Appendix XIII

Final Report
on
Abbreviated Resettlement Plan (ARP)

PREPARATORY SURVEY ON DHAKA-CHITTAGONG MAIN POWER GRID STRENGTHENING PROJECT

FINAL REPORT

ON

ABBREVIATED RESETTLEMENT PLAN (ARP)

FOR

MEGHNAGHAT-MADUNAGHAT-MATARBARI 400KV TRANSMISSION LINE PROJECT

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ON
ABBREVIATED RESETTLEMENT PLAN (ARP)

1.0 Brief Project Description

1.1 Project Proponent

Chittagong is major industrial and port city of Bangladesh. Due to having port facilities, industrial growth at Chittagong is very high. With the industrial growth, power demand at Chittagong is increased very rapidly. On the other hand, power generation at Chittagong area is low due to fuel shortage. At Present, Chittagong is connected with Dhaka via Comilla by two 230 kV circuits (Hathazari – Comilla – Meghnaghat) & two 132 kV circuits (Hathazari – Feni – Comilla – Haripur). These lines are not at all sufficient to supply near future demand of Chittagong area. Under these circumstances, at first phase, **Power Grid Company of Bangladesh (PGCB)** has planned to establish 400kV Meghnaghat-Madunghat transmission line initially which will be charged at 230kV to supply reliable power to Chittagong. In 2nd phase, after construction of Coal Base Power Plants at South Chittagong (Matarbari) in 2022, it will be charged at 400kV to evacuate power. In addition to this transmission line, Matarbari-Madunaghat 400kV line and two 400/230kV S/S at Meghnaghat and Madunaght respectively will also be required in second phase to evacuate this power to Dhaka and Chittagong city.

1.2 Project location and area

1.2.1 Proposed Meghnaghat 400kV substation:

Proposed Meghnaghat 400kV substation is located on the northern bank of the Meghna River just off the Dhaka-Comilla highway in Sonargaon Upazila of the District of Narayanganj, Bangladesh approximately 22 km Southeast of Dhaka. Map of Bangladesh showing location of the proposed Meghnaghat 400kV substation is given in **Figure-1.2.1-1.**

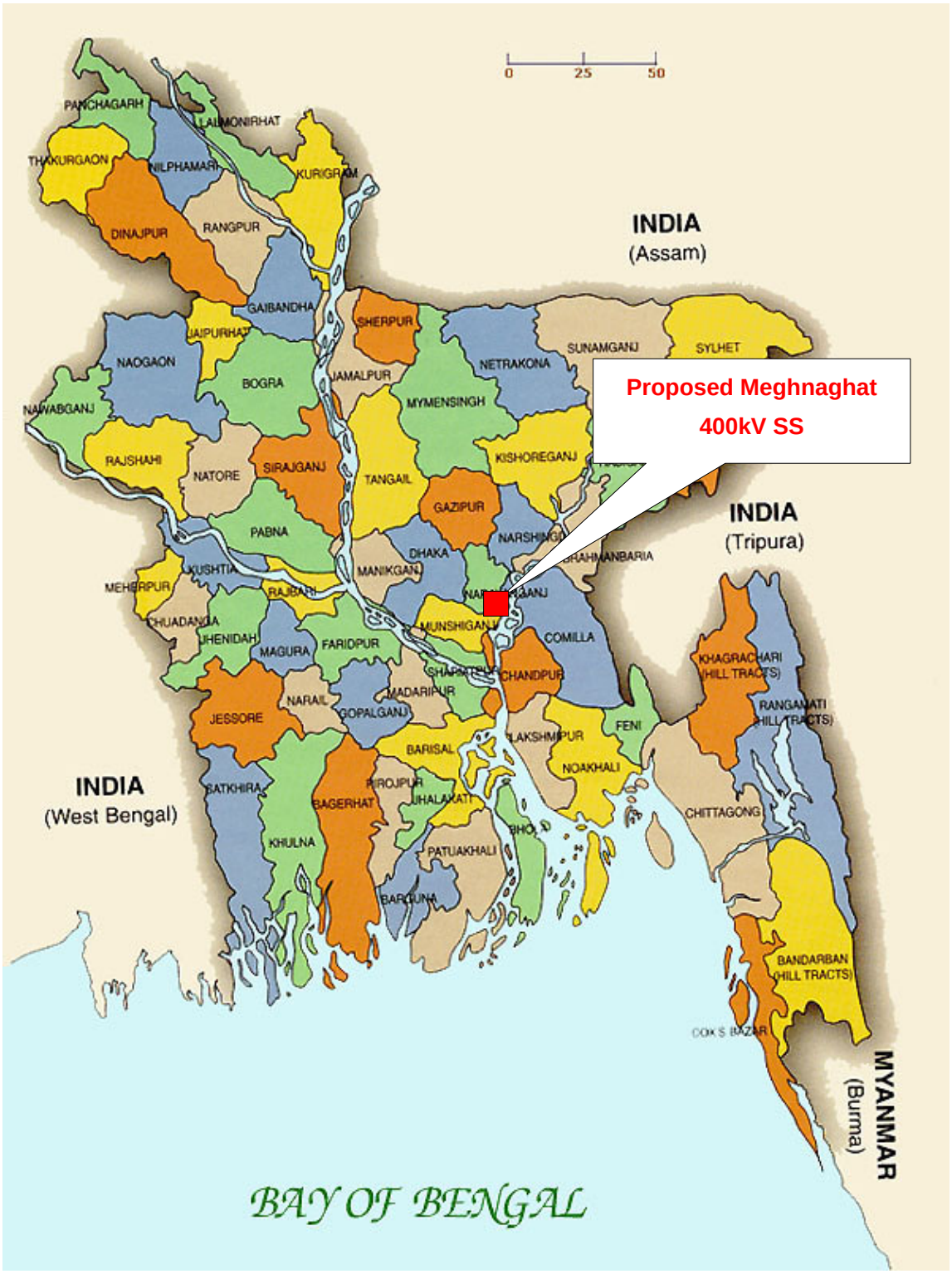

Figure-1.2.1-1: Map of Bangladesh showing location of proposed Meghnaghat 400kV substation

The Google earth map showing location of the proposed Meghnaghat substation is also given in **Figure1.2.1-2**

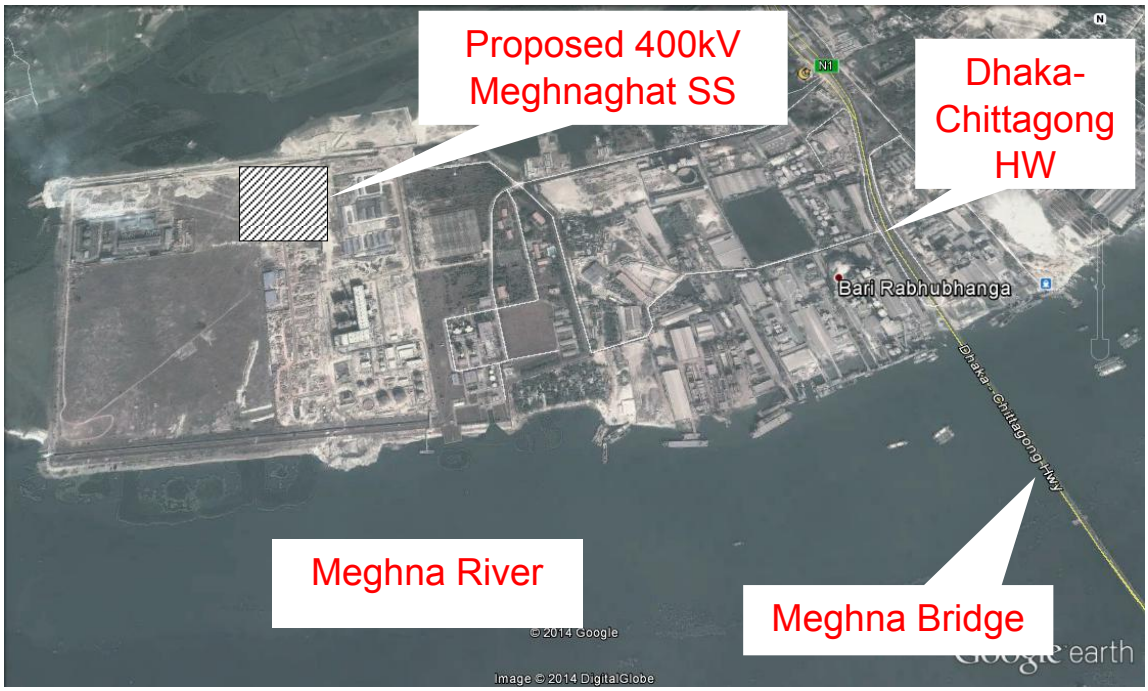

Figure-1.2.1-2: Google earth Map showing location of proposed Meghnaghat 400kV substation

1.2.2 Propposed Madunaghat 400kV substation:

Proposed Madunaghat 400kV substation is located at East Gujra Union of Raojan Upazila of Chittagong district in the North West side of RPCL's 25MW Power station located on the north side of Chittagong – Kaptai road. Map of Bangladesh showing location of the proposed Meghnaghat 400kV substation is given in **Figure-1.2.2-1.**

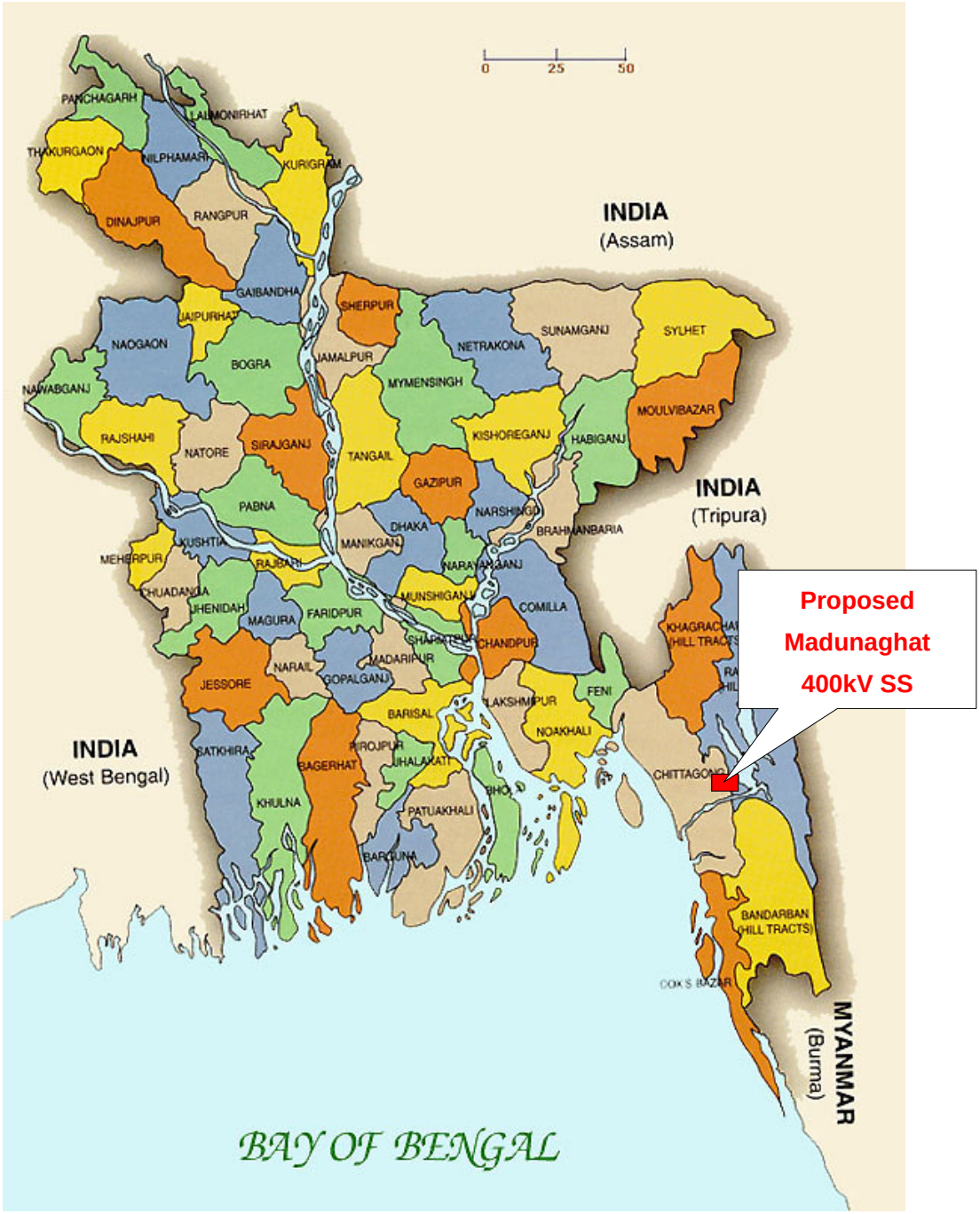

Figure-1.2.2-1: Map of Bangladesh showing location of proposed Modunaghat 400kV substation

The Google earth map showing location of the proposed Modunaghat substation is also given in **Figure 1.2.2-2**

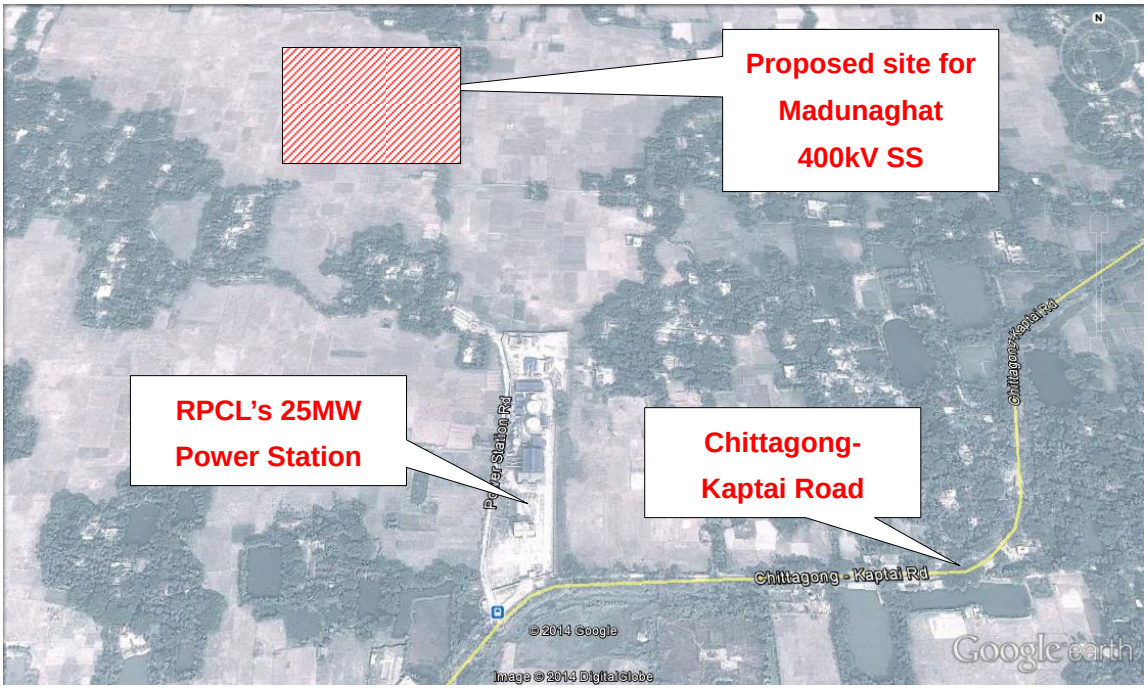

Figure-1.2.2-2: Google earth Map showing location of proposed Modunaghat 400kV substation

1.2.3 Route of Proposed 400kV Transmission Line:

The proposed 400kV double circuit Transmission line will be drawn from the proposed Meghnaghat 400kV substation to the proposed Madunaghat 400kV substation in the 1st phase of the project. Similarly, another 400kV double circuit transmission line will be drawn from the proposed Matarbari 2x600MW Coal based power plant to the proposed 400kV Madunghat substation. Map of Bangladesh showing the proposed route of 400kV transmission line from Meghnaghat 400kV substation to Matarbari coal based power plant via Madunaghat 400kV proposed substation is given in **Figure-1.2.3-1.**

The names of upazilas over which the proposed 400kV Transmission lines will be drawn are given in **Table-1.2.3.**

Table-1.2.3: List of Upazilas

Sl. No.	Section	Name of Upazilas	Approximate length in km
1.	Meghnaghat 400kV	1. Sonaragaon, Narayanganj	214

Sl. No.	Section	Name of Upazilas	Approximate length in km
	SS to Madunaghat 400kV SS	2. Gazaria, Munshiganj 3. Daudkandi, Comilla 4. Kachua, Chandpur 5. Barura, Comilla 6. Laksam, Comilla, 7. Nangolkot, Comilla 8. Feni-S, Feni 9. Chhagolnaiya, Feni 10. Mirsarai, Chittagong 11. Fatikchhari, Chittagong 12. Hathazari, Chittagong 13. Raojan, Chittagong	
2.	Madunaghat 400kV SS to Matarbari 2x600MW Coal PP	1. Boalkhali, Chittagong 2. Patiya, Chittagong 3. Anowara, Chittagong 4. Banshkhali, Chittagong 5. Pekua, Cox's Bazar 6. Moheshkhali, Cox's Bazar	100
Total		19 upazilas under 7 districts	314

Figure-1.2.3-1: Map of Bangladesh showing the proposed Route of 400kV TL

The Google earth map showing location of the proposed Modunaghat substation is

also given in **Figure 1.2.3-2**

Figure-1.2.3-2: Google earth Map showing the proposed 400kV TL Route

1.3 Nature and size of the Project

The scopes of works of the project are as follows:

First Phase:

- Meghnaghat-Madunaghat double circuit 400kV transmission line: 214km
- 230kV switching station at Madunaghat.
- Two 230kV bay extension at Meghnaghat.
- Double circuit 230kV LILO on four circuit tower at Madunaghat from Hathazar-Sikalbaha 230kV line: 8km

Second Phase:

- 400kV double circuit Matarbari-Madunaghat line: 100km
- Meghnaghat 400/230kV S/S.
- Madunaghat 400/230kV S/S.
- 230kV double circuit Madunaghat Old-Madunaghat line: 8km
- Madunaghat 230/132kV S/S.

The scopes of works are also shown in single line diagram in **Figure-1.3-1** and **Figure-1.3-2** respectively.

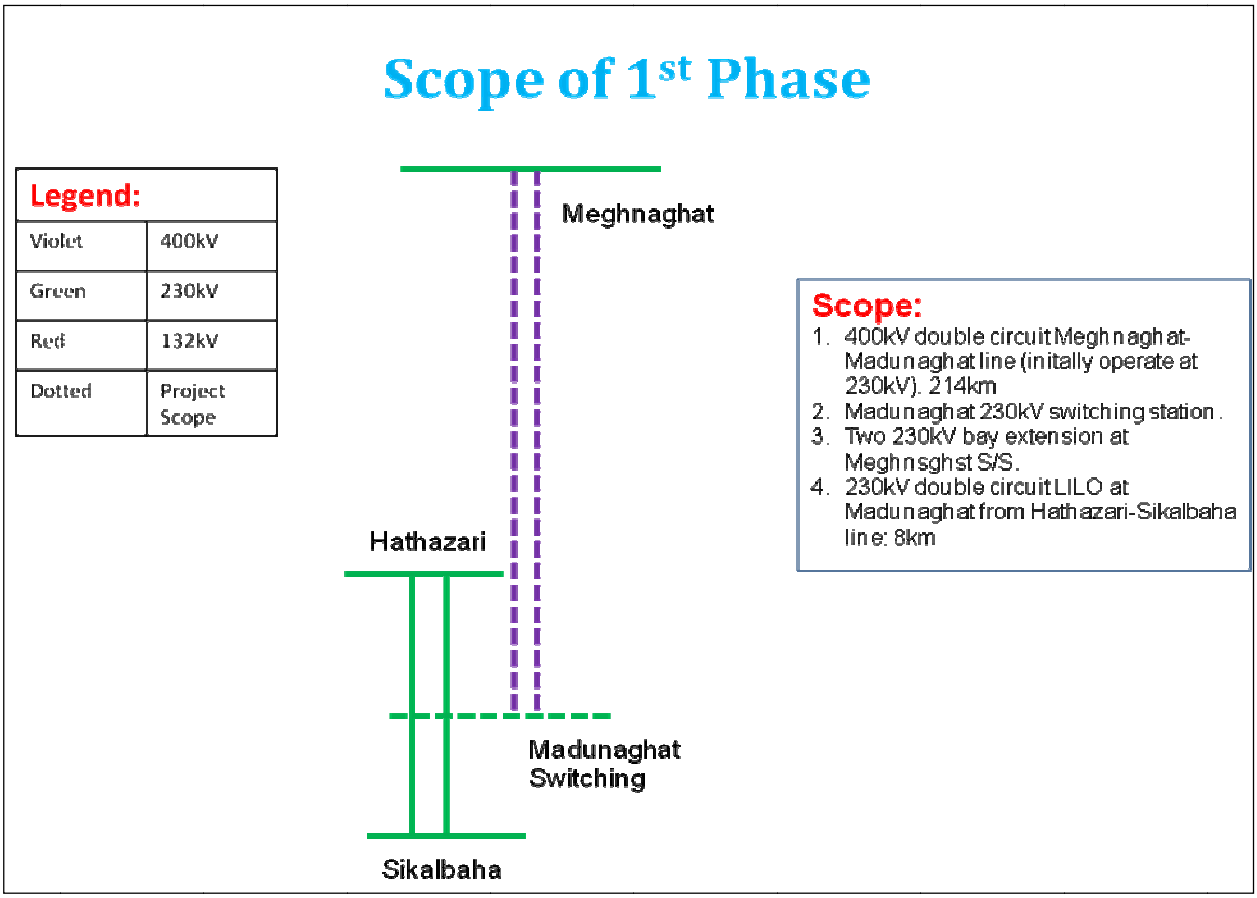

Figure 1.3-1: Scope of works in 1st phase

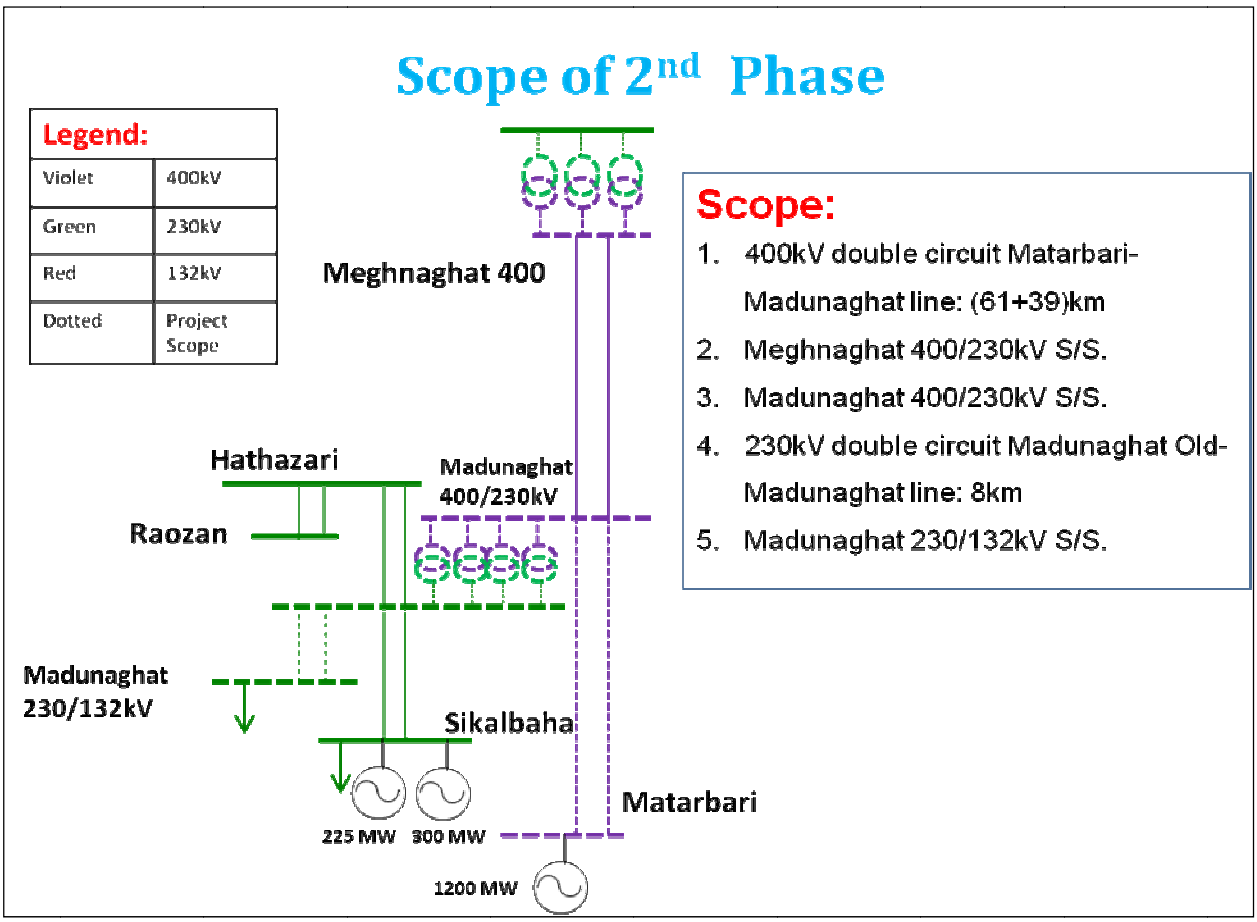

Figure 1.3-2: Scope of works in 2nd phase

2.0 Examination of Alternatives

Three routes of the proposed 400kV transmission line from Meghnaghat to Matarbari via Modunaghat have been identified from the desktop study. The routes are as follows:

- Base Route
- Alternative Route-1
- Alternative Route-2

Base Route:

The base route of 400kV transmission line started from Meghnaghat 400kV substation at Sonargaon upazila of Narayangonj district passing through Sonargaon, Gazaria, Doudkandi, Barura, Kachua, Laksam, Feni, Chagolnaiya, Mirsarai, Fatikchhari,, hat hazari, Raojan, Boalkhali, Patiya and Anowara, Banshkhali and Pekua Upazila and end at the proposed 2x600MW Matarbari Coal Based power plant. This will cross the 4 major rivers namely, Meghna, Gomoti, Karnafully and Sangu. This line will also cross a hilly area in Ramgar from Karer hat to Heyako of about

10km long.

Route-1(Alternative):

The alternative route-1 has been proposed to draw along the Dhaka-Chittagong highway (Sonargaon, Gazarai, Doudkandi, Kachua, Laksam, Feni, Mirsarai and Sitakundu upazial) up to Kumira.and then cross the hill and pass through Hathazari upazila, Modunaghat substation, Boalkhali. Patiya, Anowara upazila, , Banshkhali and Pekua Upazila and end at the proposed 2x600MW Matarbari Coal Based power plant.

Route-2(Alternative):

The alternative route-2 has been proposed to draw along the base route (Sonargaon, Gazarai, Doudkandi, Barura, Kachua, Laksam, Feni, Mirsarai Chhagolnaiya, Fatikchhari, Hathazari, Raojan (Modunaghat), Boalkhali, Patiya, Anowara, Banshkhali, Pekua and Moheshkhali)

Google earth map showing the proposed routes of the 400kV Transmission Line is given in **Figure-2.**

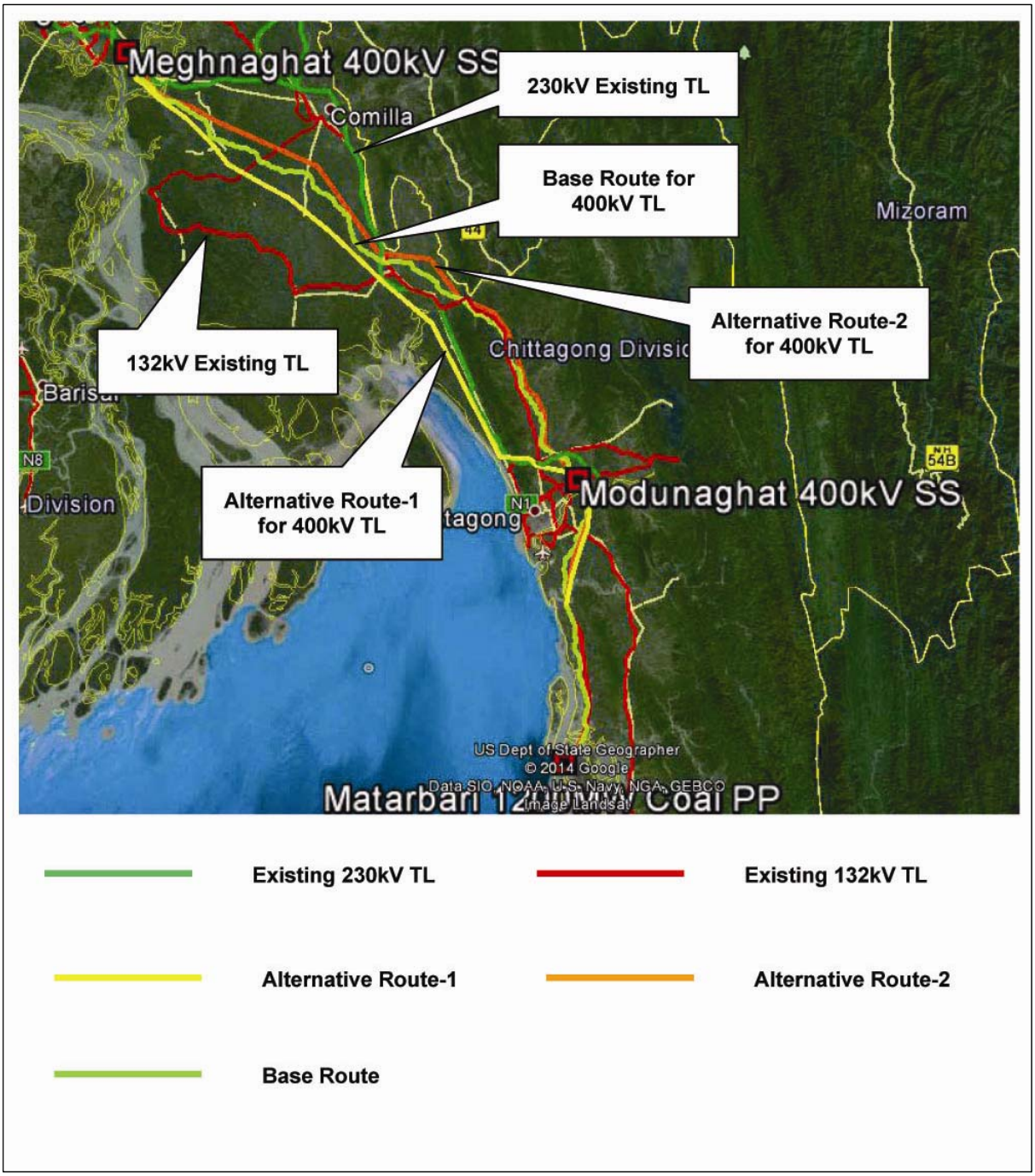

Figure-2: Google Earth Map showing the proposed Routes of 400kV TL

The comparative statement of base route and alternative routes of 400kV Transmission Lines is given in **Table-2.**

Table-2 : Comparative statement of base route and alternative routes of 400kV Transmission lines

Sl. No.	Description of Item	Base Route	Route-1 (Alternative)	Route-2 (Alternative)
1.	Length in km	314	310	320
2,	Rail Crossing	4	4	2
3.	Major River Crossing	6	7	6
4	EHV TL crossing	8	7	9
5	Hilly area crossing	1	1	1
6	National Highway Crossing	2	3	2
7	Topography	Medium Low, high and medium high land	Medium Low, high and medium high land	Medium Low, high and medium high land
8	Proximity of coast	Away from the coast	Near the coast	Away from the coast
9	Social & natural Environment	Less Resettlement required	Less resettlement required	Resettlement required
10	Right of way	Less right of way Required	More right of way required	Right of way Required
11	Remarks	More potential	Less potential	Less potential

From the above analysis, the base route has been selected for construction of 400kV transmission lines. The detailed study of this route has been conducted.

3.0 Legislations in Bangladesh and Gaps from JICA's Policy

3.1 Key legislations

The Acquisition and Requisition of Immovable Property Ordinance of 1982 and its subsequent amendments in 1993 and 1994 provide the key legal instrument for the

acquisition of private land for development activities in Bangladesh.

Salient provisions of the Ordinance which show tangible gaps with *the JICA Guidelines for Environmental and Social Considerations* are as follows:

Avoiding/ minimizing land acquisition: The Ordinance only implicitly discourages

unnecessary acquisition as land acquired for one purpose cannot be used for a different purpose. There are, however, no mechanisms to monitor if this condition is actually adhered to.

Eligibility for compensation: The Ordinance stipulates compensation only for the

persons who appear in the land administration records as the owners (i.e., titleholders).It does not recognize the rights of those without legal title to the land, who live in or make a living from it.

Compensation paid for: The Ordinance provides for compensation of land and other objects built and grown on it (structures, trees and orchards, crops and any other developments on the land like ponds, built amenities, etc.). There are no provisions to assess and restore lost income streams or income sources caused by the land acquisition to the PAPs.

Compensation standards: Landowners receive compensation under the law (CUL) as per the market value of the property at the publication date of the notice[1] with a premium of 50% on the assessed price. Any damage to standing crops or trees on the property, expenses incidental to compelled changes to the residence or place of

business, and reduction of profits of the property in the acquisition period are also entitled to a sum of 50% on top of such market value[2]. The 1994 amendment made

provisions for payment of crop compensation to tenant cultivators (*"bargadar"*). Although the Ordinance stipulates 'market prices' of the acquired land as just compensation, the legal assessment method almost always results in prices far below the actual market prices. Certain pricing standards, which are regarded as unrealistic, are used to assess other losses like structures and various built amenities, trees, and crops, etc.

Relocation of homestead losers: There is no legal obligation to relocate, or assist with the relocation of, those whose homesteads have been acquired.

Ensuring payment/ receipt of compensation: Even with the given legal provision, the compensation process is time-consuming. There is, moreover, no certainty as to when an affected landowner will obtain the stipulated compensation or whether he will obtain it at all.

Land is legally acquired and handed over to the project proponent as soon as the acquisition authority identifies the owners ('awardees') by examining the records, and

sends a legal notice advising them to claim compensation ('awards'). And it also turns

out that it is an obligation of the PAPs to prove that the acquired land legally belongs to them.

Socio-economic rehabilitation: The provisions are so restricted that the Ordinance

shows no concern about the long-term socio-economic changes the PAPs might undergo in the post-acquisition period. Except for the compensation at the legal 'market price', there are no other provisions in the acquisition or other-laws that require the government to mitigate the resultant adverse impacts caused by the acquisition.

Socio-economic rehabilitation of the involuntarily displaced persons is absent in the legal regime of Bangladesh.

