	LC	NL	5	○	
257	*Saxicola caprata*	Pied Bushchat	Direct Observation	LC	NL	2	○	
258	*Saxicola ferreus*	Grey Bushchat	Direct Observation	LC	NL	4; JMTL 4, 7	○	○
259	*Saxicola torquatus*	Common Stonechat	Direct Observation	LC	NL	2	○	
260	*Seicercus poliogenys*	Grey-cheeked Warbler	Direct Observation	LC	NL	7; JMTL 3	○	○
261	*Sitta castanea*	White-tailed Nuthatch	Direct Observation	LC	NL	4	○	

262	*Sitta cinNLmoventris*	Chestnut-bellied Nuthatch	Direct Observation	LC	NL	4	○	
263	Sitta formosa	Beautiful nuthatch	Direct Observation	VU	NL	1,10	○	
264	*Spilopelia chinensis*	Spotted Dove	Direct Observation	LC	NL	JMTL 1, 2		○
265	*Spilornis cheela*	Crested Serpent Eagle	Direct Observation	LC	S2	3; JMTL 6, 9	○	○
266	*Stachyris ruficeps*	Rufous-capped Babbler	Direct Observation	LC	NL	6	○	
267	*Streptopelia chinensis*	Spotted Dove	Direct Observation	LC	NL	1	○	
268	*Streptopelia orientalis*	Oriental Turtle Dove	Direct Observation	LC	NL	7; JMTL 1	○	○
269	*Streptopelia tranquebarica*	Red Collared Dove	Direct Observation	LC	NL	6	○	
270	*Sturnia malabarica*	Chestnut-tailed Starling	Direct Observation	LC	NL	8; JMTL 8, 9, 10	○	○
271	*Sturnia pagodarum*	Brahminy Starling	Direct Observation	LC	NL	7	○	
272	*Surniculus lugubris*	Drongo Cuckoo	Direct Observation	LC	NL	7	○	
273	*TadorNL ferruginea*	Ruddy shelduck	Direct Observation	LC	NL	8	○	
274	*Tarsiger chrysaeus*	Golden Bush Robin	Direct Observation	LC	NL	10	○	
275	*Tarsiger hyperythrus*	Rufous-breasted Bush Robin	Direct Observation	LC	NL	1	○	
276	*Tephrodornis virgatus*	Large Woodshrike	Direct Observation	LC	NL	7	○	
277	*Terpsiphone paradisi*	Asian Paradise-flycatcher	Direct Observation	LC	NL	JMTL 8	○	○
278	*Tesia castaneocoronata*	Chestnut-headed Tesia	Direct Observation	LC	NL	JMTL 1		○
279	*Tesia cyaniventer*	Grey-bellied Tesia	Direct Observation	LC	NL	7	○	
280	*Tesia olivea*	Slaty-bellied Tesia	Direct Observation	LC	NL	7	○	
281	*Tichodroma muraria*	Wallcreeper	Direct Observation	LC	NL	8	○	
282	*Treron apicauda*	Pin-tailed Green Pigeon	Direct Observation	LC	NL	6	○	
283	*Treron phoenicoptera*	Yellow-footed green pigeon	Direct Observation	LC	NL	4	○	
284	*Treron phoenicopterus*	Yellow-footed Pigeon	Direct Observation	LC	NL	JMTL 9	○	○
285	*Treron sphenurus*	Wedge-tailed Green Pigeon	Direct Observation	LC	NL	1	○	
286	*Turdoides striata*	Jungle Babbler	Direct Observation	LC	NL	3	○	
287	*Turdus albocintus*	White-collared blackbird	Direct Observation	LC	NL	7	○	

288	*Turdus obscurus*	Eyebrowed Thrush	Direct Observation	TH	NL	5	○	
289	*Turnix suscitator*	Barred Buttoquail	Direct Observation	LC	NL	6	○	
290	*Upupa epops*	Common Hoopoe	Direct Observation	LC	NL	6	○	
291	*Vanellus duvaucelii*	River Lapwing	Direct Observation	NT	NL	2	○	
292	*Vanellus indicus*	Red-wattled Lapwing	Direct Observation	LC	NL	2	○	
293	*YuhiNL bakeri*	White-NLped YuhiNL	Direct Observation	LC	NL	7	○	
294	*YuhiNL flavicollis*	Whiskered YuhiNL	Direct Observation	LC	NL	9; JMTL 1	○	○
295	*YuhiNL occipitalis*	Rufous-vented YuhiNL	Direct Observation	LC	NL	4	○	
296	*Zoothera mollissima*	Plain-backed Thrush	Direct Observation	LC	NL	3	○	
297	*Zosterops palpebrosus*	Oriental White-eye	Direct Observation	LC	NL	3; JMTL 1	○	○

Appendix 10 : Reptiles and Amphibians recorded in the project site

LC = Least Concern; EN = Endangered; VU = Vulnerable; TH = Threatened; NT = Near Threatened ; N/L = Not Listed ; N/C = Not Confirmed S1 = Schedule I ; S2 = Schedule II ; S3 = Schedule III				List Of Conservation		Survey Period		
SN	**Scientific Name**	**English Name**	**Data Source**	**IUCN (2023)**	**FNCA**	**Sampling point**	**1ST Survey (Rainy Season)**	**2ND Survey (Dry Season)**
Reptiles								
1	Ophiophagus hannah	King Cobra	Direct Observation	VU	S2	7, 60	○	None observed or encountered
2	Bungarus niger	Greater Black Krait	Direct Observation	LC	NA	2, 55	○	
3	Rhabdophis subminiatus	Red Necked Keelback	Direct Observation	LC	NA	45, 66	○	
4	Oligodon albocinctus	White Barred Kukri	Direct Observation	LC	NA	60	○	
5	Oreocryptophis porphyraceus	Black Banded Trinket	Direct Observation	LC	NA	67	○	
6	Rhadinophis prasina	Green Trinket	Direct Observation	LC	NA	27	○	
7	Dendrelaphis tristis	Bronzeback Tree Snake	Direct Observation	LC	NA	38	○	
8	Lycodon aulicus	Common Wolf Snake	Direct Observation	LC	NA	35	○	
9	Elaphe cantoris	Easterner Trinket	Direct Observation	LC	NA	28	○	
10	Oviphis monticola	Mountain Pit viper	Direct Observation	LC	NA	24	○	
11	Python bivittatus	Burmese Python	Direct Observation	VU	S2	19	○	
Amphibians								
1	Fejervarya pierrei	Pierre's Cricket Frog	Direct Observation	LC	NA	50	○	None observed or encountered
2	Hoplobatrachus tigerinus	Indian Bull Frog	Direct Observation	LC	S3	57	○	
3	Euphlyctis cyanophlyctis	Skittering Frog	Direct Observation	LC	NA	3	○	
4	Polypedates leucomystax	Common Tree Frog	Direct Observation	LC	NA	11	○	
5	Uperodon globulosus	Indian Ballon Frog	Direct Observation	LC	NA	57	○	
6	Duttaphrynus melanostictus	Asian Common Toad	Direct Observation	LC	NA	2, 29, 37, 63	○	
7	Microhylla berdmorei	Large Pygmy Frog	Direct Observation	LC	NA	76	○	
8	Polypedates maculatus	Common Indian Tree Frog	Direct Observation	LC	NA	5	○	
9	Kurixalus naso	Annandale's high-altitude frog	Direct Observation	LC	NA	67	○	
10	Hylarana leptoglossa	Assam Forest Frog	Direct Observation	LC	NA	8, 18	○	
11	Duttaphrynus stomaticus	Marbled Toad	Direct Observation	LC	NA	42	○	

12	Kurixalus bisacculus	Loei frilled tree Frog	Direct Observation	LC	NA	51	○	

Appendix 11 : Total Landholdings of Project Affected People by Land Acquisition

SN	Gewog	Owner	CID	Land Area Affected (acres)	Total Land Holdings (acres)
1	Serthi	Dorji	11111001312	0.021	10.154
2	Serthi	Pema Ugyen Namdrol	11103000548	0.021	28.892
3	Serthi	Pema Wangzom	11111000453	0.021	8.208
4	Serthi	Tashi Peljor	11111000333	0.021	19.016

Appendix 12

Record of Discussions
Stakeholder consultation meeting for proposed Jomori-Phuntshothang Transmission Line

Date: 22 January 2024
Location: Meeting hall, Gewog Office, Minjiwoong, Serthi Gewog
Time: 11:00 AM
Participants: See below

Consent for photo, video, and voice recording
Mr. Yeshey Wangchuk of BPC solicited and received consent of the participants for photo, video and voice recording during the meeting. No objection was raised.

Welcome and Introduction
The meeting was convened by Bhutan Power Corporation (BPC) with support from Serthi Gewog Administration. Mr. Yeshey Wangchuk welcomed the participants and briefly explained the objective and structure of the meeting. The purpose of the meeting was to share information with the stakeholders on:

1. the proposed 132KV transmission line project to evacuate electricity from the proposed Jomori Hydropower project to Phuntshothang sub-station.
2. Environmental and Social Impact Assessment (ESIA) exercise being undertaken by JICA consultants

Accordingly, the SHM comprised of three parts.

Part I: Presentation on proposed 68KV transmission line project by Mr. Tshering Dorji, Senior Environment Officer of BPC.
PPT was delivered in Tshangla/ Sharchokpa dialect considering majority of the participants, especially those likely to be affected by the project, were from Tshangla speaking communities. Main messages delivered during the presentation were:

About the project:

- **Name of Project:** 132kv Transmission Line (TL) from Proposed Jomori power house to Phuntshothang Substation.
- **Places/Corridors:** Serthig, Langchenphug (Daifam), Samrang, Pemathang and Phuntshothang (Bhangtar) of Samdrupjongkhar Dzongkhag
- **Length:** Approx. 63 km.
- **Numbers of Towers:** Approx. 157 Towers

Aims and Objectives:

- To Evacuate the power generated from the proposed 26MW Druk Bindu Hydropower Power plant.
- Power supply reliability in the Southern region.
- To facilitate and ensure reliability for other development activities in Southern Regions.

Analysis of alternative options

Four alternatives were explored and analyzed. The first alternative was shortest with a total length of 43 km passing through fragile terrain and high forests. The second alternative followed the long route passing through Jomotshangkha. The preferred alternative is the route that passes through multiple use zone and the buffer zone between the core zones of Jomotshangkha Wildlife Sanctuary (JWS). This option was assessed as most feasible and acceptable to JWS officials.

The preferred Alternative

The second alternative is the preferred option owing to lower social impact, shorter distance and associated lower cost of construction. The length of TL falling in different Gewogs, the number of towers falling in State Reserved Forest (SRF) and private lands were presented as below:

SN.	Gewog under Sandrupjongkhar	Approx. Line Length (km)	No. of towers in State forest land (SRFL)	No. of towers in Private Land (PL)
1.	Serthig	15.5	42 towers	4 towers
2.	Langchenphug	24.6	47 towers	1 tower
3.	Samrang	8.6	24 towers	0
4.	Pemathang	8.1	19 towers	1 tower
5.	Phuntshothang	4.9	19 towers	0
	Total	**61.7**	**151 in SRFL**	**6 towers in Pvt. Land**

He informed that there are a number of land owners under different Gewogs who will be affected by the restrictions associated with 'Right of Way' (ROW), which is essentially the passage that needs to be cleared of vegetation especially during construction and laying of cables. From a total of 157 towers, location of 151 fall in state reserved forest land (SRFL) while 6 fall on privately owned plots. In Serthig Gewog, 42 out of 46 towers will be located in SRFL while 4 towers fall in private plots. In addition, a number of private plots will come under ROW path of the TL. From a total of 63 plots identified to fall in the ROW path, 37 are in Serthig, 12 in Langchenphug, 5 in Pemathang and 9 in Phuntshothang.

He also informed the group that the above information is subject to change based on actual ground situation. Where possible, efforts will be made to minimize impact on private and community forest lands.

