GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF POWER ENERGY AND MINERAL RESOURCES

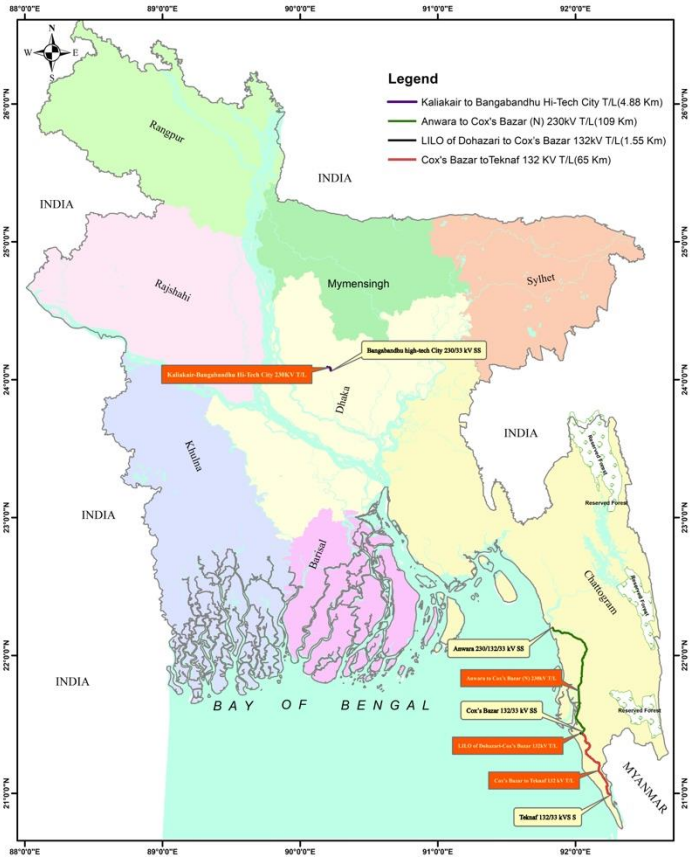
POWER GRID COMPANY OF BANGLADESH LIMITED

FINAL REPORT

Environmental and Social Impact Assessment (ESIA) Study

Of

Southern Chattogram and Kaliakoir Transmission Infrastructure Development Project



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Disclaimer

This report has been prepared by PGCB with the support of Infrastructure Investment Facilitation Company (hereinafter referred as IIFC) for the regulatory requirement of Department of Environment (DOE), Ministry of Environment, Forests and Climate Change (MoEFCC), The People's Republic of Bangladesh. IIFC has undertaken an environmental and social survey and has developed an Environmental and Social Impact Assessment (ESIA) report for Asian Infrastructure Investment Bank (hereinafter referred as AIIB). Any third party should obtain prior consent of Power Grid Company of Bangladesh Ltd. (hereinafter referred as PGCB) and IIFC before copying or reproducing, in whole or in part, the contents of this report. IIFC disclaims any responsibility for any loss or damage suffered by any third party by taking reliance of this report. Furthermore, IIFC will not be bound to discuss, explain or reply to queries raised by any agency other than the intended recipients of this report. All information in the report is intellectual property of the PGCB.

ABBREVIATIONS

AIIB	:	Asian Infrastructure Investment Bank
AIS	:	Air Insulated Switchgear
AEZ	:	Agro- Ecological Zone
BRAC	:	Bangladesh Rural Advancement Committee
BUET	:	Bangladesh University of Engineering and Technology
BIWTA	:	Bangladesh Inland Water Transport Authority
BFRI	:	Bangladesh Forest Research Institute
BWDB	:	Bangladesh Water Development Board
BMD	:	Bangladesh Meteorological Department
BNH	:	Bangladesh National Herbarium
BEZ	:	Bio-Ecological Zone
BPS	:	Bangladesh Power System
BBS	:	Bangladesh Bureau of Statistics
BPDB	:	Bangladesh Power Development Board
BPA	:	Bonneville Power Administration
CI	:	Cropping Intensity
CP	:	Contracting Party
CSA	:	Canadian Standard Association
CMP	:	Current Market Price
CIGRE	:	Council on Large High Voltage Electric Systems
DoE	:	Department of Environment
DAE	:	Department of Agriculture Extension
DIA	:	Direct Impact Area
ESU	:	Environment and Social Unit
ESMC	:	Environmental and Social Consultant
ESIA	:	Social Impact Assessment
ECC	:	Environmental Clearance Certificate
ECA	:	Environment Conservation Act
ECR	:	Environment Conservation Rules
ESMP	:	Environmental and Social Management Plan
EMMP	:	Management and Monitoring Plan
EHS	:	Environmental, Health and Safety
ESP	:	Environmental and Social Policy
ESSs	:	Environmental and Social Standards
ESMS	:	Environmental and Social Management System
ECPs	:	Environmental Code of Practice
ECA	:	Ecological Critical Area
EZs	:	Economic Zones
FD	:	Forest Department
FGD	:	Focus Group Discussions
GoB	:	Government of Bangladesh
GRM	:	Grievance Redress Mechanism
GRC	:	Grievances Redress Committees
GBV	:	Gender Based Violence
GHG	:	Greenhouse Gas
GIA	:	General Impact Area
GIS	:	Gas-Insulated Substation
GTCL	:	Gas Transmission Company Ltd.

HVDC	:	High Voltage Direct Current
HIES	:	Households Income and Expenditure Survey
IEE	:	Initial Environmental Examination
IIFC	:	Investment Facilitation Company
IUCN	:	International Union for Conservation of Nature
IESC	:	Important Environmental and Social Components
ILO	:	International Labor Organization
IBA	:	Important Bird Area
IP	:	Indigenous People
ICNIRP	:	Non-Ionizing Radiation Protection
LDCs	:	Less Developed Countries
LTWs	:	Line Transect Walks
LMP	:	Construction Labor Management Plan
KIIs	:	Key Informant Interviews
KEPZ	:	Korean EPZ
PCMs	:	Public Consultation Meetings
MT	:	Metric Ton
MEAs	:	Multilateral Environmental Agreements
MoFL	:	Ministry of Fisheries and Livestock
MoEFCC	:	Ministry of Environment, Forests and Climate Change
NWRD	:	National Water Resources Database
NCA	:	Net Cultivable Area
NEP	:	The National Energy Policy
OHS	:	Occupational Health and Safety
HS	:	Health and Safety
OP	:	Operational Policies
PGCB	:	Power Grid Company of Bangladesh Limited
PIU	:	Project Implementation Unit
PD	:	Project Director
PAPs	:	Project Affected Persons
PPE	:	Personal Protective Equipment
PCP	:	Public Communications Policy
R&R	:	Resettlement and Rehabilitation
RP	:	Resettlement Plan
RoW	:	Right of Way
RHD	:	Roads and Highway Department
SE	:	Sexual Exploitation
SOPs	:	Standard Operating Procedures
SPS	:	Social Protection Strategy
SOPs	:	Standard Operating Procedures
SPM	:	Suspended Particulate Matter
SEP	:	Stakeholder Engagement Plan
SRDI	:	Soil Resource and Development Institute
T&D	:	Transmission and Distribution
WB	:	World Bank
WHO	:	World Health Organization
WARPO	:	Water Resource Planning Organization

CURRENCY EQUIVALENTS

Currency unit	–	Bangladesh Taka (BDT)
BDT 1.00	=	$ 0.012
1 US Dollar (USD)*	=	BDT. 84.80

WEIGHTS AND MEASURES

cm	–	centimetre
ha	–	hectare
1 ha	–	2.47 acre/10,000 sqm
1 acre	–	100 decimals
km	–	kilometre (1,000 meters)
kV	–	kilovolt (1,000 volts)
kW	–	kilowatt (1,000 watts)
m	–	meter
mm	–	millimetre
MVA	–	mega-volt ampere
MW	–	megawatt

NOTE

In this report, "$" refers to US dollar

*1 US Dollar (USD) = 84.65 BDT as the exchange rate of Bangladesh Bank on 27 April 2021

GLOSSARY

Adverse Impact	An impact that is considered undesirable
Ambient Air	Surrounding air
Aquatic	Growing or living in or near water
Accident	It is an unplanned event, which has a probability of causing personal injury or property damage or both
Bangla	Bengali language
Baseline (or existing) Conditions	The 'baseline' essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the Project, i.e. the 'No-development Option'.
Bazar	Market
Beel	A 'back swamp' or depression can be either perennial or seasonal
Beneficial Impacts	Impacts, which are considered to be desirable and useful.
Biological Diversity	The variety of life forms, the different plants, animals and microorganisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity
Char	Newly accreted land: Land, sometimes islands, within main river channels and nearby mainland or in the estuary, subject to erosion and accretion
Disaster	It is defined as a catastrophic situation that causes damage, economic disruptions, loss of human life, deterioration of health and health service on a scale sufficient to warrant an extraordinary response from outside the affected area or community. Disasters occasioned by man are factory fire explosions and release of toxic gases or chemical substances, etc.
Environmental Assessment	The systematic, reproducible, and interdisciplinary identification, prediction and evaluation, mitigation, and management of impacts from a proposed development and its reasonable alternatives.
Ecosystem	A dynamic complex of plant, animal, fungal and microorganism communities and associated non-living environment interacting as an ecological unit
Emission	The total amount of solid, liquid, or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source
Endangered Species	Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction

Environmental Effects	The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity
Environmental Impact	An estimate or judgment of the significance and value of environmental effects for natural, socio-economic, and human receptors
Environment Management Plan	A plan to undertake an array of follow-up activities which provide for the sound environmental management of a Project/ intervention so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized; and sustainable development is ensured
Environmental Management	Managing the productive use of natural resources without reducing their productivity and quality
Emergency	It is defined as a situation where the resources out pass the demand. This highlights the typical nature of emergency. Situations of this kind are avoidable, but it is not possible to avoid them always.
Emergency preparedness	It is one of the key activities in the overall management. Preparedness, though largely dependent upon the response capability of the persons engaged in direct action, will require support from others in the organization before, during and after an emergency.
Erosion	Process in which wind and water removes materials from their original place; for instance, soil washed away from an agricultural field
Evaluation	The process of looking back at what has been really done or accomplished
Fauna	A collective term denoting the animals occurring in a particular region or period
Field Reconnaissance	A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal
Flora	All of the plants found in a given area
Habitat	The natural home or environment for a plant or animal
Hazard	It is defined as a physical situation, which may cause human injury, damage to property or the environment or some combination of these criteria.
Household	A household is identified as a dwelling unit where one or more persons live and eat together with common cooking arrangement. Persons living in the same dwelling unit having separate cooking arrangements constitute separate households
Important Environmental Component	These are environmental components of biophysical or socioeconomic importance to one or more interested parties. The use of important environmental components helps to focus the environmental assessment
Khal	Small channel, canal
Land use	Types include agriculture, horticulture, settlement, pisciculture and industries

Mauza	A Bangla word for the smallest government administrative area corresponding to village revenue unit
Mitigation	An action, which may prevent or minimize adverse impacts and enhance beneficial impacts
Negative Impact	Negative change from the existing situation due to the Project
Public Consultation	A range of techniques that can be used to inform, consult, or interact with stakeholders affected / to be affected by a proposal
Reversible Impact	An environmental impact that recovers either through natural process or with human assistance (e.g., cutting off fish migration by an embankment might be reversible at a later stage if a proper regulator is built)
Risk	It is defined as a likelihood of an undesired event (accident, injury, or death) occurring within a specified period or under specified circumstances. This may be either a frequency or a probability depending on the circumstances.
Stakeholders	Those who may be potentially affected by a proposal, e.g., local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the Project or to take an interest in it
Taka	Unit of Bangladeshi currency
Terrestrial	Living on land
Thana	Sub-district level of government administration, comprising several unions under district
Union	Smallest unit of local self-government comprising several villages
Upazila	Sub-district name. Upazila introduced in 1982
Zila	Bengali word for district

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Executive Summary

Introduction

The present Environmental and Social Impact Assessment (ESIA) has been carried out for the proposed "Southern Chattogram and Kaliakoir Transmission Infrastructure Development Project". The Government of Bangladesh (GoB) through the Power Grid Company of Bangladesh (PGCB) intends to undertake this project and seeks financial assistance from the Asian Infrastructure Investment Bank (AIIB) for this purpose.

This ESIA is being prepared based on the feasibility design of the Transmission lines (TLs), LILO and proposed four sub-stations. This ESIA serves to guide development, implementation, and operation of the project in compliance with the requirements of the AIIB's Environmental and Social Framework (ESF) and applicable GoB laws and regulations. This ESIA also address the hitherto unknown impacts due to the project that might result due to some changes in technical design at detailed design stages. The ESIA presents social and environmental safeguards screening procedures, specific arrangements for management of environmental and social impacts, (both negative and positive,) including monitoring and reporting for the project.

This ESIA report has been updated according to the Chunati bypass proposal. Previously the proposed route of transmission line was passing through the Chunati Wildlife Sanctuary. Hence the Anwara-Cox's Bazar (N) 230kV double circuit line was rerouted, and the length of the line changed from 109 km to 105 km. Because of the rerouting, the line will pass through Government owned/ fallow land and therefore number of sharecroppers or affected people remain almost unchanged, but if any issue arises during the implementation period, the issues will be resolved by the PD Office/ Consultant/ Contractor accordingly based on the Check survey reports as per the GoB and AIIB guidelines and the ESIA report will be duly updated. On the other hand, the site location for Cox's Bazar Substation was relocated to another place with same physiography due to the objection from the local DC office.

The proposed Anwara-Cox's Bazar230 kV Transmission Line will not pass through any sanctuaries, reserve forests or national parks. The transmission line will mostly traverse agricultural land. No critical/threatened species have been recorded during this assessment and there have been no concerns raised regarding the presence of critical habitat.

Background

Energy plays a very vital role not only in the survival of human being but also for the development of a nation. People of the adjacent as well as contiguous areas will be able to get electricity facility. National economy and growth are greatly dependent on the availability of reliable electric power supply. Uninterrupted power supply would improve the productivity, which would affect the national growth and development.

The Chattogram region is a major commercial and industrial hub with the Government taking initiatives to set up multiple economic zones (EZs) and upgrade port facility and transportation network. An aged and low-capacity grid network in this region (especially Anwara, Cox's Bazar and Teknaf) is one of the major problems that PGCB is facing and a key priority. Due to lack of electricity supply, economic growth of this area is stagnant. Operational bottlenecks of the region were identified during a network analysis performed by PGCB. This project will also assist PGCB to introduce reactive, predictive, and proactive O&M approaches. The proposed project will help to meet up the rapidly growing demands of residential, commercial along with the BHTC area at Kaliakair, Gazipur.

Project Overview

Proposed 230/132/33 kV GIS substation (future 400kV) at Anwara which will make regular grid connectivity with 230kV transmission system. Proposed 132/33kV indoor GIS substation at outer side of Cox's Bazar will receive power from Anwara substation. Existing 132 kV transmission line of Dohazari to Cox's Bazar will connect with proposed Cox's Bazar SS through 132kV four circuit lines as LILO. The proposed 132/33kV indoor GIS substation will receive power from Proposed Cox's Bazar (N) SS. Besides, proposed 230/33kV GIS substation will be constructed at BHTC located at Kaliakair, Gazipur, and power will receive from existing Kaliakair 400/230/132kV substation. Total 184.07 km overhead transmission lines and four new sub-stations will be constructed under this project. There is no underground transmission lines construction under this project. Upon completion, the transmission lines and associated substations will collectively provide 1370 MVA transmission capacity at different voltage levels.

The key construction activities will include excavation for transmission line tower and substation building foundations, construction of substation buildings and installation of equipment, erection of lattice steel towers, stringing of conductors on these towers, etc. The contractor will establish temporary facilities including construction camp, machinery yard, site office, and material storage area. These facilities are likely to be established inside the substation premises.

The associated facilities for the proposed project include the proposed substation of BHTC would receive power from existing Kaliakair 400kV/230kV substation. The existing Kaliakair sub-station is 4.8 KM away from the proposed BHTC SS where PGCB has conducted safeguard due diligence. The associated facilities identified are under the control and management of PGCB, hence compliance with AIIB ESF will be facilitated. Existing SS is owned by PGCB and all legal permission from DoE is taken through safeguard due diligence. A 230kV bay extension would be established in the existing Kaliakair SS by PGCB. During the construction of Bay-extension, further audit will be conducted by the PGCB to ensure safeguard compliance with AIIB. All necessary mitigation measures will be taken before construction of Bay-extension following the ESP of AIIB if any negative risk and impacts are identified.

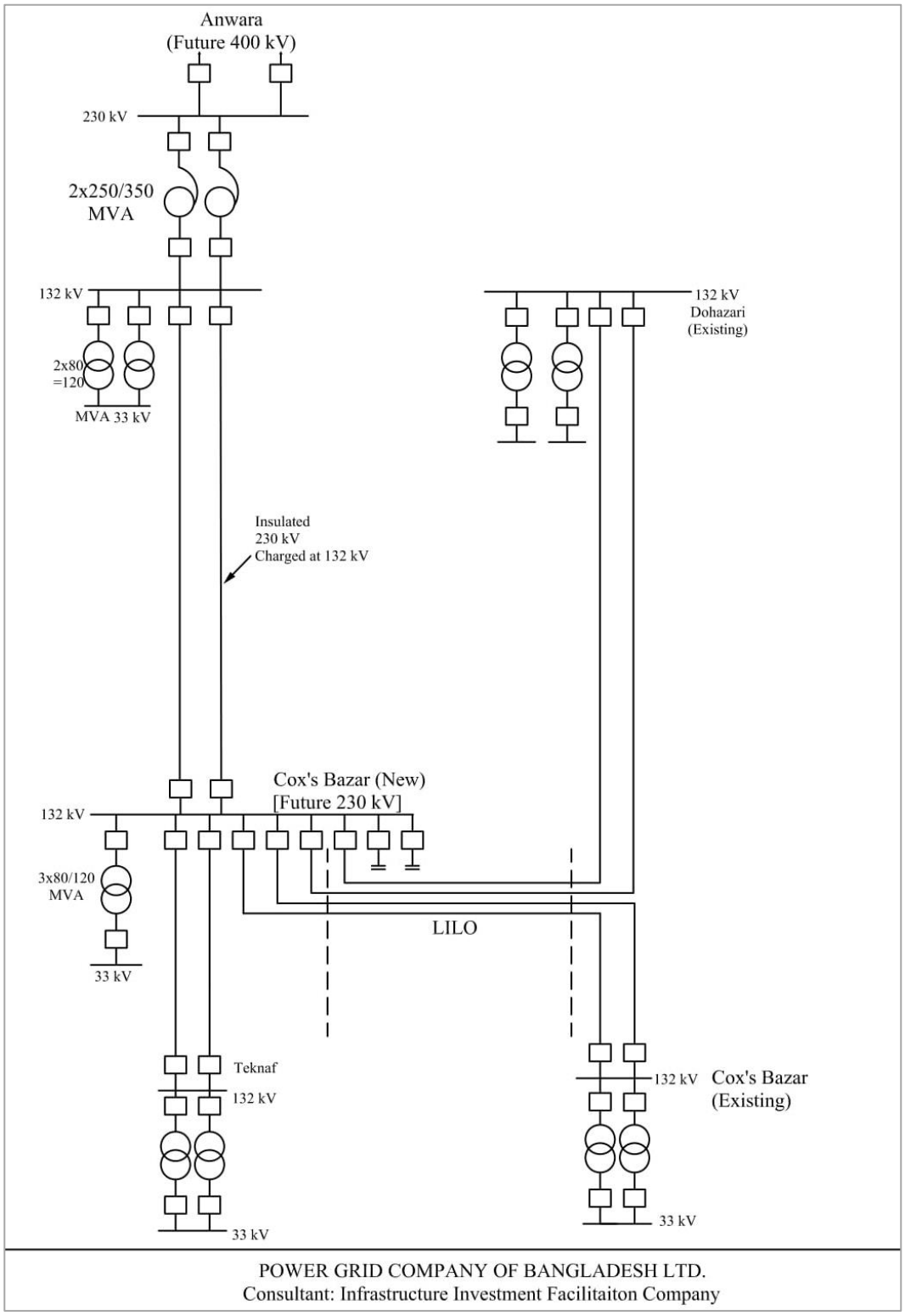


Figure-1: Single Line Diagram of the project components under Chattogram Region

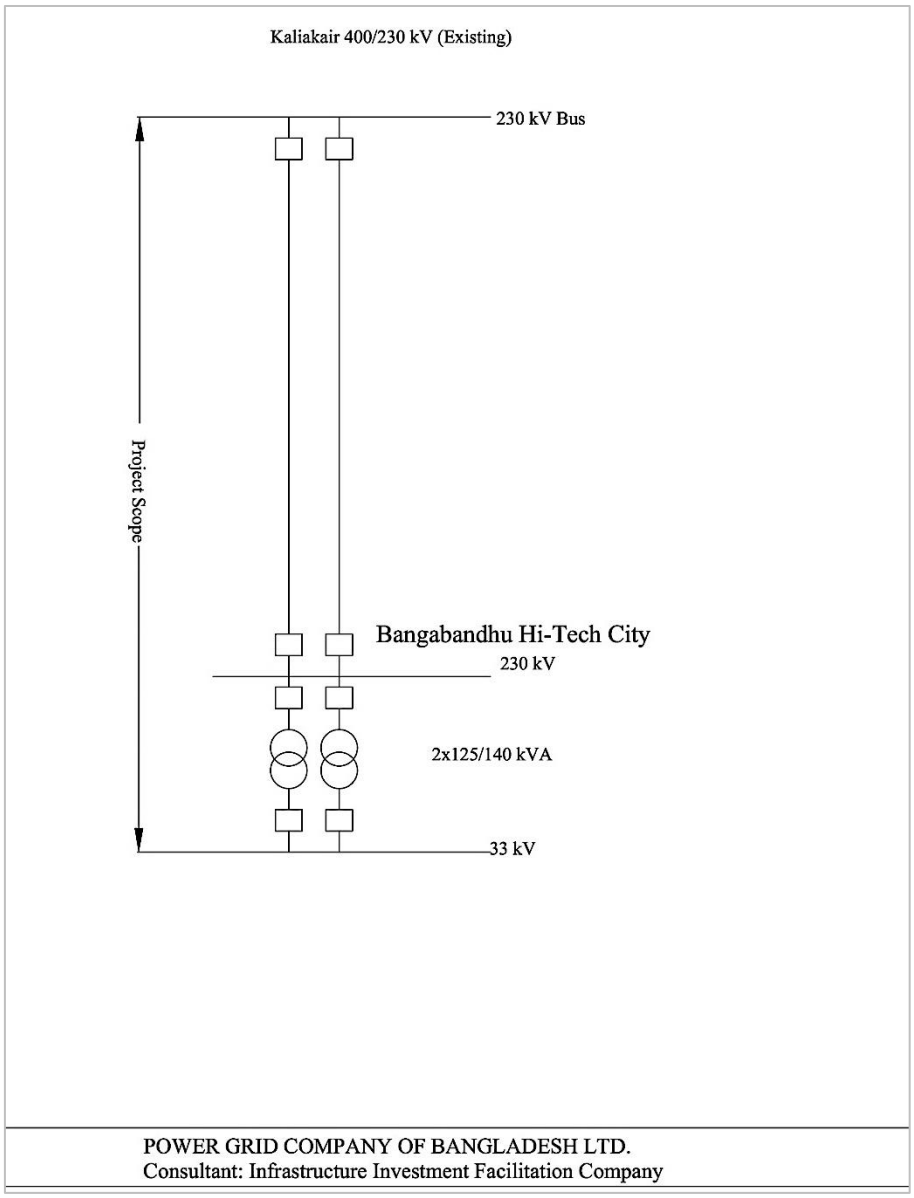


Figure-2: Single Line Diagram of the project component under Gazipur of Dhaka Region

A 400 kV double circuits TL from Anwara to Anandabazar (New Mooring) total 25.600 km (combining both overhead transmission line 19.347 km and Underground transmission line 5.253km) will be constructed under another project "Power System Upgrade and Expansion (Chattogram Area)", which is also financed by AIIB. PGCB has prepared ESIA followed by baseline study including census and IOL survey. PGCB has also conducted consultation meetings with different stakeholders. As both projects will be financed by AIIB and same ESP is being followed during preparation of ESIA and other safeguard due diligence, it may not be considered as an associated facility.

Table-1: Components of the Project

Name of Substations	Land Size (acre)	SS Type	Required Bays	Associated Transmission Lines	Length (Km)
230/132/33kV SS: Anwara 2x250/350 MVA (230/132kV) 2x80/120 MVA (132/33kV) (Future 400 kV Provision)	20	GIS	230kV: LB=8; TB=2; BCB=1 132kV: LB=2; TB=4 33kV: TB=2	Anwara-Cox's Bazar (N) 230kV double circuit line (Initially Charged at 132kV)	105
132/33kV GIS Substation: Cox's Bazar 3x80/120 MVA (Future 230 kV Provision)	10	GIS	132kV: LB=8; CBB=2; TB=3; Spare=1; BCB=1	Anwara-Cox's Bazar (N) 230kV double circuit line (Initially Charged at 132kV)	
			33kV: TB=3	LILO of Dohazari-Cox's Bazar 132kV four circuit transmission line	1.09
132/33kV GIS Substation: Teknaf 2x80/120 MVA	5	GIS	132kV: LB=2; TB=2; BCB=1 33kV: TB=2	Cox's Bazar to Teknaf 132 kV double circuit transmission line	73.10
230/33kV GIS Substation: BHTC 2x125/140 MVA	5	GIS	230kV: LB=2; TB=2; BCB=1 33kV: TB=2	Existing Kaliakair SS to BHTC 230kV double circuit transmission line (230kV Bay Extension at Kaliakair: 2 Nos.)	4.88
4 Nos.	40			Total (Transmission Line)	184.07

The key operation and maintenance (O&M) activities of the proposed substations and transmission lines would include routine inspection of transmission lines, repairing or replacing any faulty equipment at the substations, repairing or replacing any damaged transmission line tower, repairing or replacing any damaged conductor, and attending to system faults.

Study Objectives

According to the Environment Conservation Act (ECA), 1995 and Environment Conservation Rules (ECR), 1997, (amended 2002), all transmission lines and sub-stations falls under the Orange-B category as classified under Schedule-I of the ECR (SRO 349-Act/2017 of 4 (C), which requires Initial Environmental Examination (IEE) to get 'Environmental Clearance' from the Department of Environment (DoE). Meanwhile, PGCB applied for Environmental Clearance from DoE by submitting IEE report and got approval on 31 March 2021 in its Board Meeting.

Since the sensitivity of the ecological impacts and social matters due to project locations, this project will be categorized as 'A' by AIIB. However, this ESIA of the proposed transmission lines and substations Project presented in this report has been carried out considering the guidelines of the Department of Environment (DoE) under Ministry of Environment, Forests and Climate Change (MoEFCC), and requirements of AIIB's Environmental and Social Framework (ESF).

Analysis of Alternatives

As part of the present ESIA, technical, financial, environmental, and social aspects were analyzed for the several project alternatives including 'no-project' alternative, substation technology, substation siting, transmission line types, and transmission line routes.

The 'no-project' alternative was rejected because without the project, the electricity network in the Chattogram region and BHTC would not be able to support the rapidly growing commercial and industrial activities as well as residential areas, nor would any growth in the region's commercial and industrial activities be possible; and as a result, the Country will also not be able to sustain economic growth.

Two broad options for substation technologies were considered: conventional, air insulated switchgears (AIS); and technologically more advanced gas insulated switchgears (GIS). The AIS substations are generally lower in cost; however, it needs much larger area, in addition to posing greater electrocution risks to the maintenance workers as well as general public. The GIS system, on the other hand, can be established in much smaller area and being totally enclosed, poses far lesser electrocution risks to maintenance worker and general public. Also, the GIS systems offer a greater system reliability. In view of the smaller land requirements, greater safety against electrocution, and better system reliability, the GIS technology has been selected for the proposed project.

Since the site for substations namely Anwara 230/132/33kV SS, Cox's Bazar 132/33kV SS, Teknaf 132/33kV SS and BHTC 230/33kV SS have already been selected by PGCB under an earlier project, hence no siting options were considered under the proposed project, and therefore, no options have been described in the present ESIA study.

Two broad alternatives were considered for the types of transmission lines: overhead and underground. The overhead transmission lines are generally used in rural/unpopulated areas, require substantial construction works for the transmission line towers, restrict the land use, and reduce the land value, and pose safety risks for the people, livestock, and wildlife. The underground transmission lines are generally used in congested urban areas where installation of overhead transmission line is quite difficult, are higher in initial cost, generally use existing right of way (RoW), and pose a smaller safety risk. For the proposed project, only overhead transmission line has been selected as there is no urban setting congested area in the project.

Finally, three alternatives (Option-1: Finalized by PGCB during Feasibility Study; Option-2: Finalized and approved by PGCB during Check Survey carried out by IIFC; Option-3: Finalized and approved by PGCB during Check Survey carried out by National Survey Organisation) transmission line routes are considered each of the proposed new transmission lines. For these alternate routes, technical, financial, economic, environmental, and social aspects were considered through consultation with PGCB, local stakeholders, analyzing of maps and underground utilities, satellite images, traffic condition. Alternatives for underground transmission line (UGTL) and overhead transmission line (OHTL) has also been analyzed while bypassing the Chunati Wildlife Sanctuary (CWS) and Himchari National Park (HNP).

Construction of transmission lines along the coastal area technically challenging and also required extra protection considering natural calamity (cyclone prone), bank erosion & salinity. In this regard it is not economically and technically viable for PGCB to construct transmission line through the coastal area. Both side of the Chattogram to Cox's Bazar Highway comprises of densely native tree species specially Boilam *(Anisoptera Scaphula)*, Sal *(Shorearobusta)*, Garjan *(Dipterocarpus turbinatus)*, Telsur *(Dipterocarpus turbinatus)*, Chikrasi *(Chukrasia tabularis),* etc. which may require to be felled if UGTL is installed. However, transmission line outside of the forest shall increase the number of households within the width of RoW.

Baseline Conditions of the Project Area

The proposed project will be located in a combination of cultivated land, rural and semi-urban areas and hills, forests, salt pans in Chattogram, Cox's Bazar, Teknaf and Kaliakair. The key aspects of the project area are summarized below.

Administratively, the project is located in Anwara Upazila of Chattogram district, Cox's Bazar Sadar and Teknaf Upazila of Cox's Bazar district and Kaliakair Upazila of Gazipur district. Out of four substations, BHTC 230/33kV GIS SS will be constructed at the own land of Bangladesh Hi-Tech Park Authority (BHTPA). And another three substations will be constructed at Anwara, Cox's Bazar Sadar and Teknaf upazilas of Chattogram division. For the construction of substation at BHTC area, PGCB will get the land according to the project policy lead by the Govt. Policy. In this regard, a Resettlement Plan (RP) has been prepared for Anwara 230/132/33kV, Cox's Bazar and Teknaf 132/33kV GIS substations, which requires acquisition of total 35 acres of land and including its associated transmission lines. Remaining 5 acres of land for BHTC substation is owned by Bangladesh Hi-Tech Park Authority (BHTPA), where APs received the compensation.

The census and associated land data collected from the local land office found that a total of 233 households of private landowners will be affected by the construction of sub-stations of this project. However, among the 233 households, 101 households are untraceable. Among them, few have passed away and remaining households do not reside in the project influenced areas. Moreover, due to COVID-19 restrictions, team were also unable to identify them in different locations of Bangladesh. No project activities will be started without identifying, taking consent from them and paying full compensation for the affected households. RP has detailed the procedures.

Besides, 17 sharecroppers and 69 wage earners will also lose their income due to the project intervention. A total of 11 trees in sub-stations area, on private land will require felling due to construction of sub-stations.

As per transmission route plan, a total of 763 towers will have to be constructed for the project of which 223 are angel towers and 540 are suspension towers. Out of 763 towers, 420 will be constructed in agricultural land. Due to construction of towers, a total of 18.07 acre of agricultural land will be affected. As per the Electricity rules of Bangladesh (2020), if land is affected due to construction of towers, compensation will be as per market value for the land. A total of 31.09 acres of land will be required for the construction of towers. In addition, 15 households were found under the RoW of transmission lines. A total of 23,636 trees will require felling due to construction of transmission lines.

As per Census of the identified households, only 3 male headed households and 1 female headed household is listed under vulnerable groups and all of them are in substations area. Those listed as vulnerable groups will receive benefit from Project implementation. Moreover, 14 elderly persons (over 70 years) were identified during census. The entitlement matrix has provision for one-time grants who are vulnerable considering both income and age in addition to eligible compensation.

Census and IOL survey confirmed that no indigenous people (IP) will be directly or indirectly affected. During consultation meetings, no IP were also identified.

Most of the project area falls under the Chattogram Coastal Plains and Northern and Eastern Hills agroecological zones with medium to high topography. The proposed transmission lines will pass five rivers like- Sangu, Matamuhuri, Bakkhali River at Chattogram Region, and Turag and Bongshai Rivers at Kaliakair. There is no significant erosion history found on the riverbank where transmission line will be supposed to cross. There is no fish sanctuary at or near the project Right-of-Way (RoW).

The land use of substations is mostly agriculture. The Right-of-Way (RoW) of proposed overhead transmission line will pass mostly over the agriculture land (overall 62.22% of total area). Salt pan (26.21% of total area) and rural settlement (0.51% of total area) covers next in the RoW land use. Total agricultural land is 484 ha of which most of the areas are Single Cropped Area (SCA) followed by Double Cropped Area (DCA) and some Triple Cropped Areas (TCA). T. aman, Boro and summer vegetables are the main crops cultivated by local farmers in the proposed intervention area. The cropping intensity of the study area is about 174%.

Bio-ecologically, the major portion of the transmission line fall over the zone namely Chattogram Hills and the CHTs (95%) and lest of the part falls within the Coastal Plains and Ganges Floodplain (5%). Proposed Anwara to Cox's Bazar 230kV and Cox's Bazar to Teknaf 132kV bypasses near the forest ranges of Cox's Bazar South and North Forest Division of Forest Department. None of the transmission lines cross over the designated corridor areas. However, there are no important bird area (IBA) and ecologically critically areas (ECA) at or near the project RoW.

Proposed Cox's Bazar to Teknaf 132kV transmission line under the project will pass the periphery of Kutupalong Refugee Camps of Ukhia. Regarding lowest distance, boundary of Camp 01E is about 225-meter, Camp 07 about 330-meter, Camp 08E about 227-meter away from proposed transmission line. Cox's Bazar to Teknaf Highway is located between the Camps and proposed transmission line. It was found that about 6.10km of transmission line (AP 47 to AP 59) will pass with the periphery of Kutupalong Rohingya Camps. So, construction of transmission line may impact on Rohingya Camps. The impact will be temporary and limited in nature.

Potential Impacts

The potential impacts of the project's construction phase on physical and biological environment could include soil erosion particularly close to rivers and khals; dust emissions caused by operation of machinery and running vehicles on earthen tracks within the RoW and along the access routes; gaseous emissions from construction vehicles, machinery, and generators; release of waste effluents

and solid wastes from construction areas and camps causing soil and water contamination; loss of natural vegetation and trees in the RoW; natural habitat destruction and fragmentation caused by vegetation clearance and felling of trees; disturbance to wildlife species; hunting, trapping, and or catching of wild species by the project personnel at the site; and finally, occupational health and safety (OHS) hazards for the construction staff and other project site personnel. A total of 23,667 trees would need to be felled for clearing the RoW of transmission lines. The key potential impacts of the transmission lines and substations during the operation and maintenance stage include occupational health and safety risks for the maintenance workers, electrocution and collision of birds, electromagnetic radiation, radio interference, and solid waste generation.

Substations are expected to include equipment that is insulated with Sulphur hexafluoride (SF6), a powerful greenhouse gas. The possibility of leakage during installation of equipment and transport and installation of SF6 gas will be monitored by careful compliance with best international practice and compliance with international guideline. Further to detail, SF6 is used as an insulator and electric arc arrestor in electrical equipment such as lightning arrester, high voltage circuit breakers, transformers, and switches/switchgears. Aside from being a potent greenhouse gas (i.e., global warming potential is 23,900 times compared to CO2), SF6 is an inorganic, non-toxic gas that may be an occupational safety concern due to possible asphyxiation (i.e., death due to lack of oxygen) if it is not used in a well-ventilated area. There is potential for SF6 to leak during the operation phase and its decomposition byproducts may pose a risk to occupational exposure of workers. Given its global warming potential, release, or leakage of SF6 into the atmosphere should be minimized and monitored. Sources of gas leak may potentially come from losses due to poor gas handling practices and equipment installation and maintenance, and leakage from SF6-handling equipment. During Project administration, leak sources will be identified in a timely manner using handheld leak detector and monitoring of SF6 level will be monitored regularly (subject to requirement).

The most significant social impacts of the project pertain to the resettlement issues including land acquisition, devaluation land, damage to crops, trees, and structures that exist in the RoW. Other potential impacts of the project's construction phase on the local communities include temporary blockage of local routes, loss of livelihood, project-related traffic on local roads, noise generation causing nuisance and disturbance to local population, safety hazards caused by construction activities and project-related vehicular traffic, social conflict or cultural issues caused by labor influx – some of them may be from other parts of the country, additional pressure on local resources such as water and fuel, damage to sites of cultural and or religious significance such as graveyards and shrines, and disturbance to women activities. The potential impacts of the project's operation and maintenance activities on the local communities could include risk of electrocution and occasional crop damage.

Community health and safety impacts during the construction and decommissioning of transmission and distribution power lines are common to those of most large industrial facilities. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable diseases associated with the influx of temporary construction labor.

Mitigation

To address the potentially negative environmental impacts of the project, appropriate mitigation measures have been included in this ESIA. These include water sprinkling to suppress dust emissions particularly near the settlements, using properly tuned vehicles and machinery to minimize exhaust emissions; ensuring that no untreated waste effluents are released to the environment and using appropriate treatment mechanism for this purpose; preparing and implementing waste management and pollution control plans; enforcing 'no hunting, no trapping, no catching' policy for the wildlife; and preparing and implementing an Occupational Health and Safety (OHS) plan. To address the risk of bird collision and electrocution, PGCB will consider attaching visible spheres to the upper wire of the overhead transmission line section that crosses the rivers, contingent to technical viability. In the vicinity of river crossings, the sags to be considered to ensure sufficient vertical clearance. Furthermore, the spacing between transmission line conductors will be kept in a manner to avoid electrocution of birds found in the area (including migratory birds) owing to the size of their wingspan. The contractor will install diverters during laying the transmission lines. A compensatory replantation ratio of 1:5 will be carried out to mitigate the ecological loss of felling trees.

As part of the mitigation measures, PGCB has prepared Resettlement Plan (RP), Labor Management Procedures (LMP), Stakeholders Engagement Plan (SEP), GBV prevention plan along with this ESIA. And that, during preparation of these plans, PGCB has conducted several consultation meetings with relevant primary and secondary stakeholders. These documents will be updated (if required) during the detailed design stage.

Rohingya Camps

Kutupalong Rohingya Camps is separated from host communities through barbed boundary wall. Their movement is very limited and strict by the administration. The contractor and INGO will follow the labor management plan (LMP), GBV Plan and stakeholder engagement plan (SEP) during the implementation of the project. Moreover, PGCB, contractor and INGO shall make a meeting with Camps administration before doing the construction work in the periphery of Kutupalong and even Balukhali Camps, as part of stakeholder engagement plan. Contractor and INGO shall deliver the activities of the project, including work plan and schedule (for completing 6.10-km) to the administration. Fire management at this site would be performed as per fire management plan of the project. Contractor should inform the local fire station prior to start the construction work. Finally, PGCB can carry out a recheck and/or update the route survey adjacent to Camps based on the existence of Rohingya in that area before implementation of the project. Project will ensure that activities do not directly or indirectly affect any Rohingya communities during implementation. Before construction starts, relevant camp authority will be informed.

Community Health and Safety

The contractor will (a) follow the Environmental Health and Safety Guidelines of Electric Power Transmission and Distribution of IFC as mentioned in Section 2.5.3 and shown in Table 13; (b) follow the COVID 19 guidelines of WHO during the construction of the project; (c) construction camps will be located at least 500 m away from the communities, and cannot be established within the reserve forest (d) entry of the site personnel in the local communities will be minimized to the extent

possible/appropriate; (e) prepare and implement an Occupational Health and Safety (OHS) Plan that will also cover communities' health and safety aspects; (f) prepare and implement a Traffic Management Plan that will also address traffic safety for communities; (g) inform about the nature of construction activities and the associated health and safety risks; awareness raising of the communities will be carried out for this purpose with the help of training sessions, posters, signage, and other similar means; (h) perform awareness raising of communities will be carried out, in a culturally-sensitive manner, about the communicable diseases including sexually transmitted infections; (i) fence as appropriate to minimize entry of the local communities particularly children in the work areas; (j) establish GRM to address community grievances related to health and safety aspects.

Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP) has been prepared as part of the present ESIA in order to define the implementation mechanism for the above-described mitigation measures. The ESMP includes description of institutional arrangements, a mitigation plan, a monitoring plan, a training and capacity building plan, documentation protocols, and a grievance redress mechanism (GRM).

The overall responsibility of environmental and social performance of the project and effective ESMP implementation will rest with PGCB. PGCB will establish the Project Implementation Unit (PIU) to lead the Project implementation. The PIU will be headed by the Project Director (PD). An Environment and Social Unit (ESU), comprising qualified environmental and social development staff, will be established under the PIU. The PIU will engage environment social and construction monitoring consultants (ESCMC) to supervise the construction contractors in order to ensure design compliance and quality assurance of the construction activities. The ESCMC will also supervise the contractors for ESMP implementation. For this purpose, ESCMC will engage environmental and social development specialists.

The environmental and social management of the project will be achieved through implementation of a number of plans: a) Environmental Codes of Practices (ECPs); b) mitigation plan; and c) Construction Environmental and Social Management Plan (CESMP). The ECPs provide generic guidelines and control measures to address negative impacts encountered during construction phase. The mitigation plan, prepared on the basis of impact assessment carried out during the present ESIA, provides project-specific mitigation measures and assigns implementation and supervision responsibilities for these measures. The CESMP will be prepared by the construction contractor based upon the ESMP included in the present ESIA and will comprise a number of sub-plans including pollution prevention plan, waste management plan, traffic management plan, camp management plan, OHS plan, and others.

As one of the key elements of the ESMP, a two-tier monitoring program has been proposed comprising compliance monitoring and effects monitoring. The main purpose of this monitoring program is to ensure that the various tasks detailed in the ESMP particularly the mitigation measures are implemented in an effective manner, and to evaluate project's impacts on the key environment and social parameters.

Capacity building for effective implementation of the environmental and social requirements is a key element of the ESMP. This capacity building will need to be carried out at all tiers of the project, including PGCB, PIU, ESCMC, and contractors. At the construction site, ESCMC will take the lead in implementing the capacity building plan, though the contractors will also be responsible to conduct training for their own staff and workers.

PGCB will ensure the proposed ESMP and associated ECPs as part of the tender documents, and in the contract agreements of the selected bidders. PGCB shall also supervise and monitor the ESMPs during construction phase through INGO, ESCMC and external monitoring consultants.

For implementing the present ESMP, about 1398.82 million BDT will be required. The major components of this cost include about 1350.10 million for RP Budget (acquisition, compensation, allowance, etc.), Engagement of INGO/ESCMC 32.00 million BDT, and 12.72 million BDT for mitigations and trainings and other costs.

Grievance Redress Mechanism

PGCB will establish a grievance redress mechanism (GRM) to ensure social accountability and to answer queries and address complaints and grievances about any irregularities during the project implementation for ensuing environmental responsibilities and workers right. The GRM will help resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will, however, not pre-empt or deny a person's right to go to the courts of law.

Under the GRM, grievance redress committees (GRCs) will be established locally at Project sites and centrally at the Project level to receive as well as settle grievances from the affected persons and other local stakeholders. GRM will also handle any issues raise in the case of gender-based violence (GBV). The two-tier GRM will be composed of local GRCs (LGRC) at the union/municipal level as the first tier, and Project GRC (PGRC)at the central level as the second tier. Most of the grievances will be resolved at the local-level GRC, but those cases that cannot be resolved at the local level will be forwarded to PGRC. The LGRC will be constituted with representation of the local Union Parishad Chairman and affected people ensuring women's representation. The PGRC will be constituted with representation from the PIU, Implementing NGO/Agency (INGO/IA) and one independent person from the civil society having knowledge about land acquisition/ requisition law of Bangladesh and involuntary resettlement. Details of the GRM are provided in the SEP.

Stakeholder Consultations

An extensive consultation process was undertaken during the present ESIA, in accordance with the national regulatory and AIIB policy requirements. The key objectives of these consultations included informing the stakeholders particularly the local communities about the proposed interventions and soliciting their views, concerns, and recommendation concerning project and its impacts.

A participatory approach was adopted to conduct consultations particularly with the communities. A checklist was used to maintain uniformity and relevancy in discussion and in properly recording

the opinions and views of the participants. During the consultations, the socio-economic, Rohingya Community, labor and gender issues, agricultural, hydrological, fisheries, and ecological issues (reserve forest, elephant movement) were discussed in detail, including potential impacts of the interventions on the environmental and social parameters. Institutional issues were also discussed regarding which the participants provided their opinions and suggestions freely. During the present ESIA study, six consultations and six focus group discussions were held with the stakeholders. A total of 171 persons participated in these sessions, of which 164 was male and remaining 7 was female.

The key concerns shared by the stakeholders during these consultations included payment of compensation for all losses caused by the project, managing traffic congestion caused by the construction activities, maintaining liaison and coordination with other departments and entities, minimizing blockage of access particularly for essential facilities such as hospitals, removal of excavated soil and other debris from the construction sites, and provision of employment opportunities to the local population. Detailed procedures of stakeholder's engagement at different stages of the project are proposed with SEP.

Disclosure

The draft and final ESIA report will need to be disclosed in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into local language (Bengali) for the project-affected people and other stakeholders. The translated summary of ESIA report will be disclosed in DC offices, Upazila and Union Parishad of respective project areas. The PGCB and AIIB will also post the final ESIA document (at least 60 days prior to Board consideration (regular procedure), Closing Date (Streamlined Procedure), or management approval date (delegated authority) as part of their disclosure policy (e.g., on its website), and the same will be submitted to the Department of Environment (DoE) for approval and disclosure at local (DC offices, Upazila Parishad) and national level, so affected people, contractors, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation. The effectiveness of the ESIA is directly linked to the degree of continuing involvement of those affected people directly or indirectly by the project. During the preparatory stage, consultations were held at local, sub district and district level. Several additional rounds of consultations with stakeholders will be planned in ESIA finalization, and during construction as well as operation phases of the Project. Disclosure methods are also discussed in the SEP.

Recommendations

a) PGCB and Contractor should strictly maintain environmental and social monitoring compliance mentioned in Chapter 9 and in accordance with the E&S documents (RP, LMP, SEP, GVB Prevention Plan and ESIA).
b) Resettlement Plan (RP) should be implemented properly, and updated RP simultaneously during paying the compensation. All the compensation must be completed before the construction starts.
c) ESMP and ECP should be included in the tender documents and in the contracts of the selected contractors.
d) Contractor should carry out the construction work to follow the ECPs; and prepare site-specific ESMP.

e) Proper training regarding EHS should be provided to Project Management Unit as well as work forces during construction phase.
f) Detailed hydro-morphology study should be carried out for crossing Sangu, Matamuhuri and Bakkhali Rivers; Turag and Bongshai Rivers as discussed in section 5.2.4.
g) Eligible local people should be considered at least during construction phase as skill or non-skilled labor on priority basis that will be helpful for minimizing the socio-economic disruption.
h) Eventually, PGCB can introduce the concept of 'Corporate Environmental and Social Responsibility (CESR)' for the management of local environmental, their employees, adjacent communities, stakeholders, etc.

Chapter 1
Introduction

1.1 Background

Power Grid Company of Bangladesh Limited (PGCB) intends to construct, renovate, and augment the sub-stations and Transmission lines with a project titled "Southern Chattogram and Kaliakoir Transmission Infrastructure Development Project". The proposed 230kV (initially charged at 132kV) double circuits transmission line from Anwara to Cox's Bazar, 132kV double circuits transmission line from Cox's Bazar to Teknaf, 230kV double circuits transmission line from Kaliakair SS to BHTC, and LILO of Dohazari - Cox's Bazar 132kV four circuit line at Cox's Bazar (N) will help establish transmission infrastructure and evacuation of bulk electricity to major load centers. This will help to meet up the rapidly growing demands of residential, commercial, and industrial consumers in Chattogram and Dhaka regions and adjacent areas. Single diagram of the project is presented in Figure 1 and Figure 2.

Proposed 230/132/33 kV GIS substation (future 400kV) at Anwara which will make regular grid connectivity with 230kV transmission system. Proposed 132/33kV indoor GIS substation at outer side of Cox's Bazar will receive power from Anwara substation. Existing 132 kV transmission line of Dohazari to Cox's Bazar will connect with proposed Cox's Bazar SS through 132kV four circuit lines as LILO. The proposed 132/33kV indoor GIS substation will receive power from Proposed Cox's Bazar (N) SS. Besides, proposed 230/33kV GIS substation will be constructed at BHTC located at Kaliakair, Gazipur, and power will receive from existing Kaliakair 400/230/132kV substation. For this reason, a 230kV bay extension would be established in the existing Kaliakair SS by PGCB. Previously the proposed route of transmission line was passing through the Chunati Wildlife Sanctuary. Hence the Anwara-Cox's Bazar (N) 230kV double circuit line was rerouted, and the length of the line changed from 109 km to 105 km according to the Chunati bypass proposal. On the other hand, the site location for Cox's Bazar Substation was relocated to another place with same physiography due to the objection from the local DC office. Total 184.07 km overhead transmission lines and four new sub-stations will be constructed under this project. There is no underground transmission lines construction under this project.

Power Grid Company of Bangladesh (PGCB), Government of Bangladesh (GoB) will provide fund for this project and donor agency such as Asian Infrastructure Investment Bank (AIIB) has shown interest to co-finance this project if required. In this context, PGCB decided to carry out Environment and Social Impact Assessment for AIIB; and Initial Environmental Examination (IEE) report for Department of Environment (DoE) to achieve Environmental Clearance Certificate (ECC) for this project.

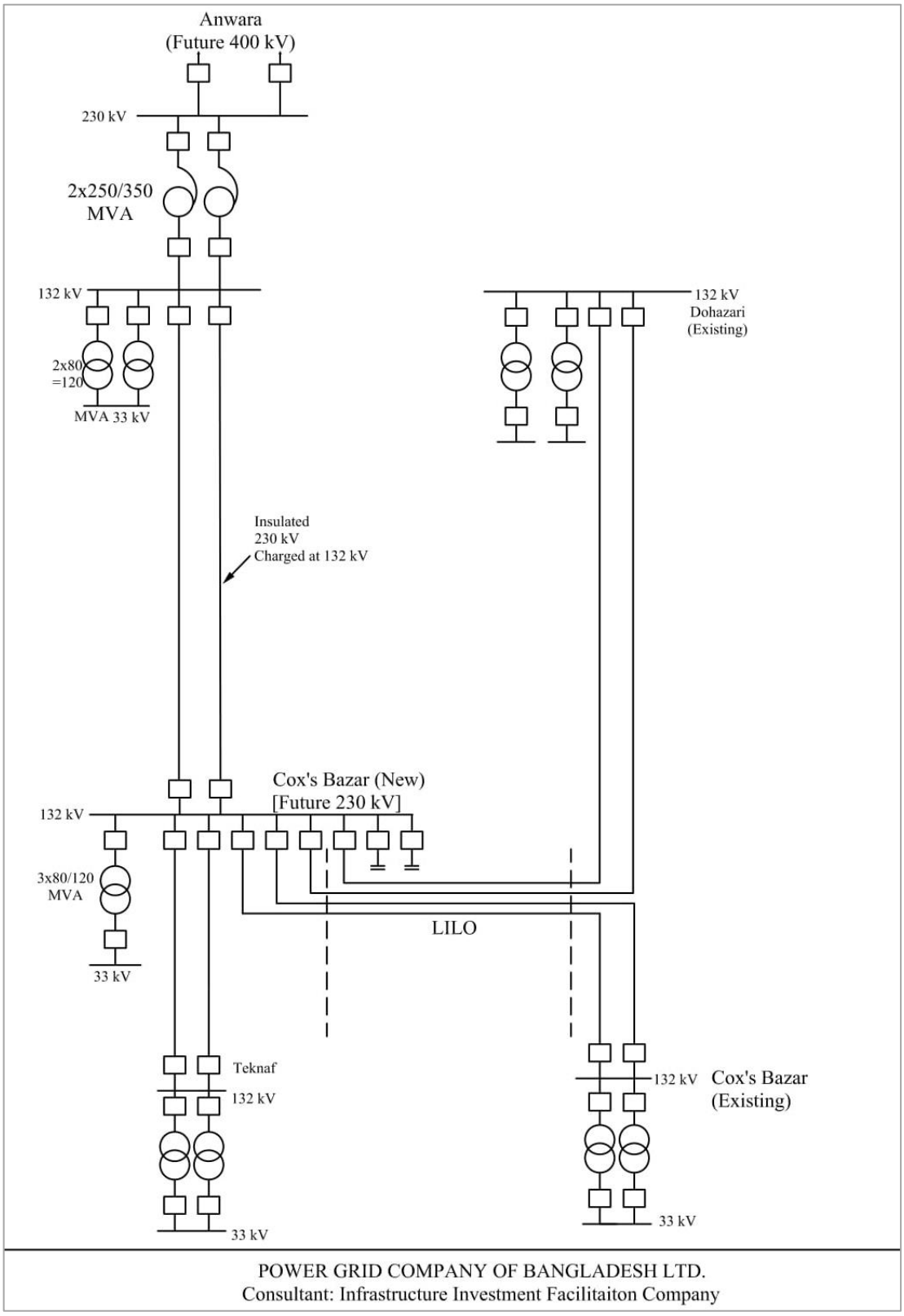


Figure 1: Single Line Diagram of the project components under Chattogram Region

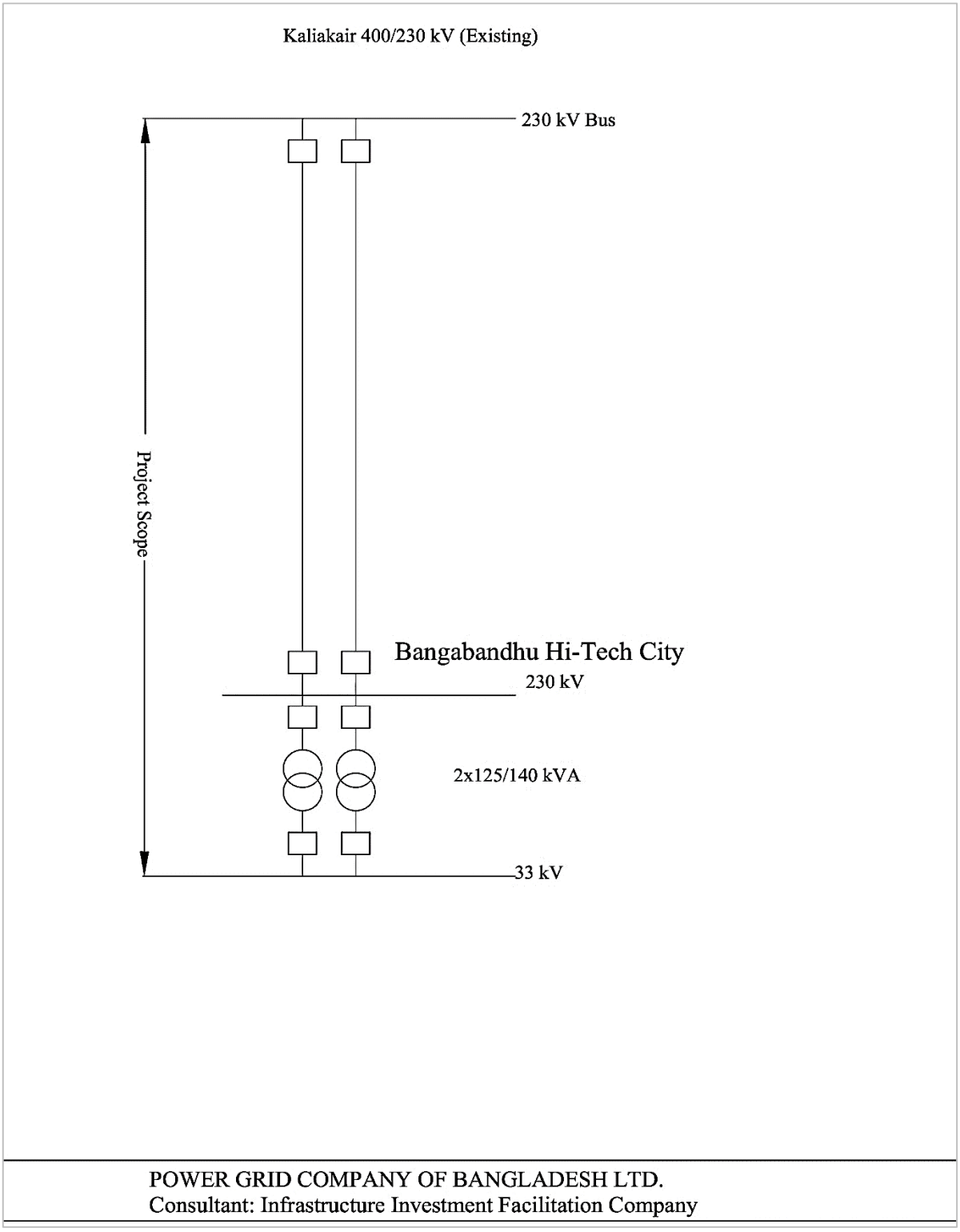


Figure 2: Single Line Diagram of the project component under Gazipur of Dhaka Region

According to the Environment Conservation Act (ECA), 1995 and Environment Conservation Rules (ECR), 1997, (amended 2002), all transmission lines and sub-stations falls under the Orange-B category as classified under Schedule-I of the ECR (SRO 349-Act/2017 of 4 (C), which requires Initial Environmental Examination (IEE) to get 'Environmental Clearance' from the Department of Environment (DoE). The ESIA of the proposed transmission lines and substations Project presented in this report has been carried out considering the guidelines of the Department of Environment (DoE)

under Ministry of Environment, Forests and Climate Change (MoEFCC), AIIB Guidelines for Environmental and Social Framework (ESF), applicable guidelines are IFC/WB general and sectoral EHS (Environmental Health and Safety) guidelines. Meanwhile, PGCB applied for Environmental Clearance from DoE by submitting IEE report and got approval on 31 March 2021 in its Board Meeting and issued on May 05, 2021: Memo No. 22.02.0000.018.72.033.21.91. The copy environmental clearance is attached in Annex-1. PGCB has engaged Infrastructure Investment Facilitation Company (IIFC) for the preparation of ESIA report.

1.2 Objective of the Project

The objectives of the project are given below:

- ✓ To establish transmission infrastructure and evacuation of bulk electricity to major load centers
- ✓ To ensure adequate and reliable power supply for upcoming economic zones (EZs) of BEZA in Chattogram region
- ✓ To meet up the rapidly growing demands of residential, commercial, and industrial consumers in Chattogram regions and BHTC

1.3 Project Rationale

The Government of Bangladesh (GoB) has targeted GDP growth of 7.4 percent per year between 2016 and 2020 in its Seventh Five Year Plan. Solid performance by the power sector is considered necessary to achieve this target. The current Power System Master Plan (PSMP) notes that if Bangladesh were to follow Thailand's growth trajectory as desired by the Government, it would have to sustain a per capita GDP growth rate of 5.2 percent per year between 2016 and 2014. This would require the development of new export-oriented industries and a significant increase in power generation capacity along with a quadrupling of the total energy used[1]. The Government has also set the goal of achieving universal access to electricity by 2021, when Bangladesh completes 50 years of independence.

The availability and reliability of power is a key constraint to job creation and poverty reduction, hampering the competitiveness of Bangladesh's economy[2]. The supply of power in Bangladesh has not been able to keep pace with the rapid growth in demand and consumers experience frequent power outages. In addition to shortfalls in power generation, Bangladesh's aging and inadequate transmission and distribution (T&D) systems impose severe constraints on power delivery to consumers. Due to lack of investment and inadequate maintenance, the reliability of the system has deteriorated substantially, resulting in several instances of major system collapse. As in other countries of South Asia, a majority of manufacturing and service firms in Bangladesh identity a shortage of reliable electricity as the most important constraint they face to smooth operations and expansion. Outages result in about 2-3 percent loss of GDP year, with significant sums spent on diesel generators for backup.

[1] The Power System Master Plan 2015. JICA/TEPCO. "PSMP2015 High-Level Discussion SUMMARY PART." April 2016.

[2] Bangladesh is ranked 107th out of 140 countries on the Global Competitiveness (GC) Index and 120th on quality of electricity supply. The GC Survey identified inadequate supply of infrastructure as the most problematic factor for doing business along with corruption.

Table 1: Transmission Lines and Substations by Voltage, Length/Quantity[3]

Transmission Lines		Substations	
Voltage Level (kV)	Circuit Km	Voltage Level (kV)	No. of Substations (MVA)
400	861	400 (HVDC)	1 (500MW)
230	3658	400/230	3 (3120 MVA)
		400/132	2 (1300 MVA)
132	7671	230/132	22 (12075 MVA)
		132/33	114 (22055 MVA)
Total	12,190		39,050 MVA

Bangladesh's transmission system mainly consists of 230kV and 132kV systems, while one 400kV High Voltage Direct Current (HVDC) system has recently been implemented. The country has about 12,190 circuit km of transmission lines and about 46,413 million kWh wheeled through the transmission network during FY 15-16. Transmission losses have come down to 2.38 percent in 2015-16 from 4.24 percent in 2000-01. The country is vertically divided by the rivers Jamuna and Padma; and the western and eastern part of Bangladesh's transmission network is interconnected by two 230kV double circuit lines.

The Chattogram region is a major commercial and industrial hub with the Government taking initiatives to set up multiple economic zones (EZs) and upgrade port facility and transportation network. An aged and low-capacity grid network in this region (especially Anwara, Cox's Bazar and Teknaf) is one of the major problems that PGCB is facing and a key priority. Due to lack of electricity supply, economic growth of this area is stagnant. Operational bottlenecks of the region were identified during a network analysis performed by PGCB. This project will also assist PGCB to introduce reactive, predictive and proactive O&M approaches.

1.4 Project Components

The major components of the project include the following:

Table 2: Components of the Project

Name of Substations	Land Size (acre)	SS Type	Required Bays	Associated Transmission Lines	Length (Km)
230/132/33kV SS: Anwara 2x250/350 MVA (230/132kV) 2x80/120 MVA (132/33kV) (Future 400 kV Provision)	20	GIS	230kV: LB=8; TB=2; BCB=1 132kV: LB=2; TB=4 33kV: TB=2	Anwara-Cox's Bazar (N) 230kV double circuit line (Initially Charged at 132kV)	105

[3] http://pgcb.gov.bd/site/page/05a258ae-2288-44d5-95c1-4e30b35eb7ec/-

Name of Substations	Land Size (acre)	SS Type	Required Bays	Associated Transmission Lines	Length (Km)
132/33kV GIS Substation: Cox's Bazar 3x80/120 MVA (Future 230 kV Provision)	10	GIS	132kV: LB=8; CBB=2; TB=3; Spare=1; BCB=1	Anwara-Cox's Bazar (N) 230kV double circuit line (Initially Charged at 132kV)	
			33kV: TB=3	LILO of Dohazari-Cox's Bazar 132kV four circuit transmission line	1.09
132/33kV GIS Substation: Teknaf 2x80/120 MVA	5	GIS	132kV: LB=2; TB=2; BCB=1 33kV: TB=2	Cox's Bazar to Teknaf 132 kV double circuit transmission line	73.10
230/33kV GIS Substation: Bangabandhu Hi-Tech City 2x125/140 MVA	5	GIS	230kV: LB=2; TB=2; BCB=1 33kV: TB=2	Existing Kaliakair SS to Bangabandhu Hi-Tech City 230kV double circuit transmission line (230kV Bay Extension at Kaliakair: 2 Nos.)	4.88
4 Nos.	40			Total (Transmission Line)	184.07

1.5 Need for the Study

Power Grid Company of Bangladesh (PGCB) would apply for financial assistance from Asian Infrastructure Investment Bank (AIIB) for the proposed Project. As part of the funding requirement, PGCB is required to address the social and environmental issues related to the Project.

The proposed Project is an establishment of new grid substations and associated transmission lines dedicated for supply electricity and is likely to have environmental and social impacts especially during construction phase mainly falls under the Orange-B category as classified under Schedule-I of the ECR 1997 (SRO 349-Act/2017 of 4 (C), which requires Initial Environmental Examination (IEE) to get 'Environmental Clearance' from the Department of Environment (DoE).

Infrastructure Investment Facilitation Company (IIFC) has been appointed by PGCB to carry out an ESIA Study for the proposed Project as per the requirements of AIIB guidelines for Environmental and Social Framework (ESF), applicable guidelines are IFC/WB general and sectoral EHS guidelines as well as Environment Conservation Rules, 1997 of Governments of the People's Republic of Bangladesh. The ESIA study has also been undertaken for the purpose of obtaining environmental clearance from the Department of Environment (DoE), Bangladesh.

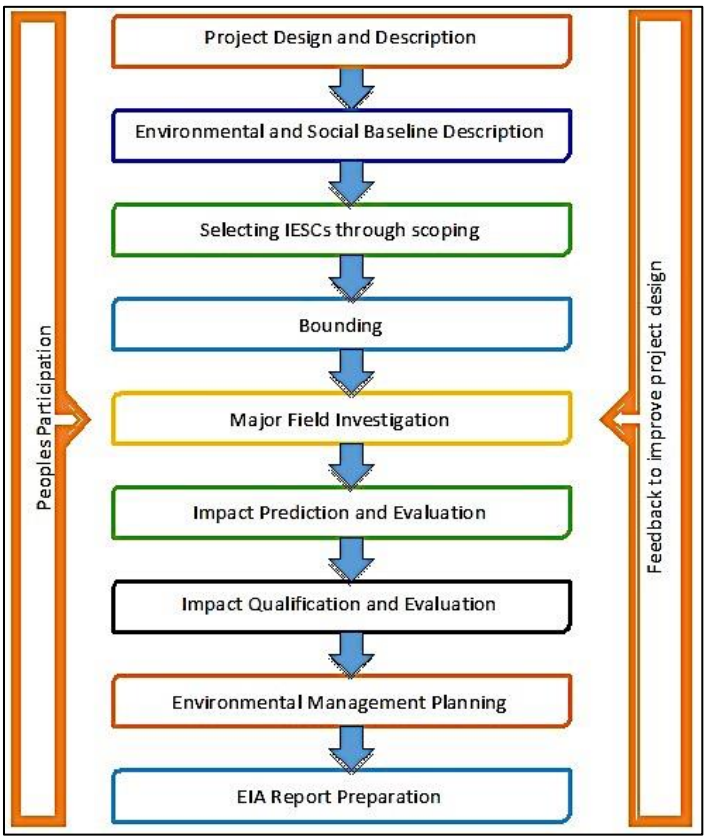
1.6 Scope and Objectives of the Study

This study provides the information on impact of different environmental and social issues due to construction of new grid substations and associated transmission lines which includes the environmental impact mainly during construction phase of the Project. With this information mitigation measures are suggested to abate the impacts on the existing environment of the Project area. The main objectives of this report are:

- Establishment of the environmental and social baseline condition in respect of water resources, air quality, noise level, land resources including land use/land cover, agriculture, fisheries, ecosystems and socio-economic conditions;
- Specific statutory requirements applicable in Bangladesh;
- Carry out public consultation and disclosure with adjacent buffer zone communities;
- Identification of Important Environmental and Social Components (IESC);
- Assessment of impacts of the proposed transmission lines and sub-stations on the environmental and social components;
- Site specific detail Environmental and Social Management Plan (ESMP);
- Suggestion recommended abatement/mitigation/management measures to ensure environmental, biological, health and social compatibilities and also to comply with the national environmental legal requirements and national environmental quality standards.

1.7 Approach and Methodology

The Environment and Social Impact Assessment study for the Project has been carried out as per the requirements of the Environment Conservation Rules, 1997, AIIB Environmental and Social Framework (ESF), applicable EHS guidelines of IFC/WB related to environment and social. Reconnaissance surveys were conducted to identify environmental and social issues in the Project area. A detailed desk-based literature survey was also undertaken, and relevant information was collected for environmental and social baseline assessment. The process of the preparation of ESIA report is presented below:



Social surveys and census were also conducted by IIFC, and the Project Affected Households was visited to collect information on the socio-economic and cultural aspects of the local community.

Various government departments and other agencies were contacted to gather information relevant to the Project or the Project area. Based on the baseline and proposed activities, an impact analysis was carried out where potential direct and indirect impacts of the Project activities have been considered. A detailed Environmental Management and Monitoring Plan (EMMP) has been formulated for the Project where measures are proposed to mitigate adverse impacts along with recommended good practices. Following plans have been developed and/or followed for the Project:

- Resettlement Plan (RP)
- Construction Labour Management Plan
- Gender Based Violence Prevention Plan
- Stakeholder Engagement Plan

1.7.1 Project Design and Description

Environmental and social impacts are triggered by physical interventions in the natural system for which it is essential to understand the proposed interventions while conducting ESIA study. Detailed information about project was collected from PGCB by the multi-disciplinary ESIA team members for gaining a thorough understanding of the proposed interventions and their possible environmental and social consequences. This information helped in designing data collection programs. The following issues have been included in the brief description of the project:

- Location of the project and its accessibility;
- Use of natural resources i.e., water and its sources;
- Use of power and its sources;
- Use of raw materials, fuels and chemicals, their quantities, characteristics, arrangements for transport to site, and storage facilities;
- Products and by-products, their storage and transport;
- List of main equipment and machinery, built-in pollution control equipment, description of detailed manufacturing process (temperature and pressure conditions of each unit operation);
- Quantities of solid, liquid and gaseous waste generated, and their points of generation;
- Noise level produced by equipment and machinery at source and capital and operating costs of pollution control;
- Social considerations of the project due to land acquisition, loss of crops, etc.
- Layout map (1:1000 scale) showing different units, roads, storage, water supply lines, sewerage, storm drainage, water pools housing, green belt etc.

1.7.2 Environmental and Social Baseline Survey

IIFC conducted the baseline survey with the help of iPAD. The KMZ (keyhole marked up zipped) files of the proposed lines were opened in iPAD through Google earth and followed the route exactly. It is convenient to locate the current position of the iPAD holder quickly that help to adjust the position with the route of T/L and cross check the location with Map through ground truthing. All the parameters selected in previous step may not be significant for the project; hence a reconnaissance survey was done to shorten this list to concentrate on significant effects. Also, data has been

collected from all possible secondary sources, whichever are available. Environmental and socio-economic data from different sources (BBS, DoE, BMD, BWDB, Agro-climatic survey of Bangladesh and other reports) of the proposed project area were collected to prepare the baseline environmental and socio- economic profile of the study area. Consultant's multi-disciplinary team of experts made reconnaissance visits to observe the condition of the project site and its surroundings and to identify various sites for investigation. AIIB provided questionnaire and checklists, and environmental baseline survey was conducted with the relevant checklist in hand to identify and delineate the significant effects of the project.

The environmental and social baseline condition of the proposed project area has been developed by collecting relevant data from primary and secondary sources. Under the ESIA study, available data on climate, geology, seismicity, water resources, land resources, soil properties, agriculture, fisheries, ecology and socio-economic components have been collected from secondary sources followed by primary. The study team made a number of field visits to the proposed interventions and collected primary data on environmental and social components using RRA techniques. During the field visits, the multidisciplinary ESIA team members made professional observations pertaining to their individual areas of expertise. Local knowledgeable persons and community representatives were also interviewed.

Secondary sources and used appropriately in preparing the environmental and socio-economic baseline of the project. All primary data and information here should be considered as the expert estimation and opinion of local people and project stakeholders.

Data from secondary as well as primary sources on physical environment, water resources, land resources, agriculture, fisheries, eco-systems and socio-economic condition have been collected for establishing the baseline condition for the project. Census has been carried out using semi-structured questionnaire for the collection of socio-demographic data on Project Affected Households (PAHs) in terms of substations and RoW of transmission lines. Resource based parameters or criteria on which data have been collected including the data sources methodology of collection are presented in the following sections.

1.7.2.1 Physical Environment

The professional observation of the multi-disciplinary team members backed by feedback from the local people during field visits was the main tool of physical environmental observation. The examination of physical environmental was backed by secondary data, high resolution recent satellite images and field observation. In general, the physical environmental data collection and survey has been carried out by a composite method of investigation including remote sensing image analysis, observation, and public consultation Analysis has been carried out with world standardized tools and the result presented with GIS interface.

The geological and seismic issues have been investigated using secondary information and field observation. The general geological features and the seismicity of the project and its surrounding areas have been collected from available secondary literature and the Geological Survey of Bangladesh. The lithology of the project area has been collected from the National Water Resources Database (NWRD) of WARPO.

Meteorological data such as rainfall, evapo-transpiration, temperature, sunshine hours, humidity, and wind speed and wind direction have been collected and analyzed for assessing local climate that are directly related to water resources of the study area. Meteorological data for selected stations has been collected from BMD station for Meteorology data Patenga (Chattogram) and Ambagan (Chattogram) the NWRD of WARPO, which contains long series of temporal data showing daily values for meteorological stations maintained by the Bangladesh Meteorological Department (BMD).

Water Resources

Information on water resources have been collected from secondary sources. The Karnaphuli River (SW- 153, Double Mooring) for Sangu River (SW- 248, Chandanaish and SW 249, Ichhakhali) systems of the study area have been selected for hydrological data collection. Data on specific fields of interest on special hydrological events such as drainage congestion, water logging, erosion – sedimentation etc. have been collected. Water resources data under four broad headings namely river hydrology, groundwater hydrology, ground and surface water quality and use have been collected from secondary sources.

Land Resources

The baseline for land resources has been developed by considering the criteria of Agro-ecological Zone (AEZ), land type with net cultivable area (NCA), land use and soil texture. The identification and development of baseline condition has been carried out through the following process:

The AEZ of the proposed project area has been identified using information from secondary sources (BARC, 2012). Information on land type, soil texture, and soil nutrient status has also been collected from different publications of Soil Resource and Development Institute (SRDI).

The secondary data on these parameters have been verified at field level through physical observations as well as during consultation with the local people and officials of the Department of Agriculture Extension (DAE) during field visits.

Field surveys have been conducted to collect ground-truth data on current land use/ land cover, soil texture etc. Finally, maps of the land use/land cover, soil texture etc. have been produced through digital classification with the help of ground-truth data.

Agricultural Resources

Data collected on agricultural resources include existing cropping patterns, crop variety, crop calendar, crop yield, crop damage and agricultural input used. Agriculture data have been collected from primary sources through extensive field survey by developing questionnaires and in consultation with local people and relevant agricultural officials. Data on agricultural resources have also been collected from secondary sources (Upazila Agriculture Extension office of the DAE).

Fishery Resources

Fisheries data have been collected for this study by considering the seasonal variance of dry and wet seasons. Prior to data collection, a checklist/ questionnaire was developed. The checklist included all kinds of information which should be looked into in the context of existing and potential

structures of the project. A combination of survey techniques was used for data collection. The survey techniques included sampling site selection, data collection, data analysis and reporting.

1.7.2.2 Ecological Resources

Ecological data have been collected from primary and secondary sources. The primary sources are mainly Line Transect Walks (LTWs) and Key Informant Interviews (KIIs); the secondary sources were from Forest Department, International Union for Conservation of Nature (IUCN), Bangladesh Asiatic Society's Encyclopedia of Flora and Fauna of Bangladesh, Bangladesh National Herbarium (BNH) and other relevant sources through literature review. In addition, the Bio-Ecological Zone (BEZ) classification of Bangladesh by IUCN Bangladesh (2002) has been used for the bio-ecological zoning of the study area. Based on information from the project site map, a field survey has been conducted to list the available flora and fauna as well as habitats in the study area. The surveys included LTWs (50-meter distances from both sides of the RoW) within the study area covering all major habitats. However, the tree inventory survey for, transmission lines, evaluating the ecological loss shall be conducted with height information. The tree inventory survey will also be conducted for substations also. The status of the threatened species has been mentioned in this report in reference to IUCN-Bangladesh Red List 2015.

1.7.2.3 Socio-economic

To establish a baseline for this ESIA study, data have been collected from different sources which can be grouped into two categories:

Primary sources

Primary data are collected through census, inventory of losses and socio-economic survey. Moreover, primary data also being collected through FGD, consultations and KII with different stakeholders and agencies. It is to be noted that due to COVID-19 restrictions team were unable to collect primary data from the untraceable 101 households. During the detailed design stage, this ESIA will be updated based on survey to all affected households and consultations with them. As the exact tower locations are finalized yet, landowners of the tower-location lands were not possible to identify at this stage.

Secondary sources

To prepare the baseline situation of the study area, information on some important socio-economic parameters have been collected from the reports of the Bangladesh Bureau of Statistics (BBS), 2011 and Households Income and Expenditure Survey (HIES), 2016. Secondary environmental data are collected from different government agencies and IUCN. Secondary data is also collected from the website-disclosed available authentic documents.

Technique of data collection

Different techniques have been used to gather relevant information on the existing socioeconomic condition of the study area. Quantitative and qualitative data have been collected from secondary and primary sources. Quantitative data have been collected through literature review, FGDs and KIIs, informal interviews and PCMs (Table 3).

Table 3: Variables and associated data collection techniques

Variables	Techniques
Demographic and household information	Literature review
Quality of life	RRA
Safety net & poverty reduction measures	RRA, informal interview
People's perception	PCM, RRA

The data collected from PCMs, RRAs and informal interviews have been analyzed using appropriate statistical tools and instruments. The sum and percentage of total values have been used to specify the percentage of households containing different values on different variables.

1.7.3 Scoping

A scoping process was followed for identifying Important Environmental and Social resources, which are likely to be impacted by the 230/132/33 kV transmission lines and substation areas. This was done in two stages. Individual professional ESIA team members made a preliminary list of the components pertaining to their disciplines, which could be impacted by the project. The second stage included village-scoping sessions where stakeholder perceptions were obtained about the environmental and social components, which could be impacted by the project interventions. Professional judgment of the ESIA team members as well as the stakeholder opinions obtained in the village scoping sessions were considered in selecting the valuable environmental and social resources.

1.7.4 Bounding

The geographical boundary of the "General Impact Area - GIA" and the potential "Direct Impact Area - DIA" were delineated as a requirement of the environment assessment study. The GIA is the physical location of the proposed power transmission lines of the project impacts resulting from implementation of the proposed power transmission lines including pre-construction, construction, and post-construction conditions. It is recognized that the benefits of the proposed 230/132/ 33 kV transmission will extend to the regional as well as national scale. For the ESIA, the focus of the study was limited to areas where the impacts of the activity will be directly felt. However, in total 50m (15 left side + 20m middle side + 15m right side) RoW is considered for the ESIA study area for the 230kV, and 132 kV transmission line, total 30m (10 left side + 10m middle side + 10m right side) RoW is considered for the ESIA study area. A general socio-economic profile was prepared for the administrative units over which the power transmission lines shall traverse.

1.7.5 Major Field Investigation

Data on the IESCs were collected through RRA, PRA, and FGD using checklists for water resource, agriculture, ecosystem, and socio-economic components. Intensive consultation with the local people was carried out in each case for securing people's participation. The multidisciplinary ESIA team members also made professional observations during the field visits. The concentration was on the historical status of the IESCs and the possible condition of the same against the proposed interventions.

Information on individual households whose land and livelihood could be permanently or temporarily impacted was collected through a questionnaire which was developed and field-tested before conducting the actual census. However, a total of 151 households (132 for substations and 19 for transmission lines) were interviewed during the census.

1.7.6 Prediction of Probable Impacts

The project implementing periods i.e., pre, during and post project situations were considered for the impact assessment. At this stage, local people's opinions obtained at the major field investigation stage were duly considered. Environmental impacts of the proposed interventions on the key environmental and social resources have been assessed through several sets of activities. The statuses of the environmental and socio-economic resources under baseline conditions have been predicted considering the possible changes under pre, during and post project situations conditions.

The differences found between the two conditions have been considered as the impacts of the proposed interventions on the environment and people. Changes expected to be brought about due to the implementation of the project has been assessed using professional judgment of the multidisciplinary ESIA team members based on information collected during the major field investigation stage and feedback received through intensive stakeholder consultation to generate the future condition.

1.7.7 Assessment of Potential Impact

Once the potential impacts are identified, each potential impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The potential impacts are qualitatively assessed based on the above characteristics to determine whether it is potentially significant or not. The significance of potential impacts was assessed using the risk assessment methodology that considers impact magnitude and sensitivity of receptors, described below.

1.7.8 Impact Magnitude

The potential implications of the project have been categorized as major, moderate, minor or nominal based on consideration of the parameters such as i) duration of the effect; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria. The magnitude of each potential impact of the Project has been identified according to the categories outlined in Table 4.

Table 4: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration of potential impact	Long term (beyond the project life)	Medium Term Lifespan of the project (within the project life span)	Limited to construction period	Temporary with no detectable potential impact

Parameter	Major	Moderate	Minor	Minimal
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond next project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Environmental or social parameter needs a year or so with some responses to come back to baseline	Baseline returns naturally or with limited response within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but violates international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Happens under worst case (negative consequences) or best case (positive impact) working conditions (Likely)	Occurs under abnormal, exceptional, or emergency conditions (occasional)	Unlikely to happen

1.7.9 Sensitivity of Receptor

The sensitivity of a receptor has been determined based on a review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. For each potential impact of the project, sensitivity of the related receptor was determined using the criteria outlined in table below.

Table 5: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very severe	Vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation.

Sensitivity Determination	Definition
Severe	Vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation.
Mild	Vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good ability to absorb proposed changes or/and excellent opportunities for mitigation

1.7.10 Assigning Significance

Following the assessment of impact magnitude and determining the quality and sensitivity of the receiving environment or potential receptor, the significance of each potential impact was established using the impact significance matrix shown in Table 6.

Table 6: Criteria for Determining Impact Significance

Magnitude of Impact	Sensitivity of Receptors			
	Very severe	Severe	Mild	Low
Major	Critical	High	Medium	Negligible
Moderate	High	High	Medium	Negligible
Minor	Medium	Medium	Minor	Negligible
Minimal	Negligible	Negligible	Negligible	Negligible

1.7.11 Identification of Mitigation and Enhancement Measures

Once the significance of potential impact has been characterized, the mitigations and enhancement measures were suggested. For this purpose, mitigation strategies adopted during earlier projects of similar nature were reviewed in addition to relying upon experts' judgment. Subsequently, residual impacts – impacts that are likely to take place even after the implementation of mitigation measures – and their significance was assessed.

1.7.12 Environmental and Social Management Plan

The environmental and social management plan (ESMP) was compiled once the impact assessment was completed and mitigation measures were identified. During the ESMP compilation, institutional arrangements for environmental and social management of the project were recommended, mitigation and monitoring plans were formulated, documentation and reporting protocols were defined, training needs were assessed, and cost of ESMP implementation estimated. It is to be noted that, following the proposed ESMP, site specific ESMP will be prepared during the implementation stages and before the construction starts.

1.7.13 Environmental and Social Monitoring Plan

Finally, an environmental monitoring plan was prepared for detecting changes taking place in the environmental and social components due to project implementation. This monitoring plan will be followed through the project period. It may be updated if any new impacts and risks are identified.

1.7.14 Budget for Environmental Management Plan

A tentative budget has been prepared for implementing environmental management plan for the proposed project. In this budget, mitigation cost, enhancement cost, contingency costs are included. The monitoring costs during implementation period is also included within this budget. This budget will be updated during the detailed design stage.

1.7.15 Public Consultation

Public consultation is necessary for identifying the problem and solution across the intervention by following participatory approach. This starts from environmental and social baseline stage when data and information on baseline conditions is collected from the directly and indirectly project impacted people. Their perceptions were considered in the selection of important environmental and social components through the scoping process. Some formal consultation was carried out during ESIA study, and some consultation meetings were conducted after completing the census for project affected person. The ESIA team arranged a formal consultation meeting with project affected people. Along with this, the study team also communicated with local government authority to inform them and to pick their perception regarding this project. A participatory approach was followed during consultation meetings. During the study, a total six consultations and six focus group discussions were held with the stakeholders, and a total of 171 persons participated in these sessions. Detailed consultation procedures through the project cycle are described with SEP.

1.8 The Study Area

The project is located in Anwara Upazila of Chattogram district, Cox's Bazar Sadar and Teknaf Upazila of Cox's Bazar district and Kaliakair Upazila of Gazipur district. Out of four substations one substation namely BHTC 230/33kV GIS SS will be constructed at the own land of Bangladesh Hi-Tech Park Authority (BHTPA). And another three substations will be constructed at Anwara, Cox's Bazar Sadar and Teknaf upazilas of Chattogram division. 500m range has been considered as directly influenced area for air, noise, water, solid waste, etc. The ESIA study team made visits along the route of 184.07 km overhead transmission line and the proposed sub-stations locations. There are no underground transmission lines of this project. The following maps namely Figure 3 and Figure 4, shows the locations of the proposed transmission line and substations under this project.

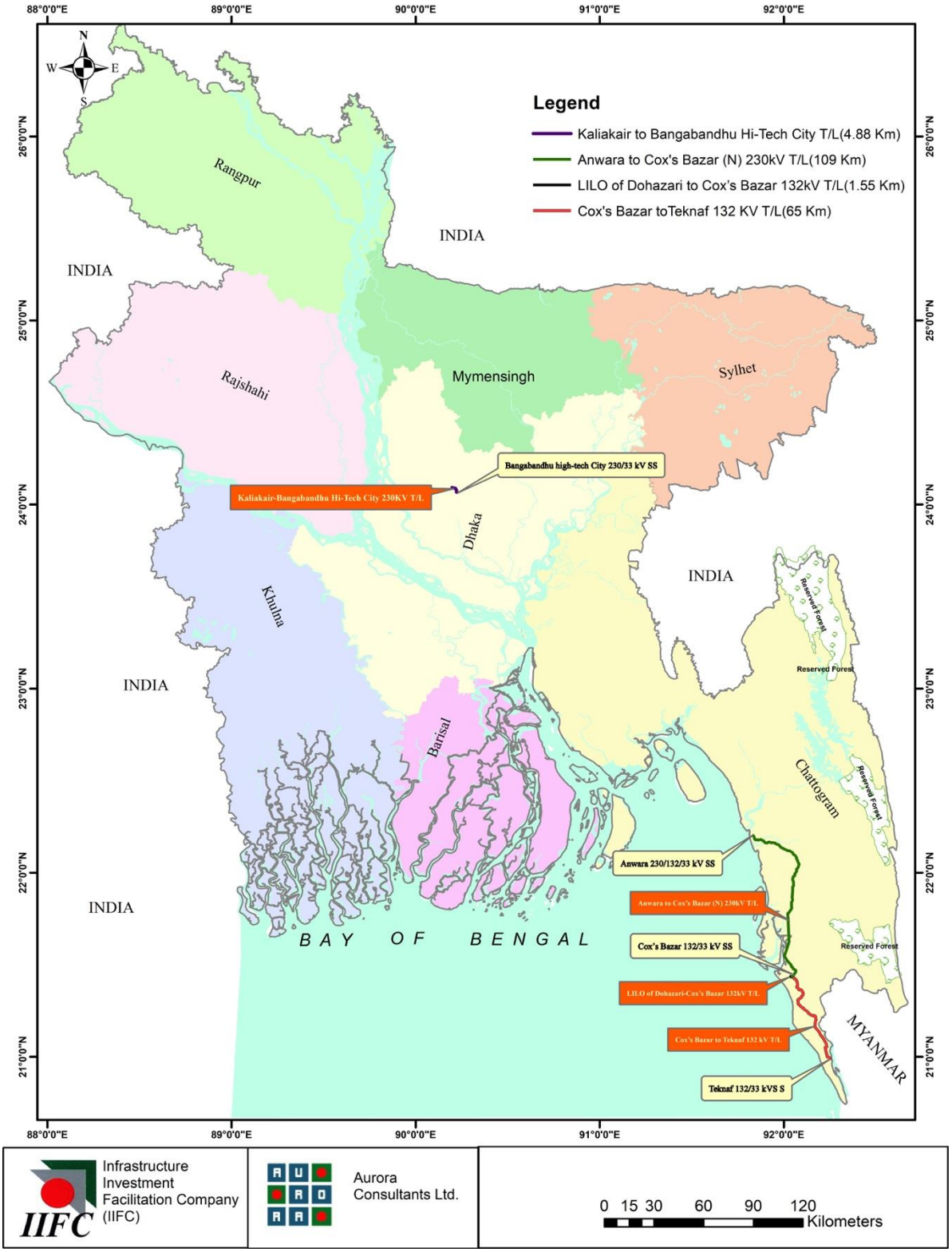


Figure 3: Location of the Project

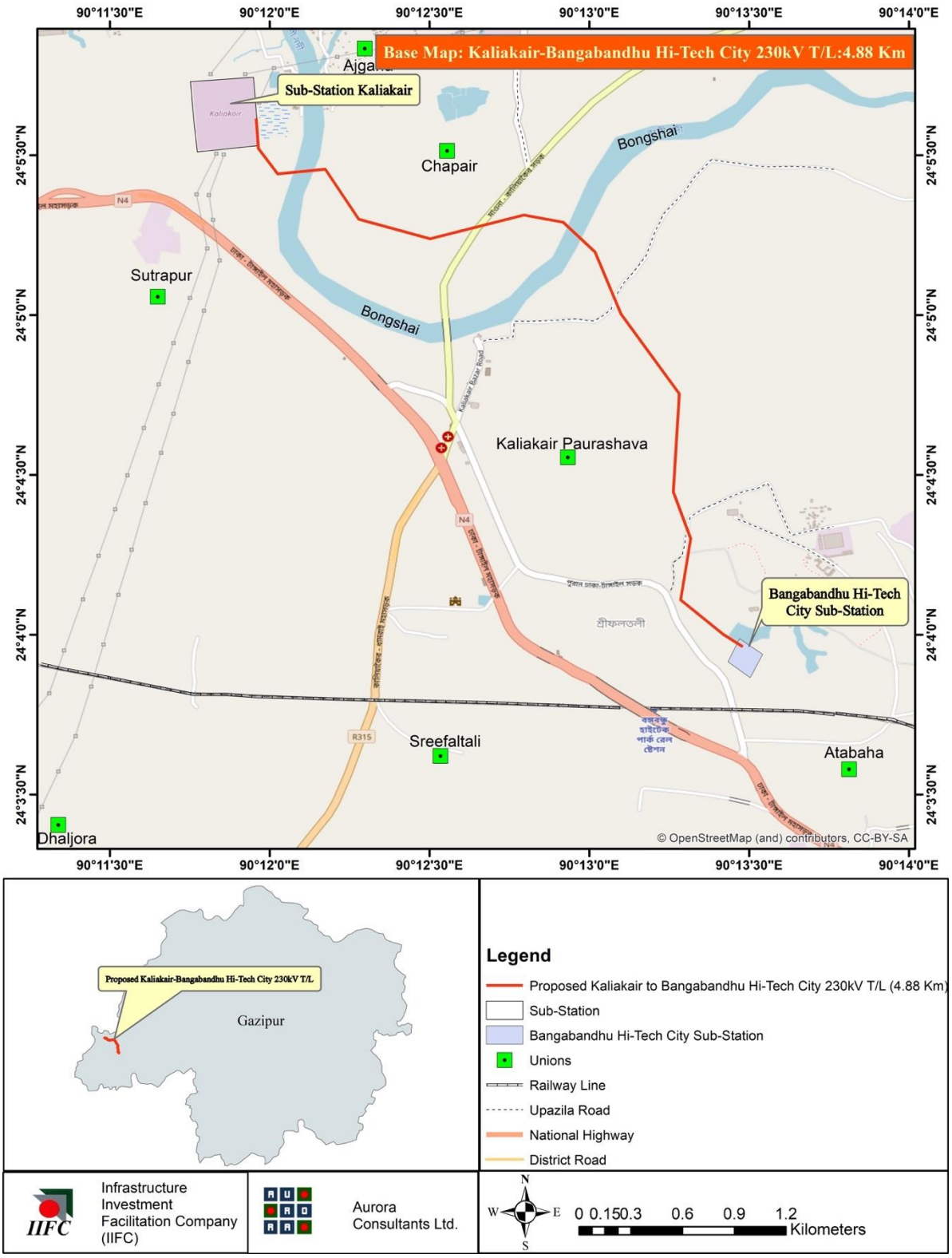


Figure 4: Base Map of Kaliakair SS Proposed BHTC Substation

1.9 Agencies Contacted

The following agencies were contacted during the course of the study:

- Bangladesh Power Development Board (BPDB)
- Power Grid Company of Bangladesh (PGCB)
- Gas Transmission Company Ltd. (GTCL)
- Bangladesh Meteorological Department (BMD)
- Local Forest Department (FD)
- Deputy Commissioner
- Nishorgo
- Department of Environment (DoE)
- Ministry of Railways
- Roads and Highways Department (RHD)
- Bangladesh Rural Advancement Committee (BRAC)
- Bangladesh University of Engineering and Technology (BUET)
- Bangladesh Meteorological Department (BMD)
- Bangladesh Inland Water Transport Authority (BIWTA)
- Bangladesh Forest Research Institute (BFRI)
- Bangladesh Water Development Board (BWDB)
- Bangladesh Fire Service and Civil Defence Department
- Local Educational Institutions (School, College, Madrasah, etc.)

1.10 Limitations

The impact assessment study for the proposed Project is largely based on the Project information from client, discussion with local community and other stakeholders and observations from various surveys and investigations undertaken in the Project area. Professional judgement and subjective interpretation of facts has been applied for this study. Any change in Project location, orientation, proposed Project activities is likely to result in variation of the impacts. It is to be noted that any technological advances during the course of construction and execution of the Project will alter the extent and severity of impacts on the surroundings.

The statements, conclusions, and opinions contained in this report are only intended to give approximations of the environmental and social condition of the site. Moreover, there are several major limitations that are inherent in the conduct of this, or any other, environmental, and social assessment.

- First, it is difficult to predict which, if any of the potential environmental and social issues identified will become actual problems in the future, environmental regulations continually change, as do the enforcement priorities of the applicable governmental agencies involved.
- Second, even for problems currently identified, it is often difficult and sometimes impossible to accurately estimate the liabilities that may be involved in mitigating the problem(s), for the legal and technological standards for evaluating, mitigating, and allocating liability for environmental issues are in a constant state of change. Moreover, the liability for mitigating

environmental problems tends to be highly dependent upon agency negotiations and the sometimes arbitrary and unpredictable nature of agency officials charged with such negotiations.

- The data collection has been carried out during COVID-19 pandemic. Team mobilization, field visit, consultations and group discussion were very difficult to arrange.

1.11 Team Composition

IIFC mobilized the Consultants from the day of signing the contract with PGCB. The team composition for conducting the ESIA Report of "Southern Chattogram and Kaliakoir Transmission Infrastructure Development Project" is given below.

Table 7:Team Composition

SN	Name of the Expert	Position
1.	Md. Nazrul Islam	Team Leader
2.	Ruhul Amin	Substation Engineer
3.	Md. Rafiqul Alam	Transmission Line Expert
4.	Muhammad Abul Foysal	Environmental Expert
5.	Md. Kamrul Islam	Route Survey Expert
6.	Dr. Aminur Rahman	Socio-economist
7.	Md. Amzad Hossain	Financial Expert
8.	Md. Ashraful Awal	Sociologist
9.	Dr. Md. Tauhid Ur Rahman	Biodiversity Expert
10.	Md. Abul Kashem Majumder	Hydrologist
11.	Dr. Zahidul Haque	Agriculturist
12.	Md. Abir Hossain	GIS Expert
13.	Dr. Santos Kumar	Fisheries Expert

1.12 Layout of the Report

The content of the ESIA has been largely structured based on the AIIB Environmental and Social Policy, and Environmental and Social Standards (Outline of an Environmental and Social Impact Assessment Report). The layout of the report is as provided below:

- **Chapter 1**: Introduction
- **Chapter 2:** Describes Policy, Legal and Administrative Framework
- **Chapter 3:** Description of the Project
- **Chapter 4:** Provides an Analysis of Alternative
- **Chapter 5:** Details Description of the Environmental and Social Baseline of Project Area
- **Chapter 6:** Provides details on the Stakeholder Analysis and Consultation
- **Chapter 7:** Presents Environmental Impact Assessment
- **Chapter 8:** Presents Social Impact Assessment
- **Chapter 9:** Institutional Arrangements

- **Chapter 10:** Provides Environmental and Social Management Plan (ESMP)
- **Chapter 11:** Grievance Redressal Mechanism
- **Chapter 12:** Conclusion and Recommendations

Chapter 2
Legislative, Regulation and Policy Considerations

2.1 Policy, Legal and Administrative Framework

This chapter provides a description of the regulatory framework applicable to the Proposed power transmission lines project. It highlights environmental, health and safety (EHS) and social regulations with applicable permits and standards in association with the Project. It broadly focuses on the:

- Legal Enforcement Agencies at National Level.
- Applicable national and local Environmental and Social Laws, Regulations and Policies.
- AIIB Environmental and Social Framework.
- International & National Environment Standards/Guidelines; and
- Applicable International Conventions/Protocols.

2.2 Legal Enforcement Agencies

The responsibility of formulation, implementation and modification of national level environmental laws in Bangladesh lies with the Ministry of Environment, Forests and Climate Change (MoEFCC). The Department of Environment (DOE) established under the Environmental Pollution Control Ordinance, 1977 which functions under the MoEFCC. It is responsible for carrying out the purposes and provisions of the Environment Conservation Act, 1995 as amended till 2010 (hereinafter referred as ECA) and Environmental Conservation Rules, 1997 as amended in December 2017 (hereinafter referred as ECR) which are the umbrella legislations regulating environmental issues in the country. A brief description of the relevant legal enforcement agencies has been described in Table 8.

Table 8: Relevant Legal Enforcement Agencies and their Functions

SN	Agency	Functions
1.	**Ministry of Environment, Forests and Climate Change (MoEFCC)**	The MoEFCC is the nodal agency in the administrative structure of the Central Government, for the planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programs. It oversees all environmental matters in the country and is a permanent member of the Executive Committee of the National Economic Council. It plays a pivotal role as a participant of the United Nations Environment Programme (UNEP). Its principal activities include: • Conservation & survey of flora, fauna, forests and wildlife; • Prevention and control of pollution; and • Forestation & regeneration of degraded areas and protection of environment in the frame work of legislations.
2.	**Department of Environment (DOE)**	An Environment Pollution Control Board was setup under the Environment Pollution Control Ordinance, 1977. It underwent a series of subsequent restructuring and was finally renamed as

SN	Agency	Functions
		Department of Environment in 1989. It is headed by a Director General appointed by the Government. The DOE through its head, divisional and District level offices conducts the following principal activities: • Advising the Government to avoid such manufacturing processes, commodities and substances which are likely to cause environmental pollution; • Advisory and issuing directions to the concerned person regarding the environmentally sound use, storage, transportation, import and export of a hazardous substance or its components; • Conducting inquiries and research activities on conservation, improvement and pollution of the environment and rendering assistance to any other authority/organization regarding the same; • Collection and publication of information about environmental pollution; • Conducting programs for observation of drinking water quality and issuing directives if necessary, for adherence to drinking water quality standards; • Formulation of environmental guidelines; • Prescribing and modifying environmental quality standards pertaining to air, water, noise, vehicular emissions etc.; • Issuing Location Clearance and Environmental Clearance Certificates to Projects; and • Implementation of provisions of ECA and rules made there under.
3.	**Bangladesh Forest Department (BFD)**	It was established under the MoEFCC and is responsible for identifying and declaring of certain areas as reserved or protected or private forest lands. It implements the provisions of Forest Act, 1927 and National Forestry Policy, 1994. It is also responsible for wildlife preservation and protection through implementation of Wildlife (Preservation & Security) Act, 2012.
4.	**Water Resources Planning Organization (WARPO)**	It was established under the Water Resources Planning Act, 1992. Its core functions include: • Monitoring the implementation of National Water Management Plan (NWMP); • Upkeep of water resource assessments; • Maintenance, updating and dissemination of the National Water Resources Database (NWRD) and MIS; • Secretariat to the National Water Resources Council (NWRC) and the Executive Committee of the National Water Resources Council (ECNWRC);

SN	Agency	Functions
		• Responding to the NWRC/ECNWRC requests for information and advice; • Periodic update of the NWMP; • Assisting other agencies in planning, monitoring, studies and investigations; • Adhoc advice on policy, strategy, institutional and legal issues; • Laying down effluent discharge standards into river in consultation with DOE; and • Special studies and research as required.
5.	**Ministry of Fisheries and Livestock (MOFL)**	The main functions of the MOFL include: • Preservation of fisheries resources; • Fulfilling the requirement of animal protein through proper management and planned development; • Increasing socio-economic conditions of fishermen; • Creating employment opportunities for rural unemployed and landless people; • Expanding foreign exchange earnings by exporting fish and fishery products; • Developing innovative technologies through research for fisheries development and preservation; and • Protection of fishes through implementation of Protection and Conservation of Fish Act, 1950 as amended till date.
6.	**Bangladesh Power Development Board (BPDB)**	It is a statutory body created in May 1, 1972 and is responsible for major portion of generation and distribution of electricity mainly in urban areas except Dhaka and West Zone of the country. It has undertaken a massive capacity expansion plan to add about 10500 MW generation capacities in next 5 years to achieve 24000 MW Capacity according to Power System Master Plan (PSMP) 2021.
7.	**Bangladesh Energy Regulatory Commission (BERC)**	It was established under the Bangladesh Energy Regulatory Commission Act, 2003. Some of its key functions include: • Issue, cancel, amend and determine conditions of licenses, exemption of licenses and determine the conditions to be followed by such exempted persons; • Regulation of generation, storage, supply, and transmission of energy; • Determine tariff for electricity distribution etc.; • Ensure control of environmental standard of energy under existing laws; • Extend co-operation and advice to the Government, if necessary, regarding electricity generation, transmission, marketing, supply, distribution and storage of energy.

SN	Agency	Functions
8.	**Ministry of Labour and Employment (MOLE)**	It was established with following objectives: • Creation of employment opportunity; • Creation of semi-skilled and skilled manpower; • Enhancement of productivity of factories by creating friendly working environment between workers & employers; • Ensuring welfare of workers in different industrial areas; • Implementation of labor laws; • Fixing up minimum wages of labor; and • Ensuring justice through Labor Court. It has been divided into four departments, viz: • Directorate of Labor • Chief Inspector of Factory and Establishment • Minimum Wages Board • Labor Appeal Tribunal
9.	**Ministry of Law and Parliamentary Affairs**	This ministry is divided in to the Law and Justice Division and the Parliamentary Affairs Division for functional purposes. The Law and Justice Division of the Ministry of Law, Justice and Parliamentary Affairs has the responsibility of providing legal advisory services to other ministries, divisions, departments, and organizations of the Government. The parliamentary affairs division is assisted by the law commission and the human rights commission and its main function lies in formulating, scrutinizing and preparing legislations. When needed, it provides legal opinions and translations for other ministries.
10.	**Ministry of Land**	The ministry of land is in charge of land administration, management and development for the overall growth of the nation. The Ministry manages Government owned lands, vested properties and abandoned properties. It is responsible for the collection of land development tax, land surveying and record keeping and updating. Land Acquisition and requisition fall under the responsibilities of this ministry.
11.	**Civil Aviation Authority, Bangladesh (CAAB)**	The Government of the People's Republic of Bangladesh formed Civil Aviation Authority, Bangladesh in the year of 1985. The main functions of CAAB are: • It is responsible for registration of aircrafts and issues license to each personnel responsible for flight operations; • To regulate air traffic and provides facilities and services for aeronautical telecommunications and air navigation; The authority is responsible for construction, maintenance and development of airports and aerodromes.
12.	**Road Transport and**	The Roads and Highways Department (RHD) was created in 1962

SN	Agency	Functions
	Highways Division (RTHD)	when the old 'Construction & Building (C&B) organization was split into 2 separate bodies (the other being Public Works Department). RHD is responsible for the construction and the maintenance of the major road and bridge network of Bangladesh. The major functions of RTHD are: • Repair, rehabilitate and maintain the highway network; • Improve and expand the national, regional highways and zilla roads; • Adopt and accomplish economically important highway projects; • Introduce and operate digital motor vehicle management system • Ensure road safety; • Introduce and operate integrated mass rapid transit system; • Provide passenger and cargo services on domestic and international routes; • Encourage Public Private Partnership (PPP) in road transport sector.
13.	**Ministry of Railways**	Among the public transport modes of the country, the railway is the largest state transport sector of the government of Bangladesh. The first railway in this country was started on 15 November 1862 with the construction of Darshana-Jagati railway line. the Ministry of Railways was constituted as per SRO No. 361 Act / 2011 dated 04-12-2011 of the Cabinet Division. The functions of ministry of railways are: • Formulation of policies and strategies for railways and rail transport and safety; • Development, expansion and maintenance of railways; • Coordination of railway system at national and international level; • Survey and monitoring of rail transport; • Formulation and implementation of safety policies for rail transport; • Establishment of international railway system and execution of transport agreements; • Determination and rescheduling of fares and tolls of Bangladesh Railway; • Conduct development and investment programs and budgetary activities of Bangladesh Railway; • Conduct and control the administrative activities of all offices and agencies under the Ministry.
14.	**Union Parishad**	Union Parishad (UP) currently is the only elected statutory local government body for the rural Bangladesh. A UP consists of a chairman and twelve members. They are elected on the basis of adult franchise. Each UP has a full-time Secretary, appointed by

SN	Agency	Functions
		the Deputy Commissioner (DC). The functions of UP are: • Maintenance of law and order and conduction of censuses of all kinds; • Registration of births, deaths, blind people, beggars and destitute; • Planning and implementation of development schemes in the field of agriculture, forestry, fisheries, livestock, education, health, small and micro enterprises, communications, irrigation and flood control; • Protection and maintenance of public property such as roads, bridges, canals, embankments, markets, telephones and electricity lines.