3.2 JICA's Policy on Land Acquisition and Resettlement

The key principles of JICA policies on involuntary resettlement are summarized below:

a Avoidance or minimization of land acquisition and involuntary resettlement
Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

b Entitlement and assistance for restoration and improvement in social and economic conditions.
Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions.

c Compensation and rehabilitation support
People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standards of living, income opportunities and production levels to pre-project levels.

d. Application of the principle of the replacement cost Compensation must be based on the full replacement cost as much as possible.

e. Actions prior to displacement
Compensation and other assistance required for relocation should be given prior to displacement. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, should be
completed prior to construction activities, except when a court of law orders so in expropriation cases. Sufficient civic infrastructure must also be provided at relocation sites before displacement takes place.

f. Assistance in transition period

Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihoods and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary
maintenance, or similar arrangements.

g. Assistance to the vulnerable
The needs of those most vulnerable to the adverse impacts of resettlement are to be fully considered. Assistance should be provided to help them improve their socio-economic status.

h. Consultation and participation of the Affected People
In preparing a resettlement plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. Appropriate participation of affected people must be promoted in the planning, implementation, and monitoring of resettlement action plans.

i. Grievance Mechanisms
Appropriate and accessible grievance mechanisms must be established for the
affected people and their communities.

In terms of categories of PAPs and types of lost assets, the gaps in the existing legal framework of Bangladesh and requirements of the JICA Guidelines are identified as presented in the table below.

Table-3.2 Gap Analysis between Bangladeshi Laws and JICA Guidelines

SL. No.	Category of PAPs/ Types of lost assets	Bangladesh Laws	JICA Guidelines
I	For lands of all types and other assets for legal land	Acquired by DC as per legal requirements/ procedures	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based
2	Land tenants	Compensation for the standing crops if harvesting of crops is not possible	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be

SL. No.	Category of PAPs/ Types of lost assets	Bangladesh Laws	JICA Guidelines
			sufficiently compensated and supported.
3	Land Users	Squatters, encroachers and unauthorized users occupiers are not recognized	Ditto
4	Owners of temporary structures	Onlv compensation under law (CUL)	Compensation must be based on the full replacement cost as much as possible.
5	Owners of permanent structure buildings	ditto	Ditto
6	Perennials crops	Market prices of the standing crops with value of plants	Compensation must be based on the full replacements cost as much as possible.
7	Timing for payment of entitled compensation by the PAPs.	No concern on the part of the project proponent. Land is handed over lo the project proponent as soon as the fund is placed to the DC	On the completion of payment of compensation to the PAPs the land to be vacated and handed over to the project proponent.
8	The issue of relocation and income generation activities	No concern about relocation and income generation activities.	People who most be resettled involuntarily and whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their

SL. No.	Category of PAPs/ Types of lost assets	Bangladesh Laws	JICA Guidelines
			standards of living, income opportunities and production levels to pre-project levels.
9	Vulnerability of PAPs	No distinction between the PAPs	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty **line,** the landless, elderly, women and children, ethnic minorities, etc.
10	Role of DC, project proponent and PAPs	DC to acquire lands, the project proponent to use the land, and PAPs to seek compensation from the DC.	DC and project proponent to assist the PAPs in getting the compensation, assist to collect the legal and required documents, and provide support for the transition period between displacement and livelihood restoration.

(Source: JICA Study Team)

3.3 Procedures of land acquisition

Under the Ordinance of 1982, the DC at District level is entrusted to acquire land for agencies requiring land for any public or private infrastructure projects. The procedures of land acquisition will follow the following steps:

Step 1: After identifying and selecting the exact ground locations of the required land, the project proponent will carry out detailed engineering surveys and design the construction work and lay them out on mauza maps. The project proponent will prepare the land acquisition proposals to obtain administrative approval by the line ministry.

Step 2: The project proponent, after obtaining the approval of the administrative ministry, will make a request to the DC, with sufficient information including the amount of land to be acquisitioned from each plot, and

the ownership status such as private and public lands, for the acquisition of the land as per the proposal.

Step 3: Within 90 days, the DC will appraise the application through a) site observation, b) consultation with local politicians and residents, c) develop project profiles, and d) cost estimates. The DC will then develop and submit a proposal on land acquisition to the Ministry of Land for an appraisal by the central government within 90 days.

- The DC will publish a notice as stipulated in Section 3 of the Ordinance of 1982 stating that there is a proposal for the property to be acquired. The persons to be displaced may submit an objection to the land acquisition to the DC within 15 days after the notice is served. All the legal titleholders will be advised to show their ID cards and other documents that verify their rights. For those with no registrations, the DC Office will call for circumstantial evidence from community leaders, local elite people, and religious leaders, etc., to add these people to the list.
- The DC will consult with the Public Works Department (PWD), Forest Department (BFD), Department of Agricultural Marketing (DAM) and Department of Fisheries (DOF) to assess the value of structures, trees, crops and aqua products for their existing rates.
- Under Section 6, a second public notice will be served stating the GOB's decision on the land acquisition and taking possession thereof. The DC Office will confirm the PAPs, exact land area and size for acquisition, number of relocated houses, agriculture land, forestry and fishing areas that will be lost. The persons to be displaced will be requested to submit their statements of property, amounts and particulars of the claims to compensation after 15 days of the second notice being served. The DC Office will respond to any grievances made by the PAPs in order to agree to the assistance package.
- The project proponent shall deposit the estimated amount of the award of compensation with the DC within 60 days from the receipt of the estimate given by the DC.
- Upon serving the last notice (Section 7), the DC shall pay the amount to the owners of the acquired property within another 60 days from the date of deposit by the project proponent. The DC will take possession of the property after completion of the compensation payment to the PAPs and immediately declare this in the official gazette, and hand the property over to the project proponent.

4.0 Social Impact Survey

Socioeconomic survey has been conducted at seven sampling locations along the proposed 400kV transmission line from Meghnaghat to Matarbari, 230kV Transmission Lines from New Madunaghat to old Madunaghat substation & Hathazari-Sikolbaha transmission line and 400kV New Madunaghat substation area.

4.1 400kV Transmission Lines

4.1.1 Questionnaire Survey:

Questionnaire survey was conducted in seven Upazillas (Mirsarai, Anowara, Banskhali, Raozan, Laksam, Gozaria and Sonargaon) along the proposed 400kV transmission line. Total 184 household heads have been interviewed,

Occupation:

32.07% of the respondents were businessmen, **20.65%** Farmers, **19.022%** Housewife, **9.24%** Service holder, **4.35%** Day labourer, **3.8%** Retired persons and **10.87%** others.

Family Size:

The average size of the family is **4.64.**

Monthly Income:

The average monthly incomes of the respondents are as follows:

21.74%	-	Tk. 612
39.67%	-	Tk. 9075
11.41%	-	Tk. 12047
12.50%	-	Tk. 14913
14.67%	-	Tk. 34703

Houses :

The roofs of **84.7%** houses are made of Tin, **6.5%** of Concrete and **8.8%** of thatch/ hay. The walls of **45.66%** houses are made of Tin, **25%** of Clay, **18.47%** of Concrete and **10.87%** of Bamboo. Similarly, the floors of **79.34%** are made of clay, **19.02%** of concrete and **1.64%** of bamboo.

Source of Drinking Water:

The main source of drinking water for the 100% households is tube well water. Besides, ponds and river water are also used in various purposes like, bathing, cooking, cleaning etc.

Electricity:

76.09% households are electrified with grid system and **2.17%** with sloar

system. The remaining houses are not electrified.

Fuels for cooking:

83.7% of households use wood for cooking purpose, **13.04%** LP Gas / Natural gas, **7.61%** cow dung, **7.07%** leaves and **5.43%** natural garbage.

Medical Treatment:

The most of the respondents used to go to Govt. Hospital for their medical treatment. Some of the respondents used to go to different places to seek medical attention, namely, private clinic, quack doctor, MBBS Doctors etc.

4.1..2 Focus Group Discussions (FGD):

14 FGDs (7 male and 7 female groups) in 7 seven upazilas (Sonargaon, Gazaria, Laksam, Mirsarai, Raozan, Anowara, Banshkhali) along the proposed 400kV transmission line were conducted from July 24, 2014 to September 5, 2014. The findings of the FGDs are as follows:

i) Uninterrupted and reliable power supply will be available.
ii) Use of costly solar panels for electricity can be avoided.
iii) Industrialization will take place in the project area and unemployment problem will be decreased.
iv) Land of tower location will be damaged. Proper compensation shall be provided to the affected land owners.
v) Trees and standing crops may be damaged during construction of transmission line. Proper compensation shall be provided for trees and crops.

4.1.3 In-depth interview:

In-depth interviews with local government officials of different upazilas along the proposed 400kV transmission line were conducted during our site survey from July 15, 2014 to August 7, 2014. Total 81 officials (5 UNOs, 6 land officers, 14 fisheries officers, 16 agriculture officers, 9 statistical officers, 9 NGO workers, 5 Union Council chairman/members 6 public health engineering officers) were interviewed. The findings of the interview are as follows:

i) Power shortage will decrease
ii) New industries will be established
iii) New transmission line will increase our export capacity and earn more foreign revenues
iv) The rate of unemployment will decrease
v) Production of crops and fruit-trees may decrease
vi) Some houses and lands may be damaged

vii) The establishment of the transmission line may result in cutting down of many trees
viii) In the season of *Boro*, there will be an increased production of this *Boro* crops
ix) Load shedding will decrease
x) The lifestyle of local people will be improved
xi) The demand of everyday electricity consumption will be fulfilled
xii) Aquatic mammals, plants/trees and crops may be affected
xiii) Discharge of air pollutants from the industries and with the discharge of industrial effluents can damage the environment and also the local trees and crops
xiv) Local houses will be affected
xv) Deforestation may bring upon a negative impact in the environment

4.1.4 Affected Land owners:

The land owners of the proposed tower locations of 400kV transmission line have been identified during route survey in June & July 2014. The lands of **788 tower locations out of 805 towers** are owned by the private land owners. **17 towers** will be located in the reserved forest area owned by Bangladesh Forest Department (BFD). The list of affected land owners for the proposed transmission line is given under **Annex-4.1.4**.

4.2 400kV Substations:

There are two 400kV substations are to be constructed under this project. The substations are as follows:

- Meghnaghat 400kV sub-station, and
- Modunaghat 400kV sub-station.

4.2.1 Meghnaghat 400kV substation:

The location of the proposed Meghnaghat 400kV sub-station is within Meghnaghat power station complex. The land of this complex was acquired and developed by BPDB. Subsequently the lands are being used by different IPPs for power generation and also by PGCB for grid substations. So, there is no need of land acquisition for the proposed Meghnaghat 400kV sub-station. No resettlement will be required.

4.2.2 Madunaghat 400kV substation:

Proposed Madunaghat 400kV substation is located at East Gujra Union of Raojan Upazila of Chittagong district in the North West side of RPCL's 25MW Power station located on the north side of Chittagong – Kaptai road. **20** acres of land will be

required to construct the proposed Modunaghat 400kV substation. For this, a survey team was sent to the proposed location of Modunaghat substation from **October 8, 2014 to October 16, 2014** to demarcate the area of the proposed substation and identify the land owners of the substation area.

For the establishment of the Madunaghat 400kV substation, 50 land owners have been identified from in total 86 plots in East Gujra union. Social survey team have conducted 36 successful interviews. Among them, 34 of them are genuine land owners, and two were share croppers and the total area of the lands possessed by the 36 people is 1867.5 decimals. The list of affected land owners for the proposed New Madunaghat substation is given in **Annex-4.2.2.**

4.2.2.1 Questionnaire Survey:

Findings of the interview with the land owners are summarized below:

Occupation:

Among the 36 respondents, no of business was the highest (27.77%) the percentage of retired and oldman and farmers are the next highest (16.66%) and House wife (14%), Service (8.33%), Teacher (5.55%) and remaining Driver, electricition, Forign service, Student, are equal (2.77%).

Monthly Income:

The monthly income of the 36 respondents has been categorized in 4 categories range Tk.5000-8000, 17 respondent their monthly income average Tk.6941 per month and range Tk. 8001-11000, 12 respondents their average monthly income Tk.9916 and range Tk.11001-14000, 2 respondents and their monthly income Tk.12000 and range Tk.14001-30000, 5 respondents their average monthly income Tk.20000 so on an average 36 respondents average monthly income Tk.10027.77

Health Services:

Among the total 36 respondents, the maximum number of respondents go to Govt. Hospital for their medical treatment, and the number of respondents going there are 34. The rest of the respondents go to M.B.B.S doctors (20) and Quack Doctors (16) respectly.

House status:

According to the remarks of the respondents, the materials that are being used in their respected house hold are as follows. Among the 36 respondents, the material that is being used in their house hold's roof is, Tin 20, Concrete 16, The material that is being used in their wall is, Tin 1, Concrete 23, Bamboo 10, Clay 2. The material that is being used in their floor is, Concrete 20, Clay 16.

Drinking Water:

*Total 36 (100%) respondents said they use and drink the tube well water and also said that there is no arsenic in the tube well water and it is completely pure. Besides, ponds and channel water is also used by the respondents in various purposes like, bathing, cooking, cleaning etc. But, they use only tube well water as their only source of drinking water.

Electricity Use:

Among the 36 respondents, there are 36(100%) respondents that have electricity in their households, There are so many respondents who use the electricity for different purposes such as fan, light, television, refrigerator, mobile charge, irrigation, small factory, computer, business centre, office, school, college etc.

Cooking Fuel:

Among the total 36 respondents all of them use wood as the material to act as a fuel in their cooking in their respected households.

Household Assets:

The types and No. of assets of the 36 respondents are as follows- TV-29, Fan-31,Almirah-36, Bed-32, Chir/Bench-36, Mobile-36, Refrigerator-23 and Watch-2, Computer-1 multiple house holds assets are found in each respective house holds.

Toilet Facilities:

36 respondent say that they use safety tank (modern 44%) and the remaining (56%) use Water Log/Slave Latrin.

4.2.2.2 Focus Group Discussions (FGD):

4 FGDs (Female group, land owners group, mixed group and agriculture labour group) were conducted in the Madunaghat substation area. The participants of the FGDs wer annoyed to participate in the group discussions as they have very bad experience with RPCL about compensation during construction of RPCL's 25MW power plant located near the proposed substation site. However, the local administrative authority and local elites motivated all the villagers in Gabullah para and Gochi under East Gujra union and finally they participated in the FGDs. The findings of the FGDs are given below:

- All affected land owners for the proposed substation reuested to give propoer compenstation of the land as the value of lanfd in that area is very high.
- They also demanded the crop compensation during land acquisition for the substation
- Priority of Employement in the substation during construction and operation

phase should be given to local people.

- Proper mitigation measures should be undertaken by the authority to avoid negative impacts of the substation construction.

4.2.2.3 In Depth Interview:

In depth interview with Chairman and one member of East Gujra Union Council, one school teacher, one journalist and one Moaque imam of East Gujra union were conducted.

The findings of in depth interviews are given below:

Positive perceptions:

- Bangladesh will be developed
- Agricultural sector will be benefited
- Education system of Bangladesh will be benefited
- Employment opportunities will be created in the project area
- Load shedding will decrease/power shortage will decrease
- Industrial sector will flourish with job opportunities and increase the number of job vacancies
- The lifestyle of local people will be improved
- The demand of everyday electricity consumption will be fulfilled
- It will further improve the technological aspect of this country
- Social development will be achieved.

Negative perceptions:

- The establishment of the transmission line/Sub-Station may result in cutting down of many trees
- Many birds may lose their lives from electrical short-circuit
- Some Crops may be damaged
- Day by day Agricultural lands will decrease
- Environment will be polluted due to rapid industrialization
- The natural habitat of mammalian / birds will be affected

Balanced Perceptions:

As the 400 kV Transmission Line/ Sub-Station will go over the populated villages, it has to be kept in mind that its establishment does not create any negative social, economic and environmental impact. The health issues of the population have to be

prioritized and focused so that they do not become a victim from the project. If there is damage to the land acquired trees, houses, proper compensation has to be provided.

4.3 230kV Transmission Lines:

a) Transmiion line from New Madunaghat to old Madunaghat substation:
The land owners of the proposed tower locations of 230kV transmission line from **New Madunaghat to old Madunaghat substation** have been identified during route survey December 2014. The list of affected land owners for the proposed transmission line is given under **Annex-4.3(a)**

b) Transmiion line from New Madunaghat to Hathazari-Sikolbaha TL:
The land owners of the proposed tower locations of 230kV transmission line from **New Madunaghat to old Madunaghat substation** have been identified during route survey December 2014. The list of affected land owners for the proposed transmission line is given under **Annex-4.3(b)**

5. Anticipated Social Impact

5.1 For Transmission Lines

The expected potential impacts for transmission line are given in **Table-5.1.**

Table 5.1 Result of scoping for Transmission Lines

Item	No.		Rating		Result
			Design / construction Phase	Operation Phase	
Pollution mitigation measure	1	Air pollution	B-	D	**Construction phase:** Generation of dust by land preparation and other construction work is expected, but the impact will be temporary. Generation of air pollutant (SOx, NOx, and others) from operation of heavy machines and trucks is predicted, but the impact will be limited only within the surrounding area.
					Operation phase: No specific air pollution is anticipated.
	2	Water pollution	B-	B-	Soil runoff may occur from the exposed soil of the embankment and cut slope and water pollution of the downstream area of the surrounding river is predicted.
	3	Noise and Vibration	B-	D	**Construction phase:** Impact of noise and vibration is predicted caused by operation of heavy machines and trucks, but will be limited to the surrounding area.

Item	No.		Rating		Result
			Design / construction Phase	Operation Phase	
					Operation phase: No specific noise and vibration is anticipated.
Natural environment	4	Natural reserve	B-	D	**Construction phase:** There is a possibility that the transmission line passes by the Ecologically Critical Area, and the impact of air pollution, noise and vibration due to construction work is anticipated.
					Operation phase: No specific impact on the natural reserve is predicted.
	5	Ecosystem	B-	B-	**Construction phase:** There is a possibility that the transmission line passes by the Reserved Forest, and the impact of air pollution, noise and vibration due to construction work is anticipated on the terrestrial ecosystem.
					Operation phase: Bird-strike and other impact is anticipated.
	6	Geography and geology	C	C	The impact is unknown (it will be identified in further site survey).
Social environment	7	Land Acquisition and Resettlement	C	D	**Design phase:** Settlements and houses are avoided when the route map was first drafted at the end of May 2014 based on the available secondary information and site survey in May. Social survey planned from June to July 2014 will identify the ground reality in detail. The extent of the impact is therefore unknown at this stage.
					Operation phase: N/A
	8	Disturbance to Poor People	C	C	The extent of the impact is unknown at this stage.
	9	Disturbance to Ethnic Minority Groups and Indigenous People	C	C	The proposed construction site of transmission line is located close to the Chittagong Hill Tracts (CHT) where indigenous population affined to neighboring Myanmar, and there is a possibility that ethnic minority groups and indigenous people live within the surrounding hill area. Social survey planned from June to July 2014 will identify the ground reality in detail.

Item	No.		Rating		Result
			Design / construction Phase	Operation Phase	
					The extent of the impact is therefore unknown at this stage.
	10	Deterioration of Local Economy such as Losses of Employment and Livelihood Means	C	C	The extent of the impact is however unknown at this stage.
	11	Land Use and Utilization of Local Resources	C	C	The extent of the impact is however unknown at this stage.
	12	Disturbance to Water Usage, Water Rights etc	C	C	In general, soil runoff may occur from the exposed soil of the embankment and cut slope, and results in water pollution of the downstream area of the surrounding river and alteration of water use. The extent of the impact is however unknown at this stage.
	13	Disturbance to the Existing Social Infrastructure and Services	B-	D	**Construction phase:** Increased traffic is predicted.
					Operation phase: No specific adverse effect is predicted on the existing social infrastructure.
	14	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	C	D	**Design phase:** The extent of the impact is unknown at this stage.
					Operation phase: No specific impact is predicted concerning the social infrastructure and local decision-making institutions.
	15	Misdistribution of Benefits and Damages	C	D	**Design phase:** The extent of the impact is unknown at this stage.
					Operation phase: No specific impact is predicted.
	16	Local Conflicts of Interest	C	D	**Design phase:** The extent of the impact is unknown at this stage.

Item	No.		Rating		Result
			Design / construction Phase	Operation Phase	
					Operation phase: No specific impact is predicted.
	17	Cultural Heritage	C	C	The extent of the impact is unknown at this stage.
	18	Landscape	C	C	The extent of the impact is unknown at this stage.
	19	Gender	C	C	The extent of the impact is unknown at this stage.
	20	Children's Rights	C	C	The extent of the impact is unknown at this stage.
	21	Infectious Diseases such as HIV/AIDS	B-	D	**Construction phase:** A temporary influx of migrant labor during construction period may increase the risk of transmitted diseases.
					Operation phase: There is no specific negative impact anticipated.
	22	Working Conditions(including working safety)	B-	B-	**Construction phase:** In general, high risk of accident is predicted in construction work.
					Operation phase: There is a risk of accidents such as electric shocks and fall-downs during maintenance work.
	23	Others	C	C	The extent of the impact is however unknown at this stage.
Others	24	Accidents	B-	B-	Accidents may occur including soil runoff caused by flood, break-down of the tower by cyclone.
	25	Cross-boundary impact and climate change	D	D	Cross boundary and CO_2 emission are not anticipated concerning the transmission line.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (Further examination is needed, and the impact may be clarified as the study progresses.)
D: No impact is expected.

(Source: JICA Study Team)

5.2 For substations

The expected potential impacts for substations during construction phase and operation phase are given in **Table-5.2.:**

Table 5.2 Results of Scoping for substations.

Item	No.	Impact	Rating		Result
			Design / construction Phase	Operation Phase	
Pollution mitigation measure	1	Air pollution	B-	D	**Construction phase:** Generation of dust by land preparation and other construction work is expected, but the impact will be temporary. Generation of air pollutant (SOx, NOx, and others) from operation of heavy machines and trucks is predicted, but the impact will be limited only within the surrounding area.
					Operation phase: No specific air pollution is anticipated.
	2	Water pollution	B-	B-	Soil runoff may occur from the exposed soil of the embankment and water pollution of the surrounding waterway for paddy field is predicted.
	3	Noise and Vibration	B-	D	**Construction phase:** Impact of noise and vibration is predicted caused by operation of heavy machines and trucks, but will be limited to the surrounding area.
					Operation phase: No specific noise and vibration is anticipated.
Natural environment	4	Natural reserve	D	D	N/A
	5	Ecosystem	D	D	No specific adverse effect is predicted on ecosystem of the site and its surrounding.
	6	Geography and geology	C	C	The impact is unknown (it will be identified in further site survey).
Social environment	7	Land Acquisition and Resettlement	B-	D	**Design phase:** As large as 220 acres of land, which is presently owned by BPDB, has already been secured and available for the future development of Meghnaghat SS. BPDB and PGCB will take all official procedures for transferring the ownership. Whereas it is anticipated that 20 acres of paddy field land is to be acquired for Madunaghat SS. The extent of the impact is however unknown at this stage. There anticipated no resettlement.
					Operation phase: N/A
	8	Disturbance to Poor People	B- / C	B-/ C	**Construction phase:** Sharecroppers (*bargadars*) at Madunaghat SS site may lose their means of livelihoods temporarily during construction phase. The extent of the impact is however unknown at this stage.
					Operation phase: the poverty resulting from losses of

Item	No.	Impact	Rating		Result
			Design / construction Phase	Operation Phase	
					livelihood means may occur if appropriate measures are not taken.
	9	Disturbance to Ethnic Minority Groups and Indigenous People	D	D	No ethnic minority group and indigenous people live at sites for Megunaghat SS and Madunaghat SS.
	10	Deterioration of Local Economy such as Losses of Employment and Livelihood Means	B-/C	B-	**Construction phase:** Sharecroppers (*bargadars*) at Madunaghat SS site may lose their means of livelihoods temporarily. The extent of the impact is however unknown at this stage.
					Operation phase: Sharecroppers at Madunaghat SS site may lose their means of livelihoods permanently.
	11	Land Use and Utilization of Local Resources	B-	B-	**Construction phase:** It is anticipated that 20 acres of paddy field land is to be acquired for Madunaghat SS.
					Operation phase: Land use will change permanently.
	12	Disturbance to Water Usage, Water Rights etc	C	C	The extent of the impact is unknown at this stage.
	13	Disturbance to the Existing Social Infrastructure and Services	B-	D	**Construction phase:** Increased traffic is predicted.
					Operation phase: No specific adverse effect is predicted on the existing social infrastructure.
	14	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	B-	D	**Design phase:** It is the Deputy Commissioner's Office of the District that takes the initiative to conduct local consultations and the detailed measurement surveys for land acquisition, which will cause certain impact to the social infrastructure and local decision-making institutions.
					Operation phase: No specific impact is predicted.
	15	Misdistribution of Benefits and Damages	C	C	The extent of the impact is unknown at this stage.
	16	Local Conflicts of Interest	C	C	The extent of the impact is unknown at this stage.
	17	Cultural Heritage	D	D	There is no cultural, historical or traditional heritage in the substation sites. No specific impact is thus predicted.
	18	Landscape	D	D	No specific impact is predicted.
	19	Gender	D	D	There is no specific negative impact anticipated.

Item	No.	Impact	Rating		Result
			Design / construction Phase	Operation Phase	
	20	Children's Rights	D	D	There is no specific negative impact anticipated.
	21	Infectious Diseases such as HIV/AIDS	B-	D	**Construction phase:** A temporary influx of migrant labor during construction period may increase the risk of transmitted diseases.
					Operation phase: There is no specific negative impact anticipated.
	22	Working Conditions(including working safety)	B-	B-	**Construction phase:** High risk of accident is predicted in construction work.
					Operation phase: There is a risk of accidents such as electric shocks and fall-downs during maintenance work.
	23	Others	C	C	The extent of the impact is unknown at this stage.
Others	24	Accidents	B-	B-	Accidents may occur including soil runoff caused by flood, break-down of the tower by cyclone.
	25	Cross-boundary impact and climate change	D	D	Cross boundary and CO_2 emission are not anticipated.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (Further examination is needed, and the impact may be clarified as the study progresses.)
D: No impact is expected.

(Source: JICA Study Team)

6.0 Livelihood Restoration and Improvement Plan

The livelihood restoration and improvement plan will be implemented based on consultation with PAPs and their socio-economic profile, living environment, level of education, etc. which were identified in the socioeconomic survey.

7.0 Organizational Responsibilities and Implementation Procedures

7.1 Finalization of land acquisition and resettlement action plan

PGCB is the implementing agency of the project, and the Deputy Commissioner's Office of Chittagong district is the immediate organization for affected people to consult for compensation as stipulated in the Ordinance 1982. PGCB will prepare and submit an application for land acquisition to MOPEMR and make a request to DC of Chittagong. It will also prepare and submit the Resettlement Action Plan (RAP) to MOPEMR.

It will allocate the required budget for Additional Grant (AG) on top of DC's payment for land and Resettlement Benefits (RBs), which are to be approved by the GOB.

7.2 Data collection and EP identification

PGCB will, as shown in Figure 6-2 below, deploy adequate human resources for supervision, consultation, and monitoring of land acquisition, resettlement and rehabilitation activities during project implementation.

PGCB, in line with the DC, will design and conduct a socioeconomic survey and collect data. A supplemental survey can be conducted to obtain additional key information and update all the data, and the RAP should be revised if required. ID cards, EP files, and Entitlement Cards will be issued at this stage. It is desirable to formulate an inventory verification committee to ensure if this procedure is properly implemented among the affected people.

7.3 Local consultation and information management

PGCB will prepare an information brochure for information dissemination. Local consultations such as public consultation meetings and focus group discussion should be organized to ensure if project affected people keep informed of the project implementation process, benefits and losses, environmental and social impact, and etc. For effective information sharing, it is recommended to conduct such meetings not only for the affected people but local residents living in the surrounding area. Meetings can be conducted and brochure be distributed at local markets.

7.4 Finalization of budget

In order to ensure if proper valuation is conducted, PGCB will set up a property valuation advisory committee (PVAC) at this stage to assess the assets value.

7.5 Implementation of land acquisition and resettlement

The Deputy Commissioner will pay the cash Compensation under Law (CCL) for the affected lands, structures crops and trees to the EPs. PGCB will pay the AG on top of DC's payment for the lands and other RBs to the EPs. PGCB is responsible for assisting EPs purchase land and relocating, and encouraging them to take advantage of the livelihood rehabilitation/improvement program. PGCB will set up a grievance redress committee (GRC) for receiving grievance from stakeholders including the affected people (see next chapter for further detail on GRC). To implement the land acquisition and resettlement, a resettlement advisory committee is recommended to be formulated for PGCB to ensure proper implementation of resettlement.

7.6 Monitoring

Appropriate reporting including auditing and redress functions, monitoring and evaluation mechanisms will be identified and set in place as part of the resettlement management system. In addition to an internal monitoring conducted by PGCB, an external monitoring group should be hired that will evaluate the resettlement process and final outcome (see the last chapter for further details).

The following diagram (Figure 7.6 shows the implementation mechanism of land acquisition and resettlement.

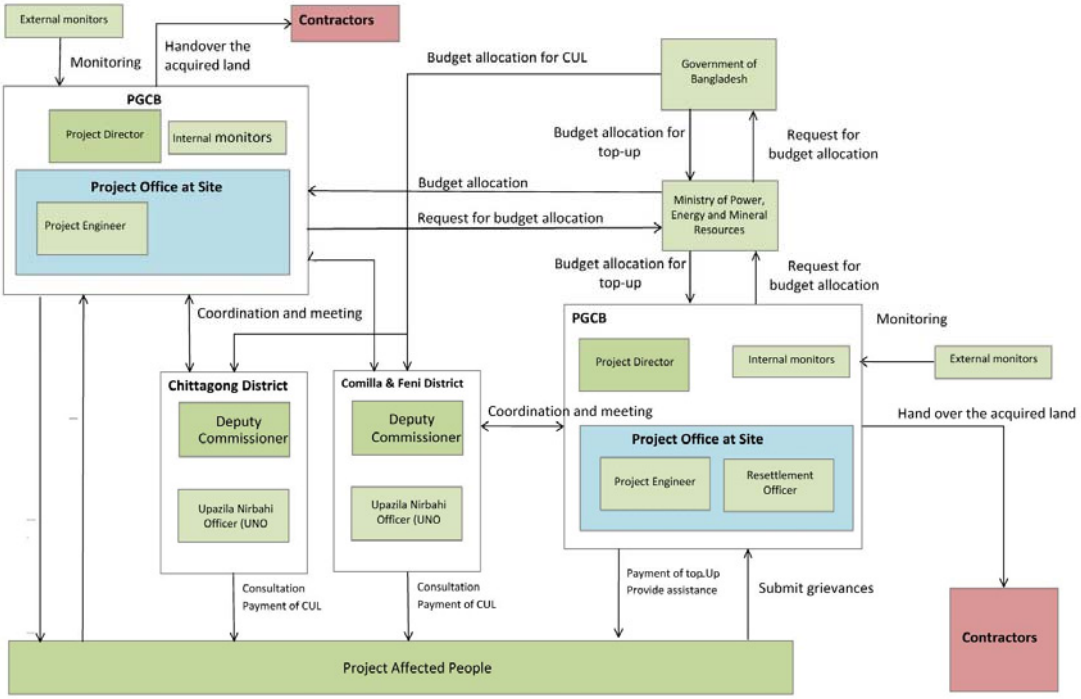

Figure 7.6 Implementation Mechanism of Land Acquisition and Resettlement

8.0 Grievance Redress Mechanisms

Other than the grievance redress mechanism stipulated by the Ordinance 1982, PGCB will make efforts at project level to resolve grievances through negotiations involving representatives of PAPs, village heads and Union Parishad Chairmen. The Project Director will allocate a resettlement officer at the project office, who deals with such negotiations up front. The resettlement officer will be the entry point and receive all the inquiries, concerns and complaints directly from PAPs. A notebook will also be installed at the project office entrance for anybody to write suggestions anonymously.

A grievance redress committee at project site will convene meetings monthly. Non-regular meetings will also be held ad-hoc basis as necessary at such places as it is considered appropriate (such as village, union, etc.) for dealing with urgent matters. The proceedings (or minutes of meetings) will be made with the object to promptly address the concerns and complaints using an accessible and transparent process to the PAPs, and to bring an amicable settlement between the parties. All reports will be recorded in Bangla language and provided to all parties concerned.

The committee at project level will include the following people:

- Resettlement Officer
- Representative from local NGO/CBOs
- Representatives of Displaced Persons
- Local intellectuals or religious figures, who would represent the residents of the project area and be publicly known to be persons of integrity, good judgment and commands respect.

In case dispute is not resolved at local level, the matter will be placed before a grievance resolution committee at the Upazila level. The Upazila Nirbahi Officer will chair the committee comprised of the project level GRC members, Project Engineers and legal advisors.

In case dispute still continues, the UNO will make a decision regarding entitlement and compensation, and the decision taken during negotiations and the meetings will be formally recorded for future reference and presentation in the court, if necessary.

If the matter cannot be resolved at the Upazila level, complaints will be referred to the Project Director, who will head a committee jointly with the Deputy Commissioner.

9.0 Specific Measures provided to Vulnerable Groups and Income Rehabilitation Assistance

The vulnerable groups of East Gujra in the project site land have to be identified. The land that will be acquired for the establishment of the substation will cause some vulnerable group of people to lose their workplace, along with their occupation related to the land that was initially being used for agricultural purposes. They have to be rehabilitated, compensated and resettled. Their health facilities also need to be prioritized.

10.0 Estimated Land Acquisition and Resettlement Cost

Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. PGCB will have to finance the resettlement compensation as they will be impacting on the local people's livelihoods.

In addition to the compensation stipulated by the ordinance 1982, PGCB will be required to finance those non-titleholders. All the compensation will be done according to the principles of the replacement cost, which will require PGCB to pay the gap between CUL (Compensation under the Law) and the replacement value (top up).

11. 0 Local Consultation, Participation, Monitoring and Evaluation Procedures

11.1 Further Consultation Process

The PAPs and their communities will be further consulted about the project, the rights and options available to them, and the proposed mitigation measures for adverse effects, and to all extents possible they will be involved in the decision-making process concerning their resettlement. The PAPs will receive prior notification of the compensation, relocation and other assistance available to them. PGCB will be responsible to hold and conduct a number of consultations with primary and secondary stakeholders and information dissemination on the following issues:

- The relevant details of the project
- The RP and various degrees of project impact
- Details of entitlements under the RP and what is required of PAPs in order to claim their entitlements

- Compensation process and compensation rates
- Relocation and resettlement site development operation in order to obtain agreement and support of affected people in participating in these operations
- Implementation schedule and timetable for the delivery of entitlements

Local participation will be spontaneously encouraged and information will be made available during the preparation and implementations of the ARP and at the minimum include community meetings and focus groups discussions.

Where a host community is affected by the development of resettlement sites in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize adverse impacts of resettlement upon host communities.

11.2 Monitoring and Evaluation Procedures

Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the Project and will evaluate the resettlement process and final outcome.