Pros and Cons

The stakeholders, especially the owners of private land and CF members, were introduced the pros and cons of the project. The Pros come in the form of benefit to the nation as a whole, enhanced reliability of power supply with minimum blackout, stimulating other development, employment generation and boosting local economy.

The group was also apprised of the Cons that include permanent land change, loss of trees, influx of foreign labors and loss of crops.

The presentation ended with the announcement that each affected landowner will have one to one opportunity to look at the detailed plan.

Land substitution and compensation

In this part of the presentation, Mr. Yeshey explained the circumstances under which affected landowners are eligible for land substitutions and compensations**.** Lands acquired for towers are eligible for substitution if adjacent state land is available. In case of land falling under ROW, the owners are only eligible for one-time cash compensation for crops damaged or trees removed during construction. The Land Record Officer from the Dzongkhag Administration provided further clarification on compensation.

Part II: Presentation on the ESIA by Mr. Sangay T. Dorji, JICA Consultant

Mr. Sangay introduced the stakeholders to the ongoing Environmental and Social Impact Assessment of project, which he explained is an important regulatory requirement that ensures minimal impact of project activities on social and economic way of life of people and natural environment in the area. He then explained the role of JICA consultants in collecting data and information to identify issues and to propose measures to avoid and mitigate them. The explained in detail the considerations to be made in formulating the project. He explained in detail the following scoping components and parameters for social and environmental considerations:

1. Permits and consultations
2. Pollution control
3. Natural Environment
4. Social Environment
5. Others such as mitigation and monitoring requirements

He also encouraged the participants to take advantage of the ESIA process to voice concerns and share ideas to help avoid and mitigate damages to social and natural environment. He informed them of the upcoming social surveys during which the consultant will interact with the people identified to be affected by construction activities.

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Part III: Question and Answer Session

There were no specific questions but concerns for which clarifications were sought. The responses offered by the BPC officials and consultants are summarized below:

Concern 1. It appears that the owners of land falling in the ROW are at the losing end considering that construction of houses are prohibited in such area.

Response: The district Land Record Officer clarified that land falling under ROW of transmission lines are not eligible for compensation or substitution. However, under special context and circumstances, substitution is entertained. In the context of owner of land falling under ROW has no other land on which he/ she can construct house, alternative land could be identified and substituted.

He also clarified that landowners are eligible for compensation in the event of damage to crops and structures caused by project activities. Such cases should be reported to the concerned Gewog Administration.

Concluding remarks

Mr. Yeshey Wangchuk invited the affected landowners for detailed review of how the proposed TL alignment will affect the identified plots. He thanked all stakeholders, sector representatives and landowners for their participation. This was followed by review of the TL alignment maps with each member after which members present signed the no-objection form.

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Supplementary meeting with members of Khandophung Community Forest

Date: 22 January 2024
Location: Lhakhang, Khandophung, Serthi Gewog
Time: 2:00 PM
Participants: Member of Khandophung Community Forest Group

Since the consultation meeting date coincided with local religious event at the village temple, the members of the community forest group were unable to join the meeting in Gewog Centre. A separate meeting was held at the village temple. The above presentations were repeated to the group following which the members were agreeable to the TL alignment.

Participants

1. Mr. Choki Wangchuk, Jomotsangkha Wildlife Sancturary, DoFPS
2. Mr. Jurmi Wangdi, Tshogpa
3. Mr. Kelzang Dorji, Mangmi
4. Mr. Ugyen Tshering, Land Registrar, Dzongkhag Administration
5. Mr. Sana Bir Rai, Agirculture Officer, Dzongkhag Administration
6. Mr. Sachin Limboo, Environment Officer, Dzongkhag Administration
7. Dr. Lam Dorji, CED
8. Mr. Sangay Thinley Dorji, OPMAC
9. Mr. Yeshey Wangchuk, BPC
10. Mr. Hom Nath Subbedi, Tshogpa
11. Ms. Pema Wangmo
12. Mr. Dorji
13. Mr. Tashi Penjor
14. Ms. Tashi Lhamo
15. Mr. Drakpa
16. Mr. Nidup Tshering
17. Mr. Yonten
18. Ms. Darmo
19. Ms. Pema Chezom
20. Mr. Dorji Wangdi
21. Mr. Sonam Tenzin
22. Mr. Tshewang Tenzin
23. Mr. Tashi Phuntsho
24. Mr. Jangchuk
25. Ms. Tashi Lham
26. Mr. Tshewang Dorji
27. Mr. Pema Tashi
28. Mr. Tashi Phuntsho

29. Mr. Kelzang Tshering
30. Ms. Ngache
31. Mr. Tashi Dawa
32. Mr. Thinley Wangdi
33. Mr. Kelzang Dorji
34. Mr. Norbu Wangdi
35. Mr. Karchung
36. Mr. Yangjay
37. Mr. Pema Chophel
38. Mr. Wang Gyeltshen
39. Mr. Sangay
40. Mr. Jomo Wangdi
41. Mr. Jomo Tshering
42. Ms. Tshering Chezom
43. Ms. Tshewang Gyelmo
44. Mr. Dawa
45. Mr. Wangchen
46. Mr. Dup Wangdi
47. Mr. Namgay
48. Mr. Lungten Norbu
49. Ms. Tashi Dema
50. Ms. Taw Lhamo
51. Ms. Phuntsho Wangmo
52. Mr. Dorji Tshewang
53. Ms. Sonam Dema
54. Ms. Gyeltshen Dema
55. Ms. Karma Choden

Record of Discussions
Stakeholder consultation meeting for proposed Jomori-Phuntshothang Transmission Line

Date: 23 January 2024
Location: Conference hall, Jomotshangkha Wildlife Sanctuary Office, Langchenphug
Time: 10:00 AM
Participants: See below

Consent for photo, video, and voice recording
Mr. Yeshey Wangchuk of BPC solicited and received consent of the participants for photo, video and voice recording during the meeting. No objection was raised.

Welcome and Introduction
The meeting was convened by Bhutan Power Corporation (BPC) with support from Serthi Gewog Administration. Mr. Yeshey Wangchuk welcomed the participants and briefly explained the objective and structure of the meeting. The purpose of the meeting was to share information with the stakeholders on:

1. the proposed 132KV transmission line project to evacuate electricity from the proposed Jomori Hydropower project to Phuntshothang sub-station.
2. Environmental and Social Impact Assessment (ESIA) exercise being undertaken by JICA consultants

Accordingly, the SHM comprised of three parts.

Part I: Presentation on proposed 132 KV transmission line project by Mr. Yeshey Wangchuk, BPC.
PPT was delivered in Tshangla/ Sharchokpa dialect considering majority of the participants, especially those likely to be affected by the project, were from Tshangla speaking communities. Main messages delivered during the presentation were:

About the project:

- **Name of Project:** 132kv Transmission Line (TL) from Proposed Jomori powerhouse to Phuntshothang Substation.
- **Places/Corridors:** Serthig, Langchenphug (Daifam), Samrang, Pemathang and Phuntshothang (Bhangtar) of Samdrupjongkhar Dzongkhag
- **Length:** Approx. 63 km.
- **Numbers of Towers:** Approx. 157 Towers

Aims and Objectives:

- ◯ To Evacuate the power generated from the proposed 26MW Druk Bindu Hydropower Power plant.
- ◯ Power supply reliability in the Southern region.
- ◯ To facilitate and ensure reliability for other development activities in Southern Regions.

Analysis of alternative options

Four alternatives were explored and analyzed. The first alternative was shortest with a total length of 43 km passing through fragile terrain and high forests. The second alternative followed the long route passing through Jomotshangkha. The preferred alternative is the route that passes through multiple use zone and the buffer zone between the core zones of Jomotshangkha Wildlife Sanctuary (JWS). This option was assessed as most feasible and acceptable to JWS officials.

The preferred Alternative

The second alternative is the preferred option owing to lower social impact, shorter distance and associated lower cost of construction. The length of TL falling in different Gewogs, the number of towers falling in State Reserved Forest (SRF) and private lands were presented as below:

SN.	Gewog under Sandrupjongkhar	Approx. Line Length (km)	No. of towers in State forest land (SRFL)	No. of towers in Private Land (PL)
1.	Serthi	15.5	42 towers	4 towers
2.	Langchenphug	24.6	47 towers	1 tower
3.	Samrang	8.6	24 towers	0
4.	Pemathang	8.1	19 towers	1 tower
5.	Phuntshothang	4.9	19 towers	0
	Total	**61.7**	**151 in SRFL**	**6 towers in Pvt. Land**

He informed that there are a number of land owners under different Gewogs who will be affected by the restrictions associated with 'Right of Way' (ROW), which is essentially the passage that needs to be cleared of vegetation especially during construction and laying of cables. From a total of 157 towers, location of 151 fall in state reserved forest land (SRFL) while 6 fall on privately owned plots. In Serthig Gewog, 42 out of 46 towers will be located in SRFL while 4 towers fall in private plots. In addition, a number of private plots will come under ROW path of the TL. From a total of 63 plots identified to fall in the ROW path, 37 are in Serthig, 12 in Langchenphug, 5 in Pemathang and 9 in Phuntshothang.

He also informed the group that the above information is subject to change based on actual ground situation. Where possible, efforts will be made to minimize impact on private and community forest lands.

Pros and Cons

The stakeholders, especially the owners of private land and CF members, were introduced the pros and cons of the project. The Pros come in the form of benefit to the nation as a whole, enhanced reliability of power supply with minimum blackout, stimulating other development, employment generation and boosting local economy.

The group was also apprised of the Cons that include permanent land change, loss of trees, influx of foreign labors and loss of crops.

The presentation ended with the announcement that each affected landowner will have one to one opportunity to look at the detailed plan.

Land substitution and compensation

In this part of the presentation, Mr. Yeshey explained the circumstances under which affected landowners are eligible for land substitutions and compensations**.** Lands acquired for towers are eligible for substitution if adjacent state land is available. In case of land falling under ROW, the owners are only eligible for one-time cash compensation for crops damaged or trees removed during construction. The Land Record Officer from the Dzongkhag Administration provided further clarification on compensation.

Part II: Presentation on the ESIA by Mr. Sangay T. Dorji, JICA Consultant

Mr. Sangay introduced the stakeholders to the ongoing Environmental and Social Impact Assessment of project, which he explained is an important regulatory requirement that ensures minimal impact of project activities on social and economic way of life of people and natural environment in the area. He then explained the role of JICA consultants in collecting data and information to identify issues and to propose measures to avoid and mitigate them. The explained in detail the considerations to be made in formulating the project. He explained in detail the following scoping components and parameters for social and environmental considerations:

1. Permits and consultations
2. Pollution control
3. Natural Environment
4. Social Environment
5. Others such as mitigation and monitoring requirements

He also encouraged the participants to take advantage of the ESIA process to voice concerns and share ideas to help avoid and mitigate damages to social and natural environment. He informed them of the upcoming social surveys during which the consultant will interact with the people identified to be affected by construction activities.

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Part III: Question and Answer Session

There were no specific questions or concerns expressed.

Concluding remarks

Mr. Yeshey Wangchuk invited the affected landowners for detailed review of how the proposed TL alignment will affect the identified plots. He thanked all stakeholders, sector representatives and landowners for their participation. This was followed by review of the TL alignment maps with each member after which members present signed the no-objection form.