2.3 Applicable Environmental and Social Laws, Regulations and Policies

The relevant Acts and Rules pertaining to the Project have been summarized in Table 9. Both Contractor and PGCB would be responsible to comply with applicable national and international laws, regulations and policies.

Table 9: Applicable Environmental, Health and Safety and Social Laws, Regulations and Policies

Summary of Applicable legislation/ Policy	Responsible Agency	Applicable Permit and Requirements
National Environment Policy, 1992 and Action Plan It sets out the framework for establishment of legislations related to 15 sectors including environment, water, agriculture, water resources development, forest & wildlife, fisheries etc. The key provisions of the policy are: • Initial Environmental Examination (IEE) and Environmental and Social Impact Assessment (ESIA) of all new public and private sector industrial Projects is mandatory; • Adoption of corrective measures by polluting industries in phases; • Prevention of land erosion, and environmentally sound management of newly accreted land; • Conservation of wildlife, bio-diversity, forest, fisheries and livestock.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Department of Environment (DOE), Bangladesh	PGCB should ensure that Project activities comply with the provisions made under the policy and the legislations made there under for implementing the same.

Summary of Applicable legislation/ Policy	Responsible Agency	Applicable Permit and Requirements
National Environmental Policy, 2018 This policy has been formulated based on the National Environmental Policy 1992 aimed to achieve Sustainable Development Goals (SDGs). The main consideration of this policy is to ensure sustainable development reducing the dependency of human on nature resources. A total of 19 sectors has been considered in this policy including environment, water, agriculture, water resources development, forest & wildlife, fisheries etc.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Department of Environment (DOE), Bangladesh	PGCB should ensure that Project activities comply with the provisions made under the policy and the legislations made there under for implementing the same.
National Environmental Management Action Plan (NEMAP), 1995 The NEMAP is a wide-ranging and multi-faceted plan which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements during the period from 1995 to 2005 and set out of the framework within which the recommendations of the National Environmental Policy were to be implemented. It identified four broad objectives and remains highly relevant today. The four key environmental management directions specified were: • identification of key environmental issues affecting Bangladesh • identification of actions necessary to halt or reduce the rate of environmental degradation of the natural environment sustainable resource use and the conservation of habitats and biodiversity • improvement of the quality of life of the people.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Department of Environment (DOE), Bangladesh	PGCB should ensure that Project activities comply with the provisions made under the policy and the legislations made there under for implementing the same.
The Environment Conservation Act, 1995 *as amended till October 5, 2010* (hereinafter referred as ECA) **The Environment Conservation Rules, 1997** *as amended till February 16, 2002 and*	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	The proposed Project being a Power Transmission Lines and construction of Substation falls under the Orange-B category as classified under Schedule-I of the ECR (SRO 349-Act/2017 of 4 (C).

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December 2017 (hereinafter referred as ECR) The salient features of the Act are as follows: • A Department of Environment (DOE) to be established subsidiary to the MoEFCC to exercise the provisions of the Act; • The Government of Bangladesh (GoB) will declare Ecologically Critical Areas (ECA) and specify the activities or processes that cannot be initiated or continued in an ECA; • An industrial unit/Project cannot be established without obtaining an Environmental Clearance Certificate (ECC) from the Director General of DOE; • Publication of environmental guidelines related to environmental pollution control and mitigation, conservation and improvement of the environment; • Prescription of rules for implementing the provisions of the Act. The provisions under the ECR are summarized as follows: ○ The industries for the purpose of obtaining ECC have been classified into the following 4 categories based on their site and impact on the environment: i. Green ii. Orange –A iii. Orange – B iv. Red *The list of industries falling under each category has been annexed in the Schedule – I to the ECR.* • For proposed industries falling under the Orange A&B and Red categories, a Location Clearance Certificate (LCC) needs to be	Department of Environment (DOE), Bangladesh	PGCB shall ensure compliance with the applicable provisions of the Act and the Rules made there under. Reportedly PGCB would collect No Objection Certificate (NOC) from Union Parishad/Ward Councilor Office/Upazila Parishad/DC Office for the Project site. Furthermore, PGCB shall apply for the Environmental Clearance Certificate (ECC) by submitting IEE report in the requisite manner along with prescribed documents. DOE Environmental Clearance Applicability and Procedure is presented in Figure 5. PGCB shall ensure that pollutant emissions/discharges from various sources, etc. during Project activities are well within the standards prescribed in the Schedules 2-12 of the ECR 1997. Some of the standards have been revised by the DOE viz. Ambient Air Quality standard Vehicular Emission standards Ambient Noise Standards The various applicable standards have been provided in subsequent sections. Compliance to such standards shall be ensured by PGCB.

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obtained from DOE prior to the issuance of ECC; • The Project entrepreneur shall apply for ECC in Form 3 along with prescribed documents and application fees; • ECC (for Red category) will be valid for 1 year from the issuance date and shall be renewed at least 30 days prior to expiry; • Various environmental quality standards pertaining to air, water, sound, odor etc. have been laid down in the schedules attached to the Act. • Emissions and waste discharge standards have been laid down in Schedules 9-11. • The person in charge of facility/unit shall notify the Director General, DOE in case of pollutant emission/ discharge in excess of prescribed standards or where there is a possibility of the same.		
Bangladesh Environmental Court Act, 2010 Bangladesh Environment Court Act, 2010 has been enacted to resolve the disputes and establishing justice over environmental and social damage raised due to any development activities. This act allows government to take necessary legal action against any parties who creates environmental hazards/ damage to environmentally sensitive areas as well as human society. According to this act, government can take legal actions if any environmental problem occurs due to project interventions.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	PGCB shall ensure compliance with legal requirements under such provisions.
Ecologically Critical Areas (ECAs) Management Rules, 2016 The Rules provide different committee systems for the management of ECAs from the national to village level. The Rules at first provide for the establishment of a	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	PGCB shall ensure compliance with legal requirements under such provisions.

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National Committee consisting of a Chairperson5 and 19 other members including academics and 2 NGO activists. The Department of Environment (DoE) provides the secretarial assistance to the National Committee. The Rules then describe responsibilities and functions of the National Committee. The National Committee plays a pivotal role in the management of ECAs. In recommending a site, the National Committee will consider existing natural conditions and biodiversity, forests, wildlife, protected areas, wetlands etc. and causes for ecological degradation, possible threats, and preventive measures for this. The Committee will also take into account livelihoods, religious and social culture of local inhabitants, and the presence of archaeological sites. The National Committee will also make recommendations regarding the generation of alternative livelihoods for the people dependent on an ECA.	Department of Environment (DoE)	
National 3R Strategy for Waste Management, 2010 The 3R strategy sets the goal of waste reduction, reuse and recycling and minimizing waste disposal in open dumps, rivers, flood plains and landfills by 2015 and promotes recycling of waste through mandatory segregation of waste at source as well as creates a market for recycled products and provides incentives for recycling of wastes. It recognizes waste as a resource and advocates for segregation of waste at source, encourages emission reducing technology through private sector investment and tapping the potential of CDM provisions, promotes “polluters pay” principle as well as cleaner production and Environmental Management System (EMS), and supports the participation of the informal sectors who are engaged in the recycling of various materials.	Department of Environment (DoE)	During construction and operation phase PGCB shall comply with this 3R strategy

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The Forest Act (1927) (Amendment, 2000, 2018) This Act was enacted to control trespass, illegal resources extraction from forests and to provide a framework for the forestry revenue collection system. It is the main legislative context for forestry protection and management in Bangladesh. The Act allows for the notification of forest reserves in which the government, through the Forest Department, regulates the felling, extraction and transport of forestry produce in Bangladesh.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Bangladesh Forest Department	. No permit is required in this case.
National Forest Policy, 1994 The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977. The policy is designed to conserve the existing forest areas, bring about 20 % of the country's land area under the Forestation Program, and increase reserve forests by 10 percent per year to 2015 through coordinated efforts of GoB-NGOs and through active participation of the people. Amendments of the existing laws (acts, rules and regulations) relating to the forestry sector and creation of new laws for sectorial activities have been recognized as important conditions for achieving the policy goals and objectives. The Forestry Policy also recognizes the importance of fulfilling the responsibilities and commitments under International Conventions, Treaties and Protocols (ICTPs).	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Bangladesh Forest Department	Some trees of the project areas need to be cut during the construction phase of the project prior to take permission from Forest Department. The width of RoW for the transmission lines on forest land can be 35m for 230kV and 27m for 132 kV due to felling of minimum trees. Up to 230kV and 132kV twin bundle 2m and 1.5m width respectively clearance below each conductor or conductor bundle can be considered while transmission line pass in the reserved forest. The trees of such strips would have to be felled but after stringing work is completed, natural regeneration will be allowed to come up. Felling/pollarding/pruning of trees will be done with the permission of Forest Department wherever necessary to maintenance of the transmission line.
Bangladesh Wildlife (Conservation & Security) Act, 2012 (previously known as Bangladesh Wildlife (Preservation) Order, 1973; amended as Bangladesh Wildlife (Preservation) Act 1974) This Order aims to protect and conserve wildlife in Bangladesh. Wildlife preservation, conservation and	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	Appropriate mitigative and monitoring measures will be strictly followed during construction and operation periods of the Project in order to protecting and conserving the biological diversity within the country.

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management fall within the jurisdiction of the Forestry Department. The previous Wildlife (Preservation) Order, 1973 & Wildlife (Preservation) (Amendment) Act, 1974 have been revamped to Wildlife (Conservation & Security) Act of 2012. The Act has adopted new types of protected areas for conservation and protection of wildlife resources, created avenue for community conserved areas and also community-based management of protected areas. This Act protects 1,307 species of plants and animals under four schedules that mandates imprisonment and fines for wildlife poaching, capturing, trapping, and trading. Bangladesh Wildlife (Preservation) Order (1973) and Act (1974) regulates the hunting, killing, capture, trade and export of wildlife and wildlife products. It designates a list of protected species and game animals. Protection of wildlife is provided with lists of species within four schedules of the Order: • First Schedule - The Schedule -1 (823) represents Protected Animal (Amphibians-14, reptiles-96, birds-578, mammals-110, fishes-25) of Bangladesh which are open to shooting and may be hunted on a special hunting permit (though since 1988 no hunting permits have been issued by the Government). • Second Schedule – Schedule-2 (424) also represents Protected Animal (Amphibians-18, reptiles-58, birds-44, mammals-3, fishes-27, phylum cnidaria – class anthozoa (coral)-32, molluscs – shells and snails-137, arthropods –crustacea (crabs and lobster)-22, insect (butterflies and moths)-59, Insect – beetles-24 those species that are	Bangladesh Forest Department	

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not to be hunted, killed or captured and CITES Specification; • Third Schedule – Schedule -3 (6) represents Vermin-6Protected animals; and • Fourth Schedule - Schedule -4 (54) represents Protected Plants-41 and Orchid-13. In addition to these, the Government of Bangladesh has declared 14 protected areas and is considering declaring more. Further, the Government of Bangladesh has recently declared seven areas as Ecologically Critical Areas under the Environmental Conservation Act (1995). These are Hakaluki Haor, Sonadia Island, St. Martin's Island, and Teknaf Peninsula (including the Cox's Bazar Sea Beach but not the buffer zones), Tanguar haor, Marjat baor and outside of Sundarbans Reserved Forest for a distance of 10 km.		
Bangladesh Biodiversity Act, 2017 The Act is to ensure conservation of biodiversity, the sustainable use of its components and fair and equitable sharing of benefits arising out of the utilization of genetic resources. This Act regulates the biodiversity conservation and sustainable use of its resources, biota and the fair and equitable share of the benefits derived from their use of and other matters. The Act focuses biodiversity and related activities undertaken and transfer restrictions, approved and rejected applications; functions of the National and Technical Committees on Biological Diversity; Biodiversity management teams, associations and sustainable uses.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Bangladesh Forest Department	PGCB shall ensure the compliance of this Act during laying the transmission lines over/within the forests area.
National Biodiversity Strategy and Action Plan (NBSAP), 2016 – 2021 National Biodiversity Strategy and Action Plan is the basic instrument for implementing the Convention on Biological Diversity (CBD) at the national level. The	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	PGCB shall ensure the compliance of this Act during laying the transmission lines over/within the forests area.

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plan has been prepared in order to fulfill the commitment of Bangladesh towards implementing the three objectives of Convention on Biological Diversity: conservation of biodiversity, the sustainable use of its components and fair and equitable sharing of benefits arising out of the utilization of genetic resources. The first generation NBSAP developed in 2004 took into consideration of the issues of implementation of 2010 biodiversity targets. The updated NBSAP has been prepared in line with CBD strategic planning 2011-2020 (Aichi Biodiversity Targets), and implementation of 20 national targets, etc.	Department of Environment (DoE)	
Protected Area Management Rules 2017 The rules aided by the Wildlife (Conservation and Security) Act, 2012 further stabilized the co-management approaches in the country whereby peoples' engagement and benefits are ensured. This rule guides how to manage PA and institutionalize all of the structure by involving the local government and local community. Guideline clearly delineate the roles and responsibilities, including managing ecosystem services, biodiversity conservation, project planning and budget, awareness raising activities of different committee and forum to manage and maintain the protected areas.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Bangladesh Forest Department	PGCB shall ensure the compliance of this rules while laying the transmission lines
Intended Nationally Determined Contributions, 2015 UNFCCC INDC sets out a number of mitigation actions that will help limit the country's GHG emissions. The INDC of Bangladesh consists of the following elements: ***Mitigation contribution:*** • An unconditional contribution to reduce GHG emissions by 5% from Business as Usual (BAU) levels by 2030 in the power, transport and industry sectors, based on existing resources. • A conditional 15% reduction in GHG emissions from BAU levels by 2030 in	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	PGCB shall ensure the compliance of this Plan during laying the transmission lines and construction of substations.

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the power, transport, and industry sectors, subject to appropriate international support in the form of finance, investment, technology development and transfer, and capacity building. • A number of further mitigation actions in other sectors which it intends to achieve subject to the provision of additional international resources. ***Adaptation component:*** • An outline of what Bangladesh has already done on adaptation and what the next steps are, including the long-term vision for adaptation in Bangladesh and synergies with mitigation measures. ***INDC implementation:*** • Proposals for governance and coordination of INDC implementation and an outline of key next steps. **Support for INDC implementation:** • A qualitative description of Bangladesh's support needs and an outline of plans to further quantify this, along with some examples of indicative costs of taking action on mitigation and adaptation.		
The Electricity Act, 2018 An Act to repeal and re-enact the Electricity Act, 1910 with modification for developing and reforming the sectors of power generation, transmission, supply and distribution and for better service delivery to consumers and meeting the increasing demand for electricity. Subsection 12 of section 3, (1) If any damage, harm or inconvenience is caused while doing civil works under this Act, the licensee shall, in such manner as may be prescribed by rules, pay compensation to the person affected or the owner of the land affected for acquiring land for construction of electricity towers. (2) lf any dispute arises from the amount payable as	Ministry of Power, Energy and Mineral Resources	PGCB shall ensure to take necessary and relevant permission before the commencement of construction work from applicable authorities according to this act.

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compensation under sub-section (1), the provisions of the Commission Act shall apply to settle such dispute. Subsection 27 of section 5, No licensee shall harm or obstruct or interfere with railways, highways, airports, waterways, canals, docks, wharves and jetties and pipes, during power generation, transmission, supply or distribution; and shall, in co-ordination with the concerned authority, take measures for protection and safety of the same. Subsection 28 of section 5, The licensee shall take all logical precautions during construction of power supply lines and doing civil works so as not to have any harmful effect on the communication system of telegraph, telephone or electromagnetic signal emitting lines by way of induction or any other means.		
Electricity Rules, 2020 Electricity Rules has been published by ministry on November 2020 based on Clause 59 of Electricity Act 2018 (SRO 297 of Act/2020) The main observation is to provide compensation for the installation of transmission line towers to the landowners as per the applicable laws and policy.	Ministry of Power, Energy and Mineral Resources	PGCB shall ensure to provide the compensation to project affected persons (PAPs) according to the rules.
Noise Pollution (Control) Rules, 2006 According to Environmental Protection Act, 1995, the government formulated the noise pollution Rules & Regulation in 2006. This regulation recommends keeping the sound level 50dB at the quieter area from 6am until 9pm and at night 40dB, similarly, at residential area on the day of 55dB and at night 45dB, a mixed area, 60dB at day time and at night 50dB, a commercial area on the day of 70dB and at night 60dB and the industrial areas of the day 75dB and at night 70dB.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	PGCB is required to undertake action for noise generation from the operation of construction machinery in order to keep the sound in standard level.
National Energy Policy, 2005 The National Energy Policy (NEP) of Bangladesh was formulated in 1996 to ensure proper exploration, production,	Ministry of Power, Energy and Mineral Resources	PGCB shall ensure following issues under this policy: To provide energy for sustainable economic growth so that the

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distribution and rational use of energy resources to meet the growing energy demands of different zones, consuming sectors and consumers groups on a sustainable basis. With rapid change of global as well as domestic situation, the policy was updated in 2005.		economic development activities of different sectors are not constrained due to shortage of energy; To ensure sustainable operation of the energy utilities; To ensure rational use of total energy sources; To ensure environmentally sound sustainable energy development programs, with due importance to renewable energy, causing minimum damage to environment, etc.
Power System Master Plan, 2010 Power System Master Plan is formulated for the attainment of stable power supply by achieving the 3Es—Economic Growth, Energy Security and Environmental Protection simultaneously. The Government of Bangladesh set the target of reducing poverty in a shortest period of time for achieving high economic growth. Planning electrification via the stabilization and efficiency of the electric power supply system can be expected to reduce poverty. This Master Plan aims to promote development that will provide a self-reinforcing cycle of poverty reduction and 3E simultaneous achievement. In addition, this Master Plan proposed the vision in line with Government energy policy and stipulates 6 value-up plans to achieve the vision.	Ministry of Power, Energy and Mineral Resources	PGCB shall ensure following issues under this policy: To realize a low carbon society by introducing a highly efficient power supply and low CO_2 emission technology.
National Water Management Plan, 2001 (Approved in 2004) • The objectives of the Plan are listed below: • To operationalize directives given in National Water Policy and to do in accordance with the Government approved Development Strategy. • To address issues related to harnessing and development of all	Water Resource Planning Organization (WARPO)	PGCB should ensure implementation of Flood Protection program with provision of embankment of adjacent River, proper maintenance and protection of existing river dykes, drainage sluices, etc. if applicable.

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forms of surface and ground water and management of these resources in an efficient and equitable manner. • Consultation and participation with the direct beneficiaries in the hand over and development of water schemes.		
Bangladesh Water Act, 2013, and Bangladesh Water Rules, 2018 Bangladesh Water Rules, 2018 have been formulated under the Bangladesh Water Act, 2013. The key features of the Act and Rules are: • A National Water Resources Council (NWRC) to be established for implementing the provisions of the Act • A National Water Policy shall be adopted by the Council addressing the following issues: i. Purpose and sectors of water use ii. Affordability of water users iii. Actual cost of water abstraction and distribution iv. Financial ability and backwardness of water users of any group thereof v. Water demand and supply vi. Any other issues considered relevant by GoB • An Executive Committee of the Council shall be established or ensuring efficient performance of the Council. • The GoB can declare certain areas as Water Stress Areas for the protection of water sources or aquifers. • Water zone demarcation (industrial, agricultural, brackish water aquaculture and hatchery water zones) through gazette notification and issuance of protection order for efficient water management in such zones • Declaration of flood control zone and its management.	Water Resource Planning Organization (WARPO)	This Act and Rules was implemented in 2013 and 2018 respectively, and the NWRC and Executive Committee are yet to be formulated. Upon formation of the aforementioned bodies, water stress areas and related provisions may be prescribed. PGCB shall ensure compliance with legal requirements under such provisions.

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• Restriction on abstraction of total water from any water source.		
Ground Water Management Ordinance, 1985 As per the provisions as per schedule 5 of this act, no tube well shall be installed in any place without a license granted by the Union Parishad. Also, no application shall be entertained by the Union Parishad unless it is accompanied by such fee as may be prescribed under the requirements of this ordinance.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh	PGCB should ensure that no tube-well shall be installed in any place without a license granted by the Union Parishad. PGCB should furnish the following information: • the aquifer condition of the soil where the tube-well is to be installed; • The distance of the nearest existing tube-well; • The area likely to be benefited by the tube-well; • The likely effect on the existing tube-wells including tube wells used for domestic purpose; • The suitability of the site for installation of the tube-well; and • The conditions on which a license, if any, may be granted.
The National Fisheries Policy, 1999 The objectives of the fisheries policy are: • Enhancement of the fisheries production; • Poverty alleviation through creation of self-employment and improvement of socio-economic conditions of the fishermen; • Fulfilling the demand for animal protein; • Achieve economic growth through earning foreign currency by exporting fish and fisheries products; and • Maintain ecological balance, conserve biodiversity, ensure public health and provide recreational facilities. The policy broadly aims at fisheries development, regulation of aquaculture,	Ministry of Fisheries and Livestock (MoFL) Department of Fisheries (DoF)	PGCB shall ensure that during construction work no fish habitats will be affected.

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biodiversity conservation and formulation of laws to ban the disposal of any untreated industrial effluents into the water bodies.		
Protection and Conservation of Fish Act, 1950 as amended through February 16, 1995 This Act was promulgated for conservation of fish in Bangladesh and their protection against indiscriminate fishing, poisoning due to industrial effluent disposal into the water, oil spills, etc.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Department of Fisheries (DoF)	PGCB shall ensure compliance with provisions mandated under this Act.
Protection and Conservation of Fish Rules, 1985 The Rules were prescribed under the provisions of Protection and Conservation of Fish Act. It provides the regulations for prohibition of fishing during certain periods, licenses for catching fishes, prevention of fish destruction due to explosives and industrial effluent disposal etc.	Ministry of Environment, Forests and Climate Change (MoEFCC), Bangladesh Department of Fisheries (DoF)	BPDB shall ensure that untreated effluent is not disposed into the river. The treated effluent shall comply with the discharge standards stipulated under the ECR.
Bangladesh National Building Code, 2006 The provisions of this Code are applicable to the design, construction, use or occupancy, alternation, moving, demolition and repair of any building or structure and to any appurtenances installed therein or connected or attached with the building/structure. The Code also sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen during construction. With relation to this, the Code set out the details about the different safety tools of specified standard. The general duties of the employer to the public as well as workers are also stipulated in the BNBC.	Ministry of Housing and Public Works	The implication of this legal binding in this proposed Project arises from the safety of public and workers in relation to the construction of 132kV/230kV power transmission lines and substations aim to evacuate the power from generation and install 33kV bay within the substation for the distribution entity for the end users.
The Building and Construction Act, 1952 • As per Section 3A of this act, no owner or occupier of a building shall, without obtaining previous permission from the Authorized Officer or the Committee	Authorized Officer or Committee	PGCB shall ensure that no building or tank shall be constructed without prior permission from the Authorized Officer or Committee of the area.

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use the building for the purpose other than that mentioned in the sanction. • All the construction, re-construction works to be undertaken as per terms or conditions prescribed.		
The Vehicle Act, 1927 • As per section 4 of this act, no owner or person in charge of a vehicle shall allow any person under the age of eighteen years to drive the same in any public place. • As per section 7, no person shall drive a vehicle in a public place unless he is licensed in the prescribed manner. • Every vehicle must possess a valid registration certificate as per section 11 of this act.	Bangladesh Road Transport Authority (BRTA)	PGCB shall ensure that every vehicle possess a certification of registration as required under this act.
The Motor Vehicle Ordinance Act, 1983 (*as modified on November, 1990*) • As per section 3 of the ordinance, no person shall drive a motor vehicle in any public place unless he holds an effective driving license. • No person under the age of eighteen years shall drive a motor vehicle in any public place.	Bangladesh Road Transport Authority (BRTA)	PGCB shall ensure that no person shall drive a motor vehicle in any public place unless he holds an effective driving license issued to himself authorizing him to drive the vehicle.
Fatal Accidents Act, 1855 This Act was promulgated to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong. The company will be liable to pay compensation in case of death of any worker/employee or damages in case death has not ensued, but such circumstances could have resulted in death.	Ministry of Labor and Employment	PGCB shall ensure compliance to the Rules.
Bangladesh Labour Act, 2006 (*as amended through July 22, 2013 and November 2018*) **Bangladesh Labor Rules, 2015** The provisions prescribed under chapters pertaining to occupational health and safety, and compensations due to accidents are entailed below. ***Chapter V: Health and Hygiene***	Ministry of Labor and Employment	PGCB shall ensure compliance to the Bangladesh Labour Act, 2006 (as amended through July 22, 2013 and November 2018) Bangladesh Labor Rules, 2015 PGCB shall also ensure that all conditions provided in chapters V, VI, VII and VIII of the Act, pertaining

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The chapter deals with provisions regarding cleanliness of the any facility, drinking water supply, ventilation, lighting, dust bean and spittoons, etc. ***Chapter VI: Safety*** This chapter addresses the issues regarding safety of building and machinery, precautions in case of fire, fencing of machinery, works on or near machinery in motion, hoists and lifts protection of eyes, explosive or inflammable dust/gas, etc. ***Chapter VII: Special Provisions related to Health, Hygiene and Safety*** This chapter deals with provisions to be taken in case of hazardous operations, notice to be given in accidents, notice of certain dangerous occurrences and diseases etc. ***Chapter VIII: Welfare*** This chapter prescribes the provisions to be facilitated in the facility regarding first-aid appliances, safety record books, washing facilities, canteens, shelters, rooms for children, etc. This Act consolidates and amends the laws relating to employment of labor, relations between workers and employers, determination of minimum wages, payment of wages and compensation for injuries to workers, formation of trade unions, raising and settlement of industrial disputes, health, safety, welfare and working conditions of workers, apprenticeship and matters connected therewith. The provisions prescribed under chapters pertaining to labour benefits and entitlements are as follows: • Conditions of Service and Employment • Employment of Adolescent • Maternity Benefit • Working Hours and Leave • Wages and Payment • Workmen's Compensation for Injury by Accidents		to Health, hygiene safety and welfare are met in accordance with the amended act. During the construction and operation phases of the proposed Project, PGCB shall ensure the facilitation of the following provisions: • Management of workers under service rules as approved by the Chief Inspector. • Provision of Letter of Appointment and ID card (with photograph) for each and every worker. • Maintenance of Service Book with the requisite details. • Retrenchment Policy and conditions of re-employment of retrenched workers, termination of employment etc. • Provisions regarding gratuity, provident fund and other payments at the time of retirement of workers. • Any adolescent employed in any dangerous operation shall be in possession of Certificate of Fitness issued by a registered medical practitioner. • Maternity benefits shall be paid as stipulated in the Act. • Cleanliness of the facility through washing, painting and varnishing etc. for ensuring hygiene. • Ventilation and removal dusts and fumes through adequate number of exhaust systems. • Adequate number of drinking water facilities equipped with cooling systems at convenient

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• Trade Unions and Industrial Relations		places in the unit. Al such places shall be legibly marked 'Drinking water' in Bangla. • Separate and adequate number of latrines and urinals for men and women. They shall be maintained in a clean and sanitary condition at all times with suitable detergents and disinfectants. • Leave Policy stating the working hours and the number of leaves the workers are entitled to under the provisions of the Act. • Compensation/wages shall be stated in the Letter of Appointment given to the workers/employees. • PGCB shall ensure that there is no policy restricting the association of workers'/trade unions. • Workmen's Compensation Policy stating the compensation to be meted out in case of injury due to accidents. Safety of workers engaged in loading and unloading of industries as per prescribed provisions.
National Land-Use Policy, 2001 The Government of Bangladesh has adopted National Land Use Policy, 2001. The silent features of the policy objectives relevant to the proposed are as follows: To prevent the current tendency of gradual and consistent decrease of cultivable land for the production of food to meet the demand of expanding population; To ensure that land use is in harmony with natural environment; To use land resources in the vest possible way and to play supplementary role in	Ministry of Land, Bangladesh	The proposed transmission lines and substations would be constructed mostly on the agricultural land; and then salt cultivation land, hill, forests, etc. However, the land will be used in manner that the existing national land use policy is adhered.

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controlling the consistent increase in the number of land less people toward the elimination of poverty and the increase of employment; To protect natural forest areas, prevent river erosion and destruction of hills; To prevent land pollution; and To ensure the minimal use of land for construction of both government and non-government buildings.		
National Child Labor Elimination Policy, 2010 The National Child Labor Elimination Policy 2010 has been adopted to provide a framework towards eradicating all forms of child labor by 2015. The policy defines and lays guidelines for underage workers, regulation of their working hours, wages, nutrition needs, mental health, education and overall work environment. As per the policy, a child is a person under the age of 14. A person between the ages of 14 and 18 is an adolescent, and should be granted special amendments, if compelled to work due to poor economic status. The policy also entails that a child may not be employed as a regular employee, not be made to work in hazardous settings, provided breaks more frequent than those for regular employees and have enough time left for study.	Ministry of Labor and Employment Ministry of Women and Child Welfare	During all stages concerning employment of labor, PGCB should take the policy as a guidance document for following ethical practices at workplace, in dealing with adolescent workers, if at all.
Children's Act, 2013 (Act No. 24 of 2013). The Act implements the Nation's ratification to the UN Convention on the Rights of the Child (CRC) and replaces The Children's Act of 1974. The main components of the act are as follows: • The Act changes the legal definition of a child from being a person under the age of 14 to one under the age of 18. • It enforces the national authorities to establish Child Welfare Boards in each	Ministry of Law, Justice and Parliamentary Affairs. District Commissioner's Office.	PGCB will ensure that at through all stages of construction and operation, no juvenile (children between ages 14 and 18) is engaged on site.

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District, besides one at the national level. • It criminalizes any kind of cruelty inflicted on children while they are working in both the formal and informal sectors. • The Act further prescribes stricter punishments for using or exploiting children in begging, in brothels, and in carrying drugs, arms, or other illegal commodities.		
The Acquisition and Requisition of Immovable Property Act 2017 The ordinance consolidates and amends the laws relating to acquisition and requisition of immovable property by the government. It lays down the procedures and conditions for acquisition of land and other immovable properties such as common property resources (wells, places of worship, burial grounds, etc.).	Ministry of Land, Bangladesh	The land for the construction of substations need acquisition and hence a resettlement action plan (RAP) has been prepared. There is no structure on the land proposed substations. However, PGCB shall ensure the compliance with provisions of this ordinance relating to compensation if applicable.
Chittagong Hill Tracts (Land Acquisition) Regulation (Amendment) Act, 2019 The below sub-section will be applicable in place of sub-section (2) of section-4 under Chittagong Hill Tracts (Land Acquisition) Regulation, 1958 (Regulation No.1 of 1958). (2) In addition to the market value of the land, as provided above, the Deputy Commissioner shall, in every case, award a sum of 200 (two hundred) per centum for public purpose and 300 (three hundred) per centum for private purpose on such market value, in consideration of the compulsory nature of the acquisition. In addition, Chittagong Hill Tracts (Land Acquisition) Regulation (Amendment) Ordinance, 2018 has been ban according to this amendment.	Ministry of Land, Bangladesh	There is no indigenous or ethnic community at or near the study area. However, PGCB should ensure the compliance with provisions of the act if applicable.

Summary of Applicable legislation/ Policy	Responsible Agency	Applicable Permit and Requirements
National River Conservation Commission Act, 2013 An Act to establish a Commission for preventing illegal occupation of rivers, pollution of water and environment, pollution of rivers caused by industrial factories, illegal constructions and various irregularities and ensuring multidimensional use of rivers for socio-economic development including restoration of the normal flow of rivers, proper maintenance thereof and making them navigable.	Ministry of Shipping	PGCB ensures the compliance of this act during crossing the transmission lines over the river and footing the towers on riverbank.
Embankment and Drainage Act, 1952 The Act consolidates the laws relating to embankments and drainage providing provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion, or other damage by water. The specific Sections and Articles relevant to the RMIP are mentioned below. • Section 4 (1) of the Act states that the embankment, watercourse, and tow-path, earth, pathways, gates, berms and hedges of the embankments shall vest in the Government of the Authority (BWDB). • Section 56 (1) states that, person will be subject to penalty (500 taka or imprisonment… if he erects, or causes of willfully permits to be erected, any new embankment, or any existing embankment, or obstructs of diverts, or causes or willfully permits to be obstructed or diverted, any water course. • Section 15 allows for the engineer (engineer in charge of Divisional level BWDB) for constructing new embankment or enlarging, lengthening or repairing existing embankments. • The other sections of the Act give powers and access to the Government or Authority or Engineers to commence necessary Project activities, for land acquisition	Ministry of Water Resources	Applicable due to site location. PGCB ensures the compliance of this act during crossing the transmission lines over the river and footing the towers on riverbank.

Summary of Applicable legislation/ Policy	Responsible Agency	Applicable Permit and Requirements
(through the Deputy Commissioner), and site clearing activities including removal of trees or houses (if necessary).		
The Civil Aviation Authority Ordinance, 1985 As per section 11 of the ordinance, only Civil Aviation Authority have control over: • All the civil airports and aerodromes in Bangladesh including their planning, construction, operation and maintenance; • All air routes in Bangladesh; • Air space management of civil airports and aerodromes.	Civil Aviation Authority, Bangladesh (CAAB)	The height of the tower may require clearance from CAAB. PGCB shall ensure compliance with rules made under this ordinance if necessary.
The Highways Act, 1925 (amended 2001) As per section 8 of the act, no person, without written permission form the Department, shall- (a) take possession or use any part of the slope, Berm, borrow pit of any highway. (b) construct or change any structure, dig of fill earth or cultivate or plant or undertake any works on or under any part of a highway or within ten meters of the highway. (c) deposit of place goods or materials on a highway.	Roads and Highway Department (RHD)	PGCB shall ensure to take permission for crossing transmission lines over the highways.
Fire Prevention and Extinction Rules, 1961; Fire Prevention and Extinction Act, 2003 and Rules, 2014 The Fire Prevention and Extinction Act 2003 is supplemented by the Fire Prevention and Extinction Rules 2014 which enumerates that owner of the building shall have to apply for occupancy certificate of the building at the end of the construction (Rule 22). These enable the authority to inspect the building, to examine whether the owner met all the requirements of the building code for the public safety or not.	Bangladesh Fire Service and Civil Defense	PGCB should ensure the compliance with the rules for the construction of substations.
Antiquities Act, 1968 and Antiquities Preservation Rules, 1986	Ministry of Cultural Affairs	Not applicable as the study area does not have any likely cultural heritage or ancient monuments of

Summary of Applicable legislation/ Policy	Responsible Agency	Applicable Permit and Requirements
These legislations govern preservation of the national cultural heritage, protects and controls ancient monuments, regulates antiquities as well as the maintenance, conservation and restoration of protected sites and monuments, controls planning, exploration and excavation of archaeological sites		national or international significance. However, in case, any such evidence of archaeological findings arises, the Project will act in consonance to the Act

The key permits required to be obtained by PGCB for the construction and operations of the proposed project are set out in Table 10.

Table 10: Key Permits Required for the Project

SN	Type of Permits	Permitting Authority	Relevant Legislation	Role of Permit	Permission Schedule
1.	Environmental Clearance Certificate (ECC)	Director General, DOE	Environment Conservation Rules, 1997	Authorization to operate the project facilities with limited environmental effects of development and operation of the proposed Project.	Prior to Operation Work
2.	Installation of a Tube-well	Union/ Upazila Parishad/DPH	Ground Water Management Ordinance 1985	Installation of tube-well in any place within the substations.	Prior to Construction Work
3.	No Objection Certificate (NOC) from Union Parishad	Union Parishad/Upazila DC office	Environment Conservation Rules, 1997	A consent in form of NOC from respective Union Parishad	Prior to Construction Work
4.	No Objection Certificate (NOC) from Railway	Ministry of Railway	The Electricity Act 2018 Bangladesh Electricity Rules, 2020	Apply for NOC for crossing the transmission lines over the railway	Prior to Construction Work
5.	No Objection Certificate (NOC) from Forest Department	Bangladesh Forest Department	The Forest Act (1927) (Amendment, 2000)	Apply for NOC for felling the trees due to crossing the transmission lines within the forest	Prior to Construction Work

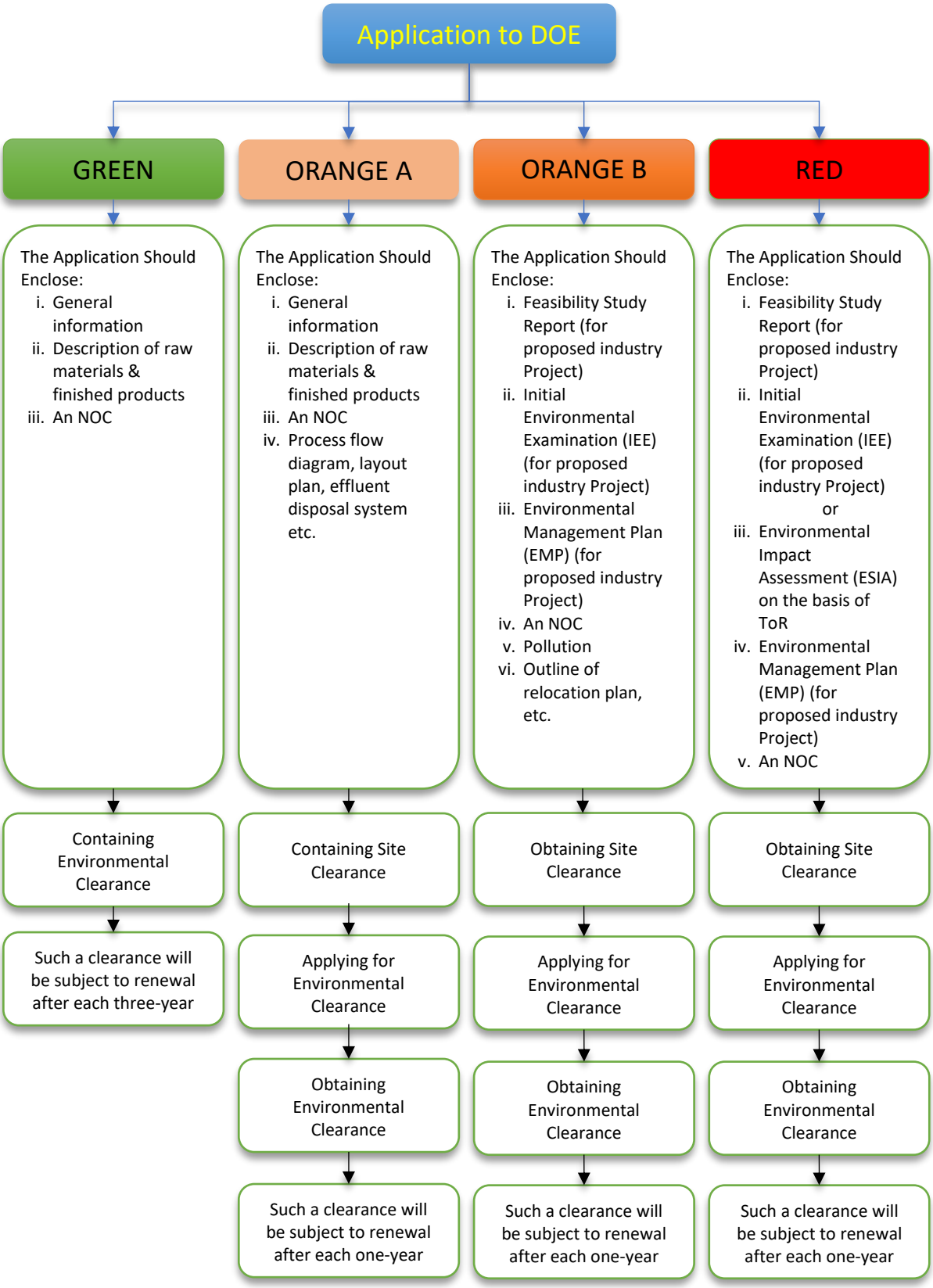


Figure 5: DOE Environmental Clearance Applicability and Procedure

2.4 AIIB Environmental and Social Framework

The proposed project is being financed by AIIB and therefore its Environmental and Social Framework will be applicable to the project.

2.4.1 Objectives of AIIB's Environmental and Social Framework

The objectives of the AIIB's environmental and social framework (ESF) are:

- Reflect institutional aims to address environmental and social risks and impacts in Projects.
- Provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to Projects' environmental and social risks and impacts.
- Ensure the environmental and social soundness and sustainability of Projects.
- Support integration of environmental and social aspects of Projects into the decision-making process by all parties.
- Provide a mechanism for addressing environmental and social risks and impacts in Project identification, preparation and implementation.
- Enable Clients to identify and manage environmental and social risks and impacts of Projects, including those of climate change.
- Provide a framework for public consultation and disclosure of environmental and social information in relation to Projects.
- Improve development effectiveness and impact to increase results on the ground, both short- and long-term.
- Support Clients, through Bank financing of Projects, to implement their obligations under national environmental and social legislation (including under international agreements adopted by the member) governing these Projects.
- Facilitate cooperation on environmental and social matters with development partners.

2.4.2 Key Elements of Environmental and Social Framework

Overarching Policy
The objective of this overarching policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects. The overarching policy comprises Environmental and Social Policy (ESP), and Environmental and Social Standards (ESSs).

Environmental and Social Policy
The ESP sets out mandatory requirements for the Bank and its Clients relating to identification, assessment and management of environmental and social risks and impacts associated with Projects supported by the Bank.

Environmental and Social Standards
The environmental and social standards (ESSs) set out more detailed mandatory environmental and social requirements, as described below.

Environmental and Social Standard 1 (ESS 1)

The ESS-1 aims to ensure the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. The ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the Bank.

Environmental and Social Standard 2 (ESS 2)

The ESS 2 is applicable if the Project's screening process reveals that the Project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project). Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent or temporary. The ESS 2 defined detailed requirements of resettlement planning of the projects involving involuntary resettlement.

Environmental and Social Standard 3 (ESS 3)

The ESS 3 is applicable if Indigenous Peoples are present in, or have a collective attachment to, the proposed area of the Project, and are likely to be affected by the Project. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (b) collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories; (c) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (d) a distinct language, often different from the official language of the country or region. In considering these characteristics, national legislation, customary law, and any international conventions to which the country is a party may be taken into account. A group that has lost collective attachment to geographically distinct habitats or ancestral territories in the Project area because of forced severance remains eligible for coverage, as an Indigenous People, under ESS 3. The ESS 3 defines the detailed requirements of People planning, in case such groups are present in the project area and are likely to be affected by the project. However, this ESS3 is not applied at this stage as census and stakeholder engagement with different stakeholders has confirmed that no IP communities will be directly or indirectly affected. If IP's are identified in detailed design stage, this ESS 3 will apply and adequate mitigation measures will be taken.

2.4.3 Applicability of ESF for proposed project

The applicability of ESP and ESSs for the proposed project is presented in Table 11.

Table 11: Environmental and Social Standards (ESS) for AIIB

Environmental and Social Standards		Applicability	Triggering Status
ESS 1	Environmental and Social Assessment and Management	ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both)	Yes, since the proposed project is likely to have negative environmental and social impacts. The present ESIA has been conducted in response to the ESS 1.
ESS 2	ESS 2 is applicable if the project is likely to cause involuntary resettlement impacts.	ESS 2 is applicable if the project is likely to cause involuntary resettlement impacts.	Yes. The project involves disruption of economic activities during the construction phase in the underground section of the transmission line which are temporary and reversible in nature. Some impacts on structures are also envisaged in the overhead section of the transmission line. Given such impacts, though low intensity in nature, ESS 2 is triggered.
ESS 3	ESS 3 is applicable if Indigenous People are present in the project area and they are likely to be affected by the project.	ESS 3 is applicable if Indigenous People are present in the project area and they are likely to be affected by the project.	No, since no Indigenous People (IP), as defined in the ESS 3 are present in the project area or project influenced area. The community in the project area are local permanent residence of Bangladesh. Migrated Rohingya people of Myanmar are observed in the Teknaf area.

2.4.4 Categorization of the Projects

All AIIB-financed projects are required to be screened and categorized in order to determine the nature and level of the required environmental and social reviews and assessment, type of information disclosure and stakeholder engagements for the respective project. The project's category is determined by the category of the project's component that presents the highest environmental or social risk, including direct, indirect, cumulative, and induced impacts, as relevant, in the project area.

Table 12: AIIB Screening and Categorization for Projects

Category	Justification	Applicability for the Proposed Project
Category A	A project is categorized as 'Category A' if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented.	Considering the potential negative and positive environmental and social impacts of this proposed project and their management, it is appropriate to fit the Project into Category A under AIIB ESF categorization.
Category B	A project is categorized as 'Category B' when it has a limited number of potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the project area; and can be successfully managed using good practice in an operational setting.	

Category	Justification	Applicability for the Proposed Project
Category C	A project is categorized as 'Category C' when it is likely to have minimal or no adverse environmental and social impacts.	Not Applicable
Category FI	A Project is categorized FI if the financing structure involves the provision of funds to or through a financial intermediary (FI) for the project, whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed sub-projects.	Not Applicable

A Project is categorized A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works and may be temporary or permanent in nature. AIIB requires PGCB to conduct an environmental and social impact assessment (ESIA) or equivalent environmental and social assessment, and to prepare an ESMP, which is included in the ESIA report for the Project. The ESIA for a Category A Project examines the Project's potential negative and positive environmental and social impacts, compares them with those of feasible alternatives (including the "without Project" situation), and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental and social performance of the Project.

Under local Bangladesh regulations, the proposed project falls under the Orange B Category according to the national law (ECR 1997, Amendment 2017), an IEE has already been prepared and submitted to DOE to meet the condition of the national law. However, DOE provided the environmental clearance to the PGCB for the implementation of the project.

2.4.5 Applicable World Bank Group EHS Guidelines

The Equator Principle III requires follow up of the environmental, health and safety requirements as per the following guidelines released by International Finance Cooperation (IFC) on 30th April 2007. These guidelines ensure that the Projects are developed in a manner that is socially responsible and reflects sound environmental management practices. EHS considerations into the site selection and plant design processes should be considered in order to maximize the range of options available to prevent and control potential negative impacts.

1. Environmental, Health, and Safety General Guidelines.
2. Environmental, Health, and Safety Guidelines for Electric Power Generation and Distribution.

The key requirements stated in the EHS guidelines have been discussed in Table 13.

Table 13: Key Requirements as per EHS Guidelines of IFC

SN	Relevant Requirements as Stated in EHS Guidelines
	ENVIRONMENTAL
A.	**Terrestrial Habitat Alteration**
1.	**Construction of Right-of-Way (RoW)**
a)	Site transmission and distribution rights-of-way, access roads, lines, towers, and substations to avoid critical habitat through use of existing utility and transport corridors for transmission and distribution, and existing roads and tracks for access roads, whenever possible[4];
b)	Installation of transmission lines above existing vegetation to avoid land clearing;
c)	Avoidance of construction activities during the breeding season and other sensitive seasons or times of day;
d)	Revegetation of disturbed areas with native plant species;
e)	Removal of invasive plant species during routine vegetation maintenance;
2.	**Right-of-Way Maintenance**
a)	Implementation of an integrated vegetation management approach (IVM). The selective removal of tall-growing tree species and the encouragement of low-growing grasses and shrubs is the common approach to vegetation management in transmission line rights-of-way. Alternative vegetation management techniques should be selected based on environmental and site considerations including potential impacts to non-target, endangered and threatened species[5];
b)	Removal of invasive plant species, whenever possible, cultivating native plant species;
c)	Scheduling activities to avoid breeding and nesting seasons for any critically endangered or endangered wildlife species;
d)	Observing manufacturer machinery and equipment guidelines, procedures with regard to noise, and oil spill prevention and emergency response;
e)	Avoiding clearing in riparian areas;
f)	Avoiding use of machinery in the vicinity of watercourses.
3.	**Forest Fires**
a)	Monitoring right-of-way vegetation according to fire risk
b)	Removing blowdown and other high-hazard fuel accumulations
c)	Time thinning, slashing, and other maintenance activities to avoid forest fire seasons;
d)	Disposal of maintenance slash by truck or controlled burning. Controlled burning should adhere to applicable burning regulations, fire suppression equipment requirements, and typically must be monitored by a fire watcher;
e)	Planting and managing fire resistant species (e.g., hardwoods) within, and adjacent to, rights-of-way;
f)	Establishing a network of fuel breaks of less flammable materials or cleared land to slow progress of fires and allow firefighting access.
4.	**Avian and Bat Collisions and Electrocutions**

[4] Considering potential for electrical interference with telecommunication lines and railway lines due to mutual induction.

[5] Mowing with heavy-duty power equipment may be used to control growth of ground covers and prevent the establishment of trees and shrubs in the right-ofway. Herbicides, in combination with mowing, may control fast-growing weedy species that have a potential to mature to heights over those permitted within the right-of-way. Trimming and pruning may be utilized at the boundaries of rights-of-way to maintain corridor breadth and prevent the encroachment of tree branches. Hand removal or removal of vegetation, while labor intensive, may be used in the vicinity of structures, streams, fences, and other obstructions which make the use of machinery difficult or dangerous.

SN	Relevant Requirements as Stated in EHS Guidelines
a)	Aligning transmission corridors to avoid critical habitats (e.g., nesting grounds, heronries, rookeries, bat foraging corridors, and migration corridors);
b)	Maintaining 1.5 meter (60-inch) spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware
c)	Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents (e.g., insulated" V's"), changing the location of conductors, and / or using raptor hoods;
d)	Considering the installation of underground transmission and distribution lines in sensitive areas (e.g., critical natural habitats);
e)	Installing visibility enhancement objects such as marker balls, bird deterrents, or diverters.
5.	**Water consumption and aquatic habitat alteration**
a)	Reduction of maximum through-screen design intake velocity to 0.5 ft/s
b)	For freshwater rivers or streams intake flow should be sufficient to maintain resource use (i.e., irrigation and fisheries) as well as biodiversity during annual mean low flow conditions.
c)	Reduction of impingement and entrainment of fish and shellfish by the installation of technologies such as barrier nets (seasonal or year-round), fish handling and return systems, fine mesh screens, wedge wire screens, and aquatic filter barrier systems.
d)	Designing the location of the intake structure in a different direction or further out into the water body may also reduce impingement and entrainment.
B.	**Aquatic Habitat Alternation**
a)	Site power transmission towers and substations to avoid critical aquatic habitat (e.g., watercourses, wetlands, and riparian areas), as well as fish spawning habitat, and critical fish over-wintering habitat;
b)	Maintaining fish access when road crossings of watercourses are unavoidable by utilizing clear span bridges, open-bottom culverts, or other approved methods
c)	Minimizing clearing and disruption to riparian vegetation
1.	**Marine Habitat Alteration**
a)	Locating and siting cable routes, and shore access, to avoid critical marine habitats (e.g., breeding grounds and eelgrass) and coral reefs;
b)	Burying submarine cables when traversing sensitive intertidal habitat;
c)	Monitoring cable laying path for presence of marine mammals;
d)	Avoiding laying submarine cable during fish and marine mammals breeding periods, calving periods, and spawning seasons.
C.	**Electric and Magnetic Fields (EMF)**
a)	Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure
b)	Considering siting new facilities so as to avoid or minimize exposure to the public. Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g., schools or offices), should be avoided
c)	If EMF levels are confirmed or expected to be above the recommended exposure limits, application of engineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers. Examples of these techniques include: ○ Shielding with specific metal alloys

SN	Relevant Requirements as Stated in EHS Guidelines
	○ Burying transmission lines ○ Increasing height of transmission towers ○ Modifications to size, spacing, and configuration of conductors
D.	**Hazardous Materials**
1.	**Insulating Oils and Fuels**
a)	Replacing existing transformers and other electrical equipment containing PCB, and ensuring appropriate storage, decontamination, and disposal of contaminated units;
b)	Prior to final disposal, retired transformers and equipment containing PCB should be stored on a concrete pad with curbs sufficient to contain the liquid contents of these containers should they be spilled or leaked. The storage area should also have a roof to prevent precipitation from collecting in the storage area. Disposal should involve facilities capable of safely transporting and disposing of hazardous waste containing PCB
c)	Surrounding soil exposed to PCB leakage from equipment should be assessed, and appropriate removal and / or remediation measures should be implemented.
2.	**Wood Preservatives**
a)	Consider use of alternative preservatives (e.g., copper azote)
b)	Evaluating the cost and benefit of using alternative pole materials (e.g., steel, concrete, and fiberglass)
c)	Undertake appropriate disposal of used poles. Landfill facilities should be capable of handling wastes that may have chemical leaching properties. Disposal through incineration or through recycling should consider associated air emissions and secondary product residues of preservative chemicals
3.	**Pesticides**
d)	Provide those responsible for deciding on pesticides application with training in pest identification, weed identification, and field scouting;
e)	Use mechanical weed control and / or thermal weeding
f)	Support and use beneficial organisms, such as insects, birds, mites, and microbial agents, to perform biological control of pests
g)	Protect natural enemies of pests by providing a favorable habitat, such as bushes for nesting sites and other original vegetation that can house pest predators;
h)	Use animals to graze areas and manage plant coverage;
i)	Use mechanical controls such as traps, barriers, light, and sound to kill, relocate, or repel pests
	OCCUPATIONAL HEALTH AND SAFETY
A.	**Live Power Lines**
a)	Only allowing trained and certified workers to install, maintain, or repair electrical equipment
b)	Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines;
c)	Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards. Qualified or trained employees working on transmission or distribution systems should be able to achieve the following: ○ Distinguish live parts from other parts of the electrical system ○ Determine the voltage of live parts ○ Understand the minimum approach distances outlined for specific live line voltages ○ Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system

SN	Relevant Requirements as Stated in EHS Guidelines
d)	Workers should not approach an exposed energized or conductive part even if properly trained unless: ○ The worker is properly insulated from the energized part with gloves or other approved insulation; or, ○ The energized part is properly insulated from the worker and any other conductive object; or, ○ The worker is properly isolated and insulated from any other conductive object (live-line work).
e)	Where maintenance and operation are required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined in a health and safety plan
f)	Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities;
g)	Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.
B.	**Working at height on poles and structures**
a)	Testing structures for integrity prior to undertaking work;
b)	Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;
c)	Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point
d)	Installation of fixtures on tower components to facilitate the use of fall protection systems;
e)	Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached
f)	Hoisting equipment should be properly rated and maintained and hoist operators properly trained;
g)	Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;
h)	When operating power tools at height, workers should use a second (backup) safety strap
i)	Signs and other obstructions should be removed from poles or structures prior to undertaking work
j)	An approved tool bag should be used for raising or lowering tools or materials to workers on structures
C.	**Electric and magnetic fields**
a)	Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities;
b)	Training of workers in the identification of occupational EMF levels and hazards;

SN	Relevant Requirements as Stated in EHS Guidelines
c)	Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
d)	Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE). Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g., 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.
D.	**Exposure to chemicals**
a)	Train personnel to apply pesticides and ensure that personnel have received the necessary certifications, or equivalent training where such certifications are not required;
b)	Respect post-treatment intervals to avoid operator exposure during reentry to crops with residues of pesticides;
c)	Ensure hygiene practices are followed (in accordance with FAO and PMP) to avoid exposure of family members to pesticides residues
	COMMUNITY HEALTH AND SAFETY
A.	**Electrocution**
a)	Use of signs, barriers (e.g., locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment;
b)	Grounding conducting objects (e.g., fences or other metallic structures) installed near power lines, to prevent shock.
B.	**Electromagnetic Interference**
a)	The corona of overhead transmission line conductors and high frequency currents of overhead transmission lines may result in the creation of radio noise. Typically, transmission line rights-of-way and conductor bundles are created to ensure radio reception at the outside limits remains normal. However, periods of rain, sleet or freezing rain sharply increases the streaming corona on conductors and may affect radio reception in residential areas near transmission lines.
C.	**Visual Amenity**
a)	Extensive public consultation during the planning of power line and power line right-of-way locations;
b)	Accurate assessment of changes in property values due to power line proximity;
c)	Siting power lines, and designing substations, with due consideration to landscape views and important environmental and community features;
d)	Location of high-voltage transmission and distribution lines in less populated areas, where possible;
e)	Burying transmission or distribution lines when power must be transported through dense residential or commercial areas
D.	**Noise and Ozone**
a)	The acoustic noise produced by transmission lines is greater with high voltage power lines (400-800 kilo volts [kV]) and even greater with ultra-high voltage lines (1000 kV and higher). Noise

SN	Relevant Requirements as Stated in EHS Guidelines
	from transmission lines reaches its maximum during periods of precipitation, including rain, sleet, snow or hail, or as the result of fog. The sound of rain typically masks the increase in noise produced by the transmission lines, but during other forms of precipitation (e.g., snow and sleet) and fog, the noise from overhead power lines can be troubling to nearby residents.
b)	Measures to mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors to the extent possible. Use of noise barriers or noise canceling acoustic devices should be considered as necessary
E.	**Aircraft Navigation Safety**
a)	Avoiding the siting of transmission lines and towers close to airports and outside of known flight path envelopes;
b)	Consultation with regulatory air traffic authorities prior to installation;
c)	Adherence to regional or national air traffic safety regulations;
d)	Use of buried lines when installation is required in flight sensitive areas

2.5 International and National Environment Standards/Guidelines

Bangladesh and World Bank environmental standards and guidelines relevant to the construction and operation of the plant cover the following issues[6]:

- Atmospheric emissions and ambient air quality;
- Water Quality;
- Liquid effluent discharges to the aquatic environment;
- Noise emissions and ambient noise levels.

2.5.1 Ambient Air Quality Standards

As per IFC EHS Guidelines "the ambient air quality standards are ambient air quality levels established and published through national legislative and regulatory processes and ambient quality guidelines refer to ambient quality levels primarily developed through clinical, toxicological, and epidemiological evidence (such as those published by the World Health Organization-WHO)". The current Air Quality Guidelines are:

Table 14: Ambient Air Quality Guidelines

Parameter	Averaging Period	Guideline value in µg/m^3
Sulphur Dioxide (SO_2)	24-hours	125 (Interim Target-1)
		50 (Interim Target-2)
		20 (Guideline)
	10-minutes	500 (Guideline)
Nitrogen dioxide (NO_2)	1-year	40 (Guideline)
	1-hour	200 (Guideline)

[6] When host country regulations differ from the levels and measures presented in the EHS Guidelines, Project is expected to achieve whichever is more stringent.

Parameter	Averaging Period	Guideline value in µg/m^3
Particulate Matter PM_{10}	1-year	70 (Interim Target-1)
		50 (Interim Target-2)
		30 (Interim Target-3)
		20 (Guideline)
	24-hours	150 (Interim Target-1)
		100 (Interim Target-2)
		75 (Interim Target-3)
		50 (Guideline)
Particulate Matter $PM_{2.5}$	1-year	35 (Interim Target-1)
		25 (Interim Target-2)
		15 (Interim Target-3)
		10 (Guideline)
	24-hours	75 (Interim Target-1)
		50 (Interim Target-2)
		37.5 (Interim Target-3)
		25 (Guideline)
Ozone	8-hours daily	160 (Interim Target-1)
	Maximum	100 (Guideline)

** Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines*

As per the provisions of Rules 12 and 13 of the ECR 1997, the MoEFCC is responsible for laying down environmental quality standards (pertaining to air, water, sound, odour and other components) and standards for discharge and emission of waste. Ambient air quality standards have been stipulated in Schedule 2 (Standards for Air) of the Rules. However, these standards were revised by MoEFCC in 2005. The revised standards have been illustrated in Table 15**.**

Table 15: Air quality Standards of Bangladesh (2005)

Pollutant	Averaging Time	Concentration
Carbon Monoxide (CO) (mg/m^3)	8 hours	10 (9 ppm)
	1 hour	40 (35 ppm)
Lead (Pb) (µg/m^3)	Annual	0.5
Oxides of Nitrogen (NO_x) (µg/m^3)	Annual	100 (0.053 ppm)
Sulphur dioxide (SO_2) (µg/m^3)	Annual	80 (0.03 ppm)
	24 hours	365 (0.14 ppm)
Suspended Particulate Matter (SPM) (µg/m^3)	8 hours	200
Coarse Particulates (PM_{10}) (µg/m^3)	Annual	50
	24 hours	150
Fine Particulates ($PM_{2.5}$) (µg/m^3)	Annual	15
	24 hours	65
Ozone (O_3) (µg/m^3)	8 hours	157 (0.08 ppm)
	1 hour	235 (0.12 ppm)

Source: Air Quality Standards, 2005

Table 16: Emissions and Effluents Guidelines of ICNIRP exposure limits for general public exposure to electric and magnetic fields.

Frequency	Electric Field (V/m)	Magnetic Field (μ/T)
50 Hz	5000	100
60 Hz	4150	83

Source: ICNIRP (1998): "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

2.5.2 Water Quality Standards

As per Schedule 12 of the ECR 1997, designated best use classification has been prescribed for inland surface water as given in Table 17.

Table 17: Standards for Inland Surface Water

SN	Best Practice based classification	Parameter			
		pH	BOD mg/l	DO mg/l	Total Coliform number/ 100
1.	Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
2.	Water usable for recreational activity	6.5-8.5	3 or less	5 or more	200 or less
3.	Source of drinking water for supply after conventional treatment	6.5-8.5	6 of less	6 or more	5000 or less
4.	Water usable by fisheries	6.5-8.5	6 of less	5 or more	---
5.	Water usable by various process and cooling industries	6.5-8.5	10 or less	5 or more	5000 or less
6.	Water usable for irrigation	6.5-8.5	10 or less	5 or more	1000 or less

Notes:

1. In water used for pisciculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2. Electrical conductivity for irrigation water – 2250 μ mhoms/cm (at a temperature of 25 ° C); Sodium less than 26%; boron less than 0.2%.

The standards for drinking water have been presented in Table 18 as per Schedule 12 of ECR-1997.

Table 18: Standards for Drinking Water

SN	Parameters	DOE Standards (Drinking Water Standards)
1.	pH	6.5 – 8.5
2.	Temperature (in °C)	20-30 °C
3.	Turbidity (in NTU)	10
4.	Color	15 Hazen
5.	TDS (in mg/l)	1000 mg/l
6.	TSS (in mg/l)	10 mg/l
7.	Oil and Grease (in mg/l)	0.01 mg/l
8.	Chlorides (in mg/l)	150-600 mg/l
9.	Total Hardness (in mg/l)	200-500 mg/l
10.	Calcium (in mg/l)	75 mg/l

SN	Parameters	DOE Standards (Drinking Water Standards)
11.	Magnesium (in mg/l)	30-35 mg/l
12.	Sulphate (in mg/l)	400 mg/l
13.	Fluorides (in mg/l)	1.0 mg/l
14.	Nitrate (in mg/l)	10 mg/l
15.	Iron (in mg/l)	0.3-1.0 mg/l
16.	COD (in mg/l)	4 mg/l
17.	BOD (in mg/l)	0.2 mg/l
18.	Ammonia (in mg/l)	0.5 mg/l
19.	Phosphate (in mg/l)	6 mg/l
20.	Copper (in mg/l)	1 mg/l
21.	Mercury (in mg/l)	0.001 mg/l
22.	Balium (in mg/l)	0.01 mg/l
23.	Cadmium (in mg/l)	0.005 mg/l
24.	Arsenic (in mg/l)	0.05 mg/l
25.	Lead (in mg/l)	0.05 mg/l
26.	Zinc (in mg/l)	5 mg/l
27.	Chromium (in mg/l)	0.05 mg/l
28.	Manganese (in mg/l)	0.1 mg/l
29.	Total Coliform (in n/100 ml)	0
30.	Faecal Coliform (in n/100 ml)	0
31.	Chlorophyll (in mg/l)	--
32.	Aluminum (in mg/l)	0.2
33.	Benzene (in mg/l)	0.01 mg/l
34.	Boron (in mg/l)	0.2 mg/l
35.	Chlorinated alkanes Carbon tetrachloride (in mg/l) Dichloroethylene (in mg/l) 1.2 dichloroethylene (in mg/l) Tetrachloroethylene (in mg/l) Trichloroethylene (in mg/l)	 0.01 mg/l 0.001 mg/l 0.03 mg/l 0.03 mg/l 0.09 mg/l
36.	Chlorinated phenols - pentachlorophenol (in mg/l) trichlorophenol (in mg/l)	 0.03 mg/l 0.03 mg/l
37.	Chlorine (residual) (in mg/l)	0.2 mg/l
38.	Chloroform	0.09 mg/l
39.	Cyanide	0.1 mg/l
40.	Detergents	0.2 mg/l
41.	DO	6 mg/l
42.	Kjeldhl Nitrogen (total)	1 mg/l
43.	Nickel	0.1 mg/l
44.	Nitrite	<1 mg/l

SN	Parameters	DOE Standards (Drinking Water Standards)
45.	Odor	Odorless
46.	Phenolic Compounds	0.002 mg/l
47.	Silver	0.02 mg/l
48.	Sodium	200 mg/l
49.	Suspended particulate matters	10 mg/l
50.	Sulfide	400 mg/l
51.	Tin	2 mg/l
52.	Selenium	0.01 mg/l
53.	Potassium	12 mg/l
54.	Radioactive materials (gross alpha activity)	0.01 Bq/l
55.	Radioactive materials (gross beta activity)	0.1 Bq/l

2.5.3 Liquid Effluent Discharges

As per Schedule 10 of ECR 1997, standards for Waste from Industrial Units or Project Waste have been described. The same has been detailed in Table 19.

Table 19: Standards for Liquid Effluent Discharge

SN	Parameter	Unit	Places for determination of standards		
			Inland Surface Water	Public Sewerage System connected to treatment at second stage	Irrigated Land
1.	Ammonical Nitrogen (as elementary N)	mg/l	50	75	75
2.	Ammonia (as free ammonia)	mg/l	5	5	15
3.	Arsenic (as)	mg/l	0.2	0.05	0.2
4.	BOD 5 at 20°C	mg/l	50	250	100
5.	Boron	mg/l	2	2	2
6.	Cadmium (as Cd)	mg/l	0.5	0.05	0.05
7.	Chloride	mg/l	600	600	600
8.	Chromium (as total Cr)	mg/l	0.5	1.0	1.0
9.	COD	mg/l	200	400	400
10.	Chromium (as hexavalent Cr)	mg/l	0.1	1.0	1.0
11.	Copper (as Cu)	mg/l	0.5	3.0	3.0
12.	Dissolved Oxygen (DO)	mg/l	4.5-8	4.5-8	4.5
13.	Electro-conductivity (EC)	micro mho/ cm	1200	1200	1200

SN	Parameter	Unit	Places for determination of standards		
			Inland Surface Water	Public Sewerage System connected to treatment at second stage	Irrigated Land
14.	Total Dissolved Solids	mg/l	2100	2100	2100
15.	Fluoride (as F)	mg/l	2	15	10
16.	Sulfide (as S)	mg/l	1	2	2
17.	Iron (as Fe)	mg/l	2	2	2
18.	Total Kjeldahl Nitrogen (as N)	mg/l	100	100	100
19.	Lead (as Pb)	mg/l	0.1	1.0	0.1
20.	Manganese (as Mn)	mg/l	5	5	5
21.	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22.	Nickel (as Ni)	mg/l	1.0	2.0	1.0
23.	Nitrate (as elementary N)	mg/l	10	Not yet Fixed	10
24.	Oil and Grease	mg/l	10	20	10
25.	Phenolic Compounds (as C_6H_5OH)	mg/l	1.0	5	1.0
26.	Dissolved Phosphorus (as P)	mg/l	8	8	15
27.	Radioactive substance	To be specified by Bangladesh Atomic Energy Commission			
28.	pH	-	6-9	6-9	6-9
29.	Selenium (as Se)	mg/l	0.05	0.05	0.05
30.	Zinc (as Zn)	mg/l	5	10	10
31.	Total Dissolved Solids	mg/l	2100	2100	2100
32.	Temperature	° C	40	40	40-Summer
			45	45	45-Winter
33.	Suspended Solids (SS)	mg/l	150	500	200
34.	Cyanide (as Cn)	mg/l	0.1	2.0	0.2

Notes:
(1) These standards shall be applicable to all industries or Projects other than those specified under the heading "Standards for sector-wise industrial effluent or emission."
(2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a Project starts operation.
(3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.
(4) Inland Surface Water means drains/ponds/tanks/water bodies/ditches, canals, rivers, springs and estuaries.
(5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.
(6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.
(7) Inland Surface Water Standards shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 5 and 6 above.

As per the IFC EHS guidelines, the treated sanitary sewage discharge is required to meet the following guideline values.

Table 20: Treated Sewage Discharge Guideline Values of IFC

Parameters	Guideline Value
pH	6 – 9
BOD	30mg/l
COD	125mg/l
Total Nitrogen	125mg/l
Oil and Grease	10 mg/l
Total Suspended Solids	50 mg/l
Total coliform bacteria	400 MPN/100 ml

IFC Wastewater and Water Quality Monitoring Programme

A wastewater and water quality monitoring program with adequate resources and management oversight should be developed. The following elements to be considered while setting up the programme:

- *Parameters*: The parameters selected for monitoring should be indicative of the pollutants of concern from the process and should include parameters that are regulated under compliance requirements.
- *Monitoring type and frequency*: Wastewater monitoring should take into consideration the discharge characteristics from the process over time. Effluents from highly variable processes may need to be sampled more frequently or through composite methods. Grab samples or, if automated equipment permits, composite samples may offer more insight on average concentrations of pollutants over a 24-hours period.
- *Monitoring locations*: Effluent sampling stations may be located at the final discharge, as well as at strategic upstream points prior to merging of different discharges.
- *Data Quality*: Sampling should be conducted by or under the supervision of trained individuals. Analysis should be conducted by entities permitted or certified for this purpose. QA/QC documentation should be included in monitoring reports.

2.5.4 Ambient Noise Standards

As per IFC EHS Guidelines, noise impacts should not exceed the levels presented in Table 21 below or result in a maximum increase in background levels of 3dB at the nearest receptor location off-site.

Table 21: Noise Level Guidelines as per IFC

Receptor	One Hour L_{eq} (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The MoEFCC under the provisions of ECR, 1997 is responsible for laying down ambient noise standards. Noise Pollution (Control) Rules, 2006 were laid down by the Ministry through a Gazette notification dated September 7, 2006. Ambient noise standards established as per the provisions Rule 5(2) of the aforementioned Rules have been furnished in Table 22.

Table 22: Ambient Noise Standards as per DOE

SN	Type of Area	Limits in dB(A)L_{eq}	
		Day	Night
1.	Silent Zone	50	40
2.	Residential area	55	45
3.	Mixed area	60	50
4.	Commercial area	70	60
5.	Industrial area	75	70

Note:

1. dB(A) L_{eq} represents time-weighted average noise level on the Decibel-A scale
2. Day time is from 6am to 9pm, Nighttime is form 9pm to 6 am
3. Mixed area is mainly residential area, and also simultaneously used for commercial and industrial purposes
4. Area up to a radius of 100 m around hospitals/educational institutions/special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

2.6 Applicable International Conventions

Environmental problems which migrate beyond the jurisdiction (Trans-boundary) require power to control such issues through international co-operation by becoming a Contracting Party (CP) i.e., ratifying treaties or as Signatory by officially signing the treaties and agreeing to carry out provisions of various treaties on environment and social safeguards. Bangladesh has signed and ratified various Multilateral Environmental Agreements (MEAs), and International Labor Organization (ILO) Conventions, etc. The relevant international conventions have been summarized in the Table 23.

Table 23: Applicable International Conventions

SN	International Conventions	Salient Features
Multilateral Environmental Agreements (MEAs)		
1.	Rio Declaration, 1992	Bangladesh is a signatory to Principle 4 of the declaration 1992 a global action program for sustainable development called *Rio Declaration* and *Agenda 21* was adopted in the annual United Nations Conference on Environment and Development (UNCED) held in Rio De Janeiro, Brazil.
2.	Convention on Biological Diversity, 1992	It was adopted on June 5, 1992. The signatory has an obligation of: • Introducing appropriate procedures requiring environmental impact assessments of its proposed Projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where appropriate allow for public participation in such procedures; and • Introducing appropriate arrangements to ensure that environmental consequences of its programs and policies, that

SN	International Conventions	Salient Features
		are likely to have significant adverse impacts on biodiversity, are duly taken into account. As per the convention, ESIA shall consider impacts on biodiversity due to Project activities.
3.	Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (1971)	This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitat. Obligation for Contracting Parties include the designation of wetlands to the "List of Wetlands of International Importance", the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves. Parts of Sundarbans Reserved Forest (Southwest of Bangladesh) are one of the Ramsar Sites.
4.	Kyoto Protocol	The protocol is aimed at reducing greenhouse gas (GHG) emissions from various industrial activities and curbing its effects on the environment. Seven GHGs have been identified for targeted emission reduction namely: • Carbon dioxide (CO_2) • Methane (CH4) • Sulphur hexafluoride (SF6) • Nitrous Oxide (N_2O) • Nitrogen trifluoride (NF3) • Hydrofluorocarbons • (HFCs) • Perfluorocarbons (PFC) The parties to the protocol shall reduce their GHG emissions through one or more of the three flexible mechanisms laid down under the protocol viz.: 1. Clean Development Mechanism 2. Joint Implementation 3. International Emissions Trading The protocol formulated in 1997 and came into force in 2008. It's currently under its second commitment period which terminates in 2020. Bangladesh signed the protocol October 22, 2001. However, it has no binding emission reduction target as it's a developing nation.
5.	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.	It was formulated to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs). It does not, however, address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate. The wastes under the Convention's scope are listed under its Annex – I, II and III. In addition to conditions on the import and

SN	International Conventions	Salient Features
		export of wastes, there are stringent requirements for notice, consent and tracking for movement of wastes across national boundaries. The Convention came into force on May 5, 1992. Bangladesh acceded it on April 1, 1993.
International Labour Organization (ILO) Conventions		
6.	International Labour Organization	Bangladesh has ratified many of the International Labour Organization conventions that are relevant to the Project including: • C1 Hours of Work (Industry) Convention, 1919 (14:07:1921, ratified); • C5 Minimum Age (Industry) Convention, 1919 (09:09:1955, ratified): • C11 Right of Association (Agriculture) Convention, 1921 (11:05:1923, ratified): • C14 Weekly Rest (Industry) Convention, 1921 (11:05:1923, ratified); • C29 Forced Labour Convention, 1930 (30:11:1954, ratified) & C105 Abolition of Forced Labour Convention, 1957 (18:05:2000, ratified); • C100 Equal Remuneration Convention, 1951 (25:09:1958, ratified); • C107 Indigenous and Tribal Populations Convention, 1957; • C111 discrimination (Employment and Occupation) Convention, 1958 (03:06:1960, ratified) This Convention limits the hours of work in industrial undertaking to eight (8) in the day and forty-eight (48) in the week.
7.	Convention Concerning the Protection of the World Cultural and natural Heritage	This convention was held in Paris in 1972; accepted in 03.08.1983 and ratified in 03.11.1983. The relevancy of this convention is: • Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc
8.	International Plant Protection Convention (Rome, 1951) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	This convention was ratified in 01.09.1978 with the following relevancy. • Ensuring that the Project work or construction materials do not introduce plant pests

Chapter 3
Project Description

3.1 Background

The existing and proposed 400 kV, 230 kV and 132 kV grid network of Bangladesh Power System (BPS) on Bangladesh geo-map is presented in the Figure 7 and the single line diagram of the existing grid network and PGCB's Optical Fiber Network are presented in Figure 8 and Figure 9 respectively. An in-house study of the whole transmission network was carried out by the PGCB System Planning. Based on the results of studies and the growing demand, Power Grid Company of Bangladesh Limited (PGCB) intends to construct new substations and transmission lines at Chattogram in Bangladesh. The substations to be built in this very project will meet the growing demand of Chattogram and Cox's Bazar area including upcoming EZs load.

The study shows that a considerable number of grid substations and transmission lines in the Chattogram area are going to fall short of capacity when demand for electricity rises in coming days. It can be envisaged that to address the boosting of load demand and ensure reliable electricity supply to concerned urban and sub-urban areas, some new 230/132 kV and associated transmission lines are required. This will not only reduce the contingencies of the system but also increase operating flexibilities as well as overcome the limitations of supplying quality and uninterrupted electricity to end users.

Many major establishments like Economic Zones, Chattogram Sea Port, Chattogram Eastern Refinery, Karnafully EPZ, Chattogram EPZ, KAFCO and Korean EPZ are already operating in and around Chattogram City and its adjacent Anwara Upazila. Bangladesh Economic Zones Authority (BEZA) has already planned new Economic Zones in the Anwara Upazila. In view of these developments and anticipated rise in future demand of the area, strengthening of 230 kV network has become essential. One portion of the 230-kV network is identified in that zone by the study and accordingly, new substations as well as the location have been selected. A project named "Southern Chattogram and Kaliakoir Transmission Infrastructure Development Project" has been conceived in the light of Power System Master Plan (PSMP)-2016 and Prioritized Investment Plan for transmission network in the Year 2015-2020 has been undertaken. This project has been proposed to be included in the Seventh Five Years Plan. Under this Project, proposed four new GIS type Substations are going to be constructed at Anwara, Cox's Bazar, Teknaf in Chattogram Division and BHTC at Gazipur of Dhaka Division. Along with these proposed substations, associated transmission lines will also be constructed to connect the substations. After analyzing the Grid network and load demand forecast of the new Substations, interventions under the Project have been finalized.

3.2Project Location and Components

The project is located in Anwara Upazila of Chattogram district, Cox's Bazar Sadar and Teknaf Upazila of Cox's Bazar district and Kaliakair Upazila of Gazipur district. Out of four substations, BHTC 230/33kV GIS SS will be constructed at the own land of BHTPA. And another three substations will be constructed at Anwara, Cox's Bazar Sadar and Teknaf upazilas of Chattogram division.

For constructing substation at BHTC area, PGCB will get the land according to the project policy lead by the Govt. Policy. In this regard, Resettlement Plan is only needed for Anwara 230/132/33kV, Cox's Bazar and Teknaf 132/33kV GIS substations, which requires acquisition of total 35 acres of land. A Resettlement Plan (RP) has been prepared for this project to pay compensation to the PAPs in compliance with Government law and international resettlement policies. The location of the substations is presented in Table 24.

Table 24: Location of Substations

Substations	Division	District	Upazila	Union	Mauza	Land Size (acre)
Anwara SS	Chattogram	Chattogram	Anwara	Barasat	Dudkumra	20
Cox's Bazar SS		Cox's Bazar	Ramu	Rashid Nagar	Panir chara	10
Teknaf SS			Teknaf	Hnilla	South Hnilla	5
BHTC SS	Dhaka	Gazipur	Kaliakair	Sreefaltali	Latifpur	5

Major components of the project are- (a) Construction of GIS substations, (b) Construction of associated overhead transmission lines. Interventions under the Project are given in Table 25. These constructions will help to meet up the rapidly growing demands of residential, commercial and industrial consumers in Chattogram and Dhaka Division and adjacent areas.

Table 25: Interventions under the Project

Substations					**Transmission Lines**	
Substations & its Capacity	Required Land (acre)	SS Type	Required Bays	Bay Extension	Associated Transmission Line	Length (Km)
230/132/33 kV SS: Anwara 2x250/350 MVA (230/132kV) 2x80/120 MVA (132/33kV) (Future 400 kV Provision)	20	GIS	230kV: LB=8; TB=2; BCB=1 132kV: LB=2; TB=4 33kV: TB=2	-	Anwara-Cox's Bazar (N) 230kV double circuit line (Initially Charged at 132kV)	105
132/33 kV GIS Substation: Cox's Bazar	10	GIS	132kV: LB=8; CBB=2; TB=3;	-	Anwara-Cox's Bazar (N) 230kV double circuit line (Initially Charged at 132kV)	

Substations					Transmission Lines	
Substations & its Capacity	Required Land (acre)	SS Type	Required Bays	Bay Extension	Associated Transmission Line	Length (Km)
3x80/120 MVA (Future 230 kV Provision)			Spare=1; BCB=1			
			33kV: TB=3		LILO of Dohazari-Cox's Bazar 132kV four circuit transmission line	1.09
132/33 kV GIS Substation: Teknaf 2x80/120 MVA	5	GIS	132kV: LB=2; TB=2; BCB=1 33kV: TB=2	-	Cox's Bazar to Teknaf 132 kV double circuit transmission line	73.10
230/33 kV GIS Substation: BHTC 2x125/140 MVA	5	GIS	230kV: LB=2; TB=2; BCB=1 33kV: TB=2	230kV Bay Extension at Kaliakair: 2 Nos.	Existing Kaliakair SS to BHTC 230kV double circuit transmission line	4.88
Total 4 Nos.	40			2 Nos.	Total (Transmission Lines)	184.07

Proposed 230/132/33kV GIS substation (future 400kV) at Anwara will make regular grid connectivity with 230 kV transmission system. Proposed 132/33kV indoor GIS substation at outer side of Cox's Bazar will receive power from Anwara substation. Existing 132kV transmission line of Dohazari to Cox's Bazar will connect with proposed Cox's Bazar SS through 132kV four circuit lines as LILO. The proposed Teknaf 132/33kV indoor GIS substation will receive power from Proposed Cox's Bazar (N) SS. Besides, proposed 230/33 kV GIS substation will be constructed at BHTC located at Kaliakair, Gazipur, and power will receive from existing Kaliakair 400/230/132/33 kV substation. Total 184.07 km overhead transmission lines and four new sub-stations will be constructed under this project. There is no underground transmission lines construction under this project.

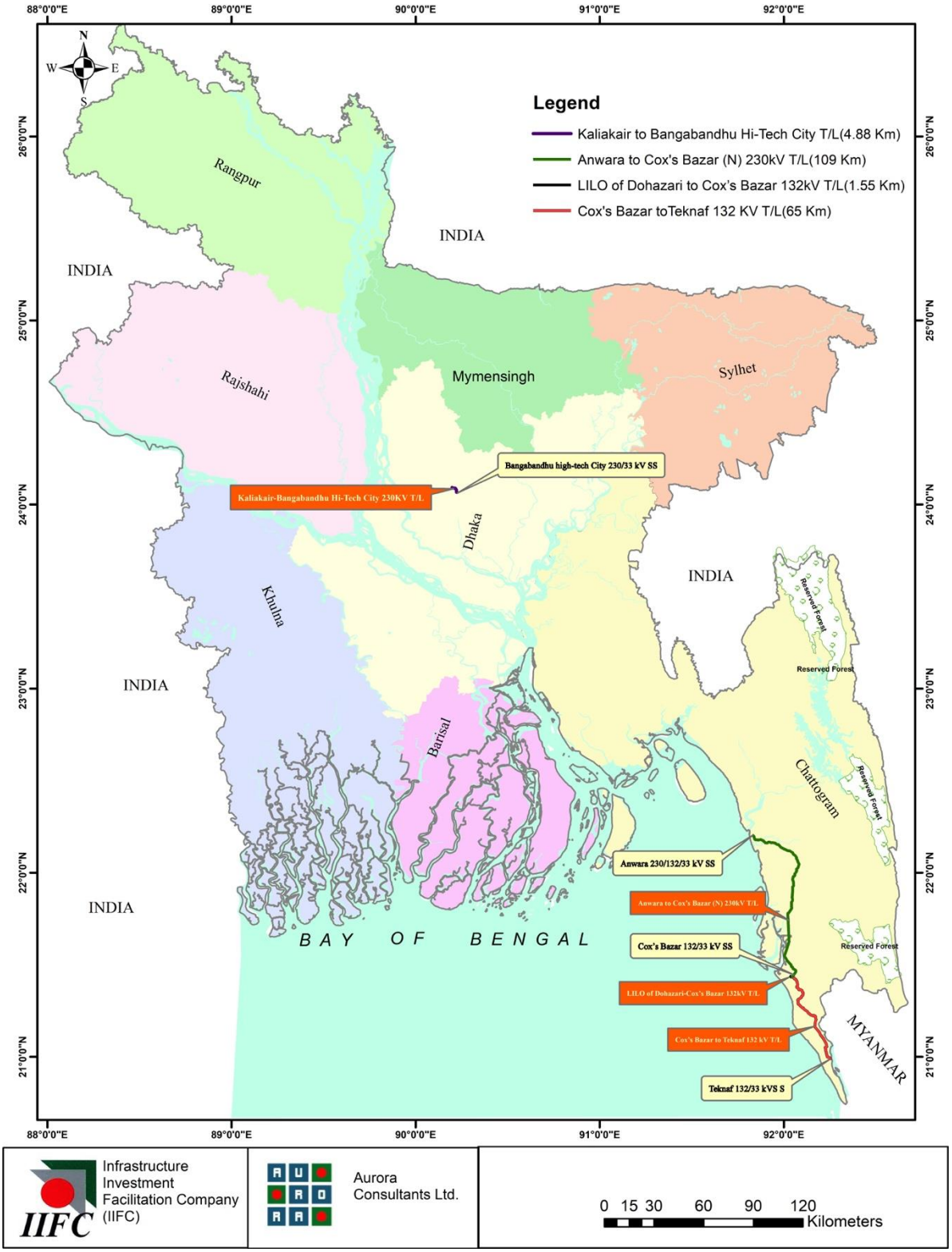


Figure 6: Location of proposed transmission lines and substations

Figure 7: Proposed and existing 400, 230 and 132 kV Grid Network of PGCB in Bangladesh

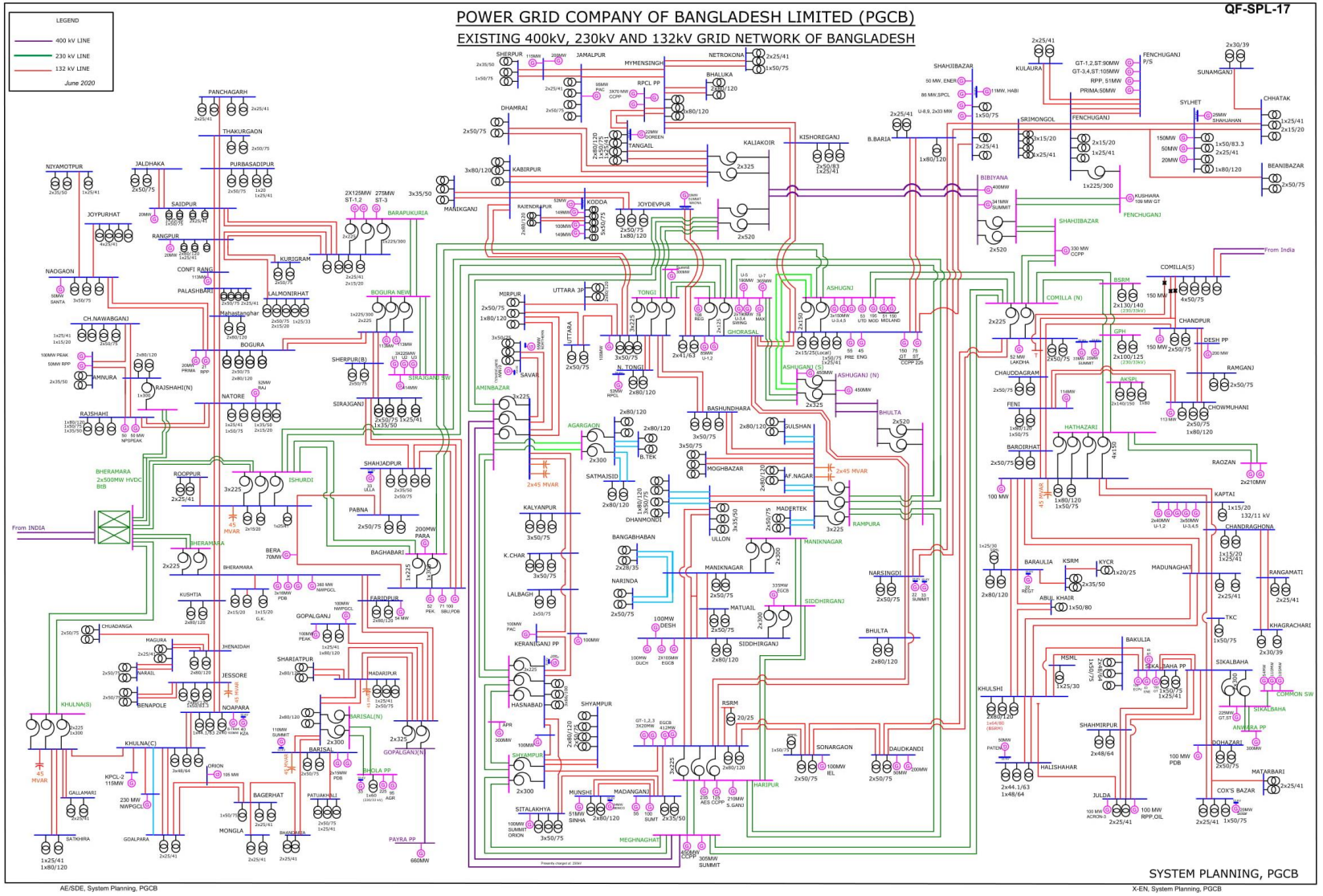


Figure 8: Existing 400, 230 and 132 kV Grid Network, PGCB in Bangladesh

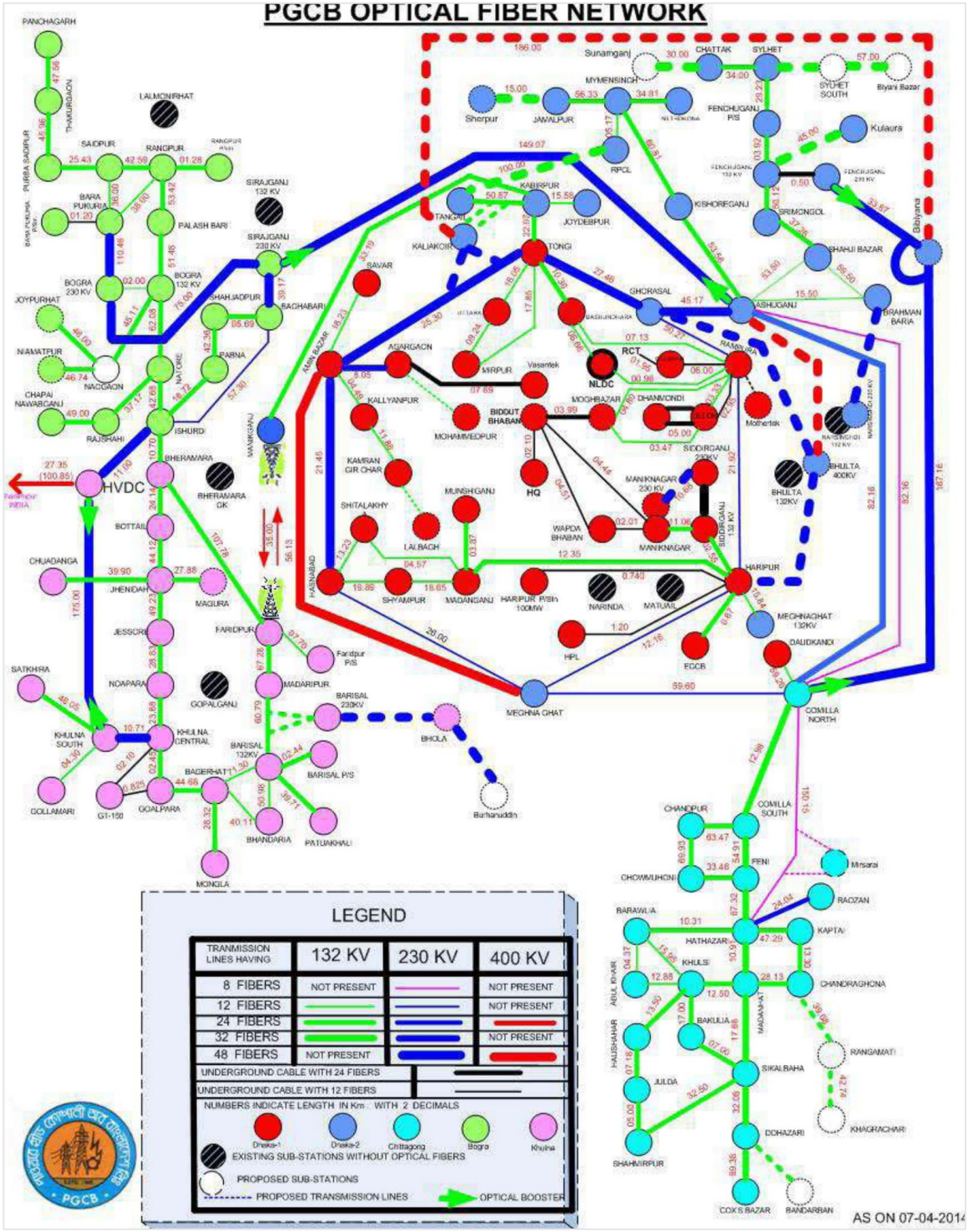


Figure 9: PGCB's Optical Fiber Network System

3.3 Project Category

Under the criteria of the Department of Environment (DoE), the Government of Bangladesh, the power grid lines above 50km falls under Orange B Category and that requires an Initial Environmental Examination (IEE)[7]. As per AIIB, the project falls into A category. The IEE report should be submitted to get Environmental Clearance Certificate (ECC).

3.4 Physical Features of GIS Substations

In Gas Insulated Substation (GIS) system, all the live components are enclosed in a grounded metal enclosure, then the whole system is housed in a chamber full of gas. GIS primarily use Sulphur hexafluoride (SF_6) gas as the primary insulator. SF_6 is non-toxic, maintains atomic and molecular properties even at high voltages, have high cooling properties, and superior arc quenching properties. "According to the Intergovernmental Panel on Climate Change, SF_6 is the most potent greenhouse gas that has been evaluated, with a global warming potential of 23,900 times that of CO_2 when compared over a 100-year period."

In addition, SF_6 is safe. It has superior dielectric properties compared to other gases; thereby provides favorable insulation for the phase to phase and phase to ground moderation. In the substation setup, the gas is contained in a grounded metal enclosure containing the conductors, current and voltage transformers, circuit breaker interrupters, switches, and lightning arrestors. The Substations have electrical specifications for voltage, switchgear, circuit breaker, transformer, and protection systems. The key physical features of four Substations are given in Table 26.

Table 26: Physical Features of Four Substations

Features	Specifications			
	Anwara SS	Cox's Bazar SS	Teknaf SS	Hi-Tech City SS
Type of Project	Proposed	Proposed	Proposed	Proposed
Land requirement	20 acres of land to be acquired by PGCB	10 acres of land to be acquired by PGCB	5 acres of land to be acquired by PGCB	5 acres owned by Hi-Tech Park
Type of SS	GIS	GIS	GIS	GIS
MVA	2x250/350 MVA (230/132kV); 2x80/120 MVA (132/33kV)	3x80/120 MVA	2x80/120 MVA	2x125/140 MVA
Voltage level	230/132/33kV	132/33kV	132/33kV	230/33kV
Insulation Medium Power Circuit Breaker	SF_6 GAS	SF_6 GAS	SF_6 GAS	SF_6 GAS
Transformer	Gas insulated	Gas insulated	Gas insulated	Gas insulated
Control System	Both manual and automation	Both manual and automation	Both manual and automation	Both manual and automation

7 http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/acc94172_ad30_44a7_947f_e19113c852fe/Gazette_24.12.2017.pdf

Features	Specifications			
	Anwara SS	Cox's Bazar SS	Teknaf SS	Hi-Tech City SS
Communication System	Optical fiber communication	Optical fiber communication	Optical fiber communication	Optical fiber communication
Fault detector	Relays	Relays	Relays	Relays
Fire Protection System	Auto fighting water spray System	Auto fighting water spray System	Auto fighting water spray System	Auto fighting water spray System

3.5 Associated Facilities

According to AIIB Environmental and Social Framework (ESF)[8] "Associated Facilities are activities that are not included in the description of the Project set out in the agreement governing the Project, but that the Bank determines, following consultation with the Client, are: (a) directly and materially related to the Project; (b) carried out or planned to be carried out, contemporaneously with the Project; and (c) necessary for the Project to be viable and would not be constructed or expanded if the Project did not exist."

The associated facilities for the proposed project include the proposed substation of BHTC would receive power from existing Kaliakair 400kV/230kV substation. The existing Kaliakair sub-station is 4.8 KM away from the proposed BHTC SS where PGCB has conducted safeguard due diligence. The associated facilities identified are under the control and management of PGCB, hence compliance with AIIB ESF will be facilitated. Existing SS is owned by PGCB and all legal permission from DoE is taken through safeguard due diligence. A 230kV bay extension would be established in the existing Kaliakair SS by PGCB. During the construction of Bay-extension, further audit will be conducted by the PGCB to ensure safeguard compliance with AIIB. All necessary mitigation measures will be taken before construction of Bay-extension following the ESP of AIIB if any negative risk and impacts are identified.

A 400 kV double circuits TL from Anwara to Anandabazar (New Mooring) total 25.600 km (combining both Overhead transmission line 19.347km and Underground transmission line 5.253km) will be constructed under another project "Power System Upgrade and Expansion (Chattogram Area)", which is financed by AIIB. PGCB has prepared ESIA followed by baseline study including census and IOL survey. PGCB has also conducted consultation meetings with different stakeholders. As both projects will be financed by AIIB and same ESP is being followed during preparation of ESIA and other safeguard due diligence, it may not be considered as an associated facility.

Figure 10 and Figure 11 shows the single line diagram of Anandabazar SS and Kaliakair SS respectively.

[8] Published in February 2016, Page no. 15

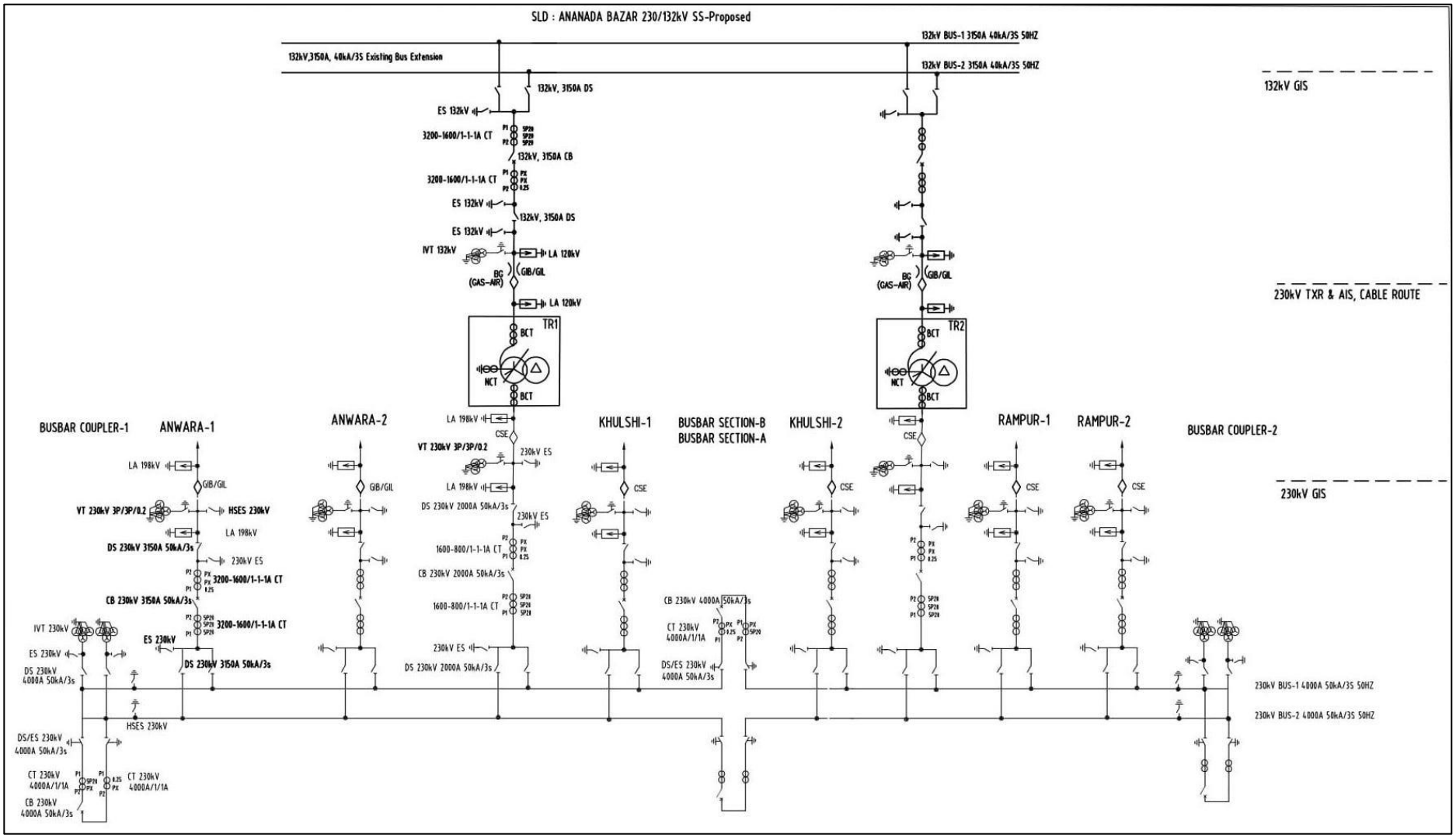


Figure 10: Single Line Diagram of Ananadabazar 230/132 kV GIS SS

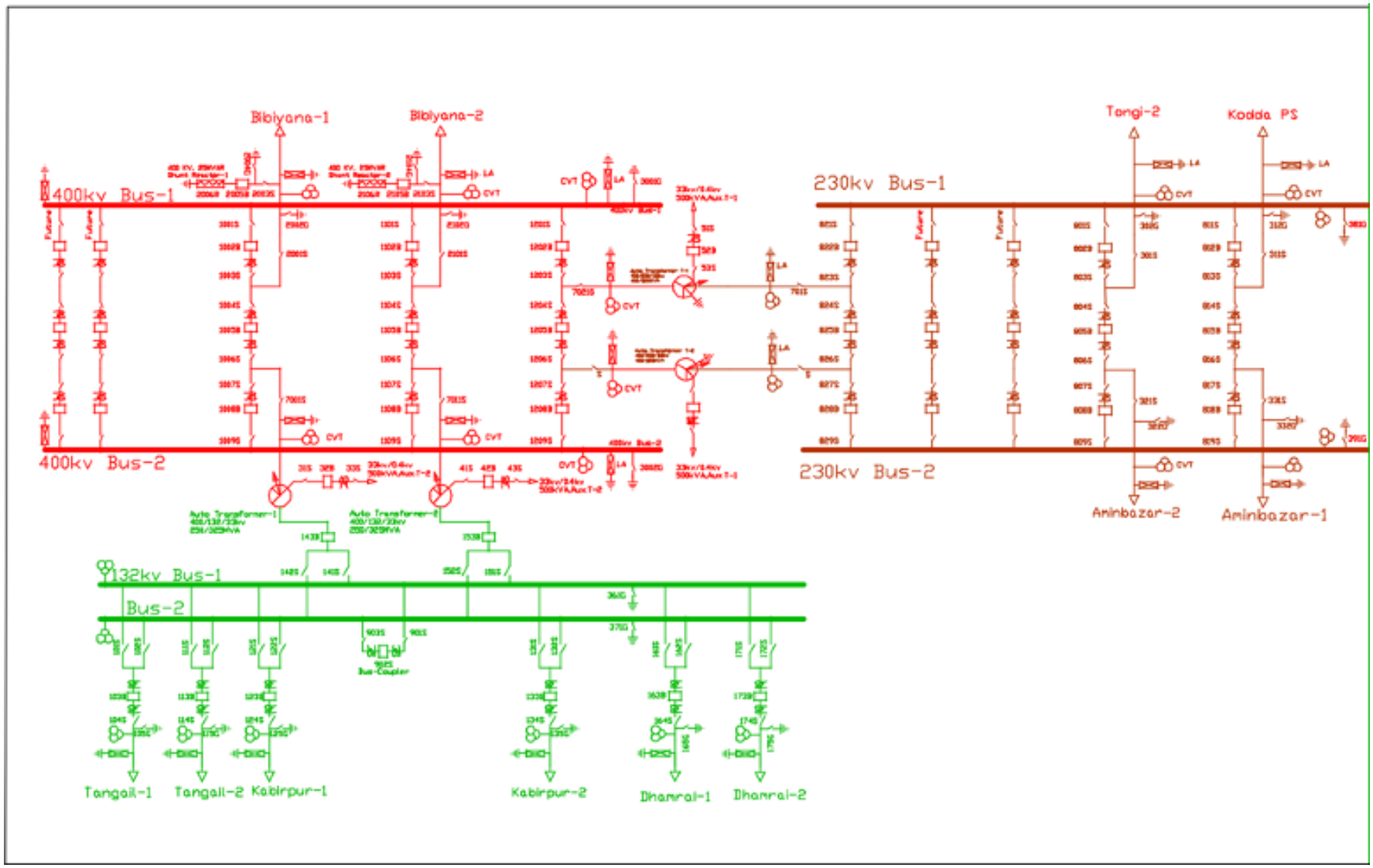


Figure 11: Single Line Diagram of existing Kaliakair 400/230/132kV Substation

3.6 Proposed Substations

3.6.1 Bangabandhu Hi-Tech City (BHTC) Substation (Selected)

The proposed substation comprises of 5 acres of land, site is located inside the BHTC which is the first ever Hi-Tech City in Bangladesh. It is situated at Gazipur alongside Dhaka-Tangail expressway comprising of industrial base, internal roads, science plaza, and some policy-covering sections. The city has an excellent location and enjoys easy transportation. It is 40 km from Dhaka city and 25-km from Hazrat Shahjalal International Airport. The 30ft wide Dhaka-Tangail expressway beside the zone links up with the inner-ring road of the city and the main communication hub of the country. The GPS coordinate proposed substation within the midpoint of the location is N $24^0$0.3'52.6'' E $90^0$13'27.4''.