An Environmental Monitoring Plan will be prepared to provide guidelines for the construction activities of the power plant. The environmental components to be monitored are those that will be positively or negatively affected, or expected to be affected, by the construction activities. The purposes of creating an Environmental Monitoring Plan for the construction of the power plant are to:

- Confirm that mitigation measures shall reduce any negative impacts on the environment to allowable levels during the construction and operation phases.
- Set up an organization that is responsible for the implementation of monitoring the plan.
- Perform appropriate monitoring during the construction and operation phases.

Table 11.1 Contents of environmental management plan during construction phase

No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
Pre-construction Phase									
1	Land acquisition	- Loss of land at tower bases - new Madunaghat substation	- the Acquisition and Requisition of Immovable Property Ordinance 1982 - JICA Guidelines for Environmental and Social Considerations (2010)	- Consideration for land owners, sharecroppers and compensation for standing agriculture products	- Towers are constructed in non-residential areas - Land acquisition should be conducted in compliance with relevant laws and regulations - Cost related to relocation (if any) will be given to the relocated residents	- Tower bases - Site of Madunaghat Substation	- During land acquisition process	- Office of the Deputy Commissioner - PGCB	Expenses to be paid by PGCB
2	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	- Changes in people's thinking through interacting with local government officers, local residents and others in the land acquisition procedure	-----	- Consideration to affected peoples' emotions	- Compensation should be conducted in compliance with relevant laws and regulations	- Tower bases - Site of Substation	- Prior to the start of construction	- Office of the Deputy Commissioner - PGCB	Expenses to be paid by PGCB

No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
Construction Stage									
1	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Loss of farmlands, being kept out of construction zones	- Employment of local residents	- Consideration of local residents' feelings	- Employ as many local residents as possible - Use the services (i.e., laundry and catering services, etc.) and products offered by the local community	- Villages along the transmission line route and substation	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant	Expenses included in contract cost by Contractor
2	Land Use and Utilization of Local Resources	- Changing the traditional land usage patterns and utilization of local resources	- Employment of local residents	- Consideration of local residents' feelings	- Employ as many local residents possible - Use the services (i.e., laundry and catering services, etc.) and products offered by the local community	- Villages along the transmission line route and substation	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant	Expenses included in contract cost by Contractor
3	Disturbance to Water Usage, Water Rights, etc.	- Water pollution caused by soil runoff	-----	- Prevention of water pollution in downstream areas	- Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant	Expenses included in contract cost by Contractor

No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
					stabilizing any slopes of construction areas with concrete, as necessary based on geological survey -Re-greening in construction areas				
4	Cultural Heritage	- Further destruction of buried cultural heritage due to engineering work	- Loss of cultural heritage	- Protect cultural heritage	- Stop construction work if any cultural heritage area is discovered and immediately consult with specialists	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant	Expenses included in contract cost by Contractor
5	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during construction may increase risk of infection	-----	- Consideration of sanitation of local residents	- Establish medical center and implementation of periodic medical check-ups - Education and training on workers' health care	- Construction area	- During construction phase	- Implementation: Contractor - Supervisor: PGCB	Expenses included in contract cost by Contractor
6	Work Conditions (including work safety)	Labor accidents	- Handling heavy loads - Working at heights	- Prevention measures against labor accidents,	- Prepare a manual for labor accident prevention	- Construction area	- During construction phase	- Implementation: Contractor - Supervisor: PGCB	Expenses included in contract cost by Contractor

No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
			- Electric shocks	accidents, and health problems	including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate during the construction period - Use facilities and equipment that protects against electric shocks				
7	Accidents	1) Traffic accidents 2) Soil runoff and tower breakages	1) Traffic accidents - Land traffic 2) Soil runoff and tower breakages	1) Prevention of traffic accidents 2) Prevention of soil runoff	1) Traffic accidents - Observation of traffic regulations, installation of	1) Construction area 2) Roads near the construction	1), 2) - During construction phase	- Implementation: Contractor - Supervisor: PGCB	Expenses included in contract cost by Contractor

No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
					traffic signs and education on safe driving - Training safe operation of vehicles 2) Soil runoff and tower breakages - Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of the construction area with concrete, as necessary based on geological survey	area			

Table 11.2 Environmental Manegement Plan during OperationPhase

No	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
1	Work Conditions (including work safety)	Labor accidents	- Handling heavy loads - Working at heights - Electric shocks	- Prevention measures against labor accidents, accidents, and health problems	- Prepare a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate during the construction period - Use facilities	- Along the transmission line route	- During the inspection work	PGCB	PGCB

No	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
					and equipment that protects against electric shocks				
2	Accidents	1) Traffic accidents 2) Soil runoff and tower breakages	1) Traffic accidents - Land traffic 2) Soil runoff and tower breakages	1) Prevention of traffic accidents 2) Prevention of soil runoff	1) Traffic accidents - Observation of traffic regulations, installation of traffic signs and education on safe driving - Training safe operation of vehicles 2) Soil runoff and tower breakages - Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of the construction	1) Roads near the construction area 2) Along the transmission line route	- During the inspection work	PGCB	PGCB

No	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Management Institution	Cost
					area with concrete, as necessary based on geological survey				

Table 11.3 Monitoring form of land acquisition, resettlement and assistance for transition (sample)

Item	Expected Impact	Actual Impact observed this mo nth	Action Taken This month	Action to be taken in the next month	Remarks
Resettlement	Land Acquisition and Resettlement				
Disturbance to Poor People	Land Acquisition and Resettlement				
Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	Loss or damage to paddy cultivation				
Land Use and Utilization of Local Resources	Change of land use				
Disturbance to Existing	Change of land use				

Item	Expected Impact	Actual Impact observed this mo nth	Action Taken This month	Action to be taken in the next month	Remarks
Social Infrastructure and Services	Increase of traffic during construction phase				
Misdistribution of Benefits and Damages	Loss or damages to paddy field by land acquisition				
Local Conflicts of Interest	Loss or damages to paddy field by land acquisition				
Gender	Change of land use				
Children's right	Change of land use				

Appendix XIV

Final Report
on
Environmental Impact Assessment (EIA)

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF POWER, ENERGY & MINERAL RESOURCES

Power Grid Company of Bangladesh LTD (PGCB)

Final Report

on

Environmental Impact Assessment (EIA) of Meghnaghat-Madunaghat-Matarbari 400kV Transmission Line Project

February 15, 2015

Submitted by:

Tokyo Electric Power CO., LTD. (TEPCO)

(Japan International Cooperation Agency Study Team)

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Abbreviations Used

BCSIR	Bangladesh Council for Scientific and Industrial Research
BFIDC	Bangladesh Forest Industries Development Corporation
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BPDB	Bangladesh Power Development Board
BUET	Bangladesh University of Engineering & Technology
BWDB	Bangladesh Water Development Board
CITES	Convention on International Trade in Endangered Species
CU	Chittagong University
CUET	Chittagong University of Engineering & Technology
DoE	Department of Environment
DU	Dhaka University
EAL	Engineers Associates Limited
ECA	Environment Conservation Act
ECR	Environment Conservation Rules
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Field
EMP	Environmental Management / Monitoring Plan
EMS	Environmental Management System
ERC	Emergency Response Cell
ERP	Emergency Response Plan
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
GOB	Government of Bangladesh
HYV	High Yielding Variety
IEE	Initial Environmental Examinations
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
kV	Kilo Volt
NEMAP	National Environment Management Action Plan
NGO	Non Governmental Organization
NLDC	National Load Dispatch Center
ODA	Overseas Development Agency
PAP	Project Affected People
PGCB	Power Grid Company of Bangladesh
PIU	Project Implementation Unit
PRO	Public Relations Officer
PSMP	Power System Master Plan
RPCL	Rural Power Company Ltd.
S/S	Sub-station/ Switching Station
TEPCO	Tokyo Electric Power Company
TEPSCO	Tokyo Electric Power Services Co. Ltd.
TOR	Terms of Reference
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNO	Upazila Nirbahi Officer
WHO	World Health Organization

Executive Summary

1.0 Background:

Chittagong is major industrial and port city of Bangladesh. Due to having port facilities, industrial growth at Chittagong is very high. With the industrial growth, power demand at Chittagong is increased very rapidly. On the other hand, power generation at Chittagong area is low due to fuel shortage. At Present, Chittagong is connected with Dhaka via Comilla by two 230 kV circuits (Hathazari – Comilla – Meghnaghat) & two 132 kV circuits (Hathazari – Feni – Comilla – Haripur). These lines are not at all sufficient to supply near future demand of Chittagong area.

Meanwhile, BPDB/GOB has undertaken a project to construct 2x600MW thermal power plants at Matarbari under Moheshkhali upazila of Cox's Bazar district. So it is recommended to construct 400kV transmission line to evacuate power from this power plant.

Under these circumstances, at first phase, PGCB has planned to establish 400kV Meghnaghat-Madunghat transmission line initially which will be charged at 230kV to supply reliable power to Chittagong. In 2nd phase, after construction of Coal Base Power Plants at South Chittagong (Matarbari) in 2022, it will be charged at 400kV to evacuate power. In addition to this transmission line, Matarbari-Madunaghat 400kV line and two 400/230kV S/S at Meghnaghat and Madunaght respectively will also be required in second phase to evacuate this power to Dhaka and Chittagong city.

BPDB is also envisaging to develop various high capacity generation projects in the Maheshkhali and Anowara area. Powers from these projects are envisaged to be brought to Dhaka area through high capacity 400kV corridors. The proposed MeghnaghatMadunaghat-Matarbari 400kV line would be integrated with the future high capacity transmission system for evacuation of power from generation projects in the Maheshkhali & Anowara area to Dhaka.

So, PGCB has undertaken **"Meghnaghat-Madunaghat-Matarbari 400kV Transmission Line Project"** with financial assistance from **JICA.** Environmental conservation is being given top priority worldwide. In Bangladesh also, for any new project, as well as plants under operation, it is mandatory to obtain environmental clearance from the Department of Environment (DoE), under Environment Conservation Act 1995, amended from time to time. According to Bangladesh Environment Conservation Rules 1997 (ECR), the 400kV transmission line project falls under the **"Red Category",** so far as environmental impact is concerned. Initial Environment Examination (IEE) followed by Environmental Impact Assessment (EIA), including Environmental Management Plan (EMP) are required for these types of installations for getting environmental clearance from DoE.

2.0 Legal and Legislative Framework, Regulation and Policy Considerations

The following act, reguklation, policies and guidelines have been taken into consideration for Environmental and Social studyt:

- **Bangladesh Enviromental Coservation Act 1995 (ECA '95).** This Act is promulgated for environment conservation, standards, development, pollution control, and abatement. It has repealed the Environment Pollution Control Ordinance of 1977. The Act has been amended in 2000, 2002, 2007 and 2010.

- ***The Bangladesh Environment Conservation Rules, 1997*** is the first set of rules, promulgated under the ECA 95 (so far there have been three amendments to this set of rules - February and August 2002 and April 2003). The Environment Conservation Rules of 1997 has provided categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects.
- **National Environment Policy**
- **National Environment Management Plan 1995**
- **The National Forest Policy (1994)**
- **JICA Environment and Social Consideration Guideline**
- **IFC/EHS Guideline, etc.**

3.0 Project Description:

3.1 Project Components:

The project components are as follows:

- 400 kV Meghnaghat – Madunaghat T/L
- 230 kV Meghnaghat S/S bay extension
- 230 kV Madunaghat switching station
- LILO from 230 kV Hathazari – Sikalbaha T/L
- 400 kV Madunaghat – Matarbari T/L
- Meghnaghat 400 kV SS
- New 400 kV Madunaghat SS construction
- Upgrade of Existing 132 kV Madunaghat SS to a 230 kV SS
- 230 kV double circuit transmission line between Existing Madunaghat and New Madunaghat SS.

The above components will be implemented in two phases:

First Phase:

- Meghnaghat-Madunaghat double circuit 400kV transmission line: 214km
- 230kV switching station at Madunaghat.
- Two 230kV bay extension at Meghnaghat.
- Double circuit 230kV LILO on four circuit tower at Madunaghat from Hathazar-Sikalbaha 230kV line: 8km

Second Phase:

- 400kV double circuit Matarbari-Madunaghat line: 100km
- Meghnaghat 400/230kV S/S.
- Madunaghat 400/230kV S/S.
- 230kV double circuit Madunaghat Old-Madunaghat line: 8km
- Madunaghat 230/132kV S/S.

3.2 Project Locations:

a) Meghnaghat 400kV substation:

Proposed Meghnaghat 400kV substation is located on the northern bank of the Meghna River just off the Dhaka-Comilla highway in Sonargaon Upazila of the District of Narayanganj, Bangladesh approximately 22 km Southeast of Dhaka.

b) Madunaghat 400kV substation:

Proposed Madunaghat 400kV substation is located at South Islam Nagar village of Raojan Upazila of Chittagong district in the North West side of RPCL's 25MW Power station located on the north side of Chittagong – Kaptai road.

c) Meghnaghat-Madunaghat- Matarbari 400kV transmission line

The proposed 400kV double circuit Transmission line will be drawn from the proposed Meghnaghat 400kV substation to the proposed Madunaghat 400kV substation in the 1st phase of the project. Similarly, another 400kV double circuit transmission line will be drawn from the proposed Matarbari 2x600MW Coal based power plant to the proposed 400kV Madunghat substation. The names of upazilas over which the proposed 400kV Transmission lines will be drawn are given in the following table:

List of Upazilas

Sl. No.	Section	Name of Upazilas	Approximate length in km
1.	Meghnaghat 400kV SS to Madunaghat 400kV SS	1. Sonaragaon, Narayanganj 2. Gazaria, Munshiganj 3. Daudkandi, Comilla 4. Kachua, Chandpur 5. Barura, Comilla 6. Laksam, Comilla, 7. Nangolkot, Comilla 8. Feni-S, Feni 9. Chhagolnaiya, Feni 10. Mirsarai, Chittagong 11. Fatikchhari, Chittagong 12. Hathazari, Chittagong 13. Raojan, Chittagong	214
2.	Madunaghat 400kV SS to Matarbari 2x600MW Coal PP	1. Boalkhali, Chittagong 2. Patiya, Chittagong 3. Anowara, Chittagong 4. Banshkhali, Chittagong 5. Pekua, Cox's Bazar 6. Moheshkhali, Cox's Bazar	100
Total		19 upazilas under 7 districts	314

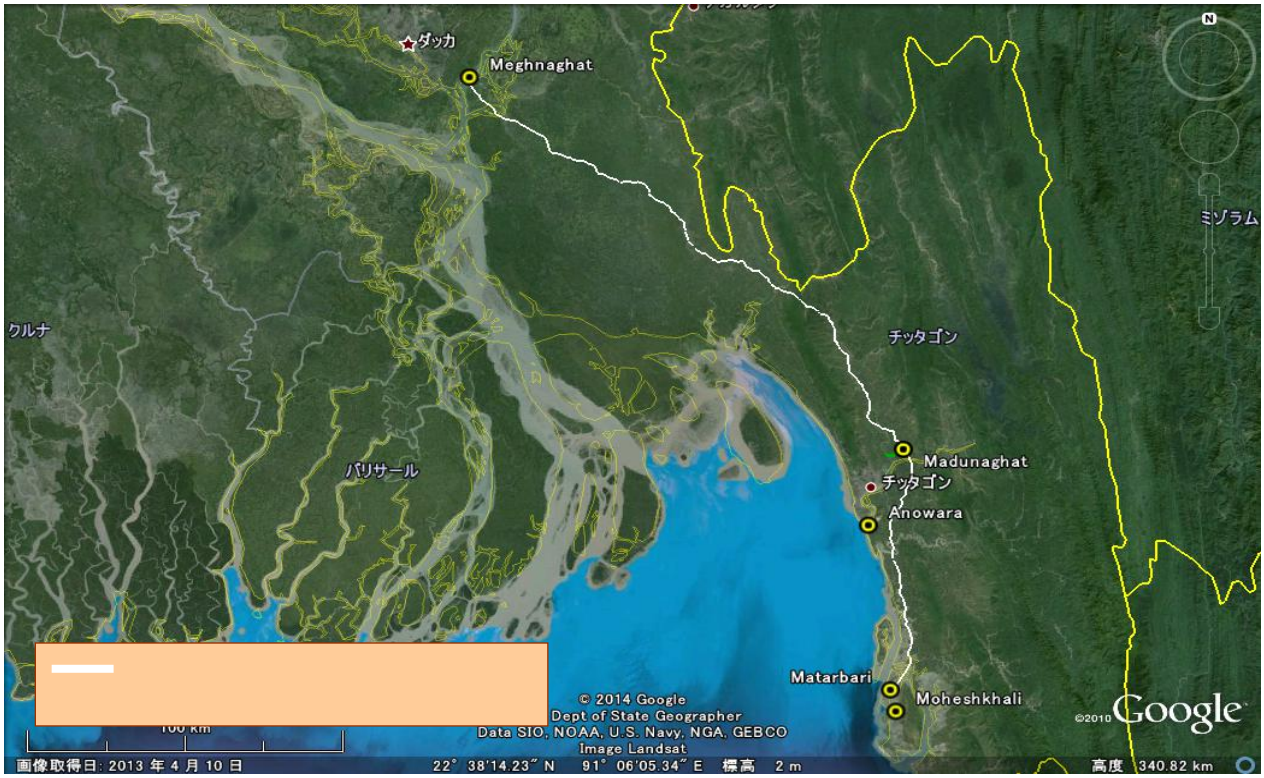
d) 230kV transmission line from Modunaghat to Hathazari – Sikolbaha 230kV transmission line:

The proposed 230kV line will be drawn from Madunaghat 400kV substation to the proposed Hathazari-Sikolbaha 230kV transmission line through Satbaria and Bartapara area under Raujan upazila of Chittagong district.

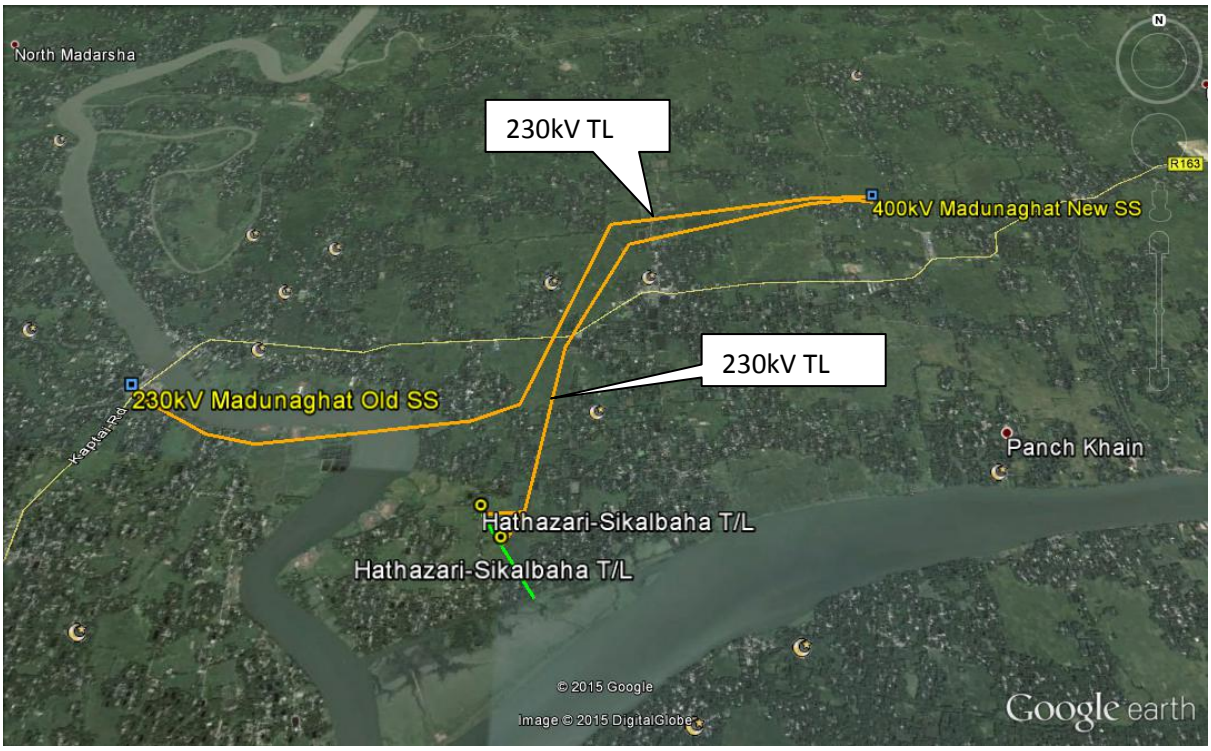
e) 230kV transmission line from Madunaghat to Madunaghat (old) substation.

The proposed 230kV line will be drawn from Madunaghat 400kV substation to the existing Madunaghat substation through Noapar and Burirchar area under Raujan upazila of Chittagong district.

Google earth map showing locations of Meghnaght substation, Madunaghat substation and Matarbari coal fired power plant and the route of 400kV transmission line from Megfhnaghat to Matarbari via Madunaghat substation is given below:



Google earth map showing the route of 230kV transmission line from Madunaghat substation to Hathazari-Sikolbaha 230kV transmission line and Madunaghat substation to Madunaghat old substation is given below:

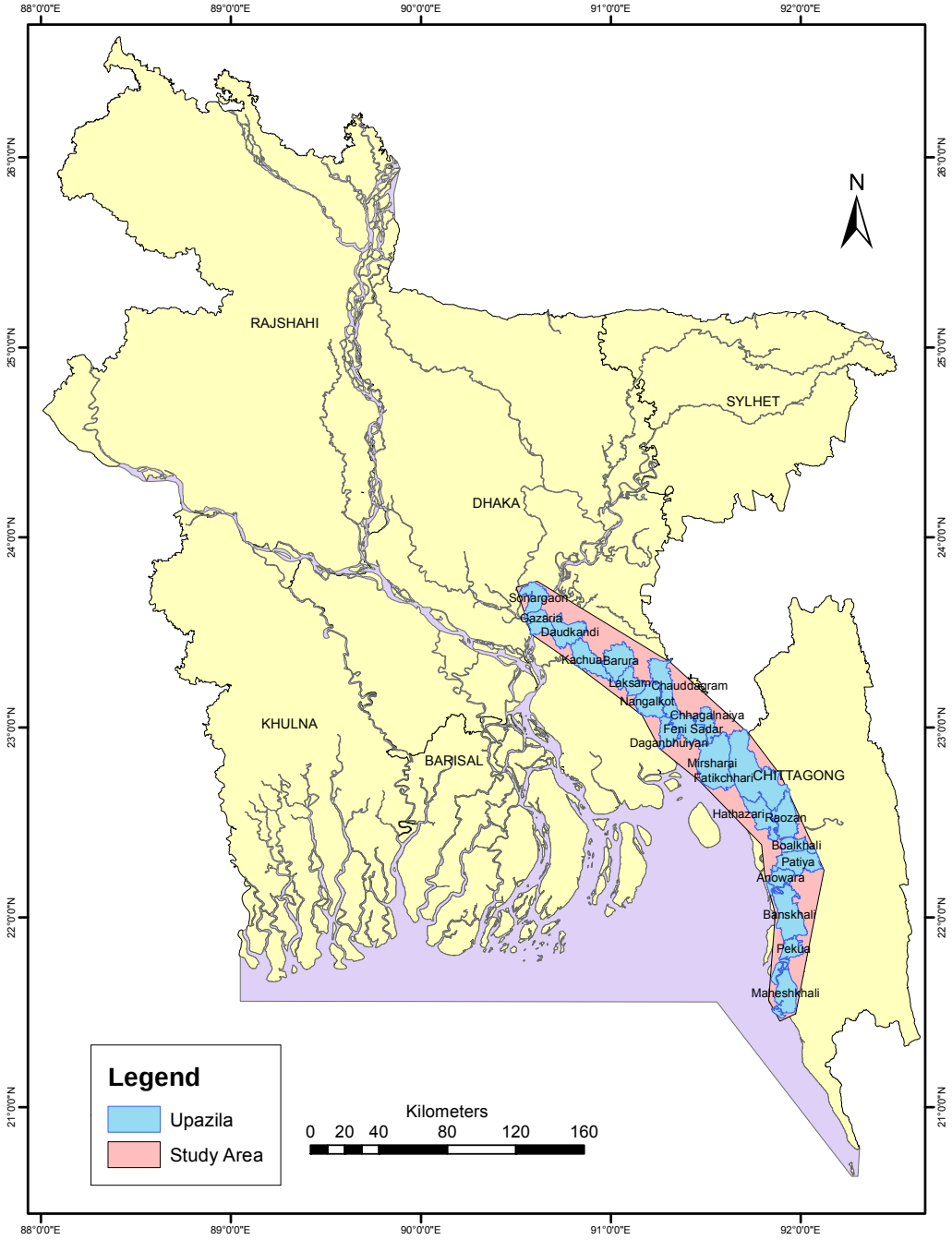


3.3 Project Implementation Schedule:

It is expected to start the construction of the project in 2015 and the first phase of construction will be copmpleted in three years from the date of starting of construction. That means the 1st phase will be completed in 2018.

4.0 Description of Environment:

The following figure gives the study area for environment



4.1 Land use of study area:

a) Meghnaghat substation:

The land for the proposed Meghnaghat 400kV substation is lying vacant.

b) Madunaghat substation:

The land for the proposed 400kV Madunaghat substation is cultivable and the main crops is paddy only.

c) 400kV Transmission Line:

The section wise land use of the proposed transmission line is described below:

i) Meghnaghat to Daudkandi:

The section of the proposed Meghnaghat-Matarbari 400kV transmission line from Meghnaghat to Daudkandi lies in the low lying land in Gazaria of Munshiganj district. The land of this area is inundated with water throughout the year.

ii) **Daudkandi to Feni:**

The section of the proposed 400kV transmission line from Daudkandi to Feni lies in the plain land. The land of this section is cultivable and it is used for paddy cultivation.

iii) **Feni to FatikChari:**

The section of the proposed 400kV transmission line from Feni to Fatikchari lies in the hilly area (reserved forest). This hilly land is occupied by natural and planted forest. There is also Rubber plantation in some hilly area.

iv) FatikChari to Matarbari:

The section of the proposed 400kV transmission line from Fatikchari to Matarbai lies in the plain land. The land of this section is cultivable and it sis used for paddy cultivation.

4.2 Hydrology (Water Availability) of study area:

Hydrological environment of the study area include water bodies and river system. The study area has been divided into two distinct regions.

A. Rivers of Dhaka and Comilla region

The major rivers of Dhaka and Comilla region are as follows:

Meghna, Gumti, Dakatia and Little Feni

B. Rivers of Chittagong region

The major rivers of Chittagong region are as follows:

Karnafully, Halda, Bakhail, Sangu, Matamuhuri, Feni, Kutubdia channel and Maheshkhali channel.

4.3 Geology of the Study Area:

Tectonically, the study area lies in the Bengal Foredeep part of the Bengal basin. The following Table gives the surface geological formations exposed in different Upazilas of the study area.

Name of Upazilas	Geological Formations Exposed on Surface
Sonaragaon Upazila, Narayanganj District	Alluvial sand and alluvial Silt
Gazaria Upazila, Munshiganj District	Alluvial sand and alluvial Silt
Daudkandi Upazila, Comilla District	Alluvial Silt and Clay; Marsh Clay and Peat
Kachua Upazila, Chandpur District	Chandina Alluvium; Alluvial Silt and Clay
Barura Upazila, Comilla District	Chandina Alluvium; Alluvial Silt and Clay

Name of Upazilas	Geological Formations Exposed on Surface
Nangalkot Upazila, Comilla District	Chandina Alluvium; Alluvial Silt and Clay
Laksam Upazila, Comilla District	Chandina Alluvium
Feni-Sadar Upazila, Feni District	Chandina Alluvium; Valley Alluvium and Colluvium
Chhagolnaiya Upazila, Feni District	Valley Alluvium and Colluvium
DaganBhuya Upazila, Feni District	Chandina Alluvium; Alluvial Silt and Clay
Mirsarai Upazila, Chittagong District	Beach and Dune Sand, Valley Alluvium and Colluvium; Tipam Sandstone, Bokabil formation and Bhuban Formation
Fatikchhari Upazila, Chittagong District	Valley Alluvium and Colluvium; Dupitila Formation, Dihing formation, Tipam Sandstone, Bokabil formation and Bhuban Formation
Hathazari Upazila, Chittagong District	Valley Alluvium and Colluvium; Dupitila Formation, Dihing formation, Tipam Sandstone, Bokabil formation and Bhuban Formation
Raojan Upazila, Chittagong District	Valley Alluvium and Colluvium; Dupitila Formation, Dihing formation,
Boalkhali Upazila, Chittagong District	Valley Alluvium and Colluvium; Dupitila Formation, Girujan clay formation, Tipam sandstone formation
Patiya Upazila, Chittagong District	Valley Alluvium and Colluvium; Dupitila Formation, Girujan clay formation, Tipam sandstone formation
Anowara Upazila, Chittagong District	Beach and Dune Sand, Valley Alluvium and Colluvium;
Banshkhali Upazila, Chittagong District	Beach and Dune Sand, Dihing and Dupitila Formation, Girujan clay formation, Tipam sandstone formation
Pekua Upazila, Cox's Bazar District	Beach and Dune Sand, Dihing and Dupitila Formation
Moheshkhali Upazila, Cox's Bazar District	Beach and Dune Sand, Dupitila Formation, Girujan clay formation, Tipam sandstone formation; Bokabil formation

4.4 Hydrogeology

Groundwater is one of the major natural resource of Bangladesh. It has been developed advantageously as a source of domestic, industrial and irrigation supplies. UNDP (1982) studied the hydrogeology of Bangladesh with a view to increase development of groundwater and to make a general appraisal of the groundwater resources of Bangladesh including collection, compilation, processing and analysis of existing data.

UNDP (1982) divided Bangladesh into 15 zones for groundwater developments. Each zone has been classified and rated as to its development potential in relation to the other zones. Figure 7.3.4 gives the Hydrogeological Classification of the study area (UNDP 1982). The study area constitutes Zone G, Zone L and Zone N.

4.5 Meteorology:

4.5.1 Climate:

a) Ambient Temperature

The proposed transmission line and substations lie in the south-eastern part of Bangladesh, where monsoon comes in July and recede in late October. Bangladesh Meteorological Department (BMD) is responsible for monitoring the climate data at different stations in Bangladesh. There are 7 stations namely, Dhaka, Comilla, Feni, Chittagong, Chittagong (Ambagan), Kutubdia and Cox's Bazar in the project area. The maximum and minimum average temperature recorded in the above seven stations for the last 10 years from 2004 to 2013 are given in the following table:

Station	Dhaka	Comilla	Feni	Chittagong	Chittagong (Ambagan)	Kutubdia	Cox's Bazar
Maximum Average temperature in deg. Celsius	35.5	34.4	33.5	33.7	34.2	33	34.1
Minimum Average temperature in deg. Celsius	12.2	10.9	10.9	12.7	12.7	13.5	13.9

b) Humidity:

The relative humidity along the route of the proposed 400kV transmission line are recorded at 7 stations namely, Dhaka, Comilla, Chandpur, Feni, Chittagong (Ambagan), Kutibdia and Cox's Bazar respectively by BMD. The maximum and minimum average relative humidity at the above seven stations during the last 10 years from 2004 to 2013 are given in the following Table:

Station	Dhaka	Comilla	Chandpur	Feni	Chittagong (Ambagan)	Kutubdia	Cox's Bazar
Maximum Average Relative Humidity in %	85	88	89	90	90	92	90
Minimum Relative Humidity in %	52	68	67	68	56	67	62

c) Rainfall:

During the monsoon (June to September), wind direction from the southwest brings moisture laden air from the Bay of Bengal, when the heaviest rainfall occurs. In the last 10 years (2004-2013), the maximum annual rainfalls recorded at Dhaka, Comilla, Chandpur, Feni, Chittagong (Ambagan), Kutubdia and Cox's Bazar stations are given in the following Table:

Stations	Dhaka	Comlla	Chandpur	Feni	Chittagong (Ambagan)	Kutubdia	Cox's Bazar
Maximum Annual Rainfall in mm	2885	2497	2545	3543	4340	4677	4440
Year	2007	2007	2013	2007	2007	2012	2011

d) Wind:

Wind speeds and directions are recorded by BMD at seven weather stations located at Dhaka, Comiila, Chandpur, Feni, Chittagong (Ambagan), Kutubdia and Cox's Bazar respectively along the proposed 400kV transmission line from Meghnaghat to Matarbari via Modunaghat. it is found that wind directions along the proposed route of transmission line are mostly from the south and southeast. During November to February the wind directions are from north or northwest and from March to October from south or southeast. it was observed that the maximum wind speed of **9.4 knots** from South-East prevailed during October, 2007 at Chittagong (Ambagan) station.

4.5.2 Natural Hazards

a) Cyclones:

The southeastern region of Bangladesh is cyclone prone area. Severe cyclones like cyclones in 1970. 1991 can damage the structures. Enough protection against cyclones is required to avoid accidents.

b) Earthquake:

Bangladesh and northeast Indian states have long been one of the seismically active regions of the world, and have experienced numerous large earthquakes during the past 200 years at an average rate in every 30 years.

Seismo-tectonic studies have been undertaken by various workers in the area comprising the Indo-Burma ranges and their western extension and in northern India a complete list of reference of which is provided in Haque (1990) using data from various source. A seismicity map of Bangladesh and its adjoining areas has also been prepared by Mominuddin (1991). Bangladesh has been classified as falling into seismic zones with zone-III the most severe and zone-I the least, prepared by BGS.

Based on the seismicity, Bangladesh has been divided into three seismic zones as follows:

Zone-I : Severe (Seismic Factor - 0.08g)

Zone-II: Moderate (Seismic Factor – 0.05g

Zone-III: Minor (Seismic Factor – 0.04g)

The proposed site falls under Zone-II (Moderate Damage), whose Seismic Factor is 0.05g.

4.6 Ambient Air and Noise Quality

The secondary data of air quality and noise level in different upazilas along the proposed 400kV transmission line have been collected from **BUET, CUET, Environmental Science (CU), DU and BCSIR.** Sampling locations were in the urban or semi-urban area. Air quality and Noise level in the study area is given in the following Table**.** It was found that air quality in most of the upazilas were found within standard limit except noise levels were above the standard limit because of having sampling location near industrial area. However, the proposed transmission line is located in the rural area where the air quality and noise level are assumed to be within standard limit.