Participants

1. Mr. Ugyen Tshering, Land Registrar, Dzongkhag Administration
2. Mr. Sana Bir Rai, Agirculture Officer, Dzongkhag Administration
3. Mr. Sachin Limboo, Environment Officer, Dzongkhag Administration
4. Dr. Lam Dorji, CED
5. Mr. Sangay Thinley Dorji, OPMAC

6. Mr. Yeshey Wangchuk, BPC
7. Mr. Mongal Singh Subba, Tshogpa
8. Mr. Kiran Rai, Jomotsangkha Wildlife Sancturary
9. Ms. Yeshi Yangzom, Tshogpa
10. Ms. SOnam Choden, Tshogpa
11. Mr. Sonam Dorji, Agriculture Extension Officer, Langchenphu Gewog
12. Mr. Chandra Bdr. Thapa, Tshogpa
13. Ms. Tshering Zangmo
14. Ms. Thinley Wangmo
15. Mr. Yangjey
16. Mr. Kezang Tshering
17. Mr. Tashi Phuntsho
18. Ms. Sonam Dema
19. Ms. Meto Dema

Record of Discussions
Stakeholder consultation meeting for proposed Jomori-Phuntshothang Transmission Line

Date: 23 January 2024
Location: Meeting hall, Samrang Gewog Office, Samrang
Time: 5:00 PM
Participants: See Below

Since there were no landowners affected by the TL in the Gewog, Mr Yeshey Wangchuk of BPC briefed the Gup, Mangmi, and the Tshogpa on the transmission line project. After briefly explaining the overall project, he informed that there are no private lands affected by the TL towers and ROW. He showed on screen the maps of TL alignment passing through the Gewog.

This was followed by a brief explanation about the ongoing Environment and Social Impact Assessment being carried out by JICA consultants. Through this explanation, the Gewog officials were informed of the need to flag issues, concerns and suggestions to avoid or minimize social and environmental impacts.

During the process of reviewing the TL alignment plan, the Gup proposed further realignment in few places. He proposed that the following:

Realignment of towers between PJ37 and PJ 48: The proposed realignment will not only help protect the Ngangtsho lake, which is the source of water supply for the Gewog office and the town but also reduce distance (and may be cost). This information flagged the need for cautious approaches to construction of towers to avoid disturbance to geology, soil and ecological stability of the lake.

Realignment of towers PJ31 to PJ36 which pass above Tsho Dhuen (7 lakes) area.

Realignment of towers PJ56, PJ57, and PJ58: The three towers pass through the area that was previously inhabited. The previous inhabitants were resettled in Dungkarling under Phuntshothang Gewog. In the interest of saving this land for future settlements, the above towers could be realigned.

Concerns and opportunities:
The Gup shared that current situation of heavy vehicles plying on the farm road has led to deteriorated road condition and destroyed road side irrigation drains. Envisaging that the TL project will also have contractors and equipment passing through the area, he expects that similar damages be avoided. At the same time, he acknowledges that the project will bring economic opportunities to his community especially in the form of employment for local youths.

In concluding the meeting, the Gup and BPC agreed to conduct a field visit to assess the feasibility of the realignments proposed by the Gup. Mr. Yeshey agreed to spend a few days with the Gewog for this purpose.

The meeting concluded at 6:00pm.

Participants

1. Mr. Jigme Singye Drukpa, Gup, Samrang Gewog
2. Mr. Arjun Rai, Mangmi
3. Mr. Leki Phuntsho, Gewog Adm. Officer
4. Mr. Ugyen Tshering, Land Registrar, Dzongkhag Administration
5. Mr. Sana Bir Rai, Agirculture Officer, Dzongkhag Administration
6. Mr. Sachin Limboo, Environment Officer, Dzongkhag Administration
7. Dr. Lam Dorji, CED
8. Mr. Sangay Thinley Dorji, OPMAC
9. Mr. Yeshey Wangchuk, BPC

Record of Discussions
Stakeholder consultation meeting for proposed Jomori-Phuntshothang Transmission Line

Date: 24 January 2024
Location: Meeting hall, Gewog Office, Pemathang
Time: 10:00 AM
Participants: See Below

Consent for photo, video, and voice recording
Mr. Yeshey Wangchuk of BPC solicited and received consent of the participants for photo, video and voice recording during the meeting. No objection was raised.

Welcome and Introduction
The meeting was convened by Bhutan Power Corporation (BPC) with support from Serthi Gewog Administration. Mr. Yeshey Wangchuk welcomed the participants and briefly explained the objective and structure of the meeting. The purpose of the meeting was to share information with the stakeholders on:

3. the proposed 132KV transmission line project to evacuate electricity from the proposed Jomori Hydropower project to Phuntshothang sub-station.
4. Environmental and Social Impact Assessment (ESIA) exercise being undertaken by JICA consultants

Accordingly, the SHM comprised of three parts.

Part I: Presentation on proposed 68KV transmission line project by Mr. Yeshey Wangchuk of BPC.
PPT was delivered in Tshangla/ Sharchokpa dialect considering majority of the participants, especially those likely to be affected by the project, were from Tshangla speaking communities. Main messages delivered during the presentation were:

About the project:

- **Name of Project:** 132kv Transmission Line (TL) from Proposed Jomori powerhouse to Phuntshothang Substation.
- **Places/Corridors:** Serthig, Langchenphug (Daifam), Samrang, Pemathang and Phuntshothang (Bhangtar) of Samdrupjongkhar Dzongkhag
- **Length:** Approx. 63 km.
- **Numbers of Towers:** Approx. 157 Towers

Aims and Objectives:

- To Evacuate the power generated from the proposed 26MW Druk Bindu Hydropower Power plant.
- Power supply reliability in the Southern region.
- To facilitate and ensure reliability for other development activities in Southern Regions.

Analysis of alternative options

Four alternatives were explored and analyzed. The first alternative was shortest with a total length of 43 km passing through fragile terrain and high forests. The second alternative followed the long route passing through Jomotshangkha. The preferred alternative is the route that passes through multiple use zone and the buffer zone between the core zones of Jomotshangkha Wildlife Sanctuary (JWS). This option was assessed as most feasible and acceptable to JWS officials.

The preferred Alternative

The second alternative is the preferred option owing to lower social impact, shorter distance and associated lower cost of construction. The length of TL falling in different Gewogs, the number of towers falling in State Reserved Forest (SRF) and private lands were presented as below:

SN.	Gewog under Sandrupjongkhar	Approx. Line Length (km)	No. of towers in State forest land (SRFL)	No. of towers in Private Land (PL)
1.	Serthig	15.5	42 towers	4 towers
2.	Langchenphug	24.6	47 towers	1 tower
3.	Samrang	8.6	24 towers	0
4.	Pemathang	8.1	19 towers	1 tower
5.	Phuntshothang	4.9	19 towers	0
	Total	**61.7**	**151 in SRFL**	**6 towers in Pvt. Land**

He informed that there are a number of land owners under different Gewogs who will be affected by the restrictions associated with 'Right of Way' (ROW), which is essentially the passage that needs to be cleared of vegetation especially during construction and laying of cables. From a total of 157 towers, location of 151 fall in state reserved forest land (SRFL) while 6 fall on privately owned plots. In Serthig Gewog, 42 out of 46 towers will be located in SRFL while 4 towers fall in private plots. In addition, a number of private plots will come under ROW path of the TL. From a total of 63 plots identified to fall in the ROW path, 37 are in Serthig, 12 in Langchenphug, 5 in Pemathang and 9 in Phuntshothang.

In additional to the above, there are three community forests in the Pemathang and Phuntshothang Gewogs that would fall in the ROW of the TL. Two of them namely Raling CF Warong and Raling CF Lebari are in Pemathang Gewog.

He also informed the group that the above information is subject to change based on actual ground situation. Where possible, efforts will be made to minimize impact on private and community forest lands.

Pros and Cons

The stakeholders, especially the owners of private land and CF members, were introduced the pros and cons of the project. The Pros come in the form of benefit to the nation as a whole, enhanced reliability of power supply with minimum blackout, stimulating other development, employment generation and boosting local economy.

The group was also apprised of the Cons that include permanent land change, loss of trees, influx of foreign labors and loss of crops.

The presentation ended with the announcement that each affected landowner will have one to one opportunity to look at the detailed plan.

Land substitution and compensation

In this part of the presentation, Mr. Yeshey explained the circumstances under which affected landowners are eligible for land substitutions and compensations**.** Lands acquired for towers are eligible for substitution if adjacent state land is available. In case of land falling under ROW, the owners are only eligible for one-time cash compensation for crops damaged or trees removed during construction. The Land Record Officer from the Dzongkhag Administration provided further clarification on compensation.

Part II: Presentation on the ESIA by Mr. Sangay T. Dorji, JICA Consultant

Mr. Sangay introduced the stakeholders to the ongoing Environmental and Social Impact Assessment of project, which he explained is an important regulatory requirement that ensures minimal impact of project activities on social and economic way of life of people and natural environment in the area. He then explained the role of JICA consultants in collecting data and information to identify issues and to propose measures to avoid and mitigate them. The explained in detail the considerations to be made in formulating the project. He explained in detail the following scoping components and parameters for social and environmental considerations:

6. Permits and consultations
7. Pollution control
8. Natural Environment
9. Social Environment
10. Others such as mitigation and monitoring requirements

He also encouraged the participants to take advantage of the ESIA process to voice concerns and share ideas to help avoid and mitigate damages to social and natural environment. He informed them of the upcoming social surveys during which the consultant will interact with the people identified to be affected by construction activities.

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Part III: Question and Answer Session

Only one question was posed by a community forest member.

Question: Will compensation be calculated on the basis of tree species? Since there are teak plantations in the CF, how will teak be compensated?

Answer: Yes, the compensation will be based on tree species and also on the age of the trees. This will be paid and calculated based on the Royalty rates determined by the Department of Forest and Park services and assessments will be carried out by the competent authority with the CF and compensation paid into the account of the CF as practiced in other TL Projects. The LRO explained the assessment will be guided by rules governing compensation for damages. Precise answer to this question will be provided later after consulting with relevant sectors.

Concluding remarks

Mr. Yeshey Wangchuk invited the affected landowners for detailed review of how the proposed TL alignment will affect the identified plots. He thanked the stakeholders, sector representatives and landowners for their participation. This was followed by review of the TL alignment maps with each member after which members present signed the no-objection form.

Participants

1. Mr. Pema Lekso, Gup, Pemathang Gewog
2. Mr. Karma Nidup, Forester, DoFPS
3. Mr. Pema Luwang, Tshogpa
4. Mr. Khemprasad Timsina, Tshogpa
5. Mr. Mon Raj Chowan, Tshogpa
6. Mr. Ugyen Tshering, Land Registrar, Dzongkhag Administration
7. Mr. Sana Bir Rai, Agirculture Officer, Dzongkhag Administration
8. Mr. Sachin Limboo, Environment Officer, Dzongkhag Administration
9. Dr. Lam Dorji, CED
10. Mr. Sangay Thinley Dorji, OPMAC
11. Mr. Yeshey Wangchuk, BPC
12. Mr. Santa Bir Rai
13. Mr. Mon Bdr. Rai
14. Mr. Mananda Regmi
15. Mr. Jit Bdr. Rai
16. Mr. Pema Yangay
17. Mr. Ganga Ram
18. Ms. Tashi Zangmo
19. Mr. Dorji Wangdi

Record of Discussions
Stakeholder consultation meeting for proposed Jomori-Phuntshothang Transmission Line

Date: 24 January 2024
Location: Local shop, Minjigang, Phuntshothang Gewog
Time: 1:00 PM
Participants: Participant list below

Introduction
The meeting was held in an informal setting outside a local shop. Mr. Yeshey Wangchuk welcomed the members of the CF. He briefly explained the objective of the meeting, which is to share information with the stakeholders on:

5. the proposed 132KV transmission line project to evacuate electricity from the proposed Jomori Hydropower project to Phuntshothang sub-station.
6. Environmental and Social Impact Assessment (ESIA) exercise being undertaken by JICA consultants

Mr. Yeshey Wangchuk briefly explained in Lhotshamkha (Nepali language) the following project details:

- **Name of Project:** 132kv Transmission Line (TL) from Proposed Jomori powerhouse to Phuntshothang Substation.
- **Places/Corridors:** Serthig, Langchenphug (Daifam), Samrang, Pemathang and Phuntshothang (Bhangtar) of Samdrupjongkhar Dzongkhag
- **Length:** Approx. 63 km.
- **Numbers of Towers:** Approx. 157 Towers

Aims and Objectives:

- To Evacuate the power generated from the proposed 26MW Druk Bindu Hydropower Power plant.
- Power supply reliability in the Southern region.
- To facilitate and ensure reliability for other development activities in Southern Regions.