BHTC was formally proposed in June 1999 at a meeting of the Bangladesh Board of Investment. The Hi-Tech City is being implemented under Private Sector Development Support Project (PSDSP) with the financial assistance of World Bank. The land of Hi-Tech City initially belonged to the Ministry of Telegraph and Telephones (MoTT) that acquired the land in 1969. Though an area of 432 acres was acquired, it remained unutilized till 2003. The Government of Bangladesh (GoB) decided to transfer 262.63 acres of T&T's unutilized land to the Ministry of Science and Technology (MoSICT), presently known as Ministry of Posts, Telecommunications and Information Technology, to set up the Hi-Tech Park[9].

The land was mostly covered with bushes and grass. The southern part of the site comprises flat high land. The eastern, western, and northern parts of the area were comparatively low-lying. Though there were some wetlands on the north-western part of the area, these wetlands, as explained in the Master Plan, will not be affected in any way[10].

BHTPA carried out Environmental Assessment Report[11], SIA including resettlement for Bangabandhu Hi-Tech City. In addition, an abbreviated RAP has been prepared by BHTPA. Affected households received compensation by BHTPA. The project also received Site Clearance from Department of Environment (DoE) in 2013 and accordingly implementing the construction works[12].

BHTPA will sign a Memorandum of Understanding (MoU) with PGCB for using the land for the construction and operation of proposed substation. BHTPA given an administrative approval on 28 February 2018 to PGCB with the following terms and conditions (attached as annex 16).

(a) Proposed land can only be used for construction and operation of substation.

(b) An MoU have to be signed between BHTPA and PGCB.

(c) PGCB can use the land till the decommissioning of the substation.

[9] http://documents1.worldbank.org/curated/en/527201468013210102/pdf/RP9770RP0P120811cum1RAP0180Feb02010.pdf
[10] http://documents1.worldbank.org/curated/en/527201468013210102/pdf/RP9770RP0P120811cum1RAP0180Feb02010.pdf
[11] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2016/10/EA_for_KHTP.pdf
[12] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2016/10/SiteClearence_KHTP.pdf

Figure 12: Proposed SS Location of BHTC at Kaliakair, Gazipur

The proposed BHTC 230/33kV GIS substation will receive power from existing Kaliakair SS 400/230/132kV SS. A 230kV bay extension would be established by PGCB in the existing Kaliakair SS which would supply the power to the proposed BHTC 230kV/33kV substation. The power demand of BHTC will be around 240 MW in future. Current demand around 1MW which being supplied by dedicated 11kV feeder by Gazipur Palli Bidyut Samity (PBS) of Bangladesh Rural Electrification Board (BREB). Power demand will increase to 10MW after completion of National Data Centre which will be delivered through 33kV dedicated feeder. Many industries already in service in BHTC and many companies are constructing new industries. For such activity led power demand in BHTC.

The master plan layout of BHTC which indicates the area proposed 230/33kV grid substation is presented in Figure 13. A due diligence report has been prepared for BHTC which attached in Annex-IX.

Figure 13: Master Plan Layout of BHTC, Kaliakair, Gazipur

Figure 14: Satellite view of BHTC Substation, Kaliakair, Gazipur

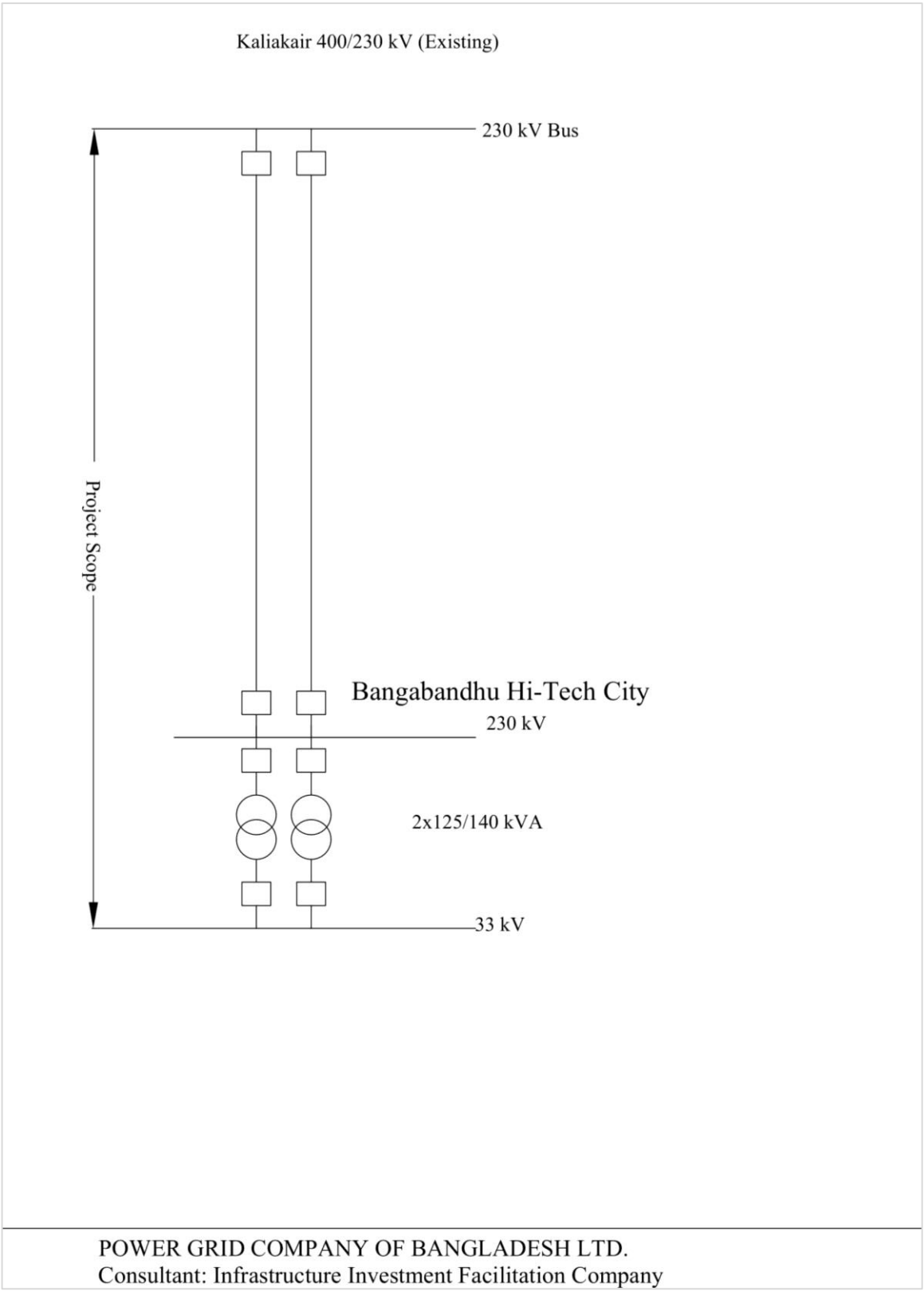


Figure 15: Single Line Diagram of proposed BHTC Substation

3.6.2 Anwara Substation (Selected)

There is a narrow road to get access to the substation (GPS- 22°12'16.54"N 91°49'38.61"E). The land is mainly private where agricultural activities are carried out. Most of the land cultivation is three cropped and the rest of the land is two cropped. As a result, land and crop compensation is mandatory. This area was affected by flood back in 1991. There is no water logging problem in this land. In rainy season if heavy rainfall occurs, water logging occurs for maximum of three days. Communication facility is sound as the site is situated beside main road. Moreover, local labor is available in that area.

Figure 16: Proposed SS Location of Anwara at Anwara Upazila, Chattogram

Anwara area is one of the prominent locations for economic zone development. Korean EPZ (KEPZ) is located on the south bank of the river Karnaphuli in Anwara Upazila. Bangladesh Economic Zones Authority (BEZA) propose two economic zones (EZs) in Anwara and acquiring (774+504) acres of land for the EZs. Chinese Industrial Economic Zone, located at Anwara, forecasted power demand around 50MW. According to BEZA, power demand of Anwara EZ is 50MW and 100MW in year 2022 and 2025 respectively.

Hence, this substation has been proposed with 230/132/33kV system. This grid substation will also supply power to Cox's Bazar district area.

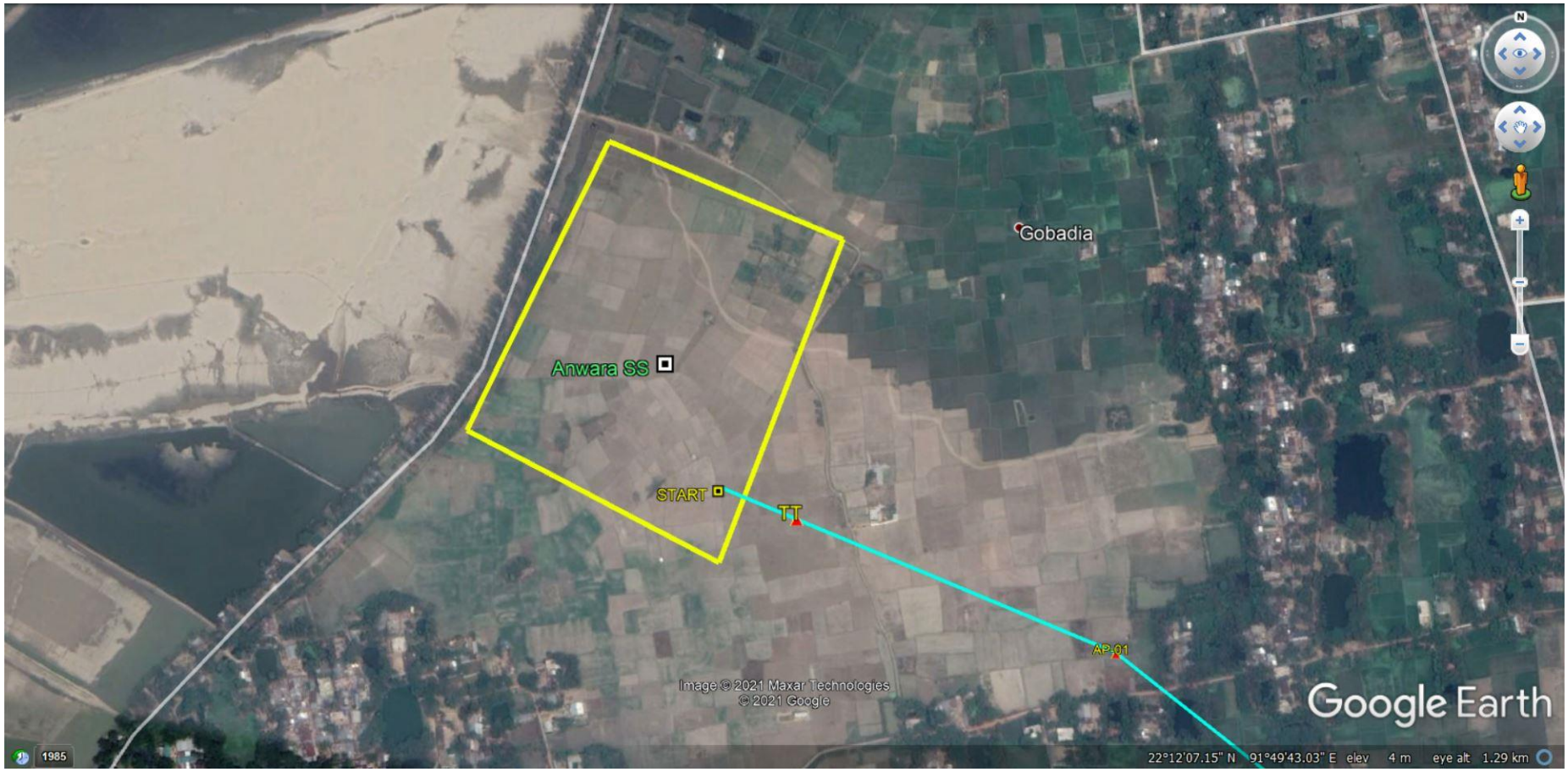


Figure 17: Satellite view of Proposed Anwara Substation

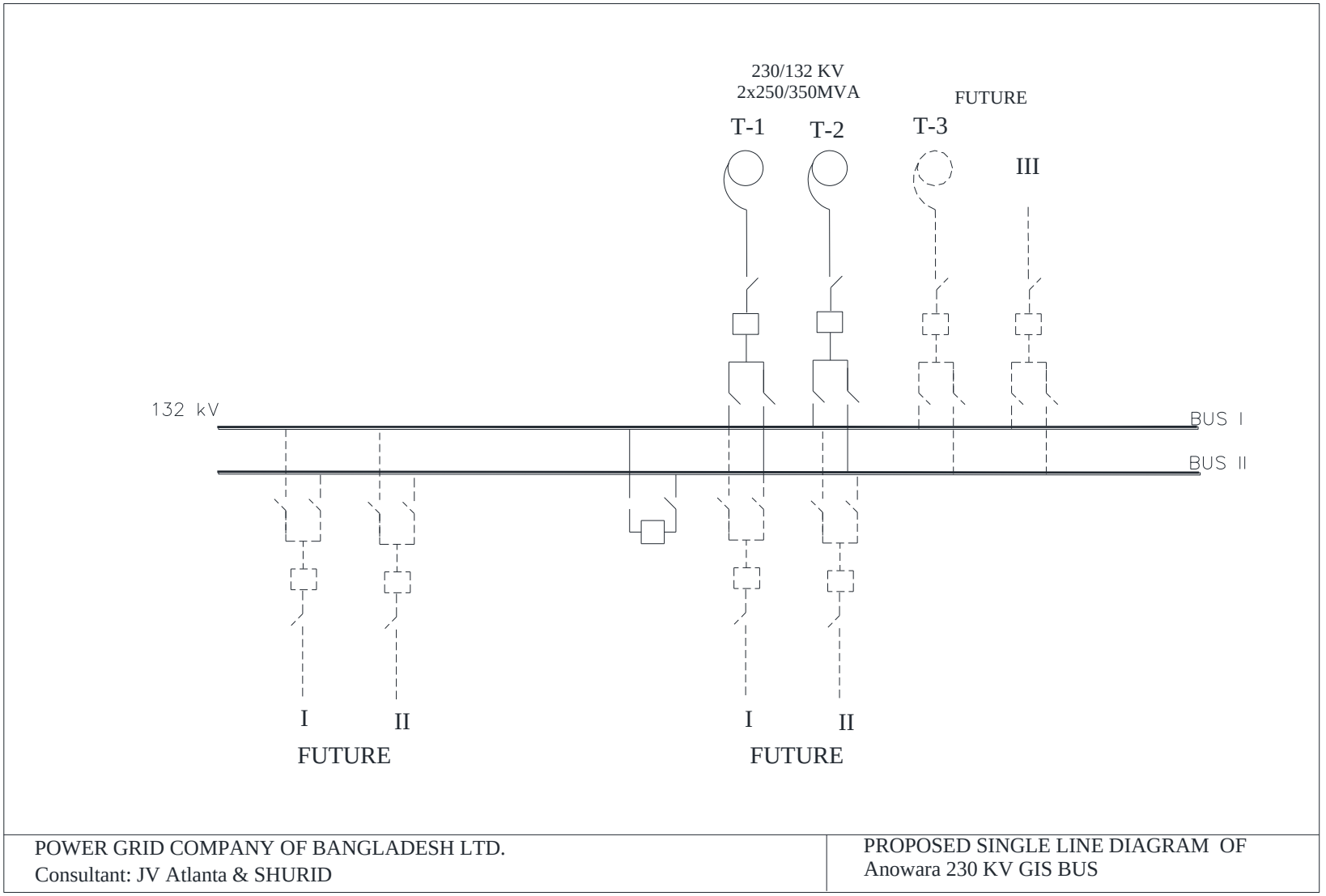


Figure 18: Single Line Diagram of proposed Anwara 230kV GIS Bus

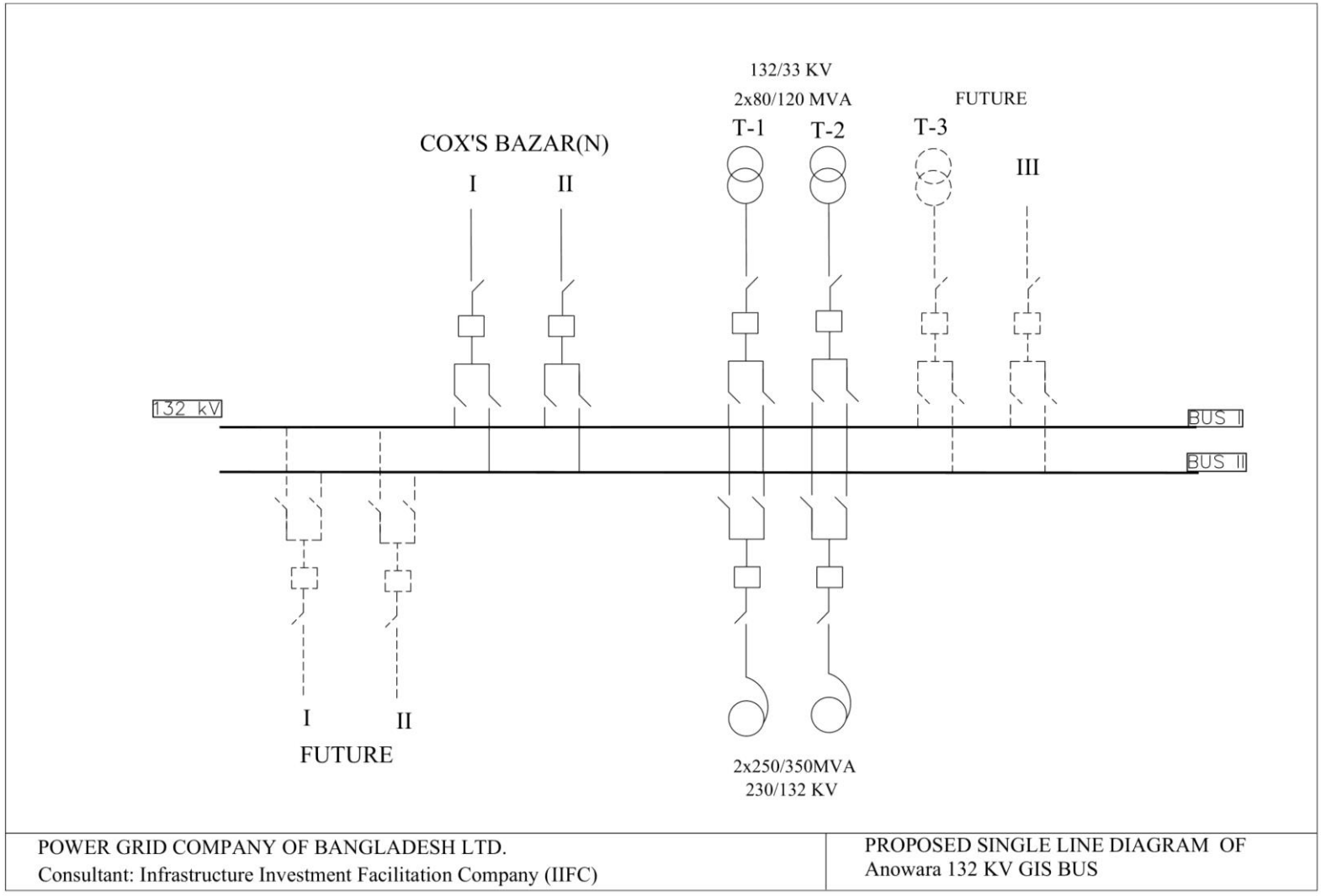


Figure 19: Single Line Diagram of proposed Anwara 132/33kV GIS Bus

3.6.3 Cox's Bazar Substation (Selected)

The proposed substation site is adjacent to Chattogram – Cox's Bazar Highway and relatively closer to Cox's Bazar town with an area of approximately 10 acres. The GPS coordinate within the midpoint of the location is 21°30'22.14"N 92°04'22.98"E. The land is mainly private where agricultural activities are carried out. Most of the land cultivation is three cropped and the rest of the land is two cropped. As a result, land and crop compensation is mandatory.

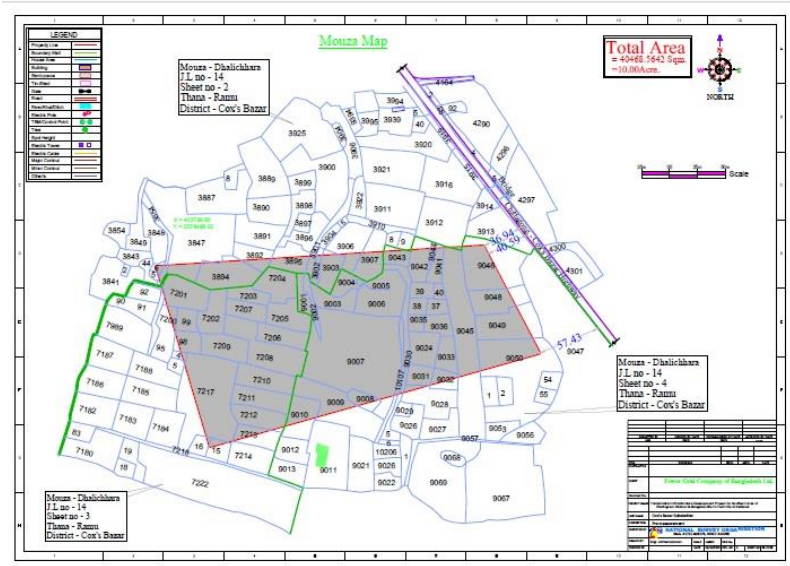


Figure 20: Proposed SS Location of Cox's Bazar at Cox's Bazar Sadar, Cox's Bazar and Mouza Map of Proposed Cox's Bazar Substation

Cox's Bazar district is going to be biggest economic area in Bangladesh. BEZA is going to establish nine (09) economic zones in Cox's Bazar district. Forecasted power demands for Cox's Bazar area economic zones are approximately 80MW and 300MW by 2022 and 2025 respectively. Moreover, Cox's Bazar district is playing significant role in Bangladesh tourism sector. World's longest sea beach is situated in Cox's Bazar. Electricity demand in Cox's Bazar is increasing day by day.

At present, Cox's Bazar area is connected by a 132kV double circuit line from Sikalbaha to Cox's Bazar, in between there is a 132/33kV substation at Dohazari. BPDB has one 102MW peaking power plant at Dohazari. If Dohazari power plant under shutdown it's not possible to deliver adequate power to Cox's Bazar area through existing 132kV line due to overloading problem. Even, reconductoring of existing line with higher capacity conductor cannot meet the future demand of those substations. To ensure reliable and adequate power for BEZA and general consumers of the area, new 230kV transmission line will be a long-term solution. However, proposed Cox's Bazar 230/132/33kV substation will receive power from Anwara SS of Chattogram, and also evacuate power to Teknaf 132 kV SS. Existing 132kV line will be LILO (Line-in Line-out) at new substation.

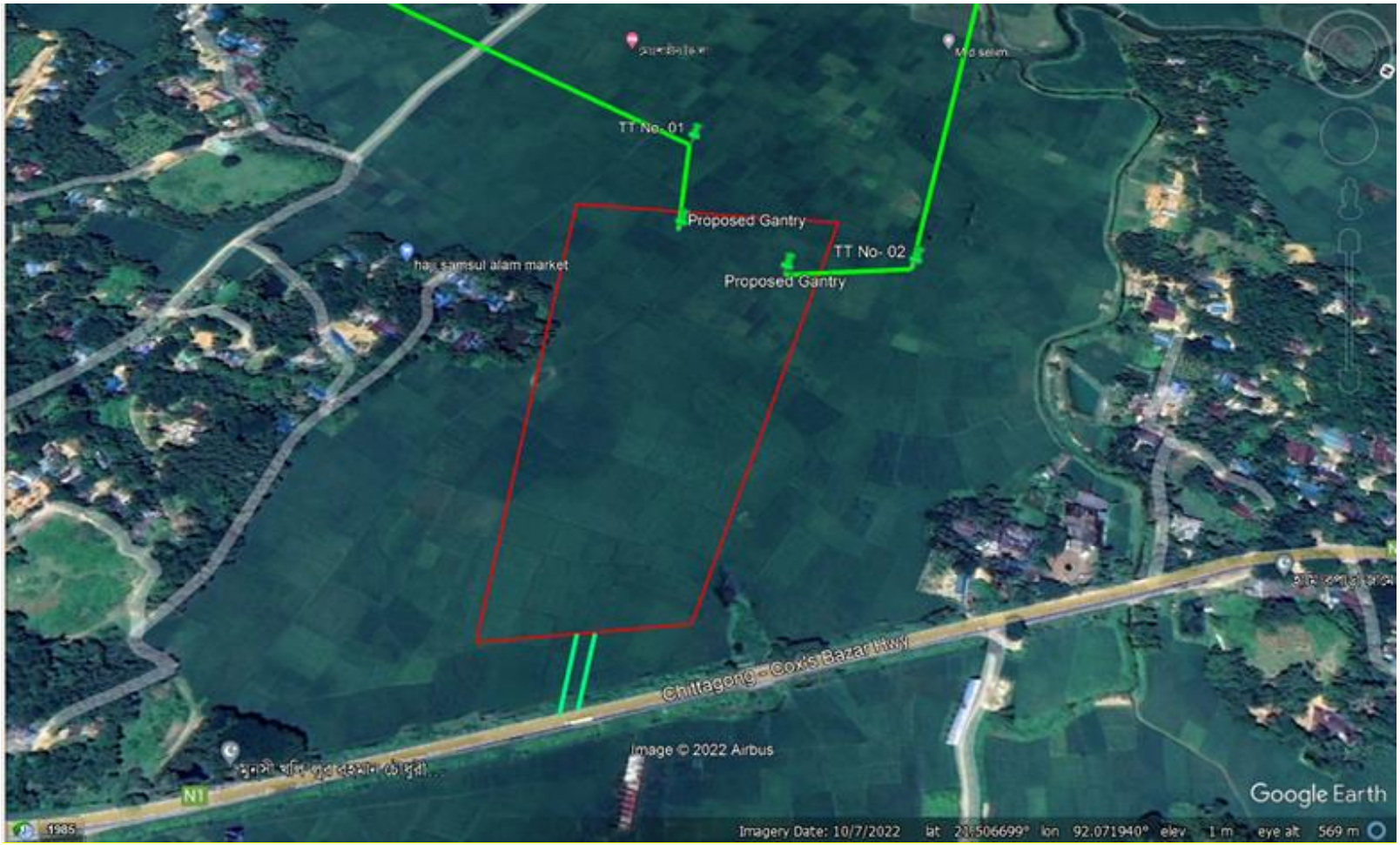


Figure 21: Satellite View of Proposed Cox's Bazar Substation

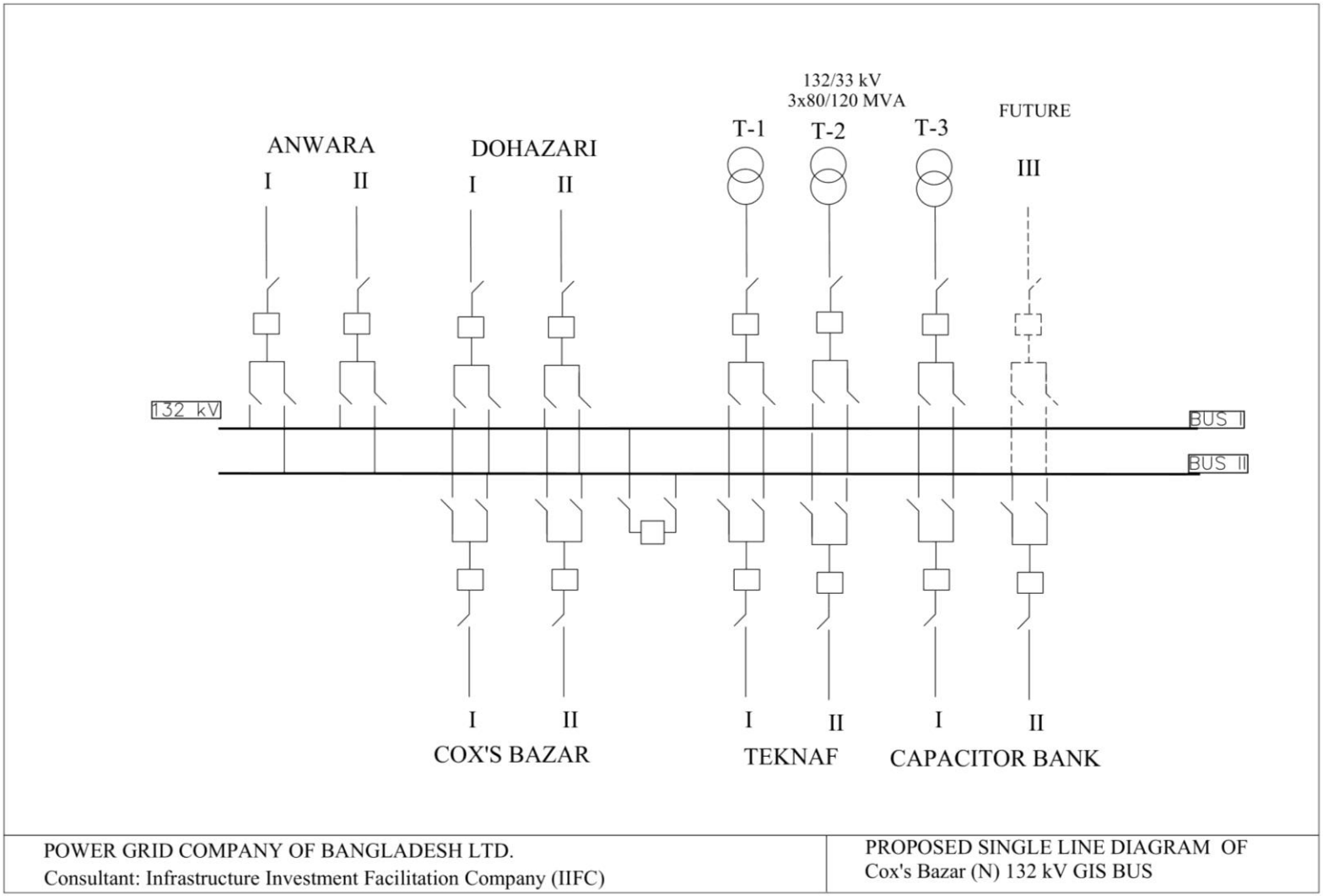


Figure 22: Single Line Diagram of proposed Cox's Bazar Substation

3.6.4 Teknaf Substation (Selected)

The proposed area of the location is 5 acres which is just beside the old Teknaf-Cox's Bazar Highway. There is a salt plant now in the substation site. But minimum 5ft land development is required to prepare the site before commencing the construction of substation. The main advantage is that the evacuation will be much more easily compared to other sites. Future expansion of the site will be much easier if this site is acquired for constructing a substation. The GPS coordinate within the midpoint of the location is 20°58'53.42"N 92°15'5.50"E. The land is mainly private where agricultural activities are carried out. Most of the land cultivation is three cropped and the rest of the land is two cropped. As a result, land and crop compensation is mandatory. The Google location is given below in association with figure of proposed site.

Figure 23: Proposed SS Location of Teknaf at Teknaf Upazila, Cox's Bazar

Among nine (09) EZs of Cox's Bazar, two EZs will be established in Teknaf area. Forecasted power demands for Teknaf area economic zones are approximately 35MW by 2025. The existing power demand of Teknaf Upazila is approximately 40MW. Due to the Rohingya Camps and to provide their associated facilities and services, electricity demand of Teknaf is increasing day by day.

There is a 20MW solar power plant evacuated power to their own SS. Besides, Teknaf now connected through long 33kV distribution line. Due to long length and capacity constraint, the Upazila is face voltage drop and load sheading problem. To ensure reliable and adequate power for BEZA and general consumers of the area, new 132kV transmission line will be a long-term solution. Proposed Teknaf grid SS is important for electrification of Rohingya Refugee Camps. Electrification will improve lifestyle of an estimated about 1 million Rohingya living in different refugee camps in Teknaf.

Figure 24: Satellite View of Proposed Teknaf Substation

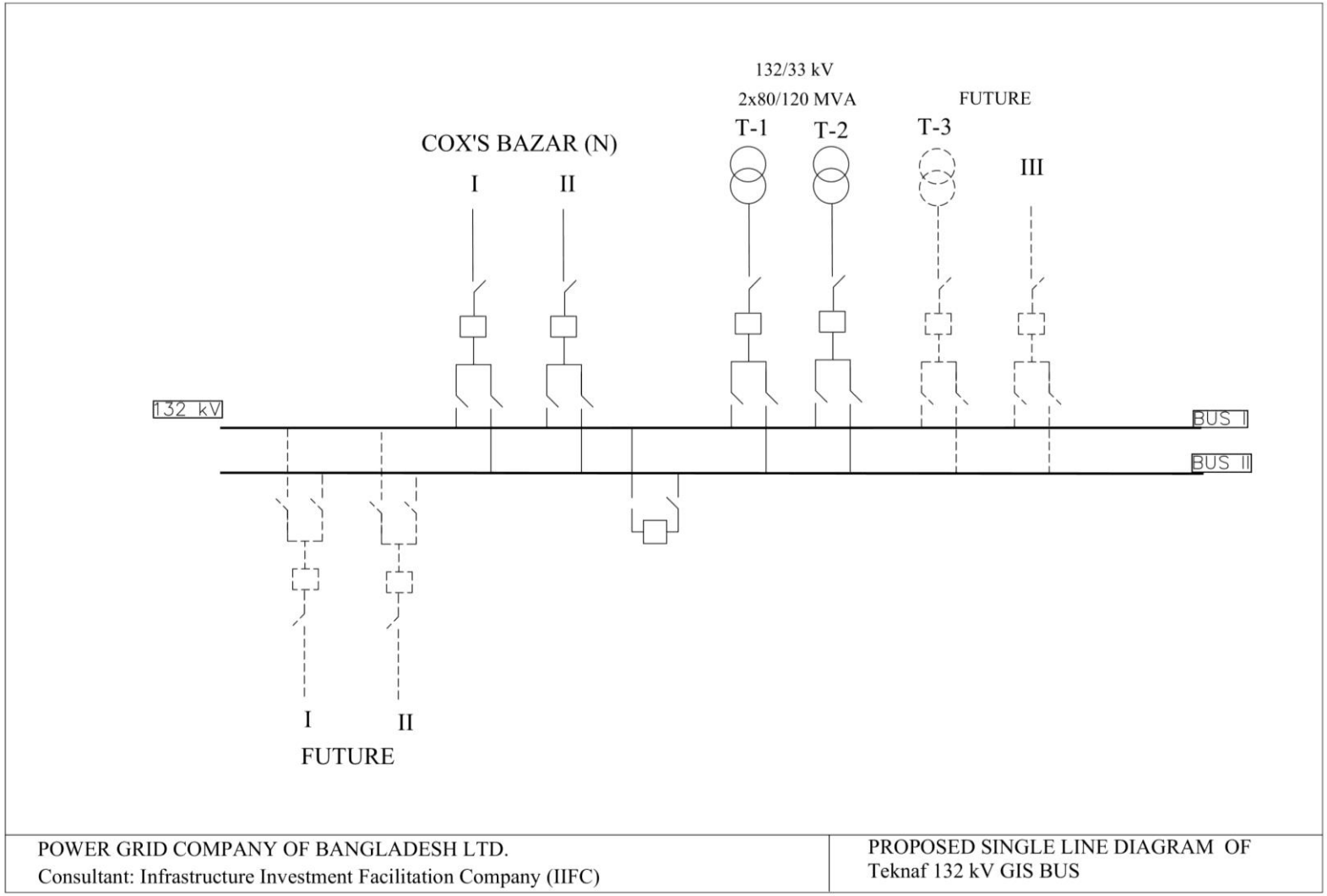


Figure 25: Single Line Diagram of proposed Teknaf Substation

3.7 Features of Transmission Lines

The proposed transmission lines would be overhead transmission line consists of 230kV and 132kV. The salient features of 230kV and 132kV transmission lines are given in Table 27. For 132kV and 230kV transmission line, the width of Right-of-Way (RoW) was considered at 30m (10m Left + 10m DIA + 10m Right) and 50m (15m Left + 20m DIA + 15m Right) respectively. The transmission line supporting structures will be steel lattice towers of two types – tension and suspension. Tension towers will be installed in angles (See Figure 26) and suspension towers will be installed along the line (See Figure 27) as load bearing support. The towers will be using disc type porcelain insulators to hold the conductors (See Figure 29).

Table 27: Silent Features of Transmission Lines

SN	Features	Anwara-Cox's Bazar	Cox's Bazar-Teknaf	LILO	Hi-Tech City
1.	Voltage Rating	230kV	132kV	132kV	230kV
2.	Type of Transmission Line	Double Circuit	Double Circuit	Four Circuit	Double Circuit
3.	Width of T/L Right of Way (RoW)	50m	30m	30m	50m
4.	Type of Line Support	Steel towers	Steel towers	Steel towers	Steel towers
5.	Conductor	Twin ACSR Mallard	Single ACSR Grosbeak	Single ACCC Grosbeak	Twin ACSR Mallard
6.	Conductor Material	Aluminum Alloy	Aluminum Alloy	Aluminum Alloy	Aluminum Alloy
7.	Line Insulator	Disc type, Porcelain	Disc type, Porcelain	Disc type, Porcelain	Disc type, Porcelain
8.	Type of Connection	Substation	Substation	Substation	Substation
9.	Number of Angle Towers	130	78	03	12
10.	Standard Tower Height (m)	38	29	29	38
11.	Length of T/L	105km	73.10km	1.09km	4.88km
12.	Total land requires for installing a typical Tower	225m^2 (15mx15m)	100m^2 (10mx10m)	100m^2 (10mx10m)	225m^2 (15mx15m)
13.	Standard Distance between phase-to-phase conductors (approx.)	6m	4m	4m	6m
14.	Duration of Project Implementation	Approximately 30 months			

Figure 26: Angle Tower

Figure 27: Suspension Tower

Figure 28: Insulators for transmission line

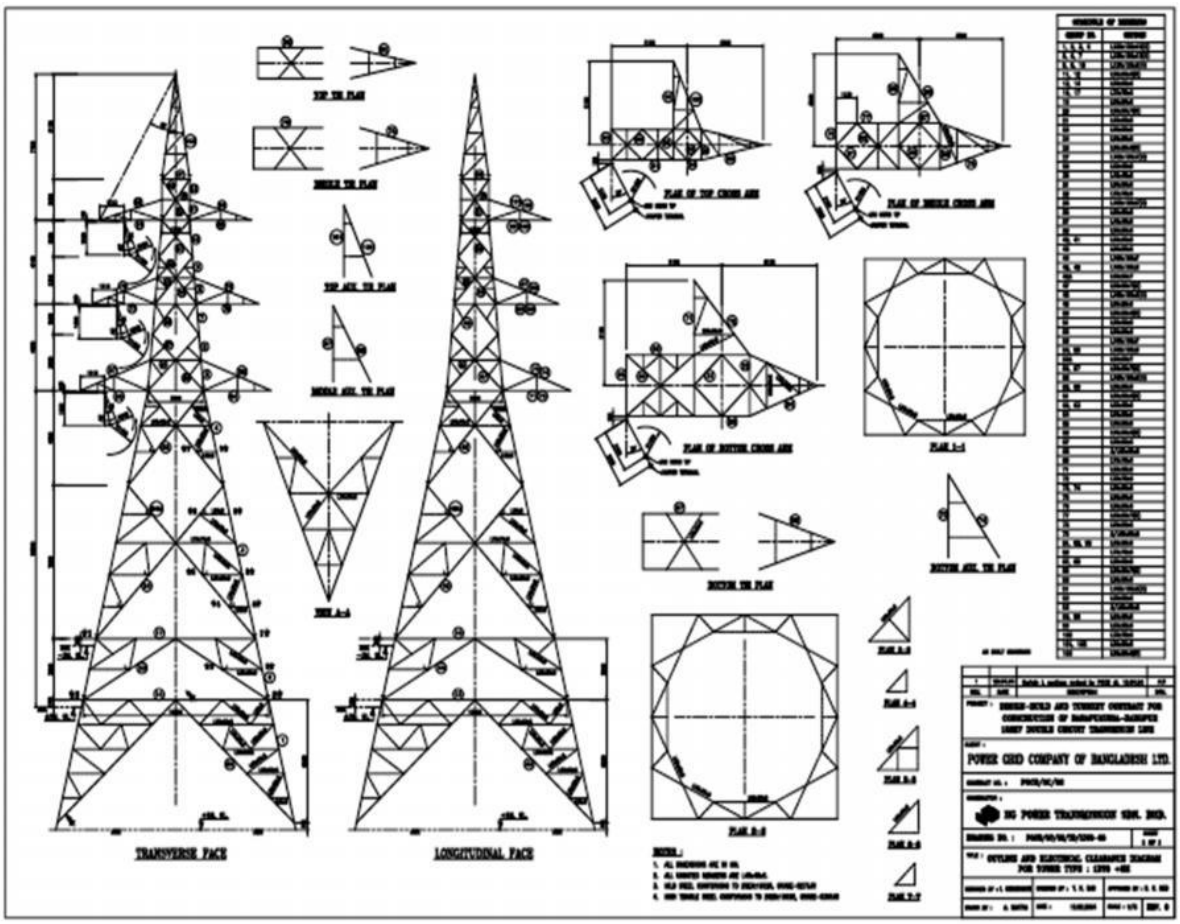


Figure 29: Drawings of 132 kV Tower

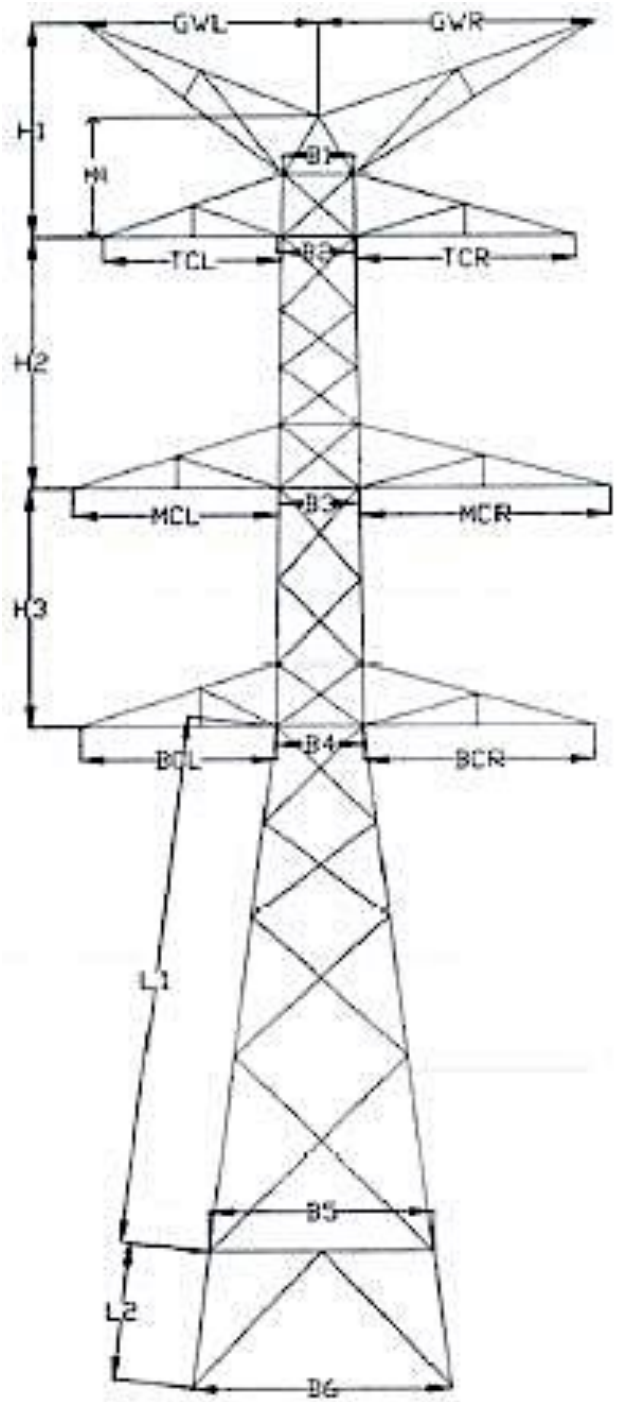


Figure 30: Schematic Drawing of 230kV Double Circuit Tower

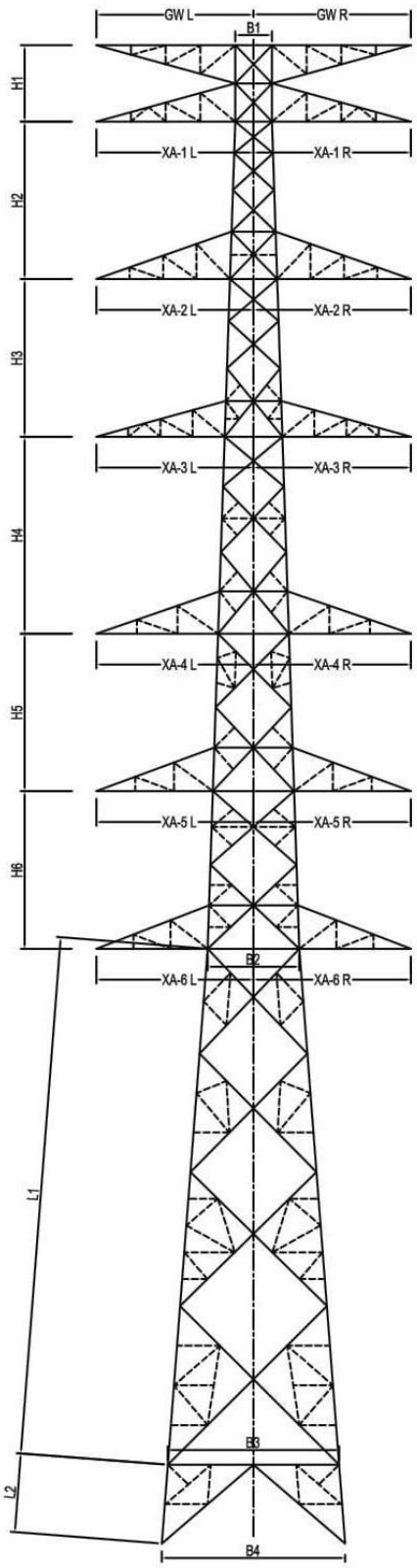


Figure 31: Schematic Drawing of 230kV Four Circuit Tower

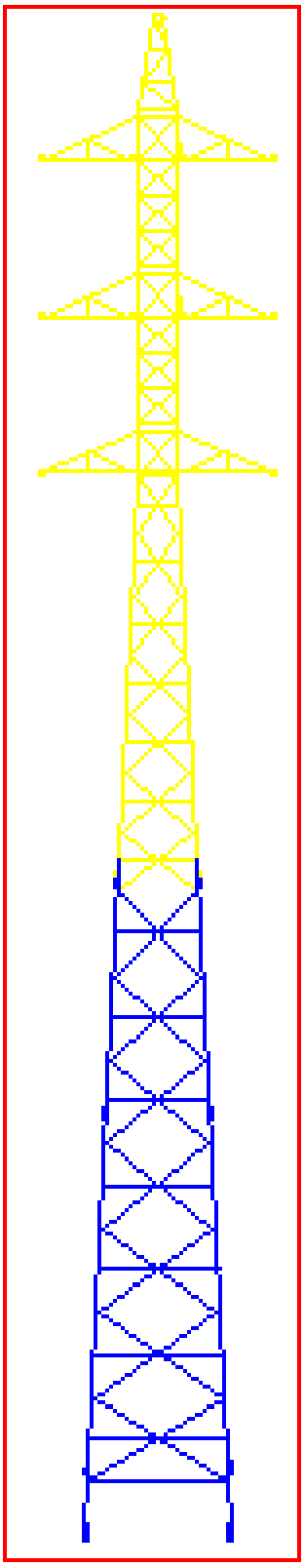


Figure 32: Schematic Drawing of 132kV Double Circuit Tower

3.8 Construction Activities

The phase wise major activities of construction work in transmission line and substations are stated in the Table 28.

Table 28: Phase-wise construction activities

Components	Activities		
	Pre-construction	During Construction	Post construction/ Operation period
Overhead Transmission Line (OHTL)	Check (Route) survey	Contractor and manpower recruitment	Regular clearing of RoW
	Tender Documents preparation	Establishment of construction camps for workers and transportation to work site (if required);	Operation and maintenance (O&M) of OHTL
	Plans for OHTL construction activities such as tower erection, conductor stringing, connection to substation, obtain clearance/permissions, utilities shift, etc.	Establishment of temporary access tracks	Dealing with accidental health and safety related to O&M of OHTL
		Clearing of RoW of OHTL route	
		Establishment of temporary material storage areas and work sites for OHTL components and construction equipment;	
		Civil works (foundation works, reinforced cement concrete (RCC) works etc.);	
		Provide compensation to landowner for tower footings land, and tower erection	
		Overhead conductor stringing;	
Sub-stations	Topographical survey	Contractor and manpower recruitment	Operation and maintenance (O&M) of the substation
	Tender Documents preparation	Land development (if required);	
	Land acquisition	Establishment of construction camps for workers (if required)	Dealing with accidental health and safety during O&M of the substation site;
	Plans for construction activities	Establishment of material storage areas and work sites including access roads	
		Establishment of temporary access tracks to the worksite (i.e., substation site)	
		Transportation of materials and equipment to substation site	
		Clearing substation site	
		Civil works (land filling, foundation works, RCC works, etc.)	
		Equipment's installation and connection	
		System integration, testing and commissioning	
		Dealing with accidental health and safety	
		Connecting OHTL with substations using Overhead Line Entry	

Components	Activities		
	Pre-construction	During Construction	Post construction/ Operation period
		Provision of gantry	
		Dealing with accidental health and safety during tower erection, conductor stringing and connecting to substations;	

Source: ESIA Study of Power System Upgrade and Expansion Project (PSUEP), PGCB, 2019, Bangladesh

3.8.1 Construction related Works for Substations

Earth Work in Foundation

Construction of the sub-station needs earthwork excavating for the foundation up to the required depth. The excavated earth should be kept in a suitable vacant place and after completion of foundation work; back-filling of the excavated area will be done with local soil and sand.

Foundation Treatment

Geo-technical investigation will be conducted to assist in designing foundations of the structures as it will help to identify whether foundation treatment will be required or not. The type of treatment like pre-cast RCC piling or in situ concrete piling, removal of peat or loose soil will be suggested as per results of geo-technical investigation. Pilling has been done 9-20m depth varying with soil type. EPC contractor will decide type of piling with recommendations from PGCB.

Back Filling with Local Sand

Back filling of the excavated area of the foundation and floor of the building will be carried with local sand. About 3m, 2m, 2m and 1.52m land filling depth would be required for Anwara, Cox's Bazar, BHTC and Teknaf SS respectively as part of the site development.

RCC Work

The RCC (Reinforced Cement Concrete) works would be required for column, beam, floor, circuit breaker structure and steel structure, etc.

Brick Work up to Plinth Level and Superstructure

Brickwork will be done for the construction of substation building with first class bricks and coarse sand and cement up to roof level.

Plastering and Finishing

Size is to be done and bulbs and switchboards are to be provided. Plastering of walls inside and outside as well as the roof of the building will be done in accordance with proper curing for at least three weeks. Following that, distemper or plastic painting will be done on the walls and roof of the building.

Wood Works/ Thai Aluminum, Windows and Glass Fittings

Wood/Thai aluminum works are to be done on door shutters and windows of the building along with glass fittings.

Figure 33: Sand Filling

Figure 34: Pilling Work

Sanitary Works

Sanitary works such as lying of sewerage line (either PVC or RCC), installation, fittings and fixing of toilet accessories will be done in the building.

Water Supply System

The water supply system where available will be activated for the workers and staff of the sub-station. Tube wells will be set up where there is no supply system.

Boundary Fencing with Concrete Pillar and Barbed Wire

The substation areas will be protected from any unauthorized entrance of public by fencing the boundary with a six feet height wall with barbed wire fitted with concrete pillars three (3) meters apart.

3.8.2 Construction Related works for Transmission Lines

Piling Work

The basement of the lattice tower will be pile foundation. There will be piles and at the top, a pile cap in each leg of the tower. For piling work a boring will be made in the soil using drilling rig. Bentonite Slurry or steel tube will be used to stabilize the bore hole. Reinforcement cage will be placed, and consequent concrete casting will be performed. For pile foundation, at least 3 piles and mostly 4 piles are cast in general. The number and depth of pile will depend on the results of geotechnical investigation.

Excavation

After the completion of piling work, the topsoil of the piles will be excavated up to specified depth. The excavation work could be done using local instrument or using excavator.

Pile Cap Casting

At the finishing of excavation, top and bottom reinforcements will be placed. Then concreting of pile cap will be performed. The pile cap transfer load to the sub soil through the piles.

Tower Erection

The steel sections of the tower will be joined by bolt to erect the tower. Crane may be used to lift the steel sections at different elevation.

Figure 35: Placing steel ring bunds

Figure 36: Welding of reinforcements

Figure 37: Tower Pilling Work

Figure 38: Pile Cap Reinforcement

Figure 39: Striping the tower footing with steel

Figure 40: Providing detail reinforcements

Figure 41: Casting CC into tower foundation

Figure 42: Placing Tower on its foundation

Electrical Works

Installation of equipment will include circuit breakers, Transformer, Lightning arrester, panel boards, batteries and battery chargers' insulators, current Transformer, Potential Transformer etc. After completion of the building, all equipment will be installed at the substation as per design specification and standard. For this project, all local materials will be used for civil construction, and mechanical and electrical items would be foreign. Therefore, use of domestic materials will be less; only local materials like bricks, sand, cement, rods, etc. will be used for the installation works. Transformers are heavy equipment. Therefore, the transportation of such equipment may require grading of river embankment and skidding through open field. Compensation may be provided to the landowners who would be affected.

Erection of Tower

The towers will be constructed to take the load of the tower itself, conductors, accessories as well as wind load and earthquake load. The towers in paddy fields will have proper clearance to maintain sag (lowest point on the line). At homesteads, if any, the sag will be maintained as per standards. Guard structures for OHL may be required in certain locations.

Figure 43: Tower Erection Work

Figure 44: Tower Erection Work

Drawing of Transmission Line

The transmission line will be drawn keeping suitable clearance at all locations. During stringing work, the lowest sag point will be maintained as per approved drawing and design. Stringing under OHL activities are but not limited to pilot line, conductor, pulling, sagging, splicing, removing rollers, final insulators, etc.

Figure 45: Conductor Stringing

3.9 Construction Equipment and Materials

Equipment required for construction of the proposed transmission lines will include bulldozer, motorized water truck, boring machine, sand carrying truck, concrete mixing truck, crane, fork lift, cable drum, trailer, boom truck, drum puller, sagging dozer, static wire reel, trailer and dump truck.

Construction equipment requirements for substations are auger, backhoe front loader, concrete truck, water truck, dump truck, excavator, trailer, crew truck/car hauler, skid steer loader, batching plant, drill rig truck with trailer, compressor, construction fork loader, vibrating roller, light pickup, crane, bucket truck, boom truck, trailer, forklift, and overhead line rig.

The construction materials required for sub-station and transmission line construction include cement, coarse and fine aggregates, sand, reinforcement steel, rough sawn timber, bellies and steel-bar, checker-plate, anchor-bolts, and electric cables. Construction equipment and materials may be kept on lands which will be requisition through DC or lease land with negotiated settlement which may cause temporary impacts to the landowners and sharecroppers.

3.10 Construction Waste and Hazardous Materials Disposal

Hazardous materials and waste produced during construction works need proper storage, handling, in accordance with local regulations. In order to ensure the proper management of these materials, a certain place within the project boundary will be selected where the materials would be deposited temporarily and then moved within the shortest possible time. Basically, the dumping zone will be selected near the boundary line where the main project entrance would be located for easy transport of these materials away from the site. Dumping site near the entrance assures easy loading and unloading of those disposed materials into the disposal carrying vehicles. In case of the project boundary being comparatively small and therefore, not having the available space for waste

disposal, then disposal site should be selected beside the project location with the approval of the appropriate authority.

3.11 Construction Manpower

PGCB usually construct the transmission line and substation through engineering, procurement and construction (EPC) contractors. The EPC contractor will engage skilled manpower as per their requirements to complete the work within given timeline. During different phases of construction work, excavators, pile-workers, foundation and superstructure laborers, carpenters, electricians, heavy equipment operators, ironworkers, masons, plasterers, plumbers, pipefitters, sheet metal workers, steel fixers, and welders will be engaged whenever necessary. The technical staff will include civil engineers, electrical engineers, supervisors, and technicians of various trades. The unskilled labor will be hired from the local community to avoid labor influx.

3.12 Temporary Facilities

The contractor's temporary facilities including construction camp, labor camp, material storage yard, and machinery/yard are established by the contractor within the substation premises. Construction of a substation is a complicated and time-consuming work (generally it takes 2-3 years) therefore site engineers and construction workers engaged by the EPC contractor have to stay close to the construction site. Camp with all necessary facilities like sanitation, safe water supply, and power supply are established for the workers. The same facilities will be used for the transmission lines works as well. Site of camp should not be within nature reserves/protected areas.

3.13 O&M Activities for Substation & Mitigation Measures for SF6

The substation sites will be kept tidy at all times. Maintenance of the substation is essential for ensuring its reliability and safety. An annual review/inspection is generally conducted, and maintenance is carried out as required. The life of a substation is about 40 to 50 years. Replacement and refurbishment work may need to be done from time-to-time. This may involve replacing some aging equipment over several days or weeks, or rebuilding certain sections of the substation which could take several months. Maintenance work can be classified as daily, weekly and yearly maintenance. Transmission lines and substation equipment like transformers with associated bay equipment, bus bar coupler, capacitor banks, battery and battery chargers, relays, and underground cables need to be regularly monitored and maintained after substation commissioning. Measurement of leakage in line current and neutral current of transmission lines, air cooler servicing and maintenance, refilling and maintenance of firefighting equipment, gardening, plantations, water supply and sanitation are also considered necessary for sound operation of substation.

In addition, SF6 pressure will be monitored periodically by the OM personnel. In case of low pressure, there will be arrangement of refilling SF6 from Refilling Bottle. Moreover, the SF6 will also be identified by SF6 leak detector.

Mitigation Measures for SF6

There are several precautionary measures that are taken during the maintenance and operation of SF6 gas-filled GIS high voltage grid substations to minimize the impact on the environment due to SF6 gas leakage. Some of these measures are:

Regular Inspections: Regular inspections of the GIS system are carried out to detect any leaks early and take necessary corrective actions.

Proper Training: All personnel involved in the maintenance and operation of the GIS system are properly trained on the safe handling of SF6 gas and the use of gas-handling equipment.

Use of Leak Detection Equipment: Leak detection equipment such as handheld leak detectors or fixed gas detectors are used to detect any SF6 gas leaks.

Use of Gas Recovery Systems: Gas recovery systems are used to recover SF6 gas that has been discharged during maintenance or operation of the GIS system.

Use of Sealed Enclosures: GIS equipment is designed with sealed enclosures to prevent the release of SF6 gas.

Proper Ventilation: Adequate ventilation is provided in the GIS substation to prevent the buildup of SF6 gas in the event of a leak.

Proper Disposal: Disposal of SF6 gas is done in accordance with environmental regulations and guidelines to prevent contamination of the environment.

By ensuring that these precautionary measures are followed during the maintenance and operation of SF6 gas-filled GIS high voltage grid substations, the impact on the environment due to leakage of SF6 gas can be minimized.

Maintenance Procedure done by PGCB

Basically, PGCB use **DILO SF6 Gas Handling Equipment** during maintenance work at specified GIS part. It is used for refilling SF6 gas in GIS substation maintenance. The DILO SF6 Gas Handling Equipment is designed to provide a reliable and efficient gas refilling, recovery, and purification process.

The SF6 gas refilling procedure involves several steps. Firstly, the gas is extracted entirely from the GIS equipment with the help of a vacuum pump. Next, the gas is purified and filtered to eliminate any moisture or impurities present in it. Once purified, the gas is compressed and stored in a storage tank. Finally, after completing the maintenance work, the GIS equipment is evacuated, and the purified & compressed gas is transferred back into it.

Overall, the use of DILO SF6 gas handling equipment is helping PGCB to ensure a reliable and efficient refilling process for SF6 gas in GIS substation maintenance, reducing the risk of leaks and minimizing the environmental impact.

3.14 O&M Activities for Transmission Lines

Operation and Maintenance (O&M) activities of transmission lines are largely dependent on built-in monitoring system of the overhead and underground cables which allows detecting short circuit or open circuit conditions. Short circuit generally occurs when cable insulation and or cable splice works are compromised, and the conductors get exposed. Open circuit occurs in case of breaking of end

connections, splice or conductor itself. Presently, advanced technology allows automatic disconnection of the faulty line(s) from the system within few milliseconds. Once the disconnection occurs, the next step followed is to determine the trigger of the fault (whether it is a false trigger or not), location of the fault (by sending and receiving signals) and mobilizing personnel after identifying the location and cause of the fault. For OHTL, fault maintenance works include replacing or repairing the damaged conductor, insulator, or any other component. Below is the list of O&M works usually conducted for transmission lines:

- Evacuation/ transmission or distribution of electric power from power plants/ substations to substations/ load centres in controlled manner;
- Monitoring of the transmission line from the control room of associated power plants/ substations;
- Periodical (for example, quarterly) visual inspection of transmission line routes;
- Fault detection in case of any occurrence of faults;
- Fault correction through replacement or repair works;
- In case of emergency works, commence work immediately following safety procedures and notify authorities immediately upon completion of work (Electricity Act, 2018 and Electricity Rules 2020);
- In case of regular schedule maintenance works, commence work following safety procedures only after notifying authorities before commencement of work (Electricity Act, 2018 and Electricity Rules 2020);
- Complete any civil works after completion of repair/ replacement works such as refilling, levelling and or rebuilding (excavated roads, sidewalks, pavements, and manholes) to the pre-repair/replacement work conditions.

3.15 Project Schedule and Cost

The completion of works will take approximately 30 months. The life span of the project is 30 years. The estimated cost of the project is given below:

Table 29: Estimated Cost of the Project

Sources	Estimated Cost (BDT in Lac)	Estimated Cost (in million USD)
GOB	65142.99	60.32
PA	172799.60	160.00
PGCB	41454.01	38.38
Others	0.00	0.00
Total	**279396.60**	**258.70**

Chapter 4
Analysis of Alternatives

4.1 Introduction

The purpose of the analysis of alternatives as part of the ESIA process is to assess the environmental and social impacts among all possible Project options. The ES assessment is then combined with the economic and financial feasibility to select the most reasonable alternative. The assessments and recommendations made by the ESIA team are presented below.

4.2 Alternate Analysis

Project alternative is required, if the impact of the Project design is significant in terms of environment and social components. Normally Project Proponent goes for analyzing different sites for the establishment of substations and associated transmission lines on the basis of location, accessibility for raw materials transportation, availability of manpower during construction work, considerable distance from the settlements, land use pattern, natural habitats and vulnerability to natural and manmade disasters, etc. However, it is important to analyze the comparative analysis of proposed routes and substations.

4.2.1 Without Project Alternative

The 'without project' or 'no project' alternative would imply that no transmission lines would be added, and no substation would be established that are envisaged under the project. This would imply that the current electricity network in the Chattogram region and Hi-Tech City will not be expanded, and its capacity will not be enhanced.

The advantages of such a scenario would include no environmental and social impacts associated with the establishment of substations and construction activities, laying of transmission lines and associated activities. Similarly, the capital investment required for the project would also be not needed, nor would any O&M activities need to be carried out. The main disadvantage of the 'no project' scenario would be the development of severe capacity constraint in the electricity network of the area. The network would not be able to handle the additional electricity generation, nor would it be able to meet the increasing demand in the area.

Chattogram is an important area with respect to the industrial output, exports, and government revenues - significantly contributing towards the economic development of the country. The area hosts important economic and industrial establishments including economic zones (EZs), seaport, oil refinery, export processing zones, in addition to the residential areas. These establishments have generated rapidly growing demand for electricity, however the power supply in the region has not kept up with this demand growth.

The proposed project has been envisaged to address the above-described growth in electricity demand. If this project is not implemented, the electricity network would not be able to support the rapidly growing commercial and industrial activities as well as residential areas, nor would any growth in the region's commercial and industrial activities be possible; and as a result, the country

will also not be able to sustain economic growth. Therefore, the 'no project' scenario is not a viable option and therefore it is rejected.

4.2.2 Alternative Technology for Substations

There are generally two technology options for the substations: more conventional air insulated switchgear (AIS); or technologically more advanced gas insulated switchgear (GIS). The technical, financial, economic, environmental and social aspects of these alternatives are presented in Table 30.

Table 30: Comparative Analysis of GIS and AIS Substations

SN	Description	GIS	AIS
A.	**Technical Aspects**		
1.	Fault Occurrence/ outage	GIS are modern and more regulated, so the chances of faults occurring is extremely low; The extremely low mean time between failures (MTBF) means there is very low outage as well.	AIS are archaic and not as much as regulated in comparison to GIS, so the chances of faults occurring is significantly high. The relatively high MTBF means there will be more outages during its lifecycle; More MTBF also is translated to more man-hours spent in repair/ replacement works during the lifecycle of an AIS.
2.	Reliability	Compartmentalized enclosure of the live parts in GIS makes for a very reliable system due to reduced disruption of the insulation system;	Open air components so the reliability is compromised in AIS system;
3.	Assembling	Quick assembly due to extensive pre-assembly; compact nature of the components mean they can be shipped assembled;	Slow assembly process due to dismantled shipment of heavy and oversized components;
4.	Replacement and Repair Works	Although very unlikely, if faults/ failures occur, it requires extensive and time-consuming works; the advanced nature of the system also means highly adept technicians are required to conduct the replacement and repair works; and more often than not, GIS based systems are required to be dismantled and sent out to designated facilities to conduct such works; these translates to longer out of service, expensive repair works, added burden of transportation etc.	AIS based systems are more prone to faults/ failures; however, the repair/ replacement work can be carried out by any regular technician because of the simplicity of the systems; the detection of faults/ failures is much easier as the components are exposed, and visible observation is sometimes more than enough to identify the faults. The repair works usually do not take long and can be

SN	Description	GIS	AIS
			done in-house, i.e., within the substation's facility so no added burden of transportation;
5.	Regular maintenance works	Extremely low; the first and only comprehensive maintenance work may not be required before 15 to 20 years; Under normal O&M, very low maintenance requirements due to expedient design and protection against external elements;	Very high; the first comprehensive maintenance work may be required within 3 to 5 years of commissioning and then every year after that; under normal O&M, high maintenance requirements due to the exposed nature of the AIS system;
6.	Procurement	Procurement and supply of SF6 gas can be a problem especially in rough terrain and offsite locations; thereby further increasing the costs;	No such procurement required for AIS substation;
7.	Structures	Small and compact components can be placed in a housing; not much foundation work is required;	Large and heavy components are placed under open area; a lot of foundation works is required to mount the switchyard components and the transformers;
B.	**Economic and Financial Aspects**		
8.	Initial Expense	GIS based substations of similar functions/ capacities tend to be 1.1 to 1.4 times higher in cost compared to AIS based systems. However low land requirements can offset this difference.	AIS based substations of similar functions/ capacities tend to cost between 70~90% compared to GIS based substation. However high cost of land can be quite significant particularly in urban areas.
9.	Life span	GIS based system has much longer lifespan. A GIS based substation can operate up to 40 years with extremely low maintenance requirements	AIS based system has much shorter lifespan; An AIS based substation can operate up to 15~20 years with considerably high maintenance requirements that tend to increase at the latter stage of the lifecycle.
C.	**Environmental considerations**		
10.	Occupational Health and Safety and Public Safety	The earthed metal enclosure allows a safe working environment for the attending personnel and also for nearby communities	The open/ exposed live components safety risk for workers as well as general public; AIS needs to be completely disconnected and

SN	Description	GIS	AIS
			discharged before conducting scheduled cleaning activities.
11.	Fire Safety	Lower risk of fire as the system operates in the presence of non-flammable, high cooling, arc quenching SF6 gas	AIS based system do not have the arc quenching property of SF6, thus, it has higher chance of fire accidents
12.	Climate impact	SF6 is a potent greenhouse gas with a high global warming potential, and its concentration in the earth atmosphere is rapidly increasing. During its working cycle, SF6 decomposes under electrical stress, forming toxic byproducts that are a health threat for working personnel in the event of exposure. Though SF6 is a very good insulator, it is also a potential greenhouse gas having a global warming potential of 22800 over a period of 100 years.	
		GIS uses a superior dielectric gas, SF6, at moderate pressure for phase-to-phase and phase-to-ground insulation. The high voltage conductors, circuit breaker interrupters, switches, current transformers, and voltage transformers are in SF6 gas inside grounded metal enclosures.	The atmospheric air insulation used in a conventional, air-insulated substation (AIS) requires meters of air insulation to do what SF6 can do in centimeters. As a result, GIS is more reliable and requires less maintenance than AIS.
13.	Construction related impacts (such as dust, noise, air emissions, and waste effluents)	No risk since all the live parts are totally sealed and encapsulated.	Open to air live parts of the substation pose risks of bird electrocution and bird hits.
D.	**Social Considerations**		
14.	Land Requirements	Requires about 20% of the land compared to the conventional AIS substation	Requires large area of land that can be difficult to arrange and can be quite expensive particularly in urban settings.
15.	Construction related impacts (such as community disturbance and labor issues)	Low since construction activities are not very extensive. Most parts of GIS come in compact and modular form requiring limited extent of on-site installation/construction works	Extensive since large equipment need to be installed
16.	Locality Preference	More suitable to urban and suburban areas where land availability and cost are significant issues.	More suitable for rural and unpopulated areas where land is available easily at reasonable costs.

Source: ESIA Study of Power System Upgrade and Expansion Project (PSUEP), PGCB, 2019, Bangladesh

Though the cost of GIS substations is substantially higher compared to the AIS system, GIS substations have been selected for the proposed project primarily in view of the smaller land

requirements since availability of large land parcel could be quite difficult and expensive in the Chattogram region. In addition, GIS systems are more reliable, safer to operate and maintain, pose minimal safety risks to the communities, and easier to install.

4.2.3 Alternatives for Transmission Lines

Two types of transmission lines have been considered for the proposed project: overhead transmission lines using bare conductors; and underground transmission lines using insulated cable. The technical, financial, economic, environmental and social aspects of these alternatives are presented in Table 31.

Table 31: Comparative Analysis of Overhead and Underground Transmission Lines

SN	Description	Overhead	Underground
A.	**Technical Aspects**		
1.	Construction activities	Extensive, requiring tower foundation construction, erection of towers, conductor stringing, and installation of insulators and other devices.	Less extensive, involving trench excavation, laying of cables, laying of sand over cables, and covering the trench,
2.	Fault Occurrence/ outage	Very high due to the exposed nature.	Very low due to the concealed nature.
3.	Fault Detection	Relatively easy as it is exposed and can be visibly identified;	Relatively difficult due to the concealed nature of the line;
4.	Replacement and Repair Works	Easy replacement and repair works; can be completed within 24 hours and less expensive;	Difficult to do replacement and repair works as it would require careful excavation, breaking of road/ pavements, sidewalks etc.; may take several weeks to complete and more expensive;
5.	Regular maintenance works	More, typically every year, maintenance is significantly high	Very low. Typically, once in every 5-10 years, low maintenance expenses, usually visual inspections, marking
6.	Terrain Preference	Flat terrain is preferred; however, can be implemented in hilly terrain as well;	Flat terrain is preferred; not recommended for hilly terrain which would add more cost in tunneling and trenching works.
7.	Water bodies	Easy to implement in case of stringing over water bodies; for wider water bodies, a few numbers of towers can be erected on the water to string transmission lines.	Extremely difficult to implement in case of passing a water body as it would require very high intervention and thus usually avoided when tower erection is possible.
8.	Insulation	It usually uses porcelain discs for insulation between the conductor and the towers, and air gap from	The buried cables come with expensive insulation compounds covering the conductors; the insulations are also covered by

SN	Description	Overhead	Underground
		conductor to conductor which are less expensive;	jackets/braids/ sheath/ screens to avoid damage and thus they are more expensive;
9.	Interference	Due to the exposed nature of the conductors, OHTL introduces significant interference to receivers/ antennas, disrupts mobile or internet communication networks.	Due to the buried/sheathed nature of the UGTL, it does not introduce any interference to receivers/ antennas, and thus does not disrupt mobile or internet communication networks.
B.	**Economic and Financial Aspects**		
10.	Implementation expenditure	Significantly low compared to UGTL, usually only 10-20% of the expenditure of the same capacity and length;	Very high, typically 5-10 times for same capacity and length;
C.	**Environmental considerations**		
11.	Safety (Public)	Due to the fact that OHTL are exposed, they pose higher public safety risks; OHTL are more prone to accidents for the same reason.	UGTL are buried and as a result they are inaccessible and thus do not pose safety issues; UGTL are thus less prone to accidents.
12.	Safety (Maintenance)	Most of the OHTL maintenance work such as replacement of insulators, clearing of vegetation etc. involve working in significantly alleviated height (25m+) resulting in higher safety risks for the maintenance crew.	UGTL maintenance works are carried out at ground level or in shallow depth (2~3m) and as such it poses lower safety concerns.
13.	Natural Calamity	Can be affected by thunderstorms, lightning, cyclones, floods, mudslide, and earthquakes.	Can be affected by floods, mudslides, and earthquakes.
14.	Vegetation	OHTL allows vegetation under certain height underneath the RoW.	UGTL does not allow vegetation of any types (irrespective of voltage ratings) above the buried cables along the route; UGTL is not recommended for fallow lands.
15.	Threat to wildlife	Although very rare, climbing mammals can be electrocuted by bridging live conductors with the steel towers.	Shielding (sheath and screen) protects earth excavating animals such as rodents to enter live conductors.
16.	Threat to birds	Overhead transmission lines pose risks of electrocution and bird hits.	Underground transmission lines pose no such risks.
D.	**Social Considerations**		
17.	Land Requirement	Requires land acquisition of the tower footings, which can be significant depending on the size (governed by voltage ratings,	Public roadside space, under the sidewalks or pavements are usually selected for UGTL thus it normally does not require land acquisition.

SN	Description	Overhead	Underground
		terrain type, soil quality etc.) and type of the tower (suspension, angular).	
18.	Structures	OHTL allows public and private structures under it up to a certain height; sometimes to allow existing structures to be under the Right of Way (RoW), tower heights are increased.	UGTL only allows limited public structures such as roads, pavements, and sidewalks above it.
19.	Locality Preference	Rural areas with fallow lands have low height structures and crop fields thus OHTL is more suited for these areas.	Urban and suburban areas have more roads that are suitable for UGTL and more taller structures that can be avoided if UGTL is used, thus UGTL is preferable for such localities.
20.	Visual Preference	Erected towers, danger signs posted, and strung conductors affect the visual aesthetics of the area.	Buried nature of the UGTL means that they are out of sight and hence no aesthetic issues.

Source: ESIA Study of Power System Upgrade and Expansion Project (PSUEP), PGCB, 2019, Bangladesh

OHTL has the threat to birds and wildlife especially while passing within the reserved forest or wildlife sanctuary. PGCB has existing 132kV OHTL from Dohazari to Cox's Bazar mentioned in Section 5.7.6 which passed through Chunati Wildlife Sanctuary and Fasiakhali National Park. No bird collision and impact on elephant due to TL, yet, has been observed by the Forest Department, and no complain has not been found by PGCB. In view of the above considerations, the overhead cables have been used under the proposed project primarily for whole routes.

Topographically, the land use of transmission line area consists of plain land and hilly areas. Installation of underground transmission line (UGTL) may increase cost compared to overhead transmission line (OHTL). UGTL, also, did not consider along the Chattogram to Cox's Bazar Highway, due to expansion of road in future, which would not be economic.

The forest floor under right-of-way (RoW) shall be cleaned if installation of UGTL. In fact, some additional areas shall be required for the storage of civil and mechanical materials and associate works. As a result, loss of trees, herbs and shrubs need to be felled for the purpose of RoW clearing. In fact, forest grasses, forest liters and numerous insects would be destroyed due to UGTL installation. UGTL has risk of landslides and erosion, as soils of these hills are brutal and lose; and during rain it becomes loamy. Even, there is no scope of replantation over the UGTL duct, and it will be unused over the time. On the other hand, OHTL require to fell tall trees for stringing the transmission line. Within the RoW from tower to tower below height trees can be replanted in discussion with Forest Department. Both side of the Chattogram to Cox's Bazar Highway comprises of densely native tree species specially Boilam (Anisoptera Scaphula), Sal (Shorea robusta), Garjan (Dipterocarpus turbinatus), Telsur (Dipterocarpus turbinatus), Chikrasi (Chukrasia tabularis), etc. which may require to be felled if UGTL is installed. However, transmission line outside of the forest shall increase the number of households within the width of RoW.

4.3 Substation Siting Alternatives

Since the site for substations namely Anwara 230/132/33kV SS, Cox's Bazar 132/33kV SS, Teknaf 132/33kV SS and BHTC 230/33kV SS have already been selected by PGCB under an earlier project (see Table 26), hence no siting options were considered under the proposed project, and therefore, no options have been described in the present ESIA study (Source: (a) ESIA report of Expansion and Strengthening of Power System Network Project and Chattogram Area carried out July 2017; (b) ESIA report of Development of Transmission Infrastructures at BEZA Areas (Chattogram) for reliable power supply (Phase-1) carried out on March 2018; and (c) IEE and EMP report of Expansion and Strengthening of Power System Network Project and Chattogram Area carried out June 2018).

4.4 Alternative Transmission Line Routes

The following criteria were considered for selecting the alignment of the route:

- Existence of open agricultural land;
- Distance from connecting road not to be more than 1 km;
- Avoiding settlement areas as much as possible;
- Avoiding urban areas as much as possible;
- Avoiding river crossings;
- Considering railway crossings;
- Avoiding water bodies;
- Considering the existing power distribution lines;
- Considering natural habitats (like reserve forests, wildlife sanctuary, national parks, elephant routes/corridor, etc.);
- Considering restricted area (like cantonment, KPI, etc.);
- Location of Air-Insulated Switchgear (AIS) and Gas-Insulated (GIS) sub-station.

Transmission line routes have also been physically observed during field visit. Two alternatives (Option-1: Finalized by PGCB during Feasibility Study; Option-2: Finalized and approved by PGCB during Check Survey carried out by IIFC; Option-3: Finalized and approved by PGCB during Check Survey carried out by National Survey Organisation) transmission line routes are considered each of the proposed new transmission lines. For these alternate routes, technical, financial, economic, environmental, and social aspects were considered through consultation with PGCB, local stakeholders, analyzing of maps and underground utilities, satellite images, traffic condition. After detailed route survey and analysis, most suitable route has been selected considering the technical and financial aspects as well as environmental and social issues/impacts.

4.4.1 Existing Kaliakair SS – Proposed BHTC Transmission Line

The total length of the finally selected transmission line (Option-2) is 4.88 km. The major land use within/under the RoW is agriculture land (70%), homestead trees, and others (10%), etc. The major crossings are agricultural land, roads, Bangshai River, homestead trees, etc. There is no reserved forest/protected area, wildlife sanctuary, ecologically critically area and living of indigenous people (IP) community falls within the RoW of proposed line. The routing options for the existing Kaliakair to Proposed BHTC transmission line are analyzed in Table 32.

Table 32: Routing Options for existing Kaliakair SS – Proposed BHTC transmission line

Attributes	Option-1	Option-2 (Final)
Technical and Financial Aspects		
Considering Length	5-km	4.88-km
Difficulty of Implementation with respect to. trenching/excavations	High	Medium
Crossing of any other existing or proposed transmission lines	Yes -33kV distribution line	Yes -33kV distribution line
Existing important infrastructure	No	No
Meet present demand	Yes	Yes
Meet future demand	Yes	Yes
Power system growth	Yes	Yes
Implementation expense	High	Moderate
Environmental and social aspects		
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	High	Moderate
River Crossing (Bongshai: 2 times)	Yes	Yes
Reserve Forest	No	No
Ecologically Critical Area (ECA)	No	No
Bird habitat and declared IBA	No	No
River erosion	Yes	Yes
Impact on Settlements	Yes (High)	Yes (very low)
Involuntary Resettlement Impacts	No	No

Source: ESIA Study, 2020

Inference:
Option-1 and 2 offers almost the same route length. Based on the route survey, it is identified that Option-2 will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is high for Option-1 and construction related impacts will be higher to the community people; all other environmental and social issues are quite similar for two options. Therefore, Option-2 has been selected for the existing Kaliakair to proposed BHTC transmission line.

The routing options for the existing Kaliakair to proposed BHTC transmission line are shown in Figure 46.

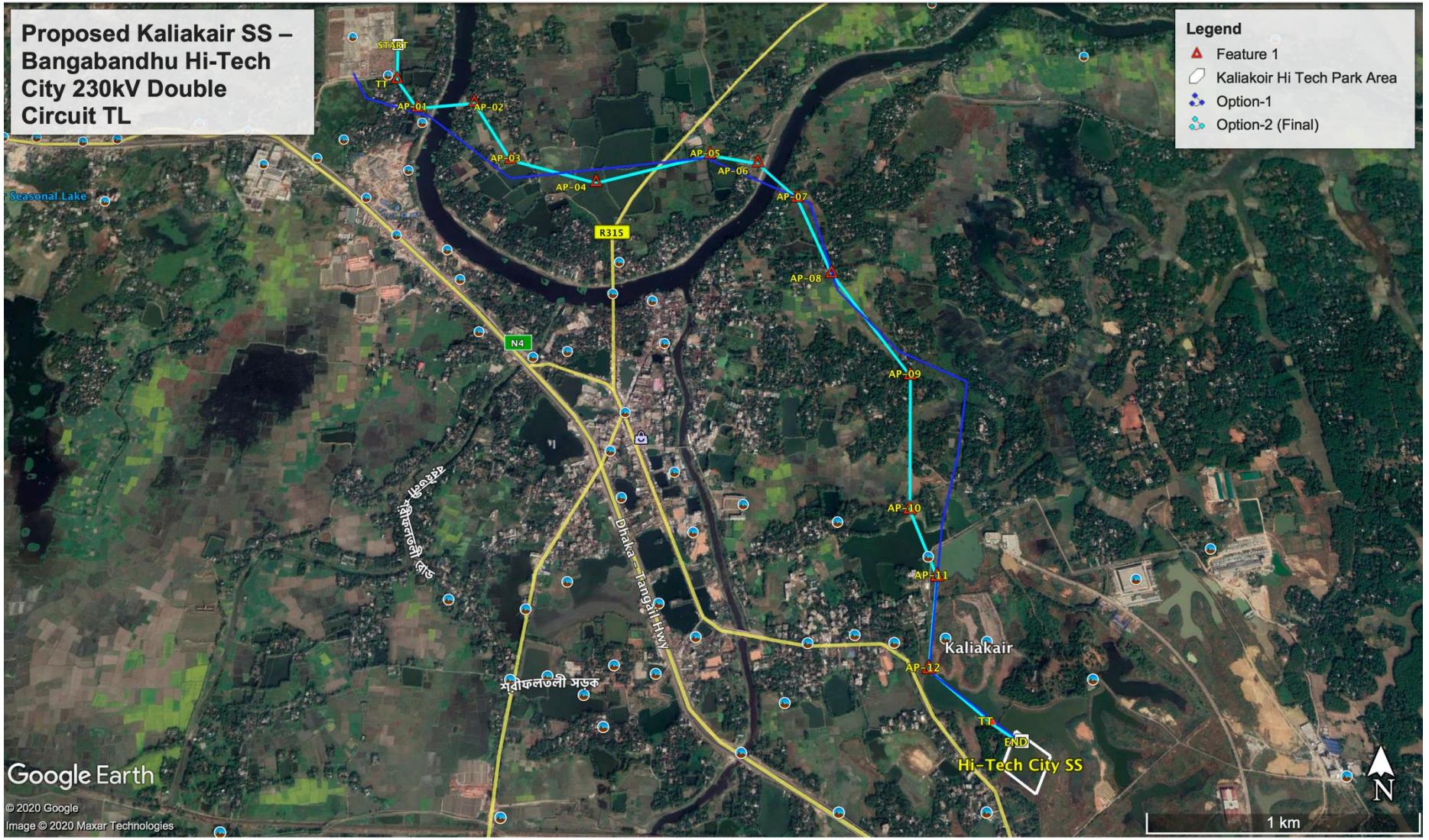


Figure 46: Alternative Routes for existing Kaliakair-BHTC transmission line

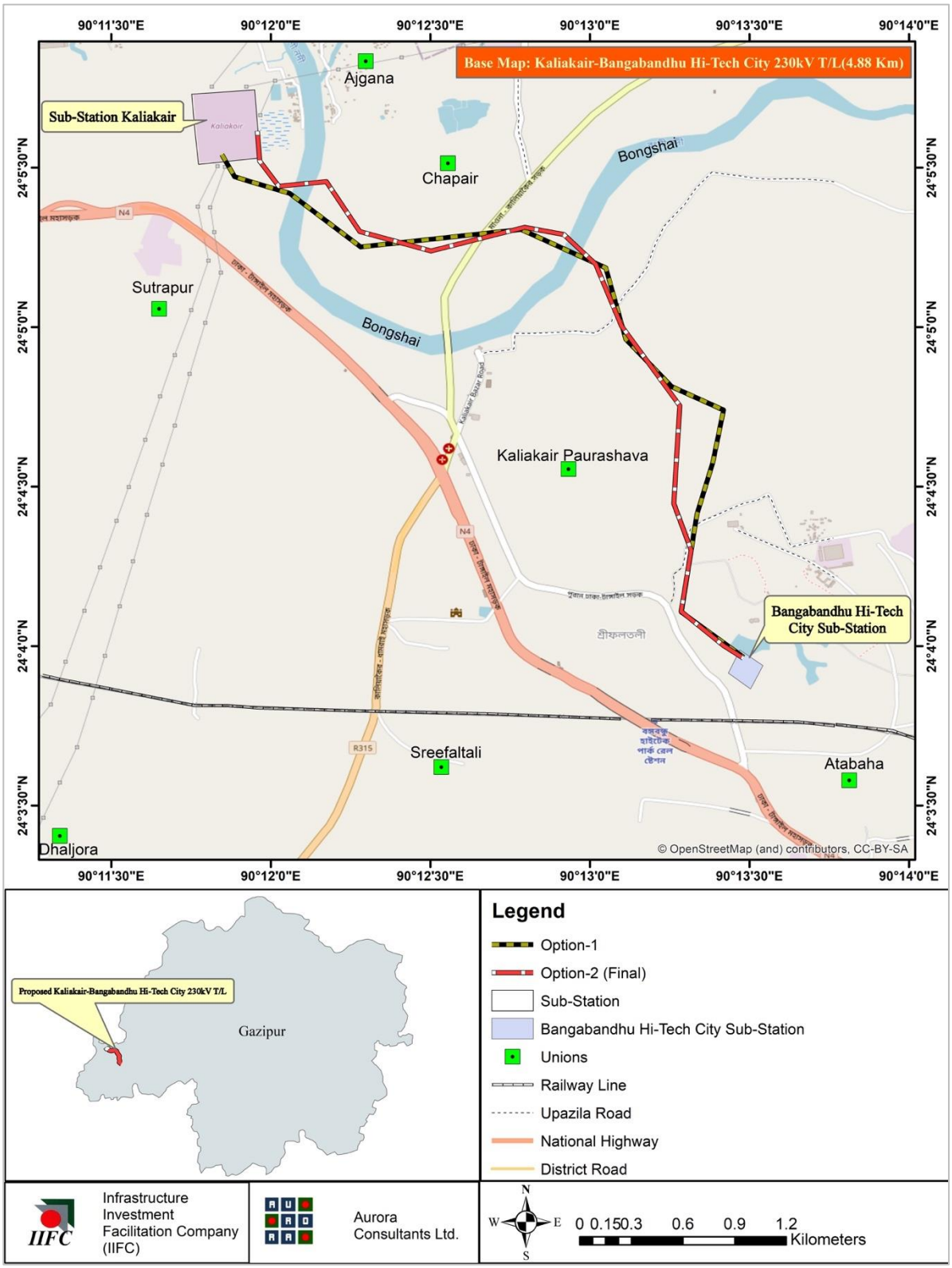


Figure 47: Base Map of existing Kaliakair - BHTC transmission line

4.4.2 Proposed Anwara to Cox's Bazar Transmission Line

The total length of the finally selected transmission line (Option-3) is 105 km consists of 71 nos. of APs considering 50m Right of Way (RoW); 25m for left and 25m for right side from the center line. The major land use within/under the RoW is agriculture land, salt cultivation land, homestead trees and roads, etc. The major crossings are Rivers (Sangu and Matamuhuri), proposed Dohazari to Cox's Bazar Railway, existing Dohazari to Cox's Bazar 132 kV transmission line, various canals, roads, etc. Sangu river is about 415m width and their river crossing tower and anchor tower to be considered as per its technical guideline. The current techniques allow river crossings over rivers wider than 1.5 km by increasing the height of tower to avoid the impacts on navigation and fishing, also, stringing will be done using pilot wire (rope) which will substantially reduce the time required to pull the wire. Mathamuhuri river is about 135m width. There is no elephant corridor under the proposed TL while bypassing the Chunati Wildlife sanctuary. This TL route has been aligned in such a way that it involves the least number of trees cutting.

Table 33: Routing Options for proposed Anwara – Cox's Bazar transmission line

Attributes	Option-1	Option-2	Option-3 (Final)
Technical and Financial Aspects			
Considering Length	108-km	109-km	105-km
Difficulty of Implementation with respect to trenching/excavations	High	Medium	Medium
Crossing of any other existing or proposed transmission lines	Yes 132kV Dohazari to Cox's Bazar TL	Yes 132kV Dohazari to Cox's Bazar TL	Yes 132kV Dohazari to Cox's Bazar TL
Existing important infrastructure	No	No	No
Meet present demand	Yes	Yes	Yes
Meet future demand	Yes	Yes	Yes
Power system growth	Yes	Yes	Yes
Implementation expense	High	Moderate	Moderate
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	High	Moderate	Moderate
River Crossing (Sangu & Matamuhuri)	Yes	Yes	Yes
Railway Crossing	Yes (3 times) (under constructed Dohazari to Cox's Bazar)	Yes (3 times) (under constructed Dohazari to Cox's Bazar)	Yes (2 times)
Reserve Forest	Yes - Chunati WS - Fasiakhali National Park	Yes - Chunati WS	No
Crossing Elephant Route	Yes	No	No
Ecologically Critical Area (ECA)	No	No	No

Attributes	Option-1	Option-2	Option-3 (Final)
Bird habitat and declared IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (High)	Yes (very low)	Yes (very low)
Involuntary Resettlement Impacts	No	No	No

Inference: Based on the route survey, it is identified that Option-3 will have the least difficulty with respect to excavation related activities; and will have lower impact on settlements. Option-1 and Option-2 both have impacts on Chunati WS and Fasiakhali National Park as well as Elephant route crossing. Therefore, Option-3 has been selected for Anwara to Cox's Bazar transmission line. The routing options for the Anwara to Cox's Bazar transmission line are shown in Figure 48.

Construction of transmission lines along the coastal area technically challenging and also required extra protection considering natural calamity (cyclone prone), bank erosion & salinity. In this regard it is not economically and technically viable for PGCB to construct transmission line through the coastal area.

Both side of the Chattogram to Cox's Bazar Highway comprises of densely native tree species specially Boilam *(Anisoptera Scaphula)*, Sal *(Shorearobusta)*, Garjan *(Dipterocarpus turbinatus)*, Telsur *(Dipterocarpus turbinatus)*, Chikrasi *(Chukrasia tabularis),* etc. which may require to be felled if UGTL is installed.

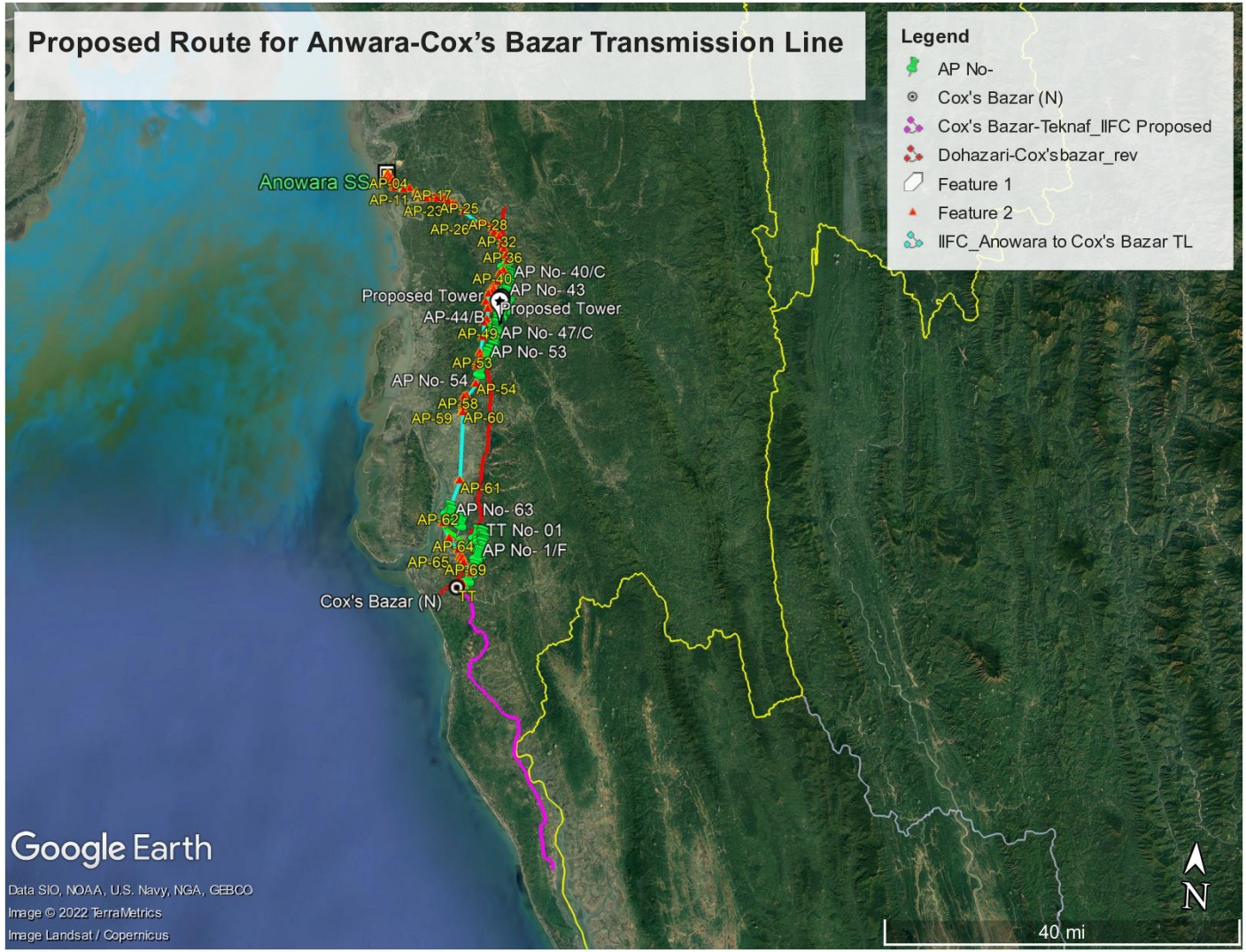


Figure 48: Proposed Route for Anwara-Cox's Bazar transmission line

4.4.3 Proposed Cox's Bazar to Teknaf Transmission Line

The total length of the finally selected transmission line (Option-3) is 73.10 km consists of 78 nos. of APs considering 30m Right of Way (RoW); 15m for left and 15m for right side from the center line. The major land use within/under the RoW is agriculture land (80%), homestead trees (5%), salt cultivation land, etc. The major crossings are Bakkhali River (160 m width), various canals, roads, proposed Dohazari-Cox's Bazar Railway, etc.

Table 34: Routing Options for proposed Cox's Bazar to Teknaf transmission line

Attributes	Option-1	Option-2	Option-3 (Final)
Technical and Financial Aspects			
Considering Length	63.5-km	65-km	73.10-km
Difficulty of Implementation with respect to trenching/excavations	High	Medium	Medium
Crossing of any other existing or proposed transmission lines	Yes 11kV distribution line for 22 times	Yes 11kV distribution line for 18 times	Yes 11kV distribution line for 18 times
Existing important infrastructure	No	No	No
Meet present demand	Yes	Yes	Yes
Meet future demand	Yes	Yes	Yes
Power system growth	Yes	Yes	Yes
Implementation expense	High	Moderate	Moderate
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	High	Moderate	Moderate
River Crossing (Bakkhali River)	Yes	Yes	Yes
Reserve Forest	Yes - Himchari National Park	Yes - Periphery of National Park	Yes - Periphery of National Park
Railway Crossing	Yes (under constructed Dohazari to Cox's Bazar)	Yes (under constructed Dohazari to Cox's Bazar)	Yes (under constructed Dohazari to Cox's Bazar)
Crossing Elephant Route	Yes	No	No
Ecologically Critical Area (ECA)	No	No	No
Bird habitat and declared IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (High)	Yes (very low)	Yes (very low)
Proximity of international boundary (Myanmar)	Very close	Within the safe distance	Within the safe distance
Proximity from Rohingya Camp	Camp 01E is about 225	Camp 01E is about 225	Camp 01E is about 225
Crossing the restricted area	Yes	No	No

Attributes	Option-1	Option-2	Option-3 (Final)
Technical and Financial Aspects			
	- Ramu Cantonment		
Involuntary Resettlement Impacts	No	No	No

Inference: Based on the route survey, it is identified that Option-3 will have the least difficulty with respect to excavation related activities; and will have lower impact on settlements. Option-1 has impact on Ramu Cantonment as well as Elephant route crossing; and is close to the international boundary. Therefore, Option-3 has been selected for Cox's Bazar to Teknaf transmission line. The proposed routing option for the Cox's Bazar to Teknaf transmission line are shown in Figure 49.

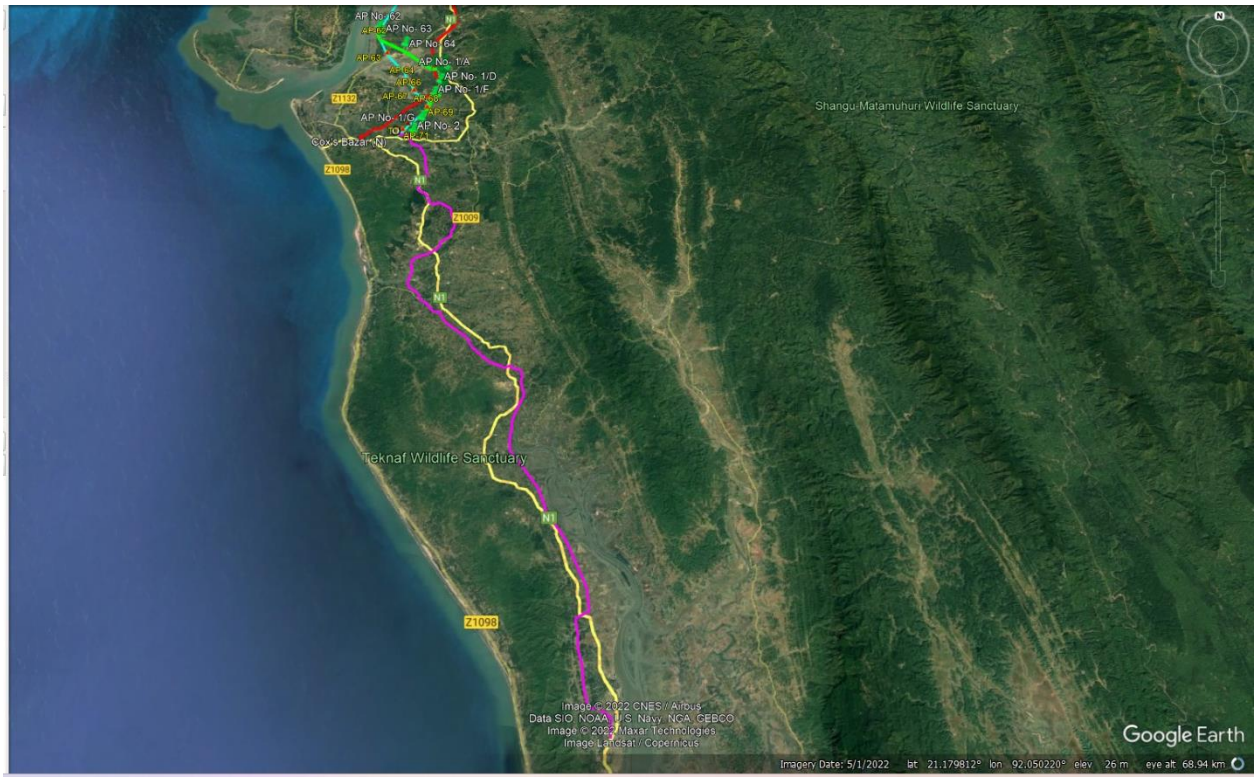


Figure 49: Proposed Route for Cox's Bazar to Teknaf Transmission Line

4.4.4 Proposed LILO of Dohazari to Cox's Bazar Transmission Line

The routing options for the LILO of Dohazari to Cox's Bazar transmission line are analyzed in Table 35 below.

Table 35: Routing Options for proposed LILO of Dohazari to Cox's Bazar transmission line

Attributes	Option-1	Option-2	Option-3 (Final)
Technical and Financial Aspects			
Considering Length	1.57-km	1.55-km	1.09-km
Difficulty of Implementation with respect to. trenching/excavations	High	Medium	Medium

Attributes	Option-1	Option-2	Option-3 (Final)
Technical and Financial Aspects			
Crossing of any other existing or proposed transmission lines	Yes 33kV distribution line	Yes 33kV distribution line	Yes 33kV distribution line
Existing important infrastructure	No	No	No
Meet present demand	Yes	Yes	Yes
Meet future demand	Yes	Yes	Yes
Power system growth	Yes	Yes	Yes
Implementation expense	High	Moderate	Moderate
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	High	Moderate	Moderate
River Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Bird habitat and declared IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (High)	Yes (Low)	Yes (Low)
Crossing the restricted area	No	No	No
Involuntary Resettlement Impacts	No	No	No

Inference: Based on the route survey, it is identified that Option-3 will have the least difficulty with respect to excavation related activities; and will have lower impact on settlements. Therefore, Option-3 has been selected for LILO of Dohazari to Cox's Bazar transmission line. However, during detailed design stage, this TL route will be finalized during detailed design stage. During the detailed design stage, PGCB will try to avoid all residential and commercial HHs (if possible).

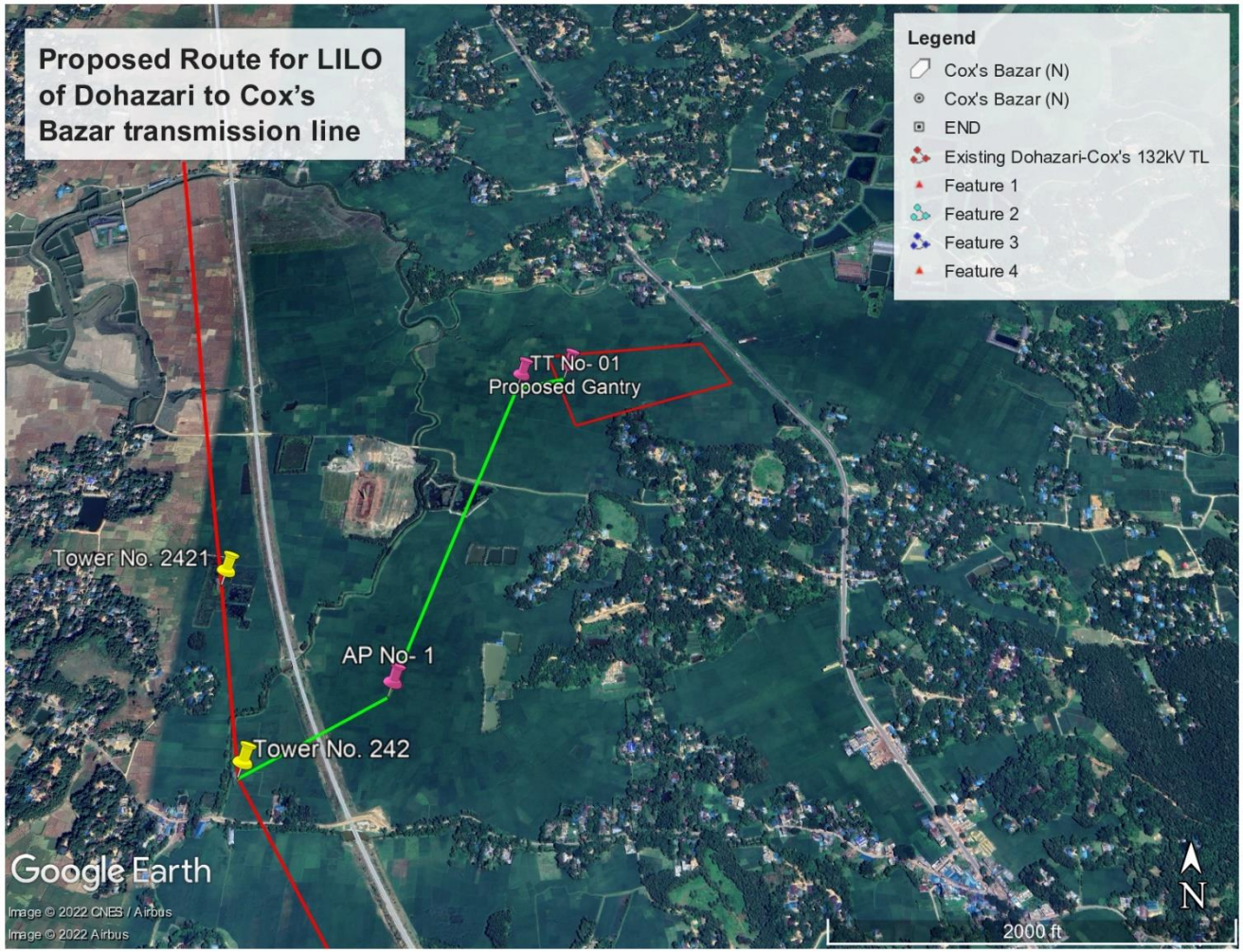


Figure 50: Proposed Route for LILO of Dohazari to Cox's Bazar transmission line

Chapter 5
Environmental and Social Baseline

The environmental baseline is the existing status of environment around the proposed Project site. It has been analyzed through assessment of environmental components like air, water, land, noise, soil, etc. and environmental characteristics like physical, and biological status of the study area. The baseline condition of water and land resources, agriculture, fisheries and ecological resources prevailing in the study area has been established by collecting data from secondary as well as primary sources. The secondary sources included Bangladesh Inland Water Transport Authority (BIWTA), Bangladesh Water Development Board (BWDB), National Water Resources Database (NWRD), Bangladesh Meteorological Department (BMD) and Bangladesh Bureau of Statistics (BBS).