Date	Upazila	Sampling Location	SPM µg/m3	SOx µg/m3	NOx µg/m3	Sound dBA	Remarks
11/07/2009	Potiya	BSCIC, Potiya	219	8.5	14.4	74.5	Urban area
30/09/2010	Mirsarai	Dhaka –Ctg Road Side	223	9.0	16.3	75.3	Urban area
12/07/2010	Boalkhali	Bazar road side	86	4.0	7.0	69.7	Urban area
20/11/2011	Anowara	Beside Kafco R/A.	73	ND	ND	69.4	Urban area
15/08/2008	Banshkhali	In front of Upzila office	124	4.2	7.3	64.2	Urban area
14/07/2012	Laksam	North side	78	ND	ND	67.5	Urban area
23/04/10	Chandpur	Beside Rail Station	182	6.0	8.5	74.2	Urban area
23/04/10	Chandpur	BesideBus Stop	209	8.5	12.6	77.3	Urban area
Bangladesh Standard			200	80	100	60	

Note:- 1, SMP- Suspended Particulate Matter. 2. NOx- Oxides of Nitrogen. 3.SOx- Oxides of Sulphur. 04. dBA-Decible. 5. ND-Not Detectable

Source : BUET, CUET, Environmental Science (CU), DU and BCSIR

4.7 Water Quality:

a) Surface Water:

The secondary data of surface water quality in different upazilas along the proposed 400kV transmission line have been collected from **BUET, CUET, Environmental Science (CU), DU and BCSIR.** Sampling locations were in the major water bodies such as river, Khal, pond etc. Surfeace water quality in the study area is given in the following Table**.** It was found that surface water quality in most of the upazilas were found within standard limit. However, the proposed transmission line is located in the rural area where the surface water quality is assumed to be within standard limit.

Upazila	Sample Location	Date	Temperature ^{0}C	PH	EC .µS/cm	Chloride mg/1	TDS mg/1	SS mg/1	DO mg/1	BOD mg/1	COD mg/1	Salinity %	Oil & Grease mg/1	Arsenic mg/1	Note
Chandpur	Dakatia River Side,Notun Bazar, Chandpur	14/07/07	30.5	7.1	132	11	66	67	5.2	4	1	-			
	Dakatia River Middle,Notun bazar,Chandpur	14/07/07	30.6	7	126	10	63	41	5.6	0.3	1	-	-		
Banshkhali	Sangu River, Under Toylardip Bridge, Baskhali, Chittagong	15/08/08	30.1	7.32		23	98	2.39	5.4	0.4	0	0.02	3.1	0	-
Raozan	Canal Water under Bridge Gohira, Raozan	24/10/10	30.5	7.22		9	76	11	5.3	0.3	0	0.02	2.5	0	-
Mirsarai	Surface water of Canel (Khal), Mirarsharai, Ctg.	16/02/07	24	7.61		112	251	32	5.4	0.4	0	0.26	3	0	-
Laksam	Canal (Khal)Beside NoakhaliRoad, Laksam,Comilla	20/05/06	30.2	7.24		41	116	35	5.2	0.5	0	0.07	2.8	0	-
Boalkhali	Karnafully River water Char Khidirpur,Boalkhali Side,Ctg.	11/6/2010	30.5	7.62		1254	2710	179	5.5	0.4	135	2.26	4	0	Jhoar

Upazila	Sample Location	Date	Temperature ^{0}C	PH	EC .µS/cm	Chloride mg/1	TDS mg/1	SS mg/1	DO mg/1	BOD mg/1	COD mg/1	Salinity %	Oil & Grease mg/1	Arsenic mg/1	Note
	Karnafully River water Charkhidirpur, Boalkhali Side,Ctg.	11/6/2010	31.1	7.21		36	154	153	5.3	0.5	31	0.06	3.5	0	Vata
Daudkandi	Water Body Beside Daudkandi Bus Stand Comilla.	13/07/10	30	7.12	122	7	56	9	5	0.5	1	-	-		
Feni	Feni River Under Bridge.Bishow Road,Feni.	16/06/07	30	7.24		19	86	213	5.5	0.3	0	0.01	3.2	0	-
Fatickchari	Pond water of Paharica Farm Ltd. Nannupur,Fotickchari, Chittagong	13/08/11	31	7.14		15	114	23	5.2	0.5	0	0.03	2.2	0	-
Potiya	Waste Water of Middie, Shikalbaha Khal, Potiya, Chittagong.	11/7/2009	29.7	7.6	154	21	87	63	5.4	0.3	3	0.03	-		
Anowara	Karnafully River water CUFL Side, Anowara, Ctg..	11/7/2009	31	7.8		10890	18540	357	5.4	0.5	467	19.6	5.5	0	Jhoar
	Karnafully River water CUFL Side, Anowara, Ctg..	11/7/2009	31.4	7.34		1246	2614	315	5.2	0.6	139	2.24	4.1	0	Vata
Standard Limit			40	6.5-8.5	1200	150-600	2100	100	4.5-8.5	50	200	-	-		

Source : BUET, CUET, Environmental Science (CU), DU and BCSIR

b) Ground water:

The secondary data of ground water quality in different upazilas along the proposed 400kV transmission line have been collected from **BUET, CUET, Environmental Science (CU), DU and BCSIR.** Sampling locations were in the urban or semi-urban area. Ground water quality in the study area is given in the following Table**.** It was found that ground water quality in most of the upazilas were found within standard limit. However, the proposed transmission line is located in the rural area where the ground water quality is assumed to be within standard limit.

Upazila	Sample Location	Date	Temperature ^{0}C	PH	Chloride mg/1	TDS mg/1	SS mg/1	Arsenic mg/1	Fe mg/1	Coli Form n/100 ml	Salinity %	DO	BOD^5	COD mg/1	Note
Chandpur	Deep Tubewell of Mohammadia Jame Mosque Puran Bazar, Chandpur	7/4/2010	30	8	1284	4175	3	0.18	2.2	0	2.31	3.7	0.3	1	-
	Deep Tubewell of Hotel Taj, Mukti Sharoni Road, Chandpur	7/4/2010	30.1	7.8	371	1208	2	0.1	1.6	0	0.67	4	0.3	0	-
Banshkhali	Deep Tubewell of Jioldi Bazar Area Bashkhali, Chittagong	16/03/06	27.2	6.7	113	277	2	0.03	2.6	0	0.21	3.6	0.4	0	-
Raozan	Deep Tubewell of Gohira Bazar, Raozan Chittagong	12/07/13`	29.3	6.7	77	152	2	0	0.32	0	0.13	3.8	0.4	0	-
Mirsarai	Deep Tubewell Water Mosque of Sona Pahar Area, Mirsharai,Chittagong	16/02/10`	28.3	7.56	302	457	4	0.04	3.1	0	0.54	3.7	0.2	0	-
Laksam	Deep Tubewell Beside Railway Station, Laksam, Comilla.	14/07/12`	29.2	7.34	73	169	2	0.02	0.56	0	0.13	4	0.1	0	-
Boalkhali	Deep Tubewell of Char khidirpur,Boalkhali,Chittagong.	12/7/2010	29.5	6.9	92	214	1	0	0.23	0	0.08	4	0.2	0	-
Daudkandi	Goripore Bazar area.Daudkandi, Comilla.	20/05/09	29.4	7.62	86	263	3	0.03	1.52	0	0.14	3.6	0.3	0	-

Upazila	Sample Location	Date	Temperature ^{0} C	P^{H}	Chloride mg/1	TDS mg/1	SS mg/1	Arsenic mg/1	Fe mg/1	Coli Form n/100 ml	Salinity %	DO	BOD^{5}	COD mg/1	Note
Feni Sadar	Deep Tubewell of Mohipal Zame Mosque, Feni.	30/07/09	28.5	6.94	153	307	2	0.03	0.95	0	0.24	3.8	0.2	0	-
Fatickchari	Deep Tubewell of Nannupur, Fotickchari, Chittagong..	13/08/11	29.1	6.82	63	138	1	0	0.27	0	0.12	3.8	0.4	0	-
Potiya	Deep Tubewell of Shatirhat,Potiya, Chittagong. ..	10/1/2010	29.3	6.82	65	134	1	0.01	0.69	0	0.11	3.9	0.2	0	-
Anowara	Deep Tubewell water Beside Korean EPZ. Dangerchar, Anowara, Ctg	20/11/2011	29.2	6.83	2564	720	1282	4	0.06	0.92	0	3.8	0.2	0	-
Standard Limit			40	6.5-8.5	150-600	1000	10	0.05	1	200	-	4.5-8.5	2	4	-

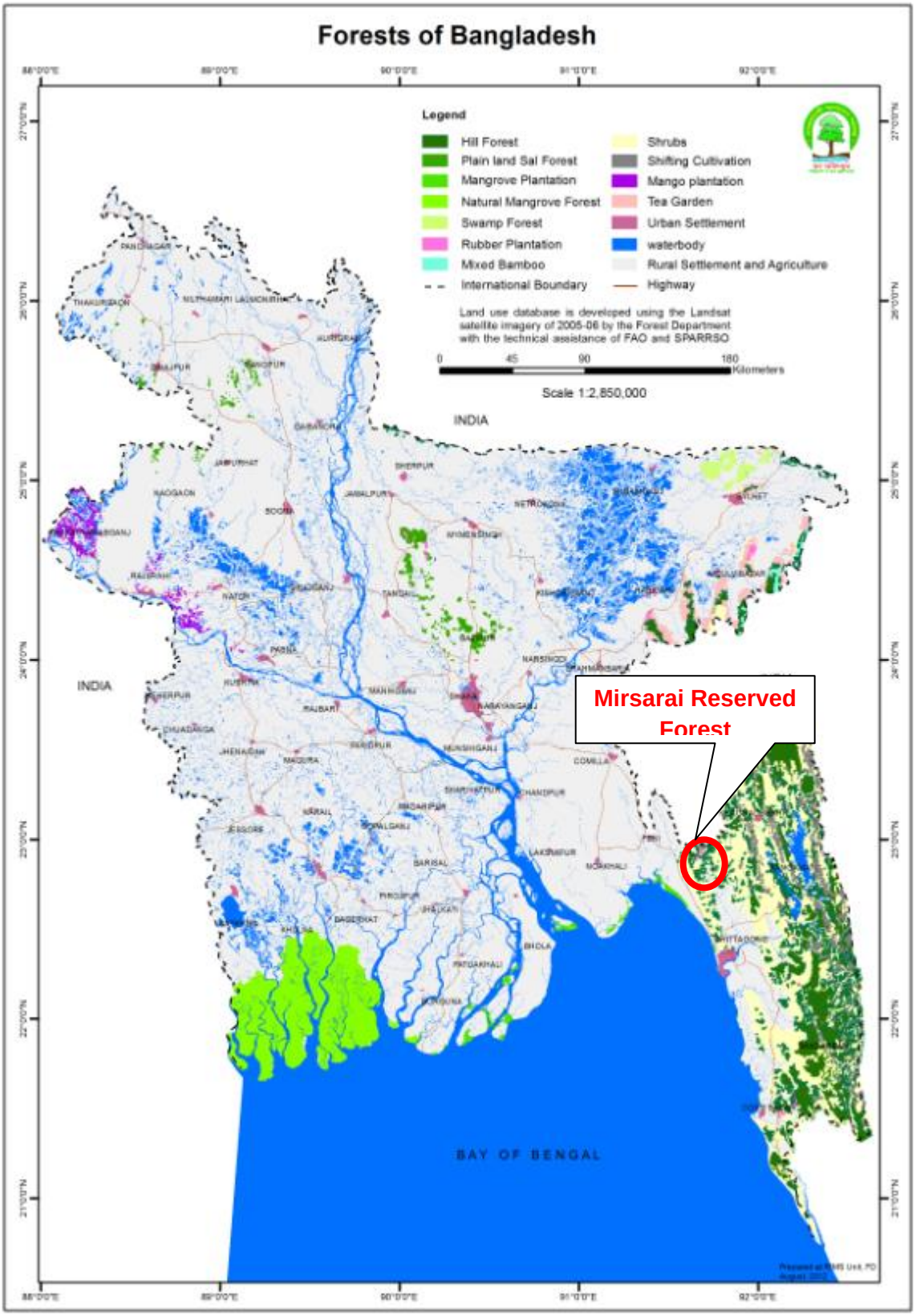
Source : BUET, CUET, Environmental Science (CU), DU and BCSIR

4.8 Ecology

4.8.1 Forests

Diversity of the study areas is very poor because maximum lands are cultivated (Paddy field), swamp, marshy and water logging condition during rainy season. There are some small and scattered forests (not dense) and vegetable field adjacent to the paddy field. There are some trees are planted along road side viz: *Albizia saman (*Rain tree), *Eucalyptus globulus* (Eucalyptus), *Acacia mangium* (Wattle) etc. There are few houses near the transmission line. Around these houses some ornamental, vegetables, trees are planted.

A section of about 13km of the proposed 400kV transmission line lies in Mirsarai reserved forest having total area of 32,900acres under Bangladesh Forest Department. A part of this reserved forest is being used for Rubber cultivation by Bangladesh Forest Industries Development Corporation (BFIDC). A map of Bangladesh showing the locations of hill forests over which the proposed 400kV transmission line has been drawn is given in the following Figure:


Forests of Bangladesh
Legend
Hill Forest
Plain land Sal Forest
Mangrove Plantation
Natural Mangrove Forest
Swamp Forest
Rubber Plantation
Mixed Bamboo
International Boundary
Shrubs
Shifting Cultivation
Mango plantation
Tea Garden
Urban Settlement
waterbody
Rural Settlement and Agriculture
Highway
Land use database is developed using the Landsat satellite imagery of 2005-06 by the Forest Department with the technical assistance of FAO and SPARRSO
0 45 90 180 Kilometers
Scale 1:2,850,000
INDIA
INDIA
Mirsarai Reserved Forest
BAY OF BENGAL

4.8.2 Flora & Fauna:

Survey of flora and fauna at seven points along the proposed 400kV transmission line and proposed Modunaghat substatios was conducted in August 2014 (wet season) and in October-November 2014 (dry season) respectively. The summary of survey results in the wet season and dry season are given below:

a) **Wet Season:**

Flora:

A total of 152 species in 121 genera under 69 families were recorded from the study site. There were some common plant species, which were present in every survey site. Viz.: *Achyranthes aspera, Alternanthera philoxeroides* etc. According to IUCN category, three threatened plant species were recorded from the study areas. Viz.: *Borassus flabellifer, Dipterocarpus turbinatus, Swietenia mahagon*

Threatened species observed in Project Sites

Taxa	No.	Scientific Name (English)	Season (Rainy)	Conservation Status		Remarks
				IUCN (2013)	Local Law	
Flora	1	*Borassus flabellifer* L.	○	EN	○	The species is common in some parts of Bangladesh
	2	*Dipterocarpus turbinatus* Gaertn.	○	CR	○	The species is very common in the forest of South-east Bangladesh
	3	*Swietenia mahagoni* (L.) Jacq.	○	EN	○	This is a introduced species. It is widely cultivated in roadsides, homestead forests throughout Bangladesh
Total	03					

Fauna

A total of 184 species were observed, from seven sampling points, including 62 insects, 11 amphibians, 31 reptilians, 61 birds and 19 mammalian species. These 62 insect were belong to 29 families of 10 orders. All the 11 amphibians were from Order Anura and five Families. The highest six species were recorded under family

Dicroglossidae, while one species from each of the following families, viz., Bufonidae, Ranidae and Rhacophoridae. Furthermore, two species recorded from the family Microhylidae. A total of 12 lizards and 19 snake species were recorded, where only one were included in CITES appendix I and three were in appendix II. 19 mammalians taxa were recorded of 6 orders and 11 families. Four mammals were included in CITES appendix III and three in appendix I. None of the observed insect, amphibian and birds taxa found to be enlisted in CITES appendices. All observed insect, amphibian, reptilian and birds were Least Concern of IUCN category whereas only 4 species of mammals (*Panthera pardus* Linnaeus 1758; *Arctonyx collaris* F.G.Cuvier 1825; *Lutra lutra* Linnaeus 1758; *Viverra zibetha* Linnaeus 1758) – were included into Near Threatened category.

b) **Dry Season:**

Flora:

A total of 145 species in 116 genera under 66 families were recorded from the study site. There were some common plant species, which were present in every survey site. Viz.: *Achyranthes aspera, Alternanthera philoxeroides* etc. According to IUCN category, three threatened plant species were recorded from the study areas. Viz.: *Borassus flabellifer, Dipterocarpus turbinatus, Swietenia mahagoni*.

Fauna:

A total of 132 species were observed, from seven sampling points, including 47 insects, 07 amphibians, 12 reptilians, 53 birds and 13 mammalian species. These 47 insects were belonging to 31 families of 12 orders. All the 7 amphibians were under order of Anura and three Families. The highest four species were recorded under family Dicroglossidae, while two species from Microhylidae and one species from Bufonidae. A total of 12 reptile species were recorded, where only one was included in CITES appendix I. 13 mammalians taxa were recorded of 4 orders and 9 families. Three mammals were included in CITES appendix III and one in appendix I. None of the observed insect, amphibian and birds taxa found to be enlisted in CITES appendices. All observed insect, amphibian, reptilian and birds were Least Concern of IUCN category whereas only 3 species of mammals (*Arctonyx collaris* F.G.Cuvier 1825; *Lutra lutra* Linnaeus 1758; *Viverra zibetha* Linnaeus 1758) – were included into Near Threatened category.

4.9 Demography Profile and Occupational Pattern

Demographic profile and occupational pattern of upazillas along the proposed 400kV transmission line is given in the following Table:

Division	District	Upazilla	No. of successful Interview	No. of Family Member	Sex		Occupation											Average Monthly income	Average Monthly expenditure
					M	F	Farmer	Business	Service	student	House wife	Agriculture Laborer/ Day Laborer	Unemp loyed	Teacher	Retired/ Old man	Driver	others		
Chittagong	Chittagong	Anowara	35	177	101	76	10	13	2	1	6		3					20085.71	15700
Chittagong	Chittagong	Banskhali	31	164	77	87	9	8	3		4	5		1		1	0	9612.90	8548.38
Chittagong	Chittagong	Raozan	27	115	64	51	5	2	1		12	1				2	4	10518.51	8703.7
Chittagong	Comilla	Laksam	29	130	67	63	5	6	1		11	1			2	2	1	9517.24	8862.06
Dhaka	Munshigonj	Gozaria	32	133	78	55	6	17	3		1	1			1		3	14937.5	13406.25
Dhaka	Narayangonj	Sonargaon	30	125	67	58	3	13	7		1				4		2	12950	12233.33
Total =			184	844	454	390	38	59	17	1	35	8	3	1	7	5	10	68008.96	67453.72

Others: Mosque Imam -1, Carpenter-2, Fuiller-1, Meson-1, Rickshaw Puller-2, Quack doctor-1, Village Police-1, Boatman-1

4.10 Land use and Cropping Pattern

Land use and cropping pattern of upazillas along the proposed 400kV transmission line is given in the following Table:

Division	District	Upazilla	No. of respondents	Land use		Land Price (per decimal)		Paddy production		Selling price of paddy		Remark
				Homestead	Agriculture	Homestead	Agriculture	Unit yield of paddy per season in average (kg per decimal)	Annual cropping intensity (%)	Normal quality (BDT/kg)	High quality (BDT/kg)	
Chittagong	Chittagong	Anowara	35	159.75	586.5	12605000	14440000	30	300%	18.75	23.75	
Chittagong	Chittagong	Banskhali	31	237	493	6981000	8620000	24	200%	18.75	23.75	
Chittagong	Chittagong	Raozan	27	148	136	17850000	5550000	24	100%	19.50	22.50	
Chittagong	Comilla	Laksam	29	327.5	611	29935000	28780000	42	300%	21.25	25.00	
Dhaka	Munshigonj	Gozaria	32	347	600	120200000	55000000	36	100%	22.50	26.25	
Dhaka	Narayangonj	Sonargaon	30	211	321	44300000	19400000	36	200%	22.50	26.25	
		Total =	184	1430.25	907.5	231871000	131790000	192	1200%	123.25	147.5	

* Average per upazilla No. of intrview 30.66, No. of homestead Land use 238.37, No. of Agriculture land 151.25,Price of homestead land per decimal value 386451. 67, Value of Agriculture land per decimal per upazilla 21965000, paddy production per decimal per upazilla 32kg, Annual cropping intensity 200%, selling price of paddy per upazilla normal quality 20.54 per kg and High quality 24.58 per kg

4.11 Socio-economic Scenario

Questionnaire survey was conducted in six Upazillas (Anowara, Banskhali, Raozan, Laksam, Gozaria and Sonargaon) along the proposed 400kV transmission line. Total 184 household heads have been interviewed,

Occupation:

32.07% of the respondents were businessmen, **20.65%** Farmers, **19.022%** housewife, **9.24%** Service holder, **4.35%** day labourer, **3.8%** retired persons and **10.87%** others.

Family Size:

The average size of the family is **4.64.**

Monthly Income:

The average monthly incomes of the respondents are as follows:

21.74%	-	Tk. 612
39.67%	-	Tk. 9075
11.41%	-	Tk. 12047
12.50%	-	Tk. 14913
14.67%	-	Tk. 34703

Houses :

The roofs of **84.7%** houses are made of Tin, **6.5%** of Concrete and **8.8%** of thatch/ hay. The walls of **45.66%** houses are made of Tin, **25%** of Clay, **18.47%** of Concrete and **10.87%** of Bamboo. Similarly, the floors of **79.34%** are made of clay, **19.02%** of concrete and **1.64%** of bamboo.

Source of Drinking Water:

The main source of drinking water for the 100% households is tube well water. Besides, ponds and river water are also used in various purposes like, bathing, cooking, cleaning etc.

Electricity:

76.09% households are electrified with grid system and **2.17%** with sloar system. The remaining houses are not electrified.

Fuels for cooking:

83.7% of households use wood for cooking purpose, **13.04%** LP Gas / Natural gas, **7.61%** cow dung, **7.07%** leaves and **5.43%** natural garbage.

Medical Treatment:

The most of the respondents used to go to Govt. Hospital for their medical treatment. Some of the respondents used to go to different places to seek medical attention, namely, private clinic, quack doctor, MBBS Doctors etc.

5.0 Identification of Environmental impacts:

5.1 Transmission Line:

The major predicted environmental impacts of transmission line during construction and operation phase are given in the following Table:

Item	No.	Impact	Rating		Result
			construction Phase	Operation Phase	
Pollution mitigation measure	1	Air pollution	B-	D	**Construction phase:** Generation of dust by land preparation and other construction work is expected, but the impact will be temporary. Generation of air pollutants (SOx, NOx, and others) from operation of heavy machines and trucks is predicted, but the impact will be limited only to within the surrounding area. **Operation phase:** No specific air pollution is anticipated.
	2	Water pollution	B-	B-	Soil runoff may occur from the exposed soil of the embankment and cut slope and water pollution of the downstream area of the surrounding river is predicted.
	3	Waste	B-	D	**Construction phase:** General waste and hazardous waste generated by the construction work is predicted. **Operation phase:** No general waste and hazardous waste is anticipated.
	4	Noise and Vibration	B-	D	**Construction phase:** Impact of noise and vibration is predicted caused by operation of heavy machines and trucks, but will be limited to the surrounding area. **Operation phase:** No specific noise or vibration is anticipated.
Natural environment	5	Natural reserve	B-	D	**Construction phase:** There is a possibility that the transmission line passes by the Ecologically Critical Area, and the impact of air pollution, noise and vibration due to construction work is anticipated. **Operation phase:** No specific impact on the natural reserve is predicted.
	6	Ecosystem	B-	B-	**Construction phase:** There is a possibility that the transmission line passes by the Reserved Forest, and the impact of air pollution, noise and vibration due to construction work is anticipated on the terrestrial ecosystem. **Operation phase:** Bird-strike and other impacts are anticipated.
Social environment	7	Land Acquisition and Resettlement	C	D	**Construction phase:** No land acquisition for towers will be required. Settlements and houses were avoided when the route map was prepared based on the available secondary information and site survey. The social survey has identified the land owners of the tower locations and crop patterns along the transmission line. Only crop compensation will be required. **Operation phase:** N/A

Item	No.	Impact	Rating		Result
			construction Phase	Operation Phase	
	8	Disturbance to Ethnic Minority Groups and Indigenous People	C	C	The proposed construction site of the transmission line is located close to the Chittagong Hill Tracts (CHT), where the indigenous population is related to neighboring Myanmar, and there is a possibility that ethnic minority groups and indigenous people live within the surrounding hill area. The social survey identified that no ethnic minority gropus and indigenous people are available along the route of transmission line. No impact has been predicted.
	9	Disturbance to Water Usage, Water Rights etc	C	C	In general, soil runoff may occur from the exposed soil of the embankment and cut slope, resulting in water pollution of the downstream area of the surrounding river and alteration of water use. The extent of the impact is, however, unknown at this stage.
	10	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	C	D	**Design phase:** The extent of the impact is unknown at this stage. **Operation phase:** No specific impact is predicted concerning the social infrastructure and local decision-making institutions.
	11	Infectious Diseases such as HIV/AIDS	B-	D	**Construction phase:** A temporary influx of migrant labor during construction period may increase the risk of transmitted diseases. **Operation phase:** There is no specific negative impact anticipated.
	12	Working Conditions (including working safety)	B-	B-	**Construction phase:** In general, a high risk of accidents is predicted in construction work. **Operation phase:** There is a risk of accidents such as electric shocks and falls during maintenance work.
Others	13	Accidents	B-	B-	Accidents may occur including soil runoff caused by floods, and break-down of towers by cyclones.

(Source: developed by the JICA Survey Team)

Note: A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

5.2 Sub-stations:

The major predicted environmental impacts of sub-stations during construction and operation phase are given in the following Table:

Item	No.	Impact	Rating		Result
			Design / construction Phase	Operation Phase	
Pollution mitigation measure	1	Air pollution	B-	D	**Construction phase:** Generation of dust through land preparation and other construction work is expected, but the impact will be temporary. Generation of air pollutants (SOx, NOx, and others) from operation of heavy machines and trucks is predicted, but the impact will be limited only to within the surrounding area. **Operation phase:** No specific air pollution is anticipated.
	2	Water pollution	B-	B-	Soil runoff may occur from the exposed soil of the embankment and water pollution of the surrounding waterway for paddy fields is predicted.
	3	Waste	B-	B-	**Construction phase:** General waste and hazardous waste generated by the construction work is predicted. **Operation phase: G**eneral waste and hazardous waste is anticipated.
	4	Noise and Vibration	B-	D	**Construction phase:** Impact of noise and vibration is predicted caused by operation of heavy machines and trucks, but will be limited to the surrounding area. **Operation phase:** No specific noise or vibration is anticipated.
Natural environment	5	Natural reserve	D	D	N/A
	6	Ecosystem	D	D	No specific adverse effect is predicted on the ecosystem of the site and its surrounding area.
Social environment	7	Land Acquisition and Resettlement	B-	D	**Design phase:** As much as 220 acres of land, which is presently owned by BPDB, has already been secured and is available for the future development of Meghnaghat SS. BPDB and PGCB will take all official procedures for transferring the ownership. Whereas, it is anticipated that 20 acres of paddy field land is to be acquired for Madunaghat SS. The extent of the impact is, however, unknown at this stage. No resettlement is anticipated. **Operation phase:** N/A
	8	Disturbance to Poor People	B- / C	B-/ C	**Construction phase:** Sharecroppers (*bargadars*) at Madunaghat SS site may lose their means of livelihoods temporarily during the construction phase. The extent of the impact is, however, unknown at this stage. **Operation phase:** Poverty resulting from losses of livelihood means may occur if appropriate measures are not taken.
	9	Deterioration of Local Economy such as Losses of Employment and Livelihood Means	B-/C	B-	**Construction phase:** Sharecroppers (*bargadars*) at Madunaghat SS site may lose their means of livelihoods temporarily. The extent of the impact is, however, unknown at this stage. **Operation phase:** Sharecroppers at Madunaghat SS site may lose their means of livelihoods permanently.

Item	No.	Impact	Rating		Result
			Design / construction Phase	Operation Phase	
	10	Land Use and Utilization of Local Resources	B-	B-	**Construction phase:** It is anticipated that 20 acres of paddy field land is to be acquired for Madunaghat SS. **Operation phase:** Land use will change permanently.
	11	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	B-	D	**Design phase:** It is the Deputy Commissioner's Office of the District that takes the initiative in conducting local consultations and the detailed measurement surveys for land acquisition, which will cause certain impact on the social infrastructure and local decision-making institutions. **Operation phase:** No specific impact is predicted.
Others	12	Accidents	B-	B-	Accidents may occur including soil runoff caused by floods, and break-down of towers by cyclones.

Note: A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

6.0 Evaluation of Impacts

6.1 Transmission Line

Item	No.	Impact	Evaluation based on scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air pollution	B-	D	B-	D	**Construction phase:** - Prevention measures for dust dispersion will be taken by spraying water. - Maintenance of machinery will be conducted regularly, resulting in reducing exhaust gas emissions. **Operation phase:** - No specific air pollution is expected.
	2	Water pollution	B-	B-	B-	D	**Construction and Operation phase:** - The transmission line route was selected avoiding any steep sloping land. - Any slopes shall be reinforced with concrete, plantation or other means to minimize soil runoff and turbid water generation.
	3	Waste	B-	D	B-	D	**Construction phase:** - General waste and hazardous waste are generated by the construction work. **Operation phase:** - No General waste and hazardous waste are expected.
	4	Noise and Vibration	B-	D	B-	D	**Construction phase:** - Construction machinery and vehicles will be maintained regularly.

Item	No.	Impact	Evaluation based on scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							- Low-noise/ low-vibration machinery will be used. - Noise levels generated from construction machinery will meet noise level standards at the nearest residential area. **Operation phase:** - No specific noise and vibration is expected.
Natural Environment	5	Natural reserve	B-	D	D	D	**Construction phase:** - Transmission line route was selected avoiding any protected areas. **Operation phase:** - No specific impact on Natural reserve areas is predicted.
	6	Ecosystem	B-	B-	D	C-	**Construction phase:** - Transmission line route was selected avoiding any protected areas. - There are no flora species listed in the IUCN Red list under the transmission line route. - Precious species of insects, amphibians, reptiles, mammals and birds designated by IUCN are not observed under/along the transmission line route. **Operation phase:** - Birds striking the lines and other impacts are expected to be insignificant.
	7	Topography and Geology	C	C	B-	D	**Construction and Operation phases:** - Transmission line route was selected avoiding any steep sloping land. - Any slopes shall be reinforced with concrete, plantation or other means to minimize soil runoff and turbid water generation.
Social Environment	8	Land Acquisition and Resettlement	C	D	B-	D	**Pre-construction phase:** - Construction of one tower base for 400kV requires $2m^2$ of land for suspension tower (approximately 550 nos) and 3m2 of land for tension tower (approximately 250 nos). It is approximately required not more than 2,000 m2 in total. - Construction of one tower base for 230kV requires $1m^2$ of land for suspension tower (approximately 20 nos) and 1m2 of land for tension tower (approximately 15 nos). It is approximately required not more than 100 m2 in total. - Land acquisition will be conducted on the basis of compensation at replacement cost. - Trees within clearance distance from cables will be removed. - Standing crops and trees will be compensated at market price. - During construction period, certain part will be blocked exclusively for the construction, where farm activities will be disturbed.
	9	Disturbance to Poor People	C	C	B-	D	**Pre-construction and Operation phases:** - Sharecroppers are among vulnerable groups.

Item	No.	Impact	Evaluation based on scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							Their livelihood means will be temporary lost during construction period.
	10	Disturbance to Ethnic Minority Groups and Indigenous People	C	C	D	D	**Pre-construction and Operation phases:** - No ethnic minority groups or indigenous people were identified along the transmission line route.
	11	Deterioration of Local Economy such as Losses of Employment and Livelihood Means	C	C	B-/B+	D	**Pre-construction and Construction phases:** - During construction period, certain part will be blocked exclusively for the construction, where farm activities will be disturbed. - As mitigation measures, employing as many local residents as possible, and using the services and products offered by the local community. **Operation phase:** - The transmission line construction area can be reused for farming after the completion of the transmission tower construction, except for the land for tower bases, therefore adverse effects on income will be very limited.
	12	Land Use and Utilization of Local Resources	C	C	**B-**	**D**	**Pre-construction phase:** - During construction period, certain part will be blocked exclusively for the construction, where farm activities will be disturbed. **Operation Phase:** - The transmission line construction area can be reused for farming after the completion of the transmission tower construction, except for the land for tower bases, therefore adverse effects on income will be very limited.
	13	Disturbance to Water Usage, Water Rights, etc.	C	C	**B-**	**B-**	**Construction and Operation phases:** - Transmission line route has been selected avoiding any steep sloping land. - Any slopes shall be reinforced with concrete, plantation or other means to minimize soil runoff and turbid water generation.
	14	Disturbance to the Existing Social Infrastructure and Services	B-	D	D	D	**Construction phase:** - Since the volume of increased traffic will be small, no significant impact is anticipated. **Operation phase:** - No specific adverse effects is predicted for existing social infrastructure.
	15	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	C	D	D	D	**Pre-construction phase:** - PGCB will, together with the contractor of the transmission lines, inform the land owners of their possible land use for the tower base, duly take into account the land owners' responses and conclude agreements in writing with the land owners with regard to the land use for the tower base. Upon such

Item	No.	Impact	Evaluation based on scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							communication with the land owners, PGCB will duly inform the land owners that they have the right to express objection to the possible land use. If PGCB does not purchase the land under the proposed transmission towers, PGCB shall restore the land to its original conditions after construction of the transmission towers. **Operation phase:** - No specific impact is predicted concerning social infrastructure and local decision-making institutions.
	16	Misdistribution of Benefits and Compensation	C	D	D	D	No specific impact is predicted concerning the misdistribution of benefits and compensation.
	17	Local Conflicts of Interest	C	D	D	D	No specific impact is predicted concerning local conflicts of interest.
	18	Cultural Heritage	C	C	D	D	- No specific impact is predicted concerning cultural heritage.
	19	Landscape	C	C	D	D	- Transmission line route has been selected avoiding any protected and scenic areas to the maximum extent.
	20	Gender	C	C	D	D	No specific negative impact expected.
	21	Children's Rights	C	C	D	D	No specific negative impact expected.
	22	Infectious Diseases such as HIV/AIDS	B-	D	B-	D	**Construction phase:** - Local people will be recruited for simple work to maximum extent possible, which will help lower low risk of infectious diseases being transmitted by external workers. Pre-employment and periodic medical check-ups will be conducted for external workers (technical workers, etc). **Operation phase:** - No specific negative impacts are expected.
	23	Work Conditions (Including Work Safety)	B-	B-	B-	B-	**Construction phase:** - The construction company shall establish a work safety plan and submit it to PGCB to obtain approval. The work safety plan shall stipulate mitigation measures on soft aspects (safety training, etc) and hard aspects (provide workers with appropriate protective equipment, etc). **Operation phase:** - The work safety plan shall be established including mitigation measures on soft aspects (safety training, etc) and hard aspects (provide workers with appropriate protective equipment, etc).
	24	Right of Way (ROW)	B-	D	B-	D	**Construction phase:** - Temporary disturbance to the local land use due to the blockage during construction period. **Operation phase:** - No specific impact is anticipated.

Item	No.	Impact	Evaluation based on scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Others	25	Accidents	B-	B-	B-	B-	**Construction and Operation phase:** - As prevention measures for land traffic accidents, observation of traffic regulations, installation of traffic signs and training and education on safe driving will be implemented.
	26	Cross-boundary Impact and Climate Change	D	D	D	D	- Cross boundary and CO2 emissions are not anticipated in relation to the transmission line.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (Further examination is needed, and the impact may be clarified as the study progresses.)
D: No impact is expected.