The ROW in Community Forests
Mr. Yeshey informed the members that there are three community forests in Pemathang and Phuntshothang Gewogs that would fall in the ROW of the TL. Mingang being one of them, he solicited their support and cooperation considering national interest and benefits that enhanced electricity supply will stimulate industrial growth, employment generation and overall economic advancement.

ESIA exercise
The group was also introduced to the Environmental and Social Impact Assessments (ESIA) being carried out by JICA fielded consultants. Mr. Sangay requested their help when he visits next.

Following the brief introduction to the project, the Chairman and members of the CF reviewed on-screen the proposed alignment of the TL. While reviewing the maps, the members requested BPC to explore potential realignment to minimize ROW over private land. One member conveyed that (based in Thimphu) has expressed unwillingness to accept the TL alignment over her land. Keeping such inconveniences in mind, the Chairman suggested a few options, the feasibility of which can only be assessed with site visit. For this, both Yeshey and the CF Chairman agreed to carry out a field visit to assess feasibility of the proposed realignments.

Concluding remarks
Mr. Yeshey Wangchuk thanked all CF members and landowners for their participation. This was followed by review of the TL alignment maps with each member after which members present signed the no-objection form.

Participants

1. Mr. Krishna Bdr. Adikhari, Mangmi
2. Mr. Surja Dhan Tamang, Tshogpa
3. Mr. Ugyen Tshering, Land Registrar, Dzongkhag Administration
4. Mr. Sana Bir Rai, Agirculture Officer, Dzongkhag Administration
5. Mr. Sachin Limboo, Environment Officer, Dzongkhag Administration
6. Dr. Lam Dorji, CED
7. Mr. Sangay Thinley Dorji, OPMAC
8. Mr. Yeshey Wangchuk, BPC
9. Ms. Sancha Maya Limboo
10. Mr. Chakra Bdr. Kami
11. Mr. Mon Bdr. Shengden
12. Mr. Phurba Singh Tamang
13. Mr. Mon Bdr. Rai

Appendix 13

Minutes of 2nd Stakeholder Meeting
for proposed 132 KV Jomori Transmission Line Project

Date: 8 April 2024
Location: Conference hall, Dzongkhag Administration, Samdrup Jongkhar
Time: 10:00 AM
Participants: See below

Welcome and Introduction

In accordance with invitation extended by Bhutan Power Corporation (BPC) vide letter no.18/BPC/MISC/CEO/2024/92 dated 29 March 2024, the second stakeholders meeting pertaining to the proposed Jomori-Phuntshothang Transmission Line project for Samdrup Jongkhar Dzongkhag was held on 8 April 2024. The meeting was facilitated by Ms. Mitsue Mishima, Lam Dorji and Mr. Sangay Thinley Dorji, who are JICA consultants with Tokyo Electric Power Services Co., Ltd. (TEPSCO) and OPMAC Corporation in Japan.

The meeting began with welcome remarks by Dasho Dzongrab (deputy District Governor) and a round of introduction by the participants. Mr. Sangay Thinley Dorji, Consultant introduced the agenda and context of the meeting. He informed the participants that the meeting was being conducted in conformity with JICA guidelines for Environmental and Social Considerations, which require the proponent to conduct two consultation meetings with stakeholders with regard to the proposed development project i.e., the 132kv Jomori-Phuntshothang transmission line project. The stakeholder meetings (SHM), he said, are conducted at the time of scoping and the when field investigation reports are ready. The first SHM was conducted in January 2024 in Serthig, Langchenphug, Samrang, Pemathang, and Phuntshothang Gewogs. The purpose of this second SHM was to inform stakeholders on the results of the i) environmental and social investigations, ii) impact assessments, iii) proposed mitigation measures and monitoring plans. Since the transmission line is closely related to the upcoming Jomori Hydropower project, he also made a brief introduction of the Jomori hydropower project. With this background information, the following power point presentations were made.

PPT on JICA Guidelines for Environmental and Social Considerations

Ms. Mitsue Mishima made a power point presentation on the JICA Guidelines for Environmental and Social Considerations. She explained the entire process of project appraisal and approval based on various environmental and social assessment components.

PPT on Assessment of Natural Environment

Mr. Lam Dorji made a presentation on the environmental considerations based on the field investigations conducted in December 2023. His presentation included:
- information on baseline environmental conditions i.e., air, water, noise, and biodiversity in the project area.
- assessment of environmental impacts before construction, during construction and during operational phase.
- proposed mitigation measures to address the assessed environmental impacts and plans for monitoring implementation of the mitigation measures before construction, during construction and operations.

PPT on Social Considerations
Mr. Sangay Thinley Dorji made a presentation on the assessment of social impacts from implementation of the proposed project.

Question and Answer Session
Based on the presentations made, the following points were raised:

Mitigation measures for elephant passage
One participant made reference to the elephant passage along the road in Raidak area, which could be adopted as mitigation measures for elephant passage route in relevant parts of JWS. It was also pointed out that the project needs to collaborate with DANTAK (Border Road Organization), which is currently building the Phuntshothang to Jomotshangkha road. Information Board and signages should be placed in appropriate places along the road.

Clarification was provided by the Survey team that the team is coordinating with the Jomotsangkha Wildlife Sanctuary to identify the known crossings and have signages go up as mitigation measure.

Need to integrate stepdown transformer / substation to address local electricity issues
Providing the benefits of Jomori Hydropower and TL project to address local electricity issues was pointed out as essential. For this, it was noted that the project does not provide for stepdown transformer/ substation to link the electricity supply from Jomori HPP with the existing distribution line. The current electricity issues suffered by three Gewogs of Lauri, Serthig, and Langchenphug can be addressed if the Jomori power was made available. For this, it was recommended that a component to build stepdown transformer be integrated in the project.

Clarification was provided by the Survey team that this is part of the DGPC porposal and was raised and addressed by the MD, DGPC during the Public Consultation hearing.

The District Agriculture Officer, who was filling in for Dasho Dzongrab, thanked the JICA consultants for the presentations and wished the project success.

The meeting concluded at 1:00pm

Participants

1. Mr. Sonam Dendup, Dzongrab
2. Mr. Kinley Wangchuk, RTO/BCTA
3. Mr. Pema Chohel, Asst. Planning Officer
4. Ms. Ugyen Dema, Asst. Environment Officer
5. Mr. Yonten Jamtsho, Project Manager, BPC
6. Mr. Sonam Jamtsho, Offtg. Manager, ESD, BPC
7. Mr. Saha Bir Rai, Chief Dzongkhag Agriculture Officer
8. Ms. Choki Wangmo, Land Record Division
9. Mr. Lam Dorji, CED
10. Mr. Sangay Thinley Dorji, OPMAC
11. Ms. Mitsue Mishima, OPMAC

Photos

Minutes of 2nd Stakeholder Meeting
for proposed 132 KV Jomori Transmission Line Project

Date: 9 April 2024
Location: Conference hall, Phuntshothang Gewog, Samdrupcholing Dungkhag, Samdrup Jongkhar Dzongkhag
Time: 10:30 AM
Participants: See below

Welcome and Introduction

In accordance with invitation extended by Bhutan Power Corporation (BPC) vide letter no.18/BPC/MISC/CEO/2024/92 dated 29 March 2024, the second stakeholders meeting pertaining to the proposed Jomori-Phuntshothang Transmission Line project for stakeholders under Samdrupcholing Dungkhag of Samdrup Jongkhar Dzongkhag was held on 9 April 2024. The meeting was facilitated by Ms. Mitsue Mishima, Lam Dorji and Mr. Sangay Thinley Dorji, who are JICA consultants with Tokyo Electric Power Services Co., Ltd. (TEPSCO) and OPMAC Corporation in Japan.

The meeting began with welcome remarks and introduction to the meeting by Mr. Yonten Jamtsho of BPC. He invited the participating stakeholders to actively participate and voice their concerns and feedback. After a round of introduction by the participants, Mr. Sangay Thinley Dorji, Consultant introduced the agenda and context of the meeting. He informed the participants that the meeting was being conducted to ensure conformity of the project with i) environmental laws of Bhutan and ii) JICA guidelines for Environmental and Social Considerations. JICA guidelines require the proponent to conduct two consultation meetings with stakeholders with regard to the proposed development project i.e., the 132kv Jomori-Phuntshothang transmission line project. The stakeholder meetings (SHM), he said, are conducted at the time of scoping and when field investigation reports are ready. The first SHM was conducted in January 2024 in Serthig, Langchenphug, Samrang, Pemathang, and Phuntshothang Gewogs. The purpose of the second SHM was to inform stakeholders on the results of the i) environmental and social investigations, ii) impact assessments, iii) proposed mitigation measures and monitoring plans. Since the transmission line is closely related to the upcoming Jomori Hydropower project, he also made a brief introduction of the Jomori hydropower project. The following power point presentations were made.

PPT on JICA Guidelines for Environmental and Social Considerations

Ms. Mitsue Mishima of OPMAC Japan made a powerpoint presentation on the JICA Guidelines for Environmental and Social Considerations. She explained the entire process of project appraisal and approval based on various environmental and social assessment components.

PPT on Assessment of Natural Environment

Mr. Lam Dorji made a presentation on the environmental considerations based on the field investigations conducted in December 2023. His presentation included:
- information on baseline environmental conditions i.e., air, water, noise, and biodiversity in the project area.

- assessment of environmental impacts before construction, during construction and during operational phase.
- proposed mitigation measures to address the assessed environmental impacts and plans for monitoring implementation of the mitigation measures before construction, during construction and operations.

PPT on Social Considerations
Mr. Sangay Thinley Dorji made a presentation on the assessment of social impacts from implementation of the proposed project.

Question and Answer Session
Based on the presentations made, the following points were raised:

Concern about potential impact of TL on water source
The Phuntshothang Gup raised concern about the potential impact of transmission line construction on water sources. He said that the proposed TL alignment falls in upper watershed areas, which may be disturbed by construction activities. He suggested that the project accord necessary care to avoid disturbance to watershed during construction.

Response: It was clarified that before construction, careful review will be carried out to ensure no disturbances to water source. (BPC)

Provide step down transformer facilities to meet future urban and industrial energy needs
The Samrang Gup shared the potential expansion of Samrang town and development of industrial area. For this, he requested that the project consider integrating options for sourcing the increased energy needs from the proposed TL.

Response: It was clarified that this would be beyond the scope of this project and be taken up during discussions with Dzongkhag Administration for integration into the Dzongkhag Development Plans.

Local government involvement in identification of worker camps and monitoring
The Samrang Gup expressed concern over potential impact of construction workers on natural environment and wildlife - illegal hunting for example. To minimize the impacts, he suggested that the project involve the Gewog Administration in identification and allocation of worker camps and to monitor them against illegal activities.