5.1 Physical Environment

The physical environment is an important determinant of the environment. The term Physical environment means the material and tangible conditions in which we live. The baseline conditions of physical environment of the study area in terms of meteorology, seismicity, environmental quality, and natural disaster are presented in the following sections. The purpose of depiction is to analyze the climate related risks and later in Chapter 7, need to propose the adaptation measures accordingly.

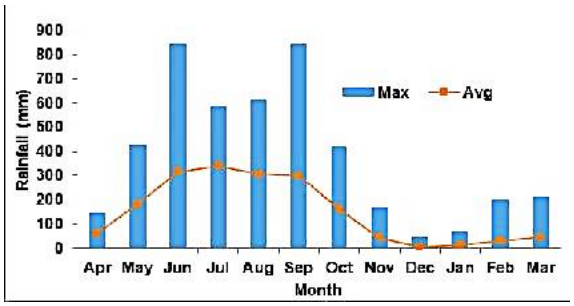
5.1.1 Meteorology

The project comprises construction of sub-station and transmission lines. The places of construction will be in the southern part of Chattogram (Anwara, Cox's Bazar and Teknaf) and Kaliakair of Gazipur under Dhaka Division. As such various meteorological data like rainfall, temperature, relative humidity, wind speed, evaporation and sunshine hours were collected from Chattogram (Patenga, Ambagan), Cox's Bazar, Teknaf and Dhaka stations of BMD within the study area. The data were analyzed and their status are discussed briefly in the following sections.

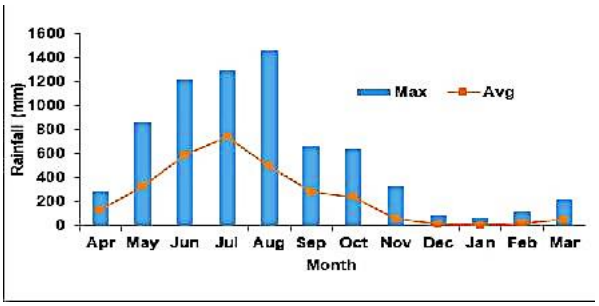
(a) Rainfall

Chattogram

Rainfall intensity is a vital parameter for the study area. The record of last 35 years (1984- 2019) of Ambagan BMD station shows that the maximum of 846 mm rainfall was experienced in June 1984 and that insignificant rainfall occurs in the month of November to January. The average annual rainfall was 2796 mm during this period. On the other hand, data of last 35 years (1984-2013) of Patenga station shows that the maximum of 1457 mm rainfall occurred in August 1984. The average annual rainfall at this station was 2902 mm during this period. The monthly maximum and average rainfall of Ambagan and Patenga stations are shown in Figure 51.



Source: BMD, Ambagan, Chattogram

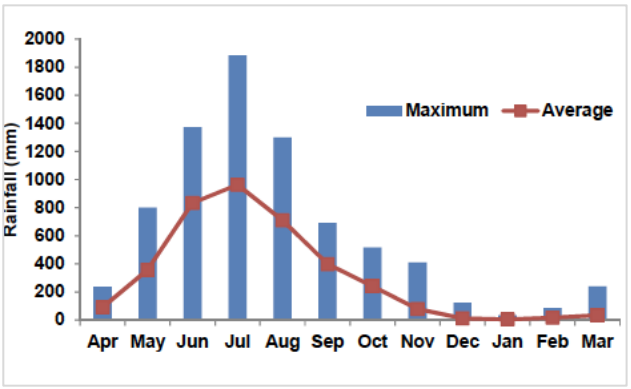


Source: BMD, Patenga, Chattogram

Figure 51: Monthly Rainfall at Ambagan (1984-2019) and Patenga BMD station (1984-2019)

Cox's Bazar

Values of monthly average rainfall in the study area were collected from the year 1984 to 2019 of the BMD station. The collected data were analyzed and presented in Figure 52. The figure shows significant rainfall during the months of May to October and insignificant rainfall during the month of December to March. The monthly maximum rainfall ever recorded in the study area is 1885mm in the month of July 1987.

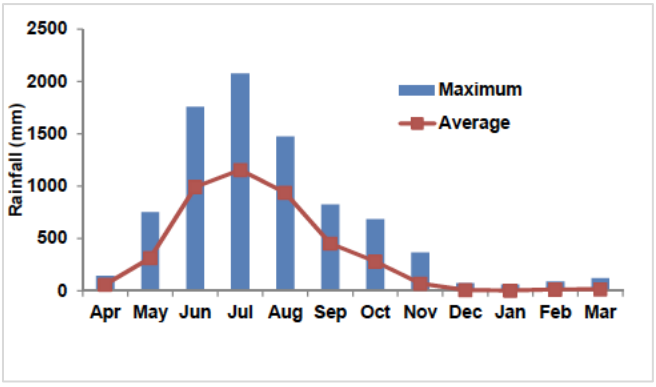


Source: BMD, Cox's Bazar

Figure 52: Monthly Rainfall at Cox's Bazar BMD station (1984-2019)

Teknaf

The record of last 30 years (1984-2019) of Teknaf station shows that the maximum of 2077 mm rainfall occurred in July 1987. No or very little rainfall was recorded in the month of December to April. The average annual rainfall was 4301mm during this period.



Source: BMD, Teknaf

Figure 53: Monthly Rainfall at Teknaf BMD station (1984-2019)

Kaliakair, Gazipur

Monthly average and monthly maximum rainfall data from 1984-2019, has been analyzed to understand the present scenario of the study area. Highest of maximum rainfall has been observed in September 2004, which is 836 mm, and lowest of maximum rainfall has been observed in January 1998, which is 49 mm. Analysis also shows that heavy rainfall occurs in between May to September, about 80% of the annual average rainfall occurs in between this period (Source: BMD, Dhaka Station).

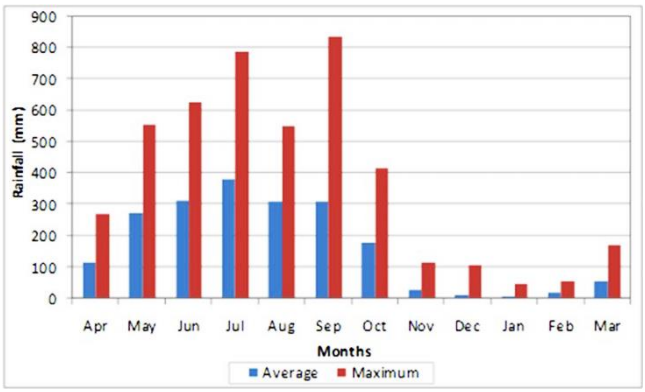
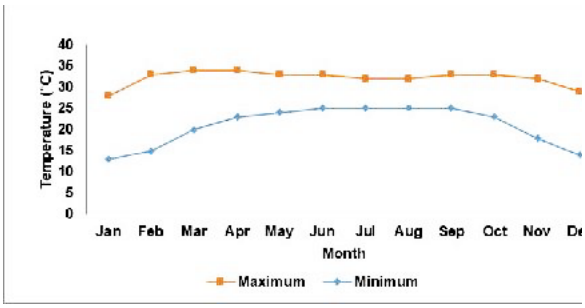


Figure 54: Monthly Rainfall at Dhaka Station (1984-2019)

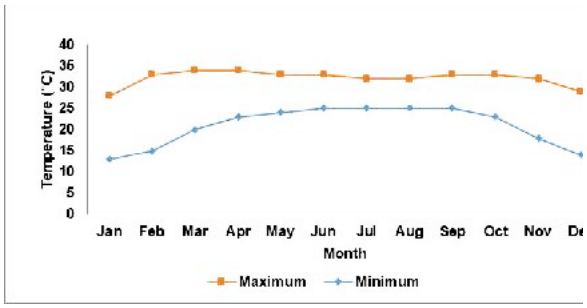
(b) Temperature

Chattogram

The monthly average of last 35 years (1984-2019) data of Ambagan station shows that the maximum temperature varied from 28°C to 34°C and April was the warmest month while the minimum temperature varied from 13°C to 25°C and January is the coldest month. On the other hand, Patenga station (1984-2019) shows that the maximum temperature varies from 28°C to 34°C while the minimum temperature varies from of 12°C to 25°C. The monthly variations of average maximum and minimum temperature of Ambagan and Patenga stations are shown in Figure 55.



Source: BMD, Ambagan, Chattogram

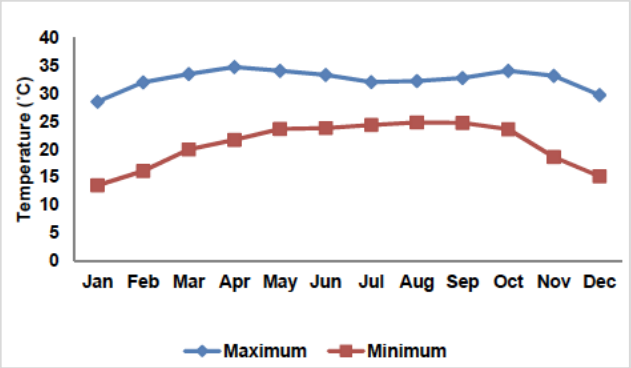


Source: BMD, Patenga, Chattogram

Figure 55: Monthly Temperature at Ambagan and Patenga BMD station (1984-2019)

Cox's Bazar

Analysis of last 35 years (1984-2019) data of this station shows that the monthly average maximum temperature varies from 28.62°C to 34.91°C and the monthly average minimum temperature varied within the range of 13.59°C to 24.90°C. The highest monthly average temperature was found 34.91°C in April whereas the lowest monthly average temperature was 13.59°C in January. The monthly variations of average maximum and minimum temperature are shown in Figure 56.

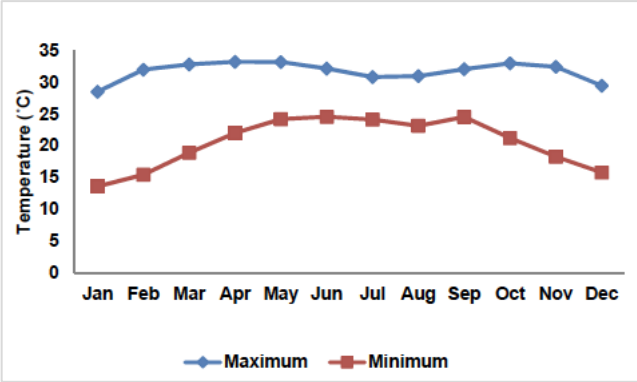


Source: BMD, Cox's Bazar

Figure 56: Monthly Temperature of Cox's Bazar BMD station (1984-2019)

Teknaf

The analysis of last 35 years (1984-2019) data shows that the monthly average maximum temperature varied from 28.5°C to 33.3°C and the monthly average minimum temperature varies within the range of 13.6°C to 24.6°C. The highest monthly average temperature was 33.3°C in April whereas the lowest monthly average temperature was 13.6°C in January. The monthly variations of average maximum and minimum temperature are shown in Figure 57.

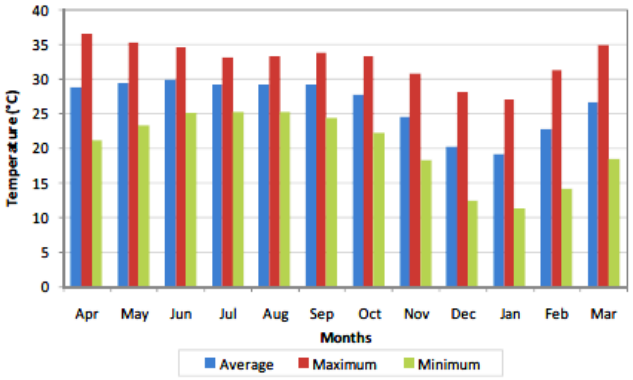


Source: BMD, Teknaf

Figure 57: Monthly Temperature of Teknaf BMD station (1984-2019)

Kaliakair, Gazipur

The monthly average of maximum and monthly average of minimum temperature data of Dhaka BMD station for the period of 1984 to 2019 has been collected. Analyzing these data, it is found that the average of maximum temperature of Dhaka varies from 27°C to 36°C and minimum temperature varies within a range of 11°C to 25°C From the month of April to July a decreasing trend has been observed, and after that slight increasing trend is found from August to September which again had a decreasing trend from October to January. After January, temperature shows a rising trend, up to April (Figure 58). Maximum temperature is observed in April, but average maximum temperature is observed in June while minimum in January.



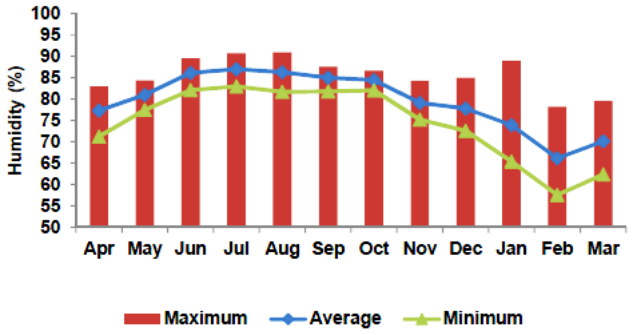
Source: BMD, Dhaka Station

Figure 58:Monthly temperature of Dhaka BMD Station (1984-2019)

(c) Relative Humidity

Chattogram

The average monthly relative humidity data collected from Ambagan BMD station for the last 35 years (1984-2019) is shown in Figure 59. It reveals that the RH varied seasonally from minimum of 67% in February to maximum of 87% in July. The most humid months during this period were May to October when relative humidity was more than 80%.

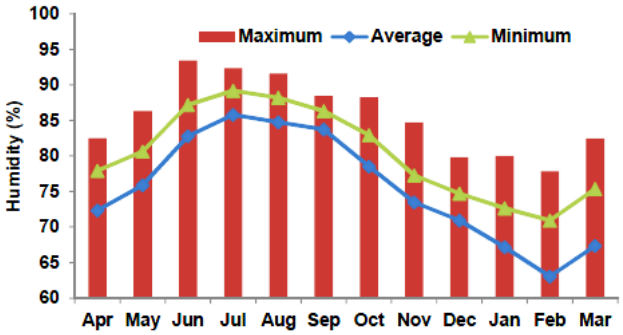


Source: BMD, Chattogram

Figure 59: Monthly relative Humidity at Ambagan BMD station (1984-2019)

Cox's Bazar

The relative humidity data of Cox's Bazaar was collected for the period from 1984 to 2019 and analyzed. It shows that the monthly maximum relative humidity was 89% which occurred in July while the monthly minimum RH was 71% in February. The monthly, maximum, minimum and average relative humidity is presented in Figure 60.

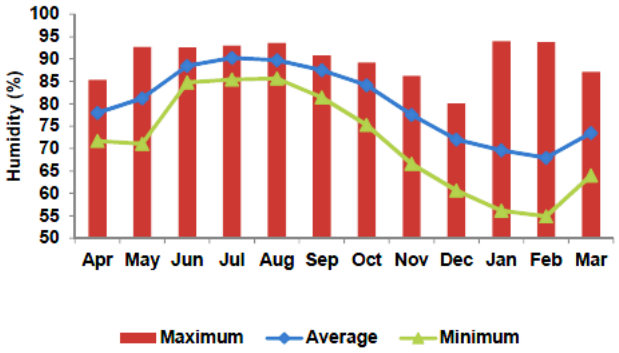


Source: BMD, Cox's Bazar

Figure 60: Monthly relative Humidity at Cox's Bazar BMD station (1984-2019)

Teknaf

The relative humidity data of Teknaf was collected for the period from 1984 to 2019 and analyzed. It shows that the monthly maximum relative humidity was 91% in July, while the monthly minimum humidity was 57% in February. The monthly, maximum, minimum and average relative humidity is presented in Figure 61.

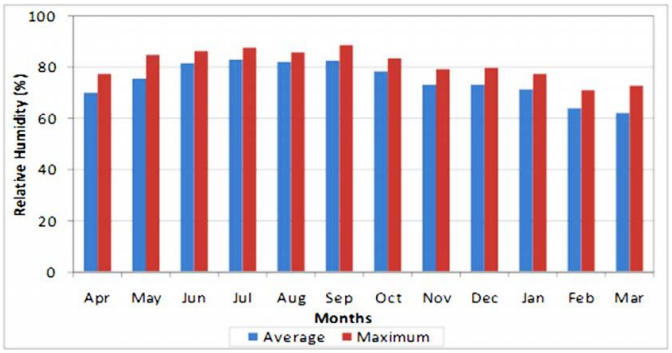


Source: BMD, Teknaf

Figure 61: Monthly relative Humidity at Teknaf BMD station (1984-2019)

Kaliakair, Gazipur

The relative humidity data of BMD Dhaka station for the period of 1984-2019 has been collected. It shows that the maximum of monthly average humidity ranges from 70% (February) to 90% (September). The monthly average humidity ranges from 60% (March) to 85% (June-September). Figure 62 illustrates the monthly variations of humidity in Dhaka.



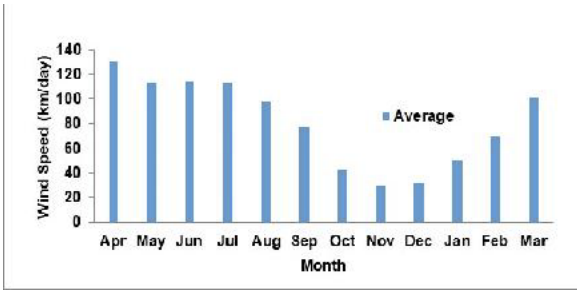
Source: BMD, Dhaka Station

Figure 62: Monthly relative humidity of Dhaka BMD station (1984-2019)

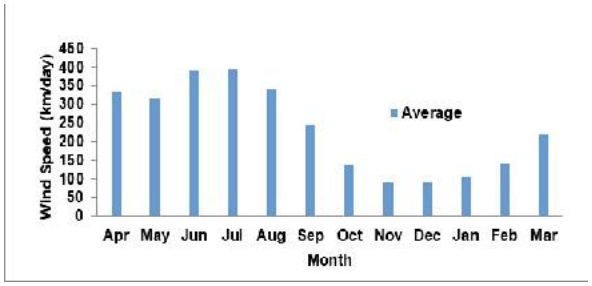
(d) Wind Speed

Chattogram

Wind speed is measured at both Ambagan and Patenga stations. Winds in the area are mostly characterized by Southerly wind from the Bay of Bengal during monsoon. The average of last 35 years (1984 to 2019) data of Ambagan station shows that the monthly maximum wind speed varied from 30 to 130 km/day in a year and the maximum wind speed occurred in the month of April. On the other hand, the average of last 35 years (1984 to 2019) data of Patenga station shows that the monthly maximum wind speed varied from 89 to 394 km/day in a year and the maximum wind speed occurred in the month of April. It may be noted that the maximum wind speed in Patenga station is much higher than that of Ambagan station due to its closeness to the sea. The maximum monthly variation of wind speed at Ambagan and Patenga BMD stations are shown in Figure 63.



Source: BMD, Ambagan, Chattogram

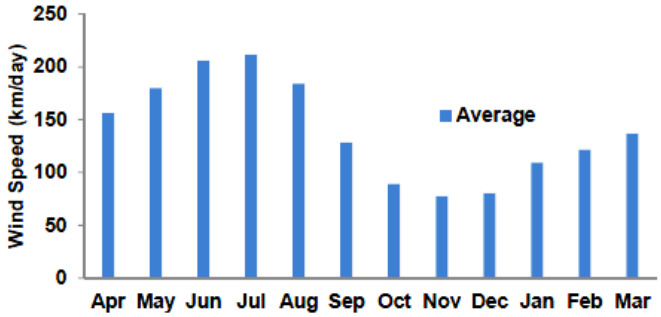


Source: BMD, Patenga, Chattogram

Figure 63: Monthly Maximum wind speed at Ambagan and Patenga BMD station (1984-2019)

Cox's Bazar

Historical wind speed data for the last 35 years (1984-2019) was collected from the Cox's bazar BMD station. It reveals from the analysis that the monthly average wind speed at Cox's bazar region varied from 68.88 to 198.7 km/day. The variation of monthly average wind speed is shown Figure 64.



Source: BMD, Cox's Bazar

Figure 64: Monthly Maximum wind speed at Coxs Bazar BMD station (1984-2019)

Teknaf

The wind speed data of Teknaf for the last 35 years (1984 to 2019) was collected and analyzed. It shows that the monthly average wind speed during this period varied from 57 to 170 km/day. The maximum wind speed is shown in Figure 65. (Source: BMD, Teknaf)

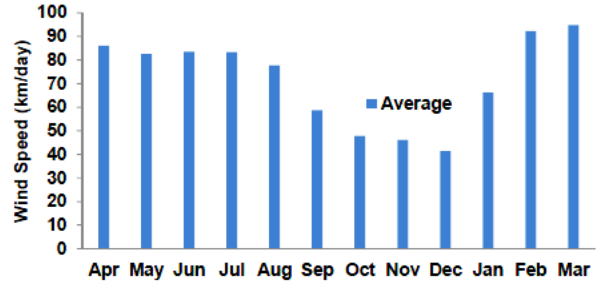
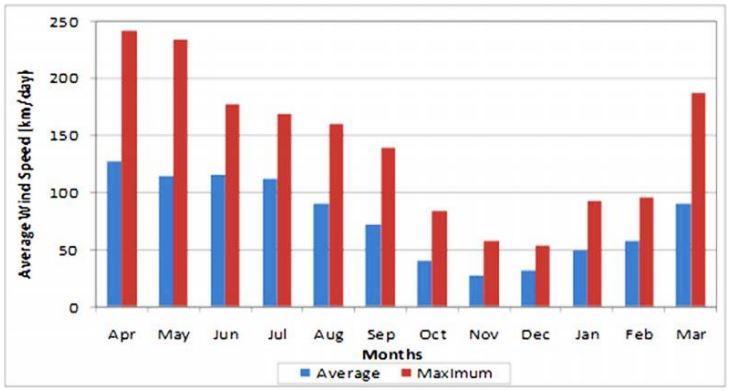


Figure 65: Monthly Maximum wind speed at Teknaf BMD station (1984-2019)

Kaliakair, Gazipur

The wind speed data for the period of 1984-2019 of Dhaka station has been collected and analyzed. Figure 66 shows the variations of monthly averaged wind speed. April is the month of highest monthly averaged wind speed (around 180 km/day) due to frequent Northwester storms. From April

to July the monthly averaged wind speeds are highest, and afterwards starts reducing, and during October-January, it appears to be the lowest (less than 50 km/day).



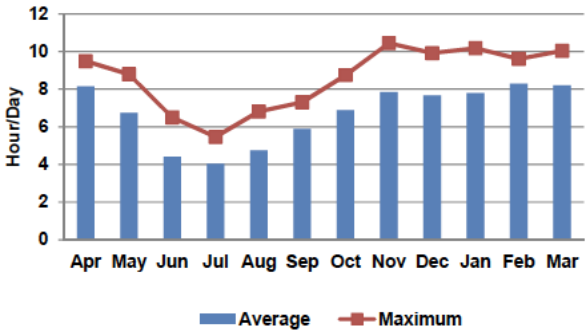
Source: BMD, Dhaka Station

Figure 66: Average wind Speed of Dhaka BMD Station (1984-2019)

(e) Sunshine Hour

Chattogram

The sunshine hours are measured at Ambagan station within the study area. The data of sunshine hours for the last 35 years (1984-2019) was collected from this BMD station and analyzed. It shows that the average monthly values of sunshine hours in this period varied from 4 to 8 hour/day. The sunshine hours remained very high during November to April and very low during June to August. The average and maximum monthly sunshine hours are plotted in Figure 67.

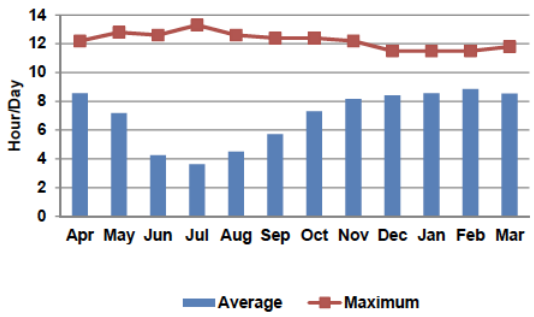


Source: BMD, Chattogram

Figure 67: Monthly maximum and average sunshine hours at Patenga BMD Station (1984-2019)

Cox's Bazar

The data of sunshine hours for the last 35 years (1984-2019) was collected from this BMD station and analyzed. It shows that the average monthly values of sunshine hours in this period varied from 3.9 to 8.2 hour/day. The sunshine hours remained very high during November to April and was very low during June to August. The average and maximum monthly sunshine hours are plotted in Figure 68.

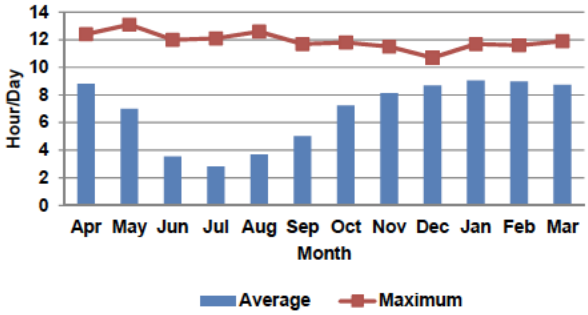


Source: BMD, Cox's Bazar

Figure 68: Monthly maximum and average sunshine hours at Cox's Bazar BMD Station (1984-2019)

Teknaf

The sunshine hours are measured at Teknaf station within the study area. The data of sunshine hours for the last 35 years (1984-2019) was collected from this BMD station and analyzed. It shows that the average monthly values of sunshine hours in this period varied from 2.81 to 9 hour/day. The sunshine hours remained very high during November to April and was very low during June to August. The average and maximum monthly sunshine hours are plotted in Figure 69.

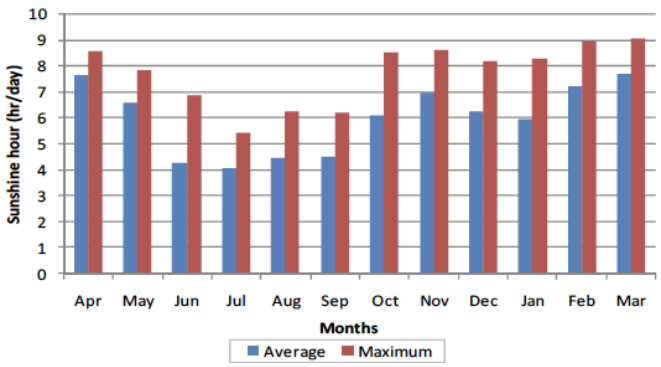


Source: BMD, Teknaf

Figure 69: Monthly maximum and average sunshine hours at Teknaf BMD Station (1984-2019)

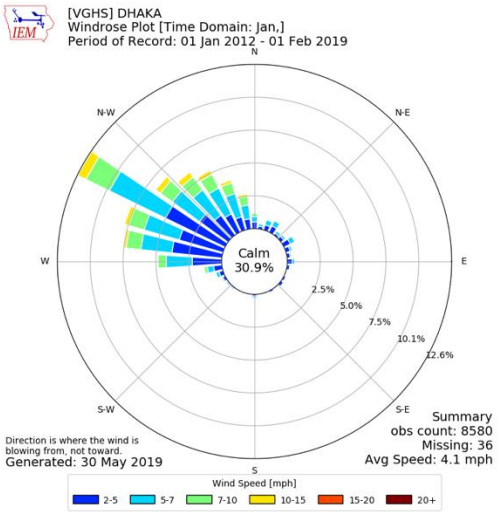
Kaliakair, Gazipur

The sunshine hour's data for the period of 1984-2019 of Dhaka station has been collected and analyzed. Figure 70 shows the variations in monthly average and monthly maximum sunshine hours round the year. The average value of sunshine hours varies from 4.1 to 7.7 hr/day. In Dhaka the sunshine hour is highest during the months of February-March. Later the sunshine hour lowers down during the monsoon months (June-September) due to the presence of cloud cover and again increases in winter.

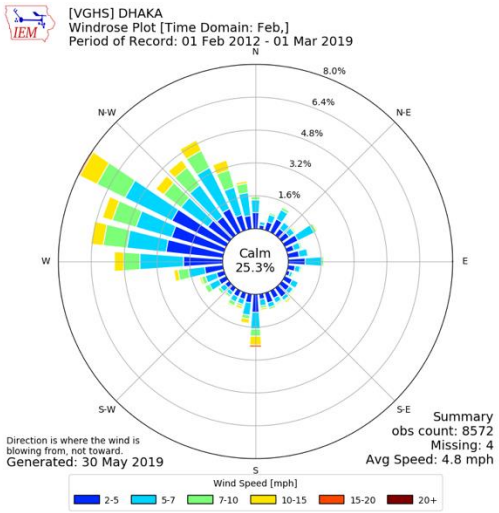


Source: BMD, Dhaka Station

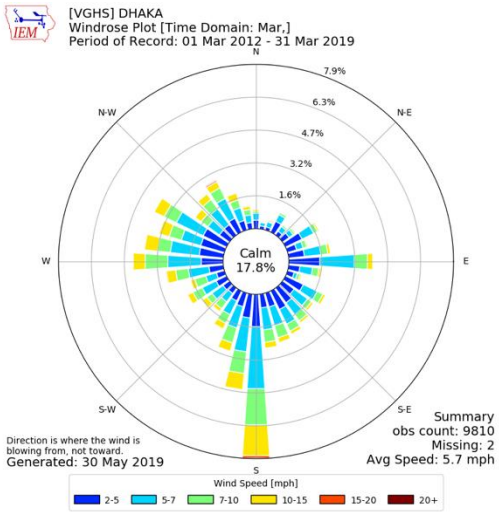
Figure 70: Maximum and Average Sunshine Hour of Dhaka BMD Station (1984-2019



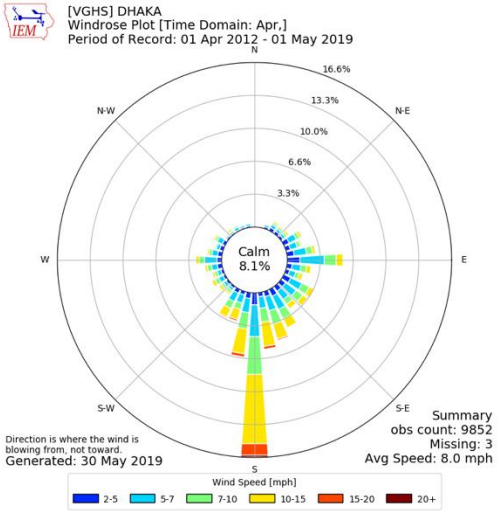
January



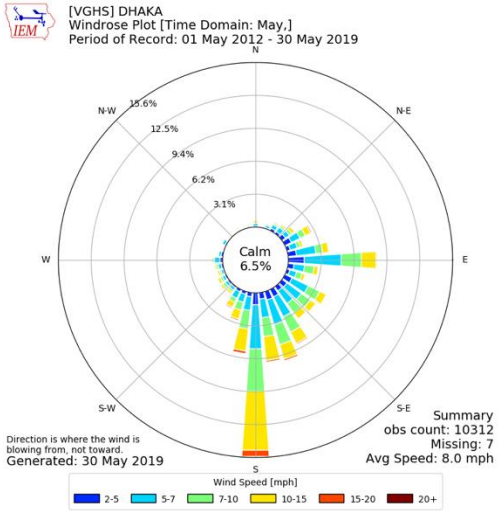
February



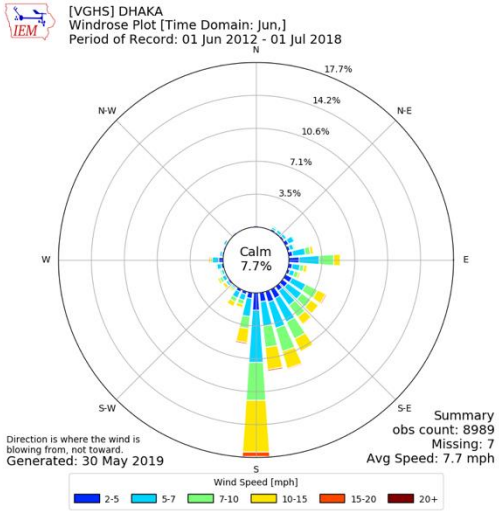
March



April

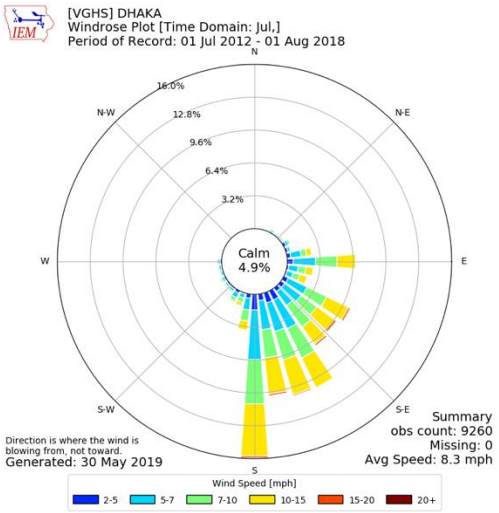


May

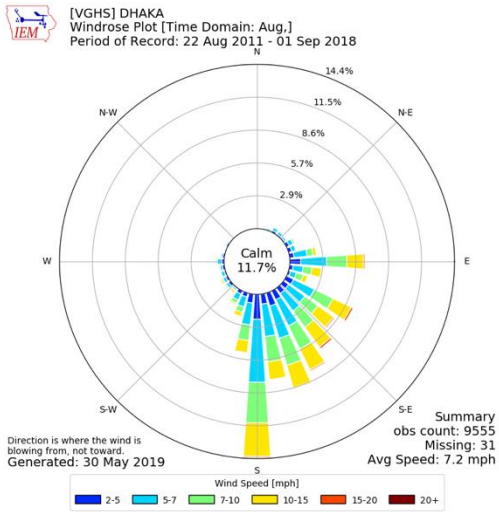


June

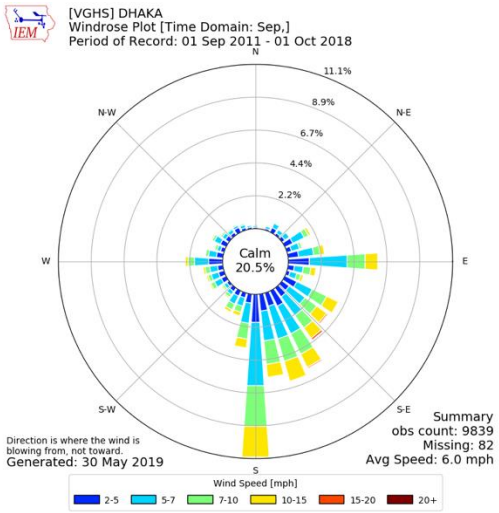
Figure 71: Monthly Wind Rose Diagram (2012 to 2019), Dhaka Weather Station (January to June)



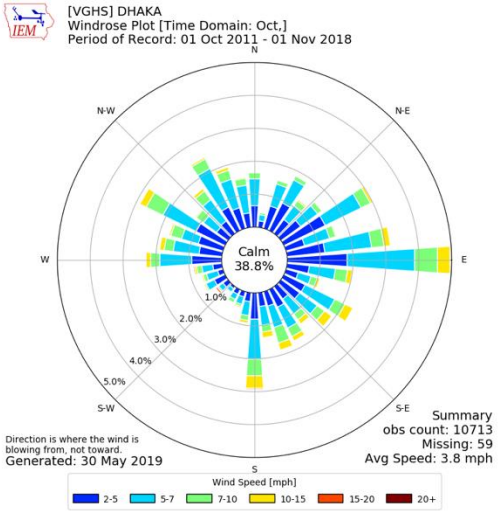
July



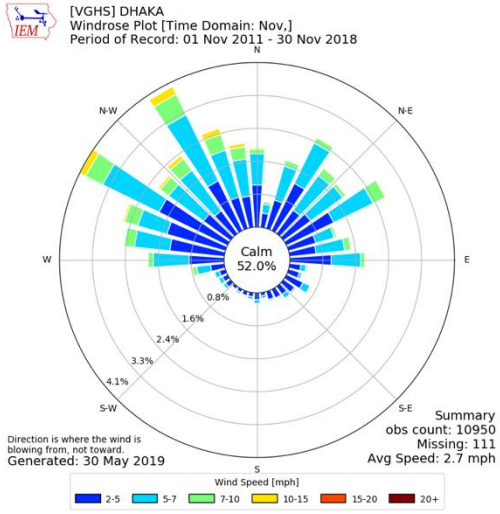
August



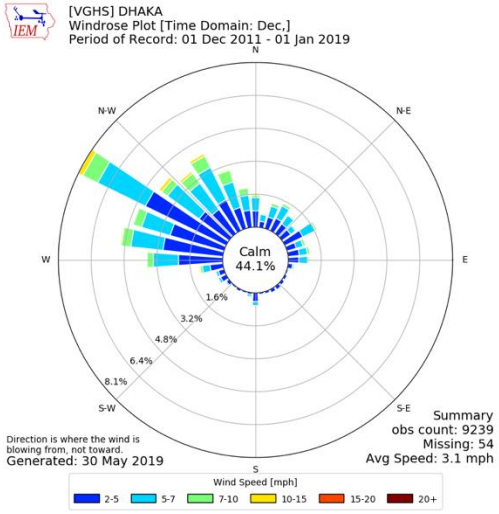
September



October

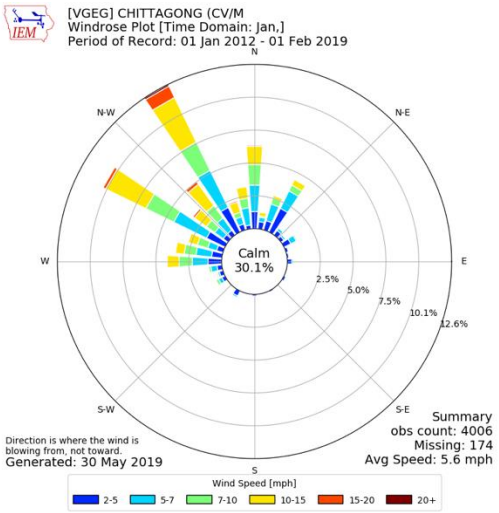


November

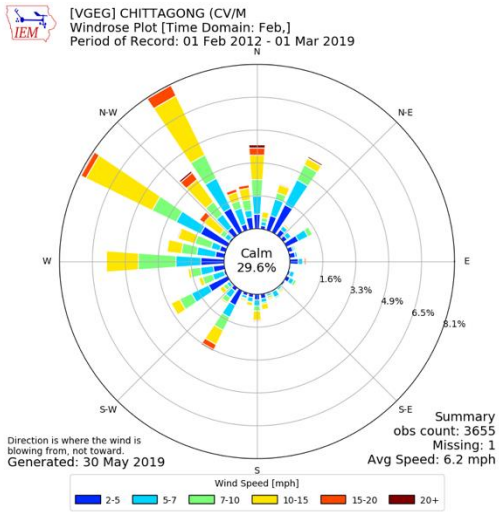


December

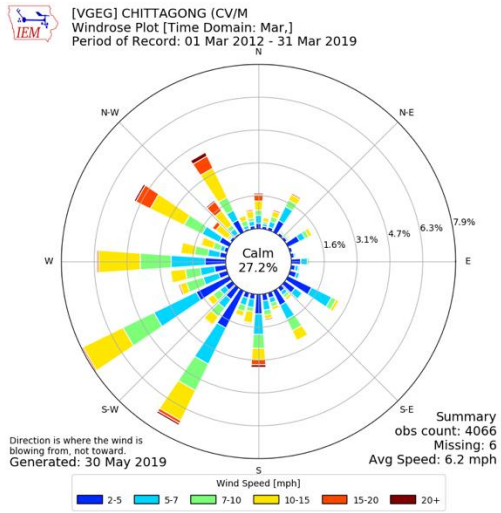
Figure 72: Monthly Wind Rose Diagram (2012 to 2019), Dhaka Weather Station (July to December)



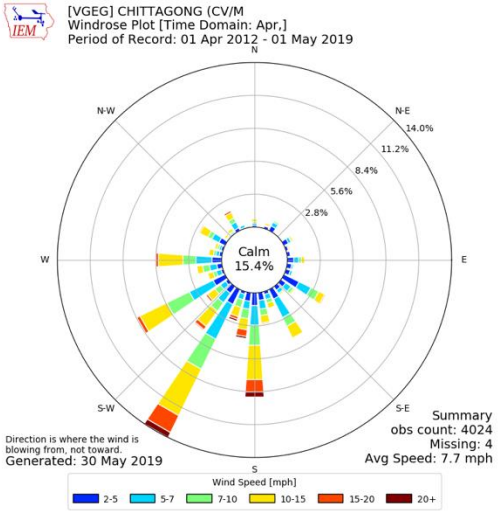
January



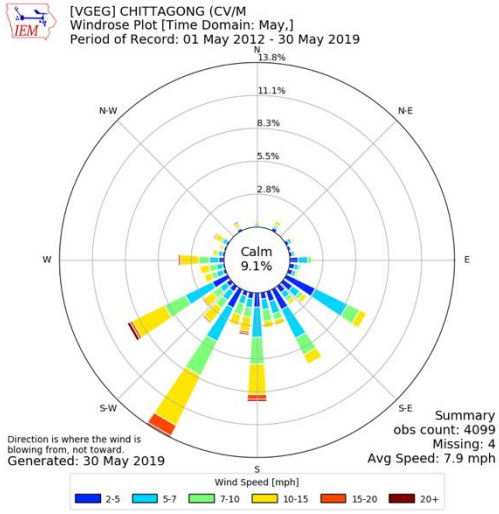
February



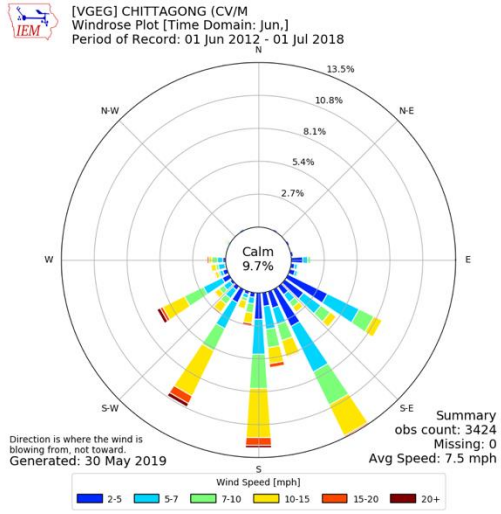
March



April

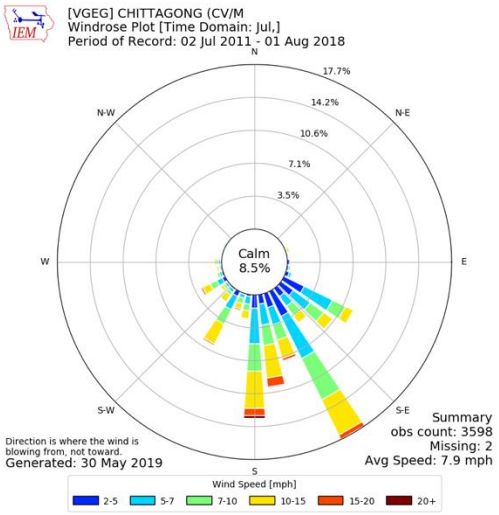


May

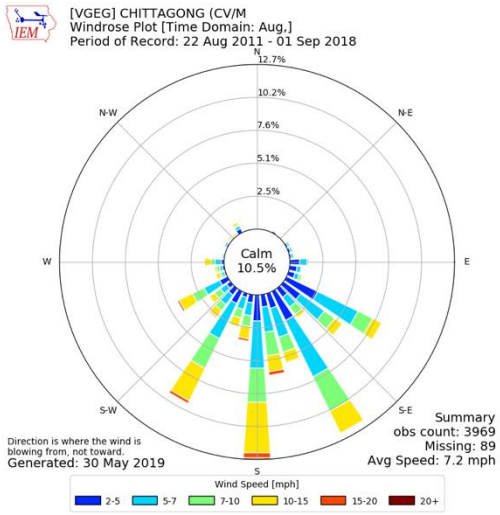


June

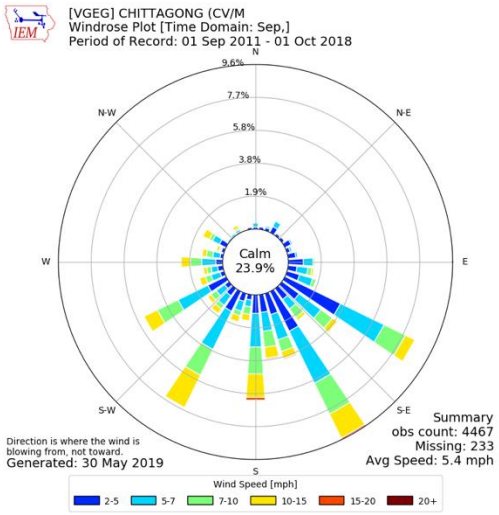
Figure 73: Monthly Wind Rose Diagram (2011 to 2019), Chattogram Region (January to June)



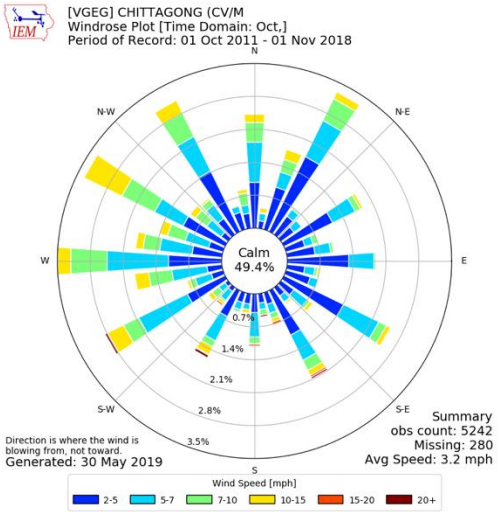
July



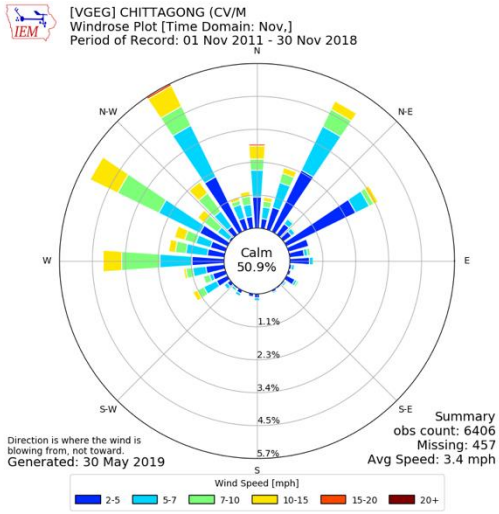
August



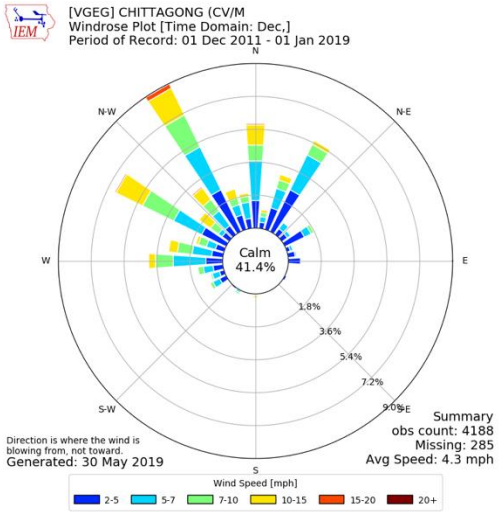
September



October



November



December

Figure 74: Monthly Wind Rose Diagram (2011 to 2019), Chattogram Region (July to December)

5.1.2 Surface Geology

Bangladesh constitutes major parts of the Bengal Basin and has been evolved by formation of successive delta systems developed by the two great rivers of the Ganges and the Brahmaputra. The Bengal Basin is a structurally complex area formed due to the presence of an active Himalayan folded belt (thrust belt) in the north and Indo-Burman fold belt in the east. It is surrounded by the Archean (3.8 to 2.6 billion years old) Indian Platform (Shield) in the west, Tertiary (time range between 65 to 1.6 million years) and, in part, Mesozoic (225 to 65 million years) metamorphic Indo-Burman ranges in the east and the Archean basement of the Shillong Plateau in the north. Tectonically, Bangladesh is divided broadly into the following divisions, on the basis of basement behavior and fault characteristics:

a) Indian Platform and Shelf

- **Dinajpur Slope (Himalayan Fore Deep)-** The Himalayan Fore deep lies south of the Main Boundary Thrust (MBT) all along the foothills of the Himalayas. It lies at the Northwest (NW) tip of Bangladesh and the basement occurs at 2500 m depth.
- **Rangpur Saddle-** The basement is most uplifted and covered with thin sedimentary deposits. The tentative boundary of the Rangpur Saddle at the northern and the southern slopes has been seismically defined by the approximately 700 m depth contour.
- **Bogura Slope-** the Bogura Shelf (Bogura slope) represents the southern slope of the Rangpur Saddle which is a regional monocline plunging gently towards southeast to the Hinge zone. This zone marks the transition between the Rangpur Saddle and the Bengal Fore deep.

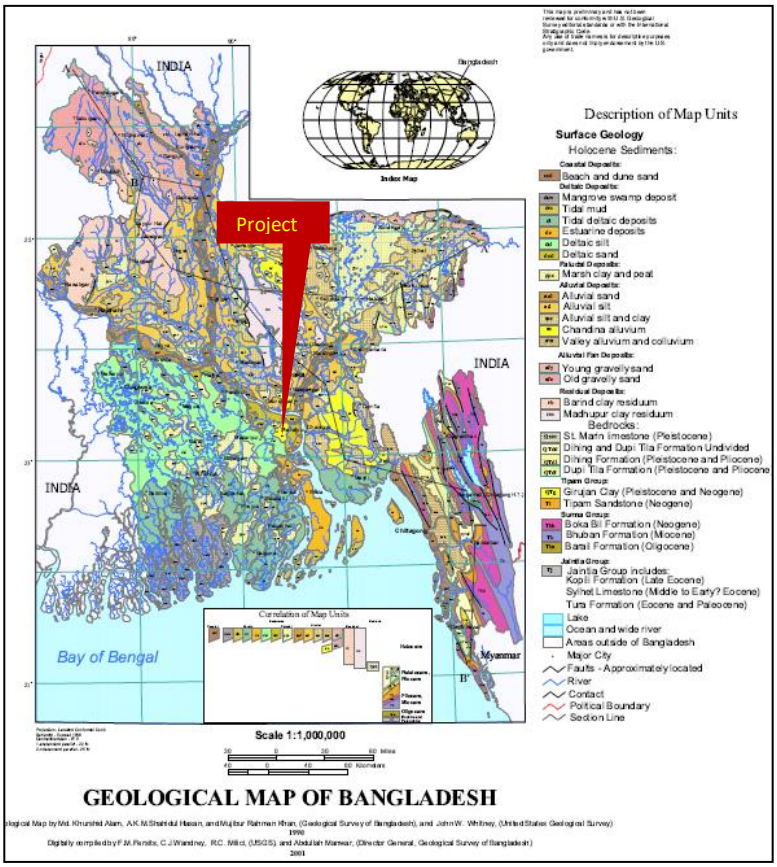


Figure 75: Geology of the Project Area

b) Hinge Zone (Eocene slope break)

It is a narrow zone trending SSW-NNE from Sylhet-Mymensingh-Pabna-Calcutta and further to the southwest along the coastline of Odisha. It is bound by the Bogura Shelf (or south slope of the Rangpur Saddle) by the seismic depth of 3,500m to the top of the Eocene Sylhet Limestone, the most prominent sedimentary reflector in Bangladesh and West-Bengal.

c) Bengal Fore Deep

The Bengal Foredeep is flanked by Hinge Line in west and the Arakan Yoma Folded System in east which plays the most important role in the tectonic history of Bengal Basin. The Bengal Foredeep can be divided into two major regions: A Western Platform Flank and an Eastern Folded Flank. The Western Platform flank is further subdivided into the Faridpur Trough, the Barishal-Chandpur High, the Hatiya Trough, the Madhupur High and Sylhet Trough.

d) Eastern Folded Flank

The Folded belt extends S-N within Bangladesh for 450 km and is about 150 km wide, covering an area of 35 000 km^2 of on-shore area. The study area is situated in the Chattogram Tripura Folded Belt which is the youngest structural province along the western flank of the Indo-Burma Ranges. The Eocene flysch (marine sedimentary rock) sequences of the Indo-Burma Range constitute the eastern limit of this tectonic province. The age of the sediments outcropping in the folded belt ranges from Lower Miocene (about 24 million years before the present) to recent age. The Miocene sediments were deposited under marine and predominantly deltaic conditions in a rapidly subsiding, unstable basin, while the depositional environments were governed by subaqueous to sub-aerial, fluviatile to lacustrine conditions in Plio-Pleistocene times (5 million years to 0.1 million years before the present).

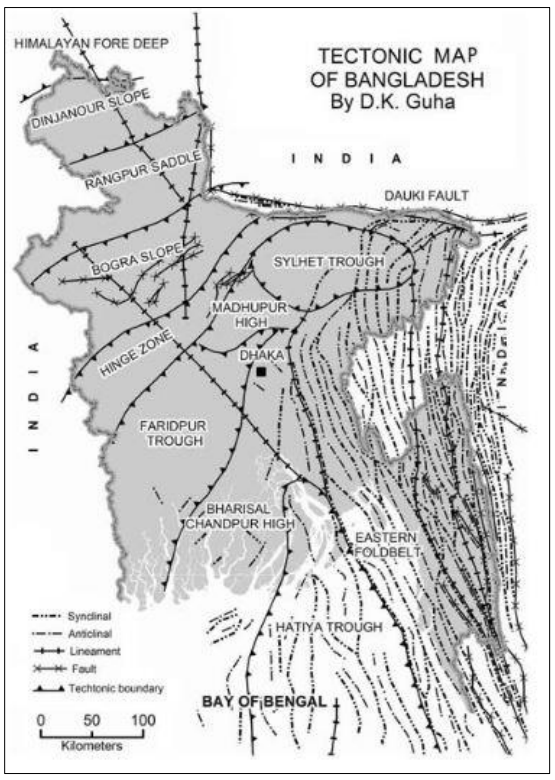


Figure 76: Tectonic Elements of Bangladesh

Source: http://217.174.128.43/web_data/iga_db/Bangladesh.pdf

5.1.3 Physiography and Topography

Physiography is the terrain condition of a particular tract of land and reveals the surface condition of the land. Physiographic region/unit refers to a region in which all land tracts are similar in terms of physical characteristics, with a uniform geomorphic history, and whose pattern of topographical features or landforms differs significantly from that of adjacent regions.

In the context of physiography, Bangladesh may be classified into three distinct regions-floodplains, terraces and hills, further divided into twenty physiographic units. The study area of the proposed project forms a part of the Chattogram Coastal Plain, which is a narrow strip of land between the Chattogram Hill Tracts and the Bay of Bengal. This physiographic unit comprises of gently sloping, mainly loamy, alluvial flats adjoining the north-eastern hills, and extensive level clay plains adjoining the three main rivers Halda, Karnaphuli, Sangu and Matamuhuri. Tidal clay plains occupy most of the offshore islands in the south.

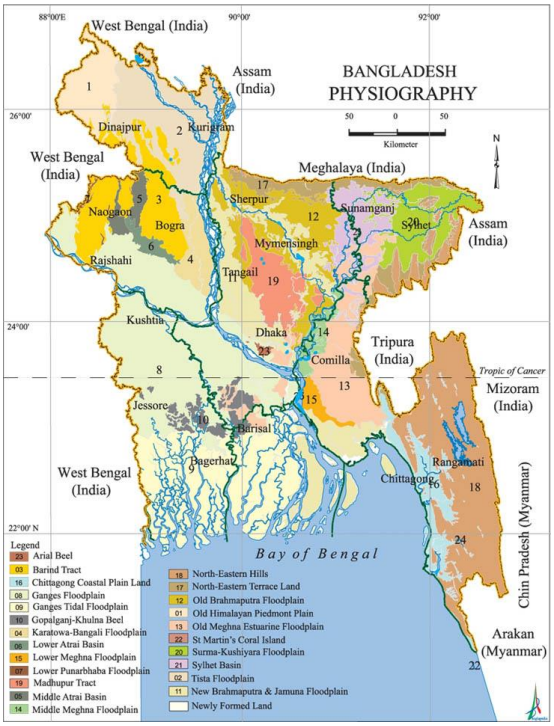


Figure 77: Physiographic Units of Bangladesh

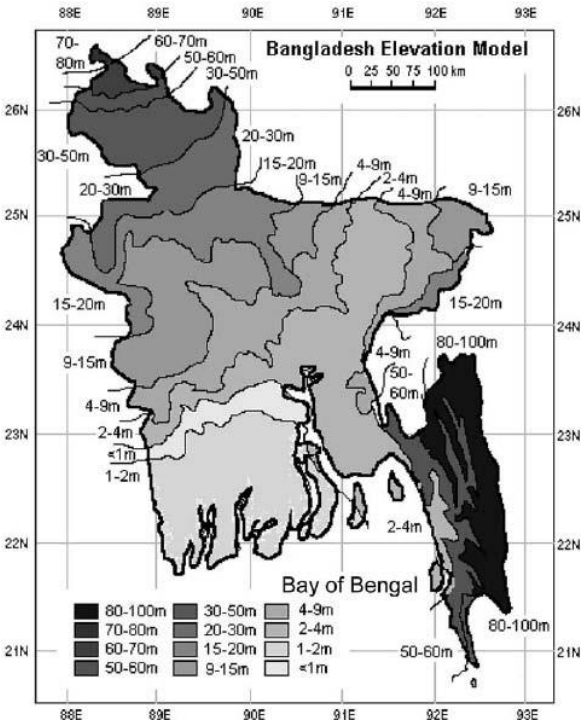


Figure 78: Contour Maps of Bangladesh

5.1.4 Geomorphology (Soil types)

For the purpose of agricultural research and planning, Bangladesh has been divided into 30 agro-ecological regions and 88 sub-regions based on soil types and characteristics. BHTC of Kaliakair, Gazipur falls in the Madhupur Tract agro-ecological zone (AEZ). This is a region of complex relief and soils are developed over the Madhupur Clay. The landscape comprises level upland, closely or broadly dissected terraces associated with either shallow or broad deep valleys.

Eleven General Soil Types exist in the area of which, Deep Red Brown Terrace, Shallow Red Brown Terrace soils and Acid Basin Clays are the major ones. The soils on the terrace are better drained, friable clay loams to clays overlying friable clay substratum at varying depths. Soils in the valleys are dark grey heavy clays. They are strongly acidic in reaction with low status of organic matter, low

moisture holding capacity and low fertility level. The soils are mainly phosphate fixing, and low in P, K, S and B levels.

Table 36: Status of Nutrients Present in Madhupur Tract AEZ

Major Land Type	Soil pH	Soil OM	Nutrient Status*								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (56%)	4.1-6.2	L	VL-L	L	L	L	L-M	L-M	L-M	L-M	L-M
Medium Highland (18%)	4.4-6.5	L	VL-L	L	L	L	L-M	L-M	L-M	L-M	L-M

* VL = Very low; L = Low; M = Medium

Chattogram, Cox's Bazar and Teknaf areas falls in the northern and eastern hills and Chattogram Coastal Plains agro-ecological zone of Bangladesh. This region includes the country's hill areas. Relief is complex. Hills have been dissected to different degrees over different rocks. In general, slopes are very steep, and few low hills have flat summits. Northern and eastern hills AEZ envisage the major hill soils are yellow brown to strong brown, permeable, friable, loamy; very strongly acidic and low in moisture holding capacity. However, soil patterns generally are complex due to local differences in sand, silt and clay contents of the underlying sedimentary rocks and in the amount of erosion that has occurred. Brown Hill soils is the predominant General Soil Types of the area. Organic matter content and general fertility level are low.

Table 37: Status of Nutrients Present in Northern and Eastern Hills AEZ

Major Land Type	Soil pH	Soil OM	Nutrient Status*								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (92%)	4.1-7.1	L-M	VL-L	L	L-M	L-M	L-M	L-M	L-M	L-M	L-M

* VL = Very low; L = Low; M = Medium

Chattogram Coastal Plains envisage the grey silt loams and silty clay loam soils are predominant. Acid Sulphate soils which are potentially extremely acidic occur in mangrove tidal floodplains. Noncalcareous Grey Floodplain soils, Noncalcareous Alluvium and Acid Sulphate soils are the major components of the General Soil Types of the area. General fertility level of the soils is medium, and N and K are limiting. Status of S is high. Organic matter content is low to moderate, and the status of Zn and B is medium.

Table 38: Status of Nutrients Present in Chattogram Coastal Plains AEZ

Major Land Type	Soil pH	Soil OM	Nutrient Status*								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (17%%)	4.3-6.0	L-M	L	VL-L	L-M	M-Opt	L-M	L-M	L-M	L-M	M
Medium Highland (43%)	4.4-6.2	L-M	L	VL-L	L-M	M-Opt	L-M	L-M	L-M	L-M	M
Medium Low Land (13%)	4.6-6.0	M	L	VL-L	L-M	M-Opt	L-M	L-M	L-M	L-M	M

* VL = Very low; L = Low; M = Medium; Opt= Optimum

5.1.5 Hydrogeology

The aquifer type and characteristics of the Madhupur Tract and Northern and Eastern Hills, in which the study area is located, is presented in the Table 39. District wise aquifer test analysis conducted by Bangladesh Water Development Board (BWDB) is presented in Table 40.

Table 39: Aquifer Types and Characteristics of the Groundwater Regions of Bangladesh

Physiographic Unit	Lithology	Thickness of Aquifer (m) /Depth to Main Aquifer (m)	Type of the Aquifer
Gazipur, Dhaka			
Madhupur Dhaka (4394). Madhupur tract a fault bounded zone distinguished by poorly drained level highland areas and well drained highland areas. The landscape is dissected in places.	Madhupur clay with thickness up to 20m. or over occurs extensively throughout the region. Under the clay, medium to coarse sands with these hands of the fine waterfalls are encountered	Aquifer thickness could be as such as 60 m. 0r more. Range: 15-90m. Average: 40m.	Semi-Confined
Chattogram and Chattogram Hill Tracts			
Complex Geology Area. Hills and Hill rages of Chattogram and Chattogram Hill Tracts characterized by high summits and deep valleys.	Surface clay of variable thickness covers the sandy materials, which are exposed or found at shallow depths in the hill ranges and occurs at greater depths in the valley. Nature of thickness of the sandy materials is also variable.	Highly variable, ranges from few tens of meters to more than 100 meters. A composite aquifer exists at shallower depth. The main aquifer is deep seated.	Extensive folding of the beds results into confined aquifer. Deep seated ones may be semiconfined, even unconfined.
Coastal Plains of Chattogram. Plains that exist in between the folded hill ranges in the east and coastline in the west; characteristically flat and plain.	A 25 to 30 m. thick zone of silt and clay covers the aquifer materials. Clay thickness gradually increases towards the Bar. Sandy materials are predominantly medium to coarse.	A shallow aquifer of about 20-50m. thickness exists near the surface. Main aquifer is deep seated whose nature and extent is not known. Shallow aquifer exists at a depth of about 50m. the depth to the main aquifer is not precisely known	Semi-confined to confined.

Source: MPO, Technical Report No.5 - June, 1987

Table 40: District-wise Aquifer Test Analysis Results Conducted by BWDB (2001)

District	Transmissivity (T) m^2/day		Storativity (S)		Permeability (K) m/day	
	Max.	Min.	Max.	Min.	Max.	Min.
Gazipur	316	1100	0.03	0.05	12	20
Chattogram	114	600	0.0007	0.03	3	10
Cox's Bazar	-	700	0.002	-	6	-

5.1.6 Natural Hazards

Seismicity

The Geological Survey of Bangladesh (GSB) has divided the country into three seismic zones, as illustrated in Figure 79, accompanied by an outline of a code for earthquake resistant design. According to the map, the Project site falls in Seismic Zone II, where the possible maximum earthquake magnitude in Richter's scale is 8.0, and the suggested Basic Seismic Coefficient is 0.05g. However, for design, the seismic loads acting on the structures shall be calculated according to Indian Standard IS 1893 with a seismic zone 5 and an importance factor of 1.5. Major earthquakes experienced in Bangladesh till date is provided in the Table 41.

Table 41: Major Earthquakes in the Region

Date	Name/ Type of the Earthquake	Magnitude (Richter)	Epicentral Distance from Dhaka (km)	Epicentral Distance from Sylhet City (km)	Epicentral Distance from Chattogram (km)
10th January, 1869	Cachar Earthquake	7.5	25	70	280
14th July, 1885	Bengal Earthquake	7	170	220	350
12th June, 1897	Great Indian Earthquake	8.7	230	80	340
8th July, 1918	Earthquake	7.6	150	60	200
2nd July, 1930	Dhubri Earthquake	7.1	250	475	415
15th January, 1934	Bihar-Nepal Earthquake	8.3	510	530	580
15th August, 1950	Assam Earthquake	8.5	780	580	540

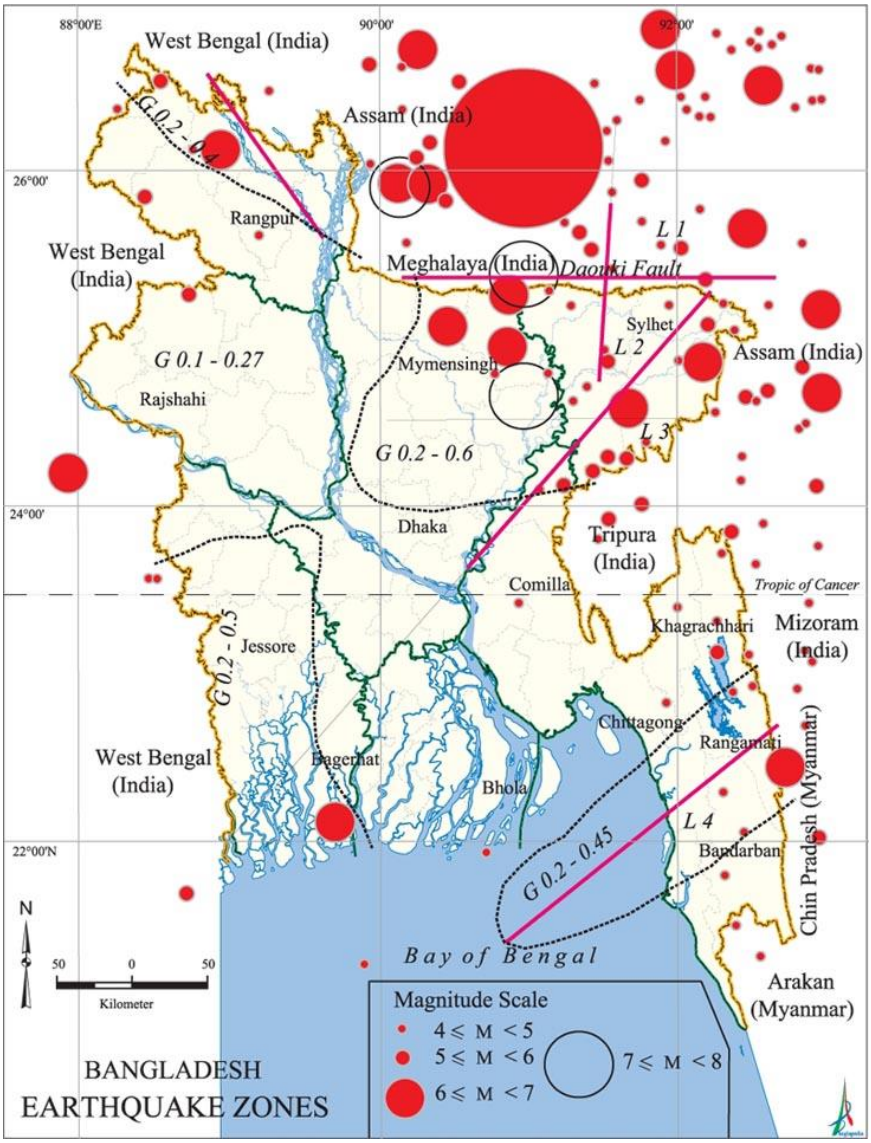


Figure 79: Seismic Zones of Bangladesh

Cyclonic Disasters

The area under the Madhupur Tract is subject to flash floods from the hills and shallow flooding that fluctuates in depth with the tide. The average daily rise in the tide is about two meters. The study area is susceptible to storm surges associated with cyclones. The coastal areas of Bangladesh experience major cyclones primarily in the months of May and October. The range of astronomical tides along the coast is so large during this period that the storm induced sea level becomes very high, resulting in a storm surge.

During the years 1797 to 1991, Bangladesh has been hit by 59 severe cyclones, 32 of which were accompanied by storm surges. Various studies suggest that the height of the surges limited to a maximum of 10 meters in the bay have an occurrence frequency of approximately once per 20 years while surges with frequency of approximately once in 5 years have a height of about 7 m. Below table provides a list of major cyclones and storm surges in Bangladesh in the past.

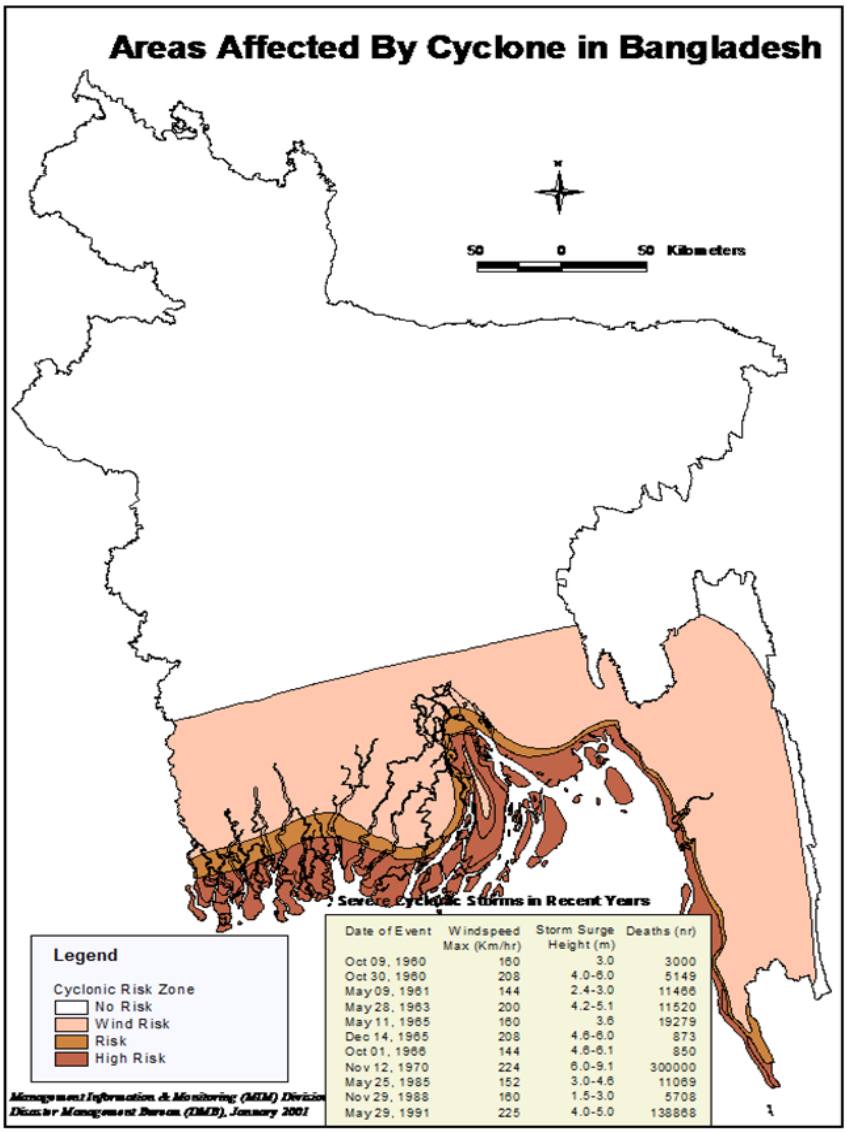


Figure 80: Cyclone Surge Susceptibility

Source: Disaster Management Board (DMB), Bangladesh

Table 42: Major Cyclones occurred in Bangladesh

Date	Nature of Phenomena	Approx. Loss/ Damage
1797, May-June	Most severe cyclone	Every hut leveled to ground and 2 vessels sunk in the Chattogram port
1876, 27th Oct-1st Nov	More severe storm surge	400,000 lives were lost and 1st Nov
1897, October	Hurricane with surge	175,000 lives were lost
1909, October	Cyclonic storm surge	Damage data not available
1948, 17th -19th May	Cyclonic storm	Damage data not available
1960, 30th– 31st October	Severe cyclonic storm, w=161 to210 km/h, s=4.2m and t=1.8m.	70% buildings in Hatia blown-off and 8,149 lives lost
1961, 27th -30th May	Cyclonic storm, w=95 to 145 km/h and total water level was 7m at Chattogram.	10,466 people killed

Date	Nature of Phenomena	Approx. Loss/ Damage
1962, 26th – 30th October	Cyclonic storm, w=200 km/h, s=5.8m and t=0.0m.	50,000 people killed
1963, 28-29th May	Severe cyclonic storm, w=201 km/h, s=5m and t=0.3m at Chattogram.	11,520 people killed
1965, 10-12th May	Severe cyclonic storm, w=161 km/h, s=4.0m and t=1.2m.	19,270 people killed
1965, 31st May – 1st June	Tide plus surge was 7.1m at Companiganj. At Chattogram 1.6m surge on tide	12,000 people killed
1966, 1st October	Severe cyclonic storm, w=145 km/h, tide plus surge was 6-7m.	850 people killed
1967,23-24th October	Cyclonic storm, w=130 km/h, s=2m and t=0.0m.	128 people killed
1970, 5-7th May	Cyclonic storm, w=148 km/h, s=2.3m and t=0.2m.	18 people killed
1970, 12-13th November	Most severe cyclonic storm, w=222 km/h, s=5.5m and t=2.1m.	300,000 lives lost and innumerable animals were killed, widespread damage to crops and properties
1971, 5-6th November	Cyclonic storm, w=105 km/h, s=2.1m and t=0.0m.	Damage data not available
1973, 16th -18th November	Cyclonic storm, w=165 km/h, s=3.5m and t=1.0m.	Damage data not available
1974, 24-28th November	Severe cyclonic storm, w=161 km/h, s=3.1m and t=0.2m.	20 people killed
1975, 9-12th May	Severe cyclonic storm, w=110km/h.	5 people killed
1977, 9-12th May	Cyclonic storm, w=113 km/h, s=0.6m and t=0.7m	Damage data not available
1983, 15th October	Cyclonic storm, w=122 km/h.	43 persons were killed, 1000 fishermen missing, and 20% Aman crops destroyed
1983, 9th November	Severe cyclonic storm, w=136 km/h, s=2.5m.	300 fishermen with 50 boats missing; 2000 houses, 22 institutions destroyed
1986, 9th November	Cyclonic storm, w=110 km/h.	14 lives lost and huge damage to crops and properties
1991, 29th April	Most severe cyclonic storm w=235 km/h, s=5.8m and t=1.7m.	145,000 people killed, 70,000 cattle killed, crops were damaged
1997, 19th May	Severe cyclonic storm, w=232 km/h, s=3.1-4.6m	Death toll of about 155
2007, 15th Nov	Severe cyclonic storm, w=223 km/h, s=4.2-4.6m	Death toll of about 3363
2009, 25th May	Cyclonic storm, w=92 km/h	Death toll of about 190
2012, 16th May	Cyclonic storm, w=130 km/h	Death toll of about 16

Note: w= Wind Speed; s= Surge height; t= Tidal height

Source: Asian Disaster and Preparedness Center (ADPC); Asian Disaster Reduction Center (ADRC)

5.2 Water Resources

5.2.1 River System

Turag and Bongshai are existing two rivers inside the study area from existing Kaliakair to BHTC overhead transmission lines which carry water throughout the year. Similarly, there are a number of khals and rivers within and around the transmission lines of Chattogram region. Matamuhuri, Sangu, Bakkhali and Naf are the major rivers in this region which carry water throughout the year. Table 43 shows the crossing locations and width of the transmission lines over the rivers and khals, and Table 44 shows Rivers and khals within and around the SS. A total of 18 shallow tube-wells falls under the RoW of transmission lines but no deep tube-wells exist in the project area which provide irrigation water to the crops of the area.

Table 43: Proposed transmission lines crossing over the rivers and khals

SN	Proposed Transmission Lines	Rivers and Khals	Crossing Width	Location
1.	Existing Kaliakair to BHTC 230kV	Bongshai River	123m	Vill: Sutrapur, Kaliakair
2.		Turag River	115m	Vill: Chapair, Kaliakair
3.	Anwara to Cox's Bazar 230kV	Sangu River	415m	Vill: Dohazari, Chandanish,
4.		Tonkaboti Khal	92m	Vill: Madinanagar Satkania
5.		Matamuhuri River	148m	Vill: Baroytali, Chakaria
6.		Joaria khal	126m, 177m 257m	Vill: Satgharia, Ramu
7.		Dharukhali	125m	Ramu, Cox's Bazar
8.		Dulhazara Khal	171m	Dulhazara, Cox's Bazar
9.	Cox's Bazar to Teknaf 132kV	Bakkhali River	165m	Vill: Khurulia, Cox's Bazar Sadar
10.		Whykong khal	42m	Vill: Whykong, Teknaf
11.		Katakhali khal	65m	Vill: Katakhali, Whykong, Teknaf
12.		Maricha Khal	35m	Vill: Haldia Palong, Ukhia
13.		Ali khali khal	39m	Vill: Dhaskhin Alikhali, Teknaf
14.		Reju Khal	85m and 60m	Vill: Goalia Palong Ukhia, Teknaf
15.	LILO of Dohazari to Cox's Bazar 132kV	Banglabazar Khal	10m	Vill: Banglabazar, Cox's Bazar Sadar

Source: IIFC Field Survey, 2020

Table 44: Rivers and khals surrounded the proposed SS

SN	Name of Substation	River System	Distance from Nearest River
1.	Proposed BHTC	Turag river is located to the North and Bangshi river to the East of the proposed SS location	2.36km from Turag River
2.	Proposed Anwara Substation	Bay of Bengal is located to the west of the proposed substation	1.45km from Bay of Bengal
3.	Proposed Cox's Bazar Substation	PM khali khal are located in north-eastern part at the SS area which is connecting with Bakkhali River to south.	1.06m from Bakkhali River
4.	Proposed Teknaf Substation	The proposed substation site is situated near the Teknaf- Cox's Bazar Regional Road. Ali khali khal is located in north-western part at the SS site which is connecting with Naf River to the East.	900m from Naf River

Source: IIFC Field Survey, 2020

5.2.2 Water level

The proposed transmission line crosses five rivers namely Turag, Bongshai, Matamuhuri, Sangu and Bakkhali River. For analyzing the surface water level using the secondary data, three surface water level measuring stations at Matamuhuri (station ID 204, Chiringa), Sangu (station ID 248, Dohazari), Bakkhali (station ID 41, Cox's Bazar) and Turag (station ID-301, Kaliakair) River has been studied in detail. Figure 81 and Figure 82 below shows a hydrograph of the monthly maximum values of surface water level at Dohazari, Chiringa, Cox's Bazar station; and Kaliakair station respectively.

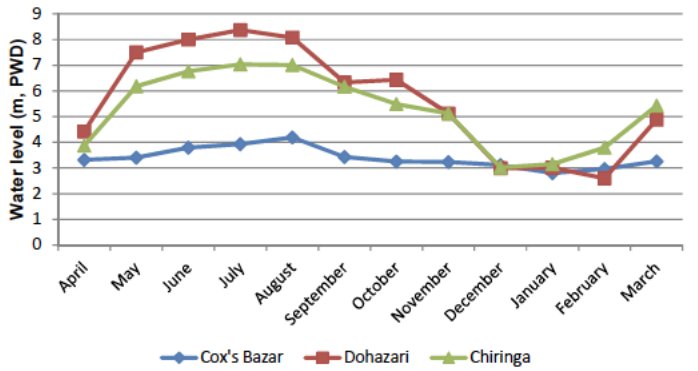


Figure 81: Monthly maximum water level at Cox's bazar, Dohazari and Chiringa station (1980-2009)

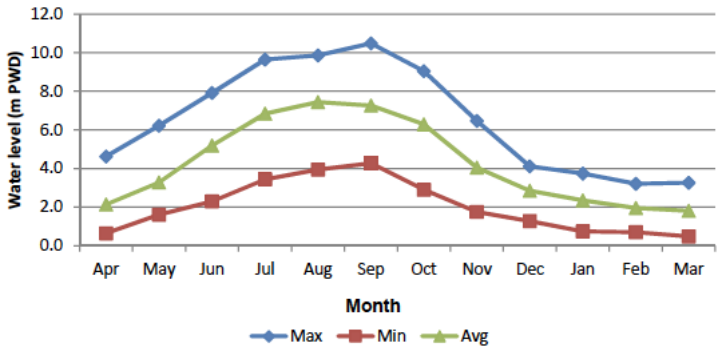


Figure 82: Monthly water level at Kaliakair station (1980-2009)

Table 45 shows the flood frequency analysis at 04 locations (BWDB stations) for different return periods.

Table 45: Water levels at different stations for different return periods

Return Period (Years)	Stn: Double Mooring 153, Chattogram Water Level (m+ PWD)	Stn: Chandanaish 248, Dohazari, Chattogram Water Level (m+ PWD)	Stn: Ichakhali 249, Satkania, Chattogram Water Level (m+ PWD)	Water Level (m PWD) at Kaliakair station
	Bakkhali	Sangu	Matamuhuri	Bongshai/Turag
2	3.72	7.09	5.43	7.38
5	4.04	7.38	5.73	9.79
10	4.30	7.62	5.97	11.34
20	4.55	7.85	6.20	13.27
50	4.87	8.15	6.50	14.68

Source: BWDB

5.2.3 Flooding and Drainage Pattern

Flooding is the major problem of the study area especially at proposed substation sites. Cox's bazar substation site facing flooding problem every year due to overtopping of Bakkhali River. The flood water enters into the substation site through East Mokterpur culvert and West Mokterpur culvert and generally stays for 1 day and drain out through PM khali khal. In case of Teknaf substation area, flood water remains for 3 to 4 days during monsoon and drain out through Ali Khali Khal.

Figure 83 shows the surrounding rivers of Dhaka Division including project area of Gazipur. The main rivers are the Buriganga, the Shitalakshya, the Balu, the Turag and the Dhaleshari. Although the total basin area consists of Balu, Bongshai, Buriganga, Dhaleswari, Shitalakshya, Tongi Khal and Turag rivers.

The main river of Chattogram region is Karnafuli. It flows through the region of Chattogram and the Chattogram Hills. It cuts across the hills and runs rapidly downhill to the west and southwest and finally to the Bay of Bengal. The river has been dammed upstream at Kaptai to create a water reservoir for hydroelectric power generation. Other important rivers of the region are the Feni, Muhuri, Sangu, Matamuhuri, Bakkhali, and Naf.

Low agricultural land has been selected for proposed sub-station site at Anwara. In monsoon, the land proposed for sub-stations are inundated with approximate 2 to 3 feet depth. It takes not more than 3 days to drain out the excess rainwater from land through the khal in front of the proposed sub-station. During monsoon, the substation area of proposed BHTC gets inundated and face drainage congestion problem. In monsoon, the land proposed for substation site is inundated with approximate 3 feet depth. It takes around 5-6 month to drain out flood water from land.

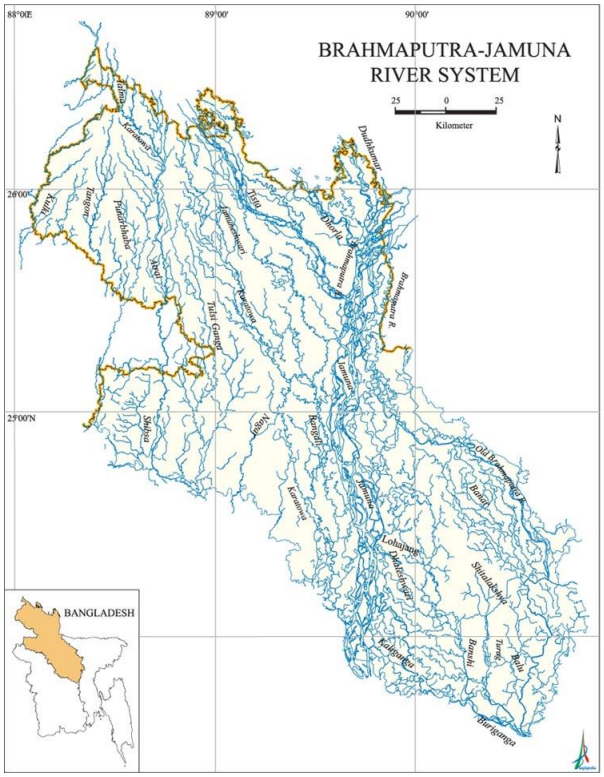


Figure 83: Brahmaputra Jamuna River System

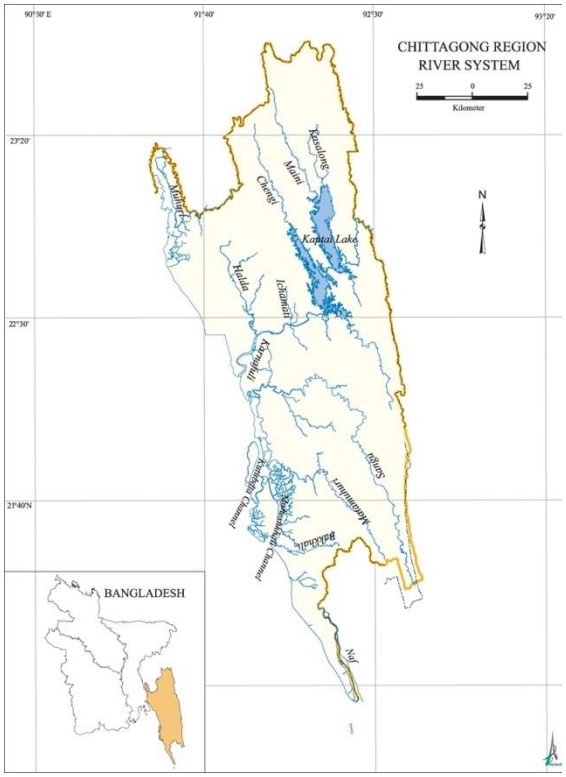


Figure 84: Chattogram Region River System

5.2.4 River Morphology

The morphology of a river is a function of a number of processes and environmental conditions, including the composition and credibility of the bed and banks (e.g., sand, clay, bedrock); erosion comes from the power and consistency of the current, and can affect the formation of the river's path. Also, vegetation and the rate of plant growth; the availability of sediment; the size and composition of the sediment moving through the river; the rate of sediment transport through the river and the rate of deposition on the floodplain, banks, bars, and bed; and regional aggradation or degradation due to subsidence or uplift. The proposed transmission line crosses five rivers namely Turag, Bongshai, Matamuhuri, Sangu and Bakkhali River. However, it is important to analyze the erosion-accretion scenario of these rivers during the planning stage of the project.

Sangu River

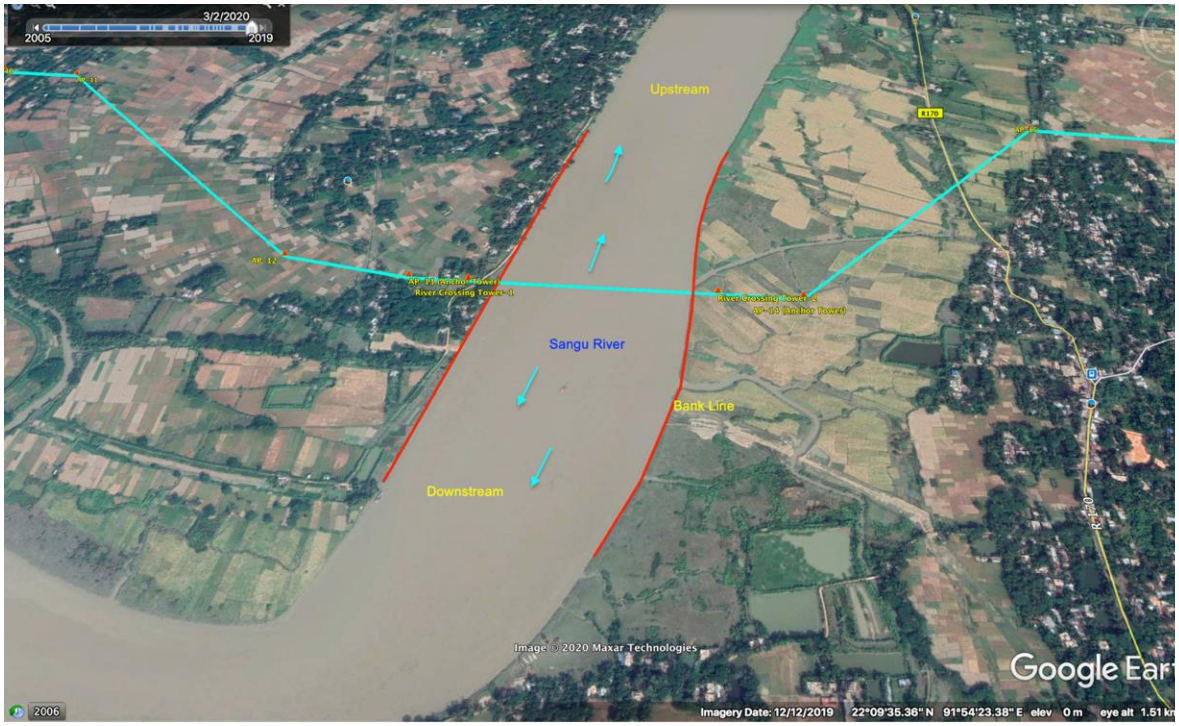


Figure 85: Satellite Image Showing the Sangu River Course, 2020

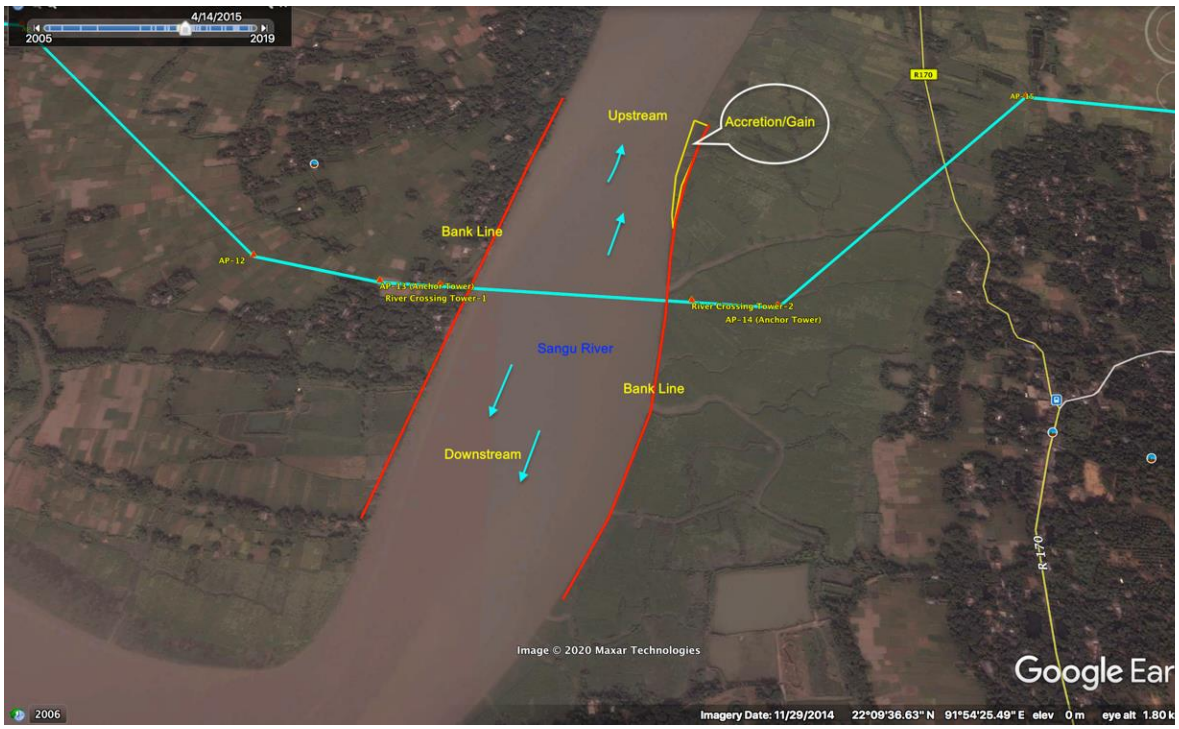


Figure 86: Satellite Image Showing the Sangu River Course, 2015

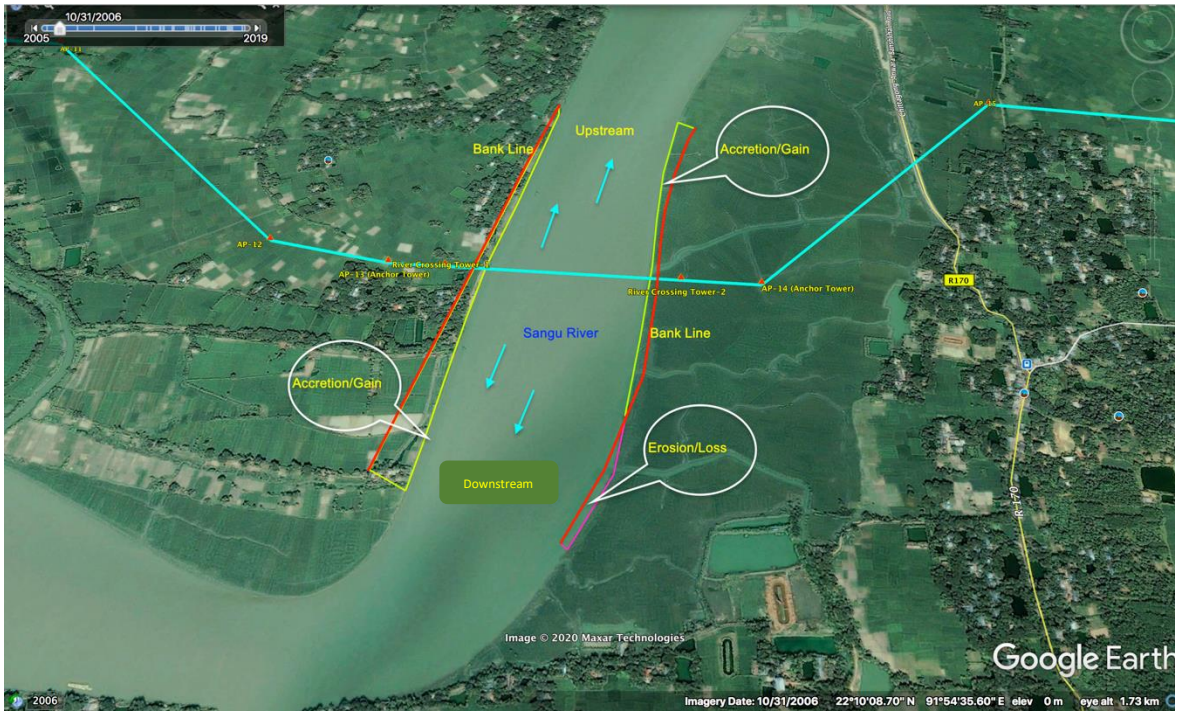


Figure 87: Satellite Image Showing the Sangu River Course, 2005

From the historical imagery (2020, 2015 and 2005) of Sangu River (considering 500m upstream and downstream for both riverbank) it can be concluded that there is an erosion and accretion scenario overserved. The status of accretion or gain is high compared to erosion or loss of riverbank. However, detail morphology study will be required before the construction of the project by PGCB.

Matamuhuri River

Figure 88: Satellite Image Showing the Matamuhuri River Course, 2018

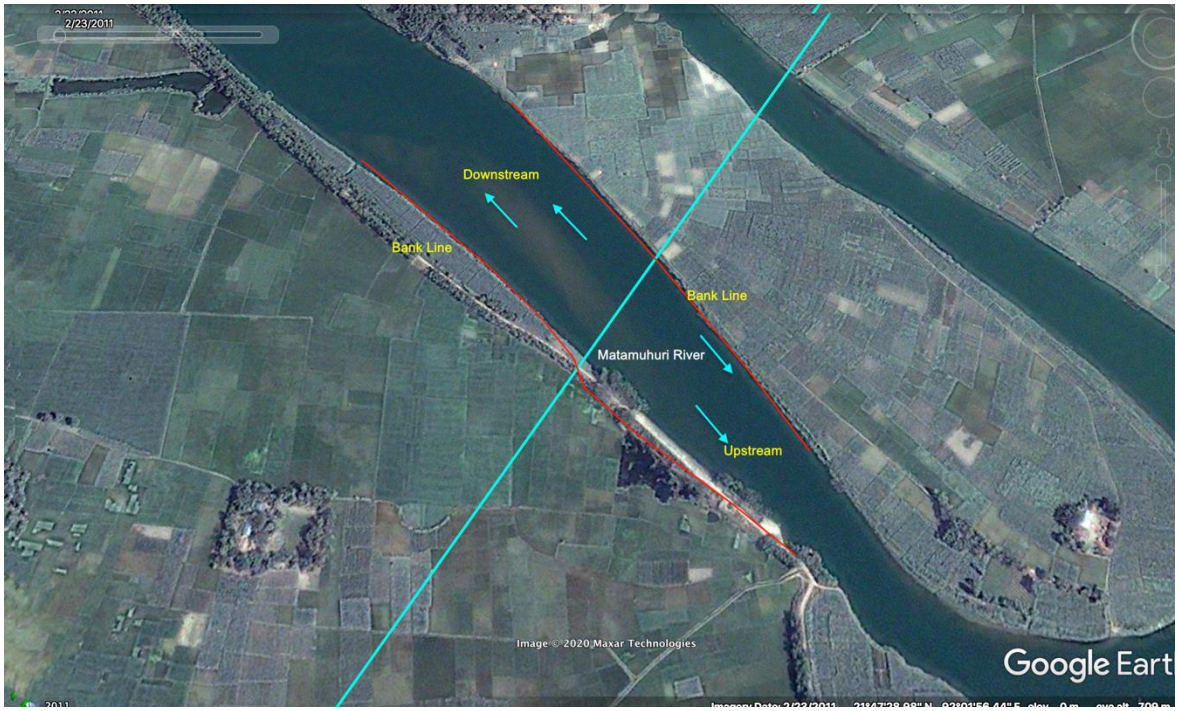


Figure 89: Satellite Image Showing the Matamuhuri River Course, 2011

From the historical imagery (2018, and 2011) of Matamuhuri River (considering 500m upstream and downstream for both riverbank) it can be concluded that there is no considerable erosion and accretion scenario overserved. However, detail morphology study will be required before the construction of the project by PGCB.