6.2 Sub-stations:

Item	No.	Impact	Evaluation based on Scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air pollution	B-	D	B-	D	**Construction phase:** - Prevention measures for dust dispersion will be taken by spraying water. - Maintenance of machinery will be conducted regularly, resulting in reducing exhaust gas emissions. **Operation phase:** - No specific air pollution is expected.
	2	Water pollution	B-	B-	D	D	**Construction and Operation phase:** - The site of Substation was selected avoiding any steep sloping land. - Any slopes shall be reinforced with concrete, plantation or other means to minimize soil runoff and turbid water generation.
	3	Waste	B-	B-	B-	B-	**Construction phase:** - General waste and hazardous waste are generated by the construction work. **Operation phase:** - General waste is generated.
	4	Noise and Vibration	B-	D	B-	D	**Construction phase:** - Construction machinery and vehicles will be maintained regularly. - Low-noise/ low-vibration machinery will be used. - Noise levels generated from construction machinery will meet noise level standards at the nearest residential area. **Operation phase:** - Noise and vibration will be borne due to the operation of substation. However, it will be

Item	No.	Impact	Evaluation based on Scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							absorbed within the site, so that no specific impact is anticipated outside.
Natural Environment	5	Natural reserve	D	D	D	D	**Pre-construction and Operation phases:** - The site of Substation was selected in rice field, so that Natural resources are not existed.
	6	Ecosystem	D	D	D	D	**Construction phase:** - The site of Substation was selected avoiding any protected areas. - There are no flora species listed in the IUCN Red list in/around site of Substation. -Precious species of insects, amphibians, reptiles, mammals and birds designated by IUCN are not observed in/around site of Substation. **Operation phase:** - Birds striking the lines and other impacts are not expected.
	7	Geography and Geology	C-	C-	D	D	**Construction and Operation phases:** - The site of Substation was selected avoiding any steep sloping land. - Any slopes shall be reinforced with concrete, plantation or other means to minimize soil runoff and turbid water generation.
Social Environment	8	Land Acquisition and Resettlement	B-	D	B-	D	**Pre-construction phase:** - Approximately 7 ha of farm land will be required for the construction of Madunaghat substation. - Land acquisition will be conducted on the basis of compensation at replacement cost. - Trees within clearance distance from cables will be removed. - Standing crops and trees will be compensated at market price.
	9	Disturbance to Poor People	B-/C-	B-/C-	B-	B-	**Pre-construction and Operation phases:** - Sharecroppers are among vulnerable groups, and they may lose their livelihood means permanently.
	10	Disturbance to Ethnic Minority Groups and Indigenous People	D	D	D	D	**Pre-construction and Operation phases:** - No ethnic minority groups or indigenous people were identified.
	11	Deterioration of Local Economy such as Losses of Employment and Livelihood Means	B-/C-	B-	B-/B+	B-	**Pre-construction and Construction phases:** - Sharecroppers may lose their livelihood means permanently. - As mitigation measures, employing as many local residents as possible, and using the services and products offered by the local community. **Operation phase:** - Sharecroppers may lose their livelihood means permanently.
	12	Land Use and Utilization of	B-	B-	B-	D	**Pre-construction phase:** - 7 ha of farm land will be permanently lost.

Item	No.	Impact	Evaluation based on Scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
		Local Resources					
	13	Disturbance to Water Usage, Water Rights, etc.	C	C	D	D	N/A
	14	Disturbance to the Existing Social Infrastructure and Services	B-	D	D	D	**Construction phase:** - Since the volume of increased traffic will be small, no significant impact is anticipated. **Operation phase:** - No specific adverse effects is predicted for existing social infrastructure.
	15	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	B-	D	B-	D	**Pre-construction phase:** - The Deputy Commissioner's Office will take responsibility for initiatives to conduct local consultations concerning compensation by law. On top of that, compensation at replacement cost shall be added according to the resettlement policy framework as agreed between PGCB and JICA. **Operation phase:** - No specific impact is predicted concerning social infrastructure and local decision-making institutions.
	16	Misdistribution of Benefits and Compensation	C	C	B-	D	**Pre-Construction phase:** Landowners and other affected people must be legitimately identified for proper payment of compensation **Operation phase:** No specific impact is predicted concerning the misdistribution of benefits and compensation.
	17	Local Conflicts of Interest	C	C	B-	D	**Pre-Construction phase:** Landowners and other affected people must be legitimately identified for proper payment of compensation **Operation phase:** No specific impact is predicted concerning local conflicts of interest.
	18	Cultural Heritage	D	D	D	D	- No specific impact is predicted concerning cultural heritage.
	19	Landscape	D	D	D	D	- Substation site has been selected avoiding any protected and scenic areas to the maximum extent.
	20	Gender	D	D	D	D	No specific negative impact expected.
	21	Children's Rights	D	D	D	D	No specific negative impact expected.
	22	Infectious Diseases such as HIV/AIDS	B-	D	B-	D	**Construction phase:** - Local people will be recruited for simple work as much as possible and there is a low risk of infectious diseases being transmitted by external workers. Pre-employment and periodic medical check-ups will be conducted for external workers (technical workers, etc). **Operation phase:** - No specific negative impacts are expected.
	23	Work	B-	B-	B-	B-	**Construction phase:**

Item	No.	Impact	Evaluation based on Scoping drafts		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
		Conditions (Including Work Safety)					- The construction company shall establish a work safety plan and submit it to PGCB to obtain approval. The work safety plan shall stipulate mitigation measures on soft aspects (safety training, etc) and hard aspects (provide workers with appropriate protective equipment, etc). **Operation phase:** - The work safety plan shall be established including mitigation measures on soft aspects (safety training, etc) and hard aspects (provide workers with appropriate protective equipment, etc).
	24	Electromagnetic Field	D	B-	D	D	**Construction phase:** - No specific impact is anticipated. **Operation phase:** - No exceeding impact bigger than the present condition.
Others	25	Accidents	B-	B-	B-	B-	**Construction and Operation phase:** - As prevention measures for land traffic accidents, observation of traffic regulations, installation of traffic signs and training and education on safe driving will be implemented.
	26	Cross-boundary Impact and Climate Change	D	D	D	D	- Cross boundary and CO2 emissions are not anticipated in relation to the Substations due to small scale facility.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (Further examination is needed, and the impact may be clarified as the study progresses.)
D: No impact is expected.

6.3 Road Expansion to Modunaghat Substation

Item	No.	Impact	Evaluation based Scoping		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air pollution	B-	D	B-	D	**Construction phase:** - Prevention measures for dust dispersion will be taken by spraying water. - Maintenance of machinery will be conducted regularly, resulting in reducing exhaust gas emissions. **Operation phase:** - No specific air pollution is expected as the length of road is only about 1,000m.
	2	Water pollution	B-	B-	D	D	**Construction :** - Increased turbidity will occur within a short period. **Operation phase:** - Any slopes shall be covered with vegetation or

Item	No.	Impact	Evaluation based Scoping		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							other means to minimize soil runoff and turbid water generation.
	3	Waste	B-	B-	B-	D	**Construction phase:** - General waste and hazardous waste are generated by the construction work. **Operation phase:** - No General waste and hazardous waste are expected.
	4	Noise and Vibration	B-	D	B-	D	**Construction phase:** - Construction machinery and vehicles will be maintained regularly. - Low-noise/ low-vibration machinery will be used. - Noise levels generated from construction machinery will meet noise level standards at the nearest residential area. **Operation phase:** - No specific noise and vibration is expected.
Natural Environment	5	Natural reserve	D	D	D	D	**Pre-construction and Operation phases:** - The expanding road will be constructed by using slope of existing road covered with grass or man-planted trees and rice field, so that Natural resources are not seen.
	6	Ecosystem	D	D	D	D	**Construction phase:** - The each side of road was paddy field and no any protected areas near. - There are no flora species listed in the IUCN Red list in/along the road. -Precious species of insects, amphibians, reptiles, mammals and birds designated by IUCN are not observed in/along the road. **Operation phase:** - Flora and Fauna along the road are observed widely.
	7	Geography and Geology	C-	C-	D	D	**Construction and Operation phases:** - The site of road was selected avoiding any steep sloping land. - Any slopes shall be covered with vegetation to minimize soil runoff and turbid water generation.
Social Environment	8	Land Acquisition and Resettlement	B-	D	B-	D	**Pre-construction phase:** - Expansion of road will require 1,000m x 2m = 2,000m^2 of land. - Land acquisition will be conducted on the basis of compensation at replacement cost. - Trees within clearance distance from cables will be removed. - Standing crops and trees will be compensated at market price.
	9	Disturbance to Poor People	B-/C-	B-/C-	B-	D	**Pre-construction:** - Sharecroppers may lose their livelihood means temporarily or partially.
	10	Disturbance to Ethnic Minority	D	D	D	D	**Pre-construction and Operation phases:** - No ethnic minority groups or indigenous people were identified.

Item	No.	Impact	Evaluation based Scoping		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
		Groups and Indigenous People					
	11	Deterioration of Local Economy such as Losses of Employment and Livelihood Means	B-/C-	B-	B-/B+	D	**Pre-construction and Construction phases:** - Sharecroppers may lose their livelihood means temporarily during construction period. - As mitigation measures, employing as many local residents as possible, and using the services and products offered by the local community.
	12	Land Use and Utilization of Local Resources	B-	B-	B-	D	**Pre-construction phase:** - Land acquisition for road expansion may hinder specific activities at homesteads and farm land along the road.
	13	Disturbance to Water Usage, Water Rights, etc.	C-	C-	D	D	N/A
	14	Disturbance to the Existing Social Infrastructure and Services	B-	D	D	D	**Construction phase:** - Since the volume of increased traffic will be small, no significant impact is anticipated. **Operation phase:** - No specific adverse effects is predicted for existing social infrastructure.
	15	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	B-	D	B-	D	**Pre-construction phase:** - The Deputy Commissioner's Office will take responsibility for initiatives to conduct local consultations concerning compensation. On top of that, compensation at replacement cost shall be added according to the resettlement policy framework as agreed between PGCB and JICA. **Operation phase:** - No specific impact is predicted concerning social infrastructure and local decision-making institutions.
	16	Misdistribution of Benefits and Compensation	C-	C-	B-	D	**Pre-Construction phase:** -Landowners and other affected people must be legitimately identified for proper payment of compensation **Operation phase:** -No specific impact is predicted concerning the misdistribution of benefits and compensation.
	17	Local Conflicts of Interest	C-	C-	B-	D	**Pre-Construction phase:** -Landowners and other affected people must be legitimately identified for proper payment of compensation **Operation phase:** -No specific impact is predicted concerning the misdistribution of benefits and compensation.
	18	Cultural Heritage	D	D	D	D	- No specific impact is predicted concerning cultural heritage.
	19	Landscape	D	D	D	D	- Road expansion will not harm scenic areas.
	20	Gender	D	D	D	D	No specific negative impact expected.

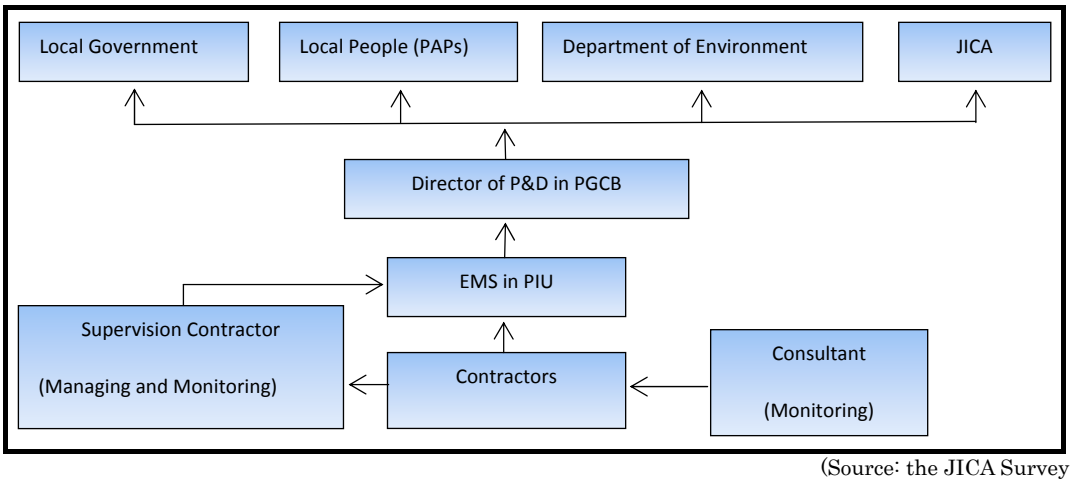
Item	No.	Impact	Evaluation based Scoping		Evaluation based on survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
	21	Children's Rights	D	D	D	D	No specific negative impact expected.
	22	Infectious Diseases such as HIV/AIDS	B-	D	B-	D	**Construction phase:** - Local people will be recruited for simple work as much as possible and there is a low risk of infectious diseases being transmitted by external workers. Pre-employment and periodic medical check-ups will be conducted for external workers (technical workers, etc). **Operation phase:** - No specific negative impacts are expected.
	23	Work Conditions (Including Work Safety)	B-	B-	B-	B-	**Construction phase:** - The construction company shall establish a work safety plan and submit it to PGCB to obtain approval. The work safety plan shall stipulate mitigation measures on soft aspects (safety training, etc) and hard aspects (provide workers with appropriate protective equipment, etc). **Operation phase:** - The work safety plan shall be established including mitigation measures on soft aspects (safety training, etc) and hard aspects (provide workers with appropriate protective equipment, etc).
	24	Others	C-	C-	D	D	N/A
Others	25	Accidents	B-	B-	B-	B-	- As prevention measures for land traffic accidents, observation of traffic regulations, installation of traffic signs and training and education on safe driving will be implemented.
	26	Cross-boundary Impact and Climate Change	D	D	D	D	- Cross boundary and CO2 emissions are not anticipated in relation to access road due to a short length of road.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (Further examination is needed, and the impact may be clarified as the study progresses.)
D: No impact is expected.

7.0 Mitigation of Impacts:

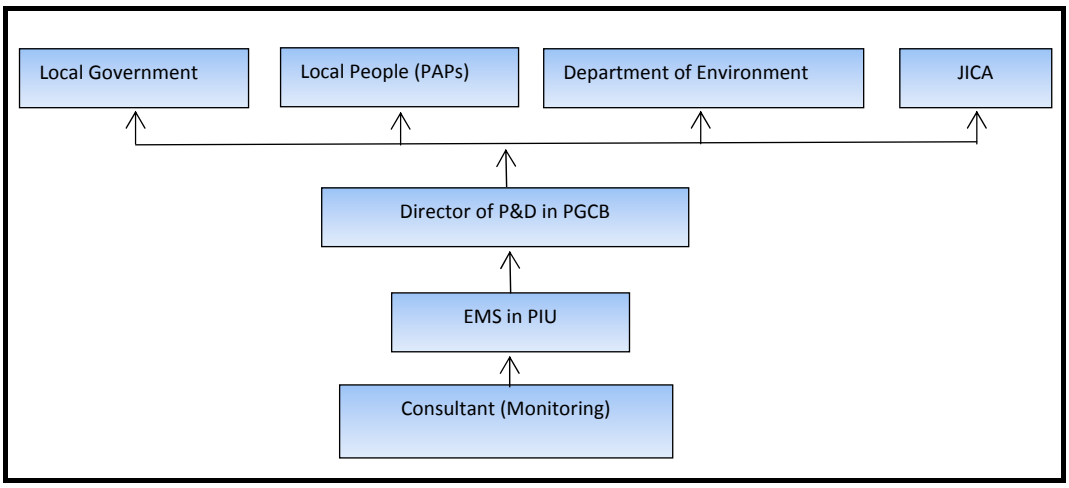
The **Environmental Management and Monitoring Implementation Structure** during construction phase and operation phase are given below:

a) Construction phase:



(Source: the JICA Survey Team)

b) Operation phase:



(Source: the JICA Survey Team)

8.0 Environmental Management Plan (EMP):

a) Construction Phase:

No	Potential Impact to be Managed	Sources of Potential Impact	Management Effort	**Management Location**	**Period of Management**	Management Institution
Pre-construction Stage:						
1	Land acquisition	- Loss of land at tower bases - new Madunaghat substation	- Towers are constructed in non-residential areas - Land acquisition should be conducted in compliance with relevant laws and regulations - Cost related to relocation (if any) will be given to the relocated residents	- Tower bases - Site of Madunaghat Substation	- During land acquisition process	- Office of the Deputy Commissioner - PGCB
2	Social Institutions	- Changes in people's	- Compensation should be conducted in	- Tower bases	- Prior to	- Office of the Deputy

No	Potential Impact to be Managed	Sources of Potential Impact	Management Effort	**Management Location**	**Period of Management**	Management Institution
	such as Social Infrastructure and Local Decision-making Institutions	thinking through interacting with local government officers, local residents and others in the land acquisition procedure	compliance with relevant laws and regulations	- Site of Substation	the start of construction	Commissioner - PGCB
Construction Stage:						
1	Air Quality	1) Dust resulting from construction work 2) Exhaust gas from construction machinery and vehicles used for mobilization of equipment 3) Air pollution arising from incineration of construction materials and waste	1) Dust prevention - Watering access roads and construction site, especially in the dry season - Using cover sheet on trucks for the transportation of soil 2) Gas emission prevention - Periodic maintenance and management of all construction machinery and vehicles 3) Waste management - Prohibit open burning and illegal dumping	1) - 3) - Construction area	1) - 3) -During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant
2	Water Quality	1) Run off water from construction area 2) Domestic wastewater of workers 3)Inappropriate disposal of waste	1) Run off water - Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of the construction area with concrete, as necessary based on geological survey 2) Domestic wastewater - Install wastewater treatment facility for workers, such as septic tanks 3) Waste management - Prohibit illegal waste disposal	1) - 3) - Construction area	1) - 3) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB / Supervision Consultant
3	Waste	1) Construction waste from construction work 2) Domestic waste from workers 3) Hazardous waste such as dry batteries, etc.	1), 2) Construction and domestic waste - Conduct separate waste collection and promote recycling and reuse - Appropriate disposal of non-recyclable waste according to rules 3) Hazardous waste - Hazardous waste should be treated under the related regulations	1) - 3) - Construction area	1) - 3) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant

No	Potential Impact to be Managed	Sources of Potential Impact	Management Effort	**Management Location**	**Period of Management**	Management Institution
4	Noise and Vibration	1) Noise and vibration caused by construction machinery 2) Noise caused by vehicles used for mobilization of equipment and workers	1) Construction machinery - Optimizing construction schedule - Perform construction work during daytime, especially piling work -Using low-noise/ low vibration equipment, as much as possible 2) Mobilization - Limit truck speed, especially around residential areas	1), 2) - Construction area	1), 2) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant
5	Ecosystem	1) Removal of vegetation 2) Loss of protected species	1) Vegetation - Tower construction area should be re-vegetated with native plants 2) Protected species - Consult with specialists about moving individual animals if any protected species are discovered	1), 2) - Transmission line route	1), 2) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant
6	Topography and Geology	- Soil runoff	- Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of construction areas with concrete, as necessary based on geological survey	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant
7	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Loss of farmlands, being kept out of construction zones	- Employ as many local residents as possible - Use the services (i.e., laundry and catering services, etc.) and products offered by the local community	- Villages along the transmission line route and substation	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant
8	Land Use and Utilization of Local Resources	- Changing the traditional land usage patterns and utilization of local resources	- Employ as many local residents possible - Use the services (i.e., laundry and catering services, etc.) and products offered by the local community	- Villages along the transmission line route and substation	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant
9	Disturbance to Water Usage, Water Rights, etc.	- Water pollution caused by soil runoff	- Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of construction areas with concrete, as necessary	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor:

No	Potential Impact to be Managed	Sources of Potential Impact	Management Effort	**Management Location**	**Period of Management**	Management Institution
			based on geological survey -Re-greening in construction areas			PGCB/ Supervision Consultant
10	Cultural Heritage	- Further destruction of buried cultural heritage due to engineering work	- Stop construction work if any cultural heritage area is discovered and immediately consult with specialists	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant
11	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during construction may increase risk of infection	- Establish medical center and implementation of periodic medical check-ups - Education and training on workers' health care	- Construction area	- During construction phase	- Implementation: Contractor - Supervisor: PGCB
12	Work Conditions (including work safety)	Labor accidents	- Prepare a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate during the construction period - Use facilities and equipment that protects against electric shocks	- Construction area	- During construction phase	- Implementation: Contractor - Supervisor: PGCB
13	Accidents	1) Traffic accidents 2) Soil runoff and tower breakages	1) Traffic accidents - Observation of traffic regulations, installation of traffic signs and education on safe driving - Training safe operation of vehicles 2) Soil runoff and tower breakages - Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of the construction area with concrete, as necessary based on geological survey	1) Construction area 2) Roads near the construction area	1), 2) - During construction phase	- Implementation: Contractor - Supervisor: PGCB

b) Operation Phase

No	Potential Impact to be Managed	Sources of Potential Impact	Management Effort	Management Location	Period of Management	Management Institution
1	Water Quality	- Run-off water from tower bases and substation	- Re-vegetation of the tower bases and slopes in substation site	- Tower bases -Substation	- During the inspection work	PGCB
2	Waste	N/A	N/A	N/A	N/A	N/A
3	Ecology	- Birds striking the lines	- Installation of lights and signs, etc., if needed	- Along the transmission line route	- During the inspection work	PGCB
4	Topography and Geology	- Soil runoff	- Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of construction area with concrete, as necessary based on geological survey	- Along the transmission line route -Inside Substation site	- During the inspection work	PGCB
5	Work Conditions (including work safety)	Labor accidents	- Prepare a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate during the construction period - Use facilities and equipment that protects against electric shocks	- Along the transmission line route	- During the inspection work	PGCB
6	Accidents	1) Traffic accidents 2) Soil runoff and tower breakages	1) Traffic accidents - Observation of traffic regulations, installation of traffic signs and education on safe driving - Training safe operation of vehicles 2) Soil runoff and tower breakages - Transmission line route was selected avoiding any steep sloped areas - Preventing soil loss by stabilizing any slopes of the construction area with concrete, as necessary based on geological survey	1) Roads near the construction area 2) Along the transmission line route	- During the inspection work	PGCB

9.0 Risk Assessment & Emergency Response Plan:

Risk Assessment:

In the substation, there are buses, protective devices, transformers etc. Transformers are filled up with mineral oil. Due to high fault current and malfunction of protective devices, the power transformer can burst with fire. . Apart from risks associated with emissions, noise generation, solid waste, hazardous waste and wastewater disposal as a result of construction and operation, substations put human beings and the environment inside and outside of the substation to a certain degree of risk of accident and sometime loss of life. It is therefore essential that a risk management plan should be devised in order to both reduce risk of accident and to take the correct action during accidents. Important risks of accidents in substation disasters or emergency situations may occur during following events:

- Risks during emergency: Fire, Explosion, Oil/acid spillage, Toxic chemical spillage, Electrocution
- Risks due to natural disasters: Flood, Cyclone, Earthquake, Storm, Lightning,
- Risks due to external threats: Sabotage, War situation, Water/food poisoning

In substation, accidents can occur at two different levels. First, these may occur due to fires, explosions, oil or chemical spillage and spontaneous ignition of inflammable materials. In such events, operators working inside the substation and at various strategic hazard locations will be affected.

Second, risks are also associated with external threats of sabotage. Failure of automatic control/warning systems, failure of mineral oil storage tanks and chemical release from acid and alkali stores and handling also pose great degree of associated risks.

Emegency Response Plan:

Emergency response plans are developed to address a range of plausible risk scenarios and emphasize the tasks required to respond to a physical event. The emergency response plan (ERP) for the proposed substation and transmission lines has been developed listing various actions to be performed in a very short period of time in a pre-determined sequence if it is to deal effectively and efficiently with any emergency, major accident or natural disaster.

The primary objective of the plan is to keep the loss of life, material, machinery/equipment damage, and impacts on the environment to minimum.

10.0 Environmental Monitoring Plan:

No	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Organization	Cost
					Method of Collecting and Analyzing Data	Location	Duration and Frequency		
Pre-Construction									
1	Land acquisition	- Loss of land at tower bases - Kept out of the construction zone - Trees will be removed if they are within clearance distance	- the Acquisition and Requisition of Immovable Property Ordinance 1982 - JICA Guidelines for Environmental and Social Considerations (2010)	- Confirmation of compensation process	- Attendance of compensation payment	- Areas for compensation	- During land acquisition process	- Deputy Commissioner's Office - PGCB	PGCB
2	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	- Changing peoples` thinking through interacting with local government officers, local residents and others in the land acquisition procedure	-----	- Confirmation of affected peoples' feelings	- Interviewing affected people	- Affected people	- Once after compensation	PGCB	PGCB

No	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Organization	Cost
					Method of Collecting and Analyzing Data	Location	Duration and Frequency		
3	Misdistribution of Benefits and Compensation	- Can occur among residents, workers, government officers, and local politicians	-----	- Same as those addressed in Land acquisition	- Same as those addressed in Land acquisition	- Same as those addressed in Land acquisition	- Same as those addressed in Land acquisition	PGCB	PGCB
4	Local Conflicts of Interest	- Can occur among residents, workers, government officers, and local politicians	-----	- Same as those addressed in Social institutions	- Same as those addressed in Social institutions	- Same as those addressed in Social institutions	- Same as those addressed in Social institutions	PGCB	PGCB
Construction Phase									
1	Air Quality	1) Dust resulting from construction work 2) Exhaust gas from construction machinery and vehicles used for mobilization	PM_{10} Ambient Air Quality Standard SO2,NO2	Evaluation of effect of the mitigation measures towards air pollution	Collecting samples and analyzing at a lab.	4 points Construction sites and surroundings, especially residential areas.	Once every three months	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant	Expenses included in contract cost by Contractor

No	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Organization	Cost
					Method of Collecting and Analyzing Data	Location	Duration and Frequency		
		of equipment							
2	Water Quality	1) Run off water from construction site 2) Domestic wastewater of workers 3) Inappropriate disposal of waste 4) Leakage of oil and chemical materials from construction activity	PH, BOD, SS, Oil, Coliforms, Wastewater standards Ambient water quality standards	Evaluation of effect of the mitigation measures towards water pollution	Collecting samples and analyzing at a lab	(Substation) 1 point- Foreside of the drain outlet. 3 points- Construction sites and surroundings, especially residential areas.	Once every three months	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant	Expenses included in contract cost by Contractor
3	Waste	1) Construction waste from construction work 2) Domestic	1) - 3) - Waste Management Rules	1) - 3) - Evaluation of effect of the mitigation measures for	1) - 3) - Record of kinds and quantity of waste, and the	1) - 3) - Construction area	1) - 3) - Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor:	Expenses included in contract cost by Contractor

No	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Organization	Cost
					Method of Collecting and Analyzing Data	Location	Duration and Frequency		
		waste from workers 3) Hazardous waste such as dry batteries, etc.		waste	disposal method			PGCB/ Supervision Consultant	
4	Noise and Vibration	1) Noise and vibration caused by construction machinery 2) Noise caused by vehicles used for mobilization of equipment and workers	Noise level Noise level standards	Evaluation of effect of the mitigation measures towards noise level	Measurement using noise level meter	7 points- Construction sites and surroundings, especially residential areas. (sampling sites of survey for environment)	Once every three months	Expenses included in contract cost by Contractor	Expenses included in contract cost by Contractor
5	Ecosystem (Endangered Species)	- Existence of endangered species	Species, Number - Bangladesh Wild Life (Preservation) (Amendment) Act, 1974 - JICA Guideline (2010)	- Confirmation of endangered species existence	1), 2) - Observation	lines - Near rivers and Forest Hill	- Once a week in migration season	- Implementation: Contractor/ Environmental Consultant - Supervisor: PGCB/ Supervision Consultant	Expenses included in contract cost by Contractor

No	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Organization	Cost
					Method of Collecting and Analyzing Data	Location	Duration and Frequency		
6	Work Environment (Including Work Safety)	- Labor accidents	- Handling heavy loads - Working at heights - Electric shocks	- Evaluation of effect of the work safety plan	- Record of accidents	- Contractor's office	- Once a year	- Implementation: Contractor - Supervisor: CPGCBL	Expenses included in contract cost by Contractor
7	Accidents	- Traffic accidents	- Land traffic	- Evaluation of effect of traffic schedule	- Record of accidents	- Contractor's office	- Once a year	- Implementation: Contractor - Supervisor: CPGCBL	Expenses included in contract cost by Contractor.
Operation Stage									
1	Ecosystem (Endangered species)	- Existence of the towers and cable	**Species, Number** - Migratory birds	- Confirmation of bird strikes	- Observation	5 lines - Near rivers and Forest Hill	- Once a month in migration season	- PGCB/ Environmental Consultant	PGCB
2	Work Environment (Including Work Safety)	1) Labor accidents	- Handling heavy loads - Working at heights - Electric shocks	- Evaluation of effect of the work safety plan	- Record of accidents	- PGCB office	- Once a year	PGCB	PGCB

11.0 Public Consultation:

Survey has been conducted in the seven sampling points along the proposed 400kV transmission and in and around the proposed Madunaghat 400kV substation in two ways – i. Quantitative approach and ii. Qualitative approach. For quantitative approach, standard questionnaire (socio economic and environmental issues) has been used for interviewing randomly selected respondents in the proposed area. On the other hand, for qualitative approach, focus group discussion guidelines have been followed.

For Quantitative approach, **184 respondents** have been randomly selected from the seven sampling points along the proposed 400kV Transmission line and **36 respondents** (affected land owners) in the proposed Madunaghat 400kV substation.

For Qualitative approach, **14 Focus Group Discussions** in seven sampling points along the proposed transmission line and **4 Focus Group Discussions** in the proposed Madunaghat substation were conducted. Apart from FGDs, in-depth interviews were also conducted with local administrative authorities and public representatives of different upazilas along the proposed transmission line and substation.

The findings of Public consultations are summarized as follows:

Positive perceptions:

- Bangladesh will be developed
- Agricultural sector will be benefited
- Education system of Bangladesh will be benefited
- Employment opportunities will be created in the project area
- Load shedding will decrease/power shortage will decrease
- Industrial sector will flourish with job opportunities and increase the number of job vacancies
- The lifestyle of local people will be improved
- The demand of everyday electricity consumption will be fulfilled
- It will further improve the technological aspect of this country
- Social development will be achieved.

Negative perceptions:

- The establishment of the transmission line/Sub-Station may result in cutting down of many trees
- Many birds may lose their lives from electrical short-circuit
- Some Crops may be damaged
- Day by day Agricultural lands will decrease
- Environment will be polluted due to rapid industrialization
- The natural habitat of mammalian / birds will be affected.

Balanced Perceptions:

As the 400 kV Transmission Line/ Sub-Station will go over the populated villages, it has to be kept in mind that its establishment does not create any negative social, economic and environmental impact. The health issues of the population have to be prioritized and focused so that they do not become a victim from the project. If there is damage to the land acquired trees, houses, proper compensation has to be provided.

12.0 Conclusions and Recommendatoions:

12.1 Conclusion

a) Transmission Lines:

The routes of all transmission lines have been selected avoiding households, trees and protected areas. Some part of 400kV transmission line will pass through reserved forest area only. As per Electricity Act, no land acquisition will be required for construction of transmission lines. Construction area for the transmission line can be reused for farming after the completion of the construction, except for the $2m^2$ x 4 = $8m^2$ of land for tower bases, and any adverse effects on income will be very limited.

As the land to be acquired for each transmission tower is small, it is not expected that there will be any semi-permanent loss of livelihood means. Also, all standing crops and trees lost by the land owners will be compensated with a market price.

The transmission line route has been selected to avoid steep sloping land, and any slopes used shall be reinforced with concrete, plantation or other means to minimize soil runoff and turbid water generation.

Installing lights or signs will be considered in order to prevent birds from striking the transmission lines.

a) Sub-stations:

The proposed Meghnaghat 400kV substation and old Madunghat 230kV substation will be located within the PGCB's own land already acquired and developed. So, no land acquisition will be required for these two substations. However, the proposed madunaghat 400kV substation will require land acquisition causing loss of livelihood of affected land owners. It was suggested to compensate the affected land owners with adequate compensation for land and standing crops etc.

The study reveals that the adverse impacts of construction of transmission lines and substations on natural and social environment are very low. These could be offset or minimized if the mitigation measures are adequately implemented.

12.2 Recommendation

The environmental assessment carried out for the proposed 400kV transmission line from Meghnaghat to Matarbari via Madunaghat and the proposed 400kV and 230kV substations suggests low scale of adverse impacts, which can be reduced to acceptable level through recommended mitigation measures as mentioned in the Environmental Management Plan. It is therefore recommended that the proposed transmission lines and substations may be installed, provided the suggested mitigation measures are adequately implemented. It is also recommended that the environmental monitoring plan be effectively implemented in order to identify any changes in the predicted impacts and take appropriate measures to off-set any unexpected adverse effects.

Chapter I Introduction

1.1 Background

Given a steep increase in the power demand in Dhaka and surrounding area, the Power Grid Company of Bangladesh Limited (PGCB) is facing urgent needs to increase transmission capacity from power generation facilities located in Chittagong to Dhaka. For assessing the project viability of capacity enhancement of the power transmission capacities with high voltage and facility improvement of the National Load Dispatching Center (NLDC), the Government of Bangladesh (GOB) has agreed with Japan International Cooperation Agency (JICA) to jointly conduct a feasibility study on high voltage transmission line network between Dhaka and Chittagong and signed the minutes of meeting.

So, Japan International Cooperation Agency (JICA) has appointed Tokyo Electric Power Company Limited (TEPCO), hereafter “JICA Study Team” to conduct a preparatory survey on Dhaka-Chittagong main power grid strengthening project.

Presently, environmental conservation is being given top priority worldwide. In Bangladesh also, for any new project, as well as plants under operation, it is mandatory to obtain environmental clearance from the Department of Environment (DoE), under Environment Conservation Act 1995, amended from time to time. According to Bangladesh Environment Conservation Rules 1997 (ECR), the 400kV transmission line project falls under the **"Red Category",** so far as environmental impact is concerned. Initial Environment Examination (IEE) followed by Environmental Impact Assessment (EIA), including Environmental Management Plan (EMP) are required for these types of installations for getting environmental clearance from DoE.

PGCB has initiated the environmental clearance from DoE and in the process, the company has already obtained IEE clearance from DoE for exemption of IEE and approval of TOR for EIA vides Memo No. DoE/Clearance/5339/22014/229 dated 11/09/2014. Copy of this Letter is given under **Annex-1.1.** . It is now required to obtain EIA clearance. TEPCO (JICA Study Team) has been engaged by JICA for such activities, for preparation of EIA.

1.2 Purpose of the Study

Environmental conservation is being given top priority worldwide. In Bangladesh also, for any new project, as well as plants under operation, it is mandatory to obtain environmental clearance from the Department of Environment (DoE), under Environment Conservation Act 1995, amended from time to time. According to Bangladesh Environment Conservation Rules 1997 (ECR), the 400kV transmission line project falls under the **"Red Category",** so far as environmental impact is concerned. Initial Environment Examination (IEE) followed by Environmental Impact Assessment (EIA), including Environmental Management Plan (EMP) are required for these types of installations for getting environmental clearance from DoE.