Response: it was clarified that, during the start of the project, it is usual practice for the project to work with the Gewog Office to identify the sites and also obtain approval of these workers campsites. The gewog finally has to approve the location before setting up camp. Similarly, the project office works closely with the Forest Officials and the Royal Bhutan Police to be vilgilant to curb illegal activities.
The meeting concluded at 1:00pm

Participants

1. Mr. Jamyang Gyeltshen, Gup, Phuntshothang Gewog
2. Lt. Pemba, Officer In Charge, Royal Bhutan Police, Samdrupchholing Dungkhag
3. Mr. Pema Lekso, Gup, Pemathang Gewog
4. Mr. Jigme Singay Drukpa, Samrang Gup
5. Mr. Ram Bdr. Legni Gurung, Surveyor, Dungkhag
6. Mr. Tashi Wangdi, BPC
7. Ms. Damcho Zangmo, Dungkhag Engineer
8. Mr. Tek Bdr. Gurung, Range Office, Samdrupchholing Forest Range
9. Mr. Karma Wangda, Agriculture Extension
10. Mr. Sangay Tenzin, Pemathang Tshogpa
11. Mr. Rudra Bdr. Rai, Userna Tshogpa
12. Mr. Pema Luwang, Railing Tshogpa
13. Mr. Khem Prasad Timsina, Metothang Tshogpa
14. Mr. Durja Dhan Tamang, Minjigang Tshogpa
15. Mr. Chandra Bdr. Gurung, Resident
16. Mr. Jeet Bdr. Gurung, Resident
17. Mr. Yonten Jamtsho, Project Manager, BPC
18. Mr. Lam Dorji, CED
19. Ms. Mitsue Mishima, OPMAC
20. Mr. Sangay Thinley Dorji, OPMAC

Photos

Minutes of 2nd Stakeholder Meeting
for proposed 132 KV Jomori Transmission Line Project

Date: 11 April 2024
Location: Conference hall, Langchenphug Gewog, Jomotshangkha Dungkhag, Samdrup Jongkhar Dzongkhag
Time: 10:00 AM
Participants: See Below.

Welcome and Introduction

In accordance with invitation extended by Bhutan Power Corporation (BPC) vide letter no.18/BPC/MISC/CEO/2024/92 dated 29 March 2024, the second stakeholders meeting pertaining to the proposed Jomori-Phuntshothang Transmission Line project for stakeholders under Langchenphug Gewog was held on 9 April 2024. The meeting was facilitated by Ms. Mitsue Mishima, Lam Dorji and Mr. Sangay Thinley Dorji, who are consultants with JICA appointed Tokyo Electric Power Services Co., Ltd. (TEPSCO) and OPMAC Corporation in Japan.

Mr. Sangay Thinley Dorji welcomed Dasho Dungpa, Gups, Tshogpas, and sector representatives of Serthig and Langchenphug Gewogs under of Jomotshangkha Dungkhag. He introduced the agenda and informed the participants that the meeting was being conducted to ensure conformity of the project with i) environmental laws of Bhutan and ii) JICA guidelines for Environmental and Social Considerations. JICA guidelines require the proponent to conduct two consultation meetings with stakeholders with regard to the proposed development project i.e., the 132kv Jomori-Phuntshothang transmission line project. He informed that the first SHM was conducted in January 2024 in Serthig, Langchenphug, Samrang, Pemathang, and Phuntshothang Gewogs. The purpose of the second SHM was to inform stakeholders on the results of the i) environmental and social investigations, ii) impact assessments, iii) proposed mitigation measures and monitoring plans. Since the transmission line is closely related to the upcoming Jomori Hydropower project, he provided a brief background to the proposed Jomori hydropower project. As per the agenda, the following power point presentations were made:

PPT on JICA Guidelines for Environmental and Social Considerations

Mr. Sangay Thinley Dorji of OPMAC Japan made a power point presentation on the JICA Guidelines for Environmental and Social Considerations. She explained the entire process of project appraisal and approval based on various environmental and social assessment components.

PPT on Assessment of Natural Environment

Mr. Lam Dorji made a presentation on the environmental considerations based on the field investigations conducted in December 2023. His presentation included:
- information on baseline environmental conditions i.e., air, water, noise, and biodiversity in the project area.

- assessment of environmental impacts before construction, during construction and during operational phase.

- proposed mitigation measures to address the assessed environmental impacts and plans for monitoring implementation of the mitigation measures before construction, during construction and operations.

PPT on Social Considerations
Mr. Sangay Thinley Dorji made a presentation on the assessment of social impacts from implementation of the proposed project.

Question and Answer Session
Based on the presentations made, the following points were raised:

Caution against impacts of HPP activities on existing electric distribution line
The BPC representative shared concern over possible destabilization ad damage to existing power distribution poles and electric lines during construction of HPP infrastructure and access roads. He suggested that piling of excavated soil underneath electric lines be avoided to allow for adequate height clearance between plants underneath and the electric line.

132kv/ 33kv interconnection transformer to address electricity reliability issues
The participants pointed out the importance of the upcoming hydropower and TL projects in addressing the inconsistent and unreliable electricity supply in Jomotsangkha Dungkhag. For this, there was consensus among stakeholders that a 132kv / 33kv interconnection transformer (substation) is crucial in enabling connectivity from the Jomori hydropower for reliable electricity supply in Serthi and Langchenphug Gewogs. The participants urged BPC and DGPC to ensure the facility is provided for in the proposed project.

Response: Clarification was provided by the JICA Survey team that this was already addressed by the MD of DGPC and a step down would be integrated into the Project to address the reliability issues in the area

Need for project assistance to facilitate proper waste disposal
While agreeing with the likely impacts from influx of project workers, Dasho Dungpa expressed concern over the lack of proper waste disposal site in Langchenphug and Samrang Gewogs. Given the lack of budget as well as capacity to provide a designated waste disposal site, he felt it appropriate for the project to support provision of waste disposal facilities.

Response: The Survey Team took note of the concern and informed the participants that it would be discussed with the BPC, Environment and Social Unit and measures be integrated into the EMP for the two geowgs for supporting the establishment of designated waste disposal facility.

Social and environmental impacts from influx of workers
As pointed out in the social impact assessment, the Dungpa also shared his concern over negative social impacts that may result from increased interaction of workers with local people and on the environment.

Response: To this, the consultants pointed out the presence of the Royal Bhutan Police in the Dungkhag and the Forest Officers (illegal hunting/ poaching/ wildlife trading) and the Dungkhag

Administration/ Gewog Administration to work closely with the Royal Bhutan Police and Park Officials to ensure the National Laws are enforced.

With the above feedback and suggestions, Mr. Sangay T. Dorji thanked Dasho Dungpa, Gups, Tshogpas and stakeholder from the Jomotshangkha Dungkhag for their participation.

The meeting concluded at 1:00pm.

Participants

1. Wangchuk, Drungpa, Jomotsangkha Dungkhag
2. Norzang, Sunbdivisional Manager, BPC
3. Mr. Wang Gyeltshen, Mangmi, Langchenphu Gewog
4. Mr. Tshering Dorji, Dungkhag Engineer
5. Mr. Kelzang Dorji, Mangmi, Serthi Gewog
6. Mr. Norbu Tshering, Administration Assistant, Dungkhag
7. Mr. Sonam Dorji, Agriculture Extension, Langchenphu Gewog
8. Mr. Tashi Pheljay, Livestock Extension, Serthi Gewog
9. Mr. Guman Singh Ganglal, Gup, Langchenphu Gewog
10. Mr. Tshewang Tenzin, Gup, Serthi Gewog

Photos

Appendix 14

Minutes of 1st National level Stakeholder consultation meeting for proposed Jomori and Druk Bindu Hydropower and Transmission Line Projects

Date: 1 February 2024
Location: Conference hall, Le Meridien Hotel, Thimphu
Time: 09:30 AM
Participants: Listed Below

Welcome and Introduction

The meeting was convened by Druk Green Power Corporation (DGPC) and Bhutan Power Corporation (BPC) and facilitated by Mr. Lam Dorji and Mr. Sangay Thinley, who are consultants with Tokyo Electric Power Company (TEPSCO) and OPMAC Japan. Mr. Lam Dorji welcomed the participants to the meeting. Prior to introducing the meeting objectives and agenda, he sought the consent of the participants for photo and video recording of the meeting sessions and proceedings, which may be used in projects reports and future publications. With no objections raised, the consent of the participants was secured.

Mr. Lam Dorji informed the participants that the Royal Government has requested Japan's overseas development assistance (ODA) loan for development of Jomori and Druk Bindu Hydropower and transmission line projects. In addition to being subject to Bhutan's regulatory requirements for environmental clearance, the projects must also fulfill the requirements of Japanese government to be eligible for ODA loan. This meeting, he said, was the first of the two stakeholder consultation meetings that must be conducted to meet the requirements of Japan International Cooperation Agency (JICA) guidelines for environmental and social considerations The purpose of this meeting was to share information with stakeholders and seek feedback on the scoping items pertaining to proposed Jomori and Druk Bindu Hydropower and Transmission line projects. He urged the participants to share opinions and sectoral concerns if any, for timely integration in the project plans.

The following meeting agenda and schedule was proposed

Sl. No.	Items	Time
1.	Registration of Participants	9:30 AM – 9:50 AM
2.	Opening address by DGPC	9:50 AM – 10:00 AM
3.	Presentation of JICA Guidelines for Environmental and Social Considerations	10:00 AM – 10:15 AM
4.	Overview: Druk Bindu Hydropower project by DGPC and transmission line by BPC	10:15 AM – 10:30 AM
5.	Presentation on scoping for environmental and social impacts by JICA Survey team	10:30 AM – 11:00 AM
	Coffee break	11:00 AM – 11:15 AM
6.	Overview: Jomori Hydropower project by DGPC and Transmission line by BPC	11:15 AM - 11: 45 PM
7.	Presentation on scoping for environmental and social impacts by JICA Survey team	11 :45 AM – 12:30 PM

	Feedback, Q and A and comments	12:30 PM – 12:50 PM
8.	Closing Remarks	12:50 PM – 1:00 PM
9.	Lunch	1:00 PM – 2:00 PM

Opening remarks by Mr. Dhanjit Singer, DGPC

On behalf of DGPC and BPC as proponents of the Jomori and Druk Bindu Hydropower and Transmission Line projects respectively, Mr. Dhanjit Singer welcomed the stakeholders and provided a brief background to the meeting. He informed the meeting about the recent accelerated approach to development of small hydropower projects to meet the increasing domestic demand for electricity. While some of the small hydropower plants are currently under construction, he said that DGPC is seeking Japanese ODA loan for implementation of the proposed Jomori and Druk Bindu hydropower and transmission line projects. Projects financed under Japanese ODA loans are subject to the requirements of JICA guidelines for Environmental and Social Considerations. For this, JICA consultants are helping DGPC and BPC to fill the gaps in information necessary to meet the requirements of the guidelines. The guidelines require two stakeholder consultations to be conducted – the first one at the scoping level and the second one at the point of finalizing the project. He invited the participants to comment and share concerns.

JICA Guidelines for Environmental and Social Considerations by Sangay T. Dorji

Mr. Sangay T. Dorji, consultant with OPMAC Japan made a PowerPoint presentation on JICA Guidelines for Environmental and Social Considerations. The following components and parameters for identification and assessment of likely environmental social impact of the projects were covered:

1. Permits and consultations
2. Pollution control
3. Natural Environment
4. Social Environment
5. Others such as mitigation and monitoring requirements

Detailed presented is provided in Appendix 2.

Question & Answer session

Ms. Tenzin, Department of Service Transport: What is the differences in requirements as per RGOB and JICA Guidelines for social and environmental considerations?

Sangay T. Dorji responded that gap analysis and review is under process. He added that the final report after 2nd SHM will identify the gaps between Bhutan & JICA's guidelines.

Overview of Druk Bindu Hydropower project by Dhanjit Singer, DGPC

Mr. Dhanji Singer of DGPC made a presentation on the Druk Bindu Hydropower Project. The presentation covered:

- Historical background of the project
- the salient features of the Druk Bindu stage I and Druk Bindu stage II

Stage i		Stage II
•Catchment area = Kachin (28 km2), Druk Bindu (53 km2)		•TRC length = 155 m
•Intake RBL= Kachin El. 967.5, Druk Bindu El 962.00		•TRC outfall = El. 615.3 (*Jaldhaka intake El. 610*)
•FSL at desilting basin = El. 960.30		•Net Head: 99 m
•HRP length=3,192.52 m, 2.3 m dia		•Design discharge= 9.36 m3/s
•Steel penstock = 437.54 m, 1.6 m dia		**•Installed capacity= 8 MW (2x 4 MW)**
•Surface powerhouse = 31m x 13m x 20m		**•Firm power = 1.21 MW**
•Machine center line = El. 731.00		**•Design energy = 33.99 GWh**
•TRC outfall = El. 726.00 m		**•PLF = 49%**
•Design head = 218 m		
•Design discharge= 9.36 m3/s		
•Installed capacity= 18 MW (2 x 9 MW)		
•Firm Power = 2.68 MW		
•Design energy = 75.83 GWh		
•PLF = 49%		

- the environmental and social assessments carried out so far and associated biological, physical, socio-economic baseline data
- the land requirement for the project by type and the temporary or permanent nature of use.
- the project financials

Detailed presentation is provided in Appendix 3.