Bakkhali River

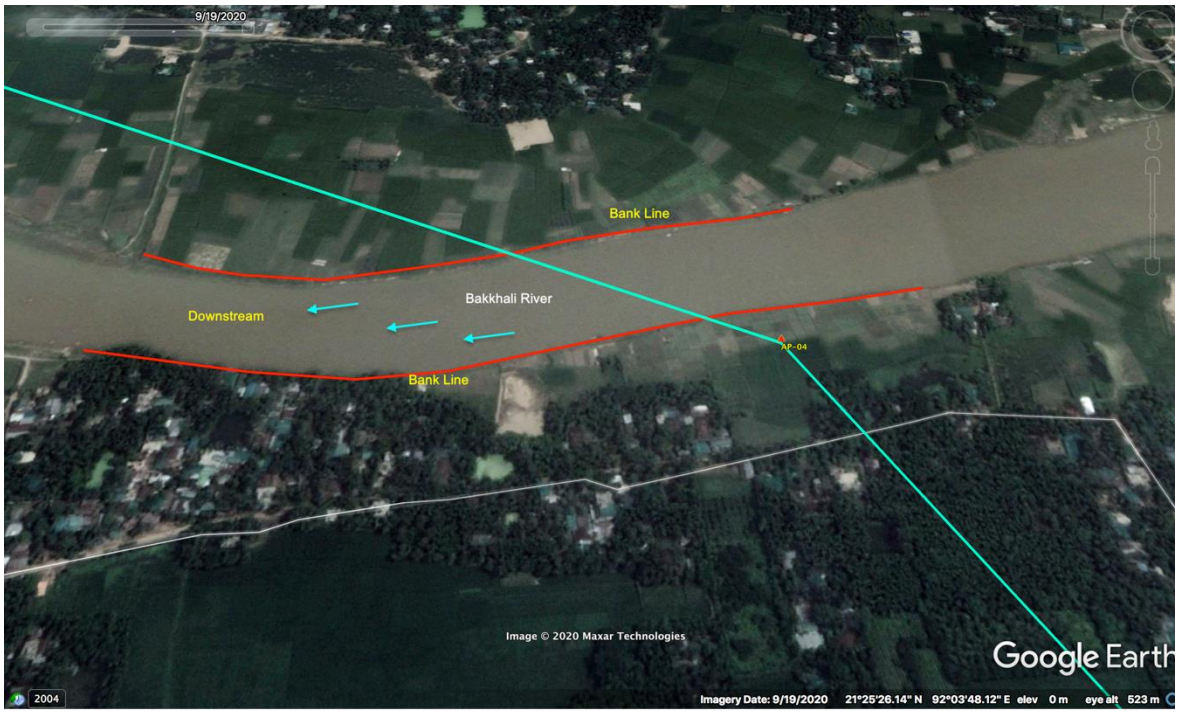


Figure 90: Satellite Image Showing the Bakkhali River Course, 2020

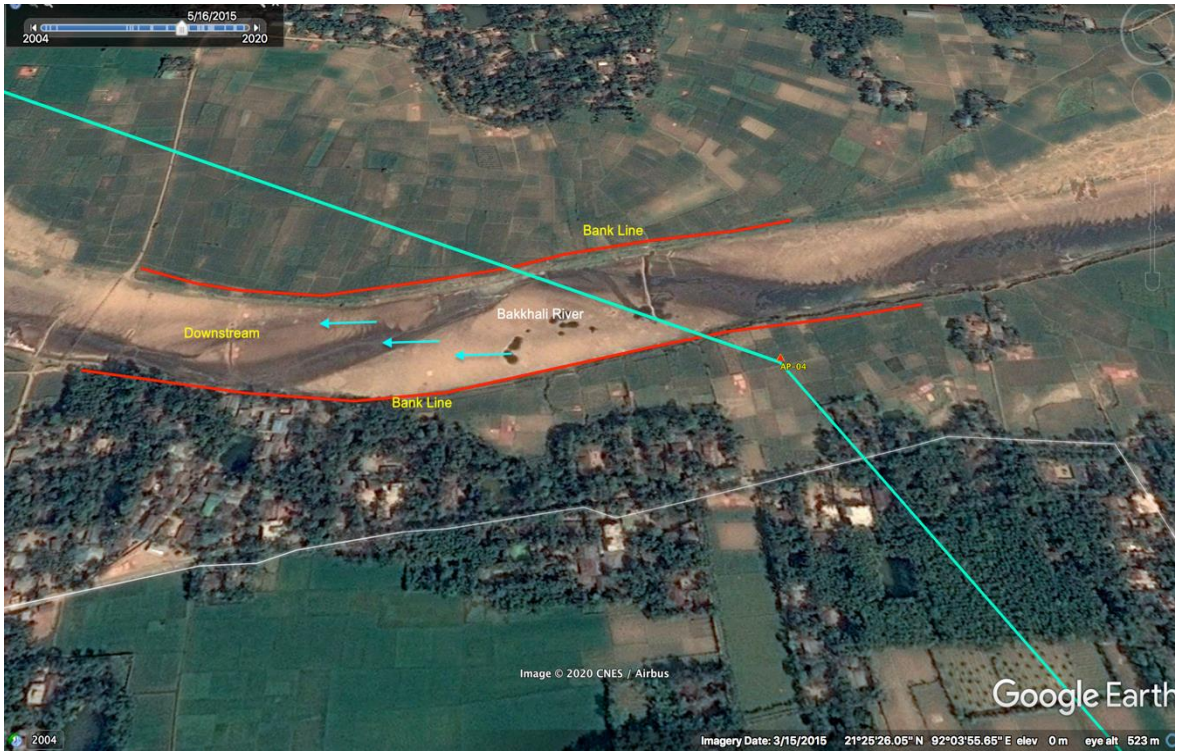


Figure 91: Satellite Image Showing the Bakkhali River Course, 2015

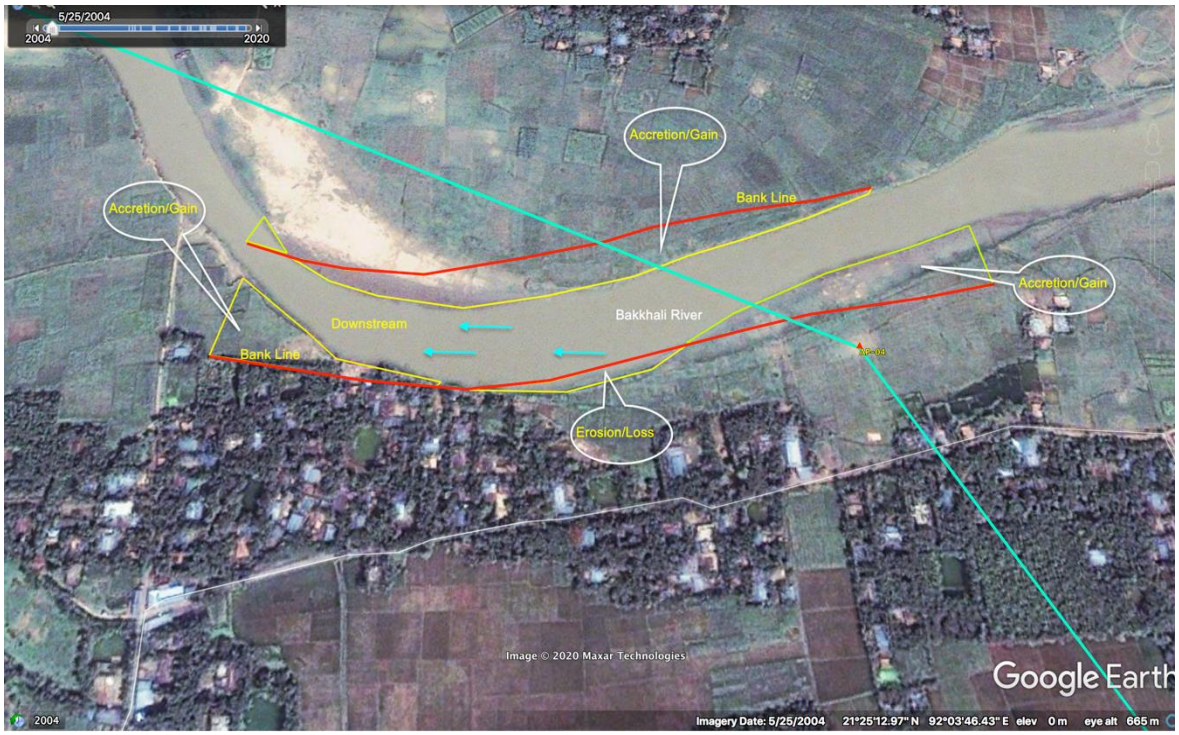


Figure 92: Satellite Image Showing the Bakkhali River Course, 2004

Turag and Bongshai River

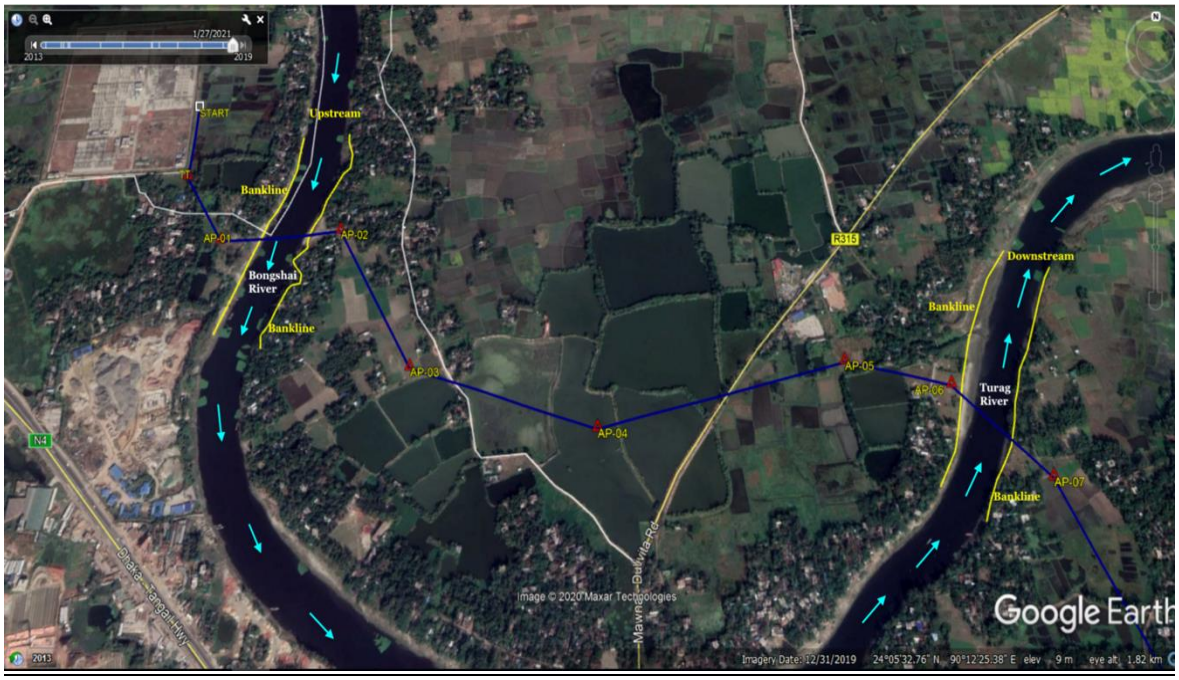


Figure 93: Satellite Image Showing the Bongshai and Turag River Course, 2019

Figure 94: Satellite Image Showing the Bongshai River Course, 2013

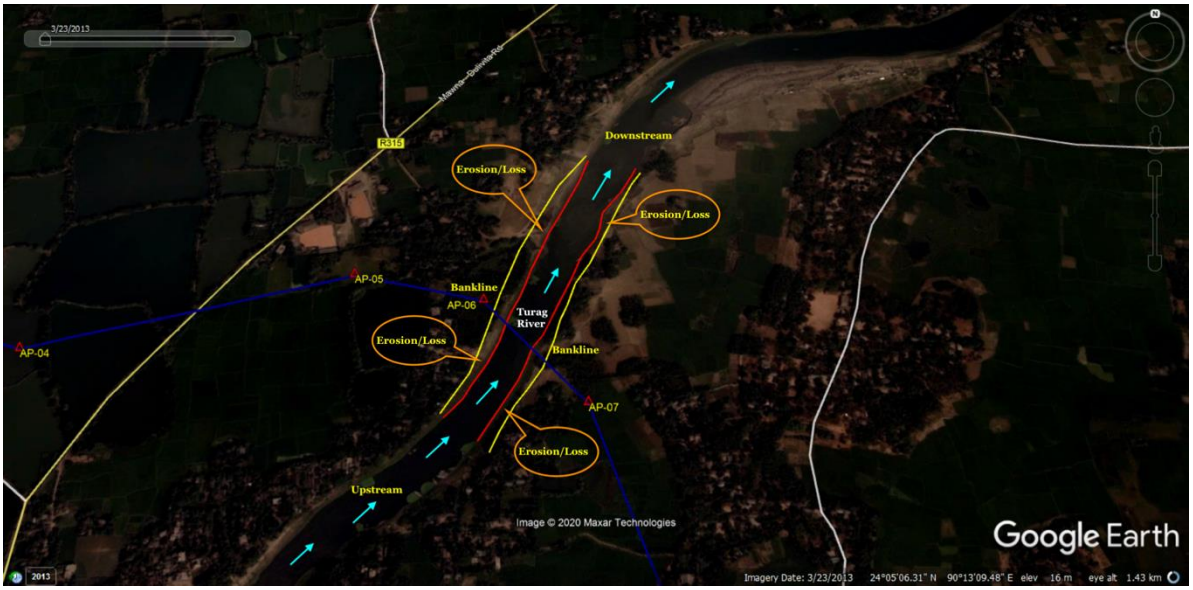


Figure 95: Satellite Image Showing the Turag River Course, 2013

From the historical imagery of Bakkhali River (considering 500m upstream and downstream for both riverbank) it can be concluded that there is no considerable erosion and accretion scenario overserved between 2020 and 2015. The river was found narrow during 2004, and afterwards the erosion was occurred which clearly indicated the shifting tendency of riverbank.

Proposed BHTC substation is far away from the major river. The main river which would be crossed by the transmission line is Bongshai and Turag River that is not affected by erosion. During field visit and analysis of satellite historical data it was found that remarkable erosion was visible around the crossing point of Turag River. However, detail morphology study will be required before the construction of the project by PGCB.

5.3 Environmental Quality

Data on air quality, water quality and noise level were collected to assess the environmental quality at baseline condition which is discussed in the following sections.

5.3.1 Air Quality

Air pollution is a primary social and environmental concern for health and sustainability of the ecosystem. Air quality depends on substances, which are present in atmosphere. When the presence of solid particles, liquid droplets or gaseous compounds in the air is higher than normal, it becomes harmful to living organisms and the air becomes polluted. There are five primary pollutants which together contribute more than 90% of global air pollution. These are: CO_2, NOx, HC, SOx, and PM. The standard values of ambient air for the area of different categories are shown in Table 14 and Table 15 Chapter 2 of the report. To establish the baseline air quality, a primary analysis of air quality shall be proposed, before commencing the construction activities of subprojects by contractors.

Since the proposed transmission line will not have any long-term impact on air quality, no data on air quality has been collected. The main concern is suspended particulate matter (SPM), which is often higher in concentration than the national air quality standard during the construction period.

Heating is the main biological effect of the electromagnetic fields produced from the high voltage transmission line. To date, no adverse health effects from low level, long-term exposure to power frequency have been observed.

5.3.2 Noise Level

The standard values for noise of Bangladesh are shown in Table 21 and Table 22 of Chapter 2. During the construction or any machinery activities induce noise level in the ambient environment e.g., heavy earth, moving machinery, compressors, welding machine, small generators and other activities. In addition, there would be movement of vehicles for construction activities which would also add to the noise levels. Noise monitoring was designed and conducted by trained specialists. Noise monitors were located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface. The observed values of noise level are presented in Table 46.

Table 46: Daytime noise levels of the study area

SN	Location	GPS	Values (dBA)	Area category by ECR, 97
1.	BHTC SS	24°0.3'52.60"N 90°13'27.40"E	38	Residential Area
2.	Anwara SS	22°12'16.54"N 91°49'38.61"E	41	Residential Area
3.	Cox's Bazar SS	21°30'22.14"N 92°04'22.98"E	47	Residential Area
4.	Teknaf SS	20°58'53.42"N 92°15'5.50"E	40	Mixed Area

Source: IIFC Field Survey, 2020

The study area falls under the category of residential and mixed area. The Environmental Conservation Rules 1997, of Department of Environment (DoE), Bangladesh has defined standard noise levels as 50 dBA for residential area and 60 dBA in mixed area during daytime. The recorded values of noise levels were found within the standard limit. To establish the baseline noise, a primary analysis of noise shall be proposed, before commencing the construction activities of subprojects by contractors.

5.3.3 Water Quality

The transmission line passes through a number of water bodies along with the demarked study area. The transmission line from existing Kaliakair substation to BHTC passes Bongshai and Turag Rivers; Anwara to Cox's Bazar passes Sangu and Matamuhuri Rivers; Cox's Bazar to Teknaf passes Bakkhali River. Water samples are collected from Turag River, Bongshai river, Sangu, Matamuhuri and Bakkhali River, and some instant parameter test has been done following appropriate methods. Temperature, Salinity, TDS, Turbidity, PH, DO, EC are measured on the site. Collected data of several parameters are given in Table 47.

Table 47: Water quality at Turag, Bongshai, Matamuhuri, Sangu and Bakkhali River

Name of the River	Location	GPS	Water Quality Parameter					
			TDS (mg/L)	EC (µs/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (^{0}C)	pH
Turag	Kaliakair	24°5'15.18"N 90°12'57.40"E	81	0.17	65.7	6.38	25.1	7.9
Bongshai	Sutrapur	24°5'26.86"N 90°12'6.04"E	70	0.16	74.6	6.9	26.4	7.7
Bakkhali	Umkhali	21°25'14.93"N 92° 3'48.80"E	56	0.57	187	8.4	31.1	7.8
Sangu	Dohazari	22° 9'41.07"N 91°54'21.94"E	40	0.47	156	7.9	30.0	7.4
Matamuhuri	Mondalpara	21°47'19.29"N 92° 1'52.09"E	48	0.50	149	8.1	30.2	6.9
Bangladesh Standard			1000	-	10	Min.6.0		6.5-8.5
WHO Standard			1000	-	5			6.5-8.5
Methods of Testing								

Source: IIFC Field Survey, 2020

Methods of Testing: pH= Electrometric Method by Microprocessor pH meter; TDS= APHA 22nd Edition 2012 (2540 C) by TDS Meter; EC= APHA 22nd Edition 2012 (2510 B); Turbidity= ISO: 7027; DO= Electrometric Method

It shows that the values of in-situ tested parameters are within the limit of Bangladesh and WHO standard except turbidity which is well beyond the standard limit.

5.4 Land Resources

The proposed project interventions under this study are establishment of overhead power transmission line and construction of four (4) substations. The proposed Anwara, Cox's Bazar and Teknaf sub-stations will be constructed in the Chattogram Coastal Plain (AEZ: 23), and Northern and Eastern Hills (AEZ: 29) respectively. The proposed transmission line will pass through the Chattogram Coastal Plain (AEZ: 23) in Anwara, Chandanaish, Lohagara, Patiya, Satkania, Chakaria, Ramu, Cox's Bazar Sadar, Ukhia and Teknaf Upazilas; Northern and Eastern Hills (AEZ: 29) in Naikhongchhari, Lohagara, Chakaria, Ramu, Cox's Bazar Sadar, Ukhia and Teknaf Upazilas (BARC, 2012). The AEZ of the study area is presented in Figure 96.

Similarly, the proposed transmission line will pass through the Madhupur Tract (AEZ: 28) and Young Meghna Estuarine Floodplain (AEZ: 18) in Kaliakair Upazila. The proposed BHTC substation will be constructed in the Madhupur Tract (AEZ: 28) (BARC, 2012).

The site description of four substations is described in Section 3.6 of the report. The land use map of four substations administrative area is presented Figure 97, Figure 98, Figure 99 and Figure 100.

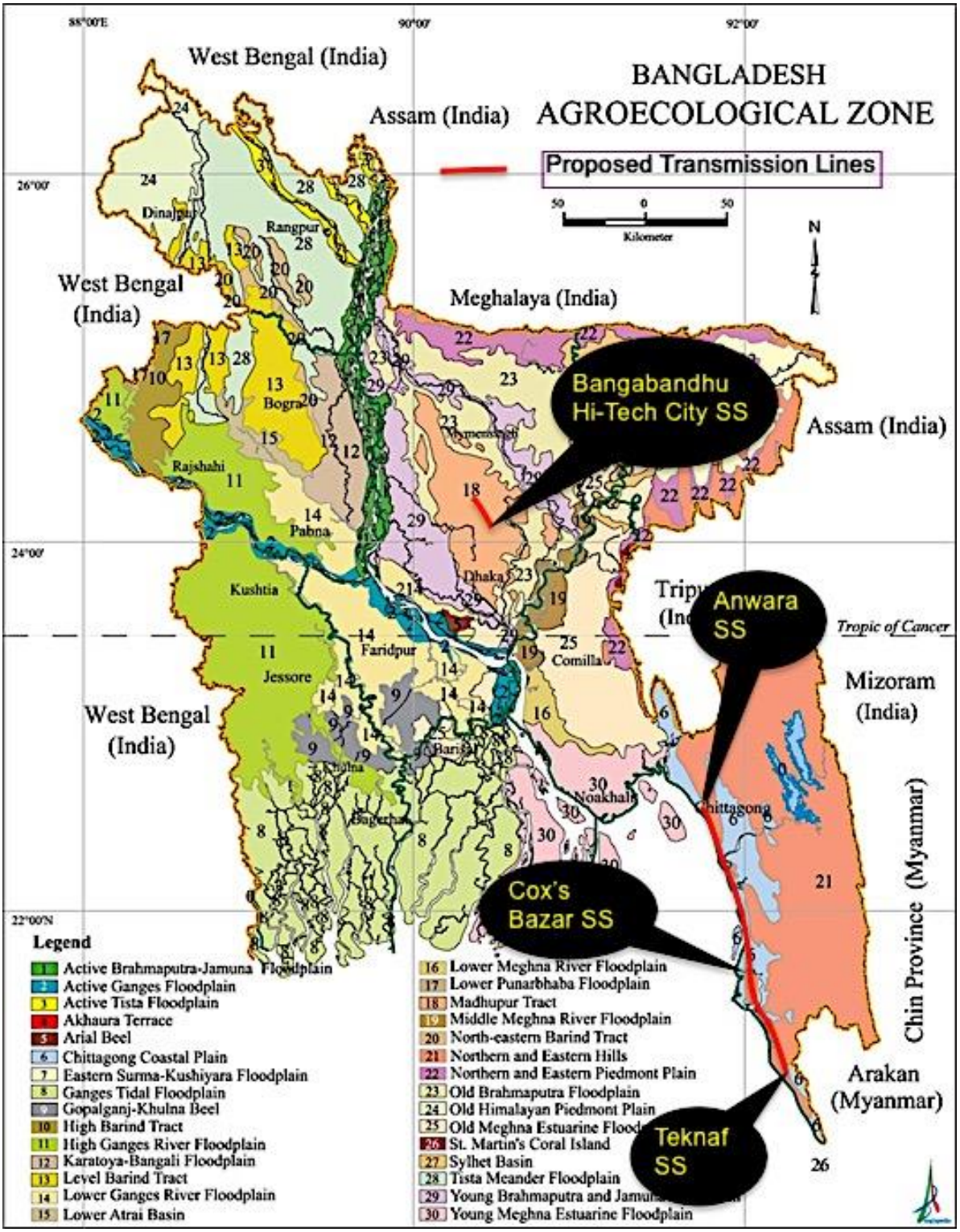


Figure 96: Agro-ecological zones in the study area

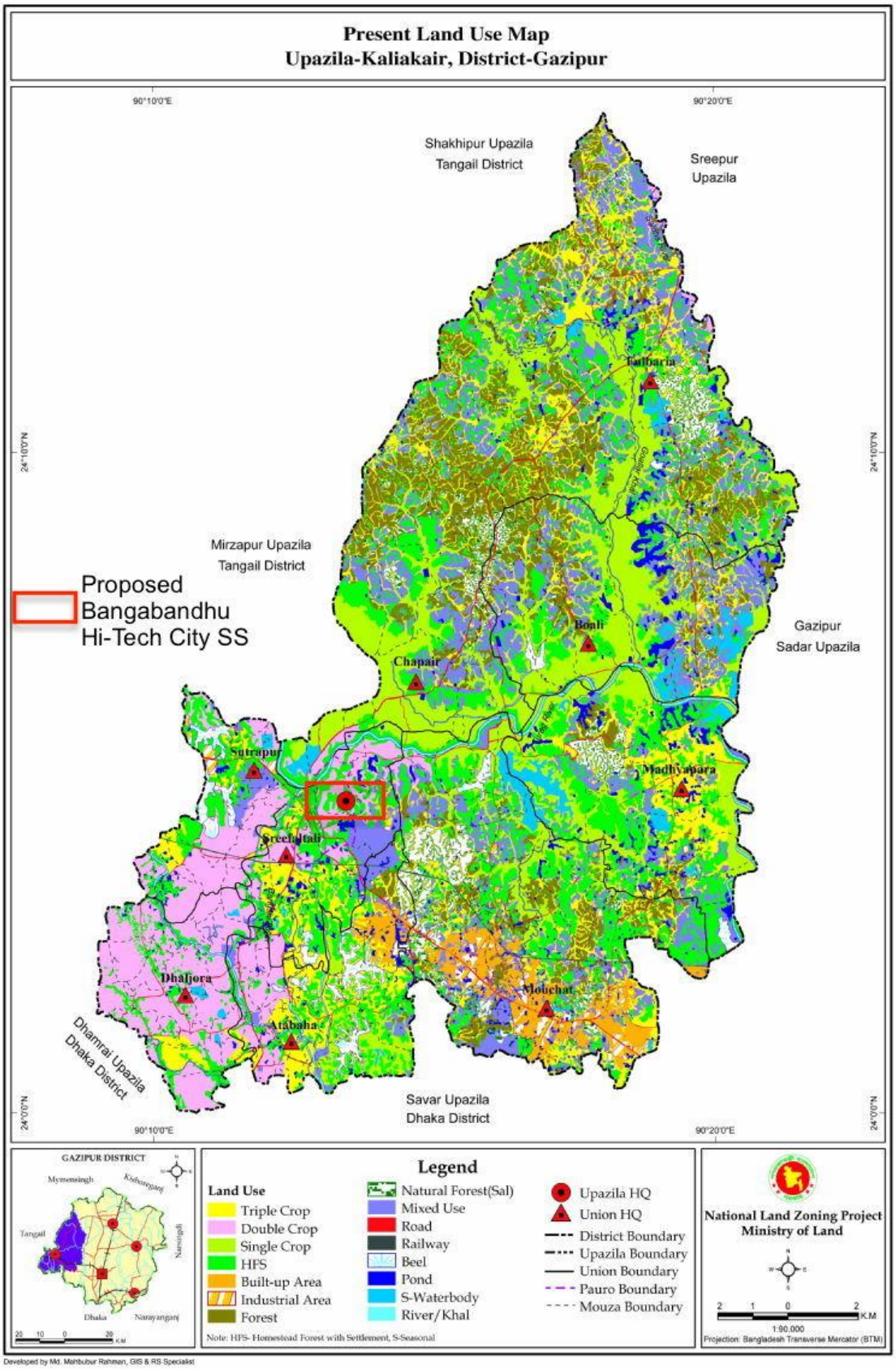


Figure 97: Land use of Kaliakair, Gazipur

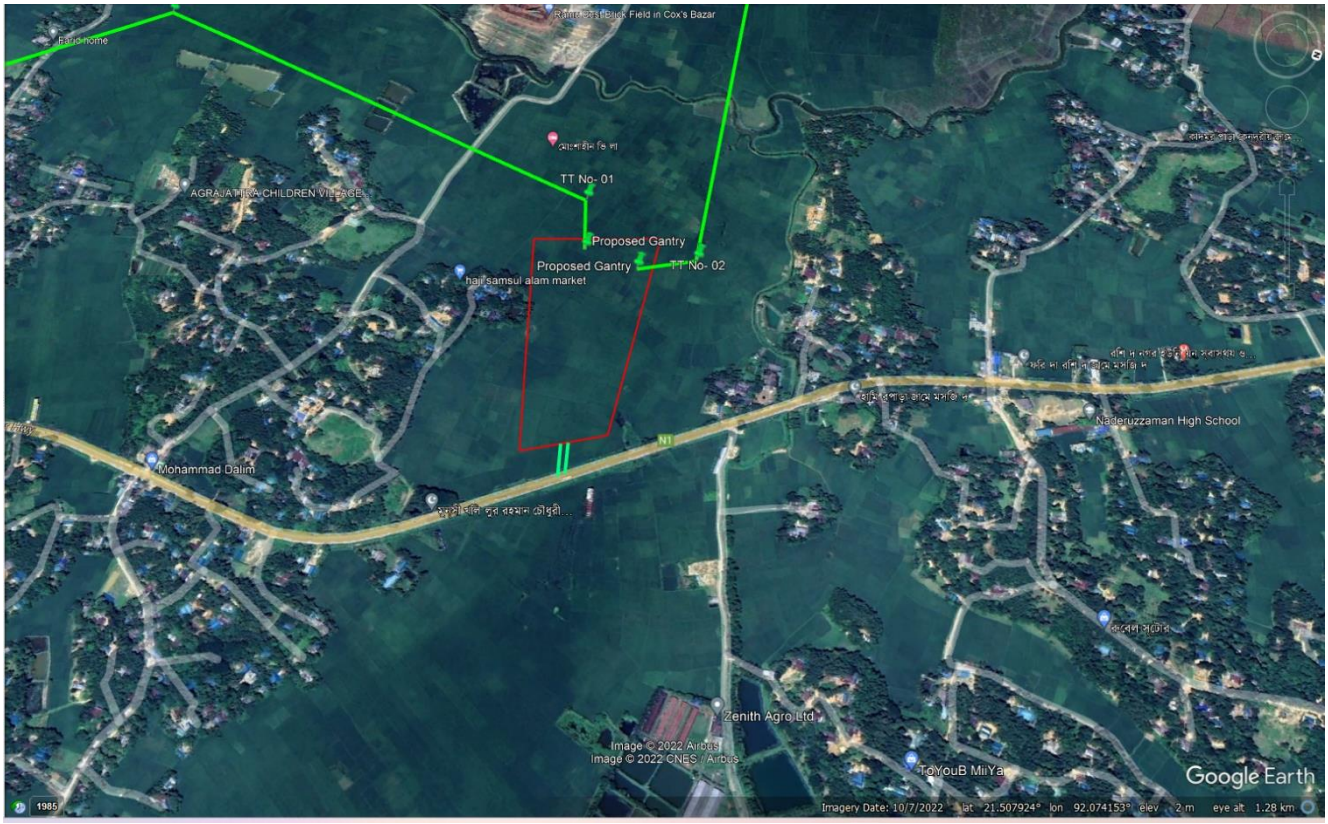


Figure 98: Land use of Cox's Bazar Substation area, Cox's Bazar

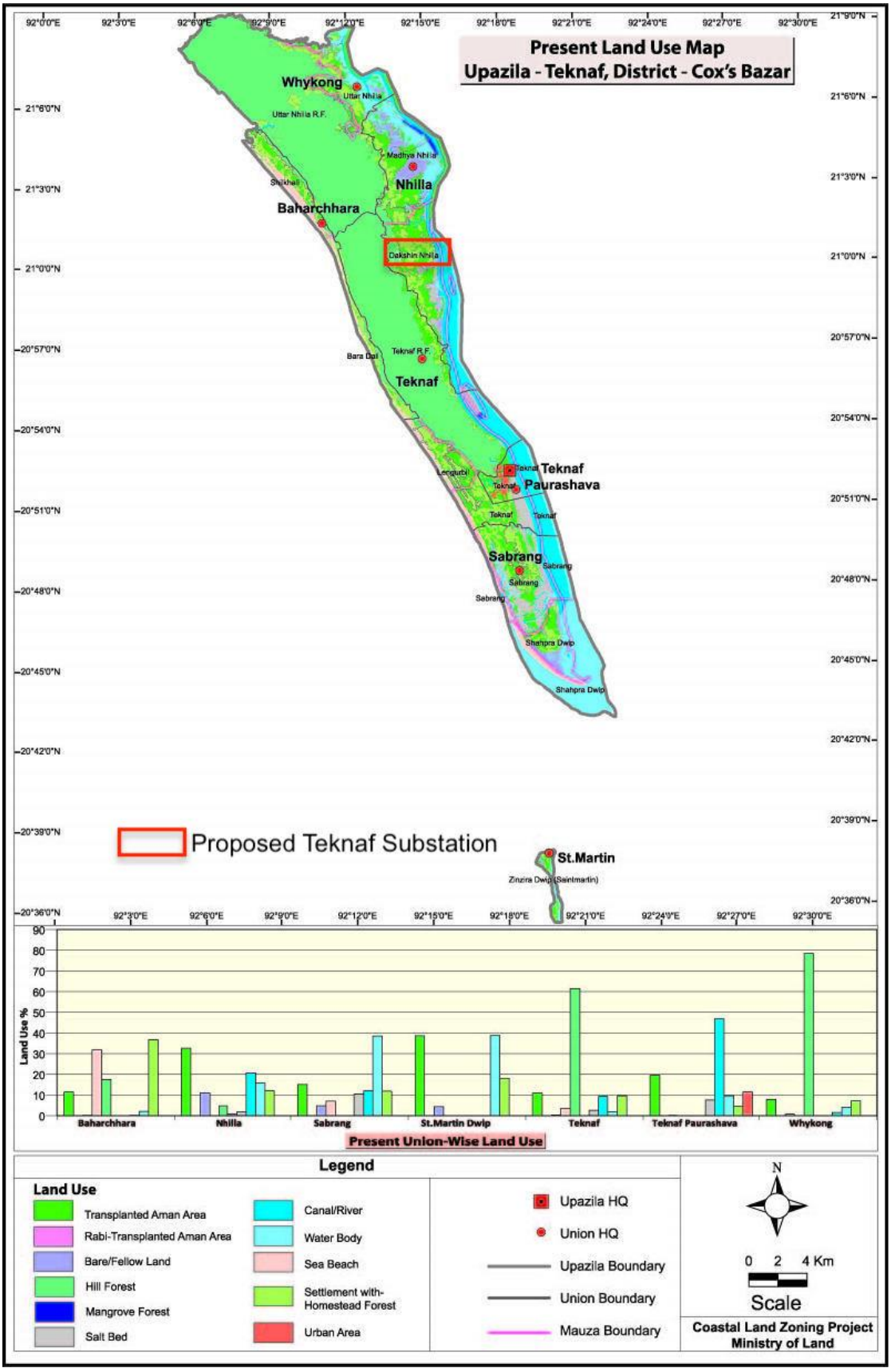


Figure 99: Land use of Teknaf Substation area

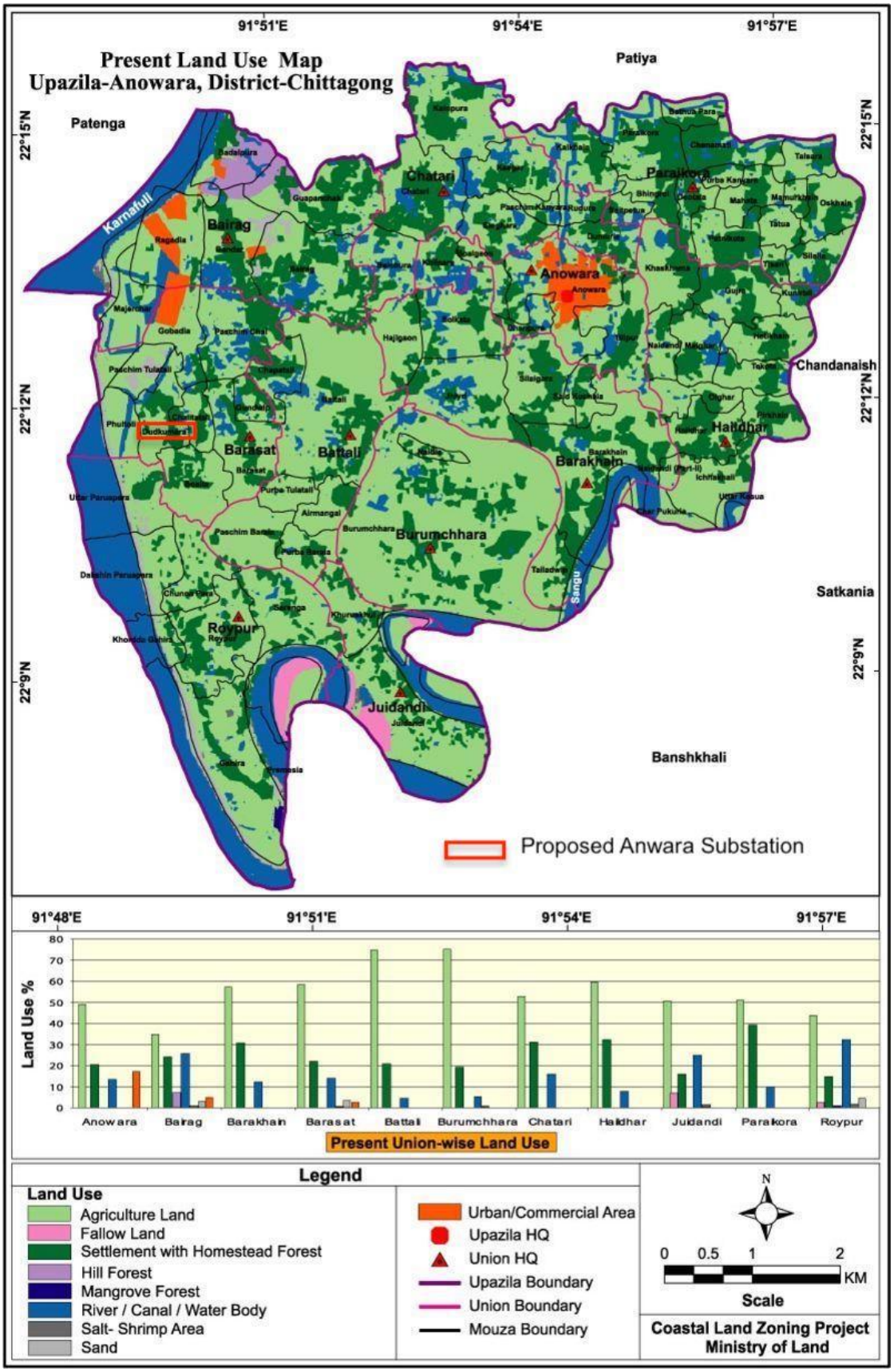


Figure 100: Land use of Anwara Substation area

The Right-of-Way (RoW) of proposed overhead transmission line from Anwara to Cox's Bazar (N), Cox's Bazar to Teknaf, LILO of Dohazari to Cox's Bazar and existing Kaliakair to BHTC will pass mostly over the agriculture land (overall 62.22% of total area). Salt pan (26.21% of total area) and rural settlement (0.51% of total area) covers next in the RoW land use. As per Electricity Rules 2020, a total of 31.09 acres of land will be required for tower footings. Detailed land use of sub-station and RoW of transmission line are presented in Table 48 and Table 49.

Table 48: Land use of sub-station areas

Land Use	Name of Substations (area in ha)				Total Area (ha)
	Anwara	Cox's Bazar (N)	Teknaf	BHTC	
Agriculture	8.09	4.04	2.02	-	14.15
Homestead	-	-	-	-	-
Salt Pan	-	-	-	-	-
Forest	-	-	-	-	-
Intertidal Zone	-	-	-	-	-
Freshwater Aquaculture	-	-	-	0.66	0.66
Herb/Shrub/Fallow	-	-	-	1.36	1.36
Total Area (ha)	8.09	4.04	2.02	2.02	16.18

Source: IIFC Field Survey, 2020

Table 49: Land use in RoW areas of Transmission Lines

Land Use	Name of Transmission Line (area in ha)								Total Land Area (ha)	% of land area
	Anwara to Cox's Bazar 230kV		Cox's Bazar to Teknaf 132kV		LILO Dohazari to Cox's Bazar 132kV		Kaliakair to Hi-Tech City 230kV			
	DIA	GIA	DIA	GIA	DIA	GIA	DIA	GIA		
Agriculture (Net Cropped Area-NCA)	132.28	198.42	42.13	84.21	1.34	2.68	5.88	8.82	475.76	62.22
Salt Pan	60.00	90.00	18.00	36.00	-	-	-	-	204	26.21
Rivers and Khals	2.74	4.12	0.80	1.20	-	-	0.47	0.71	10.04	1.29
Lakes	-	-	0.33	0.66	-	-	-	-	0.99	0.13
Ponds	0.48	0.72	0.11	0.22	-	-	3.20	4.80	1.53	0.20
Rural Settlement/ vegetation	0.8	1.21	0.12	0.79	0.18	0.37	-	-	3.47	0.51
Forest Plantation	0.57	0.96	0.61	1.12	-	-	-	-	3.26	0.42
Natural Forest/Reserved Forest	12.00	18.00	2.50	5.00	-	-	-	-	37.5	4.82
Freshwater Aquaculture	-	-	-	-	-	-	1.61	2.41	4.02	0.52
Herb/Shrub/Fallow	-	-	0.22	0.44	-	-	1.8	2.7	5.16	0.66
Built-up area	9.13	13.57	0.18	0.36	0.03	0.05	0	-	23.32	3.02
Total	218	327	65	130	1.55	3.1	9.76	14.64	769.05	100.0

Source: IIFC Field Survey, 2020

5.5 Agriculture Resources

5.5.1 Cropping Pattern and Intensity

RoW of Transmission Line

The transmission lines will pass mostly through agricultural lands. In this ESIA, 50-meter RoW is considered for impacted area, where direct impacted area (DIA) is 20 meter (in the middle of the RoW) and general impact area (GIA) is 30m (15 meter in both sides of DIA) for 230kV transmission line. For 132kV transmission line, DIA is 10m (in the middle of the RoW) and GIA is 20m (10 m in both sides of DIA). Total agricultural land is 484 ha of which most of the areas are Single Cropped Area (SCA) followed by Double Cropped Area (DCA) and some Triple Cropped Areas (TCA) (Table 50). T. aman, Boro and summer vegetables are the main crops cultivated by local farmers in the proposed intervention area. The cropping intensity of the study area is about 174%. There is a provision of compensation for damaging the crops due to laying the transmission lines by the project mentioned in RP report.

Table 50: Practiced cropping pattern and crop area in the proposed RoW of Transmission line

Land type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (November-February)	Area (Ha)	% of NCA
Medium High Land (F1)	Vegetables	T. Aman	Boro	92	18.9
	Fallow	T. Aman	Boro	133	27.5
	Vegetables	Fallow	Boro	42	8.7
			Sub total	**267**	**55.1**
Medium Low land (F2)	Fallow	Fallow	Boro	104	21.5
			Sub total	**104**	**21.5**
Low land (F3)	Fallow	Fallow	Boro	113	23.4
			Sub total	113	23.4
			Grand Total	**484**	**100**
			Single Cropped Area (SCA)	217	44.9
			Double Cropped Area (DCA)	175	36.2
			Triple Cropped Area (TCA)	92	18.9
			Cropping Intensity (CI)	-	174

Source: Field visit and consultation with local DAE officials and farmers

Substation

BHTC Substation will be constructed on partly on waterbody and herbs/shrubs/fallow land. But as per master plan of Hi-Tech City this land was dedicated for the construction of substation. Remaining three new substations will be established on agriculture land.

Total Agricultural land is about 16 ha of which most of the areas is Single Cropped Area (SCA) followed by Double Cropped Area (DCA). T. Aman and Boro is the main crops practiced in the proposed sub-station area. Cropping Intensity (CI) of the area is about 149%. Detailed cropped area of the area presented in the Table 51.

Table 51:Practiced Cropping pattern and crop area of the proposed sub-station area

Land type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (November-February)	Area (Ha)	%of NCA
Medium Low land (F2)	Fallow	T. Aman	Boro	8	48.6
	Fallow	T. Aman	Fallow	8	51.4
			Total	16	100
			SCA	8	35
			DCA	8	33
			TCA	0	0
			CI		149

Source: Field visit and consultation with local DAE officials and farmers

5.5.2 Crop area and production

RoW of Transmission Line

In RoW areas, total cropped area is about 843 ha of which rice is 709 ha and summer vegetables are 134 ha. Total production is about 3,800 metric ton, where rice production is 2,626 metric ton and vegetables production are 1,175 metric ton. The loss of production from this land can be defined as temporary. Crop yield rate has been calculated based on Yearbook of Agricultural Statistics (BBS) and consultation with local DAE officials and farmers. Detailed cropped area and production of the RoW is presented in Table 52.

Table 52: Detailed crop area and production

Crop name	Area (Ha)	% of cropped area	Yield (MT/Ha)	Production (MT)	% of crop production	Type of Loss
T. Aman	225	26.7	2.85	640	16.8	
Boro	484	57.5	4.1	1985	52.2	
Total rice	709	84.1	-	2626	69.1	Temporary
Summer vegetables	134	15.9	8.79	1175	30.9	
Non-rice	134	15.9	-	1175	30.9	
Grand total	843	100.0	-	3800	100.0	

Source: Yearbook of Agricultural Statistics and field observation

Substation

At the proposed sub-station areas, total cropped area is 24 ha of total land is used for rice cultivation. T. Aman area is 16 ha and Boro area is 8 ha. Total rice production is about 77 metric ton, where T. Aman rice is 46 metric ton and Boro rice is 32 metric ton. The loss of production from this land can be defined as permanent. Crop yield rate has been calculated based on Yearbook of Agricultural Statistics (BBS) and consultation with local DAE officials and farmers. Detailed cropped area and production of the RoW is presented in Table 53.

Table 53: Cropped area and production in proposed sub-station area

Crop name	Area (Ha)	% of cropped area	Yield (MT/Ha)	Production (MT)	% of crop production	Type of Loss
T. Aman	16	67.3	2.85	46	58.9	Permanent
HYV Boro	8	32.7	4.1	32	41.1	
Total rice	24	100.0	6.95	77	100.0	

Source: Yearbook of Agricultural Statistics (BBS) and field observation

Figure 101: Agriculture land of the project area

5.6 Fisheries Resources

The Right-of-Way (RoW) of the proposed Transmission Lines; and the area of substation site possesses river, floodplain, pond and other water bodies. These water bodies function as fish habitat seasonally and perennially and support a wide variety of freshwater fish species. A good number of households depend on these habitats by catching fish as fulltime or part-time fishers. Pulling of transmission lines by erection of tower and construction of new substation in low land[13] especially at Kaliakair might have low scale impact on fisheries resources. The contractor will work in such a way that the ecological value can be preserved. There is a provision of compensation if applicable by the project mentioned in RP report.

5.6.1 Fish Habitat Description

Fish habitats have been classified in two categories - i) capture fishery which includes in river and khal, lake, intertidal and floodplain, and ii) culture fishery which have various types of aquaculture pond and seasonal cultured waterbody. The proposed transmission lines crosses over many rivers. The important rivers are the Bongshai and Turag at Kaliakair, Bakkhali River, the Matamuhuri River, the Sangu River at Chattogram region, etc. which have tidal influence and flow of fresh and brackish water.

Turag and Bongshai Rivers carriy polluted water and become severe in dry season. In the rainy season, the intensity of pollution reduces mostly and the abundance of fishes like Boal, Baghair, Ghaura, Baim, Foli, Kakila, Bata, etc. emerges more. Local people reported that main reason of water pollution is

[13] Here low land is the 'Baid' which means depression between the terraces, where rainfall run-off water is deposited. This low land is cultured with fish seasonally.

discharge of untreated industrial effluent and disposal of wastage into the river. The river overtops in rainy season and inundates the adjacent low-lying agriculture land when flood water comes. The low-lying agriculture land identified as floodplain habitat hold water from June-October varying water depths for 3-5 feet in every year. The floodplain habitat functions as fish breeding, nursing and grazing grounds for some small indigenous fish species. The study area comprises of many homestead ponds. Aquaculture practice in these ponds is done by extensive to semi-intensive culture method. Major carp, exotic carp and other fast-growing fish species are cultured in these ponds.

Bakkhali, Matamuhuri and Sangu rivers feed water to the Bay of Bengal and function as fish migration route from river to the Bay of Bengal or vice versa. The study area also has many connecting Khals that function as fish migratory corridors for some indigenous fish species. Most of the Khals are seasonal and get connected with the nearer river in wet season. The intertidal area holds water from June-September in year reported by local people. Water depth varies from 0.5-1.0 meter during high tide and recede water fully for the period of low tide. The area functions as grazing or feeding ground for some fish species such as Guilla (Mystus gulio), Bata (Labeo bata), Baila (Glossogobius giuris), Chiring (Apocryptes bato), Golda (Macrobrachium rosenbergii), Bagda (Penaeus monodon), etc.

The study area has also aquaculture activity in ponds. Most of the ponds are situated with homestead land. Traditional to semi-intensive aquaculture practices are done in these ponds. The culture system depends on pond size, water availability and water quality. Polyculture with Indian major carp, exotic and other fast-growing fish species are practiced in the perennial larger ponds. Usually, the small ponds hold water 36-40 weeks in a year and seasonal aquaculture are practiced by adopting extensive culture method. Different types of fish habitat under the transmission lines and in the substation sites area are shown in Figure 102.

The substation site at BHTC is situated in low-lying area. In rainy season the area hold water at a level of more than 1.0 meter from July-December. Presently, there is no fish culture in this seasonal waterbody.


River Habitat (Turag)


Floodplain Habitat at Kaliakair


Seasonal Cultured Water Body in BHTC Substation


Matamuhuri River at Kaiarbil of Chakaria Upazila


Ali Khali Khal at Nhila of Teknaf Upazila


Seasonal Cultured Water Body in Anwara Substation Site

Figure 102: Different Types of Fish Habitat in the Project areas

Estimated total area of fish habitats for all transmission lines and substation site is about 24.00 hectare (ha) where the transmission lines share the most of 22.26 ha and the rest 1.7 ha is shared by substation sites. For the individual transmission lines, the existing Kaliakair to BHTC 230kV line shares about 50 percent followed by Anwara to Cox's Bazar 230kV, and Cox's Bazar to Teknaf 132kV line. Fish habitat distributions for all transmission lines and substation sites are shown in Table 54.

Table 54:Distribution of Fish Habitat for the Transmission Lines and Substation Sites

Name of Transmission Lines and Substations	Fish Habitat Area (ha)				Sub-total (ha)
	Capture Fishery		Cultured Fishery		
	River & Khal	Floodplain	Pond	Seasonal Cultured Waterbody	
Existing Kaliakair to BHTC 230kV	1.18	4.02	6.00	-	11.2
Anwara to Cox's Bazar 230kV	6.86	-	1.20	-	8.06
Cox's Bazar to Teknaf 132kV	2.00	-	1.00	-	3.00
LILO of Dohazari to Cox's Bazar 132kV	-	-	-	-	-
Sub-total	**10.04**	**4.02**	**8.20**	**-**	**22.26**
Anwara Substation	-	-	-	1.00	1
Cox's Bazar Substation	-	-	-	-	-
Teknaf Substation		-	-	-	-
BHTC Substation	-	-	-	0.7	0.7
Sub-total	**-**	**-**	**-**	**1.7**	**1.7**
Total					**23.96**

Source: IIFC estimation based on GIS imagery, 2019

5.6.2 Fish Production

Total fish production for all transmission lines and substation sites is 11.50 Metric Ton (MT). Among this fish production, the transmission lines contribute the all of it, and presently there is no fish production in the substation site. The loss of production from this waterbody would be very temporary. Contribution of fish production by different habitats is shown in Table 55.

Table 55: Fish Production Assessment by Habitats

Name of Transmission Lines and Substations	Fish Habitat Area (MT)				Sub-total (MT)
	Capture Fishery		Cultured Fishery		
	River & Khal	Floodplain	Pond	Seasonal Cultured Waterbody	
Existing Kaliakair to BHTC 230kV	0.11	1.01	3.75	-	4.87
Anwara to Cox's Bazar 230kV	1.71	-	2.40	-	4.11
Cox's Bazar to Teknaf 132kV	0.52	-	2.00	-	2.52
LILO of Dohazari to Cox's Bazar 132kV	-	-	-	-	-
Sub-total	**2.34**	**1.01**	**8.15**	**-**	**11.50**
Anwara Substation	-	-	-	-	-
Cox's Bazar Substation	-	-	-	-	-
Teknaf Substation		-	-	-	-
BHTC Substation	-	-	-	-	-
Sub-total	**-**	**-**	**-**	**-**	**-**
Total					**11.50**

Source: IIFC estimation based on FRSS[14], 2017 and Field Survey, 2020

5.6.3 Fish Species Diversity

The study area is diversified with brackish and freshwater fish species. Local fishers reported that about 30-40 fish species are caught by different fishing gears around the year. However, the biodiversity of fishes is exhibiting a declining trend over the last 10-15 years. Many factors such as habitat degradation, irrational fishing practice, reduction of water volume, increased sedimentation, violation of fisheries rules and regulation, etc. are the main causes of declining fish species diversity. A checklist of common fish species in the study area habitats reported by local fishers are shown in Table 56.

Table 56: A Checklist of common fish species in the study area habitats and IUCN Status

Scientific Name	English Name	Local Name	Habitats	IUCN status, 2015
Lates calcarifer	Sea Bass	Koral	River, Intertidal area	-
Polynemus paradiseus	Paradise threadfin	Ramchos	River	-
Otolithoides pama	Pama croaker	Poa	River, Khal	LC
Liza parsia	Goldspot mullet	Kharul	River, Khal	LC
Pomadasys argenteus	Yellow Seabream	Datina	River, Khal	-
Mystus gulio	Long-whiskered	Guilla	River, Khal,	NT

[14] FRSS, 2017. Yearbook of Fisheries Statistics of Bangladesh. Fisheries Resources Survey System (FRSS), Department of Fisheries, Bangladesh

Scientific Name	English Name	Local Name	Habitats	IUCN status, 2015
	Catfish		Intertidal area	
Mystus cavasius	Gangetic Mystus	Tengra	River, Khal	NT
Eleutheronema tetradactylum	Fourfinger threadfin	Tailla	River, Khal	-
Glossogobius giuris	Fresh Water Goby	Baila	River, Khal	LC
Apocryptes bato	Goby	Chiring	River, Khal, intertidal area	LC
Puntius chola	Green Barb	Chola Punti	River, Khal	LC
Macrobrachium rosenbergii	Giant River Prawn	Golda	River, Khal, Intertidal area	LC
Penaeus monodon	Giant Tiger Shrimp	Bagda	River, Khal, Intertidal area	LC
Metapenaeus monoceros	Brown Shrimp	Harina	River, Khal, Intertidal area	LC
Nematopalaemon tenuipes	Spider Prawn	Gura Icha	River, Khal	DD
Scylla serrata	Giant Mud Crab	Kakra	River, Intertidal area	LC
Labeo rohita	Ruhu	Rui	Pond	LC
Catla catla	Catla	Katol	Pond	LC
Cirrhinus cirrhosus	Mrigal Carp	Mrigal	Pond	NT
Labeo bata	Bata Labeo	Bata	River, Khal, Pond, Floodplain	LC
Hypophthalmichthys molitrix	Silver Carp	Silver carp	Pond	Exotic Fish
Oreochromis mossambicus	Tilapia	Tilapia	Pond	Exotic Fish
Pangasiushy pophthalmus	Sutchi Catfish	Pangas	Pond	Exotic Fish
Hypophthalmichthys molitrix	Silver Carp	Silver Carp	Pond	Exotic Fish
Macrobrachium rude	Hairy River Prawn	Icha	Floodplain	LC
Amblypharyngo donmicrolepis	Indian Carplet	Mola	Floodplain	LC
Trichogaster labiosus	Thick-lipped Gourami	Khoilsha	Floodplain	LC
Anabas testudineus	Climbing Perch	Koi	Floodplain	LC
Channapunctata	Spotted Snakehead	Taki	Floodplain	LC
Channastriatas	Snakehead Murrel	Shol	Floodplain	LC
Pethiaconchonius	Red Barb	Kanchan Punti	River, Floodplain	LC
Nandusnandus	Mottled Nandus	Meni	Floodplain	NT
Puntius chola	Chola Barb	CholaPunti	River, Floodplain	LC

Note: IUCN status (NT-Near threatened, LC-Least concern, DD - Data deficient)
Sources: IUCN Bangladesh, 2015.

5.7 Ecological Environment

The proposed power transmission line (182.26-km) and substation sites (4 nos.) are traverse over different landforms as well as different ecosystems such as agricultural land, settlements, saltpans, forest, hillocks, floodplains, canals, rivers, etc.

5.7.1 Ecological Survey

A rapid ecological baseline survey was undertaken in the study area to evaluate the ecological status of the area and to identify species of concern as per Red Data Book. The assessment was carried out by IIFC from July to September 2020.

This baseline ecological assessment was conducted within and outside areas of Project site:

i. to enlist the faunal species with their national and/or international status,
ii. to enlist the floral species with their national and/or international status,
iii. to enlist keystone, rare & threatened floral and faunal species,
iv. to investigate the distribution & abundance of floral and faunal species, etc.

Generally, floral and faunal species diversity fluctuates seasonally due to the environmental reasons. Seasonal survey, spanning over a year, could provide detailed information on the existing ecological aspects of Project site and adjacent areas.

However, an ecological field survey team visited the Project site and adjacent areas to collect first-hand data on the existing floral and faunal species. The assessment was conducted primarily at daytime but continued to nighttime to some extent. Aural and visual search was the main survey method for ornithological study. Herpeto-faunal and mammalian study was done through visual search and also through discussion with local people and literature review. Information on fish and fisheries was collected through field study, interviewing local aged people as well as local fish market survey.

Rapid field survey and discussion with local people was the main method for floral survey. Crustacean and Molluscan diversity was assessed through checking of stock of fish & invertebrate in the boat, direct field observation within / beside the waterbodies as well as local fish market survey. Therefore, informal interviews with local people were also conducted as a part of this baseline study to learn about seasonal ecological aspects of Project site and adjacent areas. The collected data was thereafter cross-checked through literature review.

5.7.2 Bio-ecological Zone

IUCN, the World conservation Union, Bangladesh has divided the whole country into 25 Bio-ecological Zones in context of biological diversity, physical geography and other parameters. The proposed lines and substation locations fall inside two of these Bio-ecological zones. In which, major portion of the transmission line fall over the zone namely Chattogram Hills and the CHTs (95%) and lest of the part falls within the Coastal Plains and Ganges Floodplain (5%) which are presented below in Table 57.

Table 57: Bio-ecological Zones of the study area

Name of Transmission Line	Length (Km)	Bio-ecological Zone	DIA (ha)	GIA (ha)	Total area (ha)	Major Ecological Features
Cox's Bazar to Teknaf 132kV	73.10	Chattogram Hills and the CHTs	73.10	146.2	219.3	Forest, Hillocks, Agriculture land, River, Canal, Homesteads, Road, Saltpans
LILO of Dohazari to Cox's Bazar 132kV	1.09	Chattogram Hills and the CHTs	1.09	2.18	3.27	Agriculture land, Road, Pond, Homesteads
Anwara to Cox's Bazar 230kV	105	Chattogram Hills and the CHTs and Coastal Plains	210	420	630	Forest, Hillocks, Agriculture land, Homesteads, Road, Canal, River, Pond, Saltpans; Numerous local and migratory birds are observed during the winter and dry season
Existing Kaliakair to BHTC 230kV	4.88	Ganges Floodplain	9.76	14.64	24.4	large number of migratory birds are found here during the winter. Other water bodies, free-floating aquatic vegetation is prominent
Total	**184.07**		**293.95**	**583.02**	**876.97**	

Source: NWRD, 2011 and IIFC Field Survey, 2020
Note: DIA= Direct Impacted Area, GIA= General Impacted Area

The Project will require removal of trees of various sizes and species. Tree inventory survey found varieties of trees on both private and Government land. Different species of trees are divided into three categories by height viz., big (> 10 m height), medium (5-10 m height) and small (< 5 m height). A total of 26798 trees including 11 trees in substation area, on private and Govt. land will be affected due to project implementation and among them 23678 are big and medium (including 2 small trees in sub-station area) and the rest 3120 trees are small which will not be required to cut due to project implementation as per Electricity act, 2018 and no compensation will be considered for small trees. The highest number of trees will have to cut are be affected are timber (20546) followed by fruit (2889), bamboo (207) and medicinal (34). The table below shows the aggregated number of trees found on both Government and private land.

Table 58: Total number of affected trees by type and number

Categories of Trees	Substations		Transmission Lines		Total	
	< 5 m height	> 5 m height	< 5 m height	> 5 m height	< 5 m height	> 5 m height
Fruit	2	5	311	2884	313	2889
Timber	0	4	2743	20542	2743	20546
Medicinal	0	0	66	34	66	34
Bamboo	0	0	0	207	0	207
Total	**2**	**9**	**3120**	**23667**	**3122**	**23676**

Source: *Tree Inventory Survey, July-September 2020*

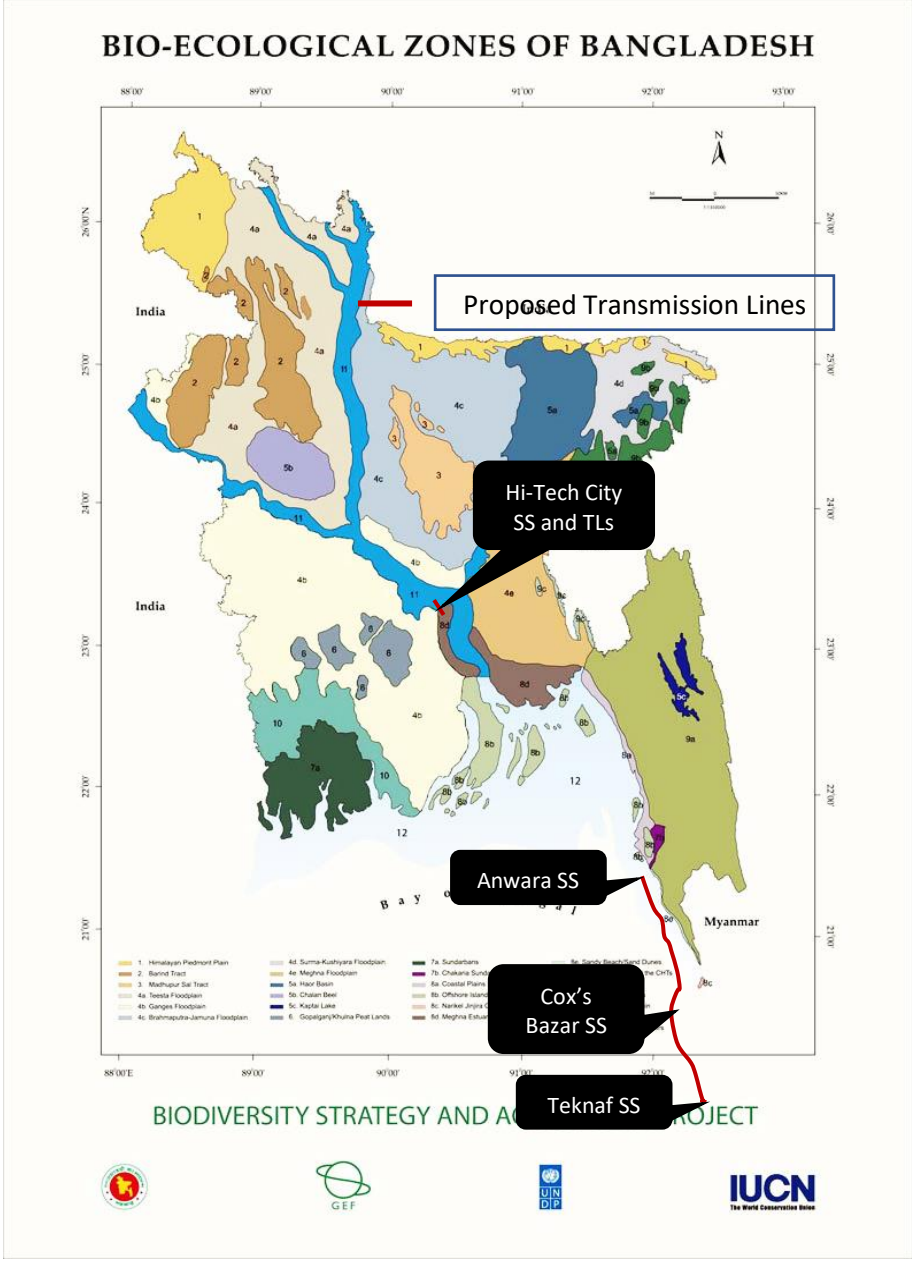


Figure 103: Bio-ecological zones in the study area (Kaliakair, Anwara, Teknaf & Cox's Bazar substations with transmission lines)

5.7.3 Ecosystem Diversity

Right-of-Way (RoW) of the proposed transmission lines predominantly comprises of paddy field/floodplains, saltpan, homesteads, forests, rivers, canals in order of significance. Table 59 shows crossing on transmission lines with their ecological diversity and area is presented below:

Table 59 : Ecological diversity with their area and percentage within the transmission lines

Ecological diversity	DIA (ha)	GIA (ha)	Total (ha)	Percentage (%)
Forest area (Hill forest, Bushy land, Cultivated forest)	17.70	28.22	45.92	5.90
Crop field with saltpans	263.01	425.21	688.22	88.44
Water bodies (Rivers, Canals, Ponds)	4.93	7.63	12.56	1.62
Rural Settlements	1.29	2.68	3.97	0.51
Freshwater Aquaculture	1.61	2.41	4.02	0.51
Others (various built-up areas)	9.43	14.08	23.51	3.02
Total	**297.97**	**480.23**	**778.20**	**100**

Source: NWRD, 2011 and ESIA field Survey, 2020, Note: DIA= Direct Impacted Area, GIA= General Impacted Area

Overall ecosystems diversity of the study area can be described as follows:

Crop field with saltpans: This land is usually used for paddy cultivation once/twice/thrice in a year and inundated during monsoon. Some of the areas are mostly used for saltpans specially Cox's Bazar and Teknaf area. Crop field ecosystem consist least diversity of floral communities and provide wide area of grazing and feeding habitats for numerous local birds, indigenous fishes and small mammals.

Settlements/Homesteads: This ecosystem comprise of mostly cultivated economic tall plants with undergrowth wild flora. As homesteads are located comparatively in higher elevation than other landforms except hills area, so settlement/homesteads ground possesses mainly terrestrial ecological components.

Hillocks with forest: A part of CHT hills falls inside the study area which is covered with tropical evergreen and semi-evergreen forest (Figure 104). The hilly terrain of Chattogram and Cox's Bazar is exceedingly irregular with a series of ridge and valleys in all direction. The predominant species of the upper story are Garjan (Dipterocarpus spp), Sal (Shorea robusta), Chapalish (Artocarpus chaplasha), Segun (Tectona grandis), Akasmoni (Acacia auriculiformis), Telsur (Hopea odorata), etc. In the lower story, important species like the Pitraj (Aphana mixispolystachys), Toon (Toona ciliata), Nageshwar (Mesua ferrea), Uriam (Mangifera sylvetica) and various Ficus species can be found. Land of this portion is characterized by seasonal flash flood and having rich faunal and floral diversity. Some portions of Anwara to Cox's Bazar 230kV, and Cox's Bazar to Teknaf 132kV transmission lines are crossing on hilly areas (mainly low hills). Name of forest ranges, their locations and ecological scenarios are presented in Table 60.

Table 60: Forest Range with their Location, Range Name and Ecological Scenario

SN	Transmission Line Crossing through Range	Forest Range name	Baseline status	Ecological scenario
Anwara to Cox's Bazar 230 kV Transmission Line				
1.	Eastern border Line	P.M. Khali Range	Crop field, Canal, Pond	Localized areas, No important wildlife habitat
2.	Western border Line	Fashiakhali Range	Crop field, Canal, Seasonal wetlands	Localized areas, No important wildlife habitat
Cox's Bazar to Teknaf 132 kV Transmission Line				
3.	Middle portion of the Range	Panerchara Range	Hillocks, Crop field, cultivated forest, Mixed hill forest	Mainly crossing on forest corridor, Exotic tree plantation (Akashmoni) on the hillock's areas
4.	Middle portion of the Range	Rajarkul Range	Hillocks, Crop field, cultivated forest, Mixed hill forest	Mainly crossing on crop field as well as forest corridor areas, Canopy coverage are high
5.	Northern- Eastern border Line	Inani Range	Crop field	Mainly crossing crop field along the village ridge areas, Canopy coverage are low
6.	Northern- Eastern border Line	Ukhia Range	Crop field, Forest corridor	No important wildlife habitat, Deforestation of Kutapalong areas due to newly formation of Rohingya Refugee Camp
7.	Eastern border Line	Whykheong Range	Crop field, Forest corridor, Hillocks	Mainly crossing on crop field, cultivated forest along the hill tops,
8.	Eastern border Line	Teknaf Range	Crop field, Plain land Forest	Mainly crossing on crop field

Source: SPOT satellite Image, ESIA Field Survey, 2020, Meeting with Forest Officers

Rivers, Canals and ponds: Canals and rivers are primary sources of water in all ecological components both terrestrial and aquatic. Matamuhuri, Sangu, Bakkhali, Bongshai and Turag, etc. are major flashy river of the study area which hold water whole of the year. Numerous canals (e.g., Tonkaboti, Joaria, Dharukhali, Dulhazara, Whykong, Maricha, Katakhali, Ali Khali, Reju Khal, etc.) have crossed the proposed transmission line which retain water for a part of the year and support scattered hydrophytes. Ponds and ditches are the close water wetlands distributed along the holistic study area provides water for both domestic needs and irrigation purposes. Water level fluctuation is high in this type of wetland due to seasonal variation, and this contributes to survive numerous water dependent animals.

Roadside vegetations: Roadside vegetations are generally planted and the vegetation develop an ecosystem which is dominated by hard wood tree species. Major species are found along the roadside of study area are Rendi Koroi (Albizia lebbeck), Sisso (Dalbergia sissoo), Babla (Acacia nilotica), Mahagoni (Swietenia mahagoni), Akashmoni (Acacia auriculiformis), Simul (Bombax ceiba), Khejur (Phoenix sylvestris) and SadaKoroi (Albizia procera), Nona Jhau (Casuarina equisetifolia) trees etc. Remarkable number of Akasmoni is found all over the study area which are selected for commercial

plantation program. In most cases, this plantation program is considered under public-private partnership afforestation. Eucalyptus, Akasmoni, Sirish, Mahagony and Bamboo are the main danger trees along the RoW of the proposed transmission lines which has maximum canopy height of 25m. No such mangrove species found in the study area.

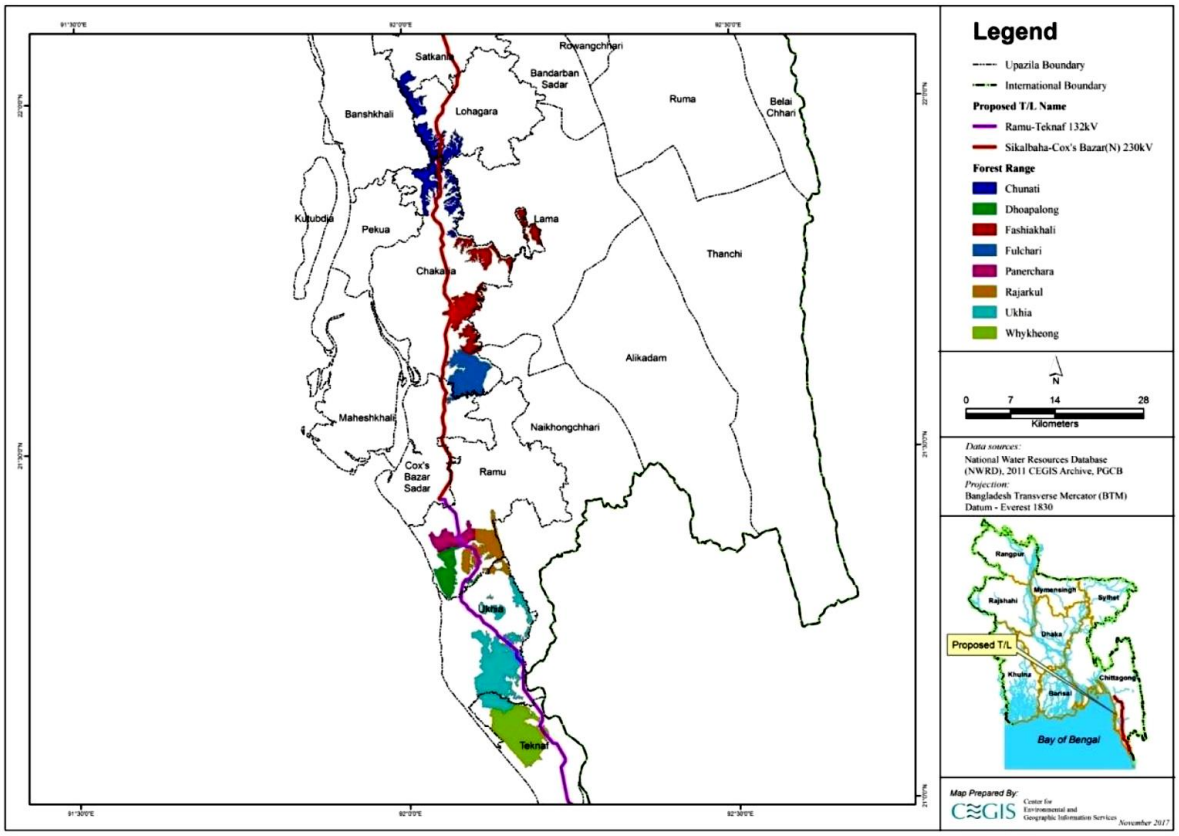


Figure 104: Forest Range map with crossing on proposed Transmission Line

Cultivated forest ecosystem at Chunati WS

Reju Khal at the crossing point of proposed transmission at Sonarpara

Figure 105: Major ecosystems adjacent to the study area

5.8 Biodiversity

Flora

Terrestrial Flora

The study area contains well floral diversity due to having different ecosystems. Upper canopy of homesteads is dominated with Rendi Sirish (Albizia saman), Sada Koroi (Albizia procera), Mahagoni (Swietenia mahagoni), etc. Kola (Musa spp), Khejur (Phoenix sylvestris), Aam (Mangifera indica), etc. are planted most of the homestead for meeting fruit demand. Remarkable number of bushy jungles are found all over the study area. Among the commercial plantations, Akashmoni (Acacia auriculiformis), Minjium (Acacia mangium) is exclusively dominated in homesteads, village roadsides and hillock foot. Garjan, Akasmoni, Chapalish, Sirish are the main danger trees along the RoW of the proposed transmission lines. Table 61 provides a major danger tree with their average height, usage and density which have been existed at the RoW of the proposed Transmission lines.

Table 61: Major trees (According to dominance along the RoW of the proposed transmission lines in the project area

Tree species	English name	Family	Usage	Average Height (Meter)	Density	IUCN Status
Mahagoni (Swietenia mahagoni)	Mahagany	Meliaceae	Timber and medicine	12-15	M	LC
Pitraj (Aphanamixis polystachys)	Pitraj tree	Meliaceae	Timber, Oil and medicine	12-15	M	LC
Simul (Bombax ceiba)	Cotton tree	Bombacaceae	Cotton and fuel wood	15-20	L	LC
Narikel (Cocos nucifera)	Coconut	Arecaceae	Fruit and fuel wood	15-20	M	LC
Udal (Sterculia villosa)	Elephant Rope tree	Sterculiaceae	Timber and fuel wood	15-20	L	LC
Bansh (Bamboosasp)	Bamboo	Poaceae	Thatching	15-20	H	LC
Sal (Shorearobusta)	Sal	Dipterocarpaceae	Timber	15-20	M	LC
Chapalish (Artocarpus chaplasha)	Chaplash	Moraceae	Timber and fuel wood	20-25	L	LC
Rendi Sirish (Albizia saman)	Monkey pod	Fabaceae	Timber and fuel wood	25-30	H	LC
SadaKoroi (Albizia procera)	White siris/ Brown albizia	Fabaceae	Timber and fuel wood	25-30	H	LC
Telshur (Hopea odorata)	Iron Wood	Dipterocarpaceae	Timber and medicine	25-30	L	LC
Segun (Tectona grandis)	Teak Wood tree	Lamiaceae	Timber and fuel wood	25-30	M	LC

Tree species	English name	Family	Usage	Average Height (Meter)	Density	IUCN Status
Garjan (Dipterocarpus sp.)	Keruing	Dipterocarpaceae	Timber and medicine	25-30	M	LC
Gagon Siris (Albiziarichardiana)	Silk trees	Fabaceae	Timber	30-35	M	LC
Eucalyptus (Eucalyptussp.)	Gum trees	Myrtaceae	Timber and fuel wood	30-35	H	LC
Bansh (Bamboosasp)	Bamboo	Poaceae	Thatching	20-25	H	LC
Khair (Senegalia catechu)	Black catechu	Fabaceae	Food, Timber and Fuel	15-20	M	LC

Source: ESIA Field Survey, 2020; Note: H = High M = Medium L = Low; IUCN status: LC=Least Concerns

Akashmoni plantation along hill foots at Ramu

Mixed plantation in Chunati WS

Figure 106: Afforestation program in the study area

Among the species level, Fabaceae, Myrtaceae and Poaceae occupied the highest number of tree species. Other common floral families of the study area are Bombacaceae, Anacardiaceae, Mimosaceae, Moraceae, Rubiaceae, Arecaceae, Dipterocarpaceae etc.

Aquatic Flora

Major floral diversity of aquatic ecosystems is concentrated at seasonal floodplains and ditches inside agricultural lands. Among the free-floating species, water hyacinth (Kochuripana), Water cabbage (Topapana) and Duckweed (Khudipana) are common inside rivers, canals, ponds and ditches. Shapla (Nymphaea spp.) and Chandmala (Nymphoidessp) grown in floodplains during monsoon are the common rooted floating plant. Hydrillaversillata, Hygrorhizaaristata, Ludwigiaare frequently followed submerge plants whereas Enhydrafluctuansis marginal species. Proposed substations and the RoW of proposed transmission lines mainly fall within the terrestrial ecosystems. Hence, aquatic flora is not such important for this study.

Fauna

Terrestrial Fauna

Mammals

Bigger mammals are found in Chattogram and Cox's Bazar hilly areas. Mammal's species are fewer in number or disappeared from the study area with the disappearance of forest patches or change in plant species composition. Small mammals such as fishing cat (Falisviverrina), Jungle cat (Falischaus), Bengal fox (Vulpes bengalensis). Golden Jackal *(Canis aureus),* Bengal Fox *(Vulpes bengalensis)* and Indian Gray Mongoose *(Herpestes edwardsii)* were seen in the study area. Common mongoose (Herpestesedwardsi) and bats are major species. Jungle Cat *(Felis chaus)* was reported to be seen by locals during field consultations in agricultural and homestead plantation areas. None of the species are reported to be listed in RED category of IUCN 2015 V2. However, Indian Gray Mongoose *(Herpestes edwardsii),* and Asian House Shrew *(Suncus murinus)* are reported to be listed in Bangladesh Wildlife Prevention Order, 1973 as Schedule-III which protects them from hunting, killing and capturing. The common lizards found within the study include the common skink (Mabuya carinata) and the garden lizard (Calotes versicolor). The population of snakes is not very rich as they have little shelter in this vast open landscape.

Table 62: Distribution of mammals found in the study area

SN	Local Name	Common Name	Scientific Name	Family	IUCN Status
1.	Khet-indur	Lesser Bandicoot Rat	Bandicota bengalensis	Muridae	LC
2.	Dhari Indur	Large Bandicoot Rat	Bandicota indica	Muridae	LC
3.	Nengti Indur	House Mouse	Mus musculus	Muridae	LC
4.	Chucho	House Shrew	Suncus murinus	Soricidae	LC
5.	Chamchika	Indian Pipistrelle	Pipistrellus coromandra	Vespertilionidae	LC
6.	Boro Beji	Common Mongoose	Herpestes edwardsii	Herpestidae	LC
7.	Khek Shial	Bengal Fox	Vulpes bengalensis	Canidae	VU
8.	Ban Biral	Jungle Cat	Felis chaus	Felidae	NT
9.	Pati Shial	Golden Jackal	Canis aureus	Canidae	LC

Data source: Study team using IUCN classification System
IUCN Status Code: EN - Endangered, VU - Vulnerable, LC - Least Concern, NT-Near Threatened

Avifuna

Birds are prevalent major terrestrial faunal groups of this area considering highest population and diversity due to having wide area of crop field and settlement vegetation and nearer existence of hilly area. Birds of prey like kites, eagles, etc. are found near open area of crop fields /floodplains. Red Vented Bulbul *(Pycnonotus cafer),* Black Drongo *(Dicrurus macrocercus),* Oriental Magpie Robin *(Copsychus saularis),* Spotted Dove *(Streptopelia chinensis),* Black Kite *(Milvus migrans),* Large Billed Crow *(Corvus macrorhynchos),* Rufous Treepie *(Dendrocitta vagabunda),* Indian Roller *(Coracias benghalensis),* Common Hoopee *(Upupa epops),* Black Rumped Flameback *(Dinopium benghalense),* White Throated Kingfisher *(Halcyon smyrnensis),* Pied Kingfisher *(Ceryle rudis),* Fulvus breasted Woodpecker *(Dendrocopos macei),* Shikra *(Accipiter badius),* White Wagtail *(Motacilla flava),* Red Wattled Lapwing *(Vanellus indicus),* Asian Koel *(Eudynamys scolopacea),* Rock Pigeon *(Columbam livia),* Common Myna *(Acridotheres tristis),* Jungle Myna *(Acridotheres grandis)* and Green Bee eater *(Merops orientalis)* are reported to be listed in Bangladesh Wildlife Prevention Order,1973 as Schedule-III which protects them from hunting, killing and capture.

The proposed Project areas have many harbors species such as Red vented bulbul, Red Watted Lapwing, Black Kite, Black Drongo, Rock Pigeon, Long–tailed Shrike and Common Myna. These species are common in the area and sufficient habitats are available within area once the construction and operation activities are commenced. None of the species were listed as threatened as per IUCN classification.

Table 63: Distribution of Birds in the Study Area

SN	Local name	Common name	Scientific name	Family	IUCN status
1.	Bangla Kaththokra	Lesser Goldenback	*Dinopium benghalense*	Alcedinidae	LC
2.	Shobuj Tia	Rose-ringed Parakeet	*Psittacula krameri*	Psittacidae	LC
3.	Halde Pakhi	Black-hooded Oriole	*Oriolus xanthornus*	Oriolidae	LC
4.	Kala Fingey	Black Drongo	*Dicrurus macrocercus*	Dicruridae	LC
5.	Pati Kak	House Crow	*Corvus splendens*	Corvidae	LC
6.	Dar Kak	Jungle Crow	*Corvus levaillanti*	Corvidae	LC
7.	Bangla Bulbul	Red-vented Bulbu	*Pycnonotus cafe*	Pycnonotidae	LC
8.	Pati Tuntuni	Common Tailorbird	*Orthotomus sutorius*	Sylviidae	LC
9.	Dhani Futki	Paddyfeld Warbler	*Acrocephalus agricola*	Sylviidae	LC
10.	Gobrey Shalik	Pied Myna	*Sturnus contra*	Sturnidae	LC
11.	Jhuti Shalik	Jungle Myna	*Acridotheres fuscus*	Sturnidae	LC
12.	Bhat Shalik	Common Myna	*Acridotheres tristis*	Sturnidae	LC
13.	Doel	Oriental Magpie Robin	*Copsychus saularis*	Muscicapidae	LC
14.	Chorui	House Sparrow	*Passer domesticus*	Passeridae	LC
15.	Gecho Chorui	Tree Sparrow	*Passer montanus*	Passeridae	LC
16.	Dhani Tulika	Paddyfeld Pipit	*Anthus rufulus*	Motacillidae	LC
17.	Tila Ghughu	Eastern Spotted Dove	*Spilopelia chinensis*	Columbidae	LC
18.	Nilmatha Hash	Mallard	*Anas platyrhynchos*	Anatidae	LC
19.	Metey Rajhash,	Greylag goose	*Anser anser*	Anatidae	NT
20.	Himaloee Kaththokra	Himalayan Flameback	*Dinopium shorii*	Picidae	DD
21.	Bada Satarey	Marsh Babble	*Pellorneum palustre*	Timaliidae	DD
22.	Holdebook Chotok	Yellow breasted Bunting	*Emberiza aureola*	Emberizidae	VU
23.	Dhub Boga	Little Egret	*Egretta garzetta*	Ardeidae	LC
24.	Boro Pankouri	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	LC
25.	Desi Pankouri	Indian Cormoran	*Phalacrocorax fuscicollis*	Ardeidae	LC
26.	Chhoto pankouri	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	LC

SN	Local name	Common name	Scientific name	Family	IUCN status
27.	Lal pa Dhenga	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	LC
28.	Proshanto Sonajiria	Pacifc Golden Plover	*Pluvialis fulva*	Charadriidae	LC
29.	Utturey Titi	Northern Lapwing	*Vanellus vanellus*	Charadriidae	LC
30.	Pati Batan	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	LC
31.	Bon Batan	Wood Sandpiper	*Tringa glareola*	Scolopacidae	LC
32.	Khoiramatha Gangchil	Brown-headed Gull	*Larus brunnicephalus*	Laridae	LC
33.	Choto Panchi	Little Tern	*Sterna albifrons*	Laridae	LC
34.	Katua Chil	Black-winged Kite	*Elanus caeruleus*	Accipitridae	LC
35.	Teela Eagle	Crested Serpent Eagle	*Spilornis cheela*	Accipitridae	LC
36.	Pati Shikre	Shikra	*Accipiter badius*	Accipitridae	LC
37.	Bhubon Chil	Black Kite	*Milvus migrans*	Accipitridae	LC
38.	Shobuj Shuichora	Green Bee-eater	*Merops orientalis*	Meropidae	LC
39.	Nilkan Machranga	Blue-eared Kingfsher	*Alcedo meninting*	Alcedinidae	LC
40.	Chhoto Maachranga	Common Kingfsher	*Alcedo atthis*	Alcedinidae	LC
41.	Lal Machranga	Ruddy Kingfshe	*Halcyon coromanda*	Alcedinidae	LC
42.	Meghou Machranga	Stork-billed Kingfsher	*Pelargopsis capensis*	Halcyonida	LC
43.	Dholagola Maachranga	White-throated Kingfsher	*Halcyon smyrnensis*	Halcyonidae	LC

Migratory Birds: In Gazipur, a large number of migratory birds are found here during the winter. In the beels and other water bodies, free-floating aquatic vegetation is prominent. Migratory birds are observed during the winter season. This floodplain (Ganges Floodplain) is characterized, mainly, by mixed vegetation.

A study of the birds of the Karnaphuli River Delta and adjacent areas in Chattogram, Bangladesh, was carried out by direct field observations between July 1999 and June 2000. Status and distribution of the birds were assessed, habitats and some other aspects were also studied. A total of 141 species of birds belonging to 12 orders, 41 families and 98 genera were recorded. Out of 141 species of birds 61 species (43%) were passerines of which 45 (74%) were resident and 16 (26%) were migratory. Among the 80 non-passerine species, 59 (74%) were resident and 21 (26%) were migratory[15].

15 https://www.researchgate.net/publication/237219466_Birds_of_the_Karnaphuli_River_Delta_and_adjacent_areas_in_Chittagong_Bangladesh

A comparative study of birds in Teknaf Wildlife Sanctuary (TWS), Inani Reserve Forest (IRF) and the Chittagong University Campus (CUC) in 2015. A total of 249 species belonging to 50 families were recorded: 210 species from 46 families in TWS, 187 species from 45 families in IRF, and 182 species from 45 families in CUC. Of these, 181 species (73%) were resident, 57 (23%) winter visitors, three (1.20%) summer visitors, two (0.80%) passage migrants and five (2%) vagrants. According to their frequency of occurrence, 73 species (29.32%) were very common, 66 (26.5%) common, 62 (25%) uncommon and 48 (19%) rare. 120 species (48%) were passerines (97 in TWS, 95 in IRF and 97 in CUC) and 129 (52%) non-passerines (113 in TWS, 92 in IRF and 85 in CUC). Among the three areas, TWS had the greatest diversity in terms of total species, (210>187>182), residents (161>148>134), non-residents (49>48>39), forest indicator birds (47>44>31) and wading birds (48>34>24)[16].

Another study carried out on migratory shorebird phenology at Sonadia Island, Cox's Bazar, Bangladesh between Oct 2009 and Mar 2010. An aggregate total of 12,710 shorebirds of 28 species were recorded in Oct 2009, Jan 2010 and Mar 2010 at seven sites on or close to Sonadia Island. Maximum numbers of shorebirds and of shorebird species were counted during northward migration in Mar 2010 (6,714 individuals of 26 species). In Oct 2009, the most abundant species were Lesser Sandplover Charadrius mongolus (22.5% of the total count), Curlew Sandpiper Calidris ferruginea (20.3%) and Greater Sandplover Charadrius leschenaultia (16%); in Jan 2010, Lesser Sandplover (36.2%), Great Knot Calidris tenuirostris (18.6%) and Greater Sandplover (19.0%); and in Mar 2010, Lesser Sandplover (11.0%), Greater Sandplover (9.4%) and Curlew Sandpiper (7.8%). However, in October and March the percentage of probably both sandplover species would have been greater because of the considerable numbers of unidentified sandplover species that were recorded. Two globally endangered species were recorded with maximum numbers of both in March 2010: 25 Spoonbilled Sandpipers (5-7% of the estimated world population of 350-500), and 28 Nordmann's Greenshanks (3-6% of the estimated world population of 500-1,000). In the same month there were peak counts of 433 Great Knots, 70 Black-tailed Godwits and 120 Eurasian Curlews which are all categorized as threatened or vulnerable by Bird Life International[17].

Aquatic Fauna

Among the all-aquatic faunal groups, fishes hold the top number of higher vertebrates. Seasonal floodplains support wide breeding and grazing habitat of indigenous fishes. Common amphibian species found in this area are Common Toad, Skipper Frog, Cricket frog and Indian bull frog. Snakes like Checkered Keel back and Smooth water snake exist in most types of wetlands. Turtles are quite rare all over the area. However, Spotted Flap shell and Indian Roofed turtles live in undisturbed wetlands and inter tidal areas. Water dependent birds are roaming along the riversides, floodplains, wetlands etc. Little cormorant, Indian pond heron, common kingfisher is referable among this type.

5.8.1 Substation wise Ecological Information

Local biodiversity and their species density and population vary in different parts of this study area according to land elevations and land use. There are proposed four substations are formed in different locations within the study area. It was found that all four substations experience flooding

[16] http://www.threatenedtaxa.org/index.php/JoTT/article/view/2942/4025

[17] https://www.researchgate.net/publication/265216605_Seasonal_occurrence_and_site_use_by_shorebirds_at_Sonadia_Island_Cox's_Bazar_Bangladesh

annually and need to plinth the area considering the historical highest flood level (HFL). Brief of proposed area with their ecological scenario are presented below:

Table 64: Sub-station wise ecological scenario

Name of Substation	Ecological scenario
Teknaf Substation BEZ: Chattogram Hills and the CHTs	The proposed substation site is used for crop cultivation i.e., paddy and is situated near the Teknaf- Cox's Bazar Regional Road. No trees are found in this site during field visit. The undergrowth vegetation of this proposed substation site is Cynodon, Croton, Cyperus, Nicotiana, etc. Alikhali Khal is located in north -western part at the SS Site which is connecting by Naf River. This area is being flooded by rainwater during monsoon. In this time aquatic diversity are enriched with free floating and submerged plants. Water hyacinth (Kochuripana), Water cabbage (Topapana) and Duckweed (Khudipana) are common free-floating community during monsoon period. Hargoza (Acanthus illicifolius) is a common plant.
Cox's Bazar Substation BEZ: Chattogram Hills and the CHTs	The proposed location is medium high land, which is used for crop cultivation i.e., paddy. No trees and shrubs are found in this proposed site. Crop field ecosystem exhibit least diversity of floral communities and provide wide area of grazing and feeding habitats for numerous indigenous Insects, little mammals and birds. This area is being flooded by rainwater during monsoon. In this time aquatic diversity is enriched with free floating and submerged plants and persists as long as water is present. Water hyacinths (Kochuripana), Water cabbage (Topapana) and Duckweed (Khudipana), Azola, Salvania etc. are common free-floating community during monsoon period. PM Khali Khalis located in northern-eastern part at the project area and is connected by Bakkhali River. The avifauna found during the field investigation is: the Asiatic Pied Starling (Sturnus contra), Common Myna (Acridotherestristis), Spotted Dove (Spilopeliachinensis), Baya Weaver (Ploceusphilippinus), Red-vented Bulbul (Pycnonotuscafer) etc.
Anwara Substation BEZ: Chattogram Hills and the CHTs and Coastal Plains	The proposed land is purely an agricultural land for cultivation of vegetables and other crop varieties. The periphery of this land is covered by bushy herbs and shrubs. Of the fauna, Black Drongo, Asian Pied Starling, and Red-vented Bulbul were noticed during the major field investigation. Water hyacinths (Kochuripana), Water cabbage (Topapana) and Duckweed (Khudipana), Azola, Salvania, etc. are common free-floating community during monsoon period.
BHTC Substation BEZ: Ganges Floodplain	This area is enriched with high floral diversity of herb, shrub and climber species. The undergrowth vegetation of this proposed substation is cynodon, cyperus, kanaibashi, lantana, dutura, hatisur, silver fern, lycopodium, bhant, banjal, talachucha, asamlata, bontamak, Dutura etc. The animals found during the field investigation are the Asiatic Pied Starling (Sturnus contra), Common Myna (Acridotherestristis), Spotted Dove (Spilopeliachinensis), Red-vented Bulbul (Pycnonotuscafer), etc. A big portion of the project area is flooded in every monsoon and becomes seasonal wetlands. These seasonal wetlands are mostly used for culture fisheries in the monsoon but are converted into most paddy fields in the dry

Name of Substation	Ecological scenario
	season. Fresh Water Aquaculture patterns is discussed in the fisheries section of this report.

5.8.2 Existence of Important Habitat

No ecologically sensitive and/or important habitat exists within the location of the proposed substation sites. Some portions of the proposed transmission lines (Anwara to Cox's Bazar 230kV, and Cox's Bazar to Teknaf 132kV) passes over the hilly areas. Hills of this region contains unique characteristics of ecosystem that is in degraded trend due to various human activities. The proposed Anwara to Cox's Bazar 230kV overhead transmission line bypasses the Chunati Wildlife Sanctuary under Chunati Range of Harbang beat. This sanctuary is also the habitat of Asian Elephant consists of many corridors and routes. The existing Dohazari to Cox's Bazar 132kV transmission line also crossed over this sanctuary. No bird collision due to this, yet has been observed by the Forest Department and no complain has not been found by PGCB. However, no designated important Bird area (IBA) is existed along the RoW of the proposed Transmission Line, but Teknaf Game Reserve/Teknaf WS is close to the TL; and no Ecological Critical Area (ECA) is existed along the RoW of the proposed Transmission Line and the location of the proposed substation sites.

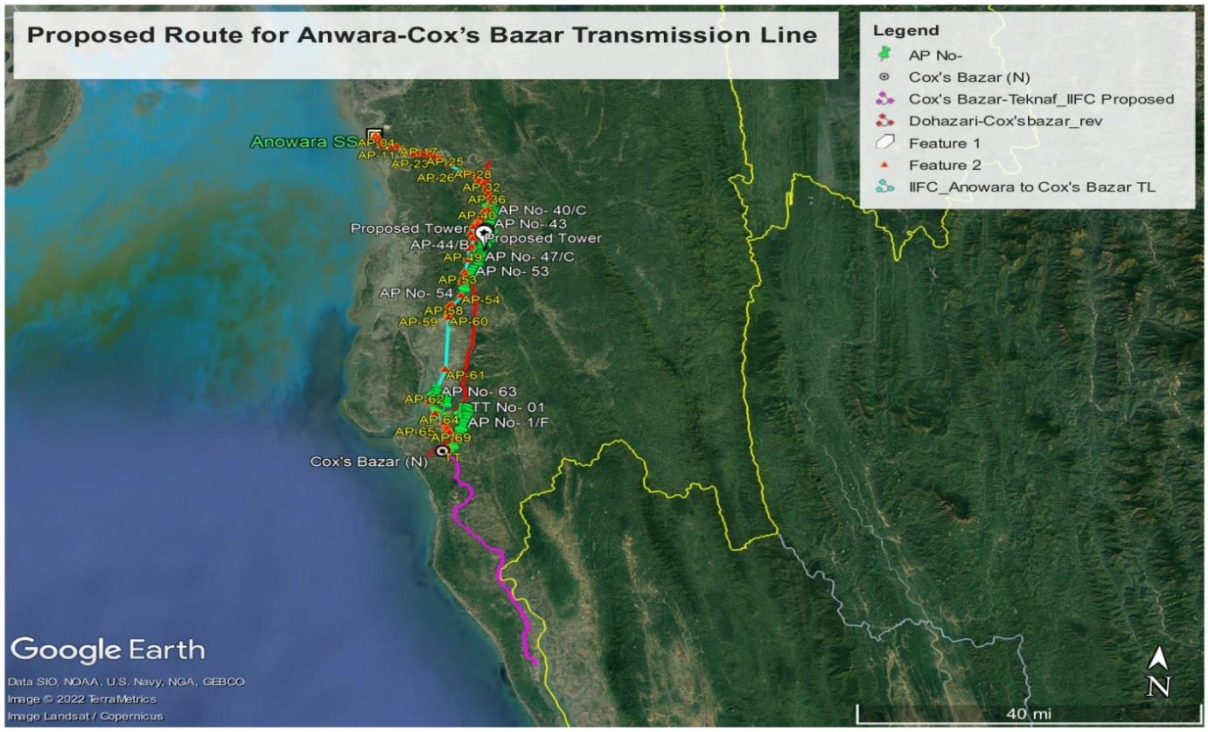
5.8.3 Critical Habitat Assessment

Critical habitat assessment is an important process to determine the essential habitat areas for endangered or threatened species. It involves evaluating the physical, biological & ecological features of an area to determine its importance to the survival and recovery of the species. The assessment considers factors such as food, water, shelter and breeding requirements of the species, as well as any potential threats to its habitat. This information is then used to identify and protect the critical habitat areas that are necessary for the conservation of the species.

The Critical Habitat Assessment process comprises several steps such as initial screening, baseline establishment & critical habitat determination. During initial screening stage we have made stakeholder consultation and literature review such as red data books of plants & animals, IUCN red list of threatened species etc. In baseline establishment part, we have collected some field data and verified some of available information. In critical habitat determination steps, ecologically appropriate area of analysis is determined & critical habitat criteria are assessed.

The proposed Anwara-Cox's Bazar230 kV Transmission Line will not pass through any sanctuaries, reserve forests or national parks. The transmission line will mostly traverse agricultural land. No critical/threatened species have been recorded during this assessment and there have been no concerns raised regarding the presence of critical habitat.

No critical habitat has been found during the assessment and further study will be conducted by the biodiversity consultant of the project during implementation stage. The biodiversity consultant will check and assess any issue related to critical habitat and conduct associated study during implementation stage of the project and submit reports with proper mitigation plans accordingly.



5.8.4 Socio-economic Baseline

Socio-economic condition refers to social and economic factors accruing to an individual or group and is mainly measured by income, education, occupation, and many other variables. Census was conducted for all affected households for TLs, and SSs. The enumerators visited house to house and collected information from the household head or his/her senior proxy. Affected entities, such as, landowners of sub-station areas, structure owners of transmission lines RoW were covered by the census. Census was conducted from July – September 2020 in 3 sub-stations area and associated transmission routes. Some data collection tools like Focus Group Discussion (FGD), Key Informant Interview (KII) and structured questionnaire were used to collect data from primary source. Relevant secondary information was collected from the Community Report of the Population and Housing Census 2011 published by Bangladesh Bureau of Statistics (BBS).

5.8.5 Administrative Bounding of Study Area

The entire study area consists of four upazilas named Anwara upazila of Chattogram district, Cox's Bazar Sadar and Teknaf upazila of Cox's Bazar district and Kaliakair upazila of Gazipur district. The name of mauzas, unions, upazilas and districts where main component, sub-stations will be constructed are given in Table 65.

Table 65: Administrative location of the study areas

SN	Mauza	Union	Upazila	District
1.	Dudkumar	Barashat	Anwara	Chattogram
2.	Khurulia	Jhilangza	Cox's Bazar	Cox's Bazar
3.	Daskin Hnila	Hnila	Teknaf	Cox's Bazar
4.	Latifpur	Sreefaltali	Kaliakair	Gazipur

5.8.6 Project Affected Households

According to the census and land data from the respective land office, it was identified that a total of 233 households (744 persons) will be affected. However, this number may require to be updated during detailed design stage. Out of the total, 101 HHs were not traceable due to residence in different locations. 132 responsive respondents (household heads), 113 are males (85.6%) and the rest 19 are females (14.4%) headed households. Total 11 HHs have no other agricultural land out of this affected land. But all of them have homestead land.

For construction of transmission lines, a total of 15 households (95 persons) will be affected. Out of total 15 household heads, 13 are males (86.66%) and the rest 2 are females (13.34%) headed households.

Table 66 presents both number of households and their population. There are 147 households (132 HHs in substations area and 15 HHs in transmission lines area) with a total population of 839. The male population is higher than that of female. There are 53% males and 47% females as found in the household census. The average male-female ratio is 112 i.e., 112 males per 100 females which is higher than the national figure of 100.3 and significantly higher than that of Chattogram 18 Division of 96.1 (BBS 2011). The average household size is 5.71; it is also higher than the national household size of 4.06 and household size of 4.47 of Chattogram division (HIES 2016[19]).

Table 66: Distribution of households no. and population

No. of Households	Population			Households Size	Sex ratio
	Male	Female	Total		
147	446[a] (53)[b]	393 (47)	839 (100)	5.71	100:113

[a] Figure in the parenthesis indicates the frequency value
[b] Figure in the parenthesis indicates the percentage value

5.8.7 Age Structure

The following figure shows distribution of population in the project area on the basis of age composition. It shows that the highest section of the population constitutes the age category of 15 to 24 years (21.76%). The second highest category is 5 to 14 years (20.02%). In most of the age groups the number of males is higher than that of females.

[18] In most cases, the data are compared with that of Chittagong Division only as three sub-stations are under that division

[19] HIES 2016 refers to House hold Income and Expenditure Survey conducted by the Bangladesh Bureau of Statistics (BBS) in 2016.

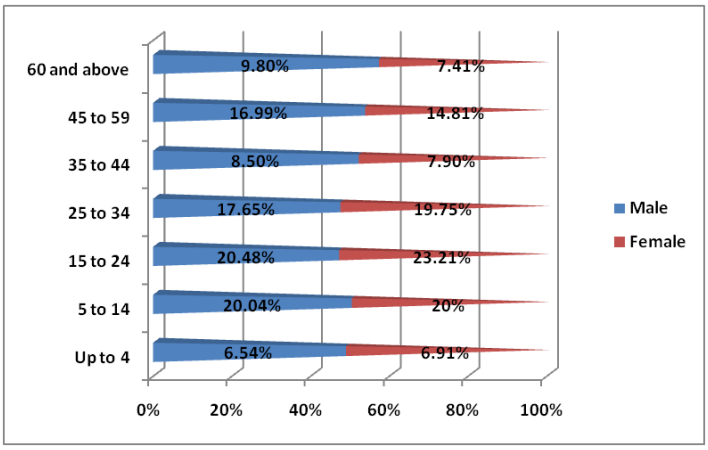


Figure 107: Population Pyramid in the project area

5.8.8 Dependency Ratio

Dependence ratio refers to the ratio of the dependent population (population aged 0-14 years and 60 years and over who are not working) to the working age population (population aged 15-59 years). The dependence ratio of project area is estimated as 35. The dependent population is 35% and probable workforce is 65% (Table 67 and Figure 108).

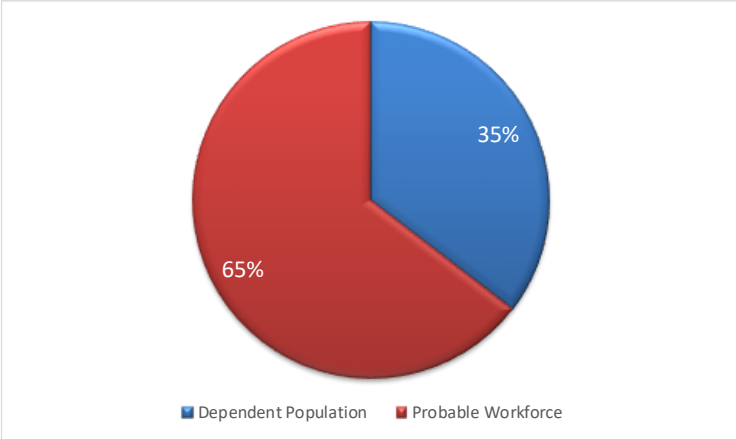


Figure 108: Dependent and probable population in the project area

Besides, it is to be mentioned that according to World Bank[20], Age dependency ratio (% of working-age population) in Bangladesh is 52.487%.

Table 67: Distribution of population in terms of dependence ratio

Total Population	Dependent Population	Probable Workforce	Dependency Ratio
839	294	545	100:35

Source: Census, August-September 2020

[20] http://data.worldbank. org/indicator / SP.POP. DPND?view=map

5.8.9 Marital status

Figure 109 shows the marital status of the total population in the Project area. It is found that the rate of unmarried people is higher than that of married people. In the married category, the rate of married females (46%) is higher than that of males (44%) but in the unmarried category, the rate of males (55%) is higher than that of females (50%). In the widow/widower category, the percentage of female is higher compared to that of male. The percentage of separated category is minimal compared to the rest of the categories.

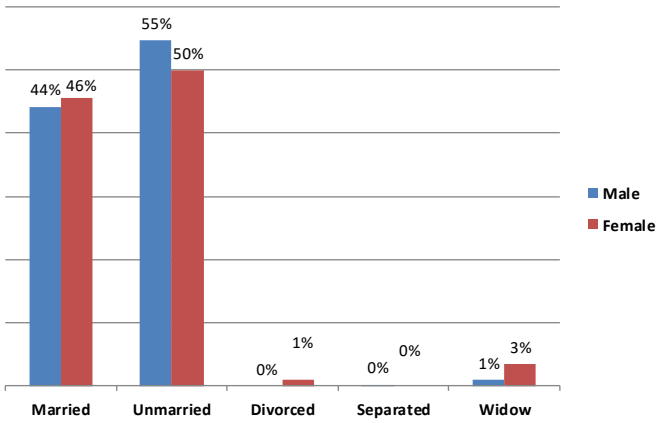


Figure 109: Marital status in the project area

5.8.10 Education

Census findings of the Project area show that concentration of literate people is higher in primary (28.8%) and secondary levels – class six to ten (25.6%) and SSC or equivalent (15.3%). About 9.6% population completed HSC or equivalent and same percent (9.6%) completed graduation and above. The percentages of males are higher than that of females in all levels except MA or equivalent. Among the study population about 8.1% are child whose age is below 5 years. The illiteracy rate in the Project area, however, is very lower i.e., only 3% are found who never attended school. In Bangladesh, 29.62% of population aged seven years and above (HIES-2016) are illiterate.

Table 68: Educational status of the affected households

SN	Level of Education	Gender		Total
		Male	Female	
1.	Up to class five/ Ebtedaye Madrasah (Religious education)	102[a] (23)[b]	139 (35)	241 (29)
2.	Class six to ten	111 (25)	101 (26)	212 (25)
3.	SSC or equivalent	67 (15)	59 (15)	126(15)
4.	HSC or equivalent	51 (12)	30 (7)	81 (10)
5.	BA or equivalent	45 (10)	15 (4)	60 (7)
6.	MA or equivalent	19 (4)	4 (1)	23 (3)
7.	Never attended a school	7 (2)	19 (5)	26 (3)
8.	Child below 5 years	41 (9)	29 (7)	70 (8)

SN	Level of Education	Gender		Total
		Male	Female	
	Total	443 (100)	396 (100)	839 (100)

[a] Figure in the parenthesis indicates the frequency value
[b] Figure in the parenthesis indicates the percentage value

5.8.11 Occupation

Out of total 839 family members of 248 households, 235 members are engaged in different occupations described in the following table from which they earn for their livelihood and the rest 604 members detailed are in the next following table do not earn. Considering occupational distribution, diverse occupational groups are found in the project area. Major occupations of the earning members are small and medium scale business (32%), government service (24%) and paddy cultivation (10%) and mostly of them are male. Other remarkable occupations are private sector employees (6%), agriculture (6%), and transport worker (5%). A few female members (8) are engaged with government service. About 4% male earners also work in abroad and they send remittance in their households, but no female earners work in abroad. Most of the female members are housewives (35.0%) and engaged with household chores. Some 43% family members are students in different grades and about 13% are unemployed and 9% are mainly children aged below 5 years.

Table 69: Primary Source of livelihoods of the households

SN	Occupation	Gender				Total	
		Male	%	Female	%	No.	%
A.	**Substations**						
1.	Paddy Cultivation	21	0.11	2	0.13	23.00	0.12
2.	Animal Husbandry	2	0.01	1	0.07	3.00	0.02
3.	Agriculture	12	0.06	1	0.07	13.00	0.07
4.	Non-agriculture Laborer	4	0.02	5	0.33	9.00	0.05
5.	Employee in Government Sector	46	0.25	1	0.07	47.00	0.24
6.	Employee in Private Sector	11	0.06	-	-	11.00	0.06
7.	Large Scale Business	7	0.04	-	-	7.00	0.04
8.	Small and Medium Scale Business	68	0.37	3	0.20	71.00	0.36
9.	Self-Employed	2	0.01	-	-	2.00	0.01
10.	Driver/Transport Worker	5	0.03	2	0.13	7.00	0.04
11.	Employee in a Foreign Country	6	0.03	-	-	6.00	0.03
12.	Armed Services	1	0.01	-	-	1.00	0.01
	Sub Total	**185**	**1.00**	**15**	**1.00**	**200**	**1.00**
B.	**Transmission Lines and LILO**						
13.	Inland Fishing	1	0.03	-	-	1	0.03
14.	Fishery Laborer	0	-	1	0.20	1	0.03
15.	Agriculture	2	0.07	-	-	2	0.06
16.	Non-agriculture Laborer	2	0.07	-	-	2	0.06
17.	Employee in Government Sector	2	0.07	3	0.60	5	0.14

SN	Occupation	Gender				Total	
		Male	%	Female	%	No.	%
18.	Employee in Private Sector	2	0.07	-	-	2	0.06
19.	Large Scale Business	3	0.10	-	-	3	0.09
20.	Small and Medium Scale Business	5	0.17	-	-	5	0.14
21.	Self-Employed	4	0.13	1	0.20	5	0.14
22.	Driver/Transport Worker	5	0.17	-	-	5	0.14
23.	Employee in a Foreign Country	3	0.10	-	-	3	0.09
24.	Skilled/Semiskilled Worker	1	0.03	-	-	1	0.03
	Sub Total	**30**	**1.00**	**5**	**1.00**	**35**	**1.00**
C.	**Overall (all lines & substations)**						
25.	Paddy Cultivation	21	0.10	2	0.10	23	0.10
26.	Inland Fishing	1	0.00	-	-	1	0.00
27.	Animal Husbandry	2	0.01	1	0.05	3	0.01
28.	Agriculture	14	0.07	1	0.05	15	0.06
29.	Fishery Labor	-	-	1	0.05	1	0.00
30.	Non-agriculture Laborer	6	0.03	-	-	6	0.03
31.	Employee in Government Sector	48	0.22	8	0.40	56	0.24
32.	Employee in Private Sector	13	0.06	1	0.05	14	0.06
33.	Large Scale Business	10	0.05	-	-	10	0.04
34.	Small and Medium Scale Business	73	0.34	3	0.15	76	0.32
35.	Self-Employed	6	0.03	1	0.05	7	0.03
36.	Driver/Transport Worker	10	0.05	2	0.10	12	0.05
37.	Employee in a Foreign Country	9	0.04	-	-	9	0.04
38.	Armed Services	1	0.00	-	-	1	0.00
39.	Skilled/Semiskilled Worker	1	0.00	-	-	1	0.00
	Overall (all lines & substations)	**215**	**1.00**	**20**	**1.00**	**235**	**1.00**

Source: *Census, August-September 2020*

Table 70: Others Occupation of the household's members

SN	Occupation	Gender				Total	
		Male	%	Female	%	No.	%
A.	**Transmission Lines and LILO**						
1.	Housewife	-	-	26	0.63	26	0.44
2.	Student	7	0.39	11	0.27	18	0.31
3.	Unemployed	4	0.22	1	0.02	5	0.08
4.	Other	7	0.39	3	0.07	10	0.17
	Sub Total	**18**	**1.00**	**41**	**1.00**	**59**	**1.00**
B.	**Substations**						
5.	Housewife	-	-	184	0.55	184	0.34

SN	Occupation	Gender				Total	
		Male	%	Female	%	No.	%
6.	Student	140	0.66	100	0.30	240	0.44
7.	Unemployed	48	0.23	27	0.08	75	0.14
8.	Other	25	0.12	21	0.06	46	0.08
	Sub Total	**213**	**1.00**	**332**	**1.00**	**545**	**1.00**
C.	**Overall (all lines & substations)**						
9.	Housewife	-	-	210	0.56	210	0.35
10.	Student	147	0.64	111	0.30	258	0.43
11.	Unemployed	52	0.23	28	0.08	80	0.13
12.	Other	32	0.14	24	0.06	56	0.09
	Overall (all lines & substations)	**231**	**1.00**	**373**	**1.00**	**604**	**1.00**

Source: *Census, July-September 2020*

5.8.12 Monthly Household Income

The following table shows that the highest range of income of the households of project areas is BDT. 10001-20000 (38.78%) followed by BDT. 20001-30000 (26.53%); BDT. >40,000 (22.45%); BDT. 30001-40000 (6.80%); BDT. 8500-10000 (2.72%); and BDT. <8,500 (2.72%). As per Household Income and Expenditure Survey 2016, national average income of a family is BDT. 15,945.