1.3 Need of the Project

Bangladesh Power Development Board (BPDB) is planning to develop a (2x600) 1200 MW Thermal Power Projects based on imported coal each at Matarbari (Cox'sbazar). Power from the generation projects at Matarbari would be partly consumed at the nearby areas like Chittagong, while the major portion of the power would be brought to the capital city Dhaka. Power from Matrbari to Dhaka is envisaged to be transferred through Meghnaghat-Madunaghat-Matarbari 400kV high capacity transmission system.

BPDB is also envisaging to develop various high capacity generation projects in the Maheshkhali and Anowara area. Powers from these projects are envisaged to be brought to Dhaka area through high capacity 400kV corridors. The proposed MeghnaghatMadunaghat-Matarbari 400kV line would be integrated with the future high capacity transmission system for evacuation of power from generation projects in the Maheshkhali & Anowara area to Dhaka.

1.4 Importance of the Project

Chittagong is major industrial and port city of Bangladesh. Due to having port facilities, industrial growth at Chittagong is very high. With the industrial growth, power demand at Chittagong is increased very rapidly. On the other hand, power generation at Chittagong area is low due to fuel shortage. At Present, Chittagong is connected with Dhaka via Comilla by two 230 kV circuits (Hathazari – Comilla – Meghnaghat) & two 132 kV circuits (Hathazari – Feni – Comilla – Haripur). These lines are not at all sufficient to supply near future demand of Chittagong area. Under these circumstances, at first phase, PGCB has planned to establish 400kV Meghnaghat-Madunghat transmission line initially which will be charged at 230kV to supply reliable power to Chittagong. In 2nd phase, after construction of Coal Base Power Plants at South Chittagong (Matarbari) in 2022, it will be charged at 400kV to evacuate power. In addition to this transmission line, Matarbari-Madunaghat 400kV line and two 400/230kV S/S at Meghnaghat and Madunaght respectively will also be required in second phase to evacuate this power to Dhaka and Chittagong city.

1.5 Scope of the EIA Study

For Environmental Impact Assessment study, the following major activities are required to be undertaken:

(a) Study of the relevant documents on policy, legal and administrative framework and their review, particularly on environmental aspects and effluent discharge limits, health and safety requirements, identification of sensitive areas and endangered species, land use etc.

(b) Carrying out an environmental baseline survey covering areas in and 2 km around the project site i.e. Study Area.

(c) Identification of major project activities, both during construction and operational phases of the project.

(d) Identification and prediction of environmental impacts of project activities on the surrounding environment, including cumulative impacts of the proposed power plant and the existing and ongoing projects/industries on selected environmental attributes.

(e) Identification of the most significant environmental and social impacts and suggestions for mitigation measures in order to reduce/eliminate negative impacts and to enhance positive impacts.

(f) Arrangement of public consultation meetings to consult with potentially affected people.

(g) Development of Environmental Management Plan (EMP) for both construction as well as operational phases of the project.

(h) Development of Corporate Environmental Policy for the project authority regarding environmental protection and sustainability.

(i) Analysis of the alternatives to the proposed project site, technology, design and operation.

(j) Identification of environmental and health risks associated with major accidents, natural disasters and external threats and recommendations for measures to be taken for reduction of these risks.

1.6 EIA Team

A Study Team was constituted comprising of specialists on various aspects for conducting the environmental impact assessment of the project. The list of team members is given in the following table:

Table-1.6 : List of EIA Study Team Members

Sl. No.	Position	No. of Specialists
1.	Team Leader	1
2.	Environmental Specialist\	1
3.	Social Research Specialist	1
4.	Biologists	2
5.	Geotechnical Exper	1
6.	Geomorphologist	1
7	Transmission Line Expert	1
8.	Legal Specialist	1
Total		9 Nos.

Tasks assigned

Tasks assigned to the individual experts are as follows:

Team Leader

(i) Monitor the activities of Social Environmental survey.

(ii) Monitor the activities of Natural Environmental survey.

(iii) Supervise the preparation of survey reports

(iv) Liaison with PGCB.

(v) Attend meetings with concerned authorities.

Environmental Specialist

(i) Guide the Natural Environmental survey team in conducting the survey.

(ii) Investigate and study the relevant documents.

(iii) Compile the results of Natural Environmental survey and document investigation and study.

(iv) Prepare Natural Environmental survey reports.

(v) Attend meetings with the concerned authorities.

(vi) Report to the Team Leader..

Social Research Specialist

(i) Develop questionnaire for social survey.

(ii) Organize Focused Group Discussions (FGD) in the project area.

(iii) Train the field supervisors and field investigators in conducting social survey.

(iv) Supervise social survey activities.

(v) Compile the results of survey and prepare survey reports.

(vi) Attend meetings with concerned authorities.

(vii) Report to the Team Leader.

Biologists

(i) To conduct survey of flora and fauna along the route of the proposed 400kV transmission line

(ii) To prepare survey reports

(iii) To report to Team leader

Geo-Technical Expert

(i) To investigate soil condition along the proposed transmission line

(ii) Topographic survey, land use and right of way survey

(iii) To prepare survey reports

(iv) To report to Team leader

Geo-morphologist

(i) To study hydro-geology along the route of TL

(ii) To study morphology of the major rivers in the project area

(v) To prepare study reports

(iii) To report to Team leader

Transmission Line Expert

(i) To study candidate routes of TL

(ii) To select the best route of TL

(iii) To prepare study reports

(iv) To report to Team leader

Legal Specialist

(i) To study on legislative and regulatory considerations

(ii) To discuss thev policy, legal and administrative framework within which the environmental ans social asserssment is carried out in Bangladesh

(iii) To identify relevant international environmental agreements to swhich Bangladesh is a party

(iv) To prepare study reports

(v) To report to Team leader

Chapter II Legal and Legislative Framework, Regulation and Policy Considerations

2.1 Overview

According to the national environmental legislation of Bangladesh all development projects are governed by some legal and institutional requirements. As such, assessment of relevant legal provisions, policies, strategies and institutional issues are very important for any project proponent or developer before execution of a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. Before initiating any development project, it is hence required to obtain environmental clearance from DOE. The activities of the power sector projects of Bangladesh Government fall under the 'red' category according to the Bangladesh Environment Conservation Rules (ECR) 1997 and therefore, need to conduct IEE and EIA studies to obtain site and environmental clearance from the DOE.

The following activities have been carried out under the EIA study:

- Identification of national legal obligations in relation to the interventions which will be required to review under the EIA study of the proposed 400kV transmission line;
- Exploration of the national legislative provisions and policy guidelines on environmental sectors;
- Identification of the international legal obligations and relevant provisions of multilateral environmental agreements related to the proposed project interventions;
- Exploration of national and international legal provisions on the 400kV transmission line development sector; and
- Identification of the standard guidelines at regional and international level related to the 400kV transmission line setup.

2.2 Provision under national law and by-laws

2.2.1 Provisions under the Environmental Legislations

National laws, by-laws and official resolutions relevant to coal based thermal power plant installation, operation and maintenance and associated activities have been identified under this study. Under the national legal framework the proposed intervention needs to comply with the environmental legislations of the land and needs to fulfill the requirements that

The ***Bangladesh Environment Conservation Act of 1995*** (ECA, 95) is the key legislation in relation to environment protection in Bangladesh. This Act is promulgated for environment conservation, standards, development, pollution control, and abatement. It has repealed the Environment Pollution Control Ordinance of 1977. The Act has been amended in 2000, 2002, 2007 and has been proposed for amendments in the year 2010.

The main objectives of the Act are:

- Conservation and improvement of the environment; and

- Control and mitigation of pollution of the environment.

The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas;
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of the industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines.

Before any new project/development interventions by the government or by non government agencies can go ahead, as stipulated under the Environment Conservation Rules 1997, the project promoter must obtain Environmental Clearance from the Director General of DOE. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment of imprisonment or fine or both. The DOE executes the Act under the leadership of the Director General.

The Bangladesh Environment Conservation Act (Amendment), 2000 focuses on: (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

The Bangladesh Environment Conservation Act (Amendment), 2002 elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

The Bangladesh Environment Conservation Rules, 1997 is the first set of rules, promulgated under the ECA 95 (so far there have been three amendments to this set of rules - February and August 2002 and April 2003). The Environment Conservation Rules of 1997 has provided categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects.

Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc., (ii) the requirement for and procedures to obtain environmental clearance, and (iii) the requirement for IEE and EIA's according to the categories of industrial and other development interventions.

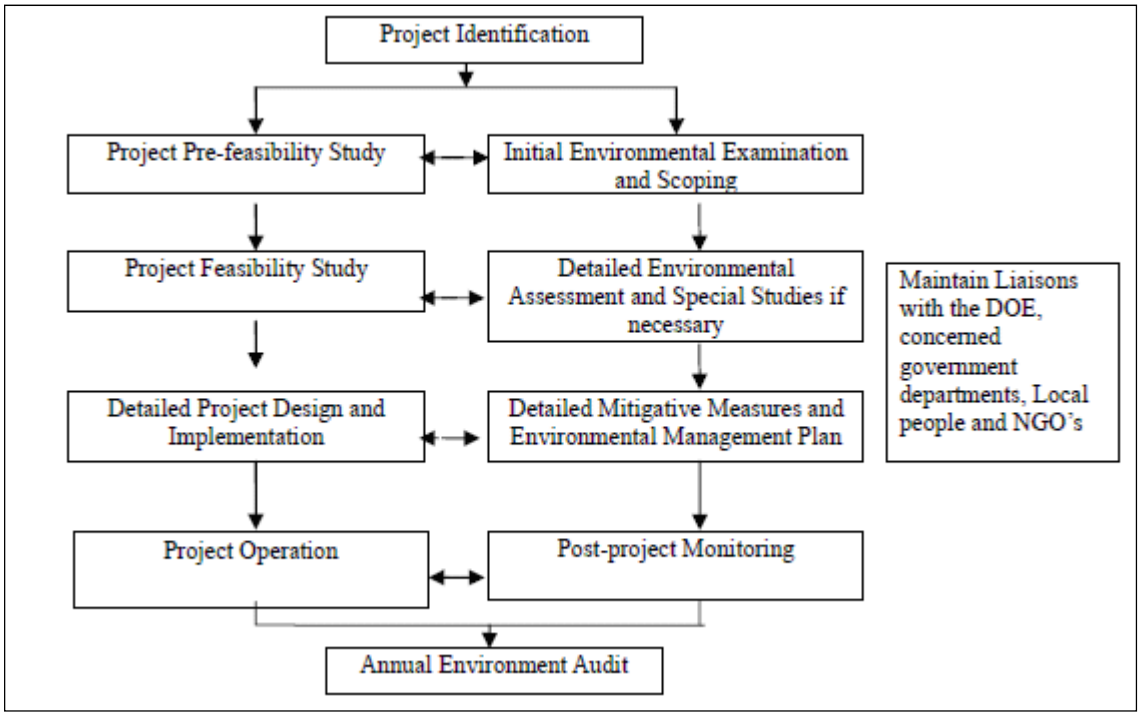
The Rules are not explicit for various oil and gas exploration interventions. Rather, this is covered under the broader heading of "exploration, extraction and distribution of mineral resources" under the 'Red' category projects.

The proposed project, according to the DOE, is considered under the Red category of the Environment Conservation Rules, 1997 (Item 65: Exploration, extraction and distribution of mineral resources).

2.2.2 Compliance with DOE's EIA Guidelines

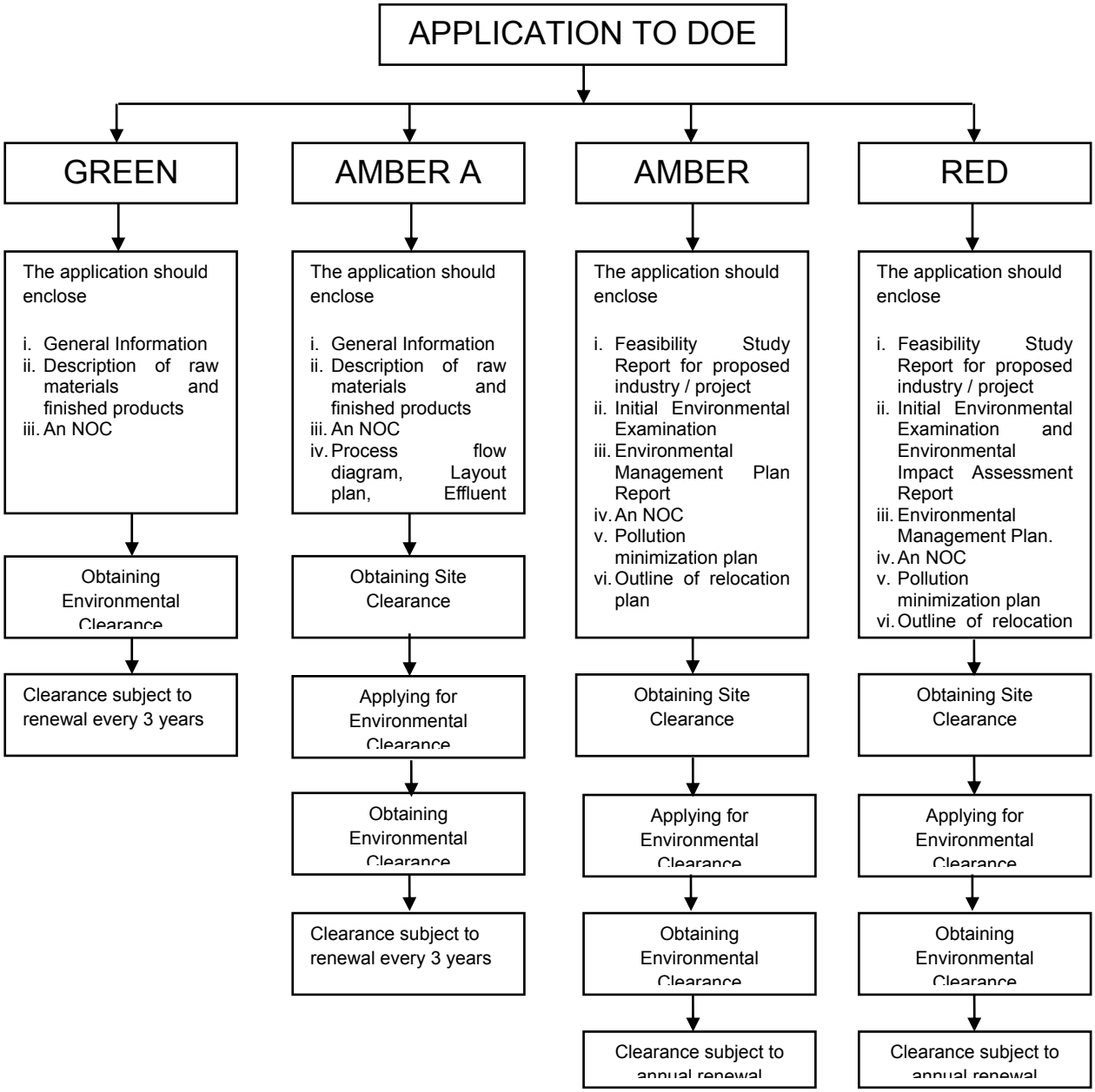
As mentioned the project activities fall under the 'Red' category according to the Environment Conservation Rules 1997. For projects under this category, it is mandatory to carry out EIA including Environmental Management Plan (EMP) and to develop a Resettlement Action Plan where required, for getting environmental clearance from the DOE. The DOE has issued *EIA Guidelines for Industries* (this document was released in December 1997) and addresses the IEE and EIA for several industrial sectors and activities. Each Project Proponent shall conduct an IEE or EIA and is expected to consult and follow the DOE guidelines (Figure 2.2-1). Under this study the provisions of the environment legislations and the EIA guidelines of the DOE will be painstakingly reviewed.

The DOE has issued application procedure for obtaining site/environmental clearance. Figure 2.2-2 shows the application procedure of all four categories:



(Source: EIA Process, EIA Guideline for Industries, Department of Environment, 1997)

Figure 2.2-1 Flow Chart of EIA Process



NOC = No Objection Certificate, usually obtained from local government.

(Source: EIA Process, EIA Guideline for Industries, Department of Environment, 1997)

Figure 2.2-2 Process of obtaining clearance certificate from DOE

2.2.3 Compliance under the National Laws

Wildlife (protection and safety) Act 2012

The Wildlife (protection and safety) Act 2012, passed in Parliament on 8th July, 2012. Under this act, the hunting, trapping, killing of wildlife are strictly prohibited. After the establishment of this Act, a board will be formed with the concerned members recommended by the Government. There are certain provisions kept in this Act, i.g entrance, management, rules and regulation of the protected area etc. If any person without license performs any kind of trade, he will be jailed for at least a year.

The Forest Act, 1927 and Amendment Act 2000

The Forest Act of 1927 provides for reserving forests over which the government has an acquired property right. This act has made many types of unauthorized uses or destruction of forest produce punishable. The Government may assign any village community its right to or over any land, which has constituted a reserved forest.

According to the Act the government may prohibit certain activities in the declared reserved forest area such as any intervention kindles, keeps or carries any fire; trespasses or pastures cattle, or permits cattle to trespass; causes any damage by negligence in felling any tree or cutting or dragging any timber; etc.

Near the proposed route of the 400kV transmission line, reserved forest exists. Therefore, the proposed project complies with this requirement of legislation. During the EIA study this law, and rules and regulations under it will be reviewed to explore whether the proposed activities of the project violates any provisions of the Forest Act.

The Supplementary Rules of 1959 empowered the concerned governmental bodies to restrict totally and for a specified period, the shooting, hunting or catching of various birds, animals and reptiles in the controlled and vested forests. The Private Forest Ordinance of 1959 provides for the conservation of private forests and for the forestation, in certain cases, of wastelands in Bangladesh.

The Penal Code, 1860

The Penal Code of 1860 has some valid provisions related to pollution management, environment protection and protection of health and safety. Some of these are: Section 277: Falling Water or Public Spring or Reservoir; Section 278: Making Atmosphere Noxious to Health; Section 284: Negligent Conduct with Respect to Poisonous Substance; Section 285: Negligent Conduct with Respect to Fire or Combustible Matter; and Section 286: Negligent Conduct with Respect to Explosive Substance.

The Acquisition and Requisition of Immovable Property Ordinance (1982)

This Ordinance has replaced the Land Acquisition Act of 1894 and the East Bengal (Emergency) Requisition of Property Act of 1948. The Ordinance governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous Acts (i.e. Act XIII of 1948), this Ordinance deals only with immovable property.

The Ordinance has well-defined procedures regarding payment of compensation for an acquired piece of land. If, for example, the land is used for rice growing, then an amount equivalent to approximately 1.5 times the market value of a given variety of rice (e.g., paddy) that is currently being (or could be) produced annually is fixed as a yearly lease value. In case of outright purchase (carried out on a 99-year lease), the compensation-value of acquired land varies widely according to the locality, soil fertility, and access to transportation and related infrastructure factors. The current compensation and resettlement provisions are however inadequate both in terms of timing of payments and quantum. The procedures involved are cumbersome and time consuming and often causes hindrance to the smooth execution of the project. Legal provisions covering adequate compensation to the project affected persons,

particularly disadvantaged groups such as women and squatters and such other vulnerable groups are yet to be framed.

Civil Aviation Ordinance 1960 and Civil Aviation Rules, 1984

The Civil Aviation Ordinance 1960 was made to make better provisions for the control of manufacture, possessions, use, operation, sale, import and export of aircraft, the control and regulation of air transport services, and the control and development of aerodromes in the country. It repealed the Aircraft Act, 1934 (XXII of 1934).

Present legal regulatory framework for civil aviation activities in Bangladesh is the Civil Aviation Rules, 1984 and the Air Navigation Orders issued by the Chairman under this rule.

All civil aviation activities in Bangladesh are regulated by the Civil Aviation Rules, 1984 which was made and promulgated by the Government in exercise of the powers conferred by sections 4,5,7 and 8 of the Civil Aviation Ordinance, 1960 (XXXII of 1960), section 10 of the Aircraft (Removal of Danger to Safety) Ordinance, 1965 (Xll of 1965), section 4 of the Telegraph Act, 1885 (XIII of 1885) and in suppression of the Aircraft Rules, 1937 and the Airport Obstruction Clearance Rules, 1981. This set of rules elaborately dealt with personnel (pilot, flight engineer, air traffic controller, aircraft maintenance engineer etc.) licensing, airworthiness requirements, operation of aircraft, rules of the air, air transport services; construction height of the surrounding infrastructure etc. Most of today's operational responsibilities and functions of CAAB are defined and formulated in these Rules.

Apart from the above-mentioned national laws the other relevant laws and by-laws e.g. Dangerous Cargoes Act, 1950; Factories Act, and Rules, 1965; Fatal Accidents Acts, 1955; Labour Code, 2006; Ports Acts, 1908; Public Safety Ordinance, 1953; and Wildlife Preservation and Security Order 2012) will be reviewed under the EIA study.

2.3 Policy guidance

Under the study a number of sectoral national policies will be reviewed to identify the guiding principles which are relevant to the transmission line and substations/ switching stations installation, operation and maintenance activities. The sectors policies will include energy, environment, water, forest, transport, import; fisheries etc.

National Environment Policy

The National Environment Policy of 1992 sets out the basic framework for environmental action, together with a set of broad sector action guidelines. The Policy provides the broader framework of sustainable development in the country. It also stated all major undertakings, which will have a bearing on the environment; (including setting up of an industrial establishment) must undertake an IEE and EIA before initiation of the project.

The Policy delineates DOE, as the approving agency for all such IEE and EIA studies to be undertaken in the country. The policy guidelines of fifteen sectors are stated in the Policy. Under the 'energy and fuel sector' (section 3.4), the use of

environmentally sound and less harmful fuel has been encouraged in Section 3.4.1. Section 3.4.5 provides, 'Conservation of country's fossil fuel reserve and renewable sources of energy' and section 3.4.6 provides that EIA should be conducted before implementation of projects for extraction of fuel and mineral resources.

Under the Environmental Action Plan Section of the Policy and sub-section 'Fuel and Energy' provides as:

i. Section 4.2 "In the rural areas the use of gas, coal, kerosene and petrol as fuel will be expanded in the rural areas, so that fuel wood, agricultural residues and cow dung are conserved. This will help the use of agricultural residues, and cow dung etc. as manure" and

ii. Section 4.7 "Appropriate measures will be taken to ensure that extraction, distribution and use of natural resources such as oil, gas, coal, peat etc. do not adversely affect air, water, land, the hydrological balance and the ecosystem".

iii. Section 3: 'Forest, wildlife and biodiversity' directs the followings:

- Conserve wildlife and biodiversity, strengthen related research and help dissemination and exchange of knowledge in these areas; and
- Conserve and develop wetlands and protection of migratory birds.

National Environment Management Plan 1995

The National Environment Management Action Plan (NEMAP) is a wide ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environment Policy (NEP). NEMAP was developed to address the issues and management requirements for a period between 1995 and 2005 and set out the framework within which the recommendations of the National Conservation Strategy (NCS) are to be implemented. NEMAP has the following broad objectives:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Improvement of the natural and built environment;
- Conservation of habitats and biodiversity;
- Promotion of sustainable development; and
- Improvement in the quality of life of the people.

One of the key issues in NEMAP regarding the energy sector is "energy conservation awareness is generally low throughout the country". NEMAP did not recognize mineral resources as an important sector and there is no separate discussion on this.

The National Forest Policy (1994)

The National Forestry Policy of 1994 is the revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major targets of the Policy are to conserve the existing forest areas; bring about 20% of the country's land area under the forestation program, and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

The need for amendments of the existing forestry sector related laws and adopt new laws for sector activities has been recognized as important condition for achieving the policy goals and objectives. The Forest Policy also recognizes the importance of fulfilling the responsibilities and commitments under international multilateral environmental agreements.

The National Energy Policy (1995)

The National Energy Policy provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy sources and environmentally sustainable energy development programs. The Policy highlights the importance of protecting the environment by requiring an EIA for any new energy development project, introduction of economically viable and environment friendly technology.

One (Section 1.2) of the seven objectives addresses the environment and states, "(vi*) to ensure environmentally sound sustainable energy development programs causing minimum damage to the environment*".

The seven specific policy recommendations are listed under Chapter 1.9. Of those, the following three are relevant to the present project:

- EIA should be made mandatory and should constitute an integral part of any new energy development project;
- Use of economically viable environment friendly technology is to be promoted; and
- Public awareness is to be promoted regarding environmental conservation.

2.4 International legal obligations

Bangladesh is signatory to a number of Multilateral Environmental Agreements (MEAs) and also some bilateral instruments. Some of them are very important in context of environmental protection. The legal obligations and provisions of MEAs related to the proposed project interventions will be reviewed; (***Convention on Biological Diversity; Convention on Wetlands of International Importance Especially as Waterfowl Habitat; United Nations Convention on the Law of the Sea; Convention concerning the Protection of the World Cultural and Natural Heritage).***

Bangladesh has already had accessed to, ratified or signed a number of important MEAs related to environment protection and conservation of natural resources which shall have to be complied with during implementation of the project. The pertinent ones of these are highlighted below:

Rio Declaration

The 1992 United Nations Conference on Environment and Development (UNCED) adopted the global action program for sustainable development called 'Rio Declaration' and 'Agenda 21'.

Principle 4 of the Rio Declaration, 1992, to which Bangladesh is a signatory along with a total of 178 countries, states as, "In order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it".

Convention on Biological Diversity (1992)

The Convention on Biological Diversity, Rio de Janeiro, 1992 was adopted on 5 June 1992 and entered into force on 29 December, 1993. Bangladesh ratified the Convention on 20 March, 1994.

The Contracting Parties of the Convention have committed to:

- 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 are likely to have significant adverse impacts on biodiversity, are duly taken into account.

Obligation has been placed on State parties to provide for environmental impact assessments of projects that are likely to have significant adverse effects on biological diversity (art. 4).

Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar (1971)

This convention is also known as the Ramsar Convention. It was adopted on 2 February, 1971 and entered into force on 21 December, 1975. Bangladesh has ratified the Convention on 20 April, 2002. This provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are 127 Parties with 1085 wetland sites designated as Wetlands of International Importance'.

This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitats. Obligations 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. Part of Sundarbans Reserved Forest (Southwest of Bangladesh) is the one of the Ramsar Site.

2.5 Development agency's guidelines

Under the study health and safety guidelines of few development agencies will be reviewed. This will include "JICA Environment and Social Consideration Guideline" and "IFC/EHS Guideline (Environmental, Health, and Safety Guidelines of the International Finance Corporation)".

JICA Environment and Social Consideration Guideline

JICA, which is responsible for ODA, plays a key role in contributing to sustainable development in developing countries. The inclusion of environmental and social costs in development costs and the social and institutional framework that makes such inclusion possible are crucial for sustainable development. Internalization and an institutional framework are requirements for measures regarding environmental and social considerations, and JICA is required to have suitable consideration for environmental and social impacts.

The objectives of the guidelines are to encourage Project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavors to ensure transparency, predictability, and accountability in its support for and examination of environmental and social considerations.

IFC/EHS Guideline

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), as defined in IFC's Performance Standard 3 on Pollution Prevention and Abatement.

2.6 Environmental Regulation

Details of the environmental standards applicable in Bangladesh are described in the Environmental Conservation Rules (ECR). Regulated Areas spread to all industries, and regulated items are air quality, water quality (surface water, drink water), noise (boundary, source), emissions from motor vehicles, waste from industrial units. Items and standards, which are related to the construction of transmission line, are listed below. Tables and annotations of environmental regulation are described as textual description of ECR.

ECR is currently in the process of amendment. There is a possibility that the environmental regulation of the following items will be amended, but the current regulation is applied until the amendment process is completed.

2.6.1 Air Quality

Table 2.6-1 shows the air quality standard in Bangladesh. Air quality standard adhere to WHO guidelines is also mentioned in the Table below.

Table 2.6-1 Standards for Air quality in Bangladesh [1]

No.	Parameter	Concentration (mg/m^3)		Exposure Time
		ECR	IFC Guideline (General: 2007)*	
a)	Carbon Mono-oxide	10	-	8 hours
		40	-	1 hour
b)	Lead (Pb)	0.5	-	Year
c)	Nitrogen Oxide	0.1	0.04	Year
		-	0.2	1 hour
		-	0.2	1 hour
d)	Suspended Particulate Matter (SPM)	0.2	-	8 hours
e)	Particulate Matter 10µm (PM_{10})	0.05	0.02	Year
		0.15	0.05	24 hours
f)	Particulate Matter 2.5µm ($PM_{2.5}$)	0.015	0.01	Year
		0.065	0.025	24 hours
g)	Ozone	0.235	-	1 hour
		0.157	0.160	8 hours
h)	Sulfur Dioxide	0.08	-	Year
		0.365	0.125	24 hours

Notes: * Air quality standard of IFC Guideline is quoted from WHO Guideline.

(Source: Bangladesh Gazette July 19, 2005, IFC Environmental Health and Safety Guidelines 2007

2.6.2 Water Quality

Table 2.6-2 shows ambient water quality standard (inland surface water) in Bangladesh.

[1] Not exceed one time in year

Table 2.6-2 Ambient water quality standards (inland surface water)[2]

No.	Best Practice Based Classification	pH	BOD mg/1	Dissolved Oxygen (DO), mg/l	Total Coliform Bacteria quantity/ml
a)	Potable water source supply after bacteria freeing only	6.5-8.5	2 or less	6 or above	50 or less
b)	Water used for recreation purpose	6.5-8.5	3 or less	5 or above	200 or less
c)	Potable water source supply after conventional processing	6.5-8.5	6 or less	6 or above	5000 or less
d)	Water used for pisci-culture	6.5-8.5	6 or less	5 or above	5000 or less
e)	Industrial use water including chilling & other processes	6.5-8.5	10 or less	5 or above	5000 or less
f)	Water used for irrigation	6.5-8.5	10 or less	5 or above	5000 or less

(Source：The Environmental Conservation Rules,1997)

3.6.3 Others

(1) Noise

As for noise, the standard limit is set for every category of zone class. Table 3.6-3 shows the Noise standard in Bangladesh.

Table 2.6-3 Standards for Sound [3]

No	Zone Class	Limits in dBA			
		ECR		IFC Guideline (General: 2007)	
		Day	Night	Day	Night
a)	Silent Zone	45	35	55	45
b)	Residential Zone	50	40		
c)	Mixed Zone (this area is used combining residential, commercial and industrial purposes)	60	50	70	70
d)	Commercial Zone	70	60		
e)	Industrial Zone	75	70		

(Source: The Environmental Conservation Rules, 1997 IFC Environmental Health and Safety Guidelines 2008)

[2] Textual annotations are as follows.
(1) Maximum amount of ammonia presence in water are 1.2 mg/l (as nitrogen molecule) which is used for pisciculture.
(2) For water used in irrigation Electrical Conductivity-2250 micro mho/cm (at 25oC). Sodium less than 26 mg/l, Boron less than 2 mg/l

[3] Textual annotations are as follows.
(1) The day time is considered from 6 a.m. to 9 p.m. and the night time is from 9 p.m. to 6 p.m.
(2) From 9 at night to 6 morning is considered night time.
(3) Area within 100 meters of hospital or education institution or educational institution or government designated / to be designated / specific institution / establishment are considered Silent Zones. Use of motor vehicle horn or other signals and loudspeaker are forbidden in Silent Zone.

(2) Electric and magnetic fields

IFC EHS Guideline (Electric Power Transmission and Distribution; 2007) recommends the following methods for managing EMF (Electric and magnetic fields) generated by transmission line.

- 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 (Table2.6-4).
- Considering sitting 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;
- If EMF levels are confirmed or expected to be the recommended exposure limits (Table2.6-4), 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
    - Burying transmission lines
    - Increasing height of transmission towers
    - Modifications to size, spacing, and configuration of conductors

Table 2.6-4 Recommended exposure limits for general public exposure to electric and magnetic fields (IFC Guideline: "Transmission and Distribution", 2007)

Frequency	Electric Field (V/m)	Magnetic Field (μT)
50 Hz	5,000	100
60 HZ	4,150	83

Source: International Commission on Non-Ionizing Radiation Protection (1998): "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

2.7 Protected area and environmentally controlled area

Classification of Protected areas and environmentally-controlled areas in Bangladesh are shown in Table 3.7-1. Those areas are declared as National Park, Wildlife Sanctuary, Game Reserve, Botanical gardens and Eco-parks under the Wildlife (Preservation) Order, Reserved Forests and Protected Forests under the Forest Act and Ecologically Critical Areas (ECA) notified under the Environmental Conservation Act.

Table 3.7-1 Classification of Protected area, environmentally controlled area

Classification		Competent Authority	Governing law
A	National Park	Department of Forest	Wildlife (Preservation) Order
B	Wildlife Sanctuary		
C	Game Reserve		
D	Botanical Gardens, Eco-parks		
E	Reserved Forests, Protected Forests		Forest Act
F	Ecologically Critical Areas	Department of Environment	Environmental Conservation Act

(Source: Power System Master Plan 2010)

There are seventeen National parks, nineteen wildlife sanctuaries, five botanical gardens and eco-parks in Bangladesh notified under the Wildlife (Preservation) Order, having total area of 2,655.9 km^2. List of Protected areas and environmentally-controlled areas declared under the Wildlife (Preservation) Order are shown in Table 3.7-2.

There are nine ECA, and the total area is 8,063.2 km^2 excluding the Gulshan – Banani - Baridhara Lake in Dhaka. Table 3.7-3 shows a list of ECA designated under the Bangladesh Environmental Conservation Act (BECA). BECA has provision for ECA declarations by the Director General of the Department of Environment in cases where ecosystem or biodiversity of area is considered to be threatened to reach a critical state. Along with the ECA declaration, each ECA has notification declared in which specific activities to be restricted in that ECA is specified.