Question & Answer session

Ms. Sonam Wangmo, Bhutan Ecological Society: Are private landowners aware of the plan and will they be compensated?

Tshering Dorji (BPC) responded that that the affected landowners are informed of the plans through the public consultations held at Gewog levels, which also helps minimize project impacts on private lands. BPC in coordination with the JICA consultants has successfully carried out the public consultation meetings and even obtained NOC from the project affected people (PAP). Where acquisition is unavoidable, the landowners have the option of availing land substitution (if adjacent state land is available) or cash compensation as per rules.

Overview of Druk Bindu Transmission Line by Tshering Dorji, BPC

Mr. Tshering Dorji, Senior Environment Officer at BPC made PowerPoint presentation on proposed transmission line for evacuation of hydroelectricity from the Druk Bindu Hydropower plant sites. The presentation covered the following features of the proposed project:

- Name of Project: 66 kV Transmission Line (TL) from Proposed Druk Bindu Powerhouse to Kangduphu (Jogimara) Substation.
- Places/Corridors: Tendu, Pemaling (Biru) and Tashicholing (Sipsu), Samtse
- Length: Approx. 13.8 km.
- Numbers of Towers: Approx. 64 Towers

Project Objectives:

- To Evacuate the power generated from the proposed 26MW Druk Bindu Hydropower Power plant.
- Power supply reliability in the southern Bhutan.
- To facilitate and ensure reliability for other development activities in Southern Regions.

He shared that every effort was being made to cause minimal impact on private lands and community forests. For the proposed transmission line alignment option, the details of state reserve forest and private land under different Gewogs that fall in the right of way or required for location of towers was presented as below:

SN.	Gewogs	Line Length (km)	No. of towers in State forest land (SRFL)	No. of Affected Pvt. Lands	No. of towers in Private Land (PL)
1	Tendu	4.8	22 Towers	5	0 Tower
2	Pemaling	3	13 Towers	14	2 Towers
3	Tashichholing	6	23 Towers	17	4 Towers
	Total	**13.8 km**	**58 Towers**	**36**	**6 Towers**

Presentation of scoping items for natural environment considerations for Druk Bindu HPP by Lam Dorji

Mr. Lam Dorji made a presentation on the scoping items to be considered for assessment of natural environmental aspects of the project. To meet the pollution control and biodiversity conservation needs of the project, specific areas of interest and the stage (pre-construction, construction, and operational) at which impacts from project activities are expected to occur were identified for each impact area. The presentation covered the following categories and associated impact areas:

- Pollution control
    - Air Quality
    - Water Quality
    - Waste
    - Soil quality
    - Noise and Vibration
    - Odor
    - Sediment
- Biodiversity Conservation
    - Protected Areas
    - Biodiversity

Detailed presentation is given in Appendix 4.

Question & Answer session

Ms. Norbu Yangden, (DOFPS): Does the project have measures in place to minimize impacts on species – prevent noise disturbance not just for humans but also for wild animals?
Mr. Lam Dorji responded by saying Yes. He said that every effort is being made to identify the expected impacts from project activities. The scoping items on protected areas and biodiversity conservation allows for such concerns to be addressed. Your concern is well noted and will be addressed in the environmental management plans of the project.

Comment by Ms. Sonam Wangmo: The likely impacts of the project activities on aquatic life was not covered in the presentation- please add this if possible.

Sangay Dorji responded that DGPC has already conducted the aquatic life assessments and whatever Dr. Lam presented is the additional study to what DGPC have conducted.

Comment by Ms. Norbu Yangden (DOFPS): The study should cover the impacts of both flora and fauna by the proposed project and appropriate mitigation measure should be in place to protect these flora and fauna.

Lam Dorji responded that the survey team is compiling the list of flora and fauna in the project area and their conservation status as per IUCN and FNCA are being identified. Impact of the project on the species will be assessed once the list is finalzed.

Ms. Norbu added that the Environmental assessment study should also take into account the water pollution and waste issues from the labour camps because there will be significant disturbances to water bodies and natural environment during the construction phase. She also informed that it is good that the project survey team are considering analyzing the impacts from the Druk Bindu project to the nearby protected areas even if the project is not located in the PA.

Presentation of scoping items for Social considerations for Druk Bindu HPP by Sangay T Dorji

Mr. Sangay T. Dorji presented the scoping items for social considerations as per the JICA guidelines. The framework for social consideration containing information on impacts areas and areas of interest to manage expected social impacts before, during and after construction activities for the proposed Druk Bindu hydropower project was presented:

a. Resettlement and Land Acquisition
b. Ethnic Minorities and Indigenous Peoples
c. Vulnerable Social Groups
d. Living and Livelihood
e. Land use and local resources use
f. Water use
g. Existing infrastructure and Social Services
h. Working conditions (labor environment)
i. Health, Safety and Security of Local Communities (Sanitation)
j. Heritage (Cultural)
k. Landscape (Scenery)

Copy of the presentation is given in Appendix 5.

Question Answer session

Comment and suggestion: Mr. Dhendup Tsheten (Department of Culture and Dzongkha Development, MOHA) appreciated the cultural heritage considerations of the project. He said that Tendu has a large number of cultural heritage sites and suggested that the project refer to the list of important cultural and heritage sites available with his Department. Sangay T Dorji took note of the concern and suggestions, which he said will be attended to during the upcoming field assessment.

Ms. Norbu Yangden (DOFPS) inquired how the project is going to mitigate the community conflict on resource sharing when the project is having influx of labors in the community. Mr. Sangay T Dorji responded that there is a Grievance Redress Mechanism (GRM) in place that will specifically address the community conflicts.

Ms. Norbu also inquired if the JICA guidelines cover the Environment, Health & Safety of the workers. Sangay T Dorji responded that the DGPC, BPC & any project will have a health screening system in place to address such issues.

Mr. Chorten Namgay (Dept. of Law and Order) expressed the need to consider minimizing impacts of Druk Bindu HPP on Jaldaka Power plant located downstream on the international border with India. He also shared a similar concern on the Druk Bindu TL. As the line is passing parallel to India-Bhutan border, he suggested that at least 10m buffer from the International border be maintained for project activities. DGPC and BPC representatives took note of his concerns for planning.

Ms. Tenzin (Department of Service Transport)commented that if the impacts to the existing roads will be assessed during this study as the existing roads and bridges will be impacted by the projects. Sangay T. Dorji responded that this is beyond the scope of this study but we will take note of this comment and reflect in this ESIA. Danjit (DGPC) also added that DGPC has already started to study the carrying capacity of the existing roads and bridges in consultation with the relevant ministries. Discussions are underway to improve the carrying capacity of the existing roads and bridges.

The session on Druk Bindu HPP and TL ended with a coffee break, after which session resumed with presentations on Jomori HPP and TL.

Presentation on proposed 90MW Jomori Hydropower project by Dhanjit Singer, DGPC
Mr. Dhanjit Singer provided an overview of the proposed Jomori Hydropower project. The following aspects of the following were introduced:

- Background and project location
- Alternatives studied
- Project layout and key features
    - Installed Capacity: 90 MW
    - Firm Power: 15.47 MW
    - Design Energy: 367.33 MU
    - Peaking Capacity: 6 hours
- Environment and Social Impact Assessments including information on:
    - Baseline Data on Biological, Physical and Socio-Environment
        - Land Use-Land Cover (Study Area)
        - Physical Environment
        - Socio-economic Environment
- Project schedule and costs

See Appendix 6 for detailed presentation.

Presentation on proposed 132 KV Jomori Transmission Line project by Tshering Dorji, BPC.
Mr. Tshering Dorji, Senior Environment Officer of BPC made a PowerPoint presentation on the the proposed transmission line for evacuation of electricity from the 90MW Jomori hydropower project. He said that the preferred and currently proposed alignment is the result of assessment of the four alternatives i.e., i) First Route (43km) that passes through core zone of Jomotshangkha Wildlife Sanctuary (JWS), ii) 75.5km route passing through Jomotsangkha/Daifam town, iii) Realignment Proposal (38.6km) to bypass JWS but still passing through high forest and rugged and

geologically fragile terrain, and iv) 62km route aligned with buffer zone around existing Phuntshothang - Jomotshangkha national highway. The fourth option with the following details is being proposed for implementation:

Name of Project: 62km 132kV D/C Transmission Line (TL) from Proposed 90MW Jomori Power House to Phuntshothang Substation, S/jongkhar.

Based on this preferred option, the following Gewog-wise details of length of transmission line, number of towers falling in state reserved forest and private lands was presented.

SN.	Gewogs	Line Length (km)	No. of towers in State forest land (SRFL)	No of private Affected Lands	No. of towers in Private Land (PL)
1	Serthi	15.5	42 Towers	37	4 Towers
2	Langchenphu	24.6	47 Towers	12	1 Tower
3	Samrang	8.6	24 Towers	0	0
4	Pemathang	8.1	19 Towers	5	1 Tower
5	Phuntshothang	4.9	19 Towers	9	0
	Total	**61.7 km**	**151 towers is SRFL**	**63 PAP**	**6 towers**

Presentation of scoping items for environmental considerations for Jomori HPP by Lam Dorji

The scoping items for environmental considerations for Jomori HPP was presented by Lam Dorji. He shared that the proximity of the proposed HPP to JWS and the associated transmission line passing through the protected area requires the project to comply with stringent safeguard measures that should be identified, managed, and monitored appropriately at pre-construction, during construction, and post construction operational phases. As presented earlier, the framework containing details of impact areas and areas of interest for pollution control and biodiversity conservation pertaining to Jomori HPP was presented. The detailed contents of the presentation is given in Appendix 4.

Presentation of scoping items for Social considerations for Jomori Hydropower project by Sangay T Dorji

The scoping items for social considerations for Jomori HPP was presented by Sangay T Dorji. Based on the JICA framework for social considerations, the areas of interest to manage expected social impacts before, during, and after construction activities of the project were presented for each of the following impact areas:

a. Resettlement and Land Acquisition
b. Ethnic Minorities and Indigenous Peoples
c. Vulnerable Social Groups
d. Living and Livelihood
e. Land use and local resources use
f. Water use
g. Existing infrastructure and Social Services
h. Working conditions (labor environment)
i. Health, Safety and Security of Local Communities (Sanitation)
j. Heritage (Cultural)
k. Landscape (Scenery)

Comment by Ms. Nima Zangmo (Electricity Regulatory Authority): Ms. Nima informed the gathering that all these assessments are requirements for issue of construction license as per Electricity Act of Bhutan.

Suggestion by Mr. Dhendup Tshering (DCDD, MOHA): Mr. Dhendup suggested that the project proponents refer to the list of cultural heritage sites to assess likely impacts of project on cultural heritage sites.

Comment by Colonel Tshering Dorji (Royal Bhutan Police): Colonel Tshering Dorji acknowledge the role of Royal Bhutan Police in ensure security and safety of the Public. For this, he requested the project authorities to involve the relevant Police stations in the project sites in future consultations.

Concluding remarks

The meeting concluded with vote of thanks by Mr. Dhanjit Singer, DGPC. He thanked all the stakeholders representatives for their active participation in the consultation meeting.

The meeting concluded at 1:00PM. Participants were served with lunch.

Participants of the 1st National level Stakeholder consultation meeting for proposed Jomori and Druk Bindu Hydropower and Transmission Line Projects

Sl. No.	Name	Organization	Email Adress
1	Tenzin Zepen (Surveyor)	Bhutan Power Corporation Ltd.	tenzinzepen@bpc.bt
2	Jaku Gap	Bhutan Power Corporation Ltd.	jakugyaplmt@gmail.com
3	Colonel Tshering Dorji	Royal Bhutan Police	tsheringd@rbp.gov.bt
4	Nima Zangmo, Deputy Executive Engineer	Elecricity Regulatory Authority	nima.zangmo@era.gov.bt
5	Sonam Wangmo, Chief Program Officer	Bhutan Ecological Society	sonamwangmo@bes.org.bt
6	Singye Wangchuk, Asst. Environment Officer	Department of Environment and Climate Change, Ministry of Energy and Natural Resources	singyewangchuk@moenr.gov.bt
7	Tshering Choden	Bhutan Power Corporation Ltd.	tsheringchoden@bpc.bt
8	Ngawang Norbu	Department of Labour, Ministry of Industry Commerce and Employment	nnorbu@moice.gov.bt
9	Tshering Dorji, Sr. Environment Officer	Bhutan Power Corporation Ltd.	tsheringdorji@bpc.bt
10	Leki Tshewang, Program Officer	Bhutan Trust Fund for Environment Comservation	leki@bhutantrustfund.bt
11	Tandin Jamtsho	Druk Green Power Corporation	t.jamtsho3628@drukgreen.bt
12	Sangay Tshering	Druk Green Power Corporation	s.tshering3617@drukgreen.bt
13	Dorji Yangdon	Druk Green Power Corporation	d.yangdon2400@drukgreen.bt
14	Pema Thinley	Department of Energy, Ministry of Energy and Natural Resources	pemathinley1@moenr.gov.bt

15	Tek Bahadur Ghalley	Department of Forest and Park Service, Ministry of Energy and Natural Resources	tbghalley@moenr.gov.bt
16	Dhendup Tshering	Department of Culture and Dzongkha Development, Ministry of Home Affairs	dtshewang@moha.gov.bt
17	Tenzin Wangmo	Department of Surface Transport, Ministry of Infrastructure and Transport	tenzinwangmo@moit.gov.bt
18	Dhajit Singer	Druk Green Power Corporation	d.singer2147@drukgreen.bt
19	Pema Dorji	Druk Green Power Corporation	p.dorji1869@drukgreen.bt
20	Tandin Tshering, Sr. Environment Officer	Druk Hydro Energy Ltd.	t.tshering8040@dhye.bt
21	Yeshi Wangchuk	Bhutan Power Corporation Ltd.	yeshiwgchuk@bpc.bt
22	Chendra Norbu	Department of School Education, Ministry of Education and Skills Development	chendranorbu@moesd.gov.bt
23	Dorji Wangdi	National Land Commission Secretariat	dorjiw@nlcs.gov.bt
24	Chorten Namgay	Department of Law and Order, Ministry of Home Affairs	cnamgyal@moha.gov.bt
25	Norbu Yangdon	Nature Conservation Division, Department of Forest and Park Services, Ministry of Energy and Natural Resources	norbuyangdon@moenr.gov.bt
26	Kunitaka Sakamoto	Tokyo Electric Power Company, Japan	sakamoto.kunitaka@tepsco.jp
27	Fumiyasu Minagawa	Tokyo Electric Power Company, Japan	fumiyasu-minagawa@tepsco.jp
28	Lam Dorji	Centre for Environment and Development	ldorjie@gmail.com
29	Sangay T. Dorji	OPMAC, Japan	sangaytdorji@gmail.com

Minutes of 2nd National level Stakeholder Consultation Meeting for proposed Jomori and Druk Bindu Hydropower and Transmission Line Projects

Date: 17th April 2024
Location: Conference Hall, Tashi Yid-Wong Hotel, Thimphu.
Time: 09:30 AM
Participants: See Participant List.

Welcome and Introduction

The meeting was convened by Druk Green Power Corporation (DGPC) and Bhutan Power Corporation (BPC).

Prior to introducing the meeting objectives and agenda, consent of the participants for photo and video recording of the meeting sessions and proceedings was sought, which may be used in projects reports and future publications. With no objections raised, the consent of the participants was secured.

Mr. Sangay T. Dorji, JICA Survey Team, informed the participants that the Royal Government has requested Japan's overseas development assistance (ODA) loan for development of Jomori and Druk Bindu Hydropower and transmission line projects. In addition to being subject to Bhutan's regulatory requirements for environmental clearance, the projects must also fulfill the requirements of Japanese government to be eligible for ODA loan.

This meeting, he said, was the second of the two stakeholder consultation meetings that must be conducted to meet the requirements of Japan International Cooperation Agency (JICA) guidelines for environmental and social considerations. The purpose of this consultation is to share findings and results of the preparatory study with stakeholders and seek feedback on the results, mitigation and moniroting pertaining to proposed Jomori and Druk Bindu Hydropower and Transmission line projects. He urged the participants to share opinions and sectoral concerns if any, for timely integration in the project plans.

The following meeting agenda and schedule was proposed

Sl. No.	Items	Time
1.	Registration of Participants	9:00 AM – 9:20 AM
2.	Opening address by DGPC	9:20 AM – 9:30 AM
3.	Presentation on Druk Bindu HPP – Results and Mitigation	9:30 AM – 9:45 AM
4.	Presentation on Druk Bindu TL – Results and Mitigation	9:45 AM – 10:00 AM
5.	Q and A	10:00 AM – 10:15 AM
	Coffee break	10:30 AM – 11:00 AM
6.	Presentation on Jomori HPP – Results and Mitigation	11: 00 AM - 11: 25 AM
7.	Presentation on Jomori TL – Results and Mitigation	11 :25 AM – 11:50 AM
8.	Q and A	12:00 PM – 12:30 PM
9.	Closing Remarks	12:30 PM – 12:40 PM
10.	Lunch	12:40 PM – 1:30 PM

Meeting Proceedings:

1. DhyE CEO Opening Remarks:

- The CEO of DhyE initiated the meeting by emphasizing the necessity of starting the small hydro project due to the need to purchase electricity at higher rates from India during winter seasons.
- Highlighted the second phase of the project involving 90MW Jomori, 26MW Druk Bindu, Gamri 54MW, and Begana 25MW.
- Stressed on sourcing main packages internally, while seeking overseas loan and funding for E&M and TL.
- Mentioned the importance of updating the ESIA report to comply with JICA guidelines for availing JICA loan.

2. Presentation of ESIA Reports (Morning Hours: Druk Bindu Projects):

- Mr. Sangay T. Dorji and Dr. Lam presented the ESIA reports for the Druk Bindu Projects.
- No significant impacts on the social front were reported on hydropower, as there was no internal displacement of people and no significant impact on the livelihood of communities.
- It was noted that there was no resettlement in TL projects as well.
- Mitigation and Monitoring plans were also presented.

Q&A Session:

- **Department of Culture:** Bhutan being a country of living culture, has several festivals and celebrations unique to individual local communities, and with projects coming, there is huge risk of cultural dilution and total disappearance of these traditions in the worst case scenario. Therefore, to encourage the local community to protect and continue their cultural tradition, a proper recognition from the Project would play a major role in its protection. This can be done by undertaking measures such as involving project in their local festival or granting leave during their local festival to those local population employed in the project.
- **CEO DHYE Response:** Stated that one to two days of holiday are given during local holidays but not entire days.
- **Department of Law and Order:** Inquired about the permanency of roads and access roads and BPC's acquisition of necessary approvals. He suggested that in cases which are close to the border areas for access road construction, it would be prudent, if permissions and approvals
- BPC responded that all access roads and ropeways required are included in the ESIA report, along with necessary approvals.

3. Presentation on Jomori Projects:

- Mr. Sangay T Dorji and Dr. Lam presented on the Jomori Projects.
- No significant impacts on the social front were reported on hydropower, as there was no internal displacement of people and no significant impact on the livelihood of communities.

- It was noted that there was no resettlement in TL projects as well.
- Mitigation and Monitoring plans were also presented.

Q&A Session:

- **NLCS:** Inquired about allocations/ requirements of land acquisition of state land.
- Mr. Sangay responded that SFL acquisition is estimated and has been included in the ESIA Report.

CEO, DHyE Closing Remarks:

- Highlighted the importance of being mindful of budgetary constraints, noting that the projects are primarily aimed at serving domestic consumers. Addressing public requests for project funding in local area developments, such as waste disposal facilities and blacktopping existing farm roads, may not be feasible in full. While the project may offer partial assistance, it's essential to recognize that the funds are acquired as a loan. Undertaking additional activities would only escalate the loan amount and add pressure to the lender.
- The meeting was concluded at 12:30 PM and all the stakeholders were thanked for taking time to participate in the stakeholder consultation.

Participants of the 2nd National level Stakeholder consultation meeting for proposed Jomori and Druk Bindu Hydropower and Transmission Line Projects

1. Mr. Ugyen Namgyal, CEO, DHyE
2. Mr. Sonam Wangdi, Director, DGPC
3. Mr. Ganesh Pradhan, Senior Surveyor, National Land Commission Secretariat
4. Mr. Chorten Namgey, Officiating Chief Program Officer, Department of Law and Order
5. Ms. Dorji Yangden, Environment Officer, DGPC
6. Mr. Tandin Jamtsho, Environment Officer, DGPC
7. Ms. Nima Zangmo, Dy. Executive Engineer, Electricity Regulatory Authority
8. Mr. Dhanjit Singer, Dy. Executive Engineer, DGPC
9. Mr. Tandin Tshering, Sr. Environment Officer, DHyE
10. Mr. Sangay Tshering, Environment Officer, DHyE
11. Mr. Sonam Tenzin, Assistant Environment Officer, DoECC, MoENR
12. Mr. Tshering Dorji, Environment Officer, BPC
13. Mr. Tenzin Zoepa, Surveyor, BPC
14. Mr. Dendup Tshewang, Department of Culture and Dzongkha Development
15. Mr. Jigme Sonam, Assistant Environment Officer, BPC
16. Mr. Kinga Tenzin, Surveyor, BPC
17. Mr. Kamal Bahun, Surveyor, BPC
18. Mr. Pema Dorji, Sr. Environment Officer, DGPC
19. Colonel Ugyen Wangchuk, Royal Bhutan Police
20. Mr. Kencho Gyeltshen, Licensing Engineer, Electricity Regulatory Authority
21. Ms. Wangmo, Assistant Engineer, Department of Energy
22. Ms. Dechen Wangmo, Engineer, Department of Energy
23. Mr. Chandra Norbu, Assistant Program Officer, Department of School Education
24. Mr. Namgyel Wangdi, Sr. Program Officer, Bhutan Ecological Society
25. Mr. Sakamoto, Survey Team
26. Mr. Minagawa, Survey Team
27. Mr. Takahashi, Survey Team
28. Mr. Wada, Survey Team
29. Ms. Mishima, Survey Team
30. Mr. Dorji, Survey Team
31. Dr. Lam Dorji, Centre for Environment and Development

Appendix 15 : Valuation form for Land Acquisition and Compensation

Factors to be taken into Account when Determining Compensation Rates for Kamzhing, Chhuzhing and Orchard Land

The following factors shall be taken into account when calculating the rural land compensation rate for all Classes of Land:

1. Distance from the High way / Feeder Road;
2. Water availability on land;
3. Topography of land;
4. Soil In-stability
5. Scenic, cultural and historical value

1. Distance from the Highway / Feeder road:

• The compensation rate shall increase by 15% if the location of the land under assessment is directly connected to highway / feeder road.

• The compensation rate shall increase by 10% if the location of the land under assessment is within half an hour (normal route) by normal walking distance from the nearest highway / feeder road.

• The compensation rate shall increase by 5% if the location of the land under assessment is more than half an hour (normal route) but less than or equal to one hour normal walking distance from the nearest high way / feeder road.

• If the land under assessment is more than 1 hour normal walking distance, there shall be no percentage increase in Compensation rate.

2. Water availability on the land: (water source within 1 km distance at the time of assessment)

• The compensation rate shall reduce by 5% if there is no water at the land under assessment at the time of assessment.

3. Topography of the land:

• The compensation rate shall remain same if the topography is less than 45°.

• The compensation rate shall decrease by 10% if the topography of the land under assessment is more than or equal to 45°.

4. Soil In-stability:

- 10% decrease if land under valuation is unstable, marshy and prone to landslides while rate will remain same should the soil be stable.

5. Scenic, cultural and historical value:

- 5% increase should the land under valuation have scenic cultural and historical significance.

		Agency -					**Valuation Reference No.**
1	Name of owner	:					
2	ID Number	:					
3	Location of land	:					
4	Plot No. / Thram No.	:					
5	Geog						
6	Dzongkhag						
7	Type of Land	Kamzhing		Chhuzhing	Orchard		
8	Total Area (A + B)						
	Area (A) Topg < 45°						
	Area (B) Topg ≥ 45°						
	Class of land	**Class A1**	**Class A**	**Class B**	**Class C**	**Class D**	**Amount (Nu)**
	Distance from MB	**≤ 1 Km**	**≤ 3 Kms**	**3 < L ≤ 6**	**C> 6-9 Kms**	**C> 9 Kms**	
A	**Base Rate (Nu. per decimal) Tick the PAPpropriate class**						
						% Addition	
	Distance from highway / feeder road	Land connected to highway/feeder road			15%		
B1		Land within half an hour walking distance			10%		
		Half hour < Land ≤ 1 hour walking distance			5%		
		More than an hour walking distance			0%		
B2	Water availability	Water availibity within 1 km distance from source			0		
		No Water availibity on land			-5%		
B3	Soil In-stability	Stable land			0		
		Unstable land			-10%		
B4	Scenic, cultural and historical value	Exist			5%		
		Regular			0		
	Adjusted Rate (AR) = A + (B1 + B2 + B3 + B4)						
	TopogrPAPhy (Topg)*	Area (A)			1.00		

		Area (B)			-10.00%		
	Therefore final value of land						
* Land topogrpahy below 45 ° will be at par with the adjusted rate (AR). However, if a parcel or a portion of							
the land is equal to or more than 45°, the land compensation rate will reduce by 10% on pro rata basis.							

Legend for chiwog valuation format				
Land Area (A)	Pertains to land that is less than 45 °			
Land Area (B)	Pertains to land that is equal to or more than 45 °			
MB	Municipal Boundary			
AR	Adjusted Rate			
Topg	TopogrPAPhy			

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time: Manjigaon Village / 25/11/2024 / 9.30am.

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
4.	Sancha maya Limbu	H-T-776	Thonggaling Phuntsholing		Tower relocated and doesn't fall in the private land.					17905993
5.	Chakra Bdr Rai	H-T-213	Selmotang Phuntsholing							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time: 25/1/2024 (Meajigay village). 9:30.

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
1.	Mon Bdr Sherpden	H-NA-1-158 T-595	Minjigang phuntsho thang							
2.	Phurba Singh Tamang	H-NA-1-159 T-04	- 11 -							
3.	Mon Bdr Rai	H-NA-1-5 68 T-905	Thongjaling phuntshothang							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time: Pemathang Gewog (Gewog CH, 24/1/2024.

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
	Santa Bir Rai	219	Laptsazor Pemathang							
	Mon Bdr Rai	218	Laptsazor Pemathang							
	Manauda Rogmi	264	Ugerna Pemathang							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time: Panakha Gewog.

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
	Jit Bdr Rai. (ROW)		Laptsazor.							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
1/	Tshering Zangmo (R)	930	Khardophug							
2/	Thinley Wangdi (R)	940	Khardophug							
3/	Yangyeg	890	Khardophug							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
4	Kezang Tshering (K)	94	Khenduphug							
5	Tashi Phuntsho (K)	920	Khenduphug							
6	Soham Dema (K)	114	Khenduphug							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
7	Meto Dema (R)	395	Khamdhung							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time: 22/1/2024 (Serthi Gewog office).

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
1	Pema Wangyal (T)	382	Denphu		As general, Serthi Mangi received concerned regarding Land substituted falling under ROW for house construction. However, LRO sir justified that if the land owner has no other land, He is eligible for land compensation.	Resolved				
2	Dorji (T)	163	Mujiwong							
3	Tashi Penjor (T)	40	Denphu							

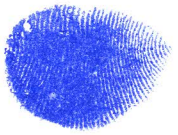
Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
4	Tashi Chamo (R)	161	Mujiwong							
5	Drakpa (R)	23	Denpin							
6	Dorji (R)	163	Mujiwong							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
7	Nidup Tshering	870	Mujiwong							
8	Yonten (R)	63	〃							
9	Darmo (R)	1085	〃							

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
10	Pema Chezom (R)	858								
11	Dorji Wangda (R)	1129								
12	Soram Pemma (R)	174								

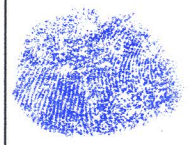
Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
13	Tshewang Lezom (R)	1124	Dagphu							
14	Lobzi Phuntsho	75	Dagphu							
15	Jangchuk	1011								

Public Consultation Report/ No-Objection Certificate (NOC).

Date, Venue & Time:

SN	Name of the Project Affected Individual (PAI), CID no/Contact no.	Thram no./House no.	Village/Gewog	Compensation	Issues Raised/ Discussion	Decision Taken	Unresolved Issues (If any)	Total Land Holding (Acre)	Household Earning/Source of income	Signatures
16	Tashi Chaw (R)	948								
17	Tshewang Dorji (R)									
18										

Date:

Community Forestry Management Group (CFMG) clearance

We, the Community Forestry Management Group (CFMG) members of Raling Community Forest would like to issue this clearance to Mr. /Mrs. ....., CID: ....., Gung No: ..... for ....., measuring ..... acres/meters that falls within/runs through our Community Forest.

We, the CFMG members have issued the clearance, knowing that we have to undertake to abide by the following conditions:

1. We will not apply/request for extension of the CF area taken by the applicant for the above purpose.
2. We will extract the timbers and other forest produces falling inside the area required for the above purpose and utilize as per the CF management plans only after the forest produces are handed over to us by the concerned forest office.
3. The forest produces that are not covered in the CF management plan will be disposed off by the concerned forest office as per the provisions of the prevailing forest acts and regulations.

No.	Name	Role	CID Number	Signature
1.	Pema Yangay	Chairman	11108001595	
2.	Pema Luwang	Accountant	11108001729	

Pema Luwang

Date:

Community Forestry Management Group (CFMG) clearance

We, the Community Forestry Management Group (CFMG) members of Pemathang KA Community Forest would like to issue this clearance to Mr. /Mrs. ..... CID: ..... Gung No: ..... for ....., measuring ..... acres/meters that falls within/runs through our Community Forest.

We, the CFMG members have issued the clearance, knowing that we have to undertake to abide by the following conditions:

1. We will not apply/request for extension of the CF area taken by the applicant for the above purpose.
2. We will extract the timbers and other forest produces falling inside the area required for the above purpose and utilize as per the CF management plans only after the forest produces are handed over to us by the concerned forest office.
3. The forest produces that are not covered in the CF management plan will be disposed off by the concerned forest office as per the provisions of the prevailing forest acts and regulations.

No.	Name	Post	CID Number	Signature
1.	Ganga Ram	Secretary	11108000993	
2.	Tashi Zangmo	Accountant	11108000150	
3.	Dorji Wangdi	Member Tshogpa	11051000 2565	

Tshogpa
Pemathang
Pemathang Samdrup Choling

Date:

Community Forestry Management Group (CFMG) clearance

We, the Community Forestry Management Group (CFMG) members of Menjigang CF Community Forest would like to issue this clearance to Mr. /Mrs. Bhutan power Corporation., CID: ....., Gung No: ..... for ....., measuring ..... acres/meters that falls within/runs through our Community Forest.

We, the CFMG members have issued the clearance, knowing that we have to undertake to abide by the following conditions:

1. We will not apply/request for extension of the CF area taken by the applicant for the above purpose.
2. We will extract the timbers and other forest produces falling inside the area required for the above purpose and utilize as per the CF management plans only after the forest produces are handed over to us by the concerned forest office.
3. The forest produces that are not covered in the CF management plan will be disposed off by the concerned forest office as per the provisions of the prevailing forest acts and regulations.

No.	Name	Role	CID Number	Signature
1.	Singh Dorji Shangdan	Chairman	11109002099	
2.	Kazme Singh Jamang	Secretary	11109004688	
3.	Phuspa Singh Jamang.	Member	11109002079	

Date:

Community Forestry Management Group (CFMG) clearance

We, the Community Forestry Management Group (CFMG) members of Khardhyophung Community Forest would like to issue this clearance to Mr. /Mrs. Gayjung Kuenphen Norbuling CID: ....., Gung No: ..... for ....., measuring ..... acres/meters that falls within/runs through our Community Forest.

We, the CFMG members have issued the clearance, knowing that we have to undertake to abide by the following conditions:

1. We will not apply/request for extension of the CF area taken by the applicant for the above purpose.
2. We will extract the timbers and other forest produces falling inside the area required for the above purpose and utilize as per the CF management plans only after the forest produces are handed over to us by the concerned forest office.
3. The forest produces that are not covered in the CF management plan will be disposed off by the concerned forest office as per the provisions of the prevailing forest acts and regulations.

No.	Name	Role	CID Number	Signature
1/	Pema Tashi	Chairperson	11111002639	
2/	Tashi Phuntsho	Accountant	11111001003	
3/				
3/	Kelzang Tshering	Member	11111001714	
4/	Ngache	11	11111001059	
5/	Tashi Dawa	11	11111002496	

ཚོགས་འཛིན།
མཁའ་འགྲོ་སྡུང་དགེ་འབྲུང་གྲུབ་ཚན་
སྤྱོང་སྡེ་ནགས་ཚལ།

ཁྲི་འཛིན།
མཁའ་འགྲོ་སྡུང་དགེ་འབྲུང་གྲུབ་ཚན་

6/	Thinley Wangdi	Member	11111 001748	
7/	Kelzang Dorji	11	11111 000237	
8/	Norbu Wangdi	11	11111 002508	
9/	Karchung	11	11111 002518	
10/	Tangjay	11	11111 00 2525	
11/	Pema Chophel	11	11111 00 2542	
12/	Wang Gyeltshen	11	11111 00 2544	
13/	Sangay	11	11111 00 2549	
14/	Jowo Wangdi	11	11111 00 2553	
15/	Jowo Tshering	11	11111 00 2549	
16/	Tshering Chezom	11	11111 00 2548	
17/	Tshewang Gyelmo	11	11111 00 2523	
18/	Dawa	11	11111 00 2647	
19/	Wangchen	11	11111 00 1362	
20/	Dup Wangdi	11	11111 00 1329	
21/	Nangay	11	11111 00 1326	
22/	Kusten Norbu	11	11111 000250	
23/	Tashi Dema	11	11111 00 9577	
24/	Tam Thamo	11	11111 00 1227	
25/	Phuntsho Wangmo	11	11111 00 2497	
26/	Dorji Tshewang	11	11111 00 0257	

27/	Sonam Dema	New member		
28/	Gyeltshen Dema	Member	11111000224	
29/	Karma Choden	11	—	

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WEBSITE:

http://www.samdrupjongkhar.gov.bt/index.php/dratshang-profile
http://www.emfs.info/sources/overhead/specific/132-kv/

ArcGIS Base Maps:

Samdrupjongkhar Land Cover Shape files and Base maps from National Land Commission, Thimphu.
Samdrupjongkhar Dzongkhag and Gewog Base maps from National Land Commission, Thimphu.