Table 71: Monthly household income

Monthly Household Income (Tk)	Frequency	Percentage
< 8,500	4	2.72
8,500–10,000	4	2.72
10,001–20,000	57	38.78
20,001–30 ,000	39	26.53
30,001–40,000	10	6.80
>40,000	33	22.45
Total	**147**	**100.0**

Source: *Census, July-September 2020*

The upper poverty line for the project region is based on the Bangladesh Bureau of Statistics (BBS) 2011 survey which was BDT. 1,125.3 per capita. Adopting national BBS inflation rates (11.5% for 2011, 6.2% for 2012, 7.5% for 2013, 7.0% for 2014, 6.2% for 2015, 5.7% for 2016 & 2017, 6% for 2018, 5.69% for 2019 and 5.53% for 2020), the upper poverty line has been updated to BDT. 2,150.04 per month per capita (i.e., BDT. 9,460.18 per household/month, for an average household size of 4.4 in Bangladesh as per the BBS data 2011). Considering an average household size of 4.06 (as per the HIES 2016), BDT. 8,729 have been adopted as the poverty line for the project area. Based on this, BDT. 8,729 x12=BDT. 104,750 are calculated as the annual poverty line. In this context, it is observed that about 3% of households (4 HHs) belong to the poorer category. On the other hand, about 97% of the total households belong to the above poverty line category.

5.8.13 Monthly Household Expenditure

Data shows that for food consumption the highest range of expenditure of the households of project areas is BDT. 5000-10000 (45.58%); for electricity, water, gas, telephone & transport purpose the highest range of expenditure of the households of project areas is BDT. < 5000 (78.91%); and for Children's education, healthcare, clothing & entertainment purpose the highest range of expenditure is BDT. < 5000 which is 74.83.

Table 72: Monthly household expenditure

Expenditure	<Tk 5,000	Tk 5,000 – Tk 10,000	Tk 10,000 – Tk 15,000	Tk 15,000 – Tk 20,000	Tk 20,000 – Tk 25,000	>Tk 25,000	Total
Food consumption	3	67	45	18	2	12	147
%	2.04	45.58	30.61	12.24	1.36	8.16	100
Electricity, water, gas, telephone & transport	116	23	2	2	2	2	147
%	78.91	15.65	1.36	1.36	1.36	1.36	100
Children's education, healthcare, clothing & entertainment	110	30	3	2	0	2	147
%	74.83	20.41	2.04	1.36	-	1.36	100

Source: *Census, July-September 2020*

5.8.14 Poverty and Gender

By assessing income status, it is found that only 3% of the households (4 nos.) belong to the poorer category. According to survey data, the household income of the poor at lower poverty level is BDT. 104,750.00/year and three female-headed household and one male headed household, respectively earn yearly income at lower poverty level.

The gender analysis conducted in this Project (separate GBV analysis report has been produced for the project) examined the differences in women's and men's lives to understand social and economic inequity for women and its underlying causes, including provisions for income restoration, training and livelihoods program for poorer women in this project.

5.8.15 Vulnerable Groups

Vulnerable households have been defined as (i) headed by single woman or woman with dependents and low incomes; (ii) headed by elderly/disabled people without means of support; (iii) households that are below the latest nationally defined poverty line; and iv) households of indigenous population or ethnic minority. It was found that total 14 households are listed under vulnerable groups and all of them are affected households due to the land acquisition of proposed substations. During the elaboration of the RP no indigenous population or ethnic minority were identified during census.

Table 73: List of vulnerable groups and households

Category	Type	Number
Female Headed HHs	Female HHs (income level up to BDT 104,750.00/year)	3
	Female & Disabled HHs (income level up to BDT.104,750.00/year)	-
	Elder Female HHs (income level up to BDT 104,750.00/year)	-
	Sub-total	**3**
Headed by elderly (70-year-old)	Elder HHs (income level up to BDT.104,750.00/year)	14
	Sub-total	**14**
Disabled HHs	Disabled male HHs	-
	Sub-total	**-**
Households under poverty line (less than BDT.104,750 /year	Male HHs, under 60 (income level up to BDT. 104,750.00/year)	1
	Total	**18**

Source: *Census, July-September 2020*

Those listed as vulnerable groups will receive special attention in relocation and benefit from Project implementation. The entitlement matrix has provision for one-time grants in addition to eligible compensation.

5.8.16 Access to health facilities

Health is universally regarded as an important index of human development that constitutes one of the basic needs of the population. Access to health care facilities is a basic right of all citizens. As per FGD findings, paramedic physician is providing services to 38% of the people and 40% of the people go to trained physician. On the other hand, people reported that people still have tendency to go to the local healer (17%) for treatment. Still 5% people (mostly the poor) do not get any medical facilities. It is assumed that economic wellbeing may drive them toward receiving treatment facilities from trained physicians.

5.8.17 Employment opportunities

Employment implies that people have earnings to support livelihood of the household. Census shows that about 28.09% population is employed in different sectors of which 91.76% are male and 8.24% are females.

5.8.18 Availability of labor and wage rate

A compatible wage rate is prevalent in the study area and is presented in following Table 74. It is found that wage rate is almost same in every proposed sub-station area, but the wage rate is quite higher than other regions of this area due to its belonging to port city. Field findings reveal that women wage rate is comparatively lower than male. But the positive side is that both male and female are working together though the FGD participants opined that women participation in labor force is very low.

Table 74: Availability of labor and wage rate of the study area

Type of Activities	Type of labor	Availability	Wage (Taka)	
			Max	Min
Farming	Male	High	600	500
	Female	Medium	500	400
Non-farming	Male	High	700	500
	Female	Low	500	400

5.8.19 Migration

Seasonal human migration is very common in agricultural cycles. The trends of seasonal migration depend on availability of work, natural disasters, industrialization and development initiatives affecting land and natural resources. Seasonal labor migration is common phenomenon where cultivable land remains under water during rainy season so rural poor people have to struggle for their livelihood. The FGD participants opined that labor is from different regions of the country. Even different national and multination organizations have their corporate brunches in Chattogram city.

5.8.20 Housing conditions

Housing condition in the study area is characterized by 45.04% pucca, 29.40% semi pucca and 13.25% tin shed. The katcha households in the study area are negligible (3.31%) in number (Figure 110).

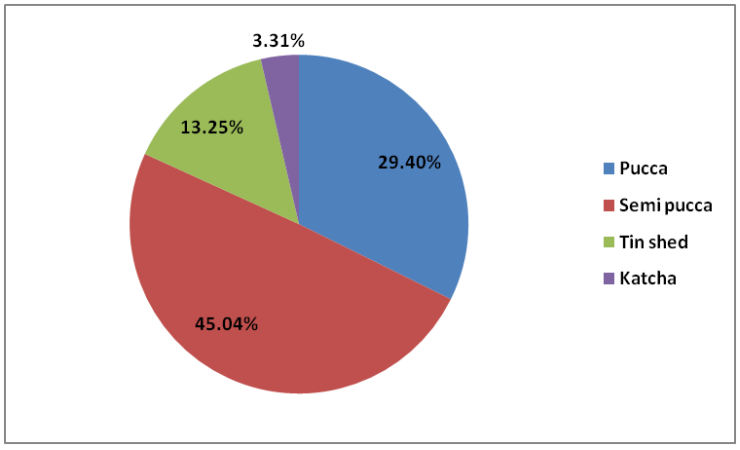


Figure 110: Household structure in the Project Area

5.8.21 Drinking Water Facilities

Quality of drinking water indicates water acceptability for human consumption. As per census, 91.39% of people are dependent on private tube-well as their main source of drinking water. The rest 8.61% use public tube-well, tap and pond water although they are used to boiling water before drinking. Tap water is mainly found in urban and sub-urban area. The FGD participants opined that salinity is found in ground water except Kaliakair sub-stations area.

5.8.22 Sanitation Facilities

In the study area, 47% households reported that they have water-seal toilet, 26% households have pit toilet, 25% households have flush toilet with commode and a meager proportion (3%) of households share toilet with their neighbor mainly who live in katcha house.

5.8.23 Access to Electricity

Access to electricity is regarded as the benchmark of modern society. It is an important indicator of measuring advancement of an area. It is found that 96.1% of the study area is under electricity coverage. As of 2015, 92% of the urban population and 67% of the rural population had access to electricity. An average of 77.9% of the population had access to electricity in Bangladesh[21]. Here electricity coverage is quite satisfactory.

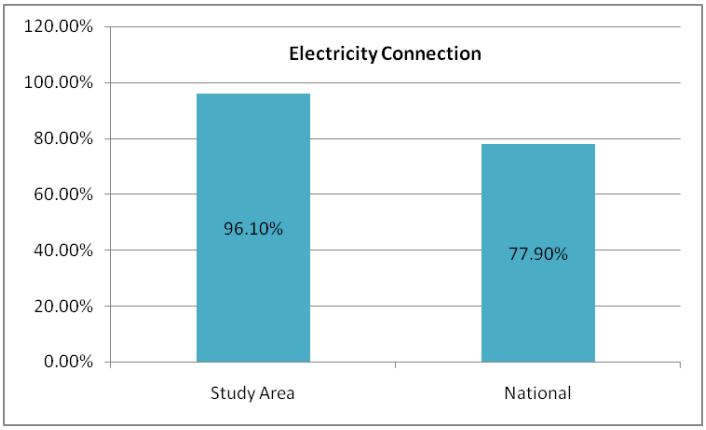


Figure 111: Electricity Connection in the Study area and National Level

5.8.24 Land Price

The agricultural land prices of Dudkumar mouza under Anwara upazila, Khurulia mouza undar Cox's Bazar Sadar upazila and Daskin Hnila mouza under Teknaf upazila have been collected from the ESIA field visit by PVS (Property Valuation Survey) form (Table 75). As required land for Kaliakair substation will be transferred BHTPA to PGCB, land price of Latifpur mouza under Kaliakair upazila has not been collected. Land prices have been collected from people of different occupations like buyer, seller, dead writer, local government representative, mason, teacher, farmer, etc. The areas are mostly in rural areas and as a result land price is low. The average land prices in the different areas are presented below.

Table 75: Land Price of the Study Areas

SN	Mauza	Union	Upazila	District	Minimum-Maximum Land price (BDT/Decimal)
1.	Dudkumar	Barashat	Anwara	Chattogram	70,000-80,000
2.	Panir chara	Rashid nagar	Ramu	Cox's Bazar	180,000-200,000
3.	Daskin Hnila	Hnila	Teknaf	Cox's Bazar	60,000-70,000

Source: Property Valuation Survey, July-September 2020

[21] "Source of Light in Bangladesh: 2015". *Archived from* the original *on 15 August 2017*. Retrieved 8 June 2017

5.8.25 Self-assessed socio-economic status

The participants assessed themselves in four categories during Census. As per respondent's opinions more than half (53%) of the households assessed themselves as average followed by 24% above average and 20% as poor. A very meager proportion (3%) of households marked themselves as very poor who are mainly live in katcha houses and share their toilet with neighbor (Figure 112).

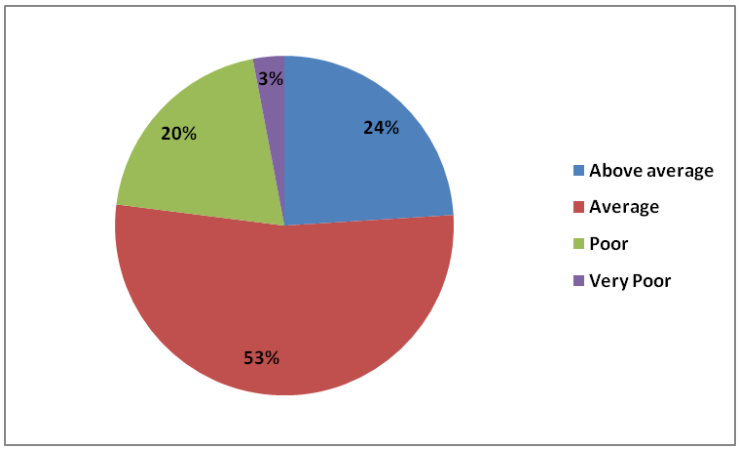


Figure 112: Household structure in the Project Area

5.8.26 Public Utilities

Public services taken into consideration for this report are water supply, sanitation, solid waste management, electricity supply, telecommunication etc. It is expected that utilities will not be interrupted during the construction of the substations and overhead transmission lines. Field visits confirmed the existence of water supply lines and secondary drainage adjacent to the alignment of RoW.

5.8.27 Cultural Resources

The IIFC field team has visited both substation and RoW of transmission line. No cultural resources and sensitive spaces are found in the alignment and the proposed location of substation. Proposed substations at Anwara, Teknaf and Cox's Bazar Sadar will be constructed in agricultural lands and Kaliakair substation will be constructed in an open space and some part of the land is water body. No cultural and archeological resource will be affected due to construction of overhead transmission lines of this project.

5.8.28 Summary findings of the census

A total of 248 households will be affected by the project. Among them, 233 HHs are of substations and 15 are of transmission lines. The census revealed that 69 wage earners and 17 sharecroppers will lose their income due to land acquisition for sub-stations. A total of 23,625 trees was counted under the RoW of transmission lines, while it was 11 for substations.

There is no structure found in the proposed acquire land for substations. So, no displacement and relocation are required for this project except land acquisition and compensation. The tower footings for laying transmission lines require land compensation as per Electricity Rules, 2020. There is no provision of land acquisition and in fact compensation for RoW of transmission lines.

Compensation will be provided for standing trees under RoW which require felling before laying the transmission lines. Furthermore, temporary losses are anticipated due to damage of crops within the RoW of the transmission lines.

Table 76: Summary impacts of the project

SN	Project Impacts	Substation	Transmission Line	Tower footings	Total
	Land				
1	Amount of land to be required (acre)	40		31.09	71.09
2	Amount of land to be acquired (acre)	35[a]	0	0	35
3	Amount of land to be compensate (acre)	0	0	31.09	31.09
	Households				
4	Number of HH to be affected	233[b]	15[c]	0	248
5	Number of HH losing only land (as per Khatian and Census)	233	0	0	233
6	Number of Wage earners lose their income	69	0	0	69
7	Number of Sharecroppers lose their income	17	0	0	17
8	Number of vulnerable HHs	4	0	0	4
9	Total number of persons affected	744	95	0	839
10	Number of trees affected	11	23,625	0	23,636

[a] Remaining 5 acres of land owned by Bangladesh Hi-Tech Park Authority under Ministry of Posts, Telecommunications and Information Technology. Hence, no need to acquire the land.
[b] **Sub-stations:** (Anwara SS – 181, Teknaf SS-17, Cox's bazar SS – 35)
[c] **TLs:** LILO – 5, Anwara to Cox's Bazar – 4, Cox's Bazar to Teknaf – 3, Kaliakair – 3

5.9 Rohingya Refugee and the Project

The proposed Cox's Bazar to Teknaf 132kV transmission line under the project will pass the periphery of Kutupalong Refugee Camps of Ukhia. Regarding lowest distance, boundary of Camp 01E is about 225-meter, Camp 07 about 330-meter, Camp 08E about 227-meter away from proposed transmission line. Cox's Bazar to Teknaf Highway is located between the Camps and proposed transmission line. Figure 113 presents distance and location of Kutupalong Refugee Camps and proposed transmission line from Cox's Bazar to Teknaf.

It is important to know the present baseline conditions of the Rohingya Refugee of Kutupalong Camps of Ukhiya. Since August 25, 2017, extreme violence in Rakhine State, Myanmar, has driven an estimated 727,000[22] people from the Rohingya community across the border into the Cox's Bazar District of Bangladesh. This exodus brings the total number of Displaced Rohingya Population (DRP) in the district to about 919,000[23] in what is one of the fastest developing forced displacement crises in the world. 85% of the DRP are living in collective sites, 13% in collective sites with host

[22] ISCG: Situation Report Rohingya Refugee Crisis, (September 27, 2018)
[23] IOM Needs and Population Monitoring round 11

communities, and 2% in dispersed sites in host communities. In Ukhiya and Teknaf, the two Upazilas where most of the DRP have settled, they outnumber the host community by over a factor of three.

Almost all the DRP are hosted in some of the world's most congested areas, including in the Kutupalong "mega-camp", which has fast become the largest refugee camp in the world. The DRP account for about one third of the total population in Cox's Bazaar, a district that was already facing severe development challenges. They are sheltered in makeshift shelters and extremely congested settlements, in areas that have minimal access to basic infrastructure and services and are prone to natural disasters, especially cyclones and floods. Setting up of camps has led to rapid deforestation, further increasing vulnerability of the DRP to disasters and monsoon rains. Relocation of households most at-risk from landslides and flooding is underway, but there is insufficient suitable land available to accommodate even the highest-risk category.

The influx is straining existing infrastructure and degrading an already resource-constrained social service delivery system and the rich natural environment in Cox's Bazar District. Most DRP are located in two sub-districts- Teknaf and Ukhiya having 5 and 6 Unions (the lowest level local government unit in the country), respectively, which are mostly rural. However, DRPs are also located in Cox's Bazar Sadar and Ramu sub-districts. In these two sub-districts (Teknaf and Ukhiya) the DRPs now constitute three times the local population. The largest settlement is in Ukhiya with 700,000 Rohingya. This rapid rise in population within a very short span of time has put enormous stress on infrastructure and public service delivery, which were already stretched even before the crisis began.

Based on the detailed design, PGCB will discuss with camp authority about the project activities, timeline and E&S policies. Moreover, these draft E&S documents will be also disclosed to the camp authority.

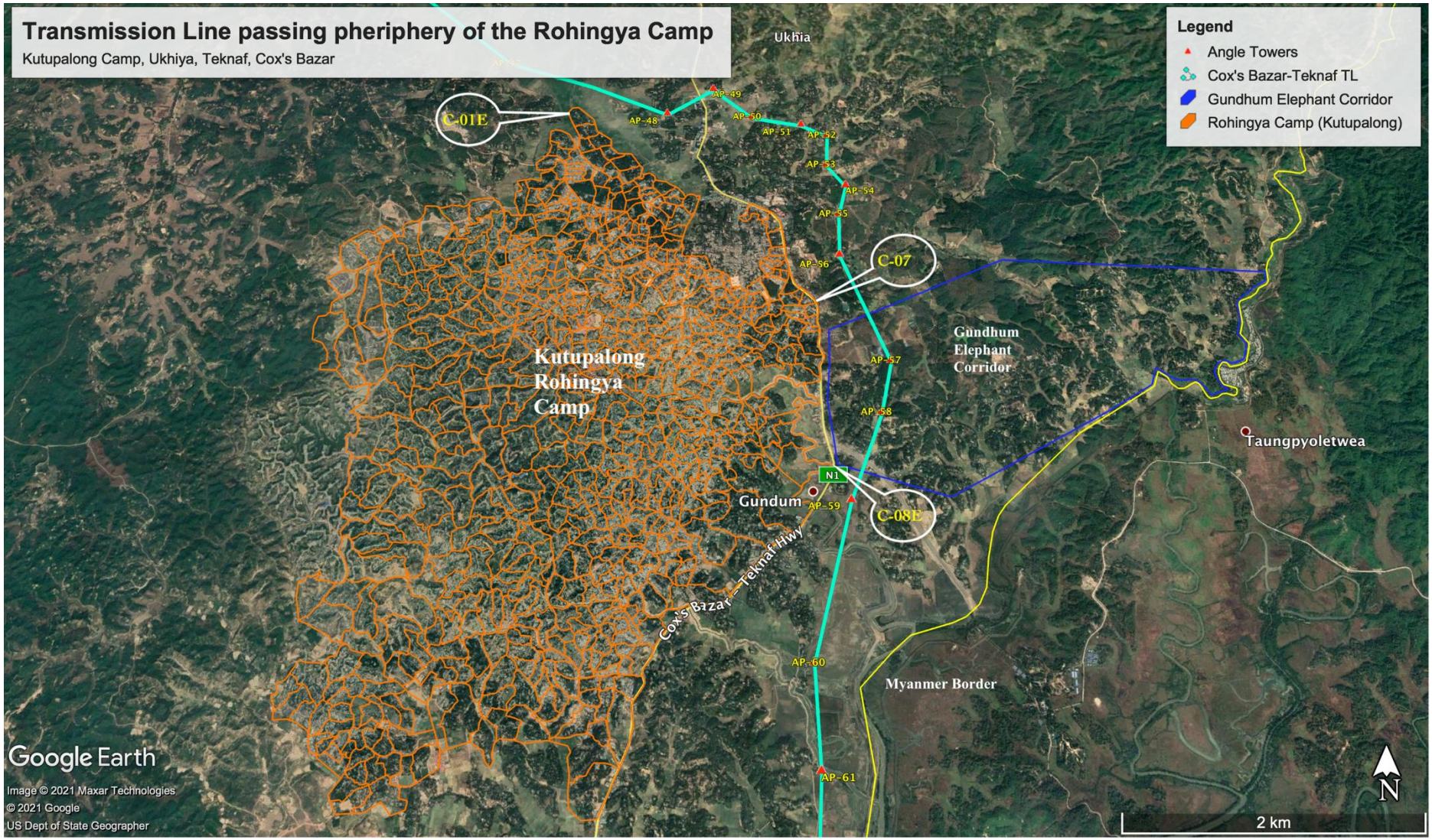
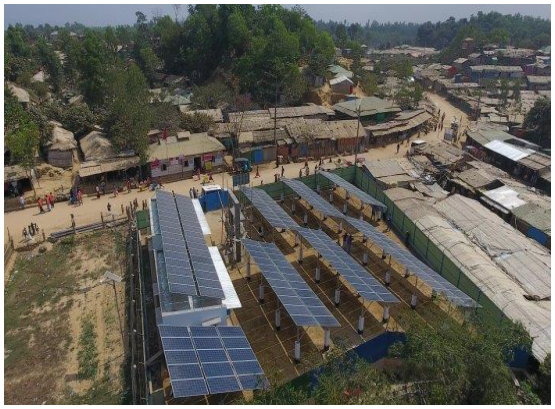


Figure 113: Transmission line passing periphery of the Kutupalong Rohingya Refugee Camps at Ukhiya, Cox's Bazar

Most DRP women stay in their shelters due to social norms as well as to minimize risks of sexual assault, trafficking and violence [24]. This has made it particularly difficult for women-headed households, who compose 16 percent of DRP households, in terms of accessing relief and support services provided by the Government of Bangladesh, local and international NGOs.

More than 90 percent of the DRP populations have no sources of income. At least 80 percent of the overall DRP is highly or entirely dependent on external assistance while the remaining 20 percent can only partially meet their needs through coping strategies. Although not strictly permitted to leave the camp or work, some members of the DRP, mostly men are taking up jobs in construction, farming, fishing and restaurants, often accepting wages below half the normal rates. This decline in wages, price rise and strained access to services has increased tensions between host communities and the DRP. Host communities that live in the immediate vicinity of the camps, estimated at about 336,000[25], initially welcomed the fleeing people but their prolonged stay has strained relations between the two communities.

To reduce the enormous pressure and meet the demand of host communities, it was difficult to provide electricity supply to Rohingya Camps. In fact, it is hard for the government of Bangladesh to supply electricity to over one million refugees. To ease the pressure, some international NGOs funded solar panels project in refugee camps around Cox's Bazar in Bangladesh which helped to improve refugees' standards of living as a whole. Electricity has allowed Rohingya refugees to engage in creative and constructive work. This facility has helped to improve law and order in the region, making camps more secure. This has further enabled refugees to concentrate more in money-generating activities and in not passing their evenings and nights as idle. Hence, the solar facility is making more refugees self-reliant and confident.



Solar-powered water supply system in Cox's Bazar, Bangladesh

Fleeing Rohingya carry one key asset-Solar Panel

Figure 114: Electricity system of Rohingya Camps

[24] ISCG Situation report: Rohingya DRP Crisis Cox's Bazar | 24 May 2018

[25] Joint Response Plan for Rohingya Humanitarian Crisis, March-December 2018

Figure 115: Kutupalong Rohingya Refugee Camps, Ukhiya

Chapter 6
Stakeholder Engagement, Public Consultation and Disclosure

6.1 Introduction

Community participation always plays a key role for sustainable development. According to the guidelines of the DoE and the development partners, people's participation in planning and implementation phases of category A&B Projects (usually red category) is essential to take necessary actions for minimizing any undue socio-cultural, political or any other conflicts and to address environmental issues. People have the right to know about what is going to happen in their surroundings. They must be informed about the positive and negative impacts for obtaining their perceptions, views and feedbacks on the probable changes likely to happen within the study area. Therefore, required numbers of public consultation meetings (PCMs) were undertaken with community stakeholders in accordance with the Environmental and Social Framework (ESF) of Asian Infrastructure Investment Bank (AIIB). A detailed SEP is prepared by PGCB which will be followed through the project cycle. The prepared SEP will be updated during the detailed design stage (if needed).

6.1.1 Stakeholder Engagement

In order to ensure effective engagement and open, frequent and honest dialogue with local communities and other key stakeholders, a stakeholder engagement plan is designed throughout the life of the Project. This plan is to be developed and implemented in order to identify stakeholder and their issues of concern, establishes the methods for consultation, and provides a specific action plan for stakeholder engagement throughout the life of the Project.

Table 77: Stakeholder Assessment

Project Proponent	:	Power Grid Company of Bangladesh (PGCB)
Related organizations/ Local government	:	DOE, DOF, DAE, RHD, BR, BWDB, Department of Fisheries, Ward Commissioner/UP member (male and female)
Local people	:	Businessmen, Service holder, Farmers, Day Labor, Teacher, Transport Worker, Homemaker, Student, Shopkeeper, etc.
Non-Governmental Organizations	:	Nishorgo, CODEC, IUCN
Engagement Methods		
ESIA phase	:	– Organizing consultation meetings by inviting key stakeholders above at draft scoping report and draft ESIA report
Pre-construction/ Construction phase/ Regular operation Phase	:	– Regular communication with local community through personal contact; – Meeting with the representative of village on the quarterly basis;

		– Participatory meeting with villagers; – Interpersonal Interview with villagers.
Information Disclosure		
ESIA phase: Pre-construction/ Construction phase/ Regular operation Phase	:	– Disclosures of draft scoping report and draft ESIA report.
– Grievance mechanism process and complaints register		
All phase	:	– Receiving complaints and opinions from the public on regular basis through the engagement method; – Meeting with the representative of villagers; – Participatory meeting with villagers.

In the present study, all the stakeholders have been primarily categorized into two categories that have been identified as:

- Primary Stakeholders: include people, groups, institutions that either have a direct influence on the project or are directly impacted (positively or adversely) by the project and its activities i.e., the grass-root stakeholders, such as project affected persons and general public including women and people with physical disabilities residing in the project area (for the proposed project: people living in the project area particularly the RoW). The Rohigya community has been considered as indirect stakeholders for this project; and
- Secondary stakeholders: are those that have a bearing on the project and its activities by the virtue of their being closely linked or associated with the primary stakeholders and due to the influence, they have on the primary stakeholder groups.
- Apart from categorization, the stakeholders have also been classified in accordance with the level of influence they have over the project as well as their priority to the project proponent in terms of importance.

The stakeholders have been classified in accordance with the level of influence they have over the Project as well as their priority to the Project proponent in terms of importance. The influence and priority have both been primarily rates as:

- High Influence/Priority: This implies a high degree of influence of the stakeholder on the Project in terms of participation and decision making or high priority for PGCB to engage that stakeholder.
- Medium Influence/Priority: This implies a moderate level of influence and participation of the stakeholder in the Project as well as a priority level for PGCB to engage the stakeholder who are neither highly critical nor are insignificant in terms of influence.
- Low Influence/Priority: This implies a low degree of influence of the stakeholder on the Project in terms of participation and decision making or low priority for PGCB to engage that stakeholder.

Based on the above attributes, the following Table 78 delineates the stakeholders identified for the Project and their analysis.

Table 78: Stakeholder Mapping for the Project

Stakeholders	Category of stakeholder	Brief profile	Influence status	Basis of Influence Rating
Management				
Project affected persons (PAPs)	Primary	Loss of land by the acquisition for the construction of SSs. Loss of trees, crops in the width of RoW of transmission lines	Medium	• No major restrictions around the Project site • Project bring development to the area • Increase in employment opportunities and preference in job during construction phase • Improvement in electrical supply and infrastructure in the area • Minimize impact
Power Grid Company of Bangladesh (PGCB)	Secondary	PGCB is the Project proponent own a controlling stake of 100% in the Project	Highest	• Primary Project proponent • Responsible for construction and operation of this Project • Primary financial beneficiaries • Responsible for all the Project related risks and impact liabilities
Community				
Regulatory/Administrative Authorities & Agencies				
Department of Environment (DOE)	Secondary	The Department of Environment is the primary government regulatory authority for Environmental protection in Bangladesh.	High	Responsible for environmental clearance, management and monitoring including necessary compliance throughout the Project lifecycle
Department of Forest (DOF)	Secondary	The Department of Forest is the primary government regulatory authority for protection of forest in Bangladesh.	High	Responsible for forest protection, conservation and management and provide permit for cutting trees for width clearing of TL during construction phase
Ministry of Railway	Secondary	Ministry of Railway is the primary	High	Responsible for the construction of new railway

Stakeholders	Category of stakeholder	Brief profile	Influence status	Basis of Influence Rating
		government regulatory authority for construction and maintenance of railways in Bangladesh		and maintenance of existing. Provides permit while use the right-of-way and/or crossing (overhead and underground) power and gas transmission and distribution lines, etc.
Roads and Highways Department (RHD)	Secondary	Roads and Highways Department is the primary government regulatory authority for the construction and repair of roads and highways in Bangladesh	High	Responsible for the construction of new roads and highways, and maintenance of existing. Provides permit while use the right-of-way and/or crossing (overhead and underground) power and gas transmission and distribution lines, etc.
Other Regulatory & Permitting Authorities	Primary		High	• Agencies required for obtaining permits and licenses for operation of the Project • Primary involvement during operation phases
Political Administration				
Upazila (sub–District Level) Political Administration	Secondary	Elected representatives of people at sub-district level for a fixed tenure	Medium	• Key linkage between the community and the PGCB
Union/Ward leaders & local representative	Secondary	Elected representatives at Union/Ward level i.e., village level for a fixed tenure	Medium	• Plays important role in providing public opinion and sentiment on the Project • Empowered to provide consent and authorization for establishment of Project on behalf of the community

A stakeholder engagement plan (SEP) prepared for the project given in **Annex-V**.

6.2 Public Consultation

Stakeholder consultations (or public consultation) during the environmental and social assessment process of development projects is increasingly considered an important notion and requirements which increases the authenticity and acceptability of assessment itself but more importantly can possibly enhance the quality of decisions making as well. The dialogues will be inclusive, meaningful and transparent. Special initiatives will be taken to ensure that vulnerable people, women and people with disabilities are consulted. Stakeholder consultation/participation during various stages of developmental projects helps improve the decision making and ultimately leads towards sustainable development.

Stakeholder consultation is a two-way process. For stakeholders, the consultation process is an opportunity to obtain project information, to raise issues and concerns, and ask questions. For the project proponents, the consultation process offers opportunity to understand the stakeholders and their concerns about the project, their needs and aspirations, and also their suggestions that can potentially help shape the project. Listening to stakeholder concerns and feedback can be a valuable source of information that can improve project design and outcomes and help the project proponent to identify and control external risks. It can also form the basis for future collaboration and partnerships.

The national legislation and AIIB policies require consultations to be carried out particularly with the affected communities as part of the environmental and social assessment process. The consultation carried out during the present ESIA and reported in this Chapter meet these requirements. The primary objective of the PCMs is to incorporate the opinions and suggestions of the public and all other stakeholders at the Project planning stage to ensure wider acceptability of the Project. The key objectives are as follows:

1. Developing and maintaining communication links between the project proponents (PGCB) and stakeholders
2. To provide information on the economic, environmental, and social benefits as well as potential negative impacts of the Project;
3. To ensure that the potential stakeholders, and local communities are engaged in a meaningful dialogue and are well informed prior to the decision of the Project Proponent as to the nature and extent of social and environmental impacts attributable to the proposed Project with respect to planning;
4. Engaging and assessing the specific needs of vulnerable groups, especially those below the poverty line, the landless, people with disabilities, the elderly, women and children, and those without legal title to land and ensure their participation to in consultations;
5. To engage stakeholders, and local communities and obtain expertise and local, traditional wisdom and knowledge from them in order to plan the mitigation measures; and
6. To facilitate periodic opportunities to the principal stakeholders to offer their inputs on all key components of the Project.

6.3 Approach and Methodology of Public Consultation Meeting

6.3.1 Approach of PCM for ESIA

PCM and disclosure offer an opportunity for people to participate in the decision-making process for design, development, and implementation of the Project. It provides a platform for Project-affected persons and different stakeholders to express their views on possible impacts of the proposed intervention on environmental and social parameters.

Public opinion has been collected through in-depth-interview, focus group discussion and consultation meeting. For better understanding the socio-economic and environmental condition six focus group discussions were held with the local people in the closest settlement area of the proposed sub-stations. In-depth Interview was held with local government representatives, and government officials in the respective field.

In order to assess stakeholder needs, expectations, perceptions, and choices, and to ensure their rights and voices, a two-fold consultation processes was carried out during the survey. Thus, meetings were conducted firstly with both the primary and secondary stakeholders. Later, indirect affected persons of different occupations groups were consulted through FGDs.

PCM and disclosure for Environmental Assessment are planned at two different stages (ESIA scoping stage and draft ESIA report stage) in order to collect opinions and feedback of the public and to disseminate information on the Project and ESIA Study. However, the consultant carried out 3 consultations adjacent to the proposed sub-station area.

a) ESIA Scoping Stage

The first stage of the PCM and disclosure for ESIA is conducted at the time of environmental scoping in the initial stage of the ESIA study. Information on the Project and scope of the ESIA study is disseminated to the public, and then comments and opinions are collected to incorporate into the report. Three consultations were carried out at the scoping stage. PCM-1 was carried out at Parki Bazar adjacent to the proposed substation of Anwara, Chattogram; PCM-2 was carried out at Bangla Bazar adjacent to the proposed substation of Cox's Bazar Sadar, Cox's Bazar and PCM-3 was carried out at Sutrapur adjacent to the Kaliakair substation.

b) Draft ESIA Report Stage

The second stage of the PCM and disclosure for ESIA is conducted at the time of preparation of draft ESIA report. At this stage all PCMs were carried out at the same place where consultation meetings were held at scoping stage. The participants were same including some new participants who could not attend in the first time PCMs. Information about findings of draft environmental and social impact assessment study and proposed mitigation measures are disseminated to the general public that are directly or indirectly affected by the Project. In addition, their feedback and opinions are obtained which are reflected in the ESIA report together with their comments and request on the environmental and social mitigation measures, Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMP).

However, the approach undertaken for consultation involved the following key processes.

- Mapping and Identification of key stakeholders such as primary (direct Project influence) and secondary (indirect Project influence) stakeholders;
- Undertaking interviews and focus group discussions (FGD) with the respective stakeholders;
- Assessing the influence and impact of the Project on these stakeholder groups;
- Summarizing of key findings and observations from the consultations.

6.4 Public Consultation Meetings (PCMS)

A total of 6 Consultations meeting were conducted in three substations area and total participants were 119. Consultations meeting were held in Banglabazar, Cox's Bazar Sadar, Cox's Bazar; Sutrapur, Kaliakair, Gazipur and Parki Bazar, Anwara, Chattogram. In each of the consultation, participants were encouraged to share their observations, suggestions, and experiences on various environmental and safety issues and suitable mitigation and enhancement measures. Issues discussed were:

1. Awareness about the proposed project and responses;
2. Protected areas (national park, sanctuaries, reserves forests, religiously sensitive sites, historical or archaeological sites, ecologically critically area, etc.), if any
3. Benefits of the Project for the economic and social advancement of the community;
4. Status of current environmental conditions in the area – air, dust, noise levels, status of soil in the area;
5. Adverse impact of the project on various habitats (natural and man-modified) e.g., home gardens, paddy fields, agricultural crops, plantations, natural forest, fish ponds) or soil resource in the locality;
6. Type of trees found in the home gardens, natural forests (if any): fruit trees, timber, medicinal trees/forest trees;
7. Threatened and endemic flora and fauna in the project area;
8. Impact of the project on Elephant Corridor/route under the proposed transmission lines;
9. Impact of the project by the Rohingya Community at Teknaf area;
10. Labor availability in the Project area or requirement of outside labor involvement;
11. Gender and/or women violence in the project area.

The details and/or summary of consultations for different areas held with issues raised or discussed and suggestions provided by the respective primary stakeholders are presented in Table 79. Public Consultations and FGDs minutes are attached in Annex-II.

Table 79: Details of Consultations Held for the Project

SN	Issues Discussed	Participants' Opinion, Comments and Suggestions
1.	Perception about the project	Participants mentioned that they need uninterrupted electricity supply for their business and daily life which will improve their economic and social status. They also mentioned that local people and industrialist would be

SN	Issues Discussed	Participants' Opinion, Comments and Suggestions
		encouraged to start new business if get available power supply. Consultants explained that proposed EZs in Chattogram and Cox's Bazar region would contribute in significant employment generation in the Southern region of Bangladesh.
2.	Kind of benefits would they expect from the project to their own communities	The participants want priority to work as labor and employee based on their qualifications during construction phase.
3.	Participant's specific concerns/fears over the electricity lines installation of transmission towers and construction of substations	Participants are afraid about the transmission line as it will go traversing over their homestead land. They are also worried about the installation of transmission tower as it will affect their agricultural cultivation. They are concern about the agricultural land that will be affected due to construction of substations.
4.	Community members' specific concerns/fears over the activities connected with civil construction work of the project and during construction work.	The participants expect that the contractor will purchase construction materials from the local vendors and during construction phase, local people will be engaged in construction work. They also expect that the direct affected families will get priority to engage in construction work.
5.	Community members observe any negative impacts on their settlements or their livelihood activities, what are their suggestions to avoid/minimize such impacts	The participants of Anwara suggested acquiring khas land that is located beside the proposed substations to avoid agricultural land as it is their earning source. On the other hand, the participants of Cox's Bazar Sadar opined to avoid agricultural land and proposed to acquire land in the adjacent mouza which is barren land.
6.	Project causes loss of crops, trees and other livelihood activities of the people– permanently or temporarily	The participants expect proper compensation for the loss of crops, trees and other livelihood activities. Some farmers will lose their total agricultural land in Anwara and they expect other livelihood opportunity from the project authority.
7.	Project causes relocation and resettlement of affected households due to land acquisitions or because they are living under the transmission towers/lines	The substations will affect agriculture land and there is no residential structure in that field. So, no relocation will be required under the project.
8.	General socio-economic conditions of the area	Most of the villagers are farmers in the proposed substation's adjacent areas. About 80% households are semi-pucca. Both Hindu and Muslims religious people are living adjacent to substations area but there is no indigenous population around the substations area. There are schools and health care centers in every substations area.

SN	Issues Discussed	Participants' Opinion, Comments and Suggestions
9.	Level of awareness among community members on sexually transmitted diseases like HIV/AIDS and their attitude toward it	Most of the participants are aware of sexually transmitted diseases like HIV/AIDS through electronic and print media. By the advertisement, the people have positive mentality toward it.
10.	Specific problems/issues that community members face in the use of electricity e.g., availability of electricity, power supply problems, costs on electricity or other energy sources, etc.	There is electricity supply in each proposed substation area and the villagers face some problems like load shedding and sometime unexpected bill from the authority.
11.	Current market prices of paddy land	The participants opined that current market price of paddy land is more than two to three times compare to mouza rate. The Consultant has conducted Property Valuation Survey (PVS) to collect information on land from different types of persons.
12.	Community participation in the project planning and implementation process	Community participation has been ensured during the planning stage of the project which will be carried out before implementation of the project for updating the ESIA and RP reports. In addition, stakeholder consultation will be conducted during implementation period of the project as part of future consultation plan.

Table 80: Details of KIIs conducted for the Project

Date	Stakeholder Details	Details of Participants	Issues discussed	Response/Suggestions
20.08.2020	Department of Forest (DoF)	Md. Humayun Kabir, Divisional Forest Officer, Cox's Bazar South Forest Division, Cox's Bazar 01819-655811; Mr. Togor Hasan, Range Officer, Panerchara, 01999-004014; Mr. Nazmul Hasan, Range Officer; Rajarkul, 01999-004014	–Route plan of transmission line –Impact of the project on reserve forest –Elephant movement route –Procedures to be followed by the authority to take transmission line on the land of forest	– PGCB should recheck proposed TL route to avoid reserve forest, elephant route as well as homestead trees; –PGCB has to submit detail route plan to the Ministry of Environment, Forests and Climate Change (MoEFCC) for laying the transmission lines over/ within the reserve forests. –DoF would carry out reforestation work under the transmission lines;

Date	Stakeholder Details	Details of Participants	Issues discussed	Response/Suggestions
20.08.2020	Department of Environment (DOE)	Sk. Md. Nazmul Huda, Deputy Director, Cox's Bazar District Office, 01556-457471	–Understanding the type of substation and extent of its impact on terrestrial and aquatic ecosystem by the substations and transmission lines –Impact due to cutting of trees	–PGCB has to take all necessary permissions from relevant authorities, and apply for ECC before starting the construction; –PGCB should develop route plan to minimize the adverse impact on biodiversity.
07.07.2020 18.08.2020 20.08.2020	Department of Agriculture Extension (DAE)	Md. Hasanuzzaman, Upazila Agriculture Officer, Anwara, Chattogram, 01712-907878; Golam Soruer Toser, Upazila Agriculture Officer, Sadar, Cox's Bazar, 01719-437665; Shafiul Alam, Sub Asstt. Agriculture Officer, Teknaf, Cox's Bazar, 01818-774286.	–Understanding and broad overview of the agricultural sector in Project Study Area –Information on the crops cultivate in the areas and agricultural practices –Impact in agriculture due to the establishment of the substations and transmission lines	– The agricultural land should be avoided for the construction of substations; –Minimum damage of crops should be considered during the laying of transmission lines and construction of angle and suspension towers; – Paddy production will be decreased and in some cases vegetable production will also be decreased. –PGCB should consider agriculture labor and sharecroppers who will lose their livelihoods.
08.07.2020 20.08.2020	Department of Fisheries	Md. Rashedul Haque, Senior Upazila Fisheries Officer, Anwara, Chattogram 01738-083301; Md. Delower Hossain, Senior Upazila Fisheries	–Primary fishing Sanctuary located in and around Project Site; –Understanding on the Fishermen community	–There is no designated fishing sanctuary in the Project sites. –No fishermen community exists in the Project impact area.

Date	Stakeholder Details	Details of Participants	Issues discussed	Response/Suggestions
		Officer, Teknaf, Cox's Bazar, 01819-943785		
17.08.2020	Roads and Highways Department (RHD)	Zulfiquar Ahmed, Executive Engineer, Chattagram, 01730782679	–Understanding the location of substations –Route of transmission line –Crossing of transmission line over National Highway	–Technical issues should consider while crossing the highways; –Traffic congestion should be avoided during laying the transmission lines over the highways. –PGCB should follow Highways Act 1925 (Bengal Act III of 1925), 2001
17.08.2020 19.08.2020	Bangladesh Water Development Board (BWDB)	M.A. Baker Siddique Bhuiyan, Executive Engineer, Chattogram, 01718236221; Probir Kumar Gossami, Executive Engineer, Cox's Bazar, 01318236247	–Understanding the location of substations –About morphological analysis of Bak khali, Sangu and Matamuhuri river –Any erosion in the bank of the River due to establishment of transmission tower.	– Technical issues should consider while crossing the rivers; –Traffic navigation should be avoided during laying the transmission lines over the rivers; –For setting up transmission towers on the bank of the rivers, morphological analysis has to be considered.
18.08.2020	Bangladesh Railway (BR)	Mohammad. Nazmul Islam, Chief Commercial Manager (East) Chattogram, 01711-506114	Route of Transmission line	– Technical issues should consider while crossing the railway, and PGCB would take permission from Ministry of Railway.
08.07.2020 16.08.2020 20.08.2020	Local Administration	Md. Saiful Islam, Upazila Nirbahi Officer, Teknaf, Cox's Bazar, 01851-966966; Md. Mahmud Ullah Maruf,	–Understanding about the project –Expectations from project –Positive and negative impact of the project	–PGCB should try to avoid agricultural land for the establishment of substations and transmission lines; –Public opinions should be taken before

Date	Stakeholder Details	Details of Participants	Issues discussed	Response/Suggestions
		Upazila Nirbahi Officer, Sadar, Cox's Bazar, 01733-373201; Tanvir Hasan Chowdhury, Deputy Commissioner (Land), Executive Magistrate, 01767-670950	–Role of local administration to the project	finalizing the route and area of substations; –Rohingya camp should be avoided during the planning of route; –PGCB should ensure proper compensation and grievance for APs as per law. –Local administration will play their responsibility regarding the process of land acquisition and transfer, compensation disbursement, etc.
16.08.2020 to 20.08.2020	Local Government Representatives	Rashed Mahmud Ali, Chairman, Hnila Union, Teknaf, Cox's Bazar 01819-118570; Tipu Sultan, Chairman, Zhilonja Union, Sadar Upazila, Cox's Bazar, 01819-330618; Md. Kaium Shah, Chairman, Barashat Union, Anwara, Chattogram	–Understanding about the project –Expectations from PGCB –Compensation packages to APs –Local people involvement in the construction works of the project –Positive and negative impact of the project.	–This substation will play role to develop economic and social condition of the project adjacent area. New industries will be constructed due to availability of power supply. – Develop route plan to minimize loss of homestead plants. –Local labor should involve by the PGCB during the construction period of the project. –PGCB should ensure proper compensation before construction work starts, and should have options for grievance during construction, operation and maintenance phases.

Date	Stakeholder Details	Details of Participants	Issues discussed	Response/Suggestions
				–Route plan should develop to avoid Rohingya community.

Inference

In the second stage of Public Consultation Meeting, it has been ensured and confirmed the local people that Project Authority has incorporated their response and suggestions arises in the previous PCM and FGDs in the draft ESIA report. Local people, basically, want to work as labor during construction phase, and their educated persons would want to work as staff in the substations during operation which is found key primary expectation by them. The involvement of the local people and their responsibility regarding the proposed substations project is mentioned in Stakeholder Engagement Plan, Grievance and Redress Mechanism, and socio-economic impacts of the report. Finally, a recommendation has been to engage eligible local people during project construction and operation stages.

Figure 116: Public Consultation Meeting at Sutrapur, Kaliakoir

Figure 117: Public Consultation Meeting at Parki Bazar, Anwara

Figure 118: Public Consultation Meeting at South Hnila, Teknaf

6.5 Focus Group Discussions

Focus Group Discussions (FGDs) were held with the communities who live in close to the proposed substations and transmission lines. FGDs were held in Gobadia Mauza of Barashat Union under Anwara Upazila of Chattogram District; Banglabazar Village of Jilangja Union under Cox's Bazar Sadar Upazila of Cox's Bazar District; Purbo Muktarpur Village of Cox's Bazar Sadar, Cox's Bazar; Ali Khali Village of Hnila Union under Teknaf Upazila of Cox's Bazar District; Sutrapur Mauza of Kaliakair Upazila of Gazipur District, and Baghchapai Mauza of same. A total of 52 participants were present in six (06) FGDs comprise of various occupation groups including businessman, farmer, teacher, day labor, transport labor, service holder, mason and shopkeeper, etc. The participation of the women was less in the consultation and FGDs due to religious and cultural matters. During implementation, INGO would recruit Female Communication Expert/Gender Specialist having proficiency in local language to outreach the women and ensure their participation with project. However, the overall discussions and outputs from the FGDs are— a) General perception about the project and the awareness about the proposed project; b) During construction stage all of the affected households get proper compensation; c) During winter season transmission line wire make noise which is disturbing; d) Benefits of the Project for the economic and social advancement of the community; e) Status of current environmental conditions in the area – air, dust, noise levels, status of soil in the area; f) Community Health and Safety; g) Labor availability in the Project area or requirement of outside labor involvement.; h) Women development; i) Trafficking; j) Rohingya Community, etc. List of participants are presented in the Annex II.

Table 81: Findings of Focus Group Discussions

Issues Discussed	Response of Participants
General perception about the project and the awareness about the proposed project	Most of the participants are not aware of the proposed substations. Only local government representatives are aware because the former consulting firm informed them regarding the issue. Motiur Rahman of Sutrapur, Kaliakair opined that" We are afraid about the transmission line as it will go over our homestead land".
Protected areas	There is no protected area like national park, sanctuaries, nature reserves, forest reserves, religiously sensitive sites, historical or archaeological sites surrounding the proposed substations. Sarwar Kamal of Ali Khali, Hnila opined that "There is no impact of the project in protected areas but reserve forest will be affected due to transmission lines".
Benefits of the Project	The participants think that if substation is constructed, the economic and social development will be increased. New industries will be constructed due to availability of power supply. Local people will get job in those industries and economically benefitted. Enamul Haque, teacher of Banglabazar, Cox's Bazar expressed that "In every development work there is a positive impact, hence, due to construction of substation new investment in different sectors will be increased as available power supply is mandatory for establishing any development entities".
Status of current environmental conditions	All the participants opined that current environmental conditions including air, dust, noise levels, status of soil in the respective areas are good.
Impact the habitats	Due to construction of substations paddy fields, agricultural crops will be affected, and agricultural production will be decreased. Due to transmission line, natural forest will be affected.
Type of trees found in the area	All types of fruit trees are found in the home garden of the proposed areas. Among that mango, jackfruit, betel nut, date palm, papaya, coconut, Jujube will be affected. In addition, due to transmission line from Chattogram to Teknaf reserve forest trees like teak, acacia, sal, Garjon will also be affected.
Threatened and endemic tree/ plant species in the project area	Out of 3,611 plant species of Bangladesh, 28 are endemic at or below species level which is about 0.78% of the total species. No endemics at generic or supra-generic level could be recognized from Bangladesh. Among these, 4 are tree species, 2 shrubs, 1 undershrub, 2 parasites, 2 woody climbers and 17 herbs. The endemics were recorded from greater Sylhet (5 species), Chattogram (Sitakhunda, Bariadhala hill, Ranguni) and Chattogram Hill Tracts (17 species), Dulahazara Safari Park of Cox's Bazar (2 species), Tangail (2 species), Dhaka-Jamalpur-Pabna (1 species) and Mymensing (1 species) districts. Within RoW of the proposed TL, no endemic trees were found or will be fall in danger due to project implementation.

Issues Discussed	Response of Participants
Indigenous, endemic, threatened animals in the project area	No indigenous, endemic, animals in the project area will be threatened due to project implementation.
Labor availability in the Project area or requirement of outside labor involvement	Labor is available in the project area and the participants expect that PGCB/Contractor will engage local labor to support the economic condition of the local community. Lutfor Rahman, a businessman in Hnila opined that "Male labour is available here for construction works and they work BDT 600 per day". Md. Monjur Alam, a mason of Gobadia, Anwara opined that "Labor is available in this area and due to Covid-19 many people have lost their jobs and waiting to engage them in any work including labour".
Project to Ethnic minority or Rohingya Population	There is no ethnic minority adjacent to substations area. Kutupalong Rohingya Camps may be affected, as transmission line pass with the periphery of this Camps.
Trafficking Status	There is no trafficking incident in the proposed substations area. But the vulnerable households, women and children may have chance to fall in a victim of trafficking.
Women Development	Women in the substations are not remaining themselves in household chores rather they have involved themselves in different types of development works including in different industries. Ziaur Rahman, a businessman of Hnila, Teknaf opined that women in this area are working in Madhumoti Salt industry, but 95% women are housewife. In Bangladesh gender violence is a common incident and the participants of the FGDs also admitted so. There are some vulnerable women in each of the proposed substations area.
Expectation from the project	Local people want priority to work as labor and employee based on their qualifications during construction phase.

Inference

The findings of the FGD show that in the project area, there are vulnerable social groups, by definition, like women, children, elderly, poor peoples, but according to the income class they are not live in vulnerable. Also, there are no ethnic and indigenous people found in the project areas. Migrated Rohingya Community may be affected by the intervention of the project from Cox's Bazar to Teknaf 132kV transmission line. The project will not require relocation as no residential house will be displaced under this project. Hence, vulnerable social groups are not major concern for this project. However, GRM can be followed by PGCB if necessary while any issue arises regarding these vulnerable groups. In addition, information from respective Union Parishad (VGD-Vulnerable Group Development program) will be checked to verify the vulnerability.

Figure 119: Focus Group Discussions in the Study Area

6.6 Future Consultation Plan for PGCB and Contractor

The stakeholder consultation and engagement are an ongoing process and will continue throughout the project's construction as well as operation and maintenance phases. The ongoing consultation process could be scheduled on monthly or quarterly basis with the stakeholders including but not limited to the concerned government departments, local administration and the community representatives from the proposed project area.

The overarching goal of consultations and community engagement is to support and facilitate the project's design and implementation, to reduce conflicts and project opposition, and to increase project's acceptability. Stakeholder consultations and participation will take place during implementation through the following means:

- Grievance Redress Mechanism (GRM) at the community level and project level;
- Awareness campaign for all stakeholders;
- Identify all the non-traceable 101 land owners and conduct detailed consultation and safeguard due-diligence
- Formal interactions through periodic workshops, consultation sessions with wider stakeholders especially institutional ones such as other Government Department relevant NGOs;
- Informal interactions during the construction phase and also during the maintenance activities;

Periodically, the Project may also hold formal workshops to consult a wide range of stakeholders on project activities. These workshops will involve PAPs from communities, DoE, PGCB, and representatives of other relevant departments/entities to share the progress and elicit the views of all the stakeholders for the improvement. Tentative future consultations plan of the project is presented in Table 82.

Table 82: Future consultations plan of the project

Stage	Target stakeholders	Topic(s) of Engagement	Method(s) used	Location/ Frequency	Responsibilities
Stage 1: Project preparation (Project design, Scoping, Resettlement Planning, ESIA, LMP, GBV Plan and SEP preparation and Disclosure)	Project Affected People: People potentially affected by land acquisition, when triggered People residing in project area Vulnerable households including women	• ESIA, LMP, Gender and GBV prevention plan, SEP, RP disclosures; • Land acquisition process; • Assistance in gathering official documents for authorized land use; • Compensation rates and methodology; • Compensation packages; • Project scope and rationale; • Project E&S principles; • Resettlement and livelihood restoration options; • Grievance mechanism process;	• Public meetings, separate meetings for women and vulnerable • Face-to-face meetings • Mass/social media communication (as needed) • Disclosure of written information: brochures, posters, flyers, websites • Information boards or desks • Grievance mechanism • Local news paper The following modes to be adopted specifically for the vulnerable groups: • Robust engagement with local community-based organizations. • The project would arrange separate consultation sessions for different target groups • Resources allocation towards local administration representatives and	• During preparation and detailed design stage- that would affect the area. • Continuous communication through mass/social media and routine interactions throughout RP development as needed.	PGCB staff responsible for land acquisition or its consultant

Stage	Target stakeholders	Topic(s) of Engagement	Method(s) used	Location/ Frequency	Responsibilities
			councilors. • Provision of transportation or transportation cost particularly for the disabled, marginalized and the elderly ones including women • Engagement of local NGO's and CBO's who work with vulnerable people at the community level to help disseminate information and organize consultations • Separate consultation with men and women to be arranged • Manageable and gendered FGD to be arranged so that women can speak freely • The project must have adequate means to reach the disabled ones in the community. If need be, teams must visit the disabled ones in their habitat • Information may be printed in Braille to allow the blind		

Stage	Target stakeholders	Topic(s) of Engagement	Method(s) used	Location/ Frequency	Responsibilities
			ones to have access to the project details		
	• Other Interested Parties (Internal) • Press and media • NGOs • Businesses and business organizations • Workers' organizations • Academic institutions • National Government Ministries • Different Government Departments • General public, Rohingya communities, jobseekers • Women's groups or organizations	ESIA, RP, LMP, SEP disclosures Grievance mechanism Project scope, rationale and E&S principles	• Public meetings, • Mass/social media communication • Disclosure of written information: Brochures, posters, flyers, website • Information boards • Grievance mechanism • Notice board for employment recruitment	• Throughout RP/ESIA/LMP/SEP and GBV prevention plan development as needed; • Project launch meetings at local PGCB office and PGCB head quarter; • Quarterly meetings in affected villages and affected communities • Disclosure meetings in local, national level	PGCB responsible for land acquisition or its consultant
	• Other Interested Parties (External) • Other Government Departments from which permissions/clearances	• Legal compliance issues • Project information scope and rationale and E&S principles • Coordination activities	• Face-to-face meetings • Invitations to public/community meetings • Submission of required reports	Disclosure meetings Reports as required	PGCB and PIU

Stage	Target stakeholders	Topic(s) of Engagement	Method(s) used	Location/ Frequency	Responsibilities
	are required; • Other project developers, donors	• Land acquisition process • Grievance mechanism process • Disclosures of E&S documents			
STAGE 2: Construction and mobilization activities	• Project Affected People • People potentially affected by land acquisition • People residing in project area • Vulnerable households	• Grievance mechanism • Health and safety impacts (ESMP, community H&S, community concerns) • Employment opportunities • Project status	• Public meetings, open houses, trainings/workshops; • Separate meetings as needed for women and vulnerable; • Individual outreach to PAPs as needed; • Disclosure of written information: brochures, posters, flyers, website Information boards in PGCB Notice board(s) at construction sites, • Grievance mechanism and as guided with ESF documents mainly RP and ESIA.	• Quarterly meetings during construction seasons • Communication through mass/social media as needed • Notice boards updated weekly • Routine interactions • Brochures in local offices	• PGCB, PIU, ESU, or its consultants' contractors, • RP implementing NGO
	Rohingya Camp authority and communities	Project activities, duration, OHS measures, fire safety measures, etc.	Face to face meetings, meeting at site management, RRRC and IOL office	As and when required. 1st meeting before the construction starts	PGCB, PIU, ESU or its consultant, contractors,
	Vulnerable communities and project affected people	• Vulnerable group has to be identified considering the households which are (i)	Face to face, consultation, FGD etc.	Before the construction starts and during the	• PGCB, PIU, ESU or its consultants,

Stage	Target stakeholders	Topic(s) of Engagement	Method(s) used	Location/ Frequency	Responsibilities
		living below the official poverty line; (ii) women headed households living below the official poverty line; and (iii) headed by elderly persons or disabled persons. • Announcement of vacancies (skilled/unskilled) at proposed site; • Announcement of contract work for small scale work associated with the proposed Project;		construction period	contractors, • RP implementing NGO
	• Other Interested Parties (External) • Governmental committees for land use and compensation • representatives in villages	• Project scope, rationale and E&S principles • Grievance mechanism • Project status • Bank compensation requirements	• Face-to-face meetings • Joint public/community meetings with PAPs	As needed (monthly during construction season)	PGCB, PIU, ESU or its consultant, contractors
	• Other Interested Parties (External) • Press and media • NGOs • Businesses and business	• Project information - scope and rationale and E&S principles • Project status • Health and safety impacts	• Public meetings, open houses, trainings/workshops • Disclosure of written information: brochures, posters, flyers, website,	Same as for PAPs	Same as above

Stage	Target stakeholders	Topic(s) of Engagement	Method(s) used	Location/ Frequency	Responsibilities
	organizations • Workers' organizations • Academic institutions • National Government Ministries • Various Government Departments • General public, tourists, jobseekers	• Employment opportunities • Environmental concerns • Grievance mechanism process	Information boards Notice board(s) at construction sites • Grievance mechanism		
	• Other Interested Parties (External) • Press and media • NGOs • Workers' organizations • Academic institutions • Local Government Departments • General public, tourists	• Grievance mechanism process • Issues of concern • Status and compliance reports	• Grievance mechanism • PGCB website • Face-to-face meetings • Submission of reports as required	As and when required	PGCB Staff, PIU, ESU or its consultant

6.7 Disclosure

The draft and final ESIA report will need to be disclosed in an accessible place (e.g., local government offices, libraries, community centers, etc.), and the executive summary translated into local language (Bengali) for the project-affected people and other stakeholders. The translated summary of ESIA report will be disclosed in DC offices, Upazila and Union Parishad of respective project areas. The PGCB and AIIB will also post the final ESIA document (at least 60 days prior to Board consideration (regular procedure), Closing Date (Streamlined Procedure), or management approval date (delegated authority) as part of their disclosure policy (e.g., on its website), and the same will be submitted to the Department of Environment (DoE) for approval and disclosure at local (DC offices, Upazila Parishad) and national level, so affected people, contractors, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation. The effectiveness of the ESIA is directly linked to the degree of continuing involvement of those affected people directly or indirectly by the project. During the preparatory stage, consultations were held at local, sub district and district level. Several additional rounds of consultations with stakeholders will be planned in ESIA finalization, and during construction as well as operation phases of the Project.

Distribution of the disclosure materials will be through making them available online under the COVID-19 situation. Upon improvement of the situation, distributions of the disclosure materials will be through making them available at venues and locations frequented by the community and places to which public have unhindered access in the usual manner. Free printed copies of the SEP in Bangla and English will be made accessible for the general public at the following locations:

- PGCB head quarter and local offices
- Affected District Administration office
- The local Project offices;
- Affected Upazila Headquarters
- Affected Union Parisad Offices
- Local NGO offices; and
- Other designated public locations to ensure wide dissemination of the materials.
- Newspapers, posters, radio, television (where relevant);
- Information centers and exhibitions or other visual displays;
- Brochures, leaflets, posters, nontechnical summary documents and reports;
- Official correspondence, meetings

Chapter 7
Environmental Impact Assessment

This chapter discusses potential impacts of the proposed project on various aspects of environment including air, water soil, flora, and fauna. Also discussed in this chapter are the mitigation and control measures to avoid, minimize, or mitigate these impacts. The potential impacts of the project on people and socio-economic resources are discussed in the next Chapter.

7.1 Summary of Potential Impacts

The project's potential impacts and their significance have been assessed using the methodology described in Section 1.7. A summary of these impacts and their significance along with the mitigation measures are presented in Table 83 the environmental impacts are discussed in the subsequent sections while the social impacts are discussed in the next Chapter as stated earlier.

Table 83: Summary of potential environmental impacts, their significance and mitigation measures

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Impacts from Siting					
Enhanced grid connectivity ensuring that additional power generation reaches the end users.	Severe	Major	Critical (positive)	Adequate maintenance of the facilities in accordance with the standard operating practices of PGCB	-
Impact on natural vegetation and wildlife (Asian Elephant) due to permanent clearing of land for siting of substations and towers and temporary clearing along RoW	Severe	Moderate	Medium	Minimizing clearance of natural vegetation particularly of WS and RF; near river banks and khals; selecting barren lands	Low-Medium
Greenhouse gas emissions (SF6) from site clearing, materials life cycle and power leakage	Mild	Moderate	Medium	Steps to minimize the amount of SF6 released include replacing older equipment with more efficient, better sealed units, improving processes to minimize emissions during manufacturing,	Medium

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				commissioning, and maintenance of switchgear, and reducing leaks while in service.	
Impacts from Construction					
Land use (substations)	Severe	Moderate	High	Barren and uncultivated land will be preferred to establish substations	Medium
Land use (transmission lines)	Mild	Moderate	Medium	Transmission lines will be aligned to minimize impacts on cultivated land and natural forests	Medium
Risk of soil contamination and soil erosion	Mild	Moderate	Medium	Pollution prevention plan and implementation of environmental code of practice (ECPs) (ECPs are discussed later in the document). Excavated top soil in the cultivated areas will be stored separately, to be used as the top most layer during backfilling. Backfilled soil will be compacted to avoid soil erosion.	Negligible
Risk of water contamination	Mild	Moderate	Medium	Implementation of pollution prevention plan and of ECPs	Negligible
Damage to canals (water courses) and tube-wells	Severe	Moderate	High	Works close to khals and tube-wells will be avoided to the extent possible; No excavated material or debris will be released in khals or wells; Any damage caused by the construction activities	Low

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				will be immediately repaired	
Dust and air pollution from construction activities	Mild	Moderate	Medium	Maintenance of construction equipment and vehicles; noise control measures as specified in ECPs.	Negligible
Noise and vibration from construction activities	Mild	Moderate	Medium	Maintenance of construction equipment and vehicles; noise control measures as specified in ECP.	Negligible
Generation of spoils	Severe	Moderate	High	To be used as filling material where needed; disposal at approved locations; implementation of ECP.	Negligible
Generation of solid waste and hazardous waste	Mild	Moderate	Medium	Minimize generation of waste. Proper collection and disposal of wastes in approved sites or to vendors; implementation of Waste Management Plan and ECPs.	Negligible
Impact on wildlife	Severe	Minor	Medium	Minimize vegetation clearance; control of noise and artificial lighting, ban on hunting, and checks for breeding birds during vegetation clearance implementation of ECPs.	Low-Medium
Impact on biodiversity of reserved forest	Severe	Moderate	High	As much as possible, damage will be minimized during the construction work	Medium
Site clearance and Restoration	Severe	Minor	Medium	Cleaning of the construction sites; implementation of ECPs	Negligible

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Disturbance of Elephant Movement	Severe	Minor	High	Crossing of elephant corridors/or routes to be avoided during the selection of proposed Anwara to Cox's Bazar 230kV transmission line	Low
Community health and safety from construction traffic and activities	Severe	Moderate	Medium	Traffic, noise and dust control measures in accordance with ECPs; Public safety and occupational health and safety (OHS) management plan to be implemented.	Low
Workers health and safety	Severe	Major	High	OHS plan to be implemented; Implementation of ECPs.	Medium
Traffic congestion	Severe	Moderate	High	Contractor to prepare and implement traffic management plan; Construction activities to be scheduled to minimize traffic disruption; coordination to be maintained with relevant authorities (e.g., Traffic Police).	Minor
Additional load on local resources	Mild	Moderate	Medium	Contractor to obtain water in a manner not to affect the local communities; liaison with local communities to be maintained; GRM to be established.	Negligible
Greenhouse gas emissions (SF6) from site clearing, materials life cycle and power leakage	Mild	Moderate	Medium	During Project administration, leak sources will be identified in a timely manner using handheld leak detector and monitoring of SF6 level will be monitored	Medium

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				regularly (subject to requirement). Follow guidelines for handling of SF6: including use of Best Available Technique (BAT). An offset for the unavoidable GHG emissions e.g. planting trees or mangroves to offset impact of SF6.	
Impacts from O&M Activities					
Impact from SF6	Mild	Moderate	Moderate	Ensure leakage prevention in accordance with international standards. Replacing older equipment with more efficient, better sealed units, improving processes to minimize emissions during manufacturing, commissioning, and maintenance of switchgear, and reducing leaks while in service. An offset for the unavoidable GHG emissions e.g. planting trees or mangroves to offset impact of SF6.	Negligible
Waste management at Substations	Severe	Moderate	High	Waste management plan as part of Standard Operating Procedures (SOPs)	Negligible
Risk of bird collision and electrocution	Severe	Moderate	High	Placing of bird markers on the transmission line cables/conductors	Negligible

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				where necessary (e.g., reserve forest, at river crossing, etc.). Design parameters (distance between live parts) to minimize bird electrocution	
Impacts from tree cutting during maintenance activities	Mild	Moderate	Medium	Compensatory tree plantation to be carried out where appropriate	Medium
Impacts from electromagnetic fields from transmission lines on community health and safety	Severe	Minimal	Negligible	Complied with WHO recognized standards on EMF through design considerations	Negligible
Audible noise and radio interference from the transmission lines	Severe	Minimal	Negligible	Design considerations to comply with the standards	Negligible
Workers health and safety during maintenance	Severe	Major	Low	Implementation of Standard Operating Procedures (SOPs) of PGCB.	Low

7.2 Environmental Impacts from Project Siting

The environmental impacts associated with the project siting are discussed below.

7.2.1 Improvement of Electricity Grid in Project Area

As stated in Section 1.3, the supply of power in Bangladesh has not been able to keep pace with the rapid growth in demand and consumers experience frequent power outages. In addition to shortfalls in power generation, Bangladesh's aging and inadequate transmission and distribution (T&D) systems impose severe constraints on power delivery to consumers. Due to lack of investment and inadequate maintenance, the reliability of the system has deteriorated substantially, resulting in several instances of major system collapse. Furthermore, as stated in end paragraph of Section 1.3, The Chattogram region is a major commercial and industrial hub with the Government taking initiatives to set up multiple economic zones (EZs) and upgrade port facility and transportation network. An aged and low-capacity grid network in this region (especially Anwara, Cox's Bazar and Teknaf) is one of the major problems that PGCB is facing and a key priority. Due to lack of electricity supply, economic growth of this area is stagnant. Operational bottlenecks of the region were identified during a network analysis performed by PGCB. The proposed project, once complete, will address these problems by adding new substations and transmission lines. This will not only

overcome the limitations of supplying quality and uninterrupted electricity to the end users but will also cater to increasing demand in the regions while also increasing the operating contingency of the system. This project will also assist PGCB to introduce reactive, predictive and proactive O&M approaches.

7.2.2 Impact on Natural Vegetation and Wildlife

The construction of new substations will permanently alter the land use and landform of the selected sites. Similarly, laying of overhead transmission lines will also similar impacts; in particular the natural vegetation and trees under the overhead transmission line will permanently be affected. However as discussed in Section 5.4 and shown in Table 48 and Table 49, most of the affected area is under cultivation (substations and overhead transmission lines). The natural vegetation and habitats in the area are mostly reserve forest, river and khals, small ponds, and on the periphery of cultivation fields, etc. In view of the altered nature of the habitat, the vegetation found in the project area mostly belongs to Forest area (Chunati Wildlife Sanctuary) i.e., hill forest, bushy land cultivable/plantation forest, roadside forest; and homestead/settlement vegetation, crop-field vegetation, as discussed in Section 5.7.3 and shown in Table 59. Therefore, the project will have a significant impact on the natural vegetation of the area especially in the reserved forest; the significance of this impact has been assessed as High, as shown in Table 83.

With respect to the faunal resources, no designated important bird area (IBA) and Ecologically Critical Area (ECA) is existed along the RoW of the proposed transmission line and the location of the proposed substation sites, except habitat of Asian Elephant and their corridors in the Chunati Wildlife Sanctuary, as discussed in Section 5.7.6. Asian Elephant is listed as endangered in IUCN's Red List and as well as in Bangladesh's red list. The conservation value is very important for the balance the biodiversity of this reserve forest. Therefore, the project will have significant impact on the faunal species of the area; the significance of this impact has been assed as High, as shown in Table 83. Migratory water birds have minimal chance of impact by the laying of transmission line.

Mitigation

The following measures will further reduce the negative impacts of the proposed project on natural vegetation (reserve forest) and habitat of wildlife (Asian Elephant) of the area:

- Clearing and removing of natural vegetation will be minimized
- Tree cutting will be minimized
- Selecting barren/fallow land for establishing substations and aligning transmission lines.
- Compensatory tree plantation will be carried out (e.g., along the periphery of substations).
- Environmental Code of Practice (ECP) (discussed later in the document) will be implemented.

For Bypassing the Reserve Forest

The width of RoW for the transmission lines on forest land can be 35m for 230kV transmission line. Up to 230kV twin bundle 2m width clearance below each conductor or conductor bundle can be considered while transmission line pass in the reserved forest. The trees of such strips would have to be felled but after stringing work is completed, natural regeneration will be allowed to come up.

Felling/pollarding/pruning of trees will be done with the permission of Forest Department wherever necessary to maintenance of the transmission line.

During construction of transmission line, pollarding/pruning of trees located outside the above width of the strips, whose branches/parts infringe with conductor stringing, shall be permitted to the extent necessary, as may be decided by local forest officer. Pruning of trees for talking construction/stringing equipment's through existing approach/access routes in forest areas shall also be permitted to the extent necessary, as may be decided by the local forest officer.

In the remaining width of RoW, trees will be felled or lopped to the extent required, for preventing electrical hazard minimum 4.6m clearance between conduction and trees for 230kV transmission line can be considered. The maximum sag and swing of the conductors are to be kept in view while working out the minimum clearance mentioned above.

To avoid any hazard, felling/cutting/pruning of those trees which because of their height/location may fall on conductors shall also be permitted as may be decided by local forest office. In the case of transmission line to be constructed, where adequate clearance is already available, trees will not be cut except that minimum required to be cut for stringing of conductors. In addition, insulated conductors shall only be used to prevent electrocution of animals while passing wildlife sanctuary and corridors. The foundations need to be strengthened for landslide risks while towers will be located in hilly areas. A compensatory replantation ratio of 1:5 will be carried out to mitigate the ecological loss of felling trees.

Residual Impacts

After implementing the above listed mitigation measures, whatever small impacts the proposed project might have on the natural vegetation and wildlife of the area, will be further reduced. The residual impacts have therefore been assessed as Mild to Medium, and significance of impact would be Negligible as shown in Table 83.

7.2.3 Greenhouse Gas (GHG) Emissions

The greenhouse gas (GHG) emissions from implementation of the proposed project are estimated using the World Bank's Guidance Manual: Greenhouse Gas Accounting for Energy Investment Operations, Version 2.0 January 2013 (hereinafter "Guidance Note") and IPCC 2006 guidelines. Three sources of emissions are considered for accounting GHG from the Project. The sources and the estimates are given below.

Direct Generation Emissions Associated with Losses

Impacts relevant to this source result from technical loss reductions in the transmission line facilities being supported by the project. Losses can be reduced by upgrading overloaded or not properly sized transformers, increasing conductor capacity, installing reactive power equipment, and undertaking other types of maintenance interventions. The losses in the transmission lines in Bangladesh are generally estimated as 3.13 percent[26]. The direct generation emissions associated with these losses (emission factor: 0.6545 tCO_2/MWh) is estimated to be 0.2 million tCO_2e per year

[26] Source: https://www.pgcb.org.bd/PGCB/upload/Reports/MIS-March'2014.pdf.

and 6.03 million tCO_2e for the entire life of the project, assuming that the life of the project is 30 years. (1820 MVA = 1456 MW. 1456 x 365 x 24 = 12,754,560 MWh. 0.6545 x 12,754,560 x 0.0313 = 261,288 tons of CO_2 equivalent; 261,288 x 30 = 7.83 million tons of CO_2 equivalent.)

Emissions from Land Clearing for Civil Works

Construction of towers, transmission line RoW, and some other project facilities such as grid stations require land clearing. The total land to be cleared for RoW is 778.20 ha (7.78 km^2) and for the substations is 16.18 ha (0.16 km^2). The clearing may affect the carbon stored in biomass and soil. Emissions from land clearing can be calculated as a one-time emission of CO_2 based on the available dry biomass carbon for the total cleared areas for construction. According to IPCC guidelines, temperate climate has 100 tons/ha of dry biomass, of which average carbon content is 47 percent. The conversion factor for carbon weight to CO_2 weight is 44/12. Total land clearing emissions for 7.94 km^2 are 0.136 million tCO_2e. (7.94 x 100 x 100 x 0.47 x 44/12 = 136,832 t tCO_2e = 0.136 million tCO_2e.)

Sulfur-hexafluoride Fugitive Emissions

Sulfur-hexafluoride (SF_6) is used in insulation and current interruption applications in transmission and distribution systems. SF_6 is used in gas-insulated switchgear and substations, gas circuit breakers, and (less frequently) in high-voltage, gas-insulated lines. SF_6 may escape as fugitive emissions during the manufacturing, installation, use, maintenance, and disposal of this equipment. Sealed distribution equipment may not emit any SF_6 during use, but transmission equipment often requires periodic refilling and hence has higher rates of fugitive emissions during use. The amount of SF_6 emitted during operation and decommissioning is related to the number and type of equipment used, as well as the maintenance and recycling procedures. SF6 emissions could occur in all transmission and distribution projects, depending on the type of equipment installed, refurbished, or maintained. Countries report SF_6 emissions from the power sector in their national emissions inventories, and emissions factors from these inventories provide one way to estimate their magnitude (emission factor is 0.119 gSF_6/MWh). Circuit breakers containing SF_6 will be used in the grid station and the SF_6 emissions are estimated as 0.026 million tCO_2e per year and 0.78 million tCO_2e for the entire life of the project (30 years). (1.8 kg of SF_6 = 40 tCO_2e); 0.119 g x 12,754,560MWh = 1,517,792.64 g or 1517kg SF_6; 1517kg of SF_6 x 40/1.8 = 33,728 tCO_2e or 0.033 million tCO_2e per year; 0.033 x 30 = 1.01 million tCO_2e for 30 years).

Total Emissions from Proposed Project

The total Project emissions from above three sources are estimated to be 8.97 million tCO_2e for the entire life of the project (30 years). Significance of these emissions has been assessed as Medium, as shown in Table 83. No mitigation measures are proposed to address these emissions. Moreover, this is an energy efficiency enhancement project, hence compare to the scenario of current outdated old lines, the emissions shall be reduced.

7.3 Impacts during Construction Phase

7.3.1 Soil Contamination and Erosion

During construction phase, there is a high risk of accidental spills and leakages (from Transformer oil (electrical transformers; SF6 (circuit breakers); battery acid (battery backup systems); minor

maintenance chemicals (paints, lubricants, gases); waste transformer oil) that may occur from fuel and oil tanks, vehicles and machinery and storage of chemicals used in construction areas, yards, batching plants, worker camps, and residential areas and from storage sites. These spills can pollute soils and contaminate surface water and groundwater in the area. Waste effluents from temporary facilities such as camps and offices can also contaminate soil and surface run off.

Disturbance of soils during construction including (and particularly) from movement of vehicles, may lead to destruction of the integrity of upper soil layers. Damaged soil is more readily eroded and washed into water courses during rainfall events and can also form dust during dry periods. This effect will be significant due to the need of access roads construction which will further damage the integrity of soil apart from vehicle movement.

Excavation for construction of transmission line towers particularly near the rivers and khals as well as hills of reserve forest can cause soil erosion which can adversely affect the water quality of the rivers/water bodies and land sliding respectively. High rainfall events can also potentially cause accelerated erosion particularly in excavated areas. The significance of impact on soil pollution and soil erosion is characterized as Medium, as given in Table 83.

Mitigation

The following mitigation measures will be implemented:

- Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected.
- Contractor will be required to implement the measures prescribed in the Environmental Code of Practices (ECP), which will be included in the contracts. Detailed ECPs are included in the Annex III.
- Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil
- Contractor will confine the contaminants immediately after such accidental spillage
- Contractor will collect contaminated soils, treat and dispose them in environment friendly manner
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation
- Top soil to be stripped and stockpiled where practical.
- Temporary stockpiles to be protected from erosion.
- For sewage waste, appropriate treatment arrangement such as septic tanks and soakage pits will be installed on site. Water will percolate into the ground so there will be no discharge. Alternatively, sewage from construction camps and other facilities will be collected and transported to nearby municipal sewage treatments plans.
- The monsoon season will be avoided to carry out construction activities particularly excavation to the extent possible to minimize soil erosion.

Residual Impacts

After implementation of the above mitigation measures, the impacts of the project on the soil contamination and soil erosion will be adequately mitigated. Hence the significance of residual impacts is expected to be Negligible, as shown in Table 83.

7.3.2 Water Contamination

The proposed transmission route crosses five river and several canals, as mentioned in Section 5.2.1 and shown in Table 43. During construction, there is a high risk of contamination of these water bodies from the following activities:

- Run-off from excavation, crushed and ground rock material from drilling
- Run off from earthmoving and spoil handling, open excavations, concrete batching for new tower construction
- Run-off from dampening systems to control dust emissions; dumping of spoil material
- Sanitary effluents from construction workers' camp
- Oil and chemical spills; washing of vehicles and other machinery

All other activities causing soil contamination discussed earlier can also cause water contamination.

The significance of impact on soil pollution and soil erosion is characterized as Medium, as given in Table 83.

Mitigation

The following mitigation measures will be implemented to address the water contamination caused by the project:

- Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected.
- Contractor will be required to implement the measures prescribed in ECP, which will be included in the contracts.
- Contractor will be required to comply with the national and WBG EHS Guidelines for waste water discharges in to the rivers.
- Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the water
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation
- For the treatment of effluent to be discharged, sedimentation ponds will be provided to allow sediment to settle for periodic removal for disposal in designated site spoil areas. Water being discharged from these ponds will be regulated to ensure they are within turbidity limits.
- Oil and water separators and settling ponds will be installed where appropriate to minimize the risk of contaminated construction water entering the river or groundwater and degrading water quality

- Construction works near river and khals will be carried out ensuring that no debris or excavated soil fells in water.

Residual Impacts

After implementation of the above mitigation measures, the impacts of the project on the water pollution will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in Table 83.

7.3.3 Damage to River/Canals and Tube-wells

The proposed transmission lines will cross several river/khals (water courses), as described in Section 5.2.1. A total of 18 shallow tube-wells falls under the RoW of transmission lines but no deep tube-wells exist in the project area which provide irrigation water to the crops of the area. Notwithstanding, the construction activities can potentially cause damage to these khals and tube-wells, which can in turn affect the irrigation system of the area and ultimately affecting the crops of the area. Significance of these impacts is High, as shown in Table 83, in view of the importance of these structures for the agriculture production of the area.

Mitigation

Tube well will be decommissioned to prevent the contamination of groundwater. Proper well decommissioning consists of removing pump, fittings, pipes and debris from tube well casing. The tube well is then filled from the bottom up with sealant materials. Sealing materials are used to prevent water from migrating into or between aquifers. They are commonly less permeable to water than the soil or rock on site. Bentonite chips or pellets, neat cement, concrete grout, and high solids bentonite slurry are approved for tube well decommissioning. A new tube well within a 500 m radius from the existing tube well will be constructed. The same volume of water will be provided as this area consists of the same aquifer. No additional impacts will be expected due to the tube well relocation. Following measures will be implemented to avoid/minimize impacts on khals and tube-wells of the area:

- During river crossings, the sags to be considered to ensure sufficient vertical clearance.
- Any excavation and other construction work near khals and tube-wells will be planned and implemented in a manner to avoid any damage to these structures.
- The vehicle movement near khals and tube-wells will be minimized. If unavoidable, it will be closely monitored to avoid any damage to these structures.
- No excavated material or debris will be released into the khals.
- The contractor will repair and restore any damage the construction activities may cause to khals and tube-wells. It will be ensured that the construction activities do not affect the water flow/availability in the khals or from the tube-wells.

Residual Impacts

After implementation of the above mitigation measures, the impacts of the project on khals and tube-wells will be mostly mitigated. Hence the significance of residual impacts will be Low, as shown in Table 83.

7.3.4 Dust and Air Pollution

Air quality will be affected, and dust will be generated during construction activities. Major sources of air quality pollution are drilling activities, excavations, emissions from construction related traffic and equipment. The construction activities will also generate airborne dust and particulate matter. Dust raised from the above activities will have impacts on crops, animals and public health. These impacts will be most severe for the sensitive receptors in the area. No sensitive receptors found within the periphery of RoW of transmission lines and substation sites. But adjacent community can be affected by the impact of dust and air pollution due the construction activities of the transmission lines and substations. Therefore, the significance of the impact has been assessed as Medium, as shown in Table 83.

Mitigation

To mitigate deterioration of air quality and generation of dust, the following measures will be taken:

- The equipment and vehicles used during the construction process will comply with the national as well as WBG EHS Guidelines on exhaust emissions.
- Concrete batching and asphalt plants will be located minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers.
- Contractor will implement dust prevention measures such as watering of roads near the residential areas and spraying of water on loose material where required and appropriate.
- Loose material such as sand will be covered with tarpaulin when being transported on trucks.
- Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards and WBG EHS Guidelines.
- Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment).
- A GRM (discussed later in the document) will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase.
- In addition, the measures in ECP on air quality management will be implemented.

Residual impacts

With the help of the above mitigation measures, the potential impacts associated with air quality deterioration are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in Table 83.

7.3.5 Noise and Vibration

The construction of the Project has the potential to generate significant noise and vibrations from blasting and piling activities. Off-site movement of construction related traffic also has the potential for significant noise generation. Potential noise levels have been estimated from various stages of construction activities and are presented in Table 84. In general, the noise levels are within the standards at a distance of 400m from the construction activities.

Table 84: Estimated Noise Levels during Construction

Stage of work	Description of works	Key Activities	Activity LAeq, 10m, dB	Predicted noise at 400m, dB	Predicted noise at 800m, dB
Site preparation	Excavation and moving soil and fill	Earthmoving	90	59	47
	Site compounds and set-up	Excavation works	90	49	37
		Transport and handling of soil/materials	70	29	30
		Storage of soil/ materials	88	47	48
		Preparation of materials (cutting, grinding)	86	45	46
Tower foundation construction	Ground preparation	Earthworks	90	51	51
	Tower foundation construction	Transport and handling of soil / materials	70	30	30
	New access road	Concrete batching	95	56	42

Vibration from drilling and excavation activities is a major source of concern if any structures and trees are located within close proximity to the blasting locations. The vibrations may cause damages to the structures and trees. The impacts of noise and vibration from construction activities has been estimated as Medium, as shown in Table 83.

Mitigation

To mitigate impacts associated with noise generation, the following measures will be taken:

- The equipment and vehicles used during the construction process will comply with the national standards as well as WBG EHS Guidelines on noise.
- Contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities. The noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around drilling equipment.
- Regular noise monitoring will be carried out near the sensitive receptors listed in Table 84.
- A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase.
- In addition, the measures in ECP on noise quality management will be implemented.

Residual impacts

With the help of the above mitigation measures, the potential impacts associated with noise generation are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as given in Table 83.

7.3.6 Spoil Generation

Excavations of the overhead tower foundations will generate excess spoils. Disposal of this spoil in cultivation fields will affect the crops and irrigation. Similarly, spoil disposal in built-up area will cause hinderance and traffic congestion. The spoils will also act source of dust. The significance of the impact has been assessed as High, as shown in Table 83.

Mitigation

The first step towards addressing the impacts of spoil is to minimize the generation of spoils by recycling the excavated soil to the maximum extent possible by using it as filling material in the substations. The excess spoils should be stored in the lands provided by local communities or in the areas approved by the project management/local authorities.

Residual Impacts

With the help of the above mitigation measures, the potential impacts associated with spoil generation are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in Table 83.

7.3.7 Solid Waste Management

The construction works generate large quantities of excess materials from construction sites (concrete, steel cuttings, discarded material, vegetation), demolition wastes (dismantled transformers and other facilities), and wastes from field camps and construction yards, including garbage, recyclable waste, food waste, and other debris. A large part of this waste is biodegradable or recyclable. In addition, small quantities of hazardous waste will also be generated mainly from the vehicle maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti-freeze; contaminated soil; spillage control materials used to absorb oil and chemical spillages; machine/engine filter cartridges; oily rags, spent filters, contaminated soil, and others). If this waste is not responsibly disposed, it can cause adverse environmental, human health and aesthetic impacts. Significance of this impacts has been assessed as Medium, as shown in Table 83.

Mitigation

The following mitigation measures will be implemented:

- Contractor will prepare and implement pollution prevention plan and waste management plan.
- The contractor will identify suitable sites for temporary storage of wastes from construction sites and demolished wastes in consultation with communities and government authorities. The wastes shall be transported for disposal in a timely manner.
- Protocols and measures will be prescribed in the ECPs to be included in the contracts with the contractors.

Residual Impacts

With the help of the above mitigation measures, the potential impacts associated with waste generation are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in Table 83.

7.3.8 Impacts on Wildlife

As discussed in Section 5.4 and shown in Table 48 and Table 49, most of the affected area is under cultivation (substations and overhead transmission lines). Therefore, the wildlife species found in the area are the ones that have adapted to human presence. These wildlife species, including mammals, reptiles and birds, are likely to be affected by construction through habitat loss/degradation, disturbance (presence of people, artificial lighting and noise), injury or death owing to construction works (including trapping in deep excavations) and increased traffic, and temporary habitat fragmentation. The natural vegetation and habitats in the area are mostly reserve forest, river and canals, small ponds, and on the periphery of cultivation fields, etc. In view of the altered nature of the habitat, the vegetation found in the project area mostly belongs to Forest area (Chunati Wildlife Sanctuary) i.e., hill forest, bushy land cultivable/plantation forest, roadside forest; and homestead/settlement vegetation, crop-field vegetation, as discussed in Section 5.7.3 and shown in Table 59. The significance of the impact has been assessed as Medium, as shown in Table 83. primarily because of low conservation value of these species and partly because these species already survive in the modified habitat, as specified above.

Mitigation

Reduction and control of artificial lighting

Artificial lighting used on construction sites and camps at night will be shaded and directed downwards to avoid light spillage and disturbance to nocturnal birds, bats and other wildlife.

Ban on hunting and poaching

A ban on hunting and poaching by construction and operation staff will be implemented to reduce pressure on threatened and protected species in the Project areas and surroundings. All construction and operation staff will be required to follow company rules and code of conduct. Signage will be installed illustrating the hunting ban on any species throughout the Project areas.

Checks for breeding birds

To minimize the potential impact to all breeding bird species, vegetation clearance will be undertaken outside of the main bird breeding period if possible. Where this is not possible, the areas to be cleared will be checked for breeding birds prior to the clearance and if nesting birds are found, appropriate mitigation measures will be implemented. This may involve avoiding construction within 50m of the active nest until the chicks have fledged.

Vegetation clearance will be carried out in a methodical manner so that any fauna present in these areas can disperse. Where clearance of dense scrub is required, it will be preceded by a hand search for mammal and/or reptile species which may be present in the sward. The dense vegetation will only be cleared once it has been established that any individuals present have fled. The incidental creation of pockets of habitat or islands will be avoided. Before and during vegetation clearance or

tree felling, any animals found will be removed and released to safe refugium. There should be no burning of natural vegetation.

For Reserve Forest and Elephant Corridors- mitigation under section 7.2.2 can be followed.

Residual Impacts

With the help of the above mitigation measures, the potential impacts on wildlife are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in Table 83.

7.3.9 Community Health and Safety

Community health and safety impacts during the construction and decommissioning of transmission and distribution power lines are common to those of most large industrial facilities. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable diseases associated with the influx of temporary construction labor. There are many existing constructions on going along the Teknaf road due to Rohingya project. Construction of the substation may cause road traffic and impact on occupation health and safety. Significance of these impacts has been assessed as High as shown in Table 83.

Mitigation

The mitigation measures to address the project impacts on communities' health and safety are listed below.

- The contractor will follow the Environmental Health and Safety Guidelines of Electric Power Transmission and Distribution of IFC as mentioned in Section 2.5.3 and shown in Table 13.
- The contractor will follow the COVID 19 guidelines of WHO during the construction of the project;
- Construction camps will be located at least 500 m away from the communities. Entry of the site personnel in the local communities will be minimized to the extent possible/appropriate.
- The contractor will prepare and implement an Occupational Health and Safety (OHS) Plan that will also cover communities' health and safety aspects.
- A Code of Conduct and Guidance on GBV is to be implemented in all construction camps. Training and orientation on the Code of Conduct and Guidance on GBV is to be carried out periodically.
- The contractor will prepare and implement a Traffic Management Plan that will also address traffic safety for communities.
- The community will be informed about the nature of construction activities and the associated health and safety risks; awareness raising of the communities will be carried out for this purpose with the help of training sessions, posters, signage, and other similar means.

- Awareness raising of communities will be carried out, in a culturally sensitive manner, about the communicable diseases including sexually transmitted infections.
- The construction sites will be fenced as appropriate to minimize entry of the local communities particularly children in the work areas.
- Construction camps and other site facilities will be fenced.
- Liaison with the community will be maintained.
- GRM will be established to address community grievances related to health and safety aspects.

Residual Impacts

Even after implementing the above-listed mitigation measures, the health and safety impacts on local communities cannot be fully mitigated. Hence the significance of residual impacts will be Medium, as shown in Table 83. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.3.10 Occupational Health and Safety

If not managed appropriately, activities such as site preparation, construction activities, operation of construction machinery and equipment, vehicular traffic, and the use of temporary workers' accommodation pose potential risks to the health, safety, security and therefore wellbeing of construction workers. Health and safety issues associated with the use of temporary accommodation sites include those relating to sanitation, disease, fire, cultural alienation, sleeping space, quality and quantity of food, personal safety and security, temperature control and recreation, amongst others.

Some of the Occupational Health and Safety risks which are likely to arise during the construction phase of the Project, and are typical to many construction sites, include: exposure to physical hazards from working on heights, use of heavy equipment including cranes; trip and fall hazards; exposure to dust, noise and vibrations; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery.

Workers on the Project, particularly sub-contracted construction workers, are vulnerable to risks to their wellbeing, health and safety on a daily basis. Appropriate health and safety management planning and execution in line with good international industry practice will be undertaken by the Project team to reduce the risks as far as possible. Significance of the above impacts has been assessed as High, as shown in Table 83.

PGCB will inform AIIB of any significant ES event such as accidents or fatalities within 2 days of the event.

Mitigation

The mitigation measures to address the project impacts on workers' health and safety are listed below.

- The contractor will follow the Environmental Health and Safety Guidelines of Electric Power Transmission and Distribution of IFC as mentioned in Section 2.5.3 and shown in Table 13.
- The contractor will follow the COVID 19 guidelines of WHO during the construction of the project;
- The contractor will prepare and implement an Occupational Health and Safety (OHS) Plan
- Contractors will have dedicated and qualified staff for ensuring compliance with the OHS Plan
- Regular trainings will be provided to the workers on OHS aspects.
- Awareness raising material will be used including posters, signage, booklets, and others
- All site personnel will be screened for communicable diseases including sexually transmitted infections.
- Use of appropriate personal protective equipment (PPE) will be mandatory. No worker (or even visitor) will be allowed on the site without the required PPE (such as hard hat, safety shoes).
- Firefighting equipment will be made available as required at construction sites, camp sites, and particularly near the fuel storage.
- The project drivers will be trained in defensive driving. They will maintain low speed while driving through / near the communities.
- Complete record of accidents and near-misses will be maintained.
- First aid facilities will be made available at the work sites and in the camps. The contractors will engage qualified first aider(s).
- Location and telephone numbers of the nearest hospital will be displayed at appropriate places at work sites and in construction camps. If necessary, the contractor will have an ambulance available at the site.

Residual Impacts

Even after implementing the above-listed mitigation measures, the health and safety impacts on site personnel cannot be fully mitigated. Hence the significance of residual impacts will be Medium, as shown in Table 83. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.3.11 Traffic Congestion

The construction activities particularly laying of overhead transmission lines in rural and partly in semi-urban areas, and along the existing roads may cause traffic disruption and congestion. Significance of these impacts has been assessed as High, as shown in Table 83.

Mitigation

The following mitigation measures will be implemented to address the traffic congestion caused by the project:

- The contractor will prepare and implement a traffic management plan that will include plans for traffic control, signage, diverting or bypass.
- Construction activities will be scheduled in a manner to avoid peak traffic hours.

- Liaison and coordination will be maintained with relevant authorities such as City Corporation/Municipality and Traffic Police.
- Traffic signage will be placed where necessary and appropriate to warn the drivers and pedestrians about the construction activities.
- ECP to be implemented.
- GRM will address the traffic congestion elated issues.

Residual Impacts

With the help of the above mitigation measures, the potential impacts associated with traffic congestion are likely to be mostly address.

7.3.12 Additional Load on Local Resources

The construction work and camp operation will require supplies such as water, fuel, and camp supplies. Obtaining these supplies from the local sources can exert additional pressure on these sources which may already be over-exploited and therefore adversely affect the local communities. Any such impact on the local community can increase their hardship and even result in disruption of the construction works. Significance of this impact has been assessed as Medium, as shown in Table 83.

Mitigation

The mitigation measures to address impacts associated with the availability of local resources and supplies are listed below.

- The contractor will prepare and implement a plan to obtain key supplies such as water and fuel, in consultation and coordination with the local community,
- The plan will ensure that there is no significant impact on the local community and local resources.
- Liaison with the community will be maintained.
- The GRM described earlier will also address community grievances related to usage of local resources.

Residual Impacts

After implementing the above-listed mitigation measures, the impacts of the project associated with usage of local resources will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in Table 83.

7.3.13 Site Clearance and Restoration

After the completion of the construction activities, the left-over construction material, debris, spoils, scraps and other wastes from workshops, and camp sites can potentially create hindrance and encumbrance for the local communities in addition to blocking natural drainage and or irrigation channels. Significance of these impacts has been determined as Medium, as shown in Table 83.

Mitigation

The contractors will be required to remove all left-over construction material, debris, spoils, and other wastes from the construction sites in a timely manner. The camps sites will be completely cleaned and restored in original condition to the extent possible. No waste disposal will be carried out in the streams and rivers.

Residual impacts

With the help of the above mitigation measures, the potential impacts associated with site clearance are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in Table 83.

7.4 Impacts during O&M Phase

7.4.1 Impact of SF6

In Gas Insulated Substation (GIS) system, all the live components are enclosed in a grounded metal enclosure, then the whole system is housed in a chamber full of gas. GIS primarily use Sulphur hexafluoride (SF_6) gas as the primary insulator. SF_6 is non-toxic, maintains atomic and molecular properties even at high voltages, have high cooling properties, and superior arc quenching properties. According to the Intergovernmental Panel on Climate Change, SF_6 is the most potent greenhouse gas that has been evaluated, with a global warming potential of 23,900 times that of CO_2 when compared over a 100-year period.

Countries report SF6 emissions from the power sector in their national emissions inventories, and emissions factors from these inventories provide one way to estimate their magnitude (emission factor is 0.119 gSF6/MWh). Circuit breakers containing SF6 will be used in the grid station and the SF6 emissions are estimated as 0.026 million tCO2e per year and 0.78 million tCO2e for the entire life of the project (30 years). (1.8 kg of SF6 = 40 tCO2e); 0.119 g x 12,754,560MWh = 1,517,792.64 g or 1517kg SF6; 1517kg of SF6 x 40/1.8 = 33,728 tCO2e or 0.033 million tCO2e per year; 0.033 x 30 = 1.01 million tCO2e for 30 years)

Mitigation

It has superior dielectric properties compared to other gases; thereby provides favorable insulation for the phase to phase and phase to ground moderation. In the substation setup, the gas is contained in a grounded metal enclosure containing the conductors, current and voltage transformers, circuit breaker interrupters, switches, and lightning arrestors. The Substations have electrical specifications for voltage, switchgear, circuit breaker, transformer, and protection systems. In addition, SF6 pressure will be monitored periodically by the OM personnel. In case of low pressure, there will be arrangement of refilling SF6 from Refilling Bottle. Moreover, the SF6 will also be identified by SF6 leak detector.

Residual Impacts

With the help of the above measures, the negative impacts associated with SF6 from substation operation and maintenance will be adequately addressed and hence the significance of residual impact would be Negligible, as shown in Table 83.

7.4.2 Waste Management at Substations

The operation and maintenance activities at the substations will generate wastes such as municipal solid waste, sewage from toilets, waste transformer oil and other lubricants, disused parts, and other similar wastes. Some of these are hazardous wastes. Particularly the used transformer oil can cause soil and water contamination if not properly disposed and can also be hazardous for people and livestock. Significance of these impacts has been assessed as High, as shown in Table 83.

Mitigation

PGCB will prepare a Waste Management Plan as part of their standard operating procedures. The municipal waste will be disposed through the city municipal services whereas hazardous wastes such as transformer oil will be disposed in accordance with its Material Safety Data Sheet (MSDS).

Residual Impacts

With the help of the above measures, the negative impacts associated with waste generation from substation operation and maintenance will be adequately addressed and hence the significance of residual impact would be Negligible, as shown in Table 83.

7.4.3 Risk of Bird Collision and Electrocution

The overhead transmission lines can potentially cause bird collision and electrocution. Fatal collisions occur mostly with cables hanging perpendicular to the flight direction particularly with the top neutral conductor because of its poor visibility. The bird collision may occur in river and forest crossing areas of the project.

Power line structures (towers) provide perching, roosting, and nesting substrates for some avian species especially for birds of prey (raptors). Due to their large wingspans, the raptors may simultaneously come in contact with two energized parts or one energized and one neutral/grounded part of the transmission lines/their towers, potentially resulting in electrocution. Although raptors are most often considered when addressing electrocution risk, other birds such as crows, ravens, magpies, small flocking birds and wading birds can also be electrocuted. Closely spaced exposed equipment, such as jumper wires on transformers, poses an electrocution risk to small birds.

The electrical design factor most crucial to avian electrocutions is the physical separation between energized and/or grounded structures, conductors, hardware, or equipment that can be bridged by birds to complete a circuit. As a general rule, electrocution can occur on structures with the following characteristics:

- Phase conductors separated by less than the wrist-to-wrist or head-to-toe (flesh-to-flesh) dimensions of a bird. The wrist is the joint toward the middle of the leading edge of a bird's wing. The skin covering the wrist is the outermost fleshy part on the wing.
- Distance between grounded hardware (e.g., grounded wires, metal braces) and any energized phase conductor that is less than the wrist-to-wrist or head-to-toe (flesh-to-flesh) distance of a bird.

Mitigation

The maximum length and wingspan of the birds are generally within 1.5m and 3m, respectively. Hence, mitigation to prevent or reduce the bird electrocution is possible by maintaining a minimum vertical distance of 1.5m and horizontal distance of 3m between the energized parts of the transmission line. The phase to phase and phase to ground separations of 132kV and 230kV towers are larger.

Contingent to its technical viability, PGCB will consider installing bird diverters such as colored balls on the top conductor of the transmission line segment crossing the river. Towers on both sides of the river should have light beams focused on the balls on the power lines, at night, during 'mid-February to end March' and again from 'mid-September to mid-November'. Bird collision and electrocution data will also be collected during early March and October.

Residual Impacts

After installation of bird diverters and colored bills, risks of bird collision and electrocution will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in Table 83.

7.4.4 Tree Cutting during Maintenance Activities

The trees under the overhead transmission line need to be trimmed to a certain height so as to maintain a safe distance from the top of the trees to the transmission line conductor. Depending upon the type of these trees, this trimming can cause loss of production (in case of fruit trees) or reduction in its value (in case of timber tree). Significance of these impacts has been assessed as Medium, as shown in Table 83.

Mitigation

Compensatory tree plantation should be carried out where necessary. In case of private trees, compensation will be paid to the owners for the loss of production or loss of its value.

Residual Impacts

Even after implementing the above mitigation measures, the impact of the project on the trees under the proposed transmission lines will not be fully mitigated. Hence the significance of residual impacts will remain Medium, as shown in Table 83.

7.4.5 Public Health Impacts from Electro Magnetic Fields from Transmission Line

Transmission lines generate electrical and magnetic fields which are considered to be health hazards although it was not scientifically proven. Though public health is not a major concern, these are estimated for the proposed transmission lines at various distances from the center of the transmission line and presented in Table 88. These values are estimated using the "Corona and Field Effects Program- Version 3", a computer program developed by the Bonneville Power Administration (BPA). The model requires detailed inputs regarding line configuration, conductors, sub-conductors, voltage and current.

The electric field denotes the difference in electric potential measured as a voltage between two points one meter apart. The electric field is generated by the line voltage on the conductors. The electric field of power lines depends on the voltage, on the circuit numbers, on the design of the circuits and on the design of the cable itself. Its strength lessens rapidly with increasing distance. Normally, the field is strongest in the middle of the transmission line span where the phase conductors have the greatest slag. The strength of the electric field is expressed in volts per meter, and in the power-line context usually in kV/m. Strong 50 Hz electric fields occur mainly in high voltage installations, i.e., inside switchyards and below transmission lines. Electric fields are shielded by objects which are earthed, such as trees and buildings.

The magnetic field around a power line is generated by the current in the conductors. Since the current is proportional to the line's load, the magnetic field often varies both over 24 hours and from one season to another. The magnetic field under a power line is strongest in roughly the same areas as the electric field. The magnetic field is expressed in terms of teslas [T] (1 T = 1 Vs/m^2), which is a measure of the field's flux density. In the context of power lines, microteslas [µT] are used. Magnetic fields are not shielded by walls and roofs. Around power lines they are often weaker than those one may come into contact within many other contexts in everyday life at work such as cellular phones that use frequencies in the range of GHz.

The electric and magnetic field are believed to cause cancer and affect nervous system. Today, among scientists there is still a considerable difference of opinion as to the degree of possible detrimental health influence caused by these fields. There are several investigations and publications reporting a severe influence of electromagnetic fields, but the discussion about biological and health effects is still going on. The International Council on Large High Voltage Electric Systems (CIGRE), a permanent non-governmental and non-profit-making international association based in France, publishes from time-to-time summaries of latest research on bio and health effects of electric and magnetic fields.

The exposure limits for EMF fields developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - a non-governmental organization formally recognized by WHO[27], are given in Table 85. WHO also concluded that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on human health. The EMF field of the proposed transmission line is within the ICNIRP Standards.

Table 85: Electrical and Magnetic Field from Transmission Line

Distance from Centre of transmission Alignment (m)	Electric Field (kV/m)	Magnetic Field (µT)
40 (edge of RoW)	1.34	104.81
50	0.59	68.33
60	0.17	46.17
70	0.03	32.30
80	0.03	23.31
90	0.03	17.3

[27]. EMF Fields, WHO Webpage http://www.who.int/peh-emf/standards/en/

Distance from Centre of transmission Alignment (m)	Electric Field (kV/m)	Magnetic Field (µT)
100	0.03	13.14
ICNIRP Standards	Public Exposure: 5; Occupational Exposure: 10	Public Exposure: 200; Occupational Exposure: 1000

Simulation and Measurement Results of 132kV Transmission Line Model

Figure 5 indicates the magnetic field distribution under 132kV transmission line model. All numerical data are extracted from the Figure 120 into Table 86 for easiness of analysis. From the graph in Figure 120, relation of data; simulation and measurement are approximately similar with percentage correlation of 97.8%. The magnetic field is higher at distance 0 mm which in the middle of a conductor. For measurement data, the average highest magnetic field is 6.88E-7 Tesla while for simulation result, the highest magnetic field is 6.3651E-7 Tesla.

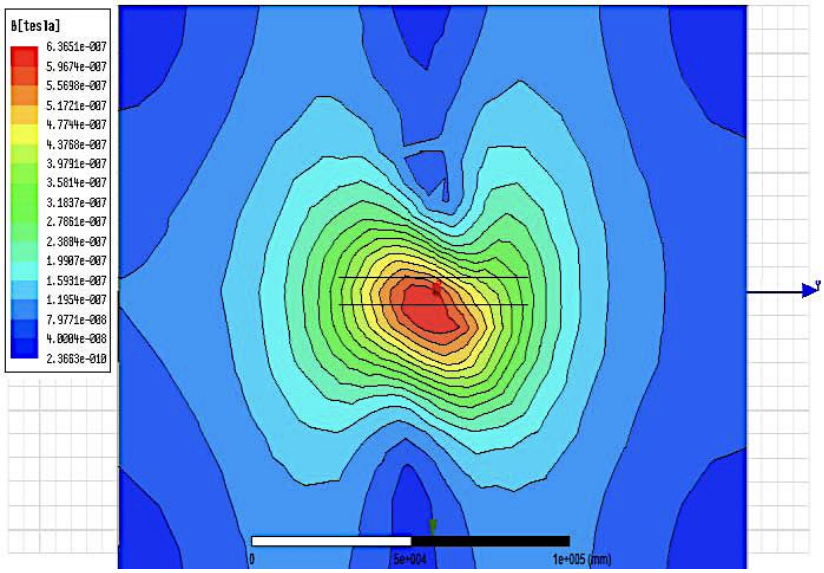


Figure 120: Magnetic field distribution under 132kV transmission line (simulation result from top view); distance tower-to-tower: 100m

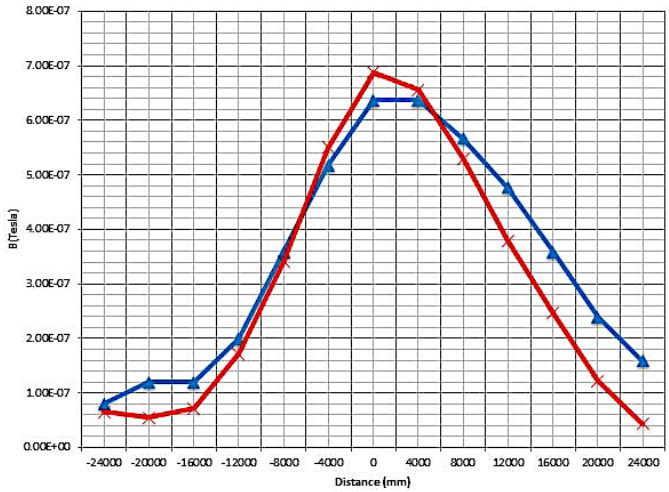


Figure 121: Graph of Magnetic Field, B (Tesla) versus Distance (mm); comparable between simulation (Blue Line) and measurement (Red Line)

There are many factors can be effect reading of measurement results. In the real time measurement, there are many elements disturbing the measurement process. Among the factors affecting the reading are temperature and electricity consumption. High temperature also influences the reading of magnetic field. Other than that, in theoretical, the magnetic field of the transmission lines is depends on current that flow in the conductor or cable. Therefore, in this situation, the measurement result had a higher magnetic field than the simulation result because of power demands on that time. The transmission line modelled using Finite Element Method (FEM) are neglecting environmental factor and power demands. In overall, the results are below than 100uTesla from RoW.

Table 86: Simulation and Measurement Data Based on Row for the 132kV Transmission Line

Distance (mm)	Magnetic Field Simulation (Tesla)	Magnetic Field Measurement (Tesla)	Correlation Between Results (%)
-24000	7.98E-08	6.60E-08	97.80
-20000	1.20E-07	5.50E-08	
-16000	1.20E-07	7.20E-08	
-12000	1.99E-07	1.72E-07	
-8000	3.58E-07	3.41E-07	
-4000	5.17E-07	5.50E-07	
0	6.37E-07	6.88E-07	
4000	6.37E-07	6.56E-07	
8000	5.67E-07	5.30E-07	
12000	4.77E-07	3.79E-07	
16000	3.58E-07	2.46E-07	
20000	2.39E-07	1.22E-07	
24000	1.59E-07	4.40E-08	

Simulation Result of 230kV Transmission Line Model

In this part, only simulation part is done due to time constraint and safety issue.

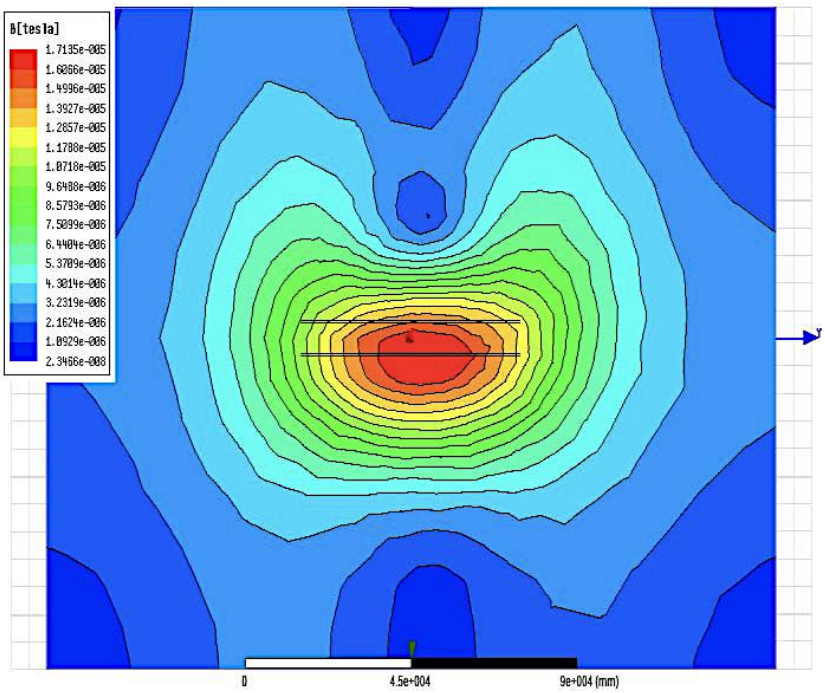


Figure 122: Magnetic field distribution under 230kV transmission line (simulation result from top view); distance tower-to-tower: 100m

Instead of that, after considering the correlation results of 132kV, the model from Finite Element Method (FEM) by ANSYS Maxwell Software is reliable and able to demonstrate the result same with actual measurement. Figure 122 shows the magnetic field distribution under 230kV transmission line tower.

All numerical data are extracted from the Figure 122 into Table 87 for easiness of analysis. Under 230kV transmission line model, the magnetic fields are higher compared to Part A because of the increasing of rated current. Meanwhile, RoW or safe distance from centerline transmission line, 20 meter indicates magnetic fields produce are not exceed 100uTesla.

Table 87: Simulation Data Based on Row for the 230kV Transmission Line

Distance (mm)	Magnetic Field Simulation (Tesla)
-25000	3.2319E-06
-20000	3.2319E-06
-15000	5.3709E-06
-10000	9.6488E-06
-5000	1.3927E-05
0	1.7135E-05
5000	1.7135E-05
10000	1.6066E-05
15000	1.2857E-05
20000	9.6488E-06
25000	7.5099E-06

Mitigation

Exposure to EMF has already been considered during the design of the transmission line conductors and right of way to ensure compliance with the internationally recognized standards. Hence, no additional mitigation measures are proposed. The electromagnetic fields will be regularly monitored during O&M phase to ensure compliance with the ICNIRP standards and if required additional mitigation measures will be proposed during O&M phase. The following figure demonstrate the EF impacts for 123kV and 230kV lines are negligible.

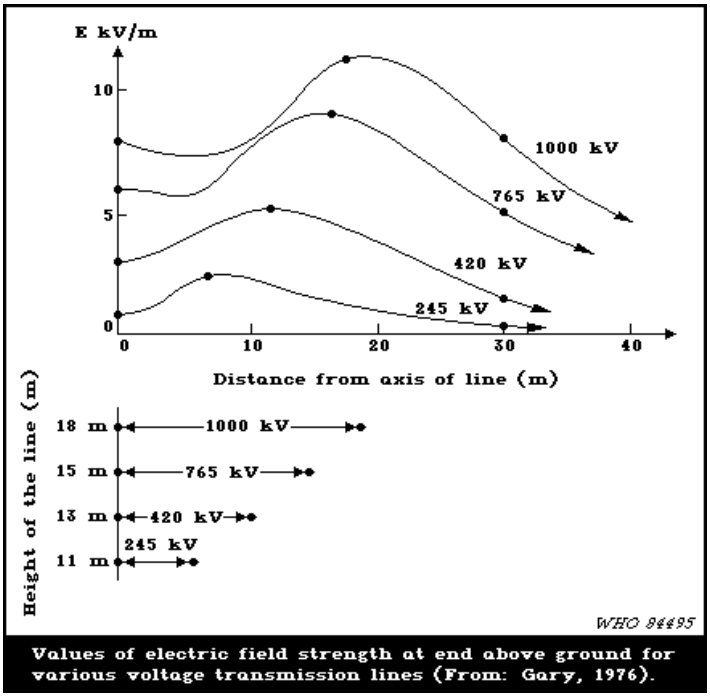


Figure 123: Electric fields of different voltages regarding height and distance

7.4.6 Audible Noise and Radio Interference from Transmission Lines

Audible noise from transmission lines occurs primarily in wet weather. In dry weather conditions, the conductor usually operates below corona inception level and generates few corona sources for audible noise. However, in wet conditions, water drops impinging or collecting on conductor produce a large number of corona discharges and thereby creating bursts of noise. Therefore, the audible noise increases to such an extent that sometimes it represents one of the limitations for the design of transmission line conductor. The audible noise for the proposed transmission lines has been estimated and presented in Table 88. The noise levels during fair weather are generally within the national standards. However, during rainy periods, the noise levels will exceed the nighttime standards up to 100m from the center of transmission line alignment.

Radio interference also called radio influence is a noise type that occurs in the Amplitude Modulation Radio reception including the standard broadcast band from 0.5 to 1.6 MHz. It does not take place in Frequency Modulation bands. Power line interference tends to be roughly in inverse proportion to the frequency. Radio interference can be predicted by applying Empirical or Comparative formula as a result of regression analysis performed on experimental data of Radio Interference of various variables such as conductor diameter, surface gradient, and lateral distance from the line. Instead of using absolute noise level, as a criterion for rating interference level, it is more logical to use a relative measure as signal to noise ratio. This parameter is generally employed to affect the effect of

transmission noise on AM Radio broadcast. The radio interference is calculated and presented in Table 88.

No standard limit exists for Radio Interference, but Canadian Standard Association (CSA) has developed the recommended limits for Electromagnetic Noise based on the line voltage. For high voltage level of 400kV, the acceptable limit is 60 dBA in fair weather measured at the distance 40 meter from center of tower. The estimated radio interference levels from the proposed transmission lines will be within these standards.

Table 88: Electrical and Magnetic Fields from Transmission Line

Distance from Centre of transmission lines Alignment (m)	Audible Noise (dBA)		Radio Interference (dBuV/m)	
	Rain Weather	Fair Weather	Rain Weather	Fair Weather
40 (edge of RoW)	51.5	26.5	59.6	42.6
50	50.8	25.8	57.4	40.4
60	50.1	25.3	55.2	38.2
70	49.4	24.4	53.5	36.5
80	48.9	23.9	52.1	35.1
90	48.4	23.4	50.9	33.9
100	47.9	22.9	49.7	32.7

Mitigation

Exposure to noise and radio interference from transmission lines has already been considered during the design of the transmission line conductors and right of way to ensure compliance with the national and international standards. Hence, no additional mitigation measures are proposed.

7.4.7 Occupational Health and Safety during Operation and Maintenance

Workers may be exposed to occupational hazards from contact with live power lines during, maintenance, and operation activities. They are also exposed to occupational hazards when working at elevation and live wires, and exposure to electric and magnetic fields, and to fuels during maintenance, and operation activities. Significance of these impacts is High, as shown in Table 83.

Mitigation

PGCB has Standard Operating Procedures (SOPs) on Workers' Health and Safety, and these will be implemented during the operation. Regular training will be provided to the staff on the SOPs and risk registers (reporting and recording of accidents and near misses) will be maintained. The SPOs are explained below.

General Principles: Accident prevention can be accomplished only through possessing and applying safety know-how and wholehearted cooperation of all members of the organization. Learn and understand the following five basic principles in job safety to deal with the hazards:

- Identify the hazards.
- Eliminate the hazards wherever practical.
- Control the hazards when they cannot be eliminated.

- Protect against injuries in case a hazard gets out of control.
- Minimize the severity of an injury, if an accident occurs.

Neither management and supervision, nor the Safety Code can prevent accident without the help of each employee. Unsafe workers are a danger to themselves, their fellow workers, the public property and the equipment with which they work. Due care and attention to all safety rules and devices is essential not only to prevent injury to the workers but also to protect equipment. Capable and mentally alert employees will avoid accidents by learning all they can about their work, using proper safeguards and protective equipment and avoiding shortcuts and makeshift work methods.

Good operation is safe operation. This is true for both employees and equipment. A job done safely is job done efficiently. Accidents do not "just happen". Accidents are the natural result of unsafe condition or unsafe acts, usually a combination of both. Machinery and equipment generally are manufactured to perform safely within limits of design. In fact, statistics show that more than 90 percent of accidents are due to the human element, such as failure to use safety devices and observe safety rules and procedures.

Residual Impacts

Even after the implementation of above measures, the safety risks will not be fully mitigated and therefore the significance of the residual impact will remain Low, as shown in Table 83.

Chapter 8
Social Impact Assessment

This chapter predicts, access and summarizes the likely positive and negative direct and indirect impacts due to loss of land, tree, structures, etc. The chapter also describes the mitigation measures in terms of its predicted impact associated with the intervention of the project.

8.1 Project Impacts

The project's potential impacts and their significance have been assessed using the methodology described in Section 1.7. A summary of these impacts and their significance along with the mitigation measures are presented in Table 89.

Table 89: Summary of potential social impacts, their significance and mitigation measures

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Impacts from Siting					
Impacts due to land acquisition for Substations	Severe	Major	High	Cash compensation as provided in the RP.	Medium
Impact on income and livelihood sources of affected households including vulnerable households	Severe	Major	High	Additional cash compensation and livelihood assistance and as provided in the RP	Low
Impacts from Construction					
Construction induced impacts	Severe	Major	High	Construction of substations, transmission lines tower, etc. compensation as provided in the RP	Low
Impacts due to construction of towers	Severe	Major	High	Cash compensation for land of tower footings	Low
Employment opportunities for local communities	Mild	Moderate	Medium (positive)	Preference to the local communities in the construction works; Employment Policy to be announce	-
Impact on land use	Severe	Moderate	Low	Agricultural land will be converted into infrastructure facility	Moderate
Crop damage	Severe	Minor	High	Crop damage will be minimized through astute construction and site management and scheduling of construction works;	Low

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				Compensation will be paid to the growers/landowners	
Impacts from access roads and damages to local infrastructure and public utilities	Severe	Major	Low	Minimize damages to infrastructure and public utilities; compensation as per RP, and relocation of utilities; Coordination with relevant entities	Medium
Blocked access due to construction activities	Mild	Moderate	Medium	Traffic management plan to be implemented; alternate routes to be identified in consultation with communities and relevant authorities; GRM to be established.	Negligible
Social conflict and privacy of women, influx of workers	Mild	Moderate	Medium	Camps to be established at least 500 m away from communities (preferably inside the substations); contractor to enforce code of conduct to respect local norms and culture; movement of outside workers will be restricted to work sites and workers' camps; liaison with local communities to be maintained; GRM to be established.	Negligible
Damage to sites/places of religious/cultural significance	Major	Moderate	High	Such sites to be demarcated and avoided during construction activities; liaison with local communities to be maintained; GRM to be established.	Negligible
Disturbance of Rohingya Camps	Mild	Moderate	High	Rohingya camps to be avoided during the selection of route from Cox's Bazar to Teknaf 132kV transmission line	Negligible
Impact of COVID 19	Major	Major	High	Guidelines of WHO will strictly be maintained	Moderate
Gender issues	Major	Major	High	The contractor will prepare and implement Gender Based Violence (GBV) Prevention Plan (as part of the construction environmental and social management plans – discussed later in the document); code of conduct for workers will include	Low

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				gender aspects (such as GBV and SE); trainings, awareness raising and orientation to be provided to workers will include gender aspects; GRM will also address gender aspects (e.g., GBV and SE).	
Impacts from O&M Activities					
Diminution of land value in the width of Right of Way Corridor	Severe	Major	High	There is no mitigation for this impact.	High

8.1.1 Impacts due to Land Acquisition

Four proposed sub-stations require total 40 acres of land. Out of 40, 35 acres are private land which require land acquisition, and the remaining 5 acres is owned by Bangladesh Hi-tech Park Authority (BHTPA). BHTPA carried out a SIA and a abbreviate RAP respectively for BHTC following the World Bank safeguard policy (OP 4.12). According to the report, they paid applicable compensation to the affected people after receiving the land from T&T Board. For construction of substations a total of 233 households (644 persons) will be affected. However, this number may vary during detailed design stage. Besides, 17 sharecroppers and 69 wage earners will also lose their income due to acquisition of land.

Mitigation

All affected households will get compensation for the acquisition of proposed land as per Acquisition and Requisition of Immovable Property Act 2017 (ARIPA) and ESS2 on Involuntary Resettlement of AIIB's Environmental and Social Framework, 2016 (amended February 2019). According to ARIPA 2017, compensation to be paid for affected land, structures, trees, crops and any other damages caused by such acquisition. The compensation such determined is called the Cash Compensation under Law (CCL). The Deputy Commissioner (DC), thereafter, enhance the assessed value by 200% and another 100% premium for loss of standing crops, structures and income due to compulsory nature of the acquisition.

Residual Impacts

After payment of the compensation for land acquisition and resettlement benefits to sharecroppers and wage earners, the impacts of the project on land acquisition of the affected households will be mitigated. Hence, the significance of the residual impacts will be Medium, as shown in Table 89. The extent of this impact will stay only on pre-construction phase of the project. So, the actual impact would be Negligible.

8.1.2 Impacts on Income and Livelihoods

Impacts due to project interventions were assessed through engineering design, ocular inspection and field surveys conducted from July to September 2020. As per Census, a total of 248 HHs will be

affected for the construction of substations and associated transmission lines. Among them 233 HHs will lose their agricultural land and 15 HHs due to construction of transmission lines as they are under the RoW. The overhead transmission lines will include agricultural land, settlement areas, rivers, etc. There is no physical displacement by the Project, and economic losses will be compensated.

Affected households (landowners, lessees, sharecroppers) mainly cultivate rice and vegetables on that land. Thus, will lose their work/employment, and wages/income, which will reduce earning scope of affected people and will have an impact on their income and livelihoods. In fact, the lands earmarked for substations are fertile land cultivated by farmers in several seasons of the year and planned to construct 'future houses' by landfilling as they are located closer to the main roads.

Mitigation

INGO through PIU consider allocating alternative land of similar quality for the affected households specifically to the leaseholders and sharecroppers, who are exclusively dependent on acquired land for their livelihoods and incomes. For households under the RoW of transmission lines, civil works can be scheduled to avoid cultivation seasons, and peak periods for other livelihood activities. In addition, related training on income restoration and livelihood assistance by INGO can be another mitigation measure.

Residual Impacts

After implementing the above-listed mitigation measures, the impacts of the project associated with income and livelihoods will be minimized, hence the significance of the impacts will be Low as shown in Table 89.

8.1.3 Impacts due to construction of Towers

A total of about 763 towers will have to construct for laying the transmission lines, of which 223 are angel towers and 540 are suspension towers. Out of 763 towers, 420 will be constructed on agricultural land and 313 on the non-agricultural land, resulting crops of agricultural land may be damaged. For each angel and suspension tower, 225 sqm (15m X 15m) and 100 sqm (10m X 10m) have been considered for 230 kV and 132kV transmission lines respectively. Hence, a total of 18.07 acres of agricultural land will be affected.

Mitigation

As per recently gazette Electricity Rules of Bangladesh (2020), if land is affected due to construction of towers, compensation has to pay in consultation with landowners. INGO will review, verify and provide the compensation to the landowners according to this Rules.

Residual Impacts

After paying the compensation properly according to the abovementioned law, the impacts due to tower footings will be mitigated, hence the significance of the impacts will be Medium as shown in Table 89.

8.1.4 Construction Induced Impacts

Since there is no land acquisition required for transmission lines, people can still retain their ownership of the land, and use it for residential and cultivation purposes provided the vertical and horizontal clearance requirement is maintained after construction. PGCB will consider increasing the vertical clearance to 8 m or extending the height of transmission towers or use of additional angle towers to avoid any direct impacts on built structures, and physical displacements of the populations living within the corridor. Additionally, PGCB will also adopt enough safety measures such as erecting bamboo sheds above the built structures during conductor stringing to avoid any damages to structures and risks of their falling and causing accidents. Also, construction work will avoid peak periods of agricultural and other livelihood activities, and seasons that are abundantly occupied for educational, religious and cultural activities. As such, neither permanent nor temporary physical displacements are anticipated due to construction of the transmission lines. During construction period of angel towers of transmission lines, vehicles movements will require to carry equipment. As there is no access road, vehicle has to move damaging crops. Moreover, temporary stake yard/construction yard will have to require for the safety of the construction equipment. For this purpose, temporary land use will be required which will also affect agricultural lands as maximum angel towers will be constructed in agricultural land.

Mitigation

The construction of substations and laying of transmission lines including tower footings in such a way, so as to occur minimum damage of adjacent public and private properties as well as social common property resources. The work schedule of contractor should prepare based on the cropping seasons including harvesting period, sub-projects social and environmental context related to the project's interventions.

8.1.5 Employment Opportunities

As described in Section 3.11, the construction contractor(s) will have a sizeable work force. A large proportion of this workforce will be skilled and semi-skilled laborers including drivers, machinery operators, steel fixers, technicians, electricians, fitters, welders, watchmen, camp staff, warehouse staff, and manual laborers. The local communities during the stakeholder consultations have shown great desire to be included in the project's workforce (see Section 6.4). In line with the aspirations of local communities, the contractors will be contractually bound to maximize employing the locals as appropriate. In addition to maintaining good relations with the local communities, maximizing local employment may also be cost effective since engaging workforce from other parts of the Country could be costlier.

Mitigation

This is a beneficial impact of the project and hence does not need any mitigation as such. The contractors will be required to formulate an employment policy to ensure equitable availability of employment opportunities to all communities within the project area particularly the project affected persons (PAPs). It will also be ensured that no child labor is engaged by the project or its contractors/suppliers.

8.1.6 Access Restrictions

8.1.6.1 Blockage of Access Routes

The construction activities can potentially block local roads and routes particularly because transmission line laying is a linear activity. This can adversely affect the local communities particularly in urban areas and also in areas where accessibility is already an issue. Any such disturbance to the local community can also result in disruption of the construction works. Significance of this impact has been assessed as Medium, as shown in Table 89.

Mitigation

The mitigation measures to address impacts associated with the blockage of local routes are listed below.

- The contractor will prepare and implement a traffic management plan, in consultation and coordination with the local community
- The community will be informed about the nature of construction activities and possibility of any blocked route; alternate routes will be identified with the help of local/affected community. Duration of such blockage will be minimized to the extent possible.
- Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police.
- Liaison with the community will be maintained.
- The GRM described earlier will also address community grievances related to any blockage of local routes.

Residual Impacts

After implementing the above-listed mitigation measures, the impacts of the project associated with blockage of routes will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in Table 89.

8.1.6.2 Impacts from Access Roads and Damages to Local Infrastructure

The construction activities will require using/establishing tracks to access the RoW from the existing road network. It has been estimated that on average about 200 m long access track will be used for each tower location. Though exact locations and hence ownership of the land under these access tracks is not known at this stage, it can however be estimated that crops will be damaged over about 49.5 ha of cultivated land (200m long x 15 m wide x 165 towers).

In addition to the crop damage, the construction activities including establishing and using access tracks may also damage the local infrastructure such as existing roads/tracks, tube-wells, water courses, and drainage channels.

Significance of these impacts has been assessed as High, as shown in Table 89. primarily because of the importance of agriculture produce as the main livelihood of the communities in the area.

Mitigation

The crop damages caused by the establishing and or using access tracks will be compensated by paying cash compensation equivalent to value of crops for two seasons. For any inadvertent damage to the existing infrastructure, the contractor will be contractually liable to repair and or replace the damaged infrastructure to original or better condition. The GRM established at the site will also address any community grievances related to the damaged infrastructure.

Residual Impacts

After payment of the compensation for crop damage, the impacts of the project on livelihood of the affected households will be mostly mitigated. Hence, the significance of residual impacts will be Medium, as shown in Table 89. The impacts associated with the damaged infrastructure will be completely mitigated and hence the significance of residual impacts will be quite negligible.

8.1.7 Impacts on Land Use

The existing land use of the project area is described in Section 5.4 and in Table 48 and Table 49. As shown in these tables, the transmission line RoW will cover an area of about 778.2 ha which will temporarily be affected due to laying TLs, and substations will require a total area of about 16.18 ha which will permanently be used for SSs. A total of 31.64 acres of land will be required for tower footings which can be used for crop cultivation based on existing land use by landowner if PGCB give permission to the landowner as Electricity Rules, 2020.

As can be seen in Table 49, about 62 percent of the transmission line RoW is covered by the agriculture land, about 26 percent by salt pan, about 5 percent by natural forest and cultivable forest, 1.29 percent by water bodies (rivers, khals, lake, and pond), about 0.5 percent by rural settlement, etc. Similarly, Table 48 provides the land use of the substation sites, which are covered by cultivation fields, aquaculture and herb/shrubs area.

Of the total land requirements for the project, the area for substations (16.18 ha) will be completely modified, and hence this impact has been assessed as High, as shown in Table 89. The RoW for the transmission line (778.2 ha) will be partly modified and will remain available for most of the pre-project land use such as cultivation and therefore this impact has been assessed as Medium, as shown in Table 89.

Mitigation Measures

The following mitigation measures will address the potential impacts discussed above to some extent:

- Location of substations have been selected in uncultivated areas, to the extent possible.
- Minimum damage and/or disturbance will be considered while passing the reserve forest as stated in Section 7.2.2.
- Transmission lines will be aligned to minimize impacts on cultivation fields and other important areas.
- Compensation will be paid to the landowners for the land permanently acquired for the project. Similarly, assistance will be paid to the persons/households losing their livelihoods

(resettlement impacts are discussed in the next Chapter, and a resettlement plan has been prepared for this project).

Residual Impacts

Even after implementing the above listed measures, the impacts of the project on the land use of the area cannot be completely mitigated. Therefore, the significance of the residual impacts is likely to remain Medium, as shown in Table 89.

8.1.8 Affected properties within the RoW

Due to laying the transmission lines, 19 residential structures may be affected temporarily. Displacement of these households will not be required. But these structures in future cannot be extended vertically due to height clearance from transmission lines and its associated risks. As per Electricity Act 2018 and Electricity Rules, 2020, there is no provision of relocation/displacement and in fact, no any scope of compensation. Some auxiliary structures like 13 tube wells, 4 toilets, 192 sft toilet slabs, and 1,251 sft tin made and pucca boundary wall will also be affected.

Mitigation

During the construction phase, transmission lines can be laid to save the auxiliary structures. Laying the lines over the residential structures should perform carefully by the contractor. However, before the implementation of the project, RP should be updated by INGO.

8.1.9 Loss of Trees

The Project will also require felling of trees of different sizes and species. A total of 26798 trees including 11 trees in substation area, will be affected due to project implementation. The highest number of trees will have to cut are be affected are timber (20546) followed by fruit (2889), bamboo (207) and medicinal (34).

Mitigation

Compensation for trees will be paid to the affected households as per the Entitlement Matrix of resettlement plan of the project. In addition, a replantation ratio of 1:5 will be considered under the project during implementation period aim to conserve the ecological balance of the environment. For plantation, sapling will be given to the persons who will loss the tree. The sapling would be mixed of fruit, timber and medicinal species. They will plant the tree at their convenient space.

8.1.10 Damage to Cultural Resources

Bangladesh is a country where civilization has existed for thousands of years and encountering physical and cultural monuments in construction related excavations is a distinct possibility. During construction, with many small construction sites along the line alignment, there is potential to unearth or discover objects of a cultural nature that will need to be protected. While there is no evidence of such sites within the study area, hence, no impact has been considered in this case. But there are various tombs, temples and other sites in the country. It is, therefore, important to have a procedure in place to ensure that there is a mechanism in place to handle any material culture finds.

Mitigation

To protect cultural resources from accidental damage from construction, existing cultural property will be treated as sensitive receptors. They will be avoided where possible and subject to the control on air pollution and noise. Implement Chance Find Protocols as soon as historical/cultural monuments are encountered during construction activities. Stop work and inform the relevant authorities including the Ministry of Cultural Affairs, Bangladesh. The Ministry would implement measures to avoid damage to monuments and valuable features which the contractor is bound to follow. Chance Find Procedures for Protection of Cultural Property is given in Annex-VII.

8.1.11 Impact on Vulnerable Households

During the elaboration of the RP no indigenous population, ethnic minority or affected person of low social group or caste were identified. As per census, only 3 male headed households and 1 female headed household is listed under vulnerable groups and all of them are in substations area.

Mitigation

Those listed as vulnerable groups will receive benefit from Project implementation. Moreover, 14 elderly persons (over 70 years) were identified during census. The entitlement matrix has provision for one-time grants who are vulnerable considering both income and age in addition to eligible compensation.

8.1.12 Social Conflict and Influx of Workers

The influx of a large number of workers from other parts of the Country can potentially cause conflict between the project personnel and the local community. This could be because of differences in culture, religion, social norms, acceptable social behavior, and even dress code. In addition, the construction activities can potentially affect the women activities and movement. Any such impact can be detrimental to the project since it can potentially cause tension between the project and local communities and even disruption of construction works.

The mitigation measures to address impacts associated with the social conflict are listed below.

- The World Bank Guidance Note[28] will be used to address potential impacts caused by temporary project induced labor influx.
- The contractor will prepare and implement a Labor Management Plan which includes a Code of Conduct for all site personnel, in consultation and coordination with the local community.
- All site personnel will be provided orientation and training on Code of Conduct. Awareness raising materials such as posters and signage will be used as appropriate.
- All site personnel will be provided awareness and training to prevent communicable diseases, sexually transmitted infections, Human immunodeficiency virus (HIV) infections / Acquired Immune Deficiency Syndrome (AIDS).

[28] Thttp://pubdocs.worldbank.org/en/497851495202591233/Managing-Risk-of-Adverse-impact-from-project-labor-influx.pdf

- Privacy of women will be respected; routes and places used by them will be avoided as far as possible.
- Entry of the site personnel in the local communities will be minimized to the extent possible/appropriate.
- The GRM described earlier will also address community grievances related to social conflict.
- No child labor will be engaged by the project or its contractors.
- Liaison with the community will be maintained.

8.1.13 Gender Issues

Primarily because of the influx of construction worker, the proposed project can potentially create a number of gender issues particularly gender-based violence (GBV) and child sex exploitation (SE). These issues can cause serious harm to women and children living in the project area. These issues can be detrimental to the project since they can potentially cause tension between the project and local communities and even disruption of construction works. A detailed GBV prevention plan is prepared which will be followed as guiding note during the project implementation. A code of conduct is provided in the LMP and GBV Plan which may be updated as needed. The following specific measures need to be taken to address the gender issues:

GBV and SE Risk Assessment

- Assess the risk of GBV and SE for the proposed project. This assessment should incorporate a variety of contextual and project-specific risk factors for GBV and SE and analyze risks to women and children separately.
- Assess risks related to labor influx for the proposed project. The risk assessment should take into account "the size and scale of a project; the scale of labor influx; the extent to which a community has capacity to absorb labor influx or requires separate camp facilities; the inflow of income to workers, which can exacerbate already existing inequities between workers and community members; and the geographic location of project activities."

GBV and SE Risk Mitigation

- Develop a plan to prevent and mitigate identified risks. A GBV Action Plan should be put into place for all projects with a substantial or higher level of risk of GBV, and a Labor Management Plan/Workers' Camp Management Plan should be put into place for projects with high risks related to labor influx. The GBV action plan should include an awareness-raising strategy, an identification of GBV services providers, and procedures for handling GBV allegations. Labor influx mitigation measures should include prioritizing the hiring of local workers (as opposed to migrant workers from other parts of the client country or from another country).
- Raise awareness among affected stakeholders on GBV risks, with a focus on women, adolescents, and children. Project staff and workers should also be trained.
- Assess the capacity of project implementing agencies and units on GBV-related issues and identify capacity-building measures needed.
- Ensure that grievance redress systems have the capacity to address GBV complaints.

- "Project-level grievance mechanism should have "multiple channels through which complaints can be registered in a safe and confidential manner," including at least one channel that is accessible to children. "The GRM should not ask for, or record, information on more than three aspects related to the GBV incident: The nature of the complaint (what the complainant says in her/his own words without direct questioning); if, to the best of their knowledge, the perpetrator was associated with the project; and, if possible, the age and sex of the survivor. For GBV, the GRM should primarily serve to: (i) refer complainants to the GBV Services Provider; and (ii) record resolution of the complaint."
- For higher-risk projects, a local organization with the capacity to serve as a GBV services provider can also operate a GBV-specific grievance redress system.

Ensure that contractors put into place GBV-prevention measures:

- Civil works contracts should incorporate GBV-prevention measures.
- Contractors should put into place zero tolerance policies for cases of GBV and SE perpetrated by project workers, and codes of conduct that prohibit these activities, including sexual harassment. Workers should be trained on these requirements.
- If needed, the contractor should be required to institute additional prevention measures, including "separate, safe and easily accessible facilities for women and men working on the site, locker rooms and/or latrines that are "located in separate areas, well-lit and include the ability to be locked from the inside," visible signs "around the project site (if applicable) that signal to workers and the community that the project site is an area where GBV is prohibited," and well-lit "public spaces around the project grounds."
- The World Bank's good practice note on addressing GBV should be followed[29].
- The contractor will prepare the above-mentioned plans as part of its site-specific environmental and social management plans (further discussed later in the document).

8.1.14 Impact on Rohingya Camps

Section 5.9 describes that proposed Cox's Bazar to Teknaf 132kV transmission line under the project will pass the periphery of Kutupalong Refugee Camps of Ukhia. Regarding lowest distance, boundary of Camp 01E is about 225-meter, Camp 07 about 330-meter, Camp 08E about 227-meter away from proposed transmission line. Cox's Bazar to Teknaf Highway is located between the Camps and proposed transmission line. Figure 113 presents distance and location of Kutupalong Refugee Camps and proposed transmission line from Cox's Bazar to Teknaf. It was found that about 6.10km of transmission line (AP 47 to AP 59) will pass with the periphery of Kutupalong Rohingya Camps. So, construction of transmission line may impact on Rohingya Camps. The impact will be temporary and limited in nature.

There is a risk of engaging Rohingya refugees as labor by the contractor. Moreover, among the refugees, about 50% are child and they tend to engage themselves with the construction related activities of the project. Project construction labors and Rohingya female may be at risk of gender-based violence (GVB), since there about 50% are Rohingya women and girls. Risk of fire by the

[29] http://pubdocs.worldbank.org/en/158041571230608289/Good-Practice-Note-Gender.pdf

construction activities of the project may affect camps. Noise due to civil work during construction phase can affect the community.

Mitigation

Kutupalong Rohingya Camps is separated from host communities through barbed boundary wall. Their movement is very limited and strict by the administration. The contractor and INGO will follow the labor management plan (LMP), GVB Prevention PLan and stakeholder engagement plan (SEP) during the implementation of the project. It can be mentioned in the bidding documents of the contractor that they cannot hire any labor who defined as Rohingya. Moreover, PGCB, contractor and INGO shall make a meeting with Camps administration before doing the construction work in the periphery of Kutupalong and even Balukhali Camps, as part of stakeholder engagement plan. Contractor and INGO shall deliver the activities of the project, including work plan and schedule (for completing 6.10-km) to the administration. Fire management at this site would be performed as per fire management plan of the project. Contractor should inform the local fire station prior to start the construction work. Finally, PGCB can carry out a recheck and/or update the route survey adjacent to Camps based on the existence of Rohingya in that area before implementation of the project.

Residual Impacts

After implementing the above-listed mitigation measures, the impacts of the project associated Rohingya Camps will be minimized, hence the significance of the impacts will be Negligible as shown in Table 89.

8.1.15 Diminution of land value in the width of RoW Corridor

There is no doubt that the value of land in the width of RoW of transmission lines will be decreased as people cannot expand their structures vertically. The presence of transmission lines and towers will significantly reduce the market value and real estate potential of the land under corridor of transmission line right of way. This impact would be major though loss of valuable agricultural land under the transmission line towers would also be significant Table 49 shows the land use in RoW areas of transmission lines. The major land use was found for agriculture (484.22 ha) followed by built-up area (23.51 ha). When the landowners intend to build structure on new land/agriculture land which fall under the RoW of this project, cannot build vertically. Moreover, it will be risk and health hazard issue for them to stay there for long time. Significance of this impact has been assessed as High, as shown in Table 89.

Mitigation

According to Electricity Rules 2020, there is no scope to provide compensation towards diminution of land value in the width of RoW corridor due to laying of transmission line. Government can explore possibility of enlarging scope of survey to include land scheduling for complete RoW width including name of landowners to facilitate payment of diminution of land value compensation to all eligible persons.

Residual Impact

Since the reduced value of the land within the transmission line RoW cannot be fully mitigated, the residual impact will remain High, as shown in Table 89.

8.1.16 Impact of COVID 19

COVID-19 situation in Bangladesh is getting worse and if the COVID safety protocols are not maintained adequately, it may spread among the labors and adjacent communities. As there will be 50% migrant labors with the project and local people may believe that COVID is being spread to the adjacent community through the migrant labors.

Mitigation

Contractor should maintain and follow the health and safety guidelines of WHO for development project during construction phase. In addition, Contractor shall close contact with nearest hospitals, and community clinic for any emergency.

8.2 Mitigations, Compensation and Assistance

For mitigation, compensation and assistance under the project, a Resettlement Plan (RP) has been prepared following- Acquisition and Requisition of Immovable Property Act 2017 (ARIPA) and ESS2 on Involuntary Resettlement of AIIB's Environmental and Social Framework, 2016 (amended February 2019). According to ARIPA 2017, compensation to be paid for affected land, structures, trees, crops and any other damages caused by such acquisition. The compensation such determined is called the Cash Compensation under Law (CCL). The Deputy Commissioner (DC), thereafter, enhance the assessed value by 200% and another 100% premium for loss of standing crops, structures and income due to compulsory nature of the acquisition. The RP also adopt the guidelines of Electricity Act 2018 and Electricity Rules 2020 under Ministry of Power, Energy and Mineral Resources. Both policies measures to address the losses at replacement cost involving cash compensation as well as relocation and resettlement of the affected households for the mitigation of adverse impact.

A two-tier Grievance Redress Mechanism (GRM) has been proposed in the RP. The fundamental objectives of the GRM, are to resolve any resettlement-related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of the social and environmental action plans. The GRM will be implemented through the formation of Grievance Redress Committees (GRC). The GRCs will be established through a gazette notification from the Ministry of Power, Energy and Mineral Resources (MoPEMR); therefore, the GRC will be a legally constituted body. A two-tier bottom up GRC system – (i) Local GRC at the UP Level and (ii) Project-Level GRC – will be established in this Project.

In the case of land acquisition and compensation payment, IA (Implementing Agency) (along with the selected representatives of DC Offices, Forest Departments, INGO and affected communities including women and members of the vulnerable groups) will carry out joint verifications of affected persons (APs) and their assets (i.e., land, crops, trees) to be acquired and compensated by the Project. During construction phase of the project, INGO will be engaged by the IA for implementing the RP. In addition, an individual Consultant will be deployed for external monitoring of the RP implementation.

The total estimated budget for RP implementation is BDT 1375.40 million (USD 16.21 million). This budget includes compensation for land, crops and trees along with other resettlement benefits. The CCL value of land is considered including 200% premium with the present mauza rate of land and

market price has been considered for the compensation of crops and trees. Bulk of the budget (about 61.27%) is required for land acquisition of sub-stations and compensation of land for tower footings. The budget also includes RP implementation and its external monitoring costs. Contingency costs are also calculated and incorporated with the budget. These costs may be updated and adjusted while any variations in land size and price.

The Monitoring and Evaluation (M&E) will assist the IA to take remedial measures of any implementation problems to ensure the achievement of targets within scheduled time. Besides, an evaluation process will also enable IA to identify lapses, procedural weaknesses, policy inadequacies and institutional problem, and take remedial measures to achieve the desired goals and objectives of RP. Monitoring will be carried out both internally and externally. Internal monitoring will be carried out by the Environmental and Social Unit (ESU). The services of an External Monitoring Consultant are required to carry out the evaluation of the RP implementation. The Consultant will submit (i) half-yearly resettlement reports (every six months after the beginning of the resettlement processes) and (ii) Resettlement Completion report (submitted within 30 days of the end of resettlement process).

Details of mitigation, compensation and assistance have been included in resettlement plan (RP) of this project.

Chapter 9
Institutional Arrangements

The main purpose of this environmental assessment is to delineate the correct measures to enhance the environmental sustainability of the proposed project through providing suggestion on design considerations, implementation, management and operation as suggested in the ESMP. The effective implementation and operation of ESMP depends on regular monitoring. The Environmental and Social Management Plan (ESMP) of the project is described in Chapter 10 of the ESIA report.

The overall responsibility of environmental and social performance of the project and effective ESMP implementation will rest with PGCB. PGCB will establish the Project Implementation Unit (PIU) to lead the Project implementation. The PIU will be headed by the Project Director (PD). An Environment and Social Unit (ESU), comprising qualified environmental and social development staff, will be established under the PIU. The ESU will assist the PIU on issues related to environmental and social management and oversee the Environmental Social and Construction Monitoring Consultant (ESCMC) and contractors. The ESU will compile quarterly regular progress reports on ESMP compliance, to be sent to the Project Director and also shared with the AIIB, throughout the construction period. The ESU will also provide trainings to the PGCB field personnel responsible for monitoring of environmental compliance during both construction and O&M phases of the project.

The PIU will engage Environmental Social and Construction Monitoring Consultant (ESCMC) to supervise the construction contractors in order to ensure design compliance and quality assurance of the construction activities. The ESCMC will also supervise the contractors for ESMP implementation. For this purpose, ESCMC will engage environmental and social development specialists.

The contractors in turn will also have environmental, (occupational) health and safety (EHS) supervisors who will be tasked to first develop CESMP in accordance with the present ESMP and then responsible for its implementation during construction activities.

The organogram of PIU is shown in Figure 124; Table 90 presents the responsibilities of PIU, its consultants, and construction contractor(s).

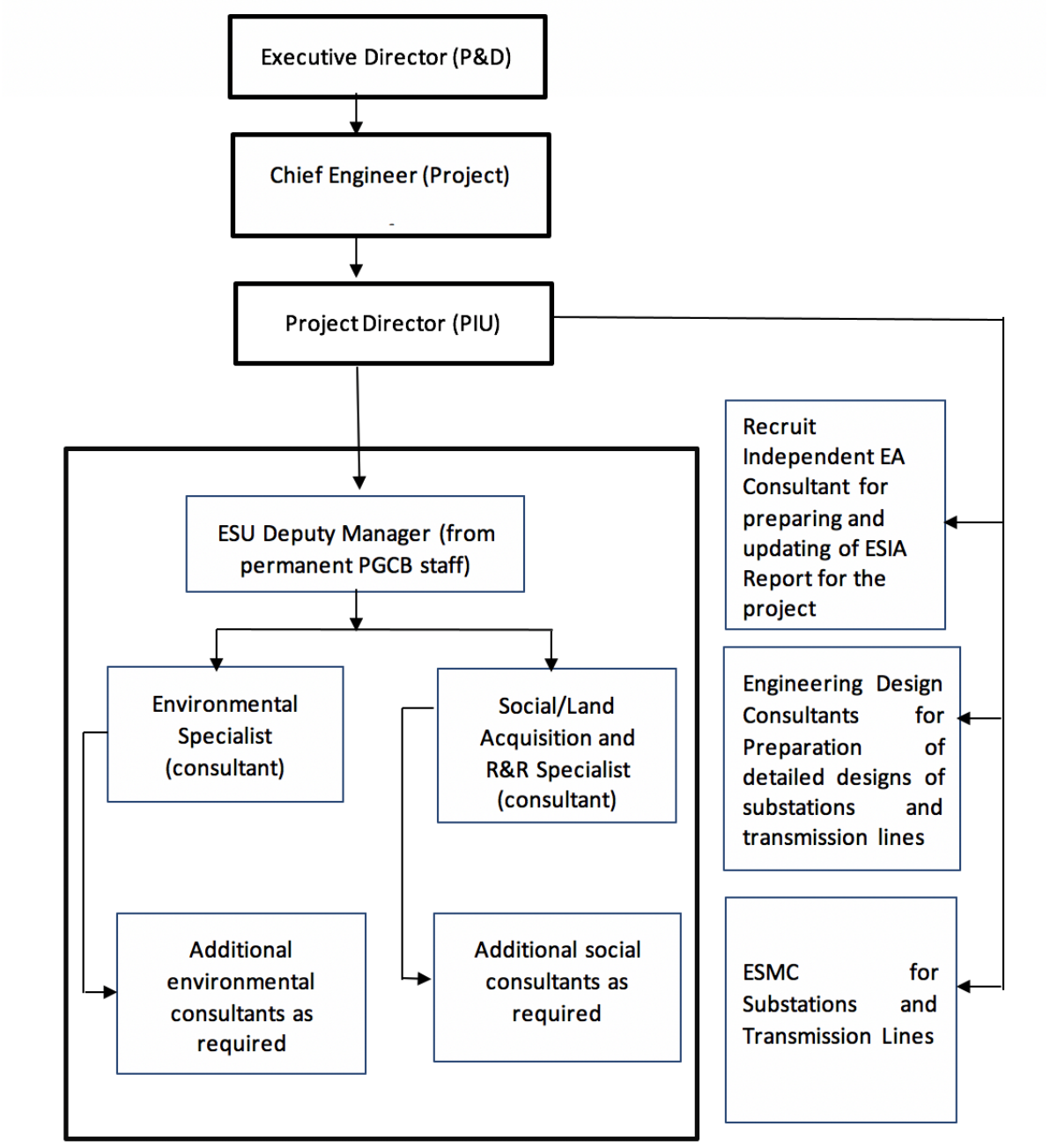


Figure 124: Organogram for Environmental and Social Management of Project

The roles and responsibilities of the PIU, ESU, ESCMC and contractor for the implementation and monitoring of ESMP have been outlined in Table 90.

Table 90: Roles and Responsibilities for ESMP Implementation

Organizations	Responsibilities
PIU	• Ensure effective implementation of the project in accordance with the plans • Ensure that all project activities are well-managed and coordinated. • Establishing ESU and engaging environmental and social development specialist in it. • Recruitment of consultants for ESIA and engineering designs; and obtain approval of ESIA from the DoE

Organizations	Responsibilities
	• Procurement of works and goods. • Payment of compensation to the project affecters • Recruitment and supervision of Environmental Social and Construction Monitoring Consultants (ESCMC) in timely manner. • PIU will submit the report to AIIB. • For GRM and RP implementation, PIU will report to AIIB on quarterly basis and any significant accident immediately inform AIIB.
ESU within PIU	• Responsible for screening and determining scope of EA work required for subprojects and studies, assisting PD with developing ToRs and hiring of consultants to carry out any required environmental assessment work, reviewing consultant's deliverables related to environmental assessment, reviewing bid documents for inclusion of ESMP measures, supervising construction activities, producing periodic monitoring reports, • Ensuring inclusion of ESMP in bidding documents. • Providing training on ESMP principles and requirements to PGCB field staffs, and others as needed to ensure effective implementation of ESMP. • Supervising ESCMC for the implementation of ESMP. • Closely coordinate with other concerned agencies, local governments and communities to support implementation of ESMP • Preparation of progress reports on implementation of ESMP. • Ensure effective implementation of ESMP components not directly tasked to the contractor including components dealing with indirect, induced and cumulative effects, as well as plans and measures for O&M phase. • Commissioning and oversight/review of consultant reports for ESIAs/ESMPs to be developed for the subcomponents of the Project. • ESU will review the report quarterly and bi-annually and submit to PIU.
ESCMC	• Supervise civil works, ensuring compliance with all design parameters including quality requirements • Supervising and monitoring contractors for ESMP implementation • ESCMC would widely implement the RP of the project • Prepare monthly reports and submit to PIU • ESCMC will have dedicated environmental, occupational health and safety, and social and RP Manager staff. • ESCMC should have an ornithologist (bird specialist) and Ecologist cum Wildlife Specialist for biodiversity management and monitoring during construction works and will closely guide Contractor. • ESCMC will prepare the report on quarterly and bi-annually basis and will submit to ESU • CESMP submitted by Contractor will be reviewed and cleared by ESCMC and then submit to ESU before the mobilization of Contractor • ESCMC will update the ESIA report if variation come during on, before or during construction works of the project

Organizations	Responsibilities
Contractor	• Responsible for implementation of mitigation measures and monitoring proposed in the ESMP • Preparation and implementation of CESMP • Each contractor will recruit Environmental, Health, and Safety Manager, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and liaising with government agencies. S/he will have adequate number of staffs to support him/her for these tasks. • Contractor will prepare the report on monthly basis and will submit to ESCMS

Chapter 10
Environmental and Social Management Plan

This chapter describes the environmental and social management plan (ESMP) of the Project. It describes institutional arrangements for the environmental and social management of the project, provides mitigation and monitoring plans, presents monitoring and reporting requirements, and recommends environmental and social trainings to be conducted by various project entities.

10.1 Objectives of ESMP

The basic objective of the ESMP is to manage adverse impacts of proposed project interventions in a way that minimizes the adverse impact on the environment and people in the project area. The specific objectives of the ESMP are to:

- Facilitate the implementation of the mitigation measures discussed earlier in the document;
- Maximize potential project benefits and control negative impacts;
- Draw responsibilities for PGCB, contractors, consultants, and other members of the project team for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters in order to:
  - Ensure the complete implementation of all mitigation measures;
  - Ensure the effectiveness of the mitigation measures;

- Assess environmental training requirements for different stakeholders at various levels.

10.2 Inclusion of Relevant Components of ESMP in Contract Documents

The ESMP of the Project along with the ECPs (discussed later in the Chapter) will be included in the construction bid documents and also reflected in the construction contracts. The technical specifications of the bid documents will clearly state that contractor will need to comply with the mitigation measures provided in ESMP and ECPs; AIIB ESP and Environmental and Social Standards described in Section 2.4, and national regulatory requirements described in Section 2.2 and 2.3.

10.2.1 BOQs in Bid Documents

The following items will be included in the bill of quantities (BOQs) of construction bid documents:

- Preparation and implementation of Contractor's Environmental Action Plan in compliance with ESMP, AIIB ESP and Environmental and Social Standards, and national standards on air, noise, water quality, and others;
- Update and implementation of RP, LMP, SEP, GBV prevention Plan with the support of ESU;
- Provision of an Environmental and Social Officer and an Occupational Health and Safety Officer by Contractor (during construction phase);
- Provision of using diverters while working in WS/RF by contractor;
- Providing and maintenance of Vibration Meters and Dust Measurement Meters for spot measurements;

- Air quality monitoring (PM_{10}, NO_2, SO_2, CO_2, CO) and noise monitoring at locations specified by the PGCB.
- Water quality monitoring where project locations within 500m of waterbodies specified by PGCB.

After award of the contract and before mobilization, the Contractor will need to prepare Construction ESMP (CESMP) with site specific mitigation measures for approval by PGCB. PGCB will ensure that contractors and their subcontractors carry out their responsibility of implementing the mitigation measures, monitoring plan as well as other environmental and safety measures provided in the ESMP.

10.2.2 Payment Milestones

Payments to contractors would be linked to environmental and social performance, measured by completion of the prescribed environmental and social mitigation measures. Contractors would be required to join forces with the executing agency, project management unit, supervising consultants, Forest Department, and local population for the mitigation of adverse impacts of the project. For effective implementation of the proposed mitigation and monitoring measures they will be required to employ trained and experienced environmental management staff. In addition, for any non-compliance causing damages or material harm to the natural environment, public or private property or resources, the contractor will be required to either remediate / rectify any such damages in a timeframe specified by and agreed with the engineer or pay PGCB for the cost (as assessed by PGCB) of contracting a third party to carry out the remediation work.

10.3 Environmental and Social Management

The environmental and social management of the project will be achieved through implementation of a number of plans, which are discussed below.

10.3.1 Environmental Code of Practices for Construction

The environmental codes of practice (ECPs) are generic, non-site-specific guidelines for the construction phase. The ECPs consist of environmental and social management guidelines and practices to be followed by the contractors for sustainable management of all environmental issues. The contractor will be required to follow them and also use them to prepare site-specific management plans (discussed later in the Section) especially for the reserve forest and elephant movement. The ECPs are listed below and attached in Annex III.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Substances Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Top Soil Management
- ECP 8: Topography and Landscaping
- ECP 9: Borrow Areas Management
- ECP 10: Air Quality Management

- ECP 11: Noise and Vibration Management
- ECP 12: Protection of Flora
- ECP 13: Protection of Fauna
- ECP 14: Protection of Fisheries
- ECP 15: Road Transport and Road Traffic Management
- ECP 16: Construction Camp Management
- ECP 17: Cultural and Religious Issues
- ECP 18: Workers Health and Safety.

10.3.2 Construction Stage Site Specific Management Plans

As stated earlier, construction contractor(s) will be required to prepare and implement CESMP. The contractors will need to obtain ESCMC's approval of the CESMP. The key elements of CESMP will include the following:

- **Pollution Prevention Plan** will be prepared and implemented by the contractor on the basis of the mitigation measures given in this ESIA and ECPs.
- **Waste Disposal and Effluent Management Plan** will be prepared and implemented by the Contractor on the basis of the ESMP and ECP.
- **Drinking Water Supply and Sanitation Plan:** Separate water supply and sanitation provisions will be needed for the temporary facilities including offices, labor camps and workshops in order not to cause shortages and/or contamination of existing drinking water sources.
- **Occupational Health and Safety (OHS) Plan** will be prepared and implemented by the contractor on the basis of the present ESMP, ECPs, and other relevant standards.
- **Traffic Management Plan** will be prepared by the contractor after discussion with PGCB and authorities responsible for roads and traffic. The Plan will be submitted to the ESCMC for their review and approval before contractor mobilization. The Plan will identify the routes to be used by the contractors, procedures for the safety of the local community particularly pedestrians, and monitoring mechanism to avoid traffic congestion.
- **Construction Camp Management Plan** will be prepared by the contractor. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal.
- **Fuel and Hazardous Substances Management Plan** will be prepared by the contractor in accordance with the present ESMP, standard operating procedures and other relevant guidelines, and where applicable, material safety data sheets (MSDS). The Plan will include the procedures for handling the oils and chemical spills.
- **Spoil Management Plan** will be prepared by the contractor on the management of excess spoils from various excavation activities.
- **Emergency Preparedness Plan** will be prepared by the contractor after assessing potential risks and hazards that could be encountered during construction.
- **Communication Plan** to deal with the interaction of the community, complaints management, workers recruitment, notice of works and workers conduct with locals.

10.3.3 Mitigations and Compliance Monitoring Plan

The mitigation and compliance monitoring plans (compliance monitoring is discussed Section 9.5.1) are the key element of ESMP to be prepared on the basis of impact assessment and mitigation measures described in Chapter 7 and 8. The plan describes the potentially negative impacts of each

subproject activity, lists mitigation and control measures to address the negative impacts and assigns responsibilities for implementation and monitoring of these measures. For instance, all the site-specific pre-construction plans to be prepared by contractor shall be provided with guidance per IFC/WB EHS general and sectoral guidelines in the ESMP chapter, to ensure that the guidelines standards and measures are followed and reflected in ECP and ESMP measures and monitoring requirements. The ESMP is given in Table 91.

Table 91: Environmental and Social Management Plan

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
Planning and Design/Pre-Construction					
1.1. Change of Land Use, land acquisition and requisition	Location of substations will be selected in uncultivated areas, to the extent possible. Transmission lines will be aligned to minimize impacts on cultivation fields and other important areas. Compensation will be paid to the landowners for the land permanently acquired for the project. Similarly, assistance will be paid to the persons/households losing their livelihoods. However, a RP has been prepared in this case.	PGCB	ESCSMC	Documentary evidence of payment of compensation and assistance; Number of complaints related to land use change and compensation received through GRM; Number of complaints resolved.	Before construction
1.2. Loss of crops, trees, buildings	Compensation and assistance will be paid to the PAPs. A RP has been prepared in this case.	PIU/ESCMC	ESCMC	Documentary evidence of payment of compensation and assistance Income levels of affected households; Number of public grievances re resettlement and compensation received; Number of complaints resolved	Before construction
	Contractors will lease the land for construction facilities on temporary basis. Proper documentation will be carried out for this leasing. Site selection will be carried out in consultation with the community and local officials; approval from ESCMC will also be required for the selected sites.	Contractor	ESCMC	Documentary evidence of land leasing for temporary facilities ESCMC approval for the selected site(s). Absence of grievances regarding temporary facilities	Before contractor mobilization
1.3 Soil, water and noise pollution	A pollution prevention plan will be prepared in accordance with ECPs, national and IFC standards	Contractor	ESCMC	Approved plan; Plan itself will outline appropriate KPIs for its implementation	Before construction
1.4 Disposal of excavated material	Identification of re-use of excavated material on site, to reduce off site effects Maximization of use excavated material in construction.	Contractor	ESCMC	Availability of plan to dispose excavated material	Before construction
1.5 Water quality	Drainage system will be designed so that all spills will be drained and collected in a sump	Contractor	ESCMC	Monitoring in accordance with Drinking Water and Sanitation Plan. No breaches of	Before construction

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	for further appropriate disposal; and Oil and chemical storage and vehicle wash and oil change facilities will be established on impermeable surfaces to avoid percolation			Material Safety Data Sheet (MSDS) for hazardous substances.	
1.6 Traffic Management	A Traffic Management Plan (TMP) will be prepared in accordance with ECP	Contractors	ESCMC	Approved TMP; Plan itself will outline appropriate KPIs for its implementation.	Before mobilization of contractor
1.7. Construction camp (and other temporary facilities) site selection	Site for construction camp will be selected with approval from the Environmental Social and Construction Monitoring Consultants (ESCMC). Areas having thick/dense vegetation will be avoided as far as possible. No beels (water ponds) or canals (water channels) will be affected. Construction camps cannot be located within the Chunati WLS and Himchari NP. Please add this restriction in the ESMP. The areas where construction camps and construction staging areas are not allowed should be made clear to the contractors.	Contractor	ESCMC	Approval from ESCMC Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.8. Construction camp management	Construction Camp Management Plan will be prepared per ECP and approval obtained from ESCMC.	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.9. Waste management	A Waste Management Plan will be prepared per ECP and approval obtained from ESCMC.	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.10. Fuels and hazardous substances management	A fuels and hazardous substances management plan will be prepared per ECP and approval obtained from ESCMC.	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.11. Water resource management	A Drinking Water Supply and Sanitation Plan will be prepared per ECP and approval obtained from ESCMC.	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
1.12. Occupational Health and Safety (OHS) management	An OHS management plan will be prepared per ECP, and approval obtained from ESCMC.	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.13. Drinking water and sanitation	A drinking water and sanitation plan will be prepared per ECP and approval obtained from ESCMC	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.14. Emergency Preparedness	An emergency preparedness plan will be prepared and approval obtained from ESCMC	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.15. Communication and community liaison	A stakeholder engagement plan will be prepared	PIU	-	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before site activities.
1.16. Biodiversity Conservation	A biodiversity conservation plan for crossing the reserve forest and elephant corridors will be prepared. Biodiversity management plan (BMP) will focus trees, avifauna, elephant, fish and any other species with ecological conservation value. BMP will be prepared based on the guidelines of AIIB by the Consultant of the Project.	Contractor	ESCMC	Approved Plan; Plan itself will outline appropriate management and mitigation plan for the conservation of reserve forest and elephant movement	Before site activities
1.17 Hydro-morphological study for 5 rivers	Hydro-morphological study for 5 rivers need to be conducted before starting of site activities.	Contractor (with PIU's assistance)	PIU and ESCMC	Approved hydro-morphological study	Before finalizing the location of river crossing towers, anchor towers and any other towers near these 5 rivers
2. Contractor Mobilization and Demobilization; Transportation of Materials and Supplies					
2.1. Traffic management	• The contractor will implement the traffic management plan. • Construction activities will be scheduled in a manner to avoid peak traffic hours. • Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police.	Contractor (with PIU's assistance)	ESCMC	Number of any non-compliance reports Number of complaints / grievances. Number of traffic accidents/incidents involving project vehicles and lorries bringing materials and supply to project	During mobilization and de-mobilization

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• Traffic signage will be placed where necessary and appropriate to warn the drivers and pedestrians about the construction activities. • ECP to be implemented • GRM will address the traffic congestion elated issues.				
2.2. Soil Erosion and Contamination	• Contractor will implement the Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected. • Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil • Contractor will confine the contaminants immediately after such accidental spillage • Contractor will collect contaminated soils, treat and dispose them in environment friendly manner • All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation • Top soil to be stripped and stockpiled where practical. • Temporary stockpiles to be protected from erosion. For sewage waste, appropriate treatment arrangement such as septic tanks and soakage pits will be installed on site. Water will percolate into the ground so there will be no discharge. Alternatively, sewage from construction	Contractor	ESCMC	Number of any non-compliance reports Number of complaints	Throughout contractor mobilization and de-mobilization

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	camps and other facilities will be collected and transported to nearby municipal sewage treatments plans. • ECPs will be implemented. • Follow 1.16 while crossing the reserve forest				
2.3. Air Quality	• The equipment and vehicles used during the construction process will comply with the national as well as IFC Guidelines on exhaust emissions. • Concrete batching and asphalt plants will be located minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers. • Contractor will implement dust prevention measures such as watering of roads near the residential areas and spraying of water on loose material where required and appropriate. • Regula air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards and IFC Guidelines. • Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment). • A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures.	Contractor	ESCMC	Number of non-compliance reports. Number of community complaints. Ambient air quality found beyond the national and WBG EHS Guidelines	Throughout contractor mobilization and de-mobilization

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	Continued consultations with the affected communities will be carried out during construction phase. • ECP on air quality management will be implemented.				
2.4. Noise	• The equipment and vehicles used during the construction process will comply with the national standards as well as IFC Guidelines on noise. • Contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities. The noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around drilling equipment. • The construction activities near the settlements will not be carried out during nighttime. • Regular noise monitoring will be carried out near the sensitive receptors • A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase. • ECP on noise quality management will be implemented	Contractor	ESCMC	Number of non-compliance reports; Noise measurement data Number of community complaints	Throughout contractor mobilization and de-mobilization

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
2.5. Safety hazards	• Occupational health and safety procedures and OHS Plan will be enforced. Public safety will be included in the Plan. • Implement fuels and hazardous substances management plan • Fencing would be provided around construction sites as appropriate to minimize public safety risks. • A Traffic Management Plan will be implemented that will aim at ensuring access to residential areas, and preventing of unsafe situations, especially near schools, housing areas, construction areas, camps and offices. • Special attention should be focused on safety training for workers to prevent and restrict accidents and on the knowledge how to deal with emergencies. • Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. • Liaison with traffic police and communities will be maintained • Project drivers will be trained on defensive driving. • Vehicle speeds near/within the communities will be kept low, to avoid safety hazards. • Awareness raising of communities will be carried out about the construction activities and associated safety hazards. • ECPs will be implemented	Contractor	ESCMC	Number of any non-compliance reports; Number of any related public complaints Number of accidents, incidents and near-misses.	Throughout contractor mobilization and de-mobilization

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
2.6. Damage to Infrastructure	All damaged infrastructure will be restored to original or better condition.	Contractor	ESCMC	Number of any non-compliance reports; Number of any public complaints	Throughout contractor mobilization and demobilization
2.7. Blocked routes	• Contractor will prepare and implement a traffic management plan, in consultation and coordination with the local community • The community will be informed about the nature of construction activities and possibility of any blocked route; alternate routes will be identified with the help of local/affected community. Duration of such blockage will be minimized to the extent possible. • Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police. • Liaison with the community will be maintained. • The GRM described earlier will also address community grievances related to any blockage of local routes.	Contractor	ESCMC	Number of any non-compliance reports Number of complaints	Before and during construction
3. Construction workers camp establishment and operation					
3.1. Soil erosion; soil and water contamination; solid waste, wastewater, sanitary facilities, PPE, drinking water	• Camp management plan will be implemented • Location of camp will be selected after obtaining ESCMC's approval and in consultation with local community • Photographs will be taken to record the site conditions prior to the establishment of the camp.	Contractor	ESCMC	Compliance to the Camp Management Plan, Waste Management Plan Number of any non-compliance reports Results of soil and water quality analysis	Before and throughout the construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• Land clearing, leveling and grading will be minimized, and carried out in a manner to minimize soil erosion. • Camp will have rainwater drainage arrangements • Camps will have protection arrangements against soil erosion • Contractors will implement the Waste Management Plan and Pollution Prevention Plan. • For the domestic sewage, appropriate treatment and disposal system (e.g., septic tank and soaking pits) will be constructed having adequate capacity • Waste oils will be collected in drums and sold to the recycling contractors. • The inert recyclable waste from the site (such as cardboard, drums, and broken/used parts) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste. • Domestic solid waste from the camp site will be disposed of in a manner that does not cause soil contamination. • The contractor will identify suitable sites for disposal of hazardous and non-hazardous waste. The selection will be done in consultation with the PIU and the local municipal authorities. No waste disposal will be carried out in canals, and rivers. • Contractor will be required to take appropriate measures to avoid and				

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	contain any spillage and pollution of the soil • Contractor will confine the contaminants immediately after such accidental spillage • Contractor will collect contaminated soils, treat and dispose them in environment friendly manner • All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation • The camp site area will be completely restored after completion of construction works. All temporary structures will be demolished, • All camps will have a temporary store of keeping necessary PPEs • ECPs will be implemented				
3.2. Air Quality	• Pollution prevention plan will be implemented • The equipment and vehicles used during the construction process will comply with the national as well as IFC Guidelines on exhaust emissions. • Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment). • A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures.	Contractor	ESCMC	Number of any non-compliance reports Air quality monitoring data Number of related grievances	Throughout the construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	Continued consultations with the affected communities will be carried out during construction phase. • ECP on air quality management will be implemented.				
3.3. Vegetation loss; threat to wildlife	• Clearing natural vegetation will be avoided as far as possible. • The camp will be established in a natural clearing, to the extent possible. • Complete record will be maintained for any tree cutting. • The camp staff will not indulge in any animal shooting, trapping, catching, or killing activities. • Include information on wildlife protection in all tool-box orientation briefings for camp staff • Contractors shall use lower wattage flat lens fixtures that direct light down and reduce glare, and shall avoid use of flood lights. • Contractors will also raise awareness about the protection of birds and other wildlife species among the work force to reduce impacts such as disturbance and poaching • ECPs will be implemented.	Contractor	ESCMC	Number of any non-compliance reports Number of trees felled Number of sighting of key wildlife species	Before and throughout the construction phase
3.4. Noise and vibration	• Pollution prevention plan will be implemented. • Generators and vehicles will have exhaust mufflers (silencers) to minimize noise generation. • Liaison with the communities will be maintained.	Contractor	ESCMC	Number of any non-compliance reports Noise monitoring data Number of grievances regarding noise	Throughout the construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• Noise monitoring will be carried out. • Compliance will be ensured with national and WBG EHS Guidelines. • GRM will be put in place • ECP will be implemented				
3.5. Health and Safety	• Construction camps will be located at least 500 m away from the communities. Entry of the site personnel in the local communities will be minimized to the extent possible / appropriate. • OHS plan will be prepared and implemented • Implement fuels and hazardous substances management plan • Drinking water management plan will be implemented • COVID-19 pandemic management plan will be prepared as per WHO guidelines • Protective fencing to be installed around the Camp to avoid any accidents. • Contain all fuel tanks in a fully bunded area with a storage capacity of at least 110 percent of the potential storage volume. • Spill control arrangements to • Firefighting equipment will be made available at the camps. • The camp staff will be provided OHS training. • All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel. Construction camps will have first aid kits	Contractor	ESCMC	Number of any non-compliance reports Number of trainings conducted Number of accidents, incidents, and near misses. Number of complaints	Before and throughout the construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• Camp crew will be provided with awareness for transmissible diseases (e.g., HIV, hepatitis B and C). • ECPs will be implemented.				
3.6. Social and Gender Issues	• Labor Management Plan including a Code of conduct will be implemented per international best practice provided in the WB Guidance Note on labor influx. • Local norms and customs will be respected • Camp crew will avoid entering the villages • No child labor will be employed in the camps. • A GBV prevention plan will be followed on social and gender issues per international best practice provided in the WB Good Practice Note on GBV/SEA/SH. • Camp staff will be provided training on code of conduct, gender issues, GBV and SE • Liaison with the community will be maintained. • GRM will be put in place • ECP will be implemented	Contractor	ESCMC	Number of non-compliance reports; Number of related complaints	Throughout the construction phase
3.7 Chance finds	In case any artifacts or sites of archeological, cultural, historical, or religious significance are discovered during camp clearance, the works will be stopped, and the Archeological Department will be informed. During excavation of tower footings refer to the chance find procedures per Annex VIII	Contractor	ESCMC	Number of non-compliance reports Number of reports of any PCR discovery	Throughout the construction phase
3.8 Increased Load on Local Services and Supplies	• The contractors to procure their supplies in a manner not significantly affecting the	Contractor	ESCMC	Number of related public grievances	Construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	availability of essential commodities in the area for the residents. • Community liaison will be maintained • GRM will be established to address community complaints and grievances.				
3.9 Access roads and damages to local infrastructure and public utilities	• Minimize damages to infrastructure and public utilities; • Compensation as per RAP, • Relocation of utilities; • Coordination with relevant entities	Contractor	ESCMC	Number of related public grievances	Construction phase
4. Construction Activities (Substations; Towers Foundations; Tower Erection; and Conductor Stringing)					
4.1. Soil erosion	• Works will be carried out in a manner not to cause soil erosion • Vehicular traffic near the bank line will be minimized • Protective measures such as mulching will be undertaken to stop erosion • Vehicular traffic on unpaved roads will be minimized • ECP will be implemented.	Contractor	ESCMC	Number of non-compliances observed. Number of complaints	Throughout the construction phase
4.2. Soil and water contamination	• Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected. • Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil • Contractor will confine the contaminants immediately after such accidental spillage • Contractor will collect contaminated soils, treat and dispose them in environment friendly manner	Contractor	ESCMC	Number of non-compliances observed or reported Monthly auditing of management of hazardous materials against Material Safety Data Sheet Soil and water quality monitoring data Number of any non-compliance Number of related complaints	Throughout the construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation • Top soil to be stripped and stockpiled where practical. • Temporary stockpiles to be protected from erosion. For sewage waste, appropriate treatment arrangement such as septic tanks and soakage pits will be installed on site. Water will percolate into the ground so there will be no discharge. Alternatively, sewage from construction camps and other facilities will be collected and transported to nearby municipal sewage treatments plans. • ECPs will be implemented.				
4.3 Air Quality	• The equipment and vehicles used during the construction process will comply with the national as well as WBG EHS Guidelines on exhaust emissions. • Concrete batching and asphalt plants will be located minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers. • Contractor will implement dust prevention measures such as watering of roads near the residential areas and spraying of water on loose material where required and appropriate. • While transporting loose material such as sand, it will be covered with tarpaulin.	Contractor	ESCMC	Number of non-compliances observed or reported Number of dust-related complaints. Number of air quality-related complaints, Air quality monitoring data	Throughout construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards and IFC Guidelines. • Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment). • A GRM (discussed later in the document) will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. • Continued consultations with the affected communities will be carried out during construction phase. • ECP on air quality management will be implemented				
4.4. Health and Safety	• The contractor will implement the OHS Plan for workers that will also cover communities' health and safety aspects • The community will be informed about the nature of construction activities and the associated health and safety risks; awareness raising of the communities will be carried out for this purpose with the help of training sessions, posters, signage, and other similar means. • Awareness raising of communities will be carried out, in a culturally-sensitive manner, about the communicable	Contractor	ESCMC	Number of non-compliances observed or reported Number of respiratory protective devices and other PPEs issues to workers. Monitoring of compliance with Health and Safety standards (including monthly reporting of accidents). Number of accidents, incidents and near misses. Number of trainings provided. Number of complaints received	Throughout construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	diseases including sexually transmitted infections. • Regular safety monitoring will be carried out at the sensitive receptors. • The construction sites will be fenced as appropriate to minimize entry of the local communities particularly children in the work areas. • Liaison with the community will be maintained. • GRM will be established to address community grievances related to health and safety aspects. • Contractors will have dedicated and qualified staff for ensuring compliance with the OHS Plan • Regular trainings will be provided to the workers on OHS aspects. • Awareness raising material will be used including posters, signage, booklets, and others • All site personnel will be screened for communicable diseases including sexually transmitted infections. • Use of appropriate personal protective equipment (PPE) will be mandatory. No worker (or even visitor) will be allowed on the site without the required PPE (such as hard hat, safety shoes). • Firefighting equipment will be made available as required at construction sites, camp sites, and particularly near the fuel storage.				

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• The project drivers will be trained in defensive driving. They will maintain low speed while driving through / near the communities. • Complete record of accidents and near-misses will be maintained. • First aid facilities will be made available at the work sites and in the camps. The contractors will engage qualified first aider(s). • Location and telephone numbers of the nearest hospital will be displayed at appropriate places at work sites and in construction camps. If necessary, the contractor will have an ambulance available at the site. • ECP will be implemented.				
4.5. Noise and Vibration	• The equipment and vehicles used during the construction process will comply with the national standards as well as WBG EHS Guidelines on noise. • Contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities. The noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around drilling equipment. • The construction activities near the settlements will not be carried out during night time. • Regular noise monitoring will be carried out near the sensitive receptors.	Contractor	ESCMC	Number of non-compliances observed or reported Record of equipment used on site capable of producing over 85dB and whether equipment has been fitted with mufflers Number of related community complaints Noise monitoring data	Throughout construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. • Continued consultations with the affected communities will be carried out during construction phase. • ECP on noise quality management will be implemented				
4.6. Vegetation loss; damage to crops	• Clearing and removing of natural vegetation and crops will be minimized • Tree cutting will be minimized • Selecting barren/fallow land for establishing substations and aligning transmission lines. • Compensatory tree plantation will be carried out (e.g., along the periphery of substations). • Compensation will be paid for any crop damage. • Replantation will be done at 1:5 ratio; • ECP will be implemented	Contractor	ESCMC	Area of vegetation lost/disturbed Number of trees felled Number of complaints received.	Throughout construction phase
4.7. Threat to wildlife	• Complete record will be maintained for any tree cutting. • The site staff will not indulge in any animal shooting, trapping, catching, or killing activities. • Include information on wildlife protection in all tool-box orientation briefings for camp staff • Contractors shall use lower wattage flat lens fixtures that direct light down and	Contractor	ESCMC	Number of any non-compliance reports Number of sighting of key wildlife species	Before and throughout the construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	reduce glare, and shall avoid use of flood lights. • Contractors will also raise awareness about the protection of birds and other wildlife species among the work force to reduce impacts such as disturbance and poaching • ECPs will be implemented.				
4.8. Damage to infrastructure	• Any damaged infrastructure such as roads, or culverts will be repaired	Contractor	ESCMC	Number of any non-compliance reports Number of related complaints	construction phase
4.9. Damage to Sites/Places of Religious / Cultural Significance	• The contractor will identify and demarcate any sites and places of religious and or cultural significance, in consultation with the local community. Such sites will be 'no-go-areas' and will be avoided as far as possible. If unavoidable, then the contractor will prepare a plan to move/restore such places in consultation with local community and (related authorities if relevant and required). Such a plan will be implemented after obtaining complete consensus of the related community. • Liaison with the community will be maintained. • Chance Find Procedures will be put in place. • Chance Find Procedure: In the event of discovery of any site or artefact of archeological, historical, cultural, or religious significance, the contractor shall immediately cease all works in that area and report the find to PGCB. Works may not recommence until approval is given	Contractor	ESCMC	Number of any non-compliance reports Number of complaints received. Number of reports of any new PCR discovered/reported	construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	by the PGCB. Upon receiving a report of a chance find, the Archeological Department will be notified and their site visit will be facilitated. Further works will be carried out on such sites only after obtaining clearance from the Archeological Department / DoE. • The GRM described earlier will also address community grievances related to any damage to sites of religious and or cultural importance.				
4.10. Loss of Access to Villages	• Contractor will prepare and implement a traffic management plan, in consultation and coordination with the local community • The community will be informed about the nature of construction activities and possibility of any blocked route; alternate routes will be identified with the help of local/affected community. Duration of such blockage will be minimized to the extent possible. • Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police. • Liaison with the community will be maintained. • The GRM will be established	Contractor	ESCMC	Number of related community complaints	construction phase
4.11. Social conflict due to the Influx of Workers; gender issues	• Labor Management Plan including Code of conduct will be implemented as per international best practice provided in the WB Guidance Note on labor influx • Local norms and customs will be respected	Contractor	ESCMC	Number of public grievances relating to in-migrants Number of trainings provided	Construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• Camp crew will avoid entering the villages • No child labor will be employed in the camps. • Camp staff will be provided training on code of conduct, gender issues, GBV and SE • WB's guidance note on GBV will be followed • Liaison with the community will be maintained. • GRM will be put in place • ECP will be implemented.				
4.13. Traffic congestion	• The contractor will implement the traffic management plan. • Construction activities will be scheduled in a manner to avoid peak traffic hours. • Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police. • Traffic signage will be placed where necessary and appropriate to warn the drivers and pedestrians about the construction activities. • ECP to be implemented • GRM will address the traffic congestion elated issues.	Contractor (with PIU's assistance)	ESCMC	Number of any non-compliance reports Number of complaints / grievances. Number of traffic accidents/incidents involving project vehicles and lorries bringing materials and supply to project	During construction phase
4.14. Damaged rivers/canals and tube-wells	• Any excavation and other construction work near rivers/canals and tube-wells will be planned and implemented in a manner to avoid any damage to these structures. • The vehicle movement near rivers/canals and tube-wells will be minimized. If	Contractor	ESCMC	Number of non-compliances Number of complaints received	During construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	unavoidable, it will be closely monitored to avoid any damage to these structures. • No excavated material or debris will be released into the rivers/canals. • The contractor will repair and restore any damage the construction activities may cause to rivers/canals and tube-wells. • GRM will be established.				
4.15. Spoil generation	• Recycle excavated material and use it in construction • Surplus spoil to be disposed in consultation of communities and relevant authorities	Contractor	ESCMC	Number of non-compliances Number of complaints received	During construction phase
4.16. Impacts of lightning	• Strengthen the insulation level of transmission line • Installing controllable discharge lightning rod • Reduce the tower grounding resistance • Add ground coupling • The proper use of transmission line lightning arrester	PIU	PGCB	During the rainy season	Construction and operation phase
5. Waste management					
5.1. Soil and water contamination	• Contractors will implement the Waste Management Plan. • Appropriate hazardous, industrial and domestic waste disposal facilities must be established • For the domestic sewage, appropriate treatment and disposal system (e.g., septic tanks and soaking pits) will be constructed having adequate capacity • Waste oils will be collected in drums and sold to the recycling contractors.	Contractor	ESCMC	Monthly auditing of management of hazardous materials against Material Safety Data Sheet Soil and water quality monitoring data Reports if any non-compliance Number of complaints received	construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• The inert recyclable waste from the site (such as cardboard, drums, and broken/used parts) will be sold to recycling contractors. • The hazardous waste will be kept separate and handled according to the nature of the waste. • Domestic solid waste will be disposed of in a manner that does not cause soil contamination. • Awareness raising for minimizing use of non-biodegradable substances • Regular maintenance of waste management facilities will be undertaken • No waste dumping/release will be carried out in environmental sensitive areas and rivers • Implement ECPs				
5.2. Odor	• Waste disposal sites will be located away from the communities • Regular maintenance of waste management facilities will be undertaken	Contractor	ESCMC	Number of related complaints	construction phase
6. Site Restoration					
6.1. Site restoration	• Demolition of temporary structures • Removal of all debris, excess construction material, scraps, spoils, other wastes • Landscaping will be carried out • Restoration of sites for camps and office buildings. • ECPs will be implemented.	Contractor	ESCMC	Photographic record Clearance from ESCMC	construction phase
7. Social management plans (RP/GAP/LMP/SEP)					
7.1. Resettlement Plan	• Land acquisition and requisition for 3 substations (35 acres of land)	PIU/ESU	External RP Monitor, INGO	As per RP report	construction phase

Impacts/ Issue	Actions/Mitigations	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	• Compensation of SSs land • Compensation of standing crops, trees, etc. • Compensation of land for tower footings • Any other allowances as mentioned in RP • Updating the RP report before providing the compensation				
7.2. GAP, LMP and SEP	• Updating, implementation and monitoring of GAP, LMP and SEP	PIU/ESU	INGO	As per Plans prepared for this project	construction phase

10.4 Monitoring Program

As one of the key elements of the ESMP, a two-tier monitoring program has been proposed comprising compliance monitoring and effects monitoring. The main purpose of this monitoring program is to ensure that the various tasks detailed in the ESMP particularly the mitigation measures are implemented in an effective manner, and also to evaluate program impacts on the key environment and social parameters. Both these types of ESMP monitoring are discussed below.

10.4.1 Compliance Monitoring

The purpose of the compliance monitoring is to ensure that the contractor implements the mitigation measures given in the ESMP are effectively and timely implemented. This monitoring will generally be carried out by the ESCMC with the help of checklists prepared on the basis of the mitigation measures given in Table 91.

10.4.2 Effects Monitoring

Effects monitoring is a very important aspect of ESMP and aims to ensure environmental protection. The effects monitoring plan proposed for the project is presented in Table 92. The monitoring will comprise surveillance to check whether the contractor is meeting the provisions of the contract during construction and operation of the project including the responsible agencies for implementation and supervision. Compliance indicators or threshold limits for the monitoring are also given in Table 92. Actual monitoring time and location will be decided by ESCMC and PIU.

Table 92: Effects Monitoring Plan

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Pre- Construction Phase						
Air (PM, CO_2,)	At sensitive sites identified by ESCMC	24-hour continuous monitoring with appropriate equipment	Compliance with national and WBG EHS Guidelines	Monthly	Contractor	ESCMC
Water quality	At sensitive sites identified by ESCMC	Testing of ground and surface water quality of standard parameters	National and WBG EHS Guidelines for drinking water	Monthly	Contractor	ESCMC
Noise	At sensitive sites identified by ESCMC	Noise measurement using potable noise meter;	Compliance with national and IFC standards	Monthly	Contractor	ESCMC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
During Construction Phase						
Hydrocarbon and chemical storage and handling	Construction camps and yards	Visual Inspection of storage facilities	No leakages from the containers in the storage. Handling follows procedures to avoid spillages.	Monthly	Contractor	ESCMC
Spoils	At substations and tower locations	Visual inspections	Disposal in approved locations	Monthly	Contractor	ESCMC
Traffic Safety	Access Roads; other roads in project area (particularly along the underground transmission line route	Visual inspection to see whether proper traffic signs are placed and flag-persons for traffic management are engaged	Smooth flowing of traffic; and placement of traffic signs and flag-person	Monthly	Contractor	ESCMC
Dust	Construction sites	Visual inspection to ensure good standard equipment is in use and dust suppression measures (e.g., spraying of waters) are in place.	No dust generation from the construction activities	Weekly	Contractor	ESCMC
	Construction Sites	Spot measurements with potable meters	Compliance with national and WBG EHS Guidelines	Monthly	Contractor	ESCMC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Noise	Construction sites; camp site	Noise measurement using potable noise meter;	Compliance with national and IFC standards	Monthly	Contractor	ESCMC
Waste Management	Construction camps and construction sites	Visual inspection that solid waste collection facilities are in place and waste is disposed at designated site	Facilities are clean and waste collection and disposal facilities are in place	Monthly	Contractor	ESCMC
Biodiversity management	WS/RF areas	Continuous monitoring by standard methods as per management plan	As per management plan principles	Regularly	ESCMC	ESCMC
Drinking water quality	Camps, offices	Testing of water quality of workers camp water supply for drinking water standards	National and WBG EHS Guidelines for drinking water	Monthly	Contractor	ESCMC
Air (PM, CO_2,)	At sensitive sites identified by ESCMC	24-hour continuous monitoring with appropriate equipment	Compliance with national and WBG EHS Guidelines	Half yearly	Contractor	ESCMC, PIU
Cultural and archeological Sites	At all work sties	Visual observation for chance finds	Indication of chance finds	Daily	Contractor	ESCMC, PIU
Restoration of Work Sites	All Work Sites	Visual Inspection	The facilities are clean with no waste at the works sites	After completion of all works	Contractor	ESCMC, PIU
Safety of workers	At work sites	Usage of PPE and	All workers should be	Monthly	Contractor	ESCMC, PIU

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Monitoring and reporting of accidents		implementation of contractor OHS plan	provided with, and use necessary PPEs			
Grievances	In the project area	Number of grievances registered and addressed	Minutes of grievance redress meetings; number of grievances received; number of grievances resolved.	Monthly	ESCMC	PIU
During Operation and Maintenance (OM) Phase						
Inspection as per Standard Operating Procedures	Tower locations	Visual Inspection of environmental related issues	Comply with PGCB SOPs	Monthly	PIU	PGCB
Bird collision and electrocution data	At locations crossed by major rivers	Walk over surveys and interviews	Zero mortality	Six monthly – in March and October	PIU	PGCB
Electro-magnetic fields	Near the residential areas along the transmission line alignment	Measurement through appropriate equipment	WHO recognized standards	Yearly	PIU	PGCB
SF6 Leakage	Substations location	Measurement through appropriate equipment	Comply with PGCB SOPs	Periodically	PIU	PGCB

10.5 Performance Indicators

For evaluating the performance of the environmental management and monitoring plan, performance indicators are identified for efficient and timely implementation of measures/actions proposed in ESMP. The indicators are defined both for implementation phase and for operation phase. ESCMC will be responsible for compiling the information on these indicators and report to PGCB.

To measure the overall environmental performance of the project, a list of performance indicators is given below:

- Number of inspections carried out by ESCMC per month.
- Number of non-compliances observed by ESCMC or PIU.
- Availability of environmental specialists in ESCMC.
- Availability of EHS specialists with contractors.
- Timely reporting of documents (as defined in ESMP and monitoring plan).
- Number of trainings imparted to stakeholders/other capacity building initiatives.
- Timely disbursement of compensation/ timely resettlement of project affectees
- Timely implementation of resettlement schedule.
- Number of grievances received.
- Number of grievances resolved.
- Number of construction-related accidents.

10.6 Capacity Building

Capacity building for effective implementation of the environmental and social requirements is a key element of the ESMP. Capacity building for environmental and social management will need to be carried out at all tiers of the project, including PGCB, PIU, ESCMC, and contractors. At the construction site, ESCMC will take the lead in implementing the capacity building plan, though the contractors will also be responsible to conduct trainings for their own staff and workers. The various aspects that are covered under the capacity building will include general environmental and social awareness, key environmental and social sensitivities of the area, key environmental and social impacts of the project, ESMP requirements, OHS aspects, and waste disposal. Table 93 provides a summary of various aspects of the environmental and social trainings to be conducted at the construction site. ESIC may revise the plan during the project implementation as required. During the O&M phase of the project, these trainings will continue to be conducted by PGCB staff for all relevant O&M personnel.

Table 93: Environmental and Social Trainings

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project influence area; Mitigation measures; Community issues and workers' code of conduct; Grievance Mechanism; ESMP; Awareness of transmissible diseases;	PIU; ESCMC; selected contractors' crew	ESCMC	Prior to the start of the field activities. (To be repeated as needed.)

Contents	Participants	Responsibility	Schedule
Workers' Code of Conduct; Social and cultural values; Gender issues including GBV and SE.			
Biodiversity management and monitoring; Elephant and human conflict; Bird collision and monitoring, etc.	PIU; ESCMC; selected contractors' crew	ESCMC	Prior to the start of the field activities. (To be repeated as needed.)
ESMP; Waste disposal; OHS; Code of Conduct; Social and cultural values; Gender issues including GBV and SE.	Construction crew	Contractors	Prior to the start of the construction activities. (To be repeated as needed.)
Road safety; Defensive driving/; Waste disposal; Cultural values and social sensitivity; Gender issues including GBV and SE; Code of Conduct.	Drivers	Contractors	Before and during the field operations. (To be repeated as needed.)
Camp operation; Waste disposal; OHS Natural resource conservation; Code of Conduct; Gender issues including GBV and SE; Housekeeping	Camp staff	Contractors	Before and during the field operations. (To be repeated as needed.)
Restoration requirements; Waste disposal.	Restoration teams	Contractors	Before the start of the restoration activities.

10.7 Documentation and Reporting

The PIU with assistance from ESCMC and contractors will produce the following environmental and social reporting documentation and report to AIIB by PIU:

Monthly Report on Environment, Health, and Safety: the contractor will prepare a monthly report covering environmental monitoring, OHS compliance, OHS incidents and accidents, trainings conducted, and any other salient activities carried out during the reporting period. The report will be submitted to ESCMC.

Quarterly/Bi-annually Progress Reports on Environment: The environmental monitoring reports will include environmental mitigation measures undertaken, environmental monitoring activities undertaken, details of monitoring data collected, analysis of monitoring results particularly the non-compliances, recommended mitigation and corrective measures, environmental training conducted, and environmental regulatory violations observed. The environmental monitoring reports will be submitted quarterly during the construction period and annually for two and half years after completion of construction. ESCMC will prepare the report on quarterly and bi-annually basis and

will submit to ESU. CESMP submitted by Contractor will be reviewed and cleared by ESCMC and then submit to ESU before the mobilization of Contractor on quarterly and bi-annually.

Quarterly Progress Reports on Social and Resettlement: The quarterly social progress reports will cover the progress on implementation of social mitigation measures including payment of compensation and assistance by ESCMC.

Project Completion Environmental Monitoring Report: One year after completion of construction, the PIU will submit a Project Completion Environmental Monitoring Report which will summarize the overall environmental impacts from the project by ESCMC and Contractor.

10.8 Budget for ESMP Implementation

For implementing the present ESMP, about 1398.82 million BDT will be required. The major components of this cost include about 1350.10 million for RP Budget (acquisition, compensation, allowance, etc.), Engagement of INGO/ESCMC 32.00 million BDT, and 12.72 million BDT for mitigations and trainings. The breakdown for the ESMP implementation cost is given in Table 94.

Table 94: Budget for the Environmental Management Plan

Item	Quantity	Rate	Total (Million BDT)
Mitigation Plan and contingency	2 years	Lump sum	3.00
Enhancement plan	2 years	Lump sum	2.00
Training of Professionals and Worker about accidental cases and safety measures	2 years	Lump sum	3.00
Replantation Cost (1:5)	118125	40	4.72
Sub-total			**12.72**
RP Budget (acquisition, compensation, allowance, etc.)	2 years		1350.10
External Consultant (Social & Environment)	2 years		3.00
Engagement of INGO/ESCMC	2 years		
(a) RP Implementation Cost		Lump sum	20.00
(b) ESMP Monitoring Cost		Lump sum	12.00
Yearly DoE renewal cost	2 years	Lump sum	1.00
Sub-Total			**1386.10**
		Total Cost (million BDT)	**1398.82**

N.B.: DoE Renewal will be as per updated ECR schedule and associated with the project implementation timeline. Quarterly environmental parameter checking will also be included in the budget and the contractor will act accordingly as per guideline provided by PIU, PGCB.

The ESMP monitoring cost includes SEP, GBV and LMP. The ToR for RP implementation, External Consultant (Social & Environment) has been provided in RP report.

Chapter 11
Grievance and Redress Mechanism

11.1 Introduction

Grievance (in the context of a development Project) is an issue, concern, problem, or claim (perceived or actual) that an individual or community group wants to be addressed and resolved by the Project Authority. The grievance mechanism is a local based, project-specific extra-legal way to deal with and resolve complaints and grievances faster and thus enhance project performance in terms of environment, social and resettlement management.

PGCB will establish a grievance redress mechanism (GRM) as a means to ensure social accountability and to answer to queries and address complaints and grievances about any irregularities in application of the guidelines adopted in this ESIA for assessment and mitigation of social and environmental impacts. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will however not pre-empt or deny a person's right to go to the courts of law.

11.2 Purpose

The fundamental objectives of the GRM, implemented through the Grievance Redress Committees (GRCs) serving as a para-legal body, are to resolve any environment, social or resettlement-related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of the project and present ESMP. Another important objective is to democratize the development process at the local level and to establish accountability to the affected people. The mechanism tends to meet the requirements of stakeholder engagement process, prevent and address community concerns, reduce risk, and assist the processes that create positive social change. A well-functioning grievance mechanism contains the following elements:

- Provides a predictable, transparent, and credible process to all stakeholders, resulting in outcomes that are seen as fair, effective, and lasting;
- Builds trust as an integral component of broader community relations activities and between employees;
- Enables more systematic identification of emerging issues and trends, facilitating corrective action and community engagement.

Managing community grievances is equally important, especially in the cases pertaining to land acquisition where often the likelihood of landowners not being satisfied with the compensation is observed. The land compensation for proposed substations will be given to follow the Acquisition and Requisition of Immovable Property Act 2017. According to this Act, the Deputy Commissioner (DC), thereafter, enhance the assessed value by 200% and another 100% premium for loss of standing crops, structures and income due to compulsory nature of the acquisition. So, there is no reason of dissatisfaction. Effective GRCs are required for providing the compensation properly to the affected persons.

11.3 Scope

The Grievance Redressal Mechanism (GRM) has been developed with an intention of it being an effective tool for early identification, assessment and resolution of complaints during Project implementation. It is a means through which acceptance, assessment and resolution of community complaints concerning the performance or behavior of the PGCB are ascertained and addressed. The GRM prepared should be implemented to the entire life cycle of the proposed transmission lines and substations project prior to the construction phase. Consultations, communication and disclosure of this plan are mandated by AIIB as per its Environmental and Social Framework (ESF) to Grievance Redress in Project (Dispute Resolution and Prevention).

The Bank (AIIB) requires the PGCB to establish, in accordance with the ESP and applicable ESSs, a suitable grievance mechanism to receive and facilitate resolution of the concerns or complaints of people who believe they have been adversely affected by the Project's environmental or social impacts, and to inform Project affected people (PAP) of its availability. The grievance mechanism is scaled to the risks and impacts of the Project. The grievance mechanism may utilize existing formal or informal grievance mechanisms, provided that they are properly designed and implemented, and deemed by the Bank to be suitable for the Project; these may be supplemented, as needed, with Project specific arrangements. The mechanism is designed to address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender sensitive, culturally appropriate and readily accessible to all affected people. The grievance mechanism includes provisions to protect complainants from retaliation and to remain anonymous, if requested. The mechanism provides for maintenance of a publicly accessible case register, and reports on grievance redress and outcomes, which are disclosed in accordance with the applicable ESS.

However, people who believe they have been or are likely to be adversely affected by a failure of the Bank to implement the ESP may also submit complaints to the Bank's Project-affected People's Mechanism in accordance with the Policy on the Project-affected People's Mechanism.

11.4 Grievance Redress Mechanism

PGCB would establish a procedure to deal with and resolve any queries as well as address complaints and grievances about any irregularities. In this regard, a policy and/or guideline will be prepared and adopted for assessing and mitigating potential social and environmental complaints/impacts through Grievance Redress Mechanism (GRM). The GRM will deal with complaints and grievances related to both social/resettlement and environmental issues of the Project. The mechanism, process or procedure will not prevent access to judicial or administrative remedies.

The Project-affected People's Mechanism (PPM) has been established by the AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement its ESF in situations when their concerns cannot be addressed satisfactorily through Project-level GRM or AIIB Management's processes. It has been advised that a multi-tier GRM will be constituted for the Project in line with the prescriptions of the PPM Policy of the Bank, building on the existing complaint mechanisms. GRM also will deals the any issues raise in the case of gender-based violence (GBV).

Local and Project-level Grievances Redress Committees (GRC) will be formed to receive and resolve complaints as well as grievances from aggrieved persons from the local stakeholders including the Project-affected persons. Based on consensus, the procedure will help resolving issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will, however, not prevent a person's right to go to the courts of law. The GRCs will be established through a gazette notification from the Ministry of Power, Energy and Mineral Resources (MPEMR); therefore, the GRC will be a legally constituted body.

11.5 Grievance Mechanism Principles

Grievance Mechanisms will respond to the Project needs if they are developed early in the Project cycle as a measure to anticipate rather than respond to the rise of apprehension with surrounding communities. As per IFC's Good Practice Note on Addressing Grievances from Project-Affected Communities, September 2009, five principles have been recommended to ensure that the mechanism becomes acceptable to the communities. The five principles relate to:

- *Proportionality:* Scaled to risk and adverse impact on affected communities
- *Cultural Appropriateness:* Designed taking into account culturally appropriate ways of handling community concerns
- Accessibility: Clear and understandable mechanism that is accessible to all segments of the affected communities at no cost
- Transparency and Accountability: To all stakeholders
- Appropriate Protection: A mechanism that prevents retribution and does not impede access to other remedies.

11.6 Approach to Grievance Redress

IFC in its "Approach to Grievance Redress in Projects" has proposed three interlinked steps of Grievance Redress. The steps are provided in the following:

- A risk-based assessment of potential grievances, disputes or conflicts that may arise during Project preparation and implementation.
- Identification of the client's existing capacity for grievance redress.
- An Action Plan that identified priority area for strengthening grievance capacity, or if necessary, establishing new mechanisms at the Project level.

11.7 Process Involved in an Effective Grievance Management

An effective grievance management encompasses a step-by-step process which is necessary along with competent personnel for proper completion of grievances handled. IFC's Good Practice Note on Addressing Grievances from Project Affected Communities highlights five steps which should be considered in implementing an effective grievance mechanism. The five process steps have been detailed in the following:

- **Publicizing Grievance Management Procedures:** An effective grievance mechanism can be determined by how popular and accessible it is to the stakeholders. By publicizing the grievance mechanism in line with the cultural characteristics and accessibility factor, the success of its acceptability can be determined among the stakeholders.

- **Receiving and Keeping Track of Grievances:** Once publicizing of the grievance's mechanism is undertaken the PGCB should have the capacity of collecting grievances, recording, registering and tracking them throughout the processing cycle to reflect their status and important details.
- **Reviewing and Investigating Grievances:** A successful grievance mechanism reflects the transparency and speed by which it records, registers and addresses the grievances.
- **Developing Resolution Options and Preparing a Response:** Once acknowledgment and understanding of the grievances is done, resolution options to commensurate with the nature of grievances by considering community preferences, Project policy, past experiences, current issues and potential outcomes is to be developed.
- **Monitoring, Reporting and Evaluating a Grievance Mechanism:** The tools of monitoring and reporting are important components for measuring the effectiveness of the grievance mechanism. Monitoring helps identify common or recurrent claims that may require structural solutions or a policy change, and it enables the PGCB to capture any lessons learned in the resolution of grievances.

11.8 Composition of GRC

The GRCs will be established locally at Project sites and centrally at the Project level to receive as well as settle grievances from the affected persons and other local stakeholders. The two-tier GRM will be composed of local GRCs at the union/municipal level (LGRC), the first tier, and Project GRC at the central level (PGRC), the second tier. Most of the grievances will be resolved at the local-level GRC, but those cases that cannot be resolved at the local level will be forwarded to PGRC. The LGRC will be constituted with representation of the local Union Parishad Chairman and affected people ensuring women's representation. The PGRC will be constituted with representation from the PIU, Implementing NGO and one independent person from the civil society having knowledge about land acquisition/ requisition law of Bangladesh and involuntary resettlement. A total of three GRCs will be created consists of above-mentioned bodies.

Local Level GRC (LGRC)

The following composition is proposed for the local level GRC (LGRC) with representations from Project Proponent, INGO, local public representatives, representatives of affected people including women in the Project area to ensure a participatory process and to allow voices of the affected communities in the grievance procedures.

1.	Executive Engineer, PGCB	Convener
2.	Representative of INGO (non-voting)	Member-Secretary
3.	Chairman of Union Parishad (UP) concerned	Member
4.	Female Member of ward of the UP concerned	Member
5.	Retired teacher from the union concerned	Member
6.	Representative of PAPs	Member

A representative of PAPs (based on the recommendation of INGO and approved by the Convener) will be a member of the LGRC. The Member-Secretary of LGRC will be available and accessible to PAPs to address concerns and grievances. Unresolved cases will be forwarded to the PGRC. The LGRC is empowered to take a decision, which is bound upon the Project Proponent. But it requires the approval of the Project Director for implementation of the decisions.

Terms of Reference for Local GRC (LGRC)
The scopes of work and the Terms of Reference (ToR) for LGRC are:

- The LGRC shall review, consider and resolve grievances related to social/resettlement and environmental mitigations during implementation of the Project.
- Any grievances presented to the LGRC, should ideally be resolved on the first day of hearing or within a period of four weeks except complicated issues requiring additional investigations. Grievances of indirectly affected persons and/or persons affected during project implementation due to social or environmental problems will also be reviewed by LGRC.
- The LGRC will not engage in any review of the legal standing of an "awardee" other than in the distribution of shares of acquired property among the legal owners and associated compensation or entitlement issues.
- LGRC decisions should ideally be arrived at through consensus, failing which resolution will be based on majority vote. Any decision made by the LGRC must be within the purview of RP policy framework and entitlements.
- The LGRC will not deal with any matters pending in the court of law.
- A minimum three members (in addition to the Member Secretary) shall form the quorum for the meeting of the LGRC to proceed.

The INGO will assist the PAPs in lodging their resettlement complaints in a proper format acceptable to the LGRC after they get ID Cards from the Project Proponent (EA) or are informed about their entitlements and losses. LGRC meetings will be held in the convener's office in the Project area or other location(s) as agreed by the aggrieved persons. If needed, LGRC members may undertake field visits to verify and review the issues at dispute, including titles/shares, left-out cases during Joint Verification Survey (JVS) or other relevant matters.

Other than disputes relating to ownership right under the court of law, LGRC will review grievances involving all resettlement benefits, relocation and other assistance. However, the major grievances that might require mitigations include:

- PAPs not enlisted;
- Losses not identified correctly;
- Compensation/assistance not as per entitlement matrix;
- Dispute about ownership;
- Delay in disbursement of compensation/assistance;
- Improper distribution of compensation/assistance in case of joint ownership;
- Incorrect name in the award book of DC.

Project-level GRC (PGRC)
The Project-level GRC will review all unresolved cases involving social and environmental issues of the project. The Project Director will head the PGRC. The composition of the PGRC will be as follows:

Project Director, PIU, PGCB	Chairperson
Team Leader of INGO	Member Secretary

Representative of Civil Society	Member

The Member-Secretary in the PGR will provide necessary knowledge and information regarding relevant standard policies and international protocols. He/she will also set examples of resolving such grievances from other development projects in Bangladesh. The PGRC should establish fairness and transparency in the resolution of grievances by project-affected persons. In case of technical or environmental issues as well as any legal matters, the Team Leader of the INGO will advise the PGRC. In specific cases, environmental and social development specialists of ESU or external legal advisors may be consulted, if required.

ToR for Project Level GRC (PGRC)
The scope of work and the Terms of Reference (ToR) for PGRC are:

- Review, consider and settle unresolved grievances forwarded by LGRCs related to social/resettlement and environmental issues.
- Any grievances presented to the PGRC should ideally be resolved within two weeks from the date of receiving the complaints from LGRC.
- In case of complicated cases, the PGRC Members can request additional information or carry out field level verifications.
- Resolutions should be based on consensus among Members, where all the decisions may be taken on majority vote.
- Any decision made by the PGRC must be within the purview of RP policy and entitlements.
- The PGRC will not deal with any matters pending in the court of law.
- All three members are required to form the quorum for the meeting of the PGRC.

11.9 Processes for Filing GRC Cases and Role of GRC

The procedural steps of resolving grievances and the grievance redress processes are presented in Figure 125, which explains the GRM in detail in a flow chart. GRC procedures and operational rules will be publicized widely through community meetings and pamphlets in the local Bangla language so that PAPs are aware of their rights and obligations, and procedure of grievance redress. All local GRC documents will be maintained, review and verification by INGO, Co-financier and any external reviewers. The PGCB Field Office(s) will act as the Secretariat to the local GRCs. As a result, the records will be up-to-date and easily accessible on-site.

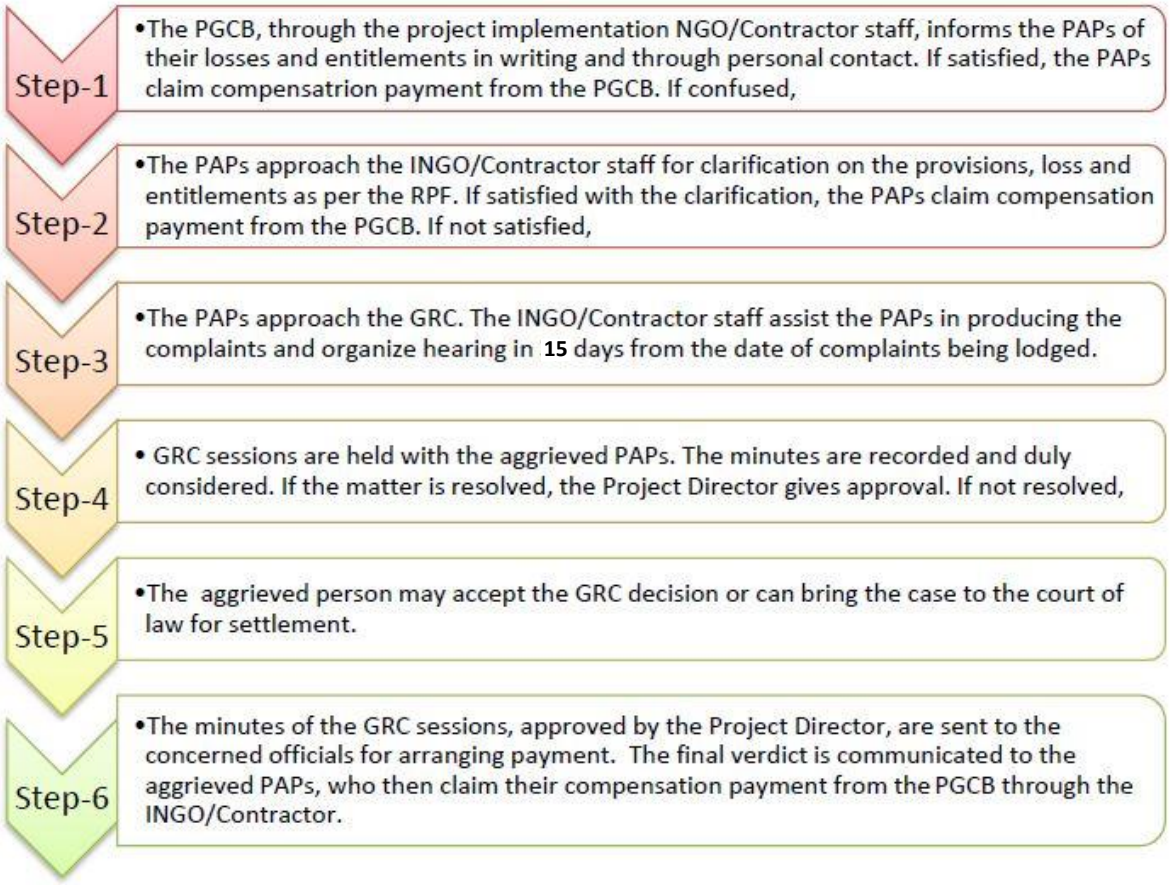


Figure 125: Grievance Redress Processes

11.10 Monitoring and Reporting

Monitoring and reporting are requisite tools of measuring the effectiveness of the grievance mechanism, the efficient use of resources, determining broad trends and acknowledging recurring problems so that they can be resolved before they reach a higher level of contention. They also create a base level of information that can be used by the PGCB to report back to the stakeholders.

11.10.1 Monitoring

Depending on the extent of Project impacts and the volume of grievances, monitoring measures like internal and external audits every six-monthly based on the complexity of the nature of grievances can be adopted by PGCB. Grievance records maintained should provide the background information for these regular monitoring exercises. Through the review of each grievance and analysis of its effectiveness and efficiency, PGCB can draw on the complaints to evaluate systematic deficiencies. In addition, monitoring of the grievance mechanism helps to ensure that the design and implementation of the mechanism is adequately responding to stakeholder's comments in a cost-effective manner.

11.10.2 Reporting

All grievances registered have to be recorded and regularly updated. PGCB and Contractor or INGO is responsible to discharging this responsibility and should be able to produce this document whenever any audits take place. In addition, a monthly reporting system should be introduced to

submit a Grievance Report to the PGCB/AIIB even if 'nil' grievances are recorded at the site level. All minutes of meetings with stakeholders, complainants and Grievance Committee are to be recorded and documented regularly for reference purposes. In addition, through the process of monitoring and the reports produced thereafter, assurance of continual improvement of the company's operations is guaranteed. The company can also use these monitoring reports to report back to the community on its implementation of the mechanism and the modification/ changes proposed to make it more user friendly. A sample Grievance Form has been provided in Table 95 which can assist to accelerate the process.

Table 95: Sample Grievance Form

Reference No.		Date	
Full Name			
Address			
Contact No.			
Date, Time and Venue of GRC Meeting			
Description of Incident or Grievance (What happened? Where did it happen? Who did it happen to? What is the result of the problem?			
Date if Incident or grievance (provide details, such as:) One-time incident/grievance (date _____) Happened more than once (how many times? _____) On-going (currently experiencing problem) _____)			
What would you like to see happen to resolve the problem?			
Signature of complainant /thump impression of complainant		Signature of person filling the form (PGCB Representative)	

Chapter 12
Conclusions and Recommendation

12.1 Conclusion

An Environmental and Social Impact Assessment (ESIA) study, for the construction of four new substations namely Anwara 230/132/33kV SS, Cox's Bazar 132/33kV SS, Teknaf 132/33kV SS and BHTC 230/33kV SS and associated overhead power transmission lines namely Anwara to Cox's Bazar 230kV double circuit line, Cox's Bazar to Teknaf 132kV line, LILO of Dohazari to Cox's Bazar 132 kV and existing Kaliakair to BHTC 230kV line, has been carried out which included development of an Environmental and Social Management Plan (ESMP) covering both the planning/design, construction and operational phases of the Project. The current ESIA study for the Project is largely based on the Project specific details as provided by PGCB, discussions with community and observations from the site visits and census/surveys conducted. Comprehensive social and ecological surveys were undertaken to assess these aspects.

As per AIIB categorization system, the Project is categorized as Category A as it is likely to have adverse environmental and social impacts mainly during construction stage which is diverse but easy to mitigate. As per Department of Environment (DOE) rules, the Project has been categorized as Orange B Category based on adverse impact anticipated specially during construction phase of the Project. The detailed ESIA of this Project was conducted following the national guideline (ECR, 1997) Department of Environment (DoE) and Environmental and Social Framework of AIIB (2016, amended 2019).

This ESIA study has examined the Project's potential negative and positive environmental impacts, alternative analysis (including the "without Project" situation), and recommended measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and to improve environmental performance. As to the results of the ESIA study for the proposed transmission lines and substations Project, the following items are found:

a) In terms of living environment, most of the impacts are controlled and limited in and around the Project area. The key negative impacts such as emission of GHG gas (CO_2 and Sulfur-hexafluoride), dust and generation of noise are expected. However, implementation of appropriate mitigation and management plan, such as to spray water to bare areas for dust prevention and to avoid the incentive operation of the construction machinery for prevention of emission gas, and noise during construction phase will minimize these impacts.
b) In terms of natural environment, some terrestrial herbs, shrubs and trees would be damaged by laying transmission line within the forests (homestead, roadside and reserve forest) during construction phase of the Project which impact would be medium to high in nature. Generation of spoils would pollute the local water sources like rivers, khals, etc. No elephant corridors fall within the RoW of transmission lines and have no chance to disturb its movement. There are no important bird Protected Area (IBA), and Environmentally Critical Area (ECA) exists at or near the Project Site. In addition, no significant erosion and accretion history found or observed for Sangu, Matamuhuri, Bakkhali, Turag and Bongshai Rivers at or near the Project Site. However,

implementation of appropriate mitigation measures suggested Chapter 7 and 9 will minimize the impact on both terrestrial and aquatic ecosystem.

c) In terms of social environment, there is land acquisition and compensation provision for the construction of new four substations; there is economic displacement for the project interventions. Detail resettlement plan (RP) has been prepared as per guidelines of GoB and AIIB. There are no sites of archaeological or cultural significance within or near the Project Site and/or study area. There are no indigenous people at or near the project area. In fact, the project has no impact on the Rohingya Refugee Camp. On the other hand, some positive impacts of the Project such as increase in job opportunity and improvement of social infrastructure are also expected.
d) In terms of health and safety, some impacts on occupational/community health and safety including COVID-19; and increase in number of accidents are expected. However, implementation of appropriate mitigation, grievance and management plan, such as to manage working conditions during the construction work and to provide security and maintain safety prevention measures during construction phase will minimize these impacts.

PGCB will establish an environmental and social management system by its PIU for the project based on a project specific ESMP. This will be overseen, monitored, and audited by PGCB, ESCMC and DoE, and implemented by a dedicated team. The Project will make its best effort to minimize the environmental and social impacts unavoidably associated with the Project during its entire life cycle by implementing suggested mitigation measures and management plans with the required management system in place as described in this ESIA to ensure compliance with the requirement of AIIB Performance standards and ECPs. PGCB will ensure that the Project conforms to all the legal, regulatory and policy objectives and ensure that all the necessary permits are obtained and renewed from time to time.

12.2 Recommendations

a) PGCB and Contractor should strictly maintain environmental and social monitoring compliance mentioned in Chapter 9;
b) Resettlement Plan (RP) should be implemented properly, and update RP before paying the compensation;
c) Contractor should carry out the construction work to follow the ECPs; and prepare site-specific ESMP;
d) Proper training regarding EHS should be provided to Project Management Unit as well as work forces during construction phase;
e) Detailed hydro-morphology study should be carried out for crossing Sangu, Matamuhuri and Bakkhali Rivers; Turag and Bongshai Rivers as discussed in section 5.2.4;
f) Eligible local people should be considered at least during construction phase as skill or non-skilled labor on priority basis that will be helpful for minimizing the socio-economic disruption;
g) Eventually, PGCB can introduce the concept of 'Corporate Environmental and Social Responsibility (CESR)' for the management of local environmental, their employees, adjacent communities, stakeholders, etc.

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LIST OF ANNEXURES

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Annex-II	:	Minutes of Public Consultations and Focus Group Discussion (FGDs)
Annex-III	:	Environmental Code of Practice (ECP)
Annex-IV	:	Stakeholder Engagement Plan (SEP)
Annex-V	:	Labour Management Plan (LMP)
Annex-VI	:	Gender Based Violence Prevention Plan
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Annex-VIII	:	Due Diligence Report Bangabandhu Hi-Tech Park
Annex-IX	:	Fire Management Plan
Annex-X	:	Outlines of Biodiversity Management Plan (BMP)

ANNEX-I

Environmental Clearance of DoE

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207
www.doe.gov.bd

Memo No: 22.02.0000.018.72.033.21-91 Date: 05/05/2021

Subject: Environmental Clearance for Transmission Infrastructure Development Project for Southern Area of Chattogram Division & Bangabandhu Hi-Tech City at Kaliakoir Project.

Ref: Your application dated 14/03/2021.

With reference to your above application, the Department of Environment (DoE) hereby accords Environmental Clearance to Transmission Infrastructure Development Project for Southern Area of Chattogram Division & Bangabandhu Hi-Tech City at Kaliakoir Project.

A copy of the Environmental Clearance Certificate is attached herewith for your kind information and necessary action.

05.05.2021
(Masud Iqbal Md. Shameem)
Director (Environmental Clearance)
Phone: 8181673

Chief Engineer (Project Monitoring)
Power Grid Company of Bangladesh Ltd
NLDC Building (6th floor)
Aftabnagar, Badda, Dhaka.

Copy Forwarded to :

1) PS to the Hon'ble Secretary, Ministry of Environment, Forest and Climate Change, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Dhaka/Chattogram Regional office, Dhaka/Chattogram.
3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Government of the People's Republic of Bangladesh
Department of Environment
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Dhaka-1207
www.doe.gov.bd

Environmental Clearance

Section 12 of the Environment Conservation Act, 1995 (Amended 2010)

Clearance Number: ৯১

File number: 22.02.0000.018.72.033.21· ৯১

Clearance Issue Date: ০৫May, 2021

Renewal date not later than: ০৪May, 2022

A. Clearance Type

Environmental Clearance

B. Clearance Holder

Chief Engineer (Project Monitoring)
Power Grid Company of Bangladesh Ltd
NLDC Building (6th floor)
Aftabnagar, Badda, Dhaka.

C. Premises to which this Clearance Applies

The project is located in Anwara Upazila of Chattogram district, Cox's Bazar sadar and Teknaf Upazila of Cox's Bazar District and Kaliakoir Upazila of Gazipur district.

D. Activities for which this Clearance Authorizes and Regulates

Major component of the projects are- a) Construction of GIS Substations and b) Construction of 230 kv double circuits transmission line from Anwara to Cox's Bazar, 132 kv double circuits line from Cox's Bazar to Teknaf, 230 kv double circuits line from Kaliakoir SS to Bangabandhu Hi-Tech city.

E. Terms and Conditions for Environmental Clearance

1. **Limit Condition for Discharges to Air and Water**: The Environmental Clearance must comply with schedule 2 and 10 of the Environment Conservation Rules, 1997.

2. **Noise Limit**: The Environmental Clearance must comply with the Noise Pollution (Control) Rules, 2006

3. **Operating Conditions:**

3.1 Activities must be carried out in a competent manner. This includes:
(a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and

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(b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

3.2 All plants and equipments installed at the premises or used in connection with the Environmental Clearance activity:
(a) must be maintained in a proper and efficient condition; and
(b) must be operated in a proper and efficient manner.

3.3 Construction works shall be restricted to day time hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.

3.4 Storage area for construction materials shall be carefully selected to avoid disturbance of the natural drainage. To avoid soil contamination at labour camp and work-site cement and petroleum derivatives shall be handled cautiously.

3.5 During site preparation, piling work, construction/re-construction of land embankments, regulators, approach roads and temporary access roads, top soil shall be kept aside and shall be restored after completion of the said activities.

3.6 The open areas that are grasslands can be used for construction but with appropriate safeguards to maintain material and dump sites from contaminating river waters.

3.7 This shall be ensured that soil is not obtained from agricultural land and it should be obtained nearby river/khal/beel areas, which are free of invasive plants. The construction equipment and vehicles shall be cleaned regularly.

3.8 Re-vegetation and replanting shall be undertaken if rehabilitation works involve extensive vegetation clearance.

3.9 Vegetation clearance shall be minimizing at the construction phase as to minimize soil erosion. Soils for embankments shall be properly tested and compacted to ensure stability.

3.10 Soil erosion caused by removal of vegetative cover and excavated loose soil shall be checked by adequate protective works and plantation with local vegetation as soon as possible; loose soil shall be covered and stored away from the edge of the sea/river.

3.11 Proper construction practices shall be followed that minimize loss of habitats and fish breeding, feeding and nursery sites.

3.12 Necessary steps shall be taken to protect flooding of local areas due to restricted flow at the project sites.

3.13 Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.

3.14 In order to control noise pollution, vehicles & equipment shall be maintained regularly; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.

3.15 No solid waste can be burnt in the project area. An environment friendly solid waste management should be in place during whole the period of the project in the field.

3.16 Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.

3.17 Any heritage site, ecological critical area and other environmentally and/or religious sensitive places shall be avoided during project construction phase.

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3.18 To control dust vehicles and equipment to be used for this project shall be maintained properly, water trucks shall be used, stockpiles to be located away from sensitive receptors and vehicle speed limits shall be enforced.

3.19 Resettlement plan should be properly implemented and people should be adequately compensated, where necessary.

3.20 Construction material should be properly disposed off after the construction work is over.

3.21 Appropriate permission would be required to obtain from the Forest Department in favor of cutting/felling of any plant/tree/sapling forested by any individual or government before doing such type of activity.

3.22 The mitigation measures described in the Initial Environmental Examination (IEE) report along with the emergency response plan shall strictly be implemented and kept functioning on a continuous basis.

4.1 Monitoring and Recording Conditions:

4.1.1 The results of any monitoring required to be conducted by this Clearance must be recorded.

4.1.2 The following records must be kept in respect of any samples required to be collected for the purposes of this Clearance:
(a) the date(s) on which the sample was taken;
(b) the time(s) at which the sample was collected;
(c) the point at which the sample was taken; and
(d) the name of the person who collected the sample.

4.2 Requirement to Monitor Concentration of Pollutants Discharged

For each monitoring, the Clearance holder must monitor (by sampling and obtaining results by analysis) the following parameter: air quality, noise, the changes in bird habitats before, during and after construction.

5. Reporting Conditions: Environmental Monitoring Reports shall be made available simultaneously to Headquarters and Dhaka/Chattogram Regional office of the Department of Environment on a quarterly basis during the whole period of the project.

6. Notification of environmental harm: The Clearance holder or its employees must notify the Department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.

F. RECORDING OF POLLUTION CONTROL:

The certificate holder must keep a legible record of all complaints made to the certificate holder or any employee or agent of the certificate holder in relation to pollution arising from any activity to which this Environmental Certificate applies. The record must include details of the following:

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(a) the date and time complaint;
(b) the method by which the complaint was made;
(c) any personal details of the complaint which were provided by the complaint or, if no such details were provided, a note to that effect;
(d) the nature of the complaint;
(e) the action taken by the certificate holder in relation to the complaint, including any follow-up contact with the complaint; and
(f) if no action was taken by the certificate holder, the reasons why no action was taken.

The record of a complaint must be kept for at least 4 (four) years after the complaint was made. The record must be produced to any authorized officer of the DOE who asks to see them.

G. VALIDITY OF THE ENVIRONMENTAL CLEARANCE:

This Environmental Clearance is valid for one year from the date of issuance and the Project authority shall apply for renewal to the Head office of DoE with a copy to Dhaka/Chattogram Regional Office of DoE in Dhaka/Chattogram at least 30 (thirty) days ahead of expiry.

Violation of any of the above conditions shall render this clearance void.

This Environmental Clearance Certificate has been issued with the approval of the appropriate authority.

05.05.2021

(Masud Iqbal Md. Shameem)
Director (Environmental Clearance)
Phone: 8181673

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ANNEX-II
Minutes of Public Consultations and Focus Group Discussion (FGDs)

Public Consultation Meeting (PCM): 1

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangabandhu Hi-Tech City at Kaliakoir Projects

PUBLIC CONSULTATION MEETING

Attendance Sheet

Date: 07.07.2020 Time: ৩.০০ টা Venue: [illegible], আনোয়ারা, চট্টগ্রাম

SL	Name	Designation/Occupation		Signature
০১	[illegible]	মেম্বার		[illegible]
০২	[illegible]	[illegible]		[illegible]
০৩	[illegible]	[illegible]		13 [illegible]
০৪	[illegible]	[illegible]		[illegible]
০৫	[illegible]	[illegible]		6731 [illegible]
০৬	[illegible]	[illegible]		5757 [illegible]
০৭	[illegible]	[illegible]		[illegible]
০৮	[illegible]	[illegible]		[illegible]
০৯	[illegible]	[illegible]		[illegible]
১০	[illegible]	[illegible]		[illegible]
১১	[illegible]	[illegible]		[illegible]
১২	[illegible]	[illegible]		[illegible]
১৩	[illegible]	[illegible]		380 [illegible]
১৪	[illegible]	[illegible]		[illegible]

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SL	Name	Designation/Occupation	Signature
১৫	মো: মনিরুল ইসলাম	[illegible]	মো: মনিরুল ইসলাম
১৬	আমিনুল হক	[illegible]	[illegible]
১৭	মো: আবুল হোসেন	দিন মজুরী	[illegible]
১৮	সুনিল চন্দ্র দাস	[illegible]	603 [illegible]
১৯	জসিম উদ্দিন	কৃষক	13 জসিম উদ্দিন
২০	[illegible]	কৃষক	[illegible]
২১	[illegible]	[illegible]	[illegible]
২২	মো: [illegible]	কৃষক	[illegible]
২৩	[illegible]	[illegible]	[illegible]
২৪	[illegible]	[illegible]	AIRMD
২৫	আব্দুল [illegible]	[illegible]	[illegible]
২৬	মো: নবী হোসেন	[illegible]	মো: নবী হোসেন
২৭	মো: [illegible]	[illegible]	[illegible]
২৮	মো: নুর	[illegible]	[illegible]
২৯	মো: [illegible]	[illegible]	[illegible]

Public Consultation Meeting (PCM): 2

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangabandhu Hi-Tech City at Kaliakoir Projects

PUBLIC CONSULTATION MEETING

Attendance Sheet

Date: ২৩.০৮.২০২০ Time: ২:৩০-৪:০০ Venue: বাংলাবাজার কক্সবাজার

SL	Name	Designation/Occupation	e
01	[illegible]	শিক্ষক	
02	[illegible]	কৃষিকাজ	
03	[illegible]	কৃষিকাজ	
04	[illegible]	চাকুরি	
05	[illegible]	কৃষিকাজ	
06	[illegible]	ড্রাইভার	
07	[illegible]	ব্যবসা	
08	[illegible]	ছাত্র	
09	[illegible]	কৃষিকাজ	
10	[illegible]	কৃষিকাজ	
11	[illegible]	ব্যবসা	
12	[illegible]	কৃষক	
13	[illegible]	বেকার	
14.	[illegible]	কৃষিকাজ	

1 | Page

Public Consultation Meeting (PCM): 3

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangabandhu Hi-Tech City at Kaliakoir Projects

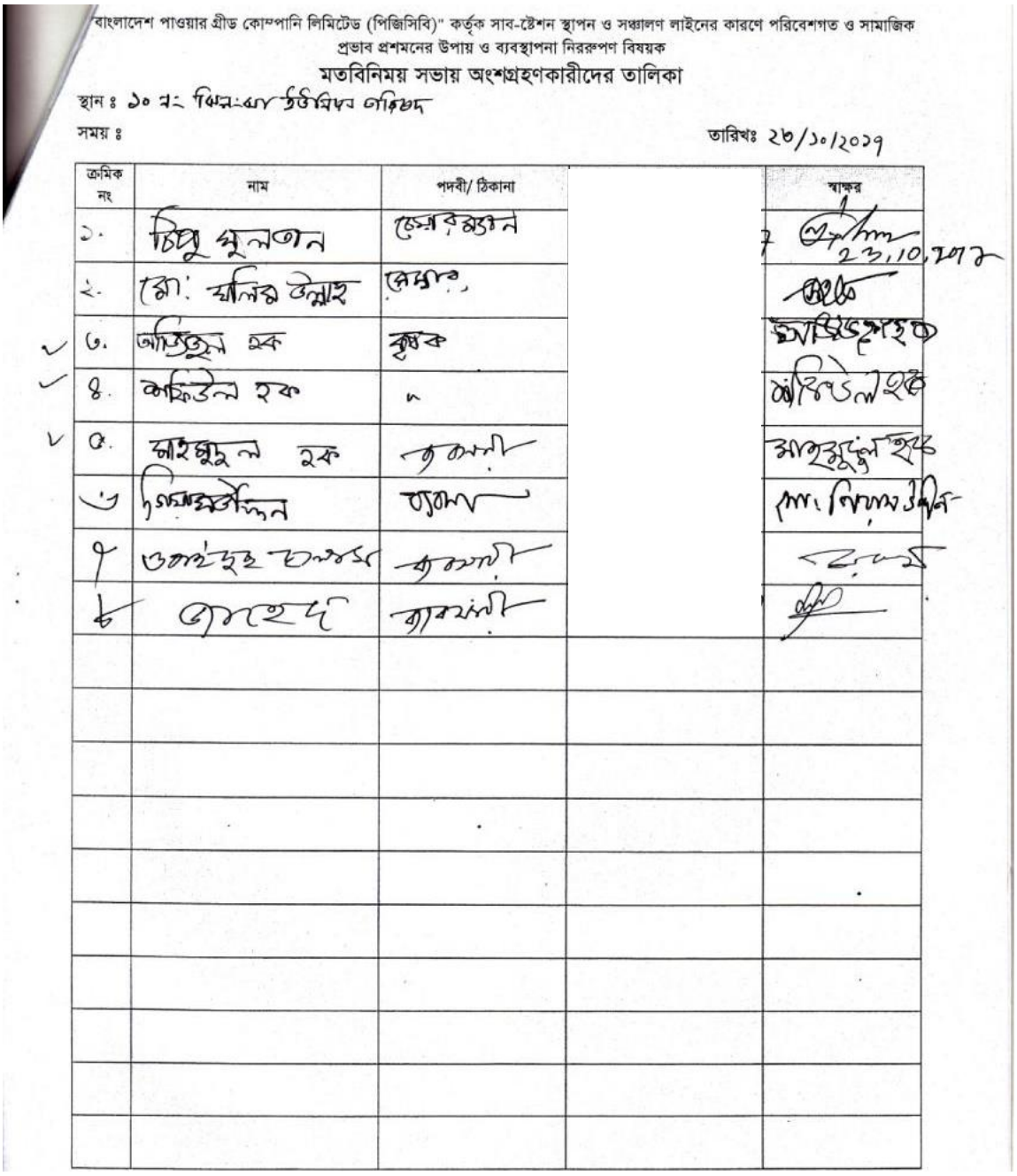
PUBLIC CONSULTATION MEETING

Attendance Sheet

Date: 21.09.2020 Time: 12.00 PM – 1.00 PM Venue: পুরাপুর, কালিয়াকৈর

SL	Name	Designation/Occupation	
01	সুজন ভৌমিক	ব্যবসা	
02	বনি কর্মকার	চাকুরী	
03	মাহিউদ্দিন	ব্যবসা	
04	গকুল কুমার	চাকুরী	
05	বনি বিশ্বয় বনিক	চাকুরী	
06	নয়ন ভৌমিক	গাড়ী চালক	
07	সন্তোষ বনিক	ব্যবসা	
08	লিটন ভৌমিক	চাকুরী	
09	সংকর বনিক	ব্যবসা	
10	সুবাস সাহা	ব্যবসা	
11	আবুল আমিন	কৃষিকাজ	
12	সবিন বয়	ব্যবসা	
13	বাবুল সাহা	চাকুরী	
14	বিউলী কর্মকার	ব্যবসা	

Public Consultation Meeting (PCM): 4



"বাংলাদেশ পাওয়ার গ্রীড কোম্পানি লিমিটেড (পিজিসিবি)" কর্তৃক সাব-ষ্টেশন স্থাপন ও সঞ্চালণ লাইনের কারণে পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিররুপণ বিষয়ক

মতবিনিময় সভায় অংশগ্রহণকারীদের তালিকা

স্থান ঃ ১০ নং খিরসাপাড়া ইউনিয়ন পরিষদ

সময় ঃ

তারিখঃ ২৩/১০/২০১৭

ক্রমিক নং	নাম	পদবী/ ঠিকানা		স্বাক্ষর
১.	চিপ্পু সুলতান	চেয়ারম্যান		23.10.2017
২.	মো: খলিল উল্লাহ	মেম্বার		
৩.	আতিকুল হক	কৃষক		
৪.	কফিল হক	"		
৫.	সাইফুল হক	কৃষক		
৬	নিজাম উদ্দিন	ব্যবসা		
৭	ওমর ফারুক	কৃষক		
৮	মোহেদী	ব্যবসা		

Public Consultation Meeting (PCM): 5

"বাংলাদেশ পাওয়ার গ্রীড কোম্পানি লিমিটেড (পিজিসিবি)" কর্তৃক সাব-ষ্টেশন স্থাপন ও সঞ্চালণ লাইনের কারণে পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিররূপণ বিষয়ক

মতবিনিময় সভায় অংশগ্রহণকারীদের তালিকা

স্থান ঃ ইদিলা বাজার

সময় ঃ

তারিখঃ ২২/১০/২০১৭

ক্রমিক নং	নাম	পদবী/ ঠিকানা		স্বাক্ষর
১।	[illegible]			[illegible]
২।	[illegible]	কৃষি		[illegible]
৩।	[illegible]			
৪।	[illegible]	কৃষি		A.HA Kim
৫।	[illegible]			
৬।	[illegible]			
৭।	[illegible]			
৮।	[illegible]			
৯।	[illegible]			
১০।	[illegible]			
১১।	[illegible]			
১২।	[illegible]	কৃষক		[illegible]
১৩।	[illegible]	কৃষি		
১৪.	[illegible]			[illegible]
১৫।	[illegible]			
১৬।	[illegible]	ইমাম সাহেব		[illegible]
১৭।	[illegible]			[illegible]
১৮।	[illegible]	কৃষি		[illegible]

Public Consultation Meeting (PCM): 6

বাংলাদেশ পাওয়ার গ্রীড কোম্পানি লিমিটেড (পিজিসিবি)" কর্তৃক সাব-ষ্টেশন স্থাপন ও সঞ্চালণ লাইনের কারণে পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক

মতবিনিময় সভায় অংশগ্রহণকারীদের তালিকা

স্থান ঃ [illegible] বাজার

সময় ঃ

তারিখঃ

ক্রমিক নং	নাম	পদবী/ ঠিকানা		স্বাক্ষর
১৯/	আবুল মনসুর	কৃষি		
২০/	মো: মোতালিব	দিনমজুর		
২১/	আমান হোসেন	কৃষি		
২২/	মুনসীর আলম	ব্যবসা		[signature]
২৩/	আবুল নূর	ব্যবসা		[signature]
২৪/	জাফর আহমদ	কৃষি		[signature]
২৫/	মো: হোসেন	কৃষি		[signature]
২৬/	মো: ইউনুছ	ব্যবসা		[signature]
২৭/	নূর আহমদ	ব্যবসা		
২৮/	জাহেদ আলম	ব্যবসা		[signature]
২৯/	[illegible]	[illegible]		[signature]
৩০/	আবু ছিদ্দিক আশিক	ছাত্র		[signature]

Focus Group Discussion (FGD)

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangbandhu Hi-Tech City at Kaliakoir Projects

FOCUS GROUP DISCUSSION (FGD) MEETING

Target Group:

Attendance Sheet

Date: ০৮.০৭.২০২০ **Time:** ১১:০০ – ১১:৪৫ **Venue:** গোবাদিয়া, আনোয়ারা

SL	Name	Occupation	Gender	
1	জসিম উদ্দিন খান	কৃষিকাজ	পুরুষ	
2	মো: ইদ্রিস	কৃষিকাজ	"	
3	হাকিম আবু রশিদ	ব্যবসা	"	
4	মো: রফিক খান	ড্রাইভার	"	
5	মো: জাহে আলম	কৃষিকাজ	"	
6	শেখ মোহাম্মদ	কৃষিকাজ	"	
7	মো: মনজুর আলম	রাজমিস্ত্রী	"	
8				
9				
0				
1				
2				

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangbandhu Hi-Tech City at Kaliakoir Projects

FOCUS GROUP DISCUSSION (FGD) MEETING

Target Group:

Attendance Sheet

Date: 23|08|2020 **Time:** 2:45-3:30 **Venue:** বাংলাবাজার - [illegible], কক্সবাজার

SL	Name	Occupation	Gender	
1	শামসুল আলম	চাকুরি	পুরুষ	
2	জাহাঙ্গীর আলম	কৃষক	পুরুষ	
3	আনোয়ারুল হক	কৃষক	পুরুষ	
4	মোজাম্মেল হক	কৃষক	পুরুষ	
5	মনিরুল আলম	সি,এন,জি চালক	পুরুষ	
6	এনামুল হক	শিক্ষক	পুরুষ	
7	জুয়েল শিকদার	ব্যবসা	পুরুষ	
8	গিয়াস উদ্দীন	কৃষক	পুরুষ	
9	সোহেল শিকদার	ফুটবলার	পুরুষ	
10	[illegible] আলম	বেকার	পুরুষ	
11	সাইদুল হক	ব্যবসা	পুরুষ	
12	আব্দুল করিম	চাকুরি	পুরুষ	

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangbandhu Hi-Tech City at Kaliakoir Projects

FOCUS GROUP DISCUSSION (FGD) MEETING

Target Group:

Attendance Sheet

Date: ১০.০৭.২০২০ **Time:** ১০:০০–১১:০০ **Venue:** পূর্ব ফুকারবুর, কক্সবাজার

SL	Name	Occupation	Gender	
1	মোঃ আমির হোসেন	কৃষিকাজ	পুরুষ	
2	মাহবুব হোসেন	কৃষিকাজ	পুরুষ	
3	মোঃ তাহের	কৃষিকাজ	পুরুষ	
4	জহির উদ্দিন	কৃষিকাজ	পুরুষ	
5	আলমগীর হোসেন	কৃষিকাজ	পুরুষ	
6	জহুর আলম	কৃষিকাজ	পুরুষ	
7	রিদোয় হোসেন	কৃষিকাজ	পুরুষ	
8				
9				
0				
1				
2				

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangbandhu Hi-Tech City at Kaliakoir Projects

FOCUS GROUP DISCUSSION (FGD) MEETING

Target Group:

Attendance Sheet

Date: 17.08.2020 **Time:** 5.00 PM – 6.00 PM **Venue:** Hnila Ali Khali, Teknaf

SL	Name	Occupation	Gender	
1	[illegible]	[illegible]	M	
2	[illegible]	[illegible]	M	
3	[illegible]	[illegible]	M	
4	[illegible]	[illegible]	M	
5	[illegible]	[illegible]	M	
6	[illegible]	[illegible]	M	
7	[illegible]	[illegible]	M	–
8				
9				
10				
11				
12				

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangabandhu Hi-Tech City at Kaliakoir Projects

FOCUS GROUP DISCUSSION (FGD) MEETING

Target Group:

Attendance Sheet

Date: ২১.০৯.২০২০ **Time:** 11.00 AM – 12. PM **Venue:** সুত্রাপুর, কালিয়াকৈর

SL	Name	Occupation	Gender
1	মহিউদ্দিন	M	অবসর
2	প্রফুল্ল কুমার সরকার	M	ব্যবসা
3	গোকুল কুমার সরকার	M	চাকুরী
4	নয়ন ভৌমিক	M	গাড়ি চালক
5	লিটন ভৌমিক	M	চাকুরী
6	মিতুল কর্মকার	M	ব্যবসা
7	সাধন রায়	M	ব্যবসা
8	বাবলু সাহা	M	চাকুরী
9	সুবাস সাহা	M	ব্যবসা
10	সুধু রায়	M	"
11	আব্দুল আজিজ	"	কৃষি
12	[illegible] সরকার	"	"

Transmission Infrastructure Development of Southern Area of Chattogram Division and Bangbandhu Hi-Tech City at Kaliakoir Projects

FOCUS GROUP DISCUSSION (FGD) MEETING

Target Group:

Attendance Sheet

Date: ২১.০৭.২০২০ **Time:** 2:40 PM **Venue:** বাঘভেলাই, নদীরপাড়, কালিয়াকৈর

SL	Name	Occupation	Gender	
1	মো: মুজিবুর রহমান	কৃষক	পুরুষ	
2	মো: মুজিবুল ইসলাম	মেকানিক	"	
3	মো: হানিফ	কৃষক	"	
4	মোয়াজ্জেম হোসেন	কৃষক	"	
5	মো: দেলোয়ার হোসেন	কৃষক	"	
6	মো: আমির হোসেন	স্যানিটারি মিস্ত্রী	"	
7	মোশারফ হোসেন	ছাত্র	"	
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1				
2				

ANNEX-III
Environmental Code of Practice (ECP)

Environmental Codes of Practice (ECP)

Introduction

The objective of the Environmental Code of Practices (ECPs) is to address all potential and general construction related impacts during implementation of the Project. The ECPs will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. These ECPs shall be annexed to the general conditions of all the contracts, including subcontracts, carried out under the Project.

The list of ECPs prepared for the Project is given below.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Goods Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Top Soil Management
- ECP 8: Topography and Landscaping
- ECP 9: Air Quality Management
- ECP 10: Noise and Vibration Management
- ECP 11: Protection of Flora
- ECP 12: Protection of Fauna
- ECP 13: Protection of Fisheries
- ECP 14: Road Transport and Road Traffic Management
- ECP 15: Construction Camp Management
- ECP 16: Cultural and Religious Issues
- ECP 17: Workers Health and Safety

Contractors will prepare Construction Environmental and Social Management Plan CESMP, in compliance with AIIB and Government of Bangladesh requirements and based on the guidance given in the ECPs. The CESMP will form the part of the contract documents and will be used as monitoring tool for compliance. It is mandatory for the main contractors procured directly by the project to include these ECPs in their subcontracts. Violation of the compliance requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractors.

Moreover, Resettlement Plan (RP), Stakeholder Engagement Plan (SEP), Construction Labor Management Plan (LMP) and Gender Based Violence/Action Plan provided in Annex-IV, V, VI and VII respectively.

ECP 1: WASTE MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall- • Develop site specific waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to supervision consultant for approval. • Organize disposal of all wastes generated during construction in the designated disposal sites approved by the Project. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the wastes, wherever practical. • Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route. • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal. • Potable water should be supplied in bulk containers to reduce the quantity of plastic waste (plastic bottles). Plastic bag use should be avoided.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall • Collect chemical wastes in 200-liter drums (or similar sealed container), appropriately labeled for safe transport to an approved chemical waste depot. • Store, transport and handle all chemicals avoiding potential environmental pollution. • Store all hazardous wastes appropriately in bunded areas away from water courses. • Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. • Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. • Construct concrete or other impermeable flooring to prevent seepage in case of spills.

ECP 2: FUELS AND HAZARDOUS GOODS MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	The Contractor shall • Prepare spill control procedures and submit them for supervision consultant approval. • Train the relevant construction personnel in handling of fuels and spill control procedures. • Store dangerous goods in bunded areas on top of a sealed plastic sheet away from watercourses. • Refueling shall occur only within bunded areas. • Store and use fuels in accordance with material safety data sheets (MSDS). Make available MSDS for chemicals and dangerous goods on-site. • Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site. • Provide absorbent and containment material (e.g., absorbent matting) where hazardous materials are used and stored; and ensure personnel trained in the correct use. • Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. • Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Store and use fuels in accordance with material safety data sheets (MSDSs). • Store all liquid fuels in fully bunded storage containers, with appropriate volumes, a roof, a collection point and appropriate filling/decanting point. • Store hazardous materials above flood level considered for construction purposes • Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.

ECP 3: WATER RESOURCES MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall • Follow the management guidelines proposed in ECPs 1 and 2. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems
Discharge from construction sites	Construction activities, sewerages from construction sites and work camps may affect the surface water quality. The construction works will modify groundcover and topography changing the surface water drainage patterns of the area. These changes in hydrological regime lead to increased rate of runoff, increase in sediment and contaminant loading, increased flooding, and	The Contractor shall • Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials. • Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from site. • Divert runoff from undisturbed areas around the construction site. • Stockpile materials away from drainage lines • Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste disposal site or recycling depot. • Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This should be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. • Ensure that roads used by construction vehicles are swept regularly to remove dust and sediment. • Water the loose material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds).
Construction activities in water bodies	Construction works in the water bodies will increase sediment and contaminant loading, and effect habitat	The Contractor Shall • Dewater sites by pumping water to a sediment basin prior to release off site – do not pump directly off site.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	of fish and other aquatic biology.	• Monitor the water quality in the runoff from the site or areas affected by dredge/excavation plumes, and improve work practices as necessary. • Protect water bodies from sediment loads by silt screen or other barriers. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems. • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.
Drinking water	Untreated surface water is not suitable for drinking purposes due to presence of suspended solids and E. coli.	The Contractor Shall • Provide the drinking water that meets national and WBG EHS Guidelines. Drinking water to be chlorinated at source, and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time.

ECP 4: DRAINAGE MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earth work, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms environment in terms of water and soil contamination, and mosquito growth.	The Contractor shall • Prepare drainage management procedures and submit them for supervision consultant approval. • Prepare a program to prevent/avoid standing waters, which supervision consultant will verify in advance and confirm during implementation. • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line. • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there. • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to national and WBG EHS Guidelines, before it is being discharged into the recipient water bodies. • Ensure that there will be no water stagnation at the construction sites and camps. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion. • Protect natural slopes of drainage channels to ensure adequate storm water drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem.
Ponding of water	Health hazards due to mosquito breeding	• Do not allow ponding of water especially near the waste storage areas and construction camps. • Discard all the storage containers that are capable of storing of water, after use or store them in inverted position.

ECP 5: SOIL QUALITY MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall • Strictly manage the wastes management plans proposed in ECP1 and storage of materials in ECP2. • Construct appropriate spill contaminant facilities for all fuel storage areas. • Establish and maintain a hazardous material register detailing the location and quantities of hazardous substances including the storage, and their disposals. • Train personnel and implement safe work practices for minimizing the risk of spillage. • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site. • Remediate the contaminated land using the most appropriate available method.
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds.

ECP 6: EROSION AND SEDIMENT CONTROL

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Clearing of construction sites	Cleared areas and slopes are susceptible for erosion of top soils, which affects the growth of vegetation and causes ecological imbalance.	The Contractor shall • Prepare site specific erosion and sediment control measures and submit them for supervision consultant approval. • Reinstate and protect cleared areas as soon as possible. • Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turf/tree plantations
Construction activities and material stockpiles	The impacts of soil erosion are (i) Increased run off and sedimentation causing a greater flood hazard to the downstream, and (ii) destruction of aquatic environment by erosion and/or deposition of sediment damaging the spawning grounds of fish	The Contractor shall • Locate stockpiles away from drainage lines. • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds. • Remove debris from drainage paths and sediment control structures. • Cover the loose sediments of construction material and water them if required. • Divert natural runoff around construction areas prior to any site disturbance. • Install protective measures on site prior to construction, for example, sediment traps. • Install 'cut off drains' on large cut/fill batter slopes to control water runoff speed and hence erosion. • Observe the performance of drainage structures and erosion controls during rain and modify as required.
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. • Ensure that roads used by construction vehicles are swept regularly to remove sediment. • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds).

ECP 7: TOP SOIL MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth or agricultural development.	The Contractor shall • Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m. • Remove unwanted materials from top soil like grass, roots of trees and similar others. • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites. • Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers, water penetration and revegetation
Transport	Vehicular movement outside ROW or temporary access roads will affect the soil fertility of the agricultural lands	• Limit equipment and vehicular movements to within the approved construction zone. • Plan construction access to make use, if possible, of the final road alignment.

ECP 8: TOPOGRAPHY AND LANDSCAPING

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Construction activities especially earthworks will change topography and disturb the natural rainwater/flood water drainage as well as will change the local landscape.	The Contractor shall • Prepare landscaping and plantation plan and submit the plan for supervision consultant approval. • Ensure the topography of the final surface of all raised lands (construction yards, approach roads and rails, access roads, etc.) are conducive to enhance natural draining of rainwater/flood water. • Keep the final or finished surface of all the raised lands free from any kind of depression that causes water logging. • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping. • Reinstate the natural landscape of the ancillary construction sites after completion of works.

ECP 9: AIR QUALITY MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall • Prepare air quality management plan (under the Pollution Prevention Plan) and submit the plan for supervision consultant approval. • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel-efficient manner. • Cover hauls vehicles carrying dusty materials moving outside the construction site. • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions. • Control the movement of construction traffic. • Water construction materials prior to loading and transport. • Service all vehicles regularly to minimize emissions. • Limit the idling time of vehicles not more than 2 minutes.
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	The Contractor shall • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof or maintenance register shall be required by the equipment suppliers and contractors/subcontractors. • Focus special attention on containing the emissions from generators. • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites. • Service all equipment regularly to minimize emissions. • Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations.
Construction activities	Dust generation from construction sites, material stockpiles and access roads are a nuisance in the environment and can be a health hazard, and also can affect the local crops;	The Contractor shall • Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted. • Minimize the extent and period of exposure of the bare surfaces. • Restore disturbed areas as soon as practicable by vegetation/grass-turfing. • Store the cement in silos and minimize the emissions from silos by equipping them with filters.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations. • Not water as dust suppression on potentially contaminated areas so that a liquid waste stream will be generated. • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems. • Not permit the burning of solid waste.

ECP 10: NOISE AND VIBRATION MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall • Prepare a noise and vibration management plan (under the Pollution Prevention Plan) and submit the plan for supervision consultant approval. • Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures. • Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site.
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Appropriately site all noise generating activities to avoid noise pollution to local residents. • Use the quietest available plant and equipment. • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment. • Avoid the unnecessary use of alarms, horns and sirens.
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Notify adjacent landholders prior any typical noise events outside of daylight hours. • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions. • Employ best available work practices on-site to minimize occupational noise levels. • Install temporary noise control barriers where appropriate. • Notify affected people if major noisy activities will be undertaken, e.g., blasting. • Plan activities on site and deliveries to and from site to minimize impact. • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.

ECP 11: PROTECTION OF FLORA

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora is important to provide shelters for the birds, offer fruits and/or timber/fire wood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has wide range of adverse environmental impacts.	The Contractor shall • Prepare a plan for protection of flora and submit the plan for supervision consultant approval. • Minimize disturbance to surrounding vegetation. • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from supervision consultant for clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce need of tree removal. • Control noxious weeds by disposing of at designated dump site or burn on site. • Clear only the vegetation that needs to be cleared in accordance with the engineering plans and designs. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill a, etc. • Not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. • Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. • Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Supply appropriate fuel in the work camps to prevent fuel wood collection.

ECP 12: PROTECTION OF FAUNA

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities	The location of construction activities can result in the loss of wild life habitat and habitat quality,	The Contractor shall • Prepare a plan for protection of fauna and submit the plan for supervision consultant approval. • Limit the construction works within the designated sites allocated to the contractors. • Check the site for animals trapped in, or in danger from site works and use
	Impact on migratory birds, its habitat and its active nests	The Contractor shall • Not be permitted to destruct active nests or eggs of migratory birds. • Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and locate active nests. • If bird nests are located/ detected within the ledges and roadside embankments then those areas should be avoided. • Petroleum products should not come in contact with the natural and sensitive ecosystems. Contractor must minimize the release of oil, oil wastes or any other substances harmful to migratory birds' habitats, to any waters, wetlands or any areas frequented by migratory birds.
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	The Contractor shall • Restrict the tree removal to the minimum numbers required. • Relocate hollows, where appropriate. • Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition.
Night time lighting	Lighting from construction sites and construction camps may affect the visibility of night time migratory birds that use the moon and stars for navigation during their migrations.	The Contractor shall • Use lower wattage flat lens fixtures that direct light down and reduce glare, thus reducing light pollution, • Avoid flood lights unless they are absolutely required. • Use motion sensitive lighting to minimize unneeded lighting. • Use, if possible, green lights that are considered as bird's friendly lighting instead of white or red colored lights. • Install light shades or plan the direction of lights to reduce light spilling outside the construction area.
Construction camps	Illegal poaching	The Contractor shall • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching. • Ensure that staff and Subcontractors are trained and empowered to identify, address and report potential environmental problems.

ECP 13: PROTECTION OF FISH

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal of wastes into the river	The Contractor shall • Prepare procedures for protection of fish and submit them for supervision consultant approval. • Ensure the construction equipment used in the river are well maintained and do not have oil leakage to contaminate river water. • Contain oil immediately on river in case of accidental spillage from equipment; make an emergency oil spill containment plan (under the Fuels and Hazardous Substances Management Plan) to be supported with enough equipment, materials and human resources. • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • Follow mitigation measures proposed in ECP 3: Water Resources Management and EC4: Drainage Management.

ECP 14: ROAD TRANSPORT AND ROAD TRAFFIC MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	The Contractor shall • Prepare a traffic management plan and submit the plan for supervision consultant approval. • Strictly follow the Project's 'Traffic Management Plan' and work with close coordination with the Traffic Management Unit. • Prepare and submit additional traffic plan, if any of his traffic routes are not covered in the Project's Traffic Management Plan, and requires traffic diversion and management. • Include in the traffic plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs, etc. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the national Traffic Regulations.
	Accidents and spillage of fuels and chemicals	The Contractor shall • Restrict truck deliveries, where practicable, to day time working hours. • Restrict the transport of oversize loads. • Operate vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit.

ECP 15: CONSTRUCTION CAMP MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	The Contractor shall • Prepare a construction camp management plan and submit the plan for supervision consultant's approval. • Locate the construction camps within the designed sites or at areas which are acceptable from environmental, cultural or social point of view; and approved by the supervision consultant. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the supervision consultant for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	Contractor shall provide the following facilities in the campsites • Adequate housing for all workers. • Safe and reliable water supply, which should meet the national and WBG EHS Guidelines. Drinking water to be chlorinated at source, and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time (WHO guideline). • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Treatment facilities for sewerage of toilet and domestic wastes. • Storm water drainage facilities. • Paved internal roads. • Provide child crèches for women working construction site. The crèche should have facilities for dormitory, kitchen, indoor and outdoor play area. Schools should be attached to these crèches

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		so that children are not deprived of education whose mothers are construction workers. • Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall • Ensure proper collection and disposal of solid wastes within the construction camps. • Insist waste separation by source; organic wastes in one container and inorganic wastes in another container at household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approval waste disposal sites.
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	The Contractor shall • Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or another biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them using biomass for cooking. • •Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.	The Contractor shall • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas. • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work. • Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis. • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		Regular mosquito repellant sprays during rainy season in offices and construction camps and yards. • Not dispose food waste openly as that will attract rats and stray dogs. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices.
Safety	In adequate safety facilities to the construction camps may create security problems and fire hazards	The Contractor shall • Provide appropriate security personnel (police or private security guards) and enclosures to prevent unauthorized entry in to the camp area. • Maintain register to keep a track on a head count of persons present in the camp at any given time. • Encourage use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding wind storms/cyclones. • Provide appropriate type of firefighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to original condition requires demolition of construction camps.	The Contractor shall • Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed. • Give prior notice to the laborers before demolishing their camps/units. • Maintain the noise levels within the national standards during demolition activities. • Different contractors should be hired to demolish different structures to promote recycling or reuse of demolished material. • Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site. • Handover the construction camps with all built facilities as it is if agreement between both parties (contactor and land-owner) has been made so. • Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner.

ECP 16: CULTURAL AND RELIGIOUS ISSUES

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	The Contractor shall • Communicate to the public through community consultation regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Not block access to cultural and religious sites, wherever possible. • Restrict all construction activities within the foot prints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) should there be any mosque/religious/educational institutions close to the construction sites and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious institution. • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given. • Provide separate prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and elderly people. • Allow the workers to participate in praying during construction time. • Resolve cultural issues in consultation with local leaders and supervision consultants. • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters. • Chance Find Procedures for Protection of Cultural Property attached in Annex-VII shall be followed.

ECP 17: Worker's Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g., noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases etc.), (ii) risk factors resulting from human behavior (e.g. STD, HIV etc.) and (iii) road accidents from construction traffic.	The Contractor shall • Prepare an Occupational Health and Safety plan and submit the plan for supervision consultant's approval. • Implement suitable safety standards for all workers and site visitors which should not be less than those laid down on the international standards (e.g., International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with national and WBG EHS Guidelines. • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas. • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job. • Appoint an environment, health and safety manager to look after the health and safety of the workers. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters.
	Child and pregnant labor	The Contractor shall • Not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks.
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	The Contractor shall • Ensure health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		should be easily accessible throughout the place of work. • Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards, in a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules. • Provide adequate lighting in the construction area, inside the tunnels, inside the powerhouse cavern and along the roads.
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services substandard living standards and health hazards, and generate	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 15 Construction Camp Management • Adequate ventilation facilities • Safe and reliable water supply. • Hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECP 2 • Solid waste collection and disposal system in accordance with ECP1. • Arrangement for trainings • Paved internal roads. • Security fence at least 2 m height. • Sick bay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	The contractor shall • Provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. Location of portable facilities should be at least 6 m away from storm drain system and surface waters. These portable toilets should be cleaned once a day and all the sewerage should be pumped from the collection tank once a day and should be brought to the common septic tank for further treatment.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Provide safe drinking water facilities to the construction workers at all the construction sites.
Other ECPs	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ECPs to reduce health risks to the construction workers and nearby community • ECP 2: Fuels and Hazardous Goods Management • ECP 4: Drainage Management • ECP 10: Air Quality Management • ECP 11: Noise and Vibration Management • ECP 14: Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work. Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. • Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on ongoing and regular basis. This should be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing.

ANNEX-IV
Stakeholder Engagement Plan (SEP)

ANNEX-V
Labor Management Plan (LMP)

ANNEX-VI
Gender Based Violence Prevention Plan

ANNEX-VII
Chance Find Procedures for Protection of Cultural Property

Chance Find Procedures for Protection of Cultural Property

Chance Find Procedures for Protection of Cultural Property
(Ref: The World Bank Operational Manual, 1999 OP4.11)

Works could impact sites of social, sacred, religious, or heritage value. "Chance find" procedures would apply when those sites are identified during the design phase or during the actual construction period and the related activity will not be eligible for financing under the project.

1. Cultural property include monuments, structures, works of art, or sites of significance points of view, and are defined as sites and structures having archaeological, historical, architectural, or religious significance, and natural sites with cultural values. This includes cemeteries, graveyards and graves.

2. The list of negative subproject attributes which would make a subproject ineligible for support includes any activity that would adversely impact cultural property.

3. In the event of finding of finding properties of cultural value during construction, the following procedures for identification, protection from theft, and treatment of discovered artifacts should be followed and included in standard bidding documents.

(a) Stop the construction activities in the area of the chance find;
(b) Delineate the discovered site or area;
(c) Secure the site to prevent any damage or loss of removable objects.
(d) Notify the supervisory Engineer who in turn will notify the responsible local authorities;
(e) Responsible local authorities and the relevant Ministry would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures.
(f) Decisions on how to handle the finding shall be taken by the responsible authorities and the relevant Ministry. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance), conservation, restoration and salvage.
(g) Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the relevant Ministry.
(h) Construction work could resume only after permission is given from the responsible local authorities and the relevant Ministry concerning safeguard of the heritage.

4. These procedures must be referred to as standard provisions in construction contracts. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed.

5. Relevant findings will be recorded in World Bank Supervision Reports and Implementation Completion Reports will assess the overall effectiveness of the project's cultural property mitigation, management, and activities, as appropriate.

ANNEX-VIII

Due Diligence Report
Bangabandhu Hi-Tech City, Kaliakair, Gazipur

1. Background

The Government of Bangladesh has declared "Vision 2021" with a target to make Bangladesh a middle-income country by using Information and Communication Technology (ICT) and by developing favorable business environment for Hi-Tech industries. Information Technology (IT) has been identified as the "thrust sector" for the economy of Bangladesh. Government has taken various initiatives to achieve the target. To fasten up the economic development of the country, Bangladesh Hi-Tech Park Authority (BHTPA) was established in 2010. BHTPA has been established with a view to achieve a set of specific mission and vision. The underlying mission and vision are:

- To establish a world class business environment for targeted high growth industrial sector and new business;
- To develop indigenous technological capability for the development of the local industries;
- To enter into foreign markets by exporting state of the art technology products;
- Infrastructure to facilitate hassle-free industrial operation with necessary support.

2. HTPA Act 2010 and its HTPA (amendment) Act 2014

Bangladesh Hi-Tech Park Authority (HTPA) Act, 2010 was passed by the parliament to make provisions for the establishment of Hi-Tech Parks in different places within the country for setting up and development of Hi-Tech industries in Bangladesh and for the establishment of Bangladesh Hi-Tech Park Authority (BHTPA) for proper management, operation and development thereof. **The authority has power to acquire, hold and dispose of property, both moveable and immovable**[30].

HTPA Act 2010 provides the legal coverage for attracting and leveraging private investment in the development of Hi-Tech Parks on a Public-Private Partnership (PPP) basis. HTPA (amendment) Act, 2014 gives more autonomy to HTPA as it now has to only inform the National Board of Revenue (NBR)on giving special tax benefits to Hi-Tech Industries in the parks, instead of seeking consent from NBR.

BHTPA is responsible for the establishment and expansion along with management, operation and development of Hi-Tech Parks within the country. Bangabandhu Hi-Tech City (BHTC), Jessore Software Technology (IT) Park, Sylhet Hi-Tech Park, Mohakhali IT Village and Janata Tower Software Technology Park are important and priority projects which would be the milestone for development of IT sector as well as industrialization of Bangladesh.

3. Bangabandhu Hi-Tech City (BHTC)

3.1 Introduction

Government of Bangladesh is implementing, the Private Sector Development Support Project (PSDSP) with the financial assistance from The World Bank. PSDSP seeks to remove constraints to private sector investment in Bangladesh through the piloting of Economic Zones (EZ/EZs). The Hi-

Tech Park at Kaliakair is one of the proposed sites for development as an economic zone. An important component of this project is development of BHTC by Bangladesh Hi Tech Park Authority (BHTPA) that houses Information and Communications Technology (ICT) enterprises catering to Bangladesh‟s economy. The Hi-tech Park was formally proposed in June 1999 at a meeting of

[30] file:///Users/muhammadfoysal/Downloads/Draft-Final-BHTPA-Roadmap-2016.pdf

the Bangladesh Board of Investment. A feasibility study was conducted in 2001[31] by the Bangladesh Hi-Tech Park Authority. The park will be a world class business environment/investment zone for the investor especially foreign investors where they could utilize vast potential of young educated and technically skilled work force.

3.2 Description of the Site

BHTC is a business park in Kaliakair, Gazipur District, Bangladesh. Originally called Kaliakair Hi-Tech Park (KHTP). It was renamed in June 2016 to honor Bangabandhu (Father of the Nation) Sheikh Mujibur Rahman. BHTC is the first ever Hi-Tech Park in Bangladesh. It is situated only 40 km North from Dhaka city and 25 km from the Zia International Airport in Dhaka covering with 232 acres of land. Additional 97 acres of land has been included with the Park[32]. The proposed project site is surrounded by seven villages, namely Janerchala, Pirer Teki, Naya Para, Goalbathan, Latifpur, Haritakitola, and Uttar Bokhtarpur.

3.3 Land Ownership and Transfer

The first initiative towards the establishment of the Hi-Tech Park was taken up by the Ministry of Science and Information & Communication and Technology in 2001. Bangladesh Computer Council (BCC) was assigned the role of the implementing agency for the park. Following this, a memorandum of understanding was signed between the Ministry of Land (MoL) and Ministry of Science and Information & Communication Technology (MoSICT) resulting in the transfer of the required land to MoSICT in April 2004.

The land was earlier held by the Telegraph and Telephone (T&T) Board under Ministry of Telegraph and Telephones (MoTT) from 1969 to 2004. Though an area of 432 acres was acquired, it remained unutilized till 2003. The Government of Bangladesh (GoB) decided to transfer 262.63 acres of T&T's unutilized land to the Ministry of Science and Technology (MoSICT), presently known as Ministry of Posts, Telecommunications and Information Technology, to set up the Hi-Tech Park[33].

3.4 Topography of the Site

The Project site was unutilized and is available without any encumbrance. The land was mostly covered with bushes and grass. The southern part of the site comprises flat high land. The eastern, western and northern parts of the area were comparatively low-lying. Though there were some wetlands on the north-western part of the area, these wetlands, as explained in the Master Plan, will not be affected in any way[34].

3.5 Retention of Waterbody

Several lakes are located in BHTC but most of the lake/ponds were silted and inaccessible due to bush and shrubs. BHTPA decided to excavate some lakes/ponds and to do beautification of the bank.

[31] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2015/06/Feasibility-study-report-khtp-2-buet.pdf
[32] http://bhtc.bhtpa.gov.bd/project-brief/
[33] http://documents1.worldbank.org/curated/en/527201468013210102/pdf/RP9770RP0P120811cum1RAP0180Feb02010.pdf
[34] http://documents1.worldbank.org/curated/en/527201468013210102/pdf/RP9770RP0P120811cum1RAP0180Feb02010.pdf

Some sitting facilities were created on the bank and neighboring road to use as walkway. BDT 165.63 lac was spent for the component, and which has been completed in March 2017[35].

3.6 Resettlement & Rehabilitation Process

No physical resettlement will be triggered by this project and no individual or household is standing to lose lands and/or assets. Consequently, no resettlement and rehabilitation process is required. According to abbreviated RAP prepared by World Bank, a total of USD 3145 was considered for the purpose of compensation for trees and Deep Tube-well[36].

3.7 Compensation for loss of assets[37]

SIA report including RAP of Hi-Tech Park carried out in 2010 identified an adverse impact made by the project that the common people (Local Community living around the park) will lose access to few mud-made villages roads which passes through the Hi-Tech Park starting from east and north-east side of the project. The report also mentioned that when the boundary wall would be completed, these access roads would be closed and would affect and blocked the easy movement of the nearby villagers. In order to mitigate this limited adverse impact, the Hi-tech Park authority is going to develop an alternate access road around the boundary of the KHTP. Therefore, they engaged a consultant to conduct a social impact Assessment (SIA) of the alternate road in compliance with the safeguard policies of the World Bank (WB) and to prepare the Resettlement Action Plan (RAP) for minimizing impacts by assessing the existing ground level information. It is worth to be mentioned that the consultant while conducted Social Impact Assessment on August 2013 there was a curve in the alignment of the road but considering the safety reason the alignment was change a bit to avoid the road accident. Due to this modification the Resettlement Action plan has been prepared on the basis of latest social survey dated on 18th February 2014 conducted by a committee formed by the Authority consist of DPD, Executive Engineer (Mayor's representative) and Assistant Commissioner (Land) (UNO's representative). It is further wise to be mentioned here that due to this change of alignment of the road in the latest survey did not identify some common resources (like youth club) affected. A total of 33 decimal of government land where some structures are constructed by squatters with tin roofs and wall made by mud or bamboos will be affected partially. No private lands will be required and so no land acquisition will be triggered. The socio-economic survey identified 15 squatter families are affected through multiple impacts of the alternate road. Out of these, ten families are identified whose structures are partially affected.

Six families are partially losing a section of their cowsheds made by tin roofs which are temporary structures and can be easily moved. Five families will be affected by the loss of their slab-toilets which are easily removable and can be re-built in a day on adjacent land in the immediate vicinity to their homesteads. Two families will be losing a tube well. Four families will be losing a room meant for kitchen and two families will be losing another room along with kitchen which is used as temporary store for firewoods. The rest five families are affected by loss of trees only.

[35] http://bhtc.bhtpa.gov.bd/lake-development-of-khtp/
[36] http://documents1.worldbank.org/curated/en/527201468013210102/pdf/RP9770RP0P120811cum1RAP0180Feb02010.pdf
[37] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2017/04/Social-Impact-Assessment-1.pdf

All these households are located in Uttar Boktarpur. Since there is ample of space to extend/repair their structures in the immediate vicinity of the original structures there is no displacement or long-term impact on livelihood anticipated under the project. A total of 252 nos. of various types of trees (consisting mostly of bamboo groves, small vegetable plants or shrubs, jackfruit and mango trees) are to be affected by the construction of alternate route. However, all impacts are partial and very temporary in nature. The replacement value will include all shifting and reconstruction costs as well. The project will not claim any dismantled material. The BHPTA formed a committee comprised with Deputy Project director, Executive Engineer of the Kaliakair Municipality, Assistant Commissioner (Land) assessed the loss of the affected families. The BHTPA agreed to provide proper compensation to the squatters as per World Bank's Safeguard Policy. The affected families are happy for getting compensation for their partial losses. They expressed that they would utilize their compensation money duly for reconstruct the structure and also by plantation of tree. All the affected people are Muslim by religion and there are no tribal people in the project affected area.

As per design of the road the land area for the access road is 4.4 km of which 1.5 km is under the BHTPA's ownership. The remaining areas of land are under Government ownership (Forest department).

No private land is required for acquisition. There is no displaced person found as per the intervention of the project. No cultural objects are found to be affected by the project.

There are no indigenous/tribal people found in the project area. The actual loss of the affected household is about BDT 60,20,000.00 (Sixty Lacs Twenty Thousand only). The project provided livelihood assistance through the Bank Cheque, against the name of the affected persons.

3.8 Disputed lands issue

In 1969, T&T Board acquired 170 decimals of land corresponding to the proposed Hi-Tech Park site. The expropriation affected a total of 81 private owners, who used the lands for agricultural purposes. Then, 81 families were compensated according to the legal practices of Bangladesh. However, the land acquired was not utilized for the original purpose for which it was expropriated. Upon request of the original owners, T&T Board decided to lease the expropriated lands back to their original owners to allow them to cultivate. The lease value was BDT.5 per decimal and leases expired in 2001. In 2001, T&T Board requested the lease holders to vacate the land issuing a lease agreement termination notice, subsequently to which it took possession of the plot of land once again.

During the consultations for the PSDSP project, it was found out that in 2005 the affected people requested the Project Director of the Hi-Tech Park (MoSICT), to use the land for agricultural purposes until the beginning of the zone development. This was only done verbally, and no written agreement exists to the knowledge of consultants. MoSICT agreed to the request as a 'goodwill' measure and allowed them to cultivate the agricultural land free of cost at the following conditions:

- Whenever required by the park authority, users will vacate the land.
- Users will not be entitled for any kind of compensation.

Based on this verbal agreement, the farmers vacated the premises in 2008. Consultants recommended to BCC that, as part of the communication strategy and protection of project site, signboards be placed at the entrances to the park indicating that the land will be henceforth used only for the purposes of the Hi-Tech Park. Also, necessary actions should be taken to protect the land and to ensure that it is not occupied either by the same group of people or others during the next cropping season.

Furthermore, a census survey and FGDs had been conducted and the results show that the majority of the land users are businessman and living outside the boundary. Moreover, the bulk of them is not dependent on agriculture for their livelihoods and will not be impacted negatively by the project. However, during the last supervision visit, it was noted that parts of the site are again under cultivation. Although this is an informal agreement and farmers may not have any enforceable right over these lands, it is imperative that the site be kept free of users from now on till construction begins.

However, reviewing SIA, RAP and EIA, due diligence report did not find any concerns and/or complaints or any major issues regarding the development of BHTC.

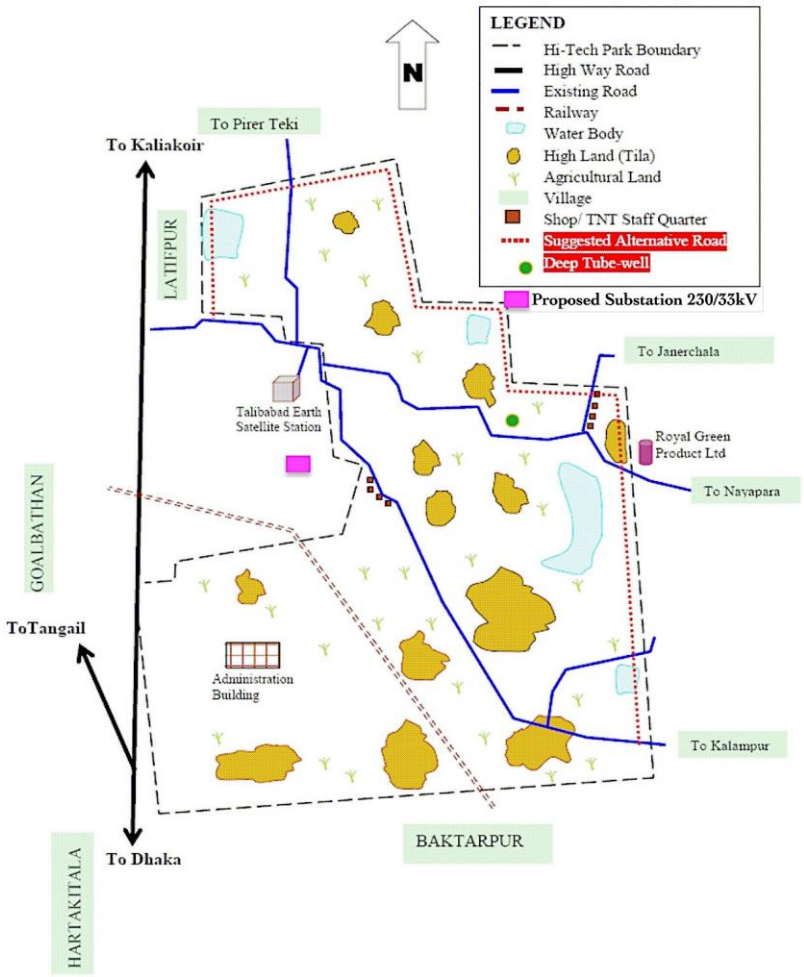

Figure-1: Land use map and location of proposed 230/33kV Substation at BHTC

Figure-2: Integrated Master Plan Layout of BHTC, Block-3 and location of proposed SS

3.9 Progress of the project

A boundary wall was constructed in 2008. A further assessment performed by the Authority and said that one advantage of the location was that land transfer was completed[38].

Main gate of Bangabandhu Hi-Tech City

Existing building in Bangabandhu Hi-Tech City

[38] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2015/06/Feasibility-study-report-by-PWCIndia-1.pdf

To enclose the new 97 acres of land and reconstruction of demolished wall need to construct boundary wall in the park. For this reason, 3500-meter-long boundary wall was constructed by November 2016 under the project with cost of BDT 621.26 lac.

The project received Site Clearance [39] from Department of Environment (DoE) in 2013, since according to Environment Conservation Rules, 1997, the project is classified as category 'B' which requires Initial Environmental Examination (IEE)[40].

A high-tension electric line for uninterrupted and a quality power supply at BHTC was established in March 2017 by spending BDT 603.00 lac. Five sub-stations in 5 places of the park also constructed along with the 5020 m long electric line. Mostly it is a underground line but partially laid through the drain beside the Internal Access Road[41].

By June 2015, the authority had awarded contracts for basic infrastructure. One of two parts of a bypass road for local residents was completed, as was an internal access road. Construction had begun on sewer lines and a sewage treatment plant; the boundary wall was being extended to enclose an expected expansion, and replaced where it had been demolished during other construction; installation of street lighting was underway; and refurbishment of a three-stored building built in 2009 but not yet occupied was in progress[42].

The original 232 acres (94 ha) site is divided into five blocks. Block 1 is reserved for government use. Blocks 2 and 5 are being built by Summit Technopolis, a joint venture between Summit Group of Bangladesh and Infinity Infotech Parks of India through Public Private Partnership (PPP) Model. Bangladesh TechnoSity is developing Block 3. As of 2020, Block 4 has not been awarded. Summit Technopolis broke ground on their portion on 28 February 2016[43]. By June of that year, the project had been expanded to 355 acres (144 ha)[44].

Signing of Contract Ceremony between BHTPA and Summit Tecnopolis Ltd (SIMCL-Infinity JV) on 28th June, 2015

[39] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2016/10/SiteClearence_KHTP.pdf
[40] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2016/10/EA_for_KHTP.pdf
[41] http://bhtc.bhtpa.gov.bd/construction-of-boundary-wall-electric-line/
[42] http://bhtc.bhtpa.gov.bd/wp-content/uploads/2016/10/Progress-Report-2014-2015.pdf
[43] https://www.thedailystar.net/business/summit-technopolis-begins-building-hi-tech-park-783745
[44] https://www.observerbd.com/2016/06/01/154246.php

The government offers various incentives to attract investors and tenants, such as tax breaks and exemptions on import duties[45].

As of November 2020, five companies are manufacturing in the park, employing 13,000 workers. Some 37 companies have got land allocation in BHTC, of which five are currently manufacturing there. They have made investment worth Tk 3.27 billion and created employment for more than 13,000 people in the country's first and the largest hi-tech park, being established on 355 acres of land in Gazipur[46].

Administrative building

Solaris Project by Bangladesh Technosity.

Custom House

Laptop Manufacturing Factory by Summit Technologies

[45] https://www.newagebd.net/article/58145/nbr-widens-tax-waiver-for-investors-in-hi-tech-parks
[46] https://thefinancialexpress.com.bd/trade/37-companies-get-land-allotment-at-bangabandhu-hi-tech-city-1604290539

BHTPA will sign an Memorandum of Understanding (MoU) with PGCB for using the land for the construction and operation of proposed substation. BHTPA given an administrative approval on 28 February 2018 to PGCB with the following terms and conditions.

(a) Proposed land can only be used for construction and operation of substation
(b) An MoU have to be signed between BHTPA and PGCB
(c) PGCB can use the land till the decommissioning of the substation

The following shows the administrative approval of using land for the construction of Grid Substation at BHTC by BHTPA

বাংলাদেশ হাই-টেক পার্ক কর্তৃপক্ষ
তথ্য ও যোগাযোগ প্রযুক্তি বিভাগ
ডাক, টেলিযোগাযোগ ও তথ্য প্রযুক্তি মন্ত্রণালয়
পরিকল্পনা শাখা
আইসিটি টাওয়ার, আগারগাঁও, ঢাকা-১২০৭
www.bhtpa.gov.bd

স্মারক নম্বর: ৫৬.১৫১.০১৮.১০.০০.০২৭.২০১২.৩৪ তারিখ: ১৬ ফাল্গুন ১৪২৪
২৮ ফেব্রুয়ারি ২০১৮

বিষয়: গ্রিড উপকেন্দ্র নির্মাণের জন্য প্রয়োজনীয় জমি ব্যবহারের প্রশাসনিক অনুমোদন প্রসঙ্গে।

উপর্যুক্ত বিষয়ের প্রেক্ষিতে জানানো যাচ্ছে যে, কালিয়াকৈরে অবস্থিত "বঙ্গবন্ধু হাই-টেক সিটিতে" গ্রিড উপ-কেন্দ্র নির্মাণের জন্য নিম্নোক্ত কো-অরডিনেটে (১৫০*১৫০) বর্গ মিটার জায়গা নিম্নে বর্ণিত শর্ত সাপেক্ষে ব্যবহারের প্রশাসনিক অনুমোদন প্রদান করা হলো।

GPS Coordinates for Land of 150*150 sq. meter:

1) 24± 3'54.86"N, 90±13'26.00"E
2) 24± 3'59.33"N, 90±13'28.16" E
3) 24± 3'56.36"N, 90±13'32.44"E
4) 24± 3'51.91"N, 90±13'30.23"E

শর্তসমূহঃ

১) বর্ণিত স্থানটি শুধুমাত্র গ্রিড উপ-কেন্দ্র নির্মাণ এবং তৎসংশ্লিষ্ট কাজে ব্যবহার করতে হবে।
২) পাওয়ার গ্রিড কোম্পানি অব বাংলাদেশ লিঃ এবং বাংলাদেশ হাই-টেক পার্ক কর্তৃপক্ষের মধ্যে একটি সমঝোতা স্মারক স্বাক্ষর করতে হবে।
৩) যতদিন গ্রিড উপ-কেন্দ্র থাকবে শুধুমাত্র ততদিন বর্ণিত স্থানটি পাওয়ার গ্রিড কোম্পানি অব বাংলাদেশ লিঃ ব্যবহার করতে পারবে।

২৮-২-২০১৮
হোসনে আরা বেগম, এনডিসি
ব্যবস্থাপনা পরিচালক

ব্যবস্থাপনা পরিচালক, পাওয়ার গ্রীড কোম্পানি অব বাংলাদেশ লিঃ

স্মারক নম্বর: ৫৬.১৫১.০১৮.১০.০০.০২৭.২০১২.৩৪/১(২) তারিখ: ১৬ ফাল্গুন ১৪২৪
২৮ ফেব্রুয়ারি ২০১৮

সদয় অবগতি ও কার্যার্থে প্রেরণ করা হলঃ

১) মাননীয় মন্ত্রী মহোদয়ের একান্ত সচিব, মন্ত্রী মহোদয়ের দপ্তর, তথ্য ও যোগাযোগ প্রযুক্তি বিভাগ
২) মাননীয় প্রতিমন্ত্রীর একান্ত সচিব, প্রতিমন্ত্রী মহোদয়ের দপ্তর, তথ্য ও যোগাযোগ প্রযুক্তি বিভাগ

২৮-২-২০১৮
হোসনে আরা বেগম, এনডিসি
ব্যবস্থাপনা পরিচালক

Administrative approval of using land for the construction of Grid Substation at BHTC by BHTPA

Government of the People's Republic of Bangladesh
Department of Environment
www.doe-bd.org
Head Office, E-16 Agargaon
Dhaka-1207

Memo No: DoE/30.33.32.4.119.040913/ ২৫৫ Date: ২২/10/2013

Subject: Site Clearance for Kaliakoir Hi-Tech Park Project at Kaliakir, Gazipur.
Ref: Your Application dated 27/08/2013 and 26/09/2013.

With reference to the above, the Department of Environment (DOE) is pleased to award the Site Clearance in favor of Kaliakoir Hi-Tech Park Project at Kakiakoir, Gazipur subject to fulfilling the following terms and conditions.

1. This clearance shall only be applicable for the development of the infrastructure of the said project.
2. The project authority shall submit a comprehensive Environmental Impact Assessment (EIA) report considering the overall activity of the said Project in accordance with the TOR and time schedule submitted to the Department of Environment (DOE).
3. The EIA shall incorporate the following components/items :

(a) Executive summary
(b) Introduction (Background, brief description, scope of study, methodology, limitation, EIA team, references)
(c) legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)
(d) Project activities: A list of the main project activities to be undertaken during site clearing, construction as well as operation
(e) Project schedule: The phase and timing for development of the project
(f) Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project
(g) Map and survey information
Location map, Cadastral map showing land plots (project and adjacent area) Topographical Map
(h) Baseline Environmental Condition should include, inter alia, following :
- Physical Environment : Geology, Topology, Geomorphology, Soils, Meteorology, and Hydrology
- Biological Environment : Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora and Fauna
- Environmental Quality : Air, Water, Soil and Sediment Quality

(i) Socio-economic environment should include, inter alia, following :
- Settlement and housing
- Traffic and transport
- Public utilities: water supply, sanitation, solid waste, drainage, dedicated industrial effluent drainage, sewerage system, green area, parking, fire hydrant, space for various utility services, etc.
- Economy and employment
- Fishing activities, fishing communities, fishing resources, commercial factors.

(j) Identification, Prediction and Evaluation of Potential Impacts (identification, prediction, magnitude, extent, quantifying, causes and effects, evaluation and assessment of positive and negative impacts likely to result from the proposed project)
(k) Management Plan/Procedures :
For each significant major impact, proposed mitigation measures both in-house and external will be set out for incorporation into project design or procedures, impacts, which are not capable of

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mitigation, will be identified as residual impacts. Both technical and financial plans shall be incorporated for proposed mitigation measures
An outline of the Environmental Management Plan shall be developed for the project.
In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise)

(l) Explore and design the project in an environmentally sound and sustainable concept by incorporating 3R policies, resources and energy efficient, optimum use of water resources energy, rain water harvesting, use of low or non waste technology, etc.

(m) Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)
Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)

(n) Conclusion and Recommendations.

4. Without approval of EIA report by the Department of Environment, the project authority shall not be able to open L/C in favor of importable machineries.
5. Without obtaining Environmental Clearance, the project authority shall not start the operation of the project.
6. Rehabilitation of human settlement or compensation for any sort of activity which will incur damage or loss or public or private property shall be addressed as per Government of Bangladesh rules and regulations.
7. Appropriate permission would be required to obtain from the forest Department in favor of cutting/felling of any plant/tree/sapling forested by any individual or government before doing such type of activity.
8. No activity of cutting/razing/dressing of hill or hilly land is endorsed without permission/clearance of the concerned authority of the government.
9. The project authority shall submit the EIA along with a filled-in application for Environmental Clearance in prescribed form, the feasibility report, the applicable fee in a treasury Chalan, the no objection certificates (NOCS) from the local authorities, NOC from other relevant agencies and other necessary documents to the Gazipur District Office of DOE with a copy to Dhaka Regional Office and Head Office of DOE in Dhaka.
10. A soft copy of the image data as well as the maps to be generated from the image shall be submitted to DOE Head Office along with the EIA.
11. Violation of any of the above conditions shall render this clearance void.
12. This Clearance is valid for one year from the date of issuance and the project authority shall apply for renewal to the District Office of DOE at Gazipur with a copy to Head Office at least 30 days ahead of expiry.
13. This Site Clearance Certificate has been issued with the approval of the appropriate authority.

22.10.2013

(Syed Nazmul Ahsan)
Deputy Director (Environment Clearance)
and
Member Secretary
Environmental Clearance Committee
Phone # 02-8181778

Project Director
Kaliakoir Hi-Tech Park Project
Bangladesh Hi-Tech Park Authority
BCC Bhaban, Agargaon, Dhaka-1207.

Copy Forwarded to:
1) Director, Department of Environment, Dhaka Region, Dhaka.
2) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

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ANNEX-IX
Fire Management Plan

ANNEX-X
Outlines of Biodiversity Management Plan (BMP)

Outlines of Biodiversity Management Plan (BMP)

The proposed project titled **"Southern Chattogram and Kaliakoir Transmission Infrastructure Development Project"** undertaken by Power Grid Company of Bangladesh Limited (PGCB) intends to construct, renovate and augment the 4 GIS sub-stations and 184.07 km overhead Transmission lines at Chattogram, Cox's Bazar and Gazipur districts of Bangladesh. The Project involves several key activities during construction and operations which have the potential to impact upon biodiversity. These include:

- Clearing of vegetation and fauna habitat;
- Planned and/or unplanned fire;
- Collisions between birds and transmission lines;
- Storage and use of potentially hazardous substances;
- Disturbances of Asian Elephant movement.

The Biodiversity Management Plan (BMP) would be developed to provide a clear and concise outline of the actions and methods required to mitigate likely impacts on biodiversity including:

- Procedures to be adopted during vegetation clearing, including wildlife rescue procedures;
- Management of flora and fauna by the intervention of the project; and
- Mitigation of potential impacts on rare, threatened species.

The BMP forms part of the Environmental Management Plan for the Project and is considered to be a working document. It will be prepared and updated by ESCMC and contractors. There are 18 Environment Codes of Practice (ECPs) has been prepared for this project attached in Annex III, which also addressed the impact and mitigations of biodiversity due to the project. The following structured outlines is proposed for the preparation of BMP on or before implementation of the project.

Chapter-1: Introduction

1.1. Project overview
1.2. Purpose of BMP
1.3. Scope of BMP
  1.3.1 The mitigation hierarchy
  1.3.2 Stakeholder consultation and engagement
1.4. The project's approach to biodiversity and natural resource management
1.5. Important document linkages

Chapter-2: Key policies, legislations and standards

2.1 Overview
2.2 National legislations and permits
2.3 International standards and commitments

Chapter-3: Priority Habitat and Species

3.1 Identification of priority habitat and species
3.2 Overview of the biodiversity characteristics in the project area
3.2.1 Protected area status
3.2.2 Habitats
3.2.3 Flora
3.2.4 Mammals
3.2.5 Avifauna
3.2.6 Reptiles
3.2.7 Amphibians
3.2.8 Fish
3.2.9 Invertebrates
3.2.10 Existing threats to biodiversity

Chapter-4: Targets and action for biodiversity management to be followed by Contractors

4.1 Overview of project related impacts to priority habitats and species and other biodiversity
4.2 Avoidance measures
4.2.1 Target A: Avoid the loss and degradation of habitats of high conservation importance
4.2.2 Target B: Avoid project related disturbance to fauna
4.2.3 Target C: Avoid adversely impacting fauna, flora and protected areas through hazardous materials
4.2.4 Target D: Avoid introduction of invasive species and pests
4.3 Mitigation and minimization measures
4.3.1 Target E: Minimize habitat loss and degradation
4.3.2 Target F: Minimize the risk of causing mortality or injury to endemic, rare and threatened vascular plant species during clearance of RoW
4.3.3 Target G: Minimize the risk of mortality and injury to Asian Elephants, its disturbance of corridors and routes
4.3.4 Target H: Minimize disturbance to fauna
4.3.5 Target I: Minimize the risk of causing the mortality and injury of local and migratory birds
4.4 Rehabilitation/restoration measures
4.4.1 Target J: Successfully rehabilitate the and restore habitats within project area

Chapter-5: Monitoring, Evaluation and Adaptation Management

5.1 Introduction
5.2 Remote sensing
5.3 Avifauna monitoring
5.4 Anecdotal observations
5.5 Monitoring habitat restoration and landscaping
5.6 Monitoring the efficacy of Elephant movement

Chapter-6: Implementation

6.1 Roles and responsibilities

ANNEX-XI
Chunati Wildlife Sanctuary

Chunati WS was formally established through a Gazette Notification in 1986 under the provision of Wildlife Preservation Act 1974. As per the Gazette Notification the Chunati Wildlife Sanctuary covers 18.700 ha of land of which 7,760 are in the core zone and rest buffer and 'impact' zone. The sanctuary area is generally hilly with shallow to deep gullies and gentle to steep slopes. The average elevation is 30 to 90 m. There are numerous creeks, which are clear with gravely, and stony beds, which traverse the area. Earlier, the sanctuary was under the jurisdiction of Chattogram (south) Forest Division, but in the recent past, it has been transferred to the newly created Wildlife and Nature Conservation Division of the Forest Department. Administratively, the sanctuary is divided into 2 Forest Ranges, Jaldi and Chunati, and 7 Forest Beats (namely, Chunati, Herbang, Aziznagar, Jaldi, Puichari, Chambol and Naporia). The Sanctuary covers 7 forest blocks.

Presently under the project titled "SASEC Chattogram – Cox's Bazar Railway Project, Phase I" funded by ADB 'Construction of greenfield Single Line Dual Gauge Railway Track from Dohazari to Cox's Bazar via Ramu is under the construction work which crossed within the Chunati WS. In fact, existing Dohazari to Cox's Bazar 132kV overhead transmission line of PGCB also crossed within this sanctuary.

The Asian Elephant (Elephas maximus)

Status and classification- The Asian elephant, a migratory species, is a critically endangered species in the South and SE Asian countries they occur in. It is listed as endangered in IUCN's Red List and as well as in Bangladesh's red list. There are likely less than 300 animals remaining in the country with about 200 resident (i.e., not crossing international borders) and 100-150 having a transboundary range with India and Myanmar, and about 40,000 animals in the world, with the greatest populations found in Myanmar and India. The presence of elephant in an area is an indicator of a healthy ecosystem, and also one of the key drivers in maintaining a diversity of habitat and inhabitants.

General Life History, Habitat and Ecology- Asian elephants are very social animals, living in family groups consisting of related females and their offspring that are led by the oldest female, the 'matriarch'. The social bond between group members is very strong, and cooperative behaviour is common, particularly in the protection and guidance of the young. The average group size is around six or seven. There is no evidence of territoriality, and groups occasionally join to form herds when food is plentiful. "At around 20 years males first come into 'musth', which occurs annually and usually lasts two or three months. During this time males will wander widely in search of receptive females. Females become sexually mature at around 10 years and generally first give birth at around 15-16 years. When habitat conditions are favourable, they are capable of giving birth every 3-4 years. Elephants can live as long as 70 years, although the period of greatest female fecundity is between 25 and 45 years of age. The gestation period lasts 18-22 months, and usually results in the birth of a single calf, weighing an average of 100 kg. The calf may continue nursing for up to 18 months, and can suckle from its mother or from other lactating females in the group".

The elephant's diet consists mostly of grasses, but bark, roots, stems, and the leaves of trees, vines and shrubs are also eaten. Cultivated crops such as bananas, rice and sugarcane planted in their

historical territory are also favoured foods, bringing them into conflict with local farmers. Individuals eat an average of 150 kg of food per day and leave about 100kgs of dung, much of it only partially digested. Calves often feed on their mother's dung for extra nutrients. Elephants must drink frequently, as they require 70-90 litres of water each day.

Importance of Species and Key Threats- Elephants play a vital role in the ecosystems they inhabit. They modify their habitat by converting areas of forest to grassland, ecotones, and are important seed dispersers. They can provide water for other species by digging holes in dry riverbeds, and the wide paths they create as they wander through the forests act as firebreaks. Consuming on average 150 kg of plant material per day an adult elephant defecates frequently, producing about 100 kg of dung per day. Dung provided food for a host of other species and helps with seed dispersion and germination.

The three greatest threats to elephant survival are poaching, habitat loss and habitat fragmentation through conversion to agriculture (mostly paddy and production forest plantings such as rubber, and oil palm) and restriction/ blockages of travel routes to food and water.

Status in the Project Influence Area- Population Distribution- In the 1950s, there were more than 500 elephant presents in their natural habitats throughout Bangladesh. Based on a recent survey by IUCN (IUCN 2015) there appear to be around 270 individuals left in the wild and are severely threatened throughout their range in Bangladesh (figure). About 85% of these animals now live in the Chattogram Hills and move mostly north-south in this range. Given the high level of habitat destruction and human intrusion into both Chunati WS and Fasiakhali WS, elephant use these areas as feeding, crop raiding and watering areas. The Forest Department is making a significant effort to restore habitat and encourage local communities to coexist with the elephant.

Range and Discrete Management Unit- In Bangladesh the population of wild elephants has declined drastically in last two centuries because of habitat fragmentation and destruction caused by the expansion of agriculture and human settlement. The growing pressure on elephant habitats and movement corridors has meant that they are restricted to population pockets in the country, in the Chattogram hills area, Sylhet, Sherpur and migrating animals from Meghalaya State in India.

Diurnal and Seasonal Activities-The species feeds during the dawn and dusk as well as evening periods, sometimes night, and rests in the shade during the heat of the day. Their home range varies greatly, anywhere from 35 to 400 km^2 (Williams, 2002 and Fernando et al, 2005[47] in IUCN red list). Hossen (2013) stated that both FWS and CWS play an essential roll on provided a travel corridor for elephant to move from the large Teknaf Ecological Area through the Himchari National Park (south of Ramu) then north and east, through FWS and exiting to the east across CWS for the Chattogram Hills zone and back again.

[47] Choudhury, A., Lahiri Choudhury, D.K., Desai, A., Duckworth, J.W., Easa, P.S., Johnsingh, A.J.T., Fernando, P., Hedges, S., Gunawardena, M., Kurt, F., Karanth, U., Lister, A., Menon, V., Riddle, H., Rübel, A. & Wikramanayake, E. (IUCN SSC Asian Elephant Specialist Group). 2008. Elephas maximus. The IUCN Red List of Threatened Species 2008: downloaded Dec. 12, 2015

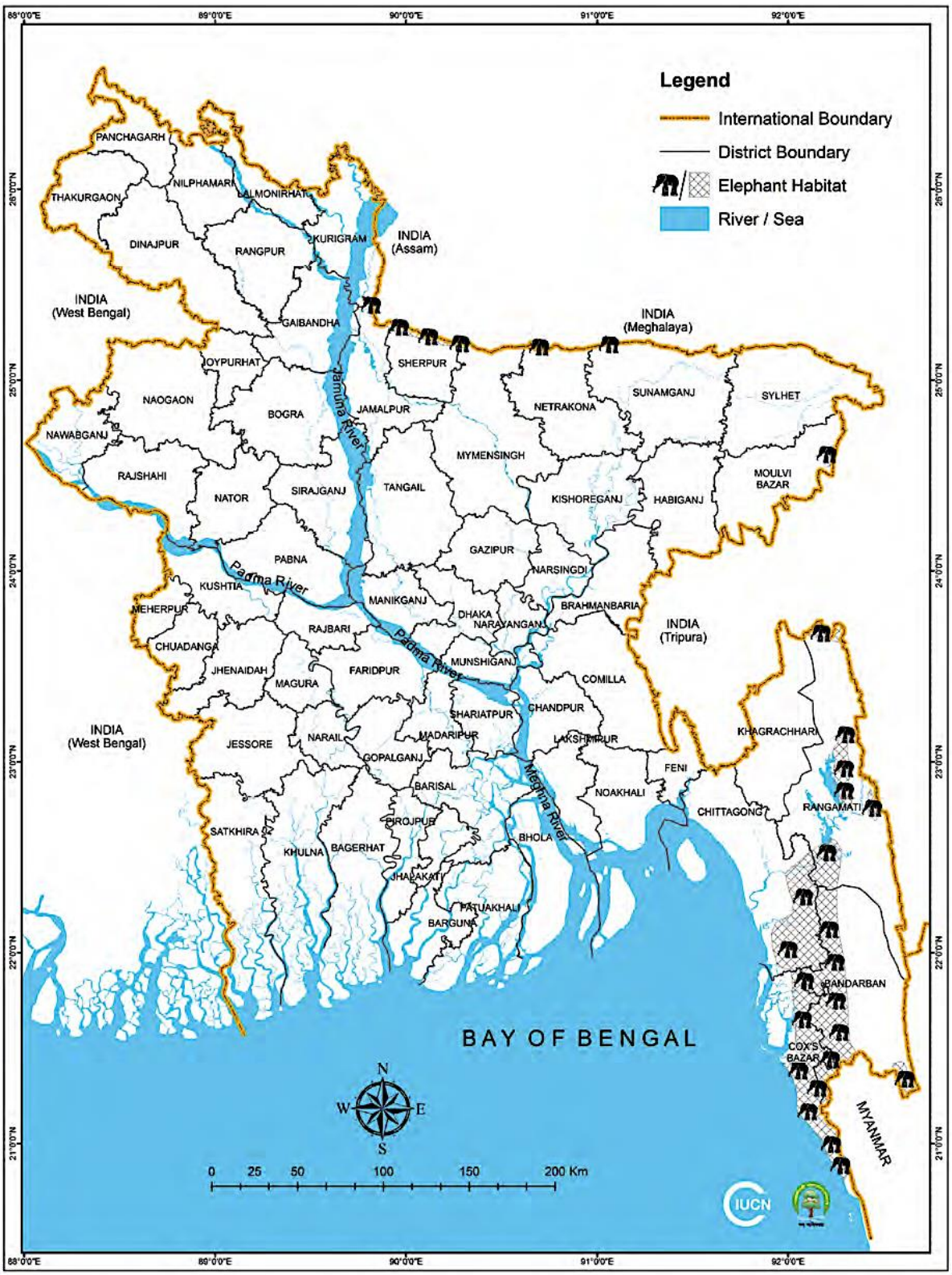

Figure: Distributions of Asian Elephants in Bangladesh

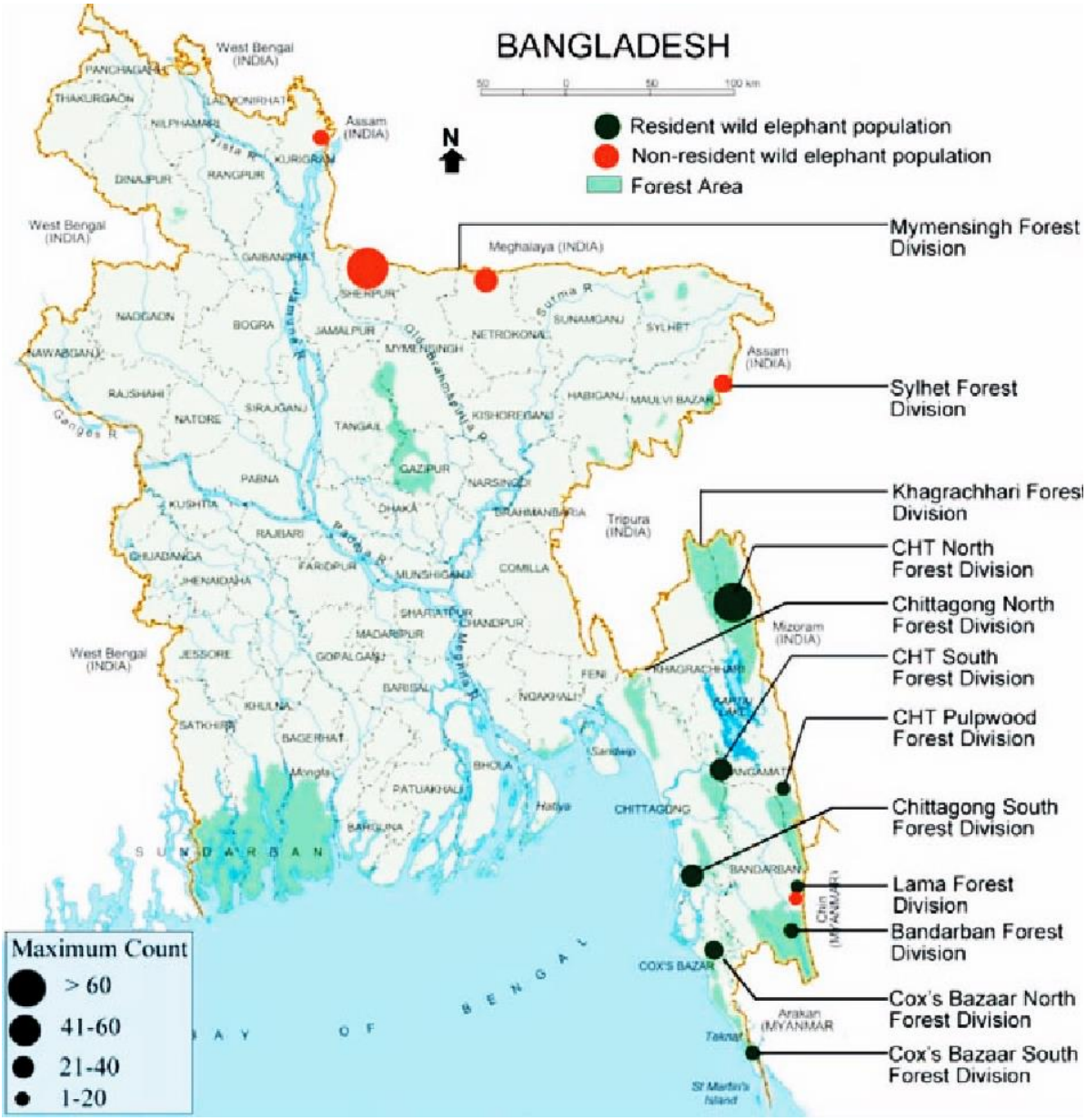

Figure : Current distribution of elephant in Bangladesh

The Asian elephant follows traditional migration routes (varying in width from a few hundred metres to one km) that are determined by the monsoon season and availability of water and food. The eldest elephant of the herd is responsible for remembering the migration route, with the migration generally takes place between the wet and dry seasons, i.e., between November and April. This is also harvest time and when crops ripen along the elephant's travel route. Since so much of the elephant's traditional territory has been converted to agricultural production there are frequent clashes between travelling herds and farmers. For example, in CWS and FWS well over 60% of the area has been converted to agriculture or commercial plantation lands, and up to 85% has seen extensive tree cutting, mostly for fuelwood.

Undoubtedly the elephant movement corridors are under serious threat and are a large part of why populations continue to decline.

Ongoing Conservation Efforts in relation to the elephant- In Bangladesh the CWS and FWS were established principally to provide habitat for the elephant. However due to large scale human encroachment and loss of traditional habitat, elephant do not appear to reside in these sanctuaries, but use them as access to food found in the illegal farming operations and water supply flowing from the hills to the east. Unfortunately, the original objectives of the two reserves have largely been lost.

Elephant Corridors of Chunati Wildlife Sanctuary (CWS)

Some portions of proposed Anwara to Cox's Bazar 230kV transmission line will cross CWS. The baseline will focus the elephant corridors of CWS. Chunati was established in 1986 and has about 18.700 ha of land of which 7,760 are in the core zone and rest buffer and 'impact' zone. The buffer and impact zones are highly degraded and make up >33% of the entire area. As of late 2015 hardly any natural forest remains in CWS (CWS Management Plan, 2015). However, Chunati has a new management plan that will not permit new development in the core zone of the sanctuary, while permitting some activity in special cases of national significance and based on a prime ministerial permit (which PGCB will obtain from the Forest Department).

The plan calls for the existing roads to be converted to walking trails and encroachers discouraged by conversion of trails used for illegal resource extraction to tourist facilities. Enrichment plantings with indigenous forest trees on 3300 ha of degraded/barren land. Native tree species will be planted in the buffer zone as well as bamboo and bushes. Soil conservation measures such slope stabilization and erosion protection, and soil conservation measures training will be provided to local communities.

Encroachers into the CWS will be encouraged to switch to the more sustainable nontimber- forest product extraction, but only in the buffer zone. In other words, a significant effort to bring CWS back to a real sanctuary status is now under way (Chunati Wildlife Sanctuary Management Plan, 2015). The management plan puts forward an ambitious set of tasks to re-establish the natural forest with many of the wild foods preferred by the elephant. First, however, the encroachment and illegal land conversion must be stopped. For example, in the 7,927-ha core zone of the CWS, 7,321 ha have been fully or partially degraded by human activity.

Despite CWS being very heavily degraded it remain as the only movement corridors of the elephant west of the national highway and with the enhancements planned by the Forest Department should begin to recover. The existing Dohazari to Cox's Bazar 132kV transmission line, under constructed new rail line, in addition to a doubling of the size of the national highway, and proposed 230kV transmission line, will mean further obstructions to the elephant movements. However, the construction work of transmission line will create very temporary disturbance on the elephant movement, and in operation there is no such impact on their movement.

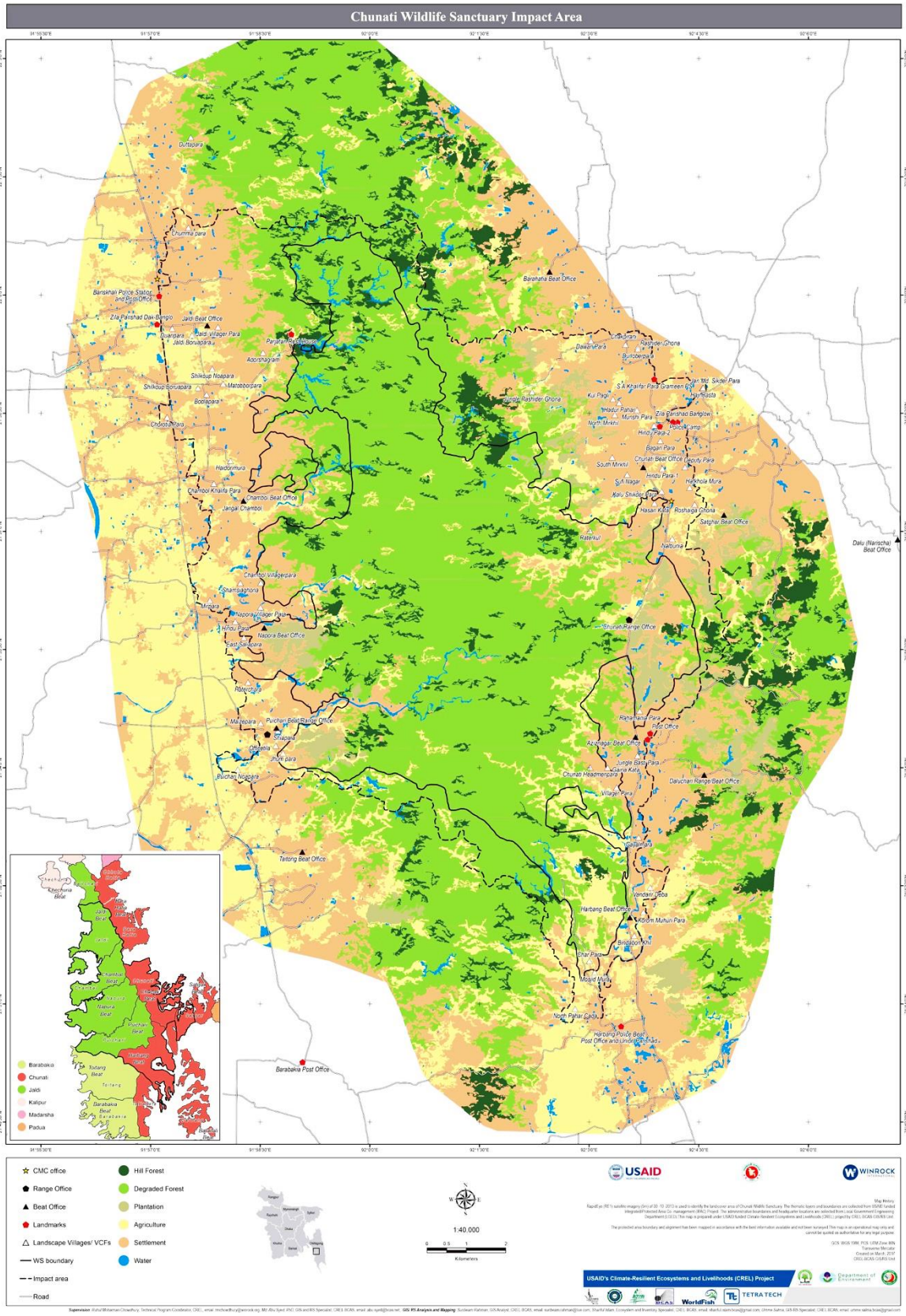

Figure: Chunati Wildlife Sanctuary

Asian Elephant Corridor: There are three elephant corridors found along the transmission line during field visit which are demarcated by FD (Forest department) and IUCN (International Union for

Conservation of Nature). But, none of the transmission lines cross over the designated corridor areas. Asian Elephant (Elephas maximus) is the critically endangered (Red list of Bangladesh, IUCN, 2015) largest terrestrial animal. The Asian elephant plays a crucial role in its forest ecosystem. The largest number of elephants can be found in Chattogram and Cox's Bazaar Hill Tracts region located in the study area. Local people informed that some corridors have been totally abandoned due to degradation of forest cover, agricultural expansion, settlements extension, road and rail construction, monoculture plantation, change of cultivation practices etc.

ANNEX-XII
Site Visit with AIIB and PGCB Officials

Figure (a): Field Visit with AIIB and PGCB Officials at Teknaf Substation, Chunati, Cox's Bazar Sadar

Figure (b): Field Visit with AIIB and PGCB Officials at Anwara Substation