Table 2.7-2 List of Protected area, environmentally controlled area

Item	No	Name	Place	Size (km^2)
A	1	Bhawal National Park	Gazipur	50.2
	2	Modhupur National Park	Tangail/ Mymensingh	84.4
	3	Ramsagar National Park	Dinajpur	0.3
	4	Himchari National Park	Cox's Bazar	17.3
	5	Lawachara National Park	Moulavibazar	12.5
	6	Kaptai National Park	Chittagong Hill Tracts	54.6
	7	Nijhum Dweep National Park	Noakhali	163.5
	8	Medha Kachhapia National Park	Cox's Bazar	4.0
	9	Satchari National Park	Habigonj	2.4
	10	Khadim Nagar National Park	Sylhet	6.8
	11	Baraiyadhala National Park	Chittagong	29.3
	12	Kuakata National Park	Patuakhali	16.1
	13	Nababgonj National Park	Dinajpur	5.2
	14	Shingra National Park	Dinajpur	3.1
	15	Kadigarh National Park	Mymensingh	3.4
	16	Altadighi National Park	Naogaon	2.6
	17	Birgonj National Park	Dinajpur	1.6
	1	Rema-Kalenga Wildlife Sanctuary	Hobigonj	18.0
	2	Char Kukri-Mukri Wildlife Sanctuary	Bhola	0.4
	3	Sundarban (East) Wildlife Sanctuary	Bagerhat	312.3
	4	Sundarban (West) Wildlife Sanctuary	Satkhira	715.0
	5	Sundarban (South) Wildlife Sanctuary	Khulna	369.7

Item	No	Name	Place	Size (km^2)
B	6	Pablakhali Wildlife Sanctuary	Chittagong Hill Tracts	420.9
	7	Chunati Wildlife Sanctuary	Chittagong	77.6
	8	Fashiakhali Wildlife Sanctuary	Cox's Bazar	32.2
	9	Dudh Pukuria-Dhopachari Wildlife	Chittagong	47.2
	10	Hazarikhil Wildlife Sanctuary	Chittagong	29.1
	11	Sangu Wildlife Sanctuary	Bandarban	57.6
	12	Teknaf Wildlife Sanctuary	Cox's Bazar	116.2
	13	Tengragiri Wildlife Sanctuary	Barguna	40.5
	14	Dudhmukhi Wildlife Sanctuary	Bagerhat	1.7
	15	Chadpai Wildlife Sanctuary	Bagerhat	5.6
	16	Dhangmari Wildlife Sanctuary	Bagerhat	3.4
	17	Sonarchar Wildlife Sanctuary	Patuakhali	20.3
	18	Nazirganj Wildlife (Dolphin) Sanctuary	Pabna	1..46
	19	Shilanda-Nagdemra Wildlife (Dolphin) Sanctuary	Pabna	0.24
D	1	National Botanical Garden	Dhaka	0.8
	2	Baldha Garden	Dhaka	-
	3	Madhabkunda Eco-Park	Moulavibazar	2.7
	4	Sitakunda Botanical Garden and	Chittagong	8.1
	5	Dulahazara Safari Parks	Cox's Bazar	6.0

(Source: http://www.bforest.gov.bd/conservation.php, accessed June 2014)

Table 2.7-3 List of Environmental Critical Areas

Item	No	Name	Place	Size (km^2)
F	1	The Sundarbans	Bagerhat, Khulna, Satkhira	7,620.3
	2	Cox's Bazar (Teknaf, Sea beach)	Cox's Bazar	104.7
	3	St. Martin Island	Cox's Bazar	5.9
	4	Sonadia Island	Cox's Bazar	49.2
	5	Hakaluki Haor	Moulavi Bazar	183.8
	6	Tanguar Haor	Sumamganj	97.3
	7	Marjat Baor	Jhinaidha	2
	8	Gulshan-Banani-Baridhara Lake	Dhaka	-
	9	Rivers (Buriganga, Turag, Sitalakhya and Balu) around Dhaka city	Dhaka	-

(Source: Biodiversity National Assessment and Programme of Action 2020, DOE Bangladesh, 2010)

Chapter III Project Data Sheet

3.1 Project Proponent

Chittagong is major industrial and port city of Bangladesh. Due to having port facilities, industrial growth at Chittagong is very high. With the industrial growth, power demand at Chittagong is increased very rapidly. On the other hand, power generation at Chittagong area is low due to fuel shortage. At Present, Chittagong is connected with Dhaka via Comilla by two 230 kV circuits (Hathazari – Comilla – Meghnaghat) & two 132 kV circuits (Hathazari – Feni – Comilla – Haripur). These lines are not at all sufficient to supply near future demand of Chittagong area. Under these circumstances, at first phase, **Power Grid Company of Bangladesh (PGCB)** has planned to establish 400kV Meghnaghat-Madunghat transmission line initially which will be charged at 230kV to supply reliable power to Chittagong. In 2nd phase, after construction of Coal Base Power Plants at South Chittagong (Matarbari) in 2022, it will be charged at 400kV to evacuate power. In addition to this transmission line, Matarbari-Madunaghat 400kV line and two 400/230kV S/S at Meghnaghat and Madunaght respectively will also be required in second phase to evacuate this power to Dhaka and Chittagong city.

3.2 Project location and area

3.2.1 Proposed Meghnaghat 400kV substation:

Proposed Meghnaghat 400kV substation is located on the northern bank of the Meghna River just off the Dhaka-Comilla highway in Sonargaon Upazila of the District of Narayanganj, Bangladesh approximately 22 km Southeast of Dhaka. Map of Bangladesh showing location of the proposed Meghnaghat 400kV substation is given in **Figure-3.2.1-1.**

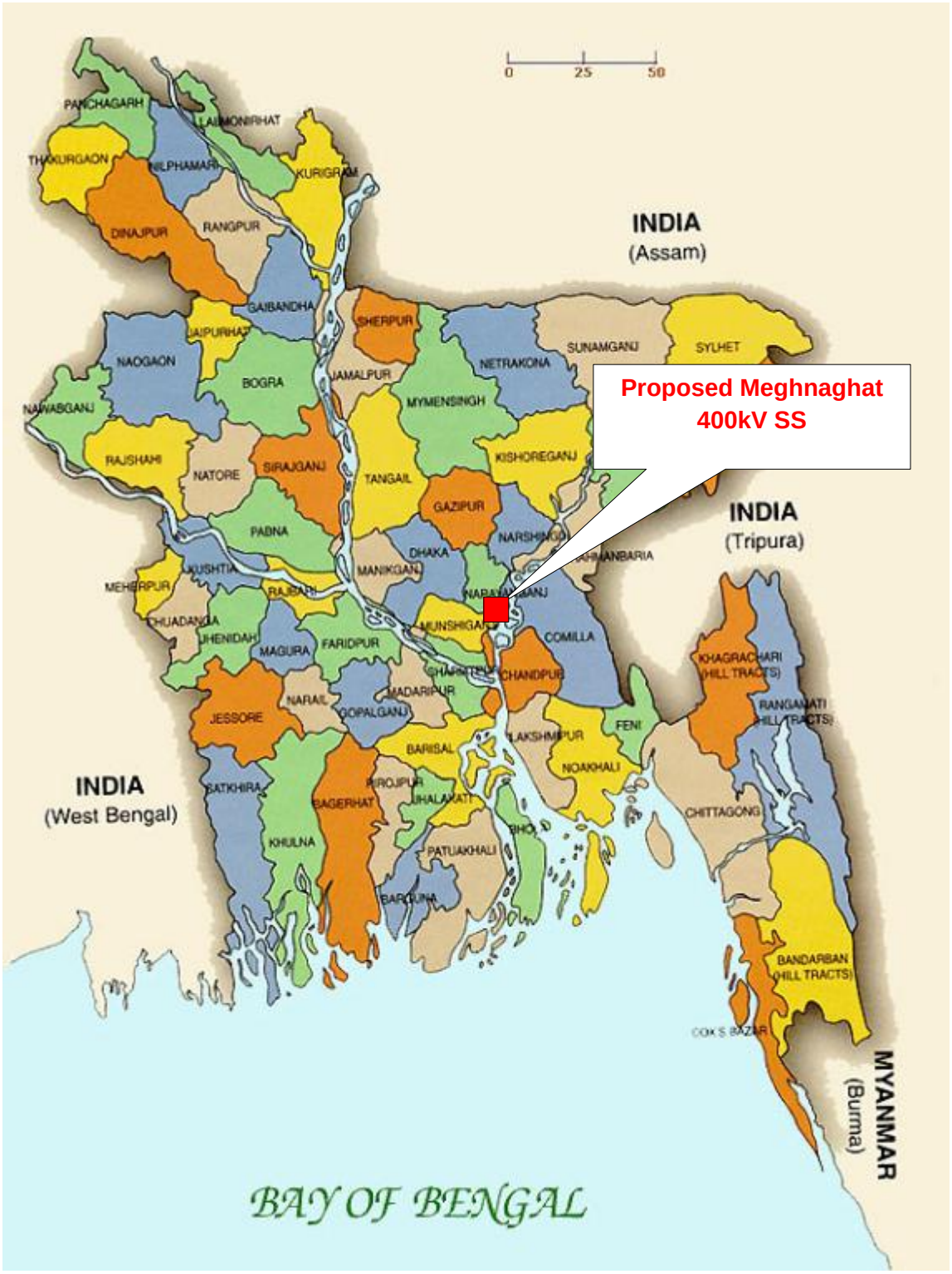


Figure-3.2.1-1: Map of Bangladesh showing location of proposed Meghnaghat 400kV substation

The Google earth map showing location of the proposed Meghnaghat substation is also given in **Figure3.2.1-2**

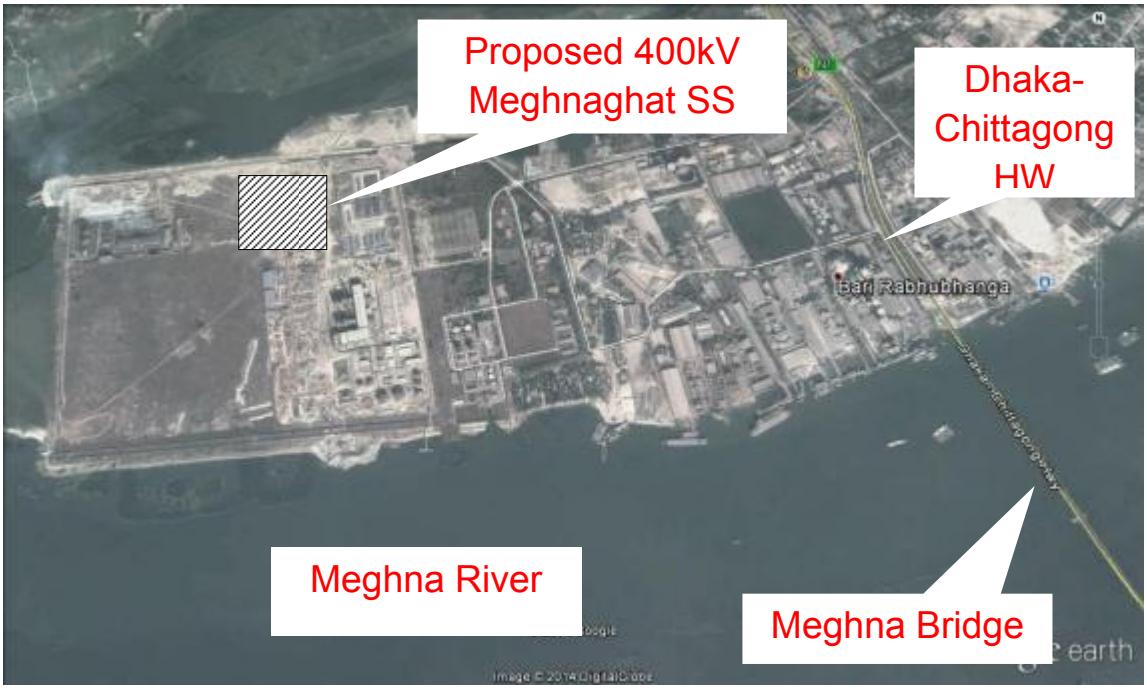


Figure-3.2.1-2: Google earth Map showing location of proposed Meghnaghat 400kV substation

3.2.2 Propposed Madunaghat 400kV substation:

Proposed Madunaghat 400kV substation is located at South Islam Nagar village of Raojan Upazila of Chittagong district in the North West side of RPCL's 25MW Power station located on the north side of Chittagong – Kaptai road. Map of Bangladesh showing location of the proposed Meghnaghat 400kV substation is given in **Figure-3.2.2-1.**

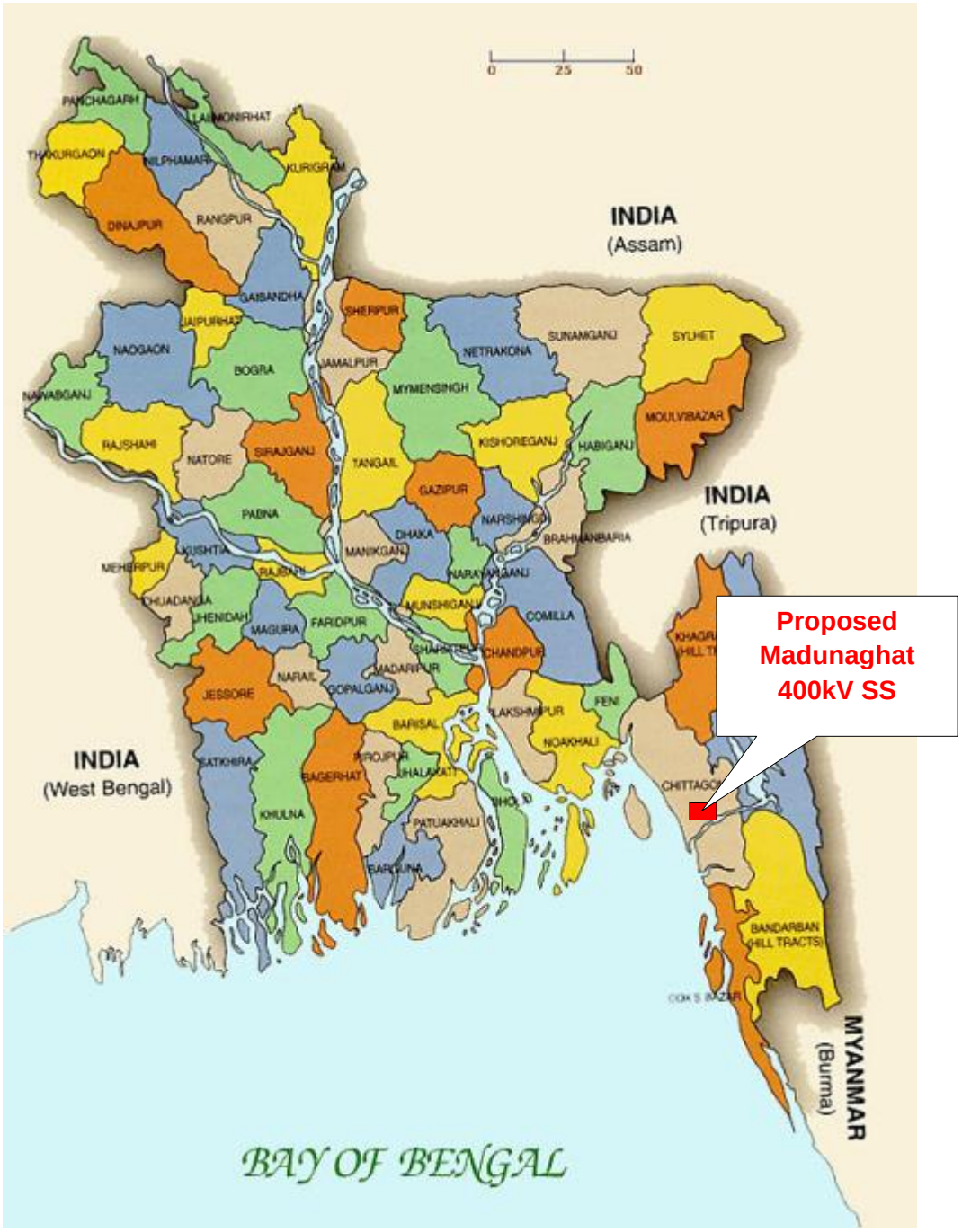


Figure-3.2.2-1: Map of Bangladesh showing location of proposed Modunaghat 400kV substation

The Google earth map showing location of the proposed Modunaghat substation is also given in **Figure 1.5.1-2**

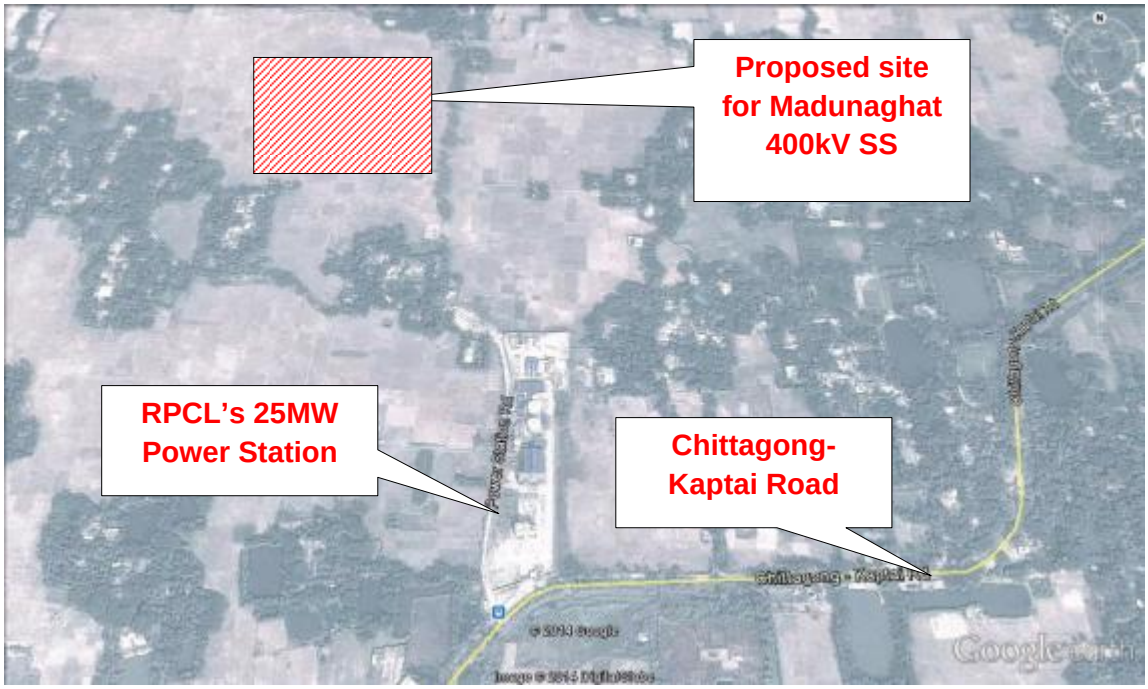


Figure-3.2.2-2: Google earth Map showing location of proposed Modunaghat 400kV substation

3.2.3 Route of Proposed 400kV Transmission Line:

The proposed 400kV double circuit Transmission line will be drawn from the proposed Meghnaghat 400kV substation to the proposed Madunaghat 400kV substation in the 1st phase of the project. Similarly, another 400kV double circuit transmission line will be drawn from the proposed Matarbari 2x600MW Coal based power plant to the proposed 400kV Madunghat substation. Map of Bangladesh showing the proposed route of 400kV transmission line from Meghnaghat 400kV substation to Matarbari coal based power plant via Madunaghat 400kV proposed substation is given in **Figure-3.2.3-1.**

The names of upazilas over which the proposed 400kV Transmission lines will be drawn are given in **Table-3.2.3.**

Table-3.2.3: List of Upazilas

Sl. No.	Section	Name of Upazilas	Approximate length in km
1.	Meghnaghat 400kV SS to Madunaghat 400kV SS	14. Sonaragaon, Narayanganj 15. Gazaria, Munshiganj 16. Daudkandi, Comilla 17. Kachua, Chandpur 18. Barura, Comilla 19. Laksam, Comilla, 20. Nangolkot, Comilla 21. Feni-S, Feni 22. Chhagolnaiya, Feni 23. Mirsarai, Chittagong 24. Fatikchhari, Chittagong 25. Hathazari, Chittagong 26. Raojan, Chittagong	214
2.	Madunaghat 400kV SS to Matarbari 2x600MW Coal PP	7. Boalkhali, Chittagong 8. Patiya, Chittagong 9. Anowara, Chittagong 10. Banshkhali, Chittagong 11. Pekua, Cox's Bazar 12. Moheshkhali, Cox's Bazar	100
Total		19 upazilas under 7 districts	314

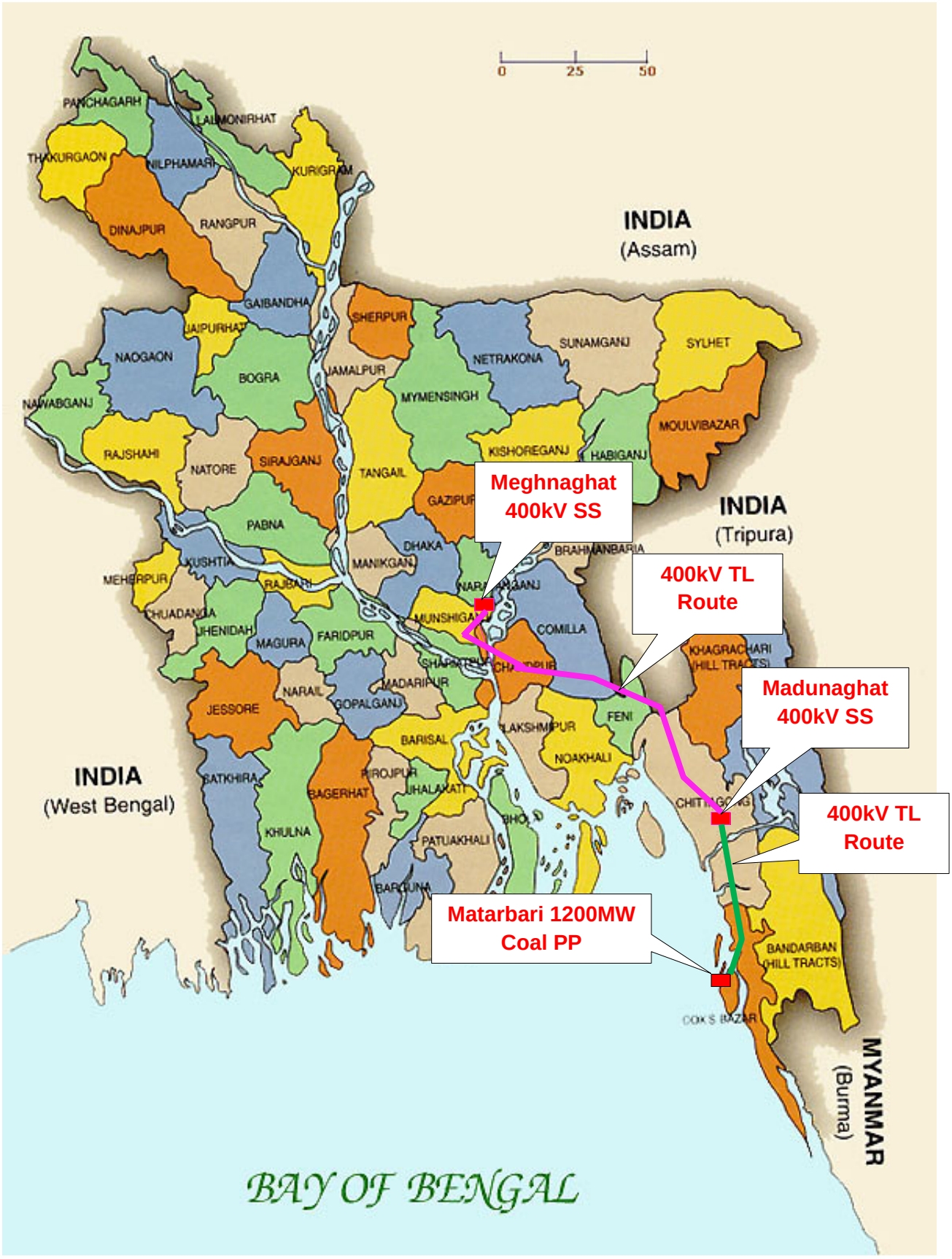


Figure-3.2.3-1: Map of Bangladesh showing the proposed Route of 400kV TL

The Google earth map showing location of the proposed Modunaghat substation is also given in **Figure 3.2.3-2**

400kV TL Route

Figure-3.2.3-2: Google earth Map showing the proposed 400kV TL Route

3.3 Nature and size of the Project

The scopes of works of the project are as follows:

First Phase:

- Meghnaghat-Madunaghat double circuit 400kV transmission line: 214km
- 230kV switching station at Madunaghat.
- Two 230kV bay extension at Meghnaghat.
- Double circuit 230kV LILO on four circuit tower at Madunaghat from Hathazar-Sikalbaha 230kV line: 8km

Second Phase:

- 400kV double circuit Matarbari-Madunaghat line: 100km
- Meghnaghat 400/230kV S/S.
- Madunaghat 400/230kV S/S.
- 230kV double circuit Madunaghat Old-Madunaghat line: 8km
- Madunaghat 230/132kV S/S.

The scopes of works are also shown in single line diagram in **Figure-3.3-1** and **Figure-3.3-2** respectively.

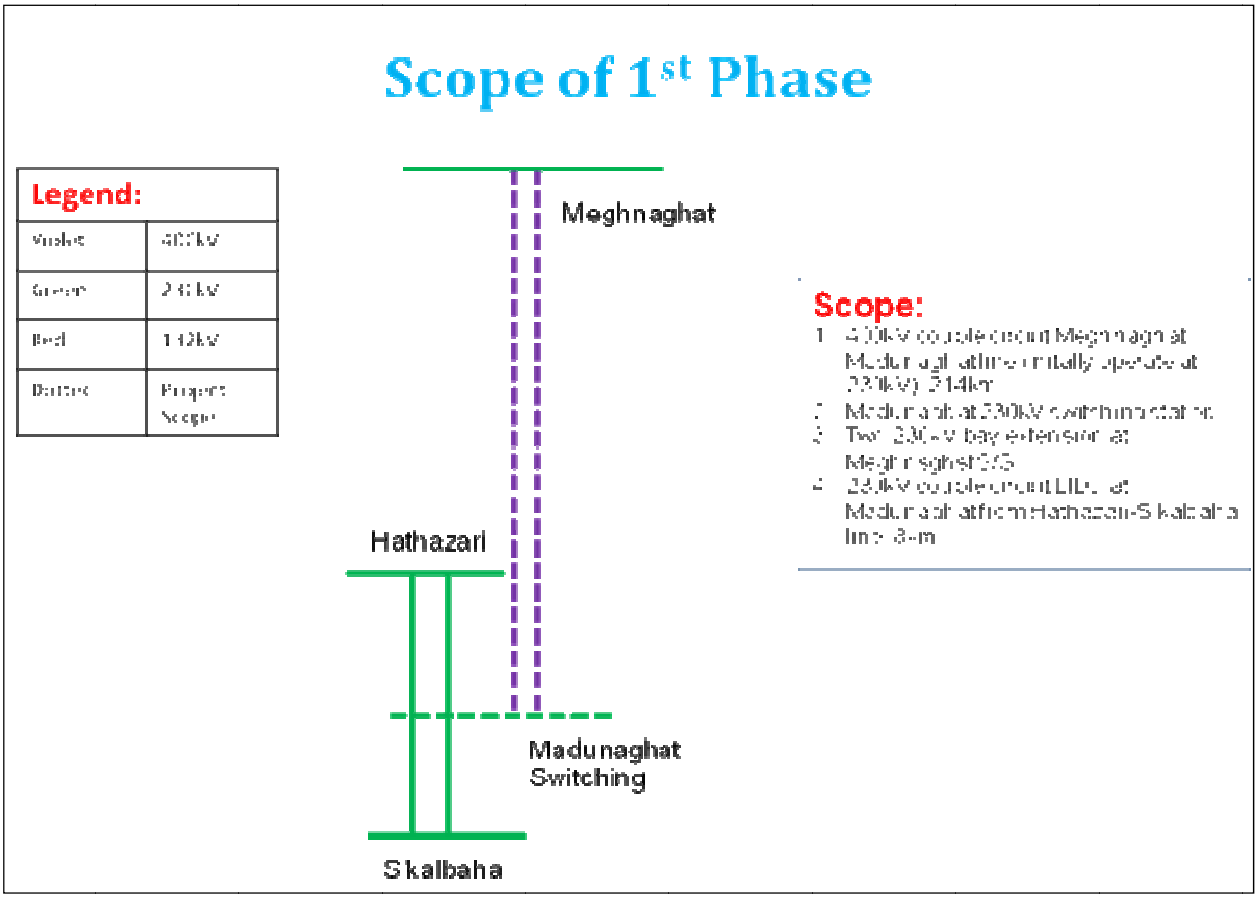


Figure 3.3-1: Scope of works in 1st phase

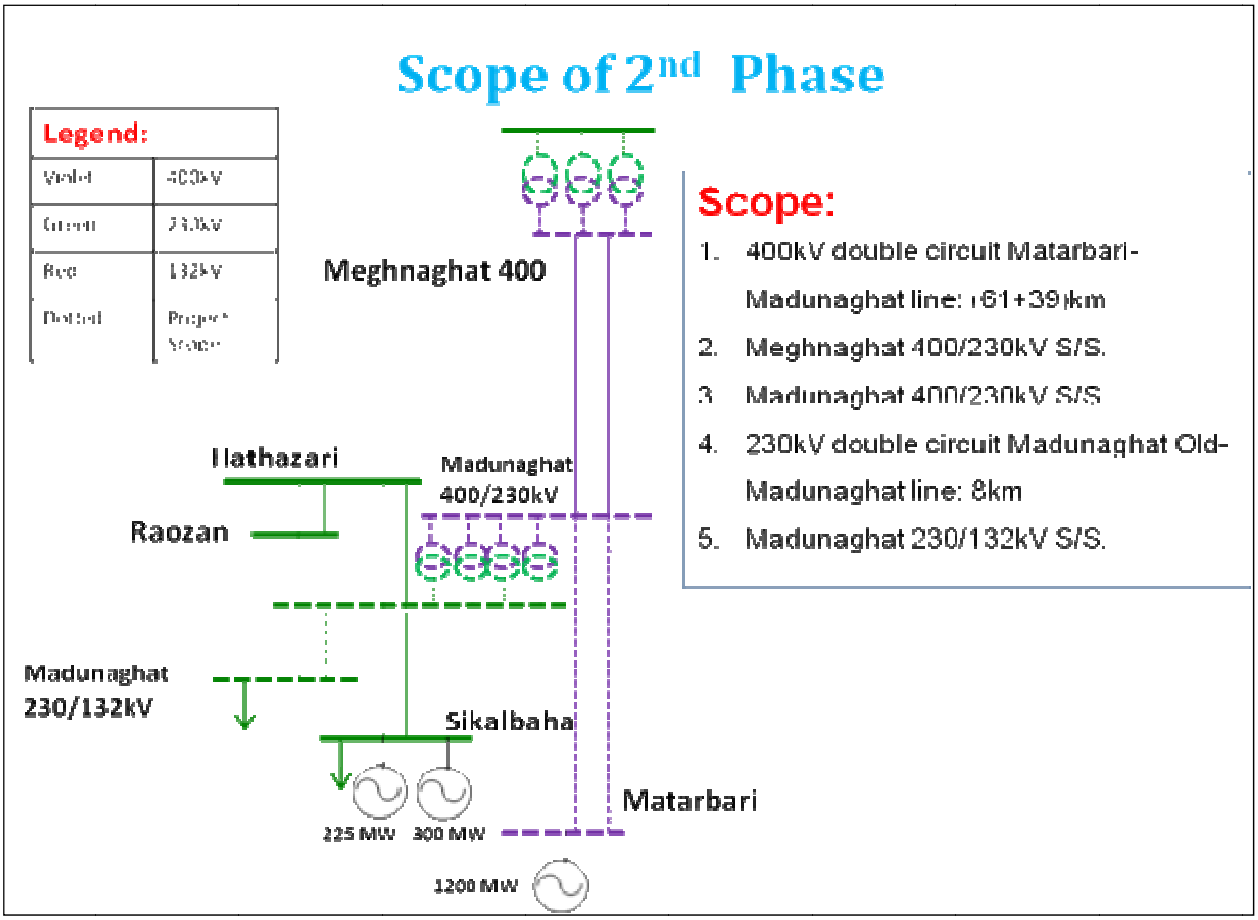


Figure 3.3-2: Scope of works in 2nd phase

3.4 Project Components

The project components are as follows:

- 400 kV Meghnaghat – Madunaghat T/L
- 230 kV Meghnaghat S/S bay extension
- 230 kV Madunaghat switching station
- LILO from 230 kV Hathazari – Sikalbaha T/L
- 400 kV Madunaghat – Matarbari T/L
- Meghnaghat 400 kV SS
- New 400 kV Madunaghat SS construction
- Upgrade of Existing 132 kV Madunaghat SS to a 230 kV SS
- 230 kV double circuit transmission line between Existing Madunaghat and New Madunaghat SS.

3.5 Project Activities

Among the abovementioned sub-projects, the following is better to be operated at the earlier stage of the Project's implementation to transmit the power from Dhaka to

Chittagong when the large scaled power plants such as Matarbari or Moheskhali would not yet have been in operation.

- 400 kV Meghnaghat – Madunaghat T/L
- 230 kV Meghnaghat SS bay extension
- 230 kV Madunaghat switching station
- LILO from Hathazari – Sikalbaha 230 kV T/L

3.6 Project schedule

It is expected to start the construction of the project in 2015 and the first phase of construction will be copmpleted in three years from the date of starting of construction. That means the 1st phase will be completed in 2018.

Chapter IV Project Description

4.1 Project's Scope

Revised Proposed Project's Scope are as follows:

- 400 kV Meghnaghat – Madunaghat T/L
- 230 kV Meghnaghat S/S bay extension
- 230 kV Madunaghat switching station
- LILO from 230 kV Hathazari – Sikalbaha T/L
- 400 kV Madunaghat – Matarbari T/L
- Meghnaghat 400 kV SS
- New 400 kV Madunaghat SS construction
- Upgrade of Existing 132 kV Madunaghat SS to a 230 kV SS
- 230 kV double circuit transmission line between Existing Madunaghat and New Madunaghat SS.

Among the abovementioned sub-projects, the following is better to be operated at the earlier stage of the Project's implementation to transmit the power from Dhaka to Chittagong when the large scaled power plants such as Matarbari or Moheskhali would not yet have been in operation.

- 400 kV Meghnaghat – Madunaghat T/L
- 230 kV Meghnaghat SS bay extension
- 230 kV Madunaghat switching station
- LILO from Hathazari – Sikalbaha 230 kV T/L

4.2 Project Layout

4.2.1 Substations:

Meghnaghat 400kV substation:

New 400 kV units, such as 400 kV Switchgears and Transformers, are installed in the vicinity of the existing Meghnaghat Switch Station. The conditions of the site are nearly flat and secured for this project; hence, it is unlikely to raise any problem of excessive civil cost.

Figure 4.2.1-1 Pictures of Candidate Site for New 400 kV unit Meghnaghat Switch Station

Figure 4.2.1-2 Site Location for Existing 230 kV Meghnaghat Switch Station

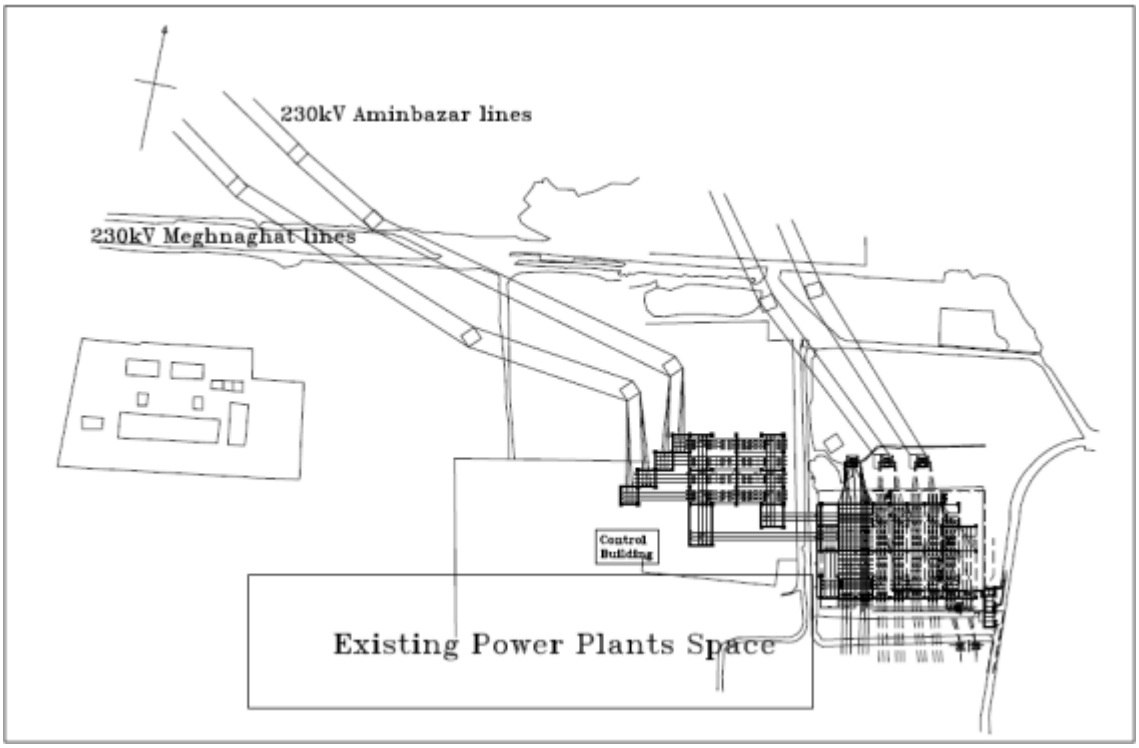


Figure 4.2.1-3 Tentative layout of 230 kV Meghnaghat Switching Station (As of Phase I)

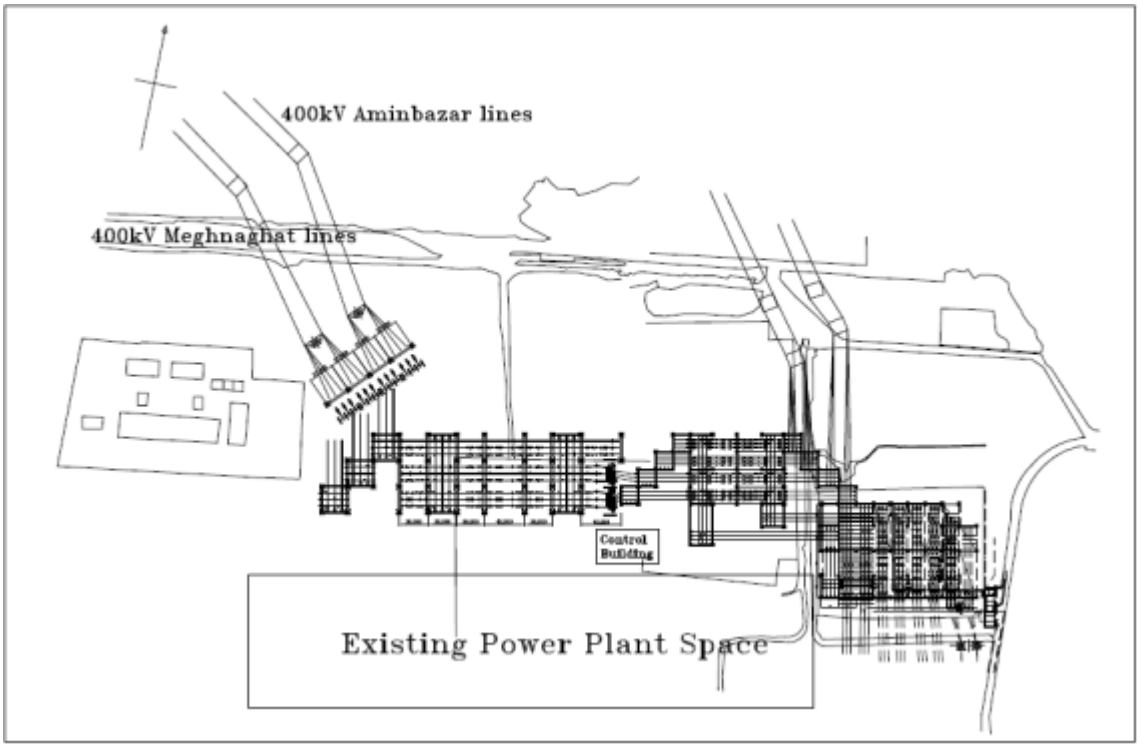


Figure 4.2.1.4 Tentative layout of 400 kV Meghnaghat SS (As of PhaseII)

Modunaghat 400kV substation:

Proposed Madunaghat 400kV substation is located at South Islam Nagar village of Raojan Upazila of Chittagong district in the North West side of RPCL's 25MW Power station located on the north side of Chittagong – Kaptai road. The location of the proposed Meghnaghat 400kV substation on google earth map is given in **Figure-4.2.1-5.**

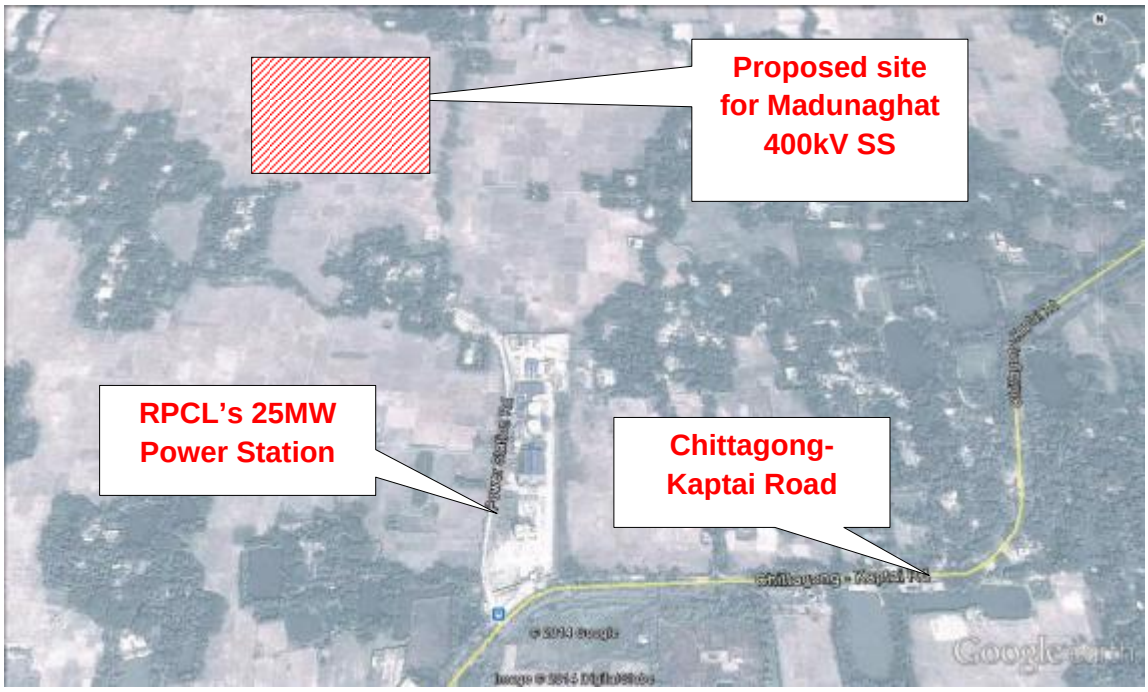


Figure-4.2.1.-5 Location of Modunaghat 400kV SS on Google Earth Map

The preliminary layout of the proposed Modunaghat 400kV substation is given in **Figure-4.2.1-6.**

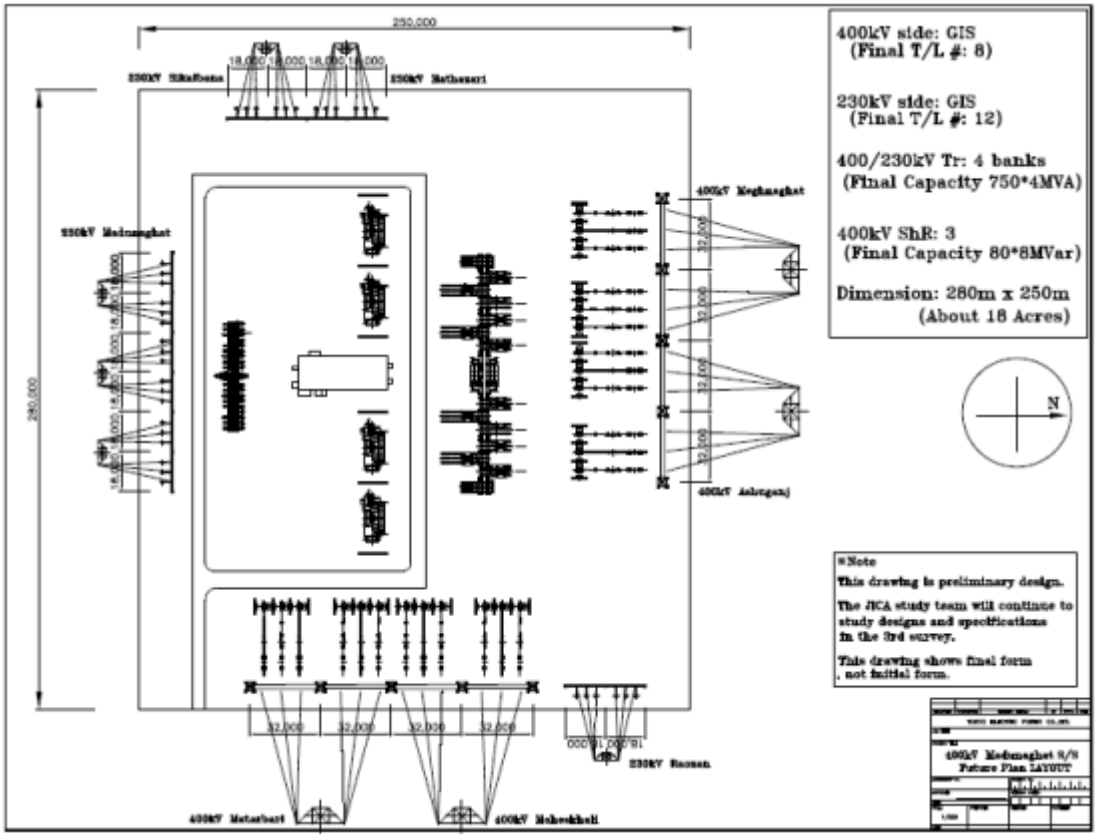


Figure 4.2.1-6 The Preliminary Layout of Madunaghat SS

4.2.2 Transmission Line:

Meghnaghat-Matarbari 400kV Tranmission Line:

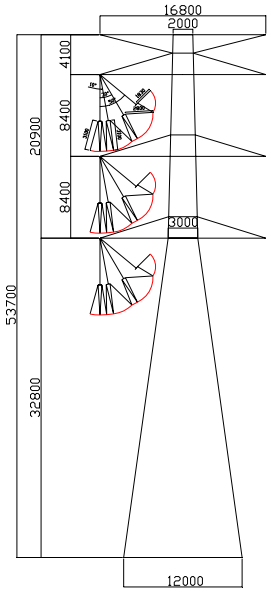
The proposed 400kV double circuit Transmission line will be drawn from the proposed Meghnaghat 400kV substation to the proposed Madunaghat 400kV substation in the 1st phase of the project. Similarly, another 400kV double circuit transmission line will be drawn from the proposed Matarbari 2x600MW Coal based power plant to the proposed 400kV Madunghat substation. the proposed route of 400kV transmission line from Meghnaghat 400kV substation to Matarbari coal based power plant via Madunaghat 400kV proposed substation on Google earth map is given in **Figure-4.2.2-1.** The estimated total 400 kV transmission line route length is approximately 310 km.

Figure 4.2.2-1 400 kV Transmission Line Route

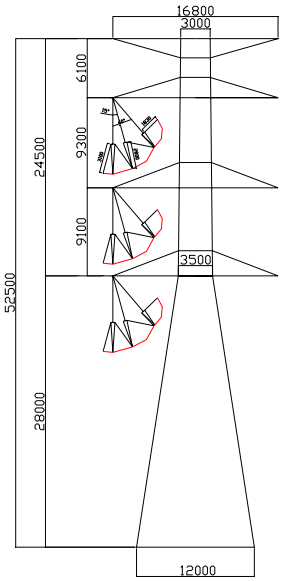
The towers shall normally be the following 6 standard types.

Table 4.2.2-1 Tower Types and the Applied Conditions

Tower Type	Position of Use	Angle of Deviation/Entry	Insulator String Type
4DL	Straight line	0 – 1 deg.	Suspension
4D1	Straight line	0 – 3 deg.	Heavy Suspension
4DR	River crossing	0 – 3 deg.	Heavy Suspension
4D25	Angle	5 – 25 deg.	Tension
4D45	Angle	25 – 45 deg.	Tension
4DT60	Angle Terminal	45 – 60 deg. 0 – 30 deg.	Tension



iv. **Figure 4.2.2-2 Suspension Tower (+3 m)**



v. **Figure 4.2.2-3 Tension Tower (+3 m)**

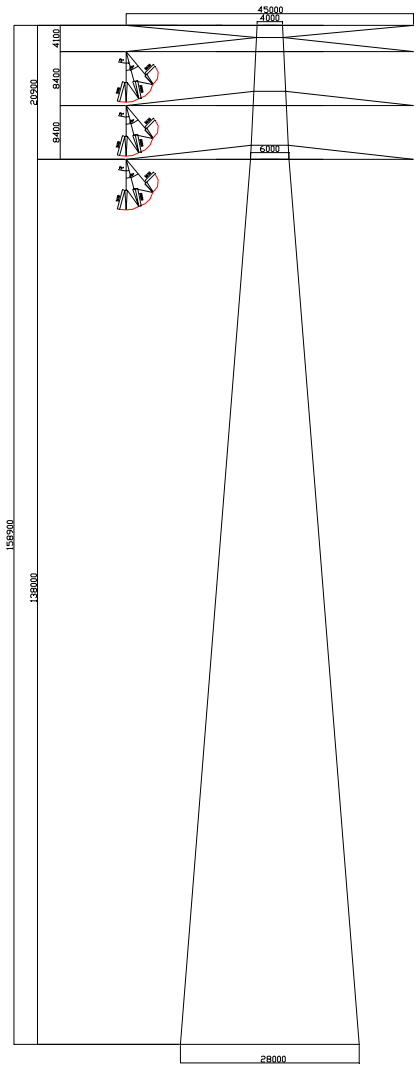


Figure 4.2.2.-4 Meghna River Crossing Tower (Span: 1,200 m)

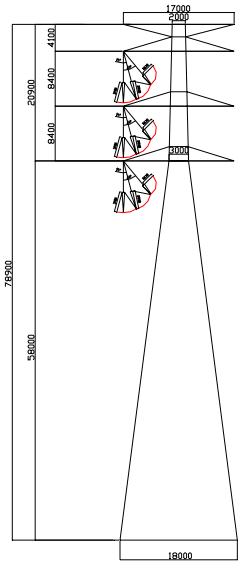


Figure 0-5 Sangu River Crossing Tower (Span: 600 m)

230 kV Transmission Line

The expected outline routes for the 230 kV Madunaghat – Old Madunaghat T/L and LILO at Madunaghat SS from Hathazari – Sikalbaha T/L are shown below.

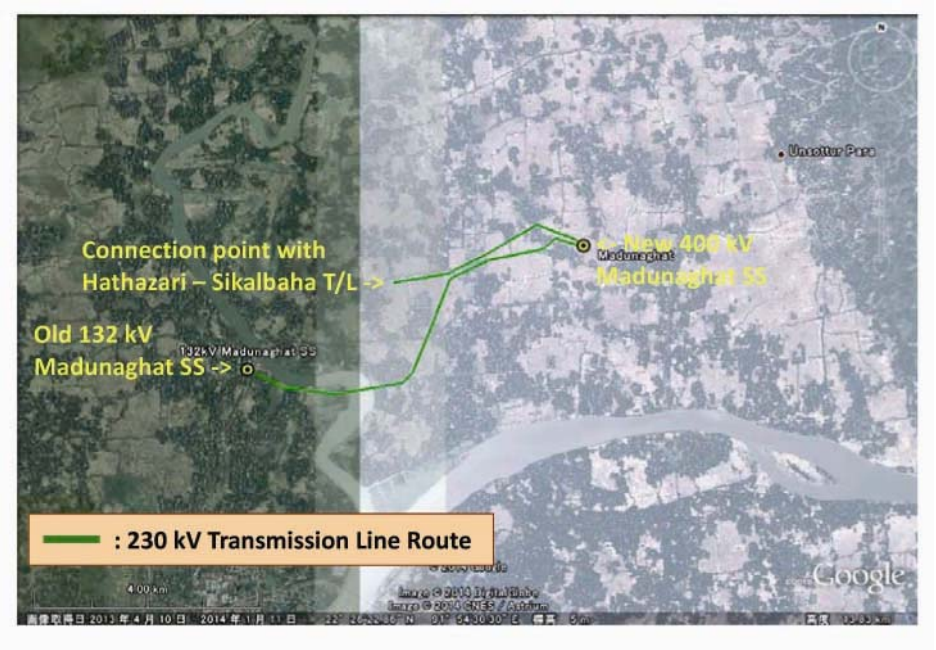


Figure 4.2.2-6 230 kV Transmission Line Route

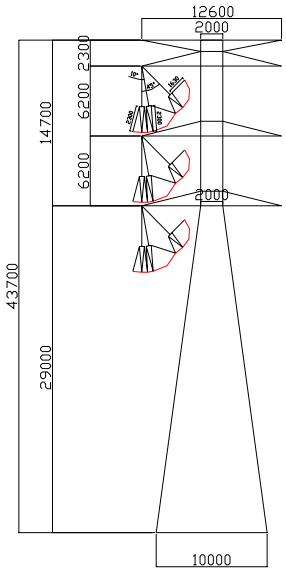
The estimated 230 kV transmission line route length is as below.

Madunaghat SS – Existing Madunaghat SS: 8 km
LILO at Madunaghat SS from Hathazari – Sikalbaha T/L: 4 km

The double-circuit towers shall normally be the following 4 standard types.

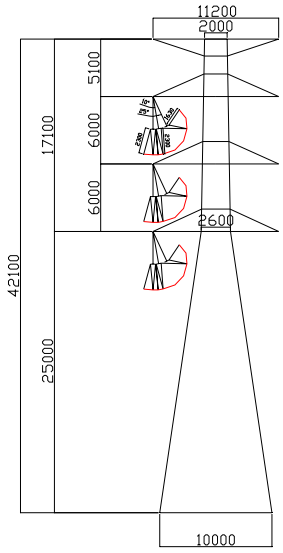
Table 4.2.2-2 Tower Types and the Applied Conditions

Tower Type	Position of Use	Angle of Deviation/Entry	Insulator String Type
2DL	Straight line	0 – 1 deg.	Suspension
2D1	Straight line	1 – 10 deg.	Suspension
2D25	Angle/Section	0 – 25 deg.	Tension
2DT6	Angle Terminal	25 – 60 deg. 0 – 30 deg.	Tension



vi.

iii. Figure 4.2.2-6 Suspension Tower (+ 0)



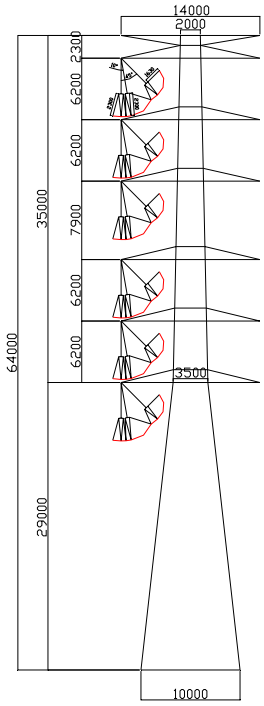
vii.

ix. Figure 4.2.2-7 Tension Tower (+ 0)

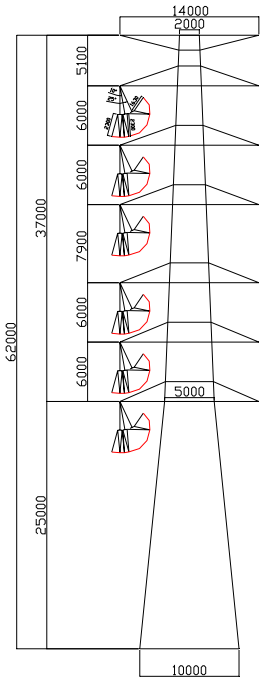
And the four-circuit towers shall normally be the following 5 standard types.

Table 4.2.2-3 Tower Types and the Applied Conditions

Tower Type	Position of Use	Angle of Deviation/Entry	Insulator String Type
2QL	Straight line	0 – 1 deg.	Suspension
2Q15	Angle	0 – 15 deg.	Tension
2Q30	Angle	0 – 30 deg.	Tension
2QT6	Angle Terminal	30 – 60 deg. 0 – 30 deg.	Tension



x. **Figure 4.2.2-8 Suspension Tower (+ 0)**



xi. **Figure 4.2.2-9 Tension Tower (+ 0)**

4.3 Land Requirement

4.3.1 Sub-stations

Both Meghnaghat 400kV sub-station and Modunaghat (old) substation are located in PGCB's own land. Hence no land requirement is necessary for construction of substations. But about 20acre land will be required for new 400kV Modunaghat substation.

4.3.2 Transmission Lines

As per Electricity Act, no land acquisition is required for construction of transmission lines.

Chapter V Analysis of Suitability for Different Alternatives

5.1 General:

In order to identify the best route of the proposed 400kV transmission line from Meghnaghat to Matarbari, one base route and two alternative routes have been studied. The base route has been selected from the feasibility study of 400kV transmission line from Meghnaghat to Anowara conducted by World Bank.

5.2 Routes of proposed 400kV Transmission Line:

Three routes of the proposed 400kV transmission line from Meghnaghat to Matarbari via Modunaghat have been identified from the desktop study. The routes are as follows:

- Base Route
- Alternative Route-1
- Alternative Route-2

Base Route:

The base route of 400kV transmission line started from Meghnaghat 400kV substation at Sonargaon upazila of Narayangonj district passing through Sonargaon, Gazaria, Doudkandi, Barura, Kachua, Laksam, Feni, Chagolnaiya, Mirsarai, Fatikchhari,, hat hazari, Raojan, Boalkhali, Patiya and Anowara, Banshkhali and Pekua Upazila and end at the proposed 2x600MW Matarbari Coal Based power plant. This will cross the 4 major rivers namely, Meghna, Gomoti, Karnafully and Sangu. This line will also cross a hilly area in Ramgar from Karer hat to Heyako of about 10km long.

Route-1(Alternative):

The alternative route-1 has been proposed to draw along the Dhaka-Chittagong highway (Sonargaon, Gazarai, Doudkandi, Kachua, Laksam, Feni, Mirsarai and Sitakundu upazial) up to Kumira.and then cross the hill and pass through Hathazari upazila, Modunaghat substation, Boalkhali. Patiya, Anowara upazila, Banshkhali and Pekua Upazila and end at the proposed 2x600MW Matarbari Coal Based power plant.

Route-2(Alternative):

The alternative route-2 has been proposed to draw along the base route (Sonargaon, Gazarai, Doudkandi, Barura, Kachua, Laksam, Feni, Mirsarai Chhagolnaiya, Fatikchhari, Hathazari, Raojan (Modunaghat), Boalkhali, Patiya, Anowara, Banshkhali, Pekua and Moheshkhali)

Google earth map showing the proposed routes of the 400kV Transmission Line is given in **Figure-5.2.**

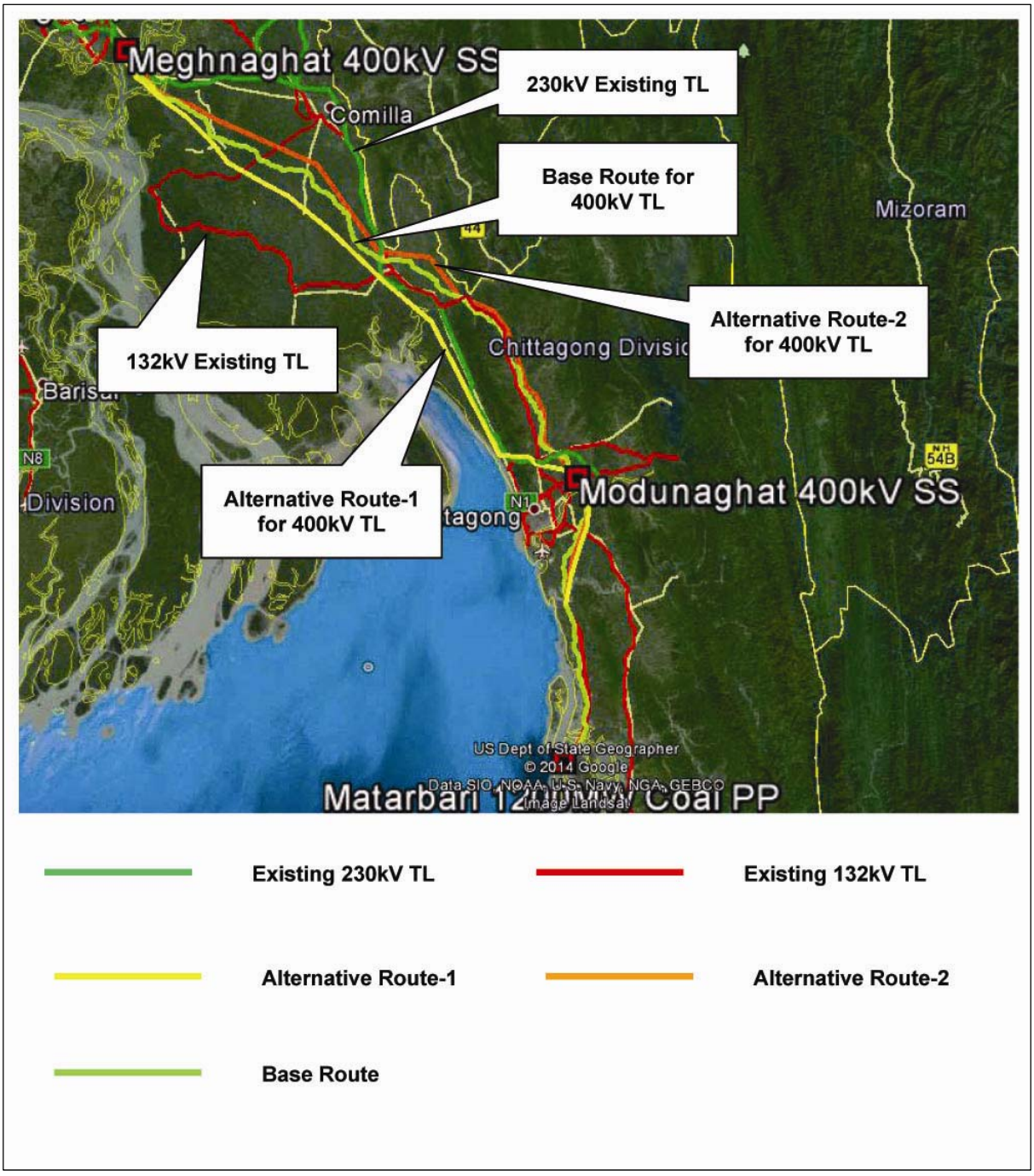


Figure-5.2: Google Earth Map showing the proposed Routes of 400kV TL

The comparative statement of base route and alternative routes of 400kV Transmission Lines is given in **Table-5.2.**

Table-5.2 : Comparative statement of base route and alternative routes of 400kV Transmission lines

Sl. No.	Description of Item	Base Route	Route-1 (Alternative)	Route-2 (Alternative)
1.	Length in km	314	310	320
2,	Rail Crossing	4	4	2
3.	Major River Crossing	6	7	6
4	EHV TL crossing	8	7	9
5	Hilly area crossing	1	1	1
6	National Highway Crossing	2	3	2
7	Topography	Medium Low, high and medium high land	Medium Low, high and medium high land	Medium Low, high and medium high land
8	Proximity of coast	Away from the coast	Near the coast	Away from the coast
9	Social & natural Environment	Less Resettlement required	Less resettlement required	Resettlement required
10	Right of way	Less right of way Required	More right of way required	Right of way Required
11	Remarks	More potential	Less potential	Less potential

From the above analysis, the base route has been selected for construction of 400kV transmission lines. The detailed study of this route has been conducted.

5.3 Survey of Selected Route:

JICA Study Team finally selected the best route for the proposed 400kV transmission line from Meghnaghat to Madunaghat and Madunaghat to Matarbari bypassing Anowara in consultation with PGCB. Satellite image of the relevant area showing the route of the proposed 400kV transmission line from Meghnaghat to Madunaghat and Madunaghat to Matarbari is given in **Figure-5.3.** The route of the proposed 400kV Transmission line from Mreghnaghat to Matarbari via Madunaghat showing on the geographic map of Bangladesh is given under **Annex-5.3.**

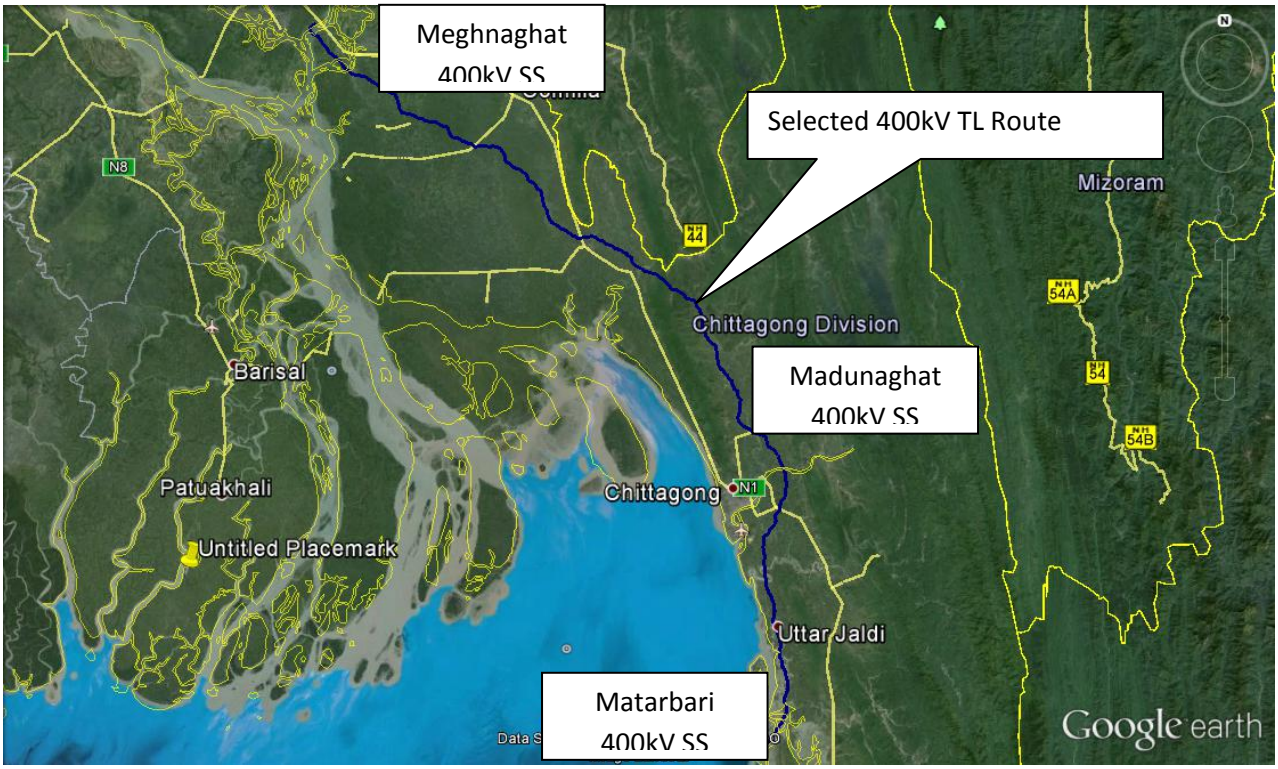


Figure 5.3: Satellite Image showing Selected Route of 400kV TL from Meghnaghat to Matarbari

The proposed 400kV transmission line from Meghnaghat to Matarbari has been divided into the following two sections:

Section-1: From Meghnaghat to Madunaghat

Section-2: From Madunghat to Matarbari

A brief summary of the above sections are given in **Table-5.3**

Table-5: Brief Summary of Selected Route

Item No.	Description of Item	Unit	Quantity		
			Section-1: From Meghnaghat to Madunaghat	Section-2: From Madunaghat to Matarbari	Total
1.	Length	km	214.316	91.762	306.078
2.	Tower	Nos.	565	239	804
3.	Major River Crossings	Nos.	8	4	12
4.	Major Road Crossings	Nos.	18	4	22
5.	Rail Crossings	Nos.	3	1	4
6.	132kV/230kV Power Line crossings	Nos.	7	2	9
7.	Hill crossing	km	13		13

Chapter VI Detail description of the land use

The land use of the proposed substations and transmission lines are described below:

6.1 Substations:

a) Meghnaghat 400kV Substation:

The land for the proposed 400kV Meghnaghat substation is lying vacant. Some pictures of this substation are given below:

b) Modunaghat 400kV substation:

The land of the proposed Modunasghat substation is cultivable and it is used for paddy cultivation. Some pictures of the proposed Modunaghat subatation are given below:




c) Modunaghat 230kV substation:

Modunaghat 230kV substation will be constructed in the existing coation. mpound of Modunaghat 132kV substation. The land of this substation is lying vacant. At present, transmission line materials have been stored in some area of this substation. Some pictures of this substation are given below:


6.2 Transmiission Lines:

b) Meghnaghat to Matarbari 400kV Transmission Line:

The section wise land use of the proposed transmission line is described below:

i. Meghnaghat to Daudkandi:

The section of the proposed Meghnaghat-Matarbari 400kV transmission line from Meghnaghat to Daudkandi lies in the low lying land in Gazaria of Munshiganj district. The land of this area is inundated with water throughout the year. Some pictures of this section are given below:

ii. Daudkandi to Feni:

The section of the proposed 400kV transmission line from Daudkandi to Feni lies in the plain land. The land of this section is cultivable and it sis used for paddy cultivation. Some pictures of this section are given below:

iii. Feni to FatikChari:

The section of the proposed 400kV transmission line from Feni to Fatikchari lies in the hilly area (reserved forest). This hilly land is occupied by natural and planted forest. There is also Rubber plantation in some hilly area. Some pictures of this section are given below:




iv. FatikChari to Matarbari:

The section of the proposed 400kV transmission line from Fatikchari to Matarbai lies in the plain land. The land of this section is cultivable and it sis used for paddy cultivation. Some pictures of this section are given below: