Initial Environmental Examination(Draft)

Project No. 42378
August 2013

BAN: Power System Expansion and Energy Efficiency Improvement Investment Program-Tranche 2

Prepared by the Ministry of Power, Energy and Mineral Resources for the Asian Development Bank

CURRENCY EQUIVALENTS

(As of 1 July 2013)

Currency Unit – Taka (Tk)
Tk 1.00 = $0.0128
$1.00 = Tk 79

ABBREVIATIONS

ADB	-	Asian Development Bank
AfD	-	l'Agence Française de Développement
BPDB	-	Bangladesh Power Development Board
CCGT	-	Combined-cycle gas turbine
CITES	-	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DC	-	Double circuit
DESCO	-	Dhaka Electric Supply Company Ltd.
DIA	-	Direct Impact Area
DOE	-	Department of Environment
DPDC	-	Dhaka Power Distribution Company Ltd.
DS	-	Distribution system
EA	-	Executing Agency
ECA	-	Environment Conservation Act
ECC	-	Environmental Clearance Certificate
ECR	-	Environment Conservation Rules
EIA	-	Environmental Impact Assessment
EIB	-	European Investment Bank
EMP	-	Environmental Management Plan
FFA	-	Framework Financing Agreement
GIA	-	General Impact Area
GIS	-	Gas insulated switchgear
GOB	-	Government of Bangladesh
GRC	-	Grievance Redress Committee
IDB	-	Islamic Development Bank
IEE	-	Initial Environmental Examination
IPCC	-	Investment Program Coordinating Committee
MFF	-	Multitranche Financing Facility
MOEF	-	Ministry of Environment and Forests
MPEMR	-	Ministry of Power, Energy and Mineral Resources
NGO	-	Non-government Organization
NOC	-	No Objection Certificate
NWPGCL	-	North-West Power Generation Company Ltd.
OCGT	-	Open cycle gas turbine
PGCB	-	Power Grid Company of BangladeshLtd.
PMU	-	Project Management Unit
RP	-	Resettlement Plan
ROW	-	Right-of-Way
SPS	-	Safeguard Policy Statement
SS	-	Substation
TA	-	Technical Assistance
T/L	-	Transmission Line

WEIGHTS AND MEASURES

m	-	meter
km	-	kilometer
ha	-	hectare
MVA	-	megavolt-ampere
kV	-	kilovolt (1,000 volts)
mG	-	milliGauss
MW	-	megawatt
°C	-	degree Celsius
lahk	-	100,000

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

EXECUTIVE SUMMARY

1.0 Project Description

1. Tranche 2 will be financed through the Power System Expansion and Efficiency Improvement Investment Program under the multitranche financing facility (MFF) approved by Asian Development Bank (ADB) in December 2012 together with Tranche 1. The MFF was designed to cover investments in three tranches for power generation, transmission and distribution to be implemented within 2012-2015 in order to meet the current severe energy shortfall in Bangladesh. The total amount of the Investment Program is $1.6B financed by ADB, the European Investment Bank (EIB), Islamic Development Bank (IDB) and the l'Agence Française de Développement (AfD). The executing agencies (EA) for Tranche 2 are Power Grid Company of Bangladesh Ltd. (PGCB), Dhaka Power Distribution Company Ltd. (DPDC), and Dhaka Electricity Supply Company Ltd. (DESCO).

2. The total estimated cost of Tranche 2 is US$952M with financing contribution of $655M from ADB, IDB, and AfD. Tranche 2 will consist of three parts as follows:

Part A: Transmission Network Improvement for PGCB

This will cover three components consisting of installation of new transmission lines and rehabilitation/upgrading of existing transmission lines, and construction of new substation to improve the power transmission facilities in the north-east of Dhaka division to the north-east and eastern side of Dhaka City including the core areas of Chittagong and Sylhet.

Component 1 (Financed by IDB) – Transmission Lines

- 14 subprojects with varying capacities of 400 kV (28 km), 230 kV (51 km) and 132 kV (99 km)

Component 2 (Financed by IDB) – Substations

- 12 subprojects consisting of six 132/33 kV gas insulated substations (GIS), two 132/33 kV air insulated substations (AIS), one 230 kV switching station at Ghorasal, two 230/132 kV gas insulated substations, and one 230/132/33 kV air insulated substations

Component 3 (Financed by ADB)

- Combination of substations and transmission line with four subprojects: 230/132 kV gas insulated substation, 132/33 kV gas insulated substation, 230 kV double circuit (DC) line in-line out (LILO) 4 km, and 132 kV DC LILO (2 km)

Part B: South Dhaka Distribution Improvement for DPDC

This includes four components of substations and 11 kV distribution lines to strengthen the power supply in the southern part of Dhaka City.

Component 4 (Financed by AfD)

- Seven 132/33 kV GIS substations at Mohtijheel, Kazla, Charsayedphur, New Ramna, Fatullah, Postogola, and Zigatola contributing a total capacity of 600 MVA with a total capacity of 196 MVA

Component 5 (Financed by AfD)

- Seven 33/11 kV GIS substations at BS Mujib Medical University, P&T, Monipuripara, BB Avenue, Green Road Dormitory, Dhaka Udyan, and Segunbagicha with a total capacity of 196 MVA

Component 6 (Financed by ADB)

- Eight 33/11 kV GIS substations in Banasree, Mugdapara Hospital, Dapha (Fatullah), Dhaka Medical College, Kamalapur Railway Hospital, Mondalapara, Nandalapur, and Laxminarayan Cotton Mill (LNCM) with a total capacity of 224 MVA

Component 7 (Financed by ADB)

- Two subprojects of feeders and distribution transformer with a total capacity of 300 MVA and distribution lines (450 km) of 11 kV

Part C: North Dhaka Distribution Improvement (DESCO)

There will be two components in Part C needed to strengthen the power supply in the northern part of Dhaka City. This consists of 32 subprojects which include construction of five 132/33 kV GIS substations and 14 substations of 33/11 kV capacity, and rehabilitation of 10 substations of 33/11 kV capacity, and distribution lines.

Component 8 (Financed by ADB)

- Five substations with 132/33 kV capacity at Dumni, Aftabnagar, Uttara 3rd Phase, Gulshan-Banani, and Purbachal with a total capacity of 800 MVA; and 42.9 circuit km of 132 kV transmission line for the source of these substations
- Rehabilitation of 10 substations with 33/11 kV capacity
- 14 substations of 33/11 kV capacity

Component 9 (Financed by ADB)

- Construction of 33 kV underground cable distribution lines (70 circuit km)
- Construction of 11 kV and 0.415 kV overhead distribution line (500 km)
- Construction of 11 kV underground cable distribution line (200 circuit km)
- Installation of distribution transformer with 300 MVA capacity

2.0 Environmental Requirements for Tranche 2

3. An environmental assessment and review framework (EARF) was prepared for the MFF in September 2012 to ensure that subprojects or project components in succeeding tranches comply with the requirements of ADB and the co-financiers. According to the Safeguard Policy Statement 2009 (SPS 2009) of ADB, Tranche 2 is classified as category B requiring an initial environmental examination (IEE). Following the EARF and SPS 2009, this draft IEE was prepared as the unified environmental assessment and planning process for consultation, information disclosure, grievance redress procedure, and safeguard documentation to meet the safeguard principles and requirements of ADB and the co-financiers.

4. The environmental safeguard of the Government of Bangladesh (GoB) as provided for by the Environment Conservation Act of 1995 and the Environment Conservation Rules of 1997 requires that power projects like Tranche 2 also prepare an IEE and an environmental impact assessment (EIA) in obtaining the site clearance and environmental clearance certificate (ECC) from the Department of Environment (DOE).

3.0 Anticipated Environmental Impacts and Mitigation Measures

5. The impacts of the 30 subprojects in Part A are mainly during the construction of the substations and the installation of the transmission towers which are temporary, of short duration (e.g., about 4-6 months for reconductoring of 27 km Ghorasal-Tongi 230 kV transmission line), and can be easily mitigated by proper construction planning and good engineering practices. The routes of the transmission lines traverse predominantly agricultural land planted to rice, vegetables and other cash crops. No threatened, endangered or protected species, sanctuary or ecologically sensitive areas will be affected by the subprojects included in Part A.

6. There is only one substation site in Kamalapur, out of the 22 substation sites for Part B, which require land acquisition. All the 24 subprojects in Part B (both substations and feeder improvement) are located within the built-up areas in Dhaka and Narayaganj for the South Dhaka distribution improvement. The associated impacts are disruption and inconvenience during construction of the substationsdue to movements of construction vehicles, transport of construction materials and equipment, and earthmoving and civil works. Dismantling of structures and equipment will be required for the upgrading of the existing substations which may pose risks to workers and the community.

7. There are a total of 32 subprojects for Part C (substations and distribution lines improvement). The 29 substation sites for the improvement of the North Dhaka distribution networks are also within the built-up areas of Dhaka, Mirpur, and Gazipur. Impacts will be mainly during construction similar to the subprojects of Part B. There will be dismantling of structures and equipment also from 10 existing substations.

8. Environmental impacts of Tranche 2 are mostly associated during construction and the costs of mitigation measures are included in the engineering, procurement, and construction contract(s) while the costs during the operation phase are borne by the EAs. The mitigation measures are included in the environmental management plan (EMP) with cost estimates. Debris that are no longer useful from dismantling works will be disposed of in designated government-controlled dumpsites while usable scrap materials will be transported to the warehouse of PGCB, DPDC, and DESCO in Tongi and Mirpur for resale and auction.**Table E.1** presents the EMP while **Table E.2** gives the monitoring plan for Tranche 2.

4.0 Information Disclosure, Consultation, and Participation

9. Initial consultations were done for Part A from June 5-19, 2013 and a total of 48 persons were consulted. Formal consultations will be done during the preparation of the environmental impact assessment (EIA) required by the DOE to secure the ECC. Some concerns persons consulted are load shedding, lack of transparency and clarity in electricity charges and how these are calculated,and impacts of land acquisition.

10. Consultations for Part B and Part C were carried out in May and January 2013, respectively. Concerns of the affected people include: temporary disruptions during construction such as drainage congestion, traffic, risks from dismantling of existing substations to be upgraded; delays in construction works, provision of safety nets to minimize risks to workers and community health and safety. They are hopeful that with stable and reliable supply of electricity resulting from Tranche 2, there will be more housing and real estate business as well as industries to create jobs.

11. This draft IEE will be updated to include the results of formal consultations for all the components to meet the requirements of ADB's SPS 2009 and Public Communications Policy 2011. The updated IEE will be posted to the websites of PGCB, DPDC and

DESCO and a project brief in Bangla will be prepared and made available to the public at the field offices of PGCB, DPDC and DESCO.

5.0 Implementation Arrangements and Grievance Redress Mechanism

12. A Project Management Unit (PMU) will be set up in PGCB, DPDC, and DESCO headed by a PMU Manager who will supervise the daily implementation of the subprojects and responsible for reporting all subproject-related issues to their respective Chair and Managing Director. The PMU will consist of technical, financial, and procurement staff while safeguards (environment and social) support will be hired, as and when required. The safeguards staff will be responsible in preparing the environmental monitoring reports to be submitted to ADB twice a year during construction and annually during operation phase. Tranche 2 will be implemented over five years including procurement and construction activities.

13. A grievance redress mechanism will be set up in each EA to deal with complaint(s) from project affected persons (PAPs) during implementation.PAPs can seek redress of their grievance at three levels: (i) the PMU at each EA, (ii) the grievance redress committee (GRC), and (iii) the appropriate courts of law. The GRC is set up by the EAs as soon as the project commence. The GRC set up is common for Part A, Part B and Part C which consists of Manager, PMU-EA as the Convenor, Contractor's representative as Secretary, and the members are neighbor of the complainant, female representative of affected people, school teacher or *Imam* (church leader), and chair of the union.

6.0 Conclusion

14. The selection of the subprojects for Tranche 2 was consistent with the EARF and Schedule 5 of the Framework Financing Agreement for the Investment Program approved in December 2012. Aside from this, the selection of the substation sites and the transmission line routes was guided by a general criteria based on best construction and engineering practices which include minimizing the environmental impacts.

15. Tranche 2 is not expected to cause significant adverse environmental impacts during construction and also during operation. The impacts on vegetation and land clearing within the ROW and substation sites during installation of transmission towers, stringing of conductors, reconductoring, and construction of new substations can be easily mitigated by proper planning, consultation, and best practices in construction engineering.

16. Measures for mitigation of impacts and monitoring have been included in the environmental management plan (EMP) and environmental monitoring plan. PGCB, DPDC, and DESCO will ensure that adequate resources are provided to ensure the implementation and compliance to the EMP and the environmental monitoring plan.

17. Consultations with key stakeholders will continue throughout the implementation of Tranche 2 and the appropriate grievance redress mechanism will be followed to prevent complaints and issues from affected persons.

18. This draft IEE will be updated and submitted to ADB for review, and will be publicly disclosed at the websites of ADB, PGCB, DPDC, and DESCO. A project brief and/or factsheet will be prepared in Bangla and made available to the public at the field offices of PGCB, DPDC, and DESCO. All the appropriate and relevant environmental clearances will be obtained from the DOE and copies submitted to ADB prior to civil works.

Table E.1 Environmental Management Plan for Tranche 2

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
Pre-Construction and Design Phase					
• Preparation of feasibility study and other desktop technical and engineering study • Land acquisition	• Land and people	• Mainly desktop review • Walk-over survey may cause temporary disturbance to localized area • Permanent loss of private land Part A - six substation sites of PGCB require land acquisition Part B – one substation site in Kamalapur requires transfer from Bangladesh Railway to DPDC Part C – no land acquisition required	• Study topographical and geotechnical information, environmental and socioeconomic data, etc, and integrate with engineering design of substation and transmission lines • Consultation with private land owner(s) and ensure compliance with SPS 2009 on the process of land acquisition	Included in the Project Costs * Cost of land acquisition is borne by PGCB and DPDC and not included in Contractor(s) costs	Design or survey engineers/Consultants, PGCB, DPDC, DESCO, District Commissioner Office
Construction Phase					
Orientation for contractor and workers	• People	• Awareness of workers on the environmental requirements during construction and their responsibility • Contractors' understanding of their responsibility in implementing the EMP	• Conduct briefing and/or training for Contractor on the EMP, records management, and reporting • Agreement on the critical areas to be monitored and the required mitigation measures • Create awareness of sexually-transmitted diseases such as HIV/AIDs	Included in the costs of Contractor(s)	PMU of PGCB, DPDC and DESCO
Prepare construction management workplan	• People • Land • Air Quality and Noise • Waste	• Avoid effects of Contractors' unplanned activities • Smooth work implementation	• Temporary pedestrian and traffic management plan • Materials management plan • Waste management plan • Noise and dust control plan • Community and Safety plan	Included in costs of Contractor(s)	Contractor(s), PMUof PGCB, DPDC, and DESCO
Hiring of project staff and workers	• People	• Conflict due to potential workers' migration • Lack of local support to the project	• Use local labour for manual work and eligible local workforce for clerical and office jobs	---	Contractor(s), PMU of PGCB, DPDC, DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)		Responsible agency/unit
		• Opportunity for local people to engage in non-agricultural employment and small-scale business				
Presence of workers at construction sites	• People	• Potential for increase demands in services such as food, temporary housing, etc. • Presence of construction workers may become small-scale and temporary opportunity for local people to provide services such as food, temporary housing, etc.	None required	---		---
Site preparation, vegetation and land clearing for substations and transmission line right-of-way (ROW)	• Land • Vegetation	• Dismantling of structure(s) and equipment from existing substations • Dismantled equipment may be suspected or potentially-PCB contaminated • Excavation and earth moving works for the construction of substations • Loss of habitat	• Civil works guidelines and/or construction management plan will be strictly implemented • Only minimal vegetation in the substation sites will be cleared • Debris/dismantled structures/equipment will be disposed of in designated landfill and/or controlled dumpsites • Scrap materials stored in warehouses at Tongi and Mirpur for resale/auction • Use of proper safety clothes/equipment in dismantling structure(s) and equipment • Coordinate with BPDB and DOE for management or disposal of suspected or potentially PCB-contaminated equipment • Erosion-control measures will be implemented	Soil erosion and soil quality	PGCB - 28 DPDC - 29 DESCO - 33	Contractor(s), PMU of PGCB, DPDC and DESCO together with their environmental staff
				Drainage	PGCB - 14 DPDC – 14.5 DESCO – 16.5	
				Revegetation and landscaping	PGCB - 14 DPDC – 14.5	

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)		Responsible agency/unit
			• Landscaping will be done after completion of construction works • Laying of underground cable will be done at nighttime to reduce disruption to economic activities of local people • Compensation for loss of trees and temporary damages to crops along ROW		DESCO – 16.5	
	• Air quality	• Use of construction vehicles may increase vehicular emissions • Transport of construction materials to project sites may increase dust level • Earthmoving works, excavations, and opened land areas may increase dust levels	• Construction vehicles will be maintained to minimize vehicular emissions • Temporary enclosure of construction sites to contain dust dispersion • Provision of warehouse for construction materials in the sites to reduce trips of construction vehicles • Direct Contractor(s) to maintain construction vehicles and heavy equipment machineries properly • Spray water to exposed areas or sources of dusts • Cover trucks transporting materials to reduce dust dispersion	PGCB – 80 DPDC – 65 DESCO - 71		Contractor(s), PMU of PGCB, DPDC and DESCO together with their environmental staff
	• Noise	• Potential increase in noise level from construction works and ground vibration from construction vehicles	• Observance of low speed by vehicles to reduce noise • Noise-generating works done at daytime • Proper and regular maintenance of construction vehicles to reduce noise • Observe/Comply with traffic management plan • Temporary enclosure to noise-	Included in the air quality cost		Contractor(s), PMU of PGCB, DPDC and DESCO together with their environmental staff

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
			generating activities at the sites		
Construction of substations, installation of required equipment at substations, erection of transmission lines, and reconductoring of existing transmission line	• People • Land	• Interference with road crossings	• Danger and clearly visible warning signs will be posted at designated sites • Scaffoldings will be placed over road crossing points • Construction vehicles to strictly follow road regulations	PGCB – 70 DPDC – 110 DESCO - 140	Contractor(s), PMU of PGCB, DPDC and DESCO together with their environmental staff
		• Potential safety risks to community	• Maintain necessary fence or barricade (as appropriate), sufficient lights, warning signs and danger signals, and take all required precautions for public safety • Assign security personnel to prevent accidents, trespassing, and pilferage • Require Contractor to direct drivers of construction vehicles to strictly follow road regulations		Contractor(s), PMU of PGCB, DPDC and DESCO together with their environmental staff
		• Potential health and safety risks to workers	• Provide sanitary facilities and wash areas • Provide safe drinking water and garbage bins • Enforce good housekeeping at all times • Study safety plan before start of construction • Provide workers with hard hat, safety shoes and belts • Coordinate with nearest hospital for arrangements in case of accidents • Assign nurse or medical staff to make weekly rounds at substation sites	PGCB – 14 DPDC – 14.5 DESCO – 16.5	Contractor(s), PMU of PGCB, DPDC and DESCO together with their environmental staff

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
			• Set up first aid treatment within construction sites and field office • Observance and compliance with relevant safety measures required by law and best engineering practices • Provide communication devices to designated workers		
Operation Phase					
Hazards due to accidental failure of power transmission and distribution lines	• People • Land	• Electrocution hazards will occur only if someone comes too close or in contact with the transmission line cable	• A protection system that shuts off during power overload or similar emergencies will be provided • Distribution lines entering and leaving the substations are insulated (or covered) to minimize impacts to birds • Regular monitoring and maintenance to ensure safety and integrity of power transmission and distribution lines and substations • Conduct information and education campaign to local people to enhance awareness on safety practices of living near substations	Included in the O & M costs of Project	DPDC
Use of mineral oil for transformers	• People • Land • Water	• Accidental spillage that would contaminate land and water • Occupational health risks to workers due to exposure	• Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free • Provision of oil-water separator • Fire extinguishers readily available in storage areas for mineral oil	Included in the O&M costs	PGCB, DPDC, and DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
			• Provide for oil containment structure		
Presence of substations, power transmission and distribution lines	• People • Land	• Potential depreciation of land property values near or adjacent to substations and power transmission and distribution lines	• Availability of stable and reliable power will trigger economic development in the area	---	---
	• Noise	• Noise generated by equipment in the substations	• Periodic maintenance of equipment such as transformers and capacitors to minimize noise generation • Provide enclosure of noise-generating equipment • Monitor ambient noise levels	Included in the O&M costs	PGCB, DPDC, and DESCO
	• People	• Generation of employment	• More than 200 positions will be created during the operation of Tranche 2	---	PGCB, DPDC, and DESCO
	• People	• Potential exposure to electric and magnetic fields (EMF)	• Electric and magnetic field from the substations, power transmission and distribution lines are expected to be way below the limits set by International Commission on Non-Ionizing Radiation Protection(ICNRP)which is 4.17 kV/m for electric field and 833 mG for magnetic field • Substations will be fenced and security staff assigned to prevent unauthorized public access • Information and education campaign will be conducted to local people to create awareness on safety practices	Included in the O&M costs	PGCB, DPDC, and DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
Use of SF_6 handling equipment	• People • Air	• Fugitive emissions from SF_6 handling equipment • SF_6 is a potent GHG • Occupational hazards of exposure to fugitive emissions of SF_6 gas	• Regular monitoring of SF_6 through pressure gauges • Use of handheld leak detectors to monitor leaks • Prepare annual inventory checklist of SF_6 consumption, purchase, and losses to track emissions • Provide training to staff on proper handling of SF_6	Included in the O&M costs	PGCB, DPDC, and DESCO

Table E.2 Environmental Monitoring Plan for Tranche 2

Project Stage	Parameter/Indicator	Location	Frequency	Responsibility (Implementation and Supervision)
Pre-Construction	Soil sampling	Substation sites (particularly those with existing structure and equipment dismantled)	Once before construction	PMUs (PGCB, DPDC, DESCO), Contractor(s)
	Local recruitment of workers and staff	Substations, transmission lines	Monthly	PMUs (PGCB, DPDC, DESCO), Contractor(s)
	Orientation of Contractor(s) and workers on issues like HIV/AIDS, compliance to EMP, etc.	Substations and Transmission line	Once before construction, and as needed	PMUs (PGCB, DPDC, DESCO)
Construction	Spraying of water to exposed land and before movement of construction vehicles	Substations and road easements when laying of underground cable to connect substations	• Weekly at road easements (or as needed) • Every day at substation sites during dry season and as needed during monsoon season	Contractor(s), Environmental Staff of PMUs (PGCB, DPDC, DESCO)
	Solid waste management	Substations, transmission lines	Every week	Contractor(s), Environmental Staff of PMUs (PGCB, DPDC, DESCO)
	Danger and warning signs for safety of workers and the public	Substations and road easements affected by laying of underground cable, transmission lines	Once a month	Contractor(s), Environmental Staff of PMUs (PGCB, DPDC, DESCO)
	Announcement to the public of works schedule	Along the road easement affected by laying of cables and substations	As needed	Contractor(s), PMUs (PGCB, DPDC, DESCO)
	Erosion control measures such as silt traps	Substations, transmission lines (if needed)	Once a month	Contractor(s), Environmental Staff of PMUs (PGCB, DPDC, DESCO)
	Smoke belching construction vehicles	Substations and transmission lines	Weekly	Contractor(s), Environmental Staff of PMUs (PGCB, DPDC, DESCO)
	Dust and noise level	Substations, transmission lines	Twice a month	Contractor(s), Environmental Staff of PMUs (PGCB, DPDC, DESCO)
	Housekeeping	Substations, and transmission lines	Weekly	Contractor(s), Environmental Staff of PMUs (PGCB, DPDC, DESCO)
Operation	Failure of transmission towers and/or distribution lines	Along the alignment	Every month	PGCB, DPDC, DESCO
	Maintenance of landscape	Substations	Quarterly	PGCB, DPDC,

Project Stage	Parameter/Indicator	Location	Frequency	Responsibility (Implementation and Supervision)
				DESCO
	Housekeeping	Substations	Monthly	PGCB, DPDC, DESCO
	Waste Management (i.e., oil, garbage, etc.)	Substations	Monthly	PGCB, DPDC, DESCO
	Inventory of SF_6	Substations	Annual	PGCB, DPDC, DESCO
	Pilferage of cables	Along transmission and distribution lines	Quarterly	PGCB, DPDC, DESCO

1.0 INTRODUCTION

19. Bangladesh is facing severe power shortage for more than two decades now resulting from varying factors such as inability to build new generation capacity due to timely investments, poor preventative maintenance and performance of the existing generating capacity, and gas shortages to operate some of the existing power plants. Aside from these constraints, the growing population entails an increasingdemand for electricity. One of the main challenges is to provide a stable and reliable power supply.

20. With severe power shortage, the potential economic growth in Bangladesh has been constrained and the cost was estimated at about 0.5% of gross domestic product.[1]Recognizing this challenge, there is a need for significant investments in power generation, transmission and distribution to achieve access to an uninterrupted and reliable power supply.

1.1 Overview of Power System Expansion and Efficiency Improvement Investment Program

21. On 12 December 2012, the Asian Development Bank (ADB) has approved the BAN: Power System Expansion and Efficiency Improvement Investment Program under the multitranche financing facility (MFF).[2] The Investment Program was designed to cover investments in three tranches for power generation, transmission and distribution to be implemented within 2012-2015 so that the Government of Bangladesh (GoB) can meet its current energy shortfall. The total amount of the Investment Program is $1.6B (see **Table 1.1**). ADB financed $700 milllion for the three tranches, while the European Investment Bank (EIB), Islamic Development Bank (IDB) and l'Agence Française de Développement (AfD) invested a total of $678 million to the whole Investment Program (see **Table 1.2**).

Table 1.1 Financing Plan of the Investment Program

Source	Amount ($ million)	Share of Total (%)
Power System Expansion and Efficiency Improvement		
Asian Development Bank	700	44
Co-financing	678	42
Government	222	14
Total (Investment Program)	**1,600**	**100**
Tranche 1		
Asian Development Bank	185	46
Co-financing	183	46
Government	32	8
Subtotal (Tranche 1)	**400**	**100**
Tranche 2[a]		
Asian Development Bank	310	44
Co-financing	295	42
Government	105	14
Subtotal (Tranche 2)	**710**	**100**
Tranche 3		

[1] Government of Bangladesh, Ministry of Planning, Planning Commission. 2011. *Sixth Five Year Plan, FY2011–FY2015: Accelerating Growth and Reducing Poverty.* Dhaka (Part 1: Strategic Directions and Policy Framework).

[2] MFF is a flexible financing instrument of ADB which provides financing that is aligned to project readiness and long-term needs of the client. MFF is a modality consists of tranches that can finance multiple projects under an investment program in a sector or in several sectors, or large stand-alone projects with substantial and related individual components with long-term implementation plans. A tranche may comprise a loan, grant, guarantee, or ADB-administered cofinancing to finance a project or a component under the facility. (ADB Operations Manual, Multitranche Financing Facility, OM Section D14/BP, 18 May 2010)

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank	205	42
Co-financing	200	41
Government	85	17
Subtotal (Tranche 3)	**490**	**100**

[a]Tranche2 and Tranche 3 co-financing arrangements were discussed with co-financiers and broadly agreed. Confirmation of Tranche 2 and Tranche 3 co-financing is subject to the board approvals of the co-financing partners.
Source: Asian Development Bank estimates (2012)

Table 1.2 Co-financing Plan of the Investment Program

Source	Amount ($ million)	Share of Total (%)
Tranche 1		
EIB (loan)	91	54 (both loan and grant)
EIB (grant)	7	
IDB	85	46
AfD	---	---
Subtotal (Tranche 1)	**183**	**100**
Tranche 2		
EIB	---	---
IDB	195	66
AfD	100	34
Subtotal (Tranche 2)	**295**	**100**
Tranche 3		
EIB	100	50
IDB	100	50
AfD	---	---
Subtotal (Tranche 3)	**200**	**100**
Investment program		
EIB	198	29
IDB	380	56
AfD	100	15
Total (Tranche 1, Tranche 2 and Tranche 3)	**678**	**100**

22. Together with the MFF, **Tranche 1**was also approved on 12 December 2012 with three components: (i) conversion of existing open cycle gas turbine (OCGT) power plant in Khulna (150 MW to 225 MW) into combined-cycle gas turbine (CCGT); (ii) construction of five 132 kV double circuit (DC) transmission lines from Mymensingh to Tangail (100 km), from Brahmanbaria to Narshingdi (50 km), from Chandraghona to Khagrachary through Rangamati (80 km), from Beanibazar to Sylhet (28 km), from Sunamganj to Chhatak (30 km); and, (iii) capacity building for the Executing Agency(s) in the preparation of succeeding tranches, and in better systems management.

23. This **Tranche 2** proposes three parts with a total of 89 subprojects divided into nine components: (i) the improvement in power transmission facility that will strengthen the power supply stability, reliability and transmission capability in the north-east of Dhaka district (Gazipur and Narayaganj), to the north-east and eastern side of Dhaka city, and the core areas of Chittagong and Sylhet area; (ii) construction and expansion of the distribution network systems of southern half of Dhaka City; and, (iii) augmentation and rehabilitation of distribution networks in the northern half of Dhaka City. The total estimated cost of Tranche 2 is $952 M. **Table 1.3** presents the tentative financing plan for Tranche 2.

Table 1.3 Tentative Financing Plan for Tranche 2

('000 thousand)

Financing	Part A	Part B	Part C	Total	%
Asian Development Bank	35	75	200	310	33%
Islamic Development Bank	220	-	-	220	23%
French Development Agency	-	125	-	125	13%
GoB/EA[1]				297	31%
Total Project Cost				952	100%

[1] The contribution by GoB/EAs does not include the safeguard related costs to be borne by the EAs/GoB which are being finalized in consultation with EAs. This includes financing charges during implementation of ADB components and part of the related contingencies amounting to 5% of the base costs of ADB components.

24. The components of **Tranche 3** will include modernizing and conversion of existing OCGT power plants to improve energy efficiency, and installation of transmission lines and substations.

25. The Power Division of the Ministry of Power, Energy and Mineral Resources (MPEMR) is the Coordinating Agency for the MFF and oversees the implementation of the Investment Program and reports to ADB. **Table 1.4** presents the details of the tranches by Executing Agency (EA).

Table 1.4 Project Details of the Tranches by Executing Agency

Tranche	Project		Description	Executing Agency
1	Component 1		Conversion of OCGT in Khulna (150 MW to 225 MW) into CCGT	North-West Power Generation Company Ltd. (NWPGCL)
	Component 2		Transmission lines • Mymensingh to Tangail, 132 kV double circuit (100 km) • Brahmanbaria to Narshingdi, 132 kV double circuit (50 km) • Chandraghona to Khagrachari through Rangamati, 132 kV double circuit (80 km) • 28 km 132 kV double circuit Beanibazar to Sylhet • 30 km 132 kV double circuit from Sunamganj to Chhatak	Power Grid Company of Bangladesh Ltd. (PGCB)
	Component 3		• Capacity building on two main activities: (i) provision of resources for the preparation of subsequent tranches (Tranche 2 and Tranche 3); and, (ii) strengthen the institutional capacity of Executing Agencies for better systems management.	Ministry of Power, Energy and Mineral Resources (MPEMR)
2	Part A	Component 1	Transmission Lines - Financed by IDB • 14 subprojects with varying capacities of 400 kV (28 km), 230 kV (51 km) and 132 kV (99 km)	PGCB
		Component 2	Substations - Financed by IDB • 12 subprojects consisting of six 132/33 kV gas insulated substations (GIS), two 132/33 kV air insulated substations (AIS), one 230 kV switching station at Ghorasal, two 230/132 kV gas insulated substations, and one 230/132/33 kV air insulated substations	

Tranche	Project		Description	Executing Agency
		Component 3	Financed by ADB • Combination of substations and transmission line with four subprojects: 230/132 kV gas insulated substation, 132/33 kV gas insulated substation, 230 kV double circuit (DC) line in-line out (LILO) 4 km, and 132 kV DC LILO (2 km)	
	Part B	Component 4	Financed by AfD • Seven 132/33 kV GIS substations at Mohtijheel, Kazla, Charsayedphur, New Ramna, Fatullah, Postogola, andZigatola (with 132 kV U/G cable and O/H transmission line) contributing a firm capacity of 600 MVA	Dhaka Power Distribution Company (DPDC)
		Component 5	Financed by AfD • Seven 33/11 kV GIS substations at BS Mujib Medical University, P&T, Monipuripara, BB Avenue, Green Road Dormitory, Dhaka Udyan, and Segunbagicha (with 33 kV U/G cable) giving a total capacity of 196 MVA	
		Component 6	Financed by ADB • Eight 33/11 kV GIS substations in Banasree, Mugdapara Hospital, Dapha (Fatullah), Dhaka Medical College, Kamalapur Railway Hospital, Mondalapara, Nandalapur, and Laxminarayan Cotton Mill with 33 kV U/G cable (LNCM) giving a total capacity of 224 MVA	
		Component 7	Financed by ADB • Two subprojects of feeders and distribution transformer with a total capacity of 300 MVA and distribution lines (450 km) of 11 kV	
	Part C	Component 8	Financed by ADB • Five substations with 132/33/11 kV capacity at Dumni, Aftabnagar, Uttara 3rd Phase, Gulshan-Banani, and Purbachal with a total capacity of 800 MVA; and 42.9 circuit km of 132 kV transmission line for the source of these substations • Rehabilitation of 10 substations with 33/11 kV capacity • 14 new substations of 33/11 kV capacity	Dhaka Electric Supply Company Ltd. (DESCO)
		Component 9	Financed by ADB • Construction of 33 kV underground cable distribution lines (70 circuit km) • Construction of 11 kV and 0.415 kV overhead distribution line (500 km) • Construction of 11 kV underground cable distribution line (200 circuit km) • Installation of distribution transformer with 300 MVA capacity	
3	Component 1		Conversion of existing OCGT into CCGT	BPDB
	Component 2		Installation of transmission line and new substations; improvement to existing substations	PGCB

26. As shown in **Table 1.4**, BPDB and NWPGCL will implement the energy efficiency investments, the PGCB will implement the power transmission components, DPDC and DESCO will execute the distribution components, and the Power Division of MPEMR will oversee the capacity building component.

27. An Investment Program Coordinating Committee (IPCC), chaired by the Secretary of Power Division, MPEMR was established who will be responsible for coordinating the overall implementation of the Investment Program. Members of IPCC are the Chairs and Managing

Directors of the EAs, and representatives from the Economic Relations Division, Finance Division, Planning Commission, and the Implementation, Monitoring and Evaluation Division. The Implementing Units are the Project Management Unit (PMU) of each EA headed by a PMU Manager who will be responsible for reporting all subproject-related issues to the Chair and Managing Director of each EA. The PMU consists of technical, financial, and procurement staff while safeguards support will be hired, as and when required. The capacity building component will cover training activities of all power sector agencies needed to ensure the delivery of the outcomes identified for the investment program.

28. The MPEMR will conduct the review and due diligence of new project proposals submitted by the EAs prior to approval, and will monitor the performance and improvement in service delivery of the EAs. If necessary, consulting services will be provided to the PMU as support to supervision of technical due diligence process, safeguards due diligence, monitoring, and reporting.**Figure 1.1**shows the overall implementation arrangement of the Investment Program.

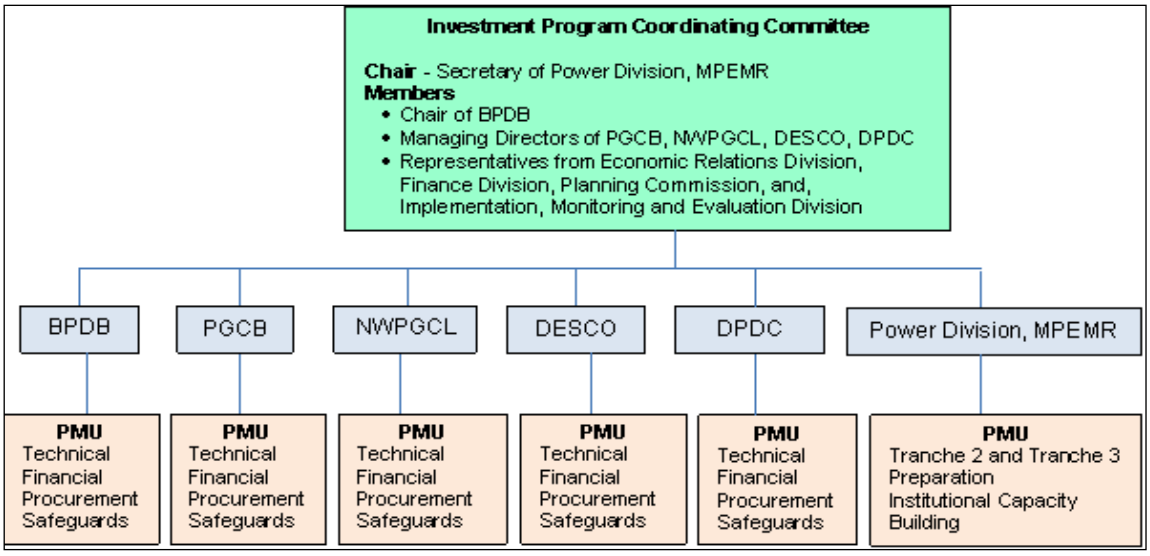


Figure 1.1 Implementation Arrangement of the Investment Program

1.2 Environmental Requirements for Tranche 2

29. An environmental assessment and review framework (EARF) was prepared for the MFF in September 2012. The EARF aims to ensure that the subprojects or project components implemented under the framework comply with ADB safeguard objectives, principles and requirements (para. 62, SPS 2009, p22). The EARF provides guidance on environmental screening, assessment, institutional arrangements, and procedures to be followed for the succeeding tranches in the MFF, where components have not yet been fully defined and locations not yet identified, to ensure compliance with SPS 2009 and the applicable national laws and regulations. Components or subproject selection will be based on the environmental selection criteria outlined in the EARF and the Schedule 4 of the Framework Financing Agreement (FFA).According to SPS 2009, Tranche 2 is Category B on environment requiring the preparation of an IEE. According to SPS 2009, Tranche 2 is Category B on environment requiring the preparation of an IEE.[3]

30. In the national environmental regulations set forth by the Environment Conservation Act (ECA) of 1995 and Environment Conservation Rules (ECR) of 1997, power projects such

[3]ADB, Safeguard Policy Statement, June 2009, para.50, p.19.

as Tranche 2 are within the Red Category requiring both an IEE to secure the site clearance from the Department of Environment (DOE)and an EIAto get the ECCafter obtaining the site clearance.

31. DESCO, DPDC, and PGCB contracted the Center for Environmental and Geographic Information Services (CEGIS), a public Trust under the Ministry of Water Resources, to prepare the IEE of some subprojects included in Tranche 2 following the requirements of DOE to obtain the site clearance and ECC. This draft IEE was based on some of the findings of CEGIS.

1.3 Structure of the Report

32. **Section 1.0** provides a background of the Investment Program and introduces Tranche 2, **Section2.0**defines the policy, legal, and administrative framework applicable to Tranche 2 while **Section 3.0**, **Section 4.0**,and **Section 5.0** present the environmental assessment for Part A, Part B, and Part C, respectively.

2.0 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

2.1 National Environmental Requirements

33. This section presents the regulatory agency, process, regulations and international environmental agreements relevant to the Investment Program.

2.1.1 Environmental Authority

34. The Ministry of Environment and Forests (MOEF) is the agency of the GOB in planning, promotion, coordination and overseeing the implementation of environmental and forestry programs. MOEF oversees all national environmental matters and is responsible for activities such as prevention and control of pollution, forestation and regeneration of degraded areas and protection of the environment, and in the framework of legislations. MOEF also conducts surveys, impact assessment, control of pollution, research, and collection and dissemination of environmental information and creation of environmental awareness among all sectors in Bangladesh.

35. Under the MOEF, the DOE was established as the primary government authority mandated to regulate and enforce environmental management regulations to ensure sustainable development and to conserve and manage the environment of Bangladesh. The DOE implements the duties of the MOEF on-the-ground through the consistent application of environmental rules and regulations, and provide guidance, training and promotional campaign on improving the awareness of environmental issues.

2.1.2 Applicable Environmental Regulations

31. The *Environment Conservation Act* (ECA) of 1995 (amended in 2000 and 2002) provides for the protection of the environment, improvement of environmental standards, and the control and abatement of environmental pollution. This Act gives authority to the DOE to carry out any activity needed to conserve and enhance the quality of environment, and to control, prevent and mitigate pollution.

32. The *Environment Conservation Rules (ECR)* of 1997 (adopted under the provision of ECA 1995 and amended in 2002 and 2003) provides rules related to the declaration of ecologically-critical areas, obtaining environmental clearance certificate, environmental quality standards, acceptable limits for discharges of waste, and environmental guidelines on pollution prevention. ECA 1995 and ECR 1997 outline the regulatory mechanism to protect the environment in Bangladesh.

2.1.3 SecuringEnvironmental Clearance

33. Section 12 of ECA 1995 provides that no industrial unit or project can be established or undertaken without obtaining an environmental clearance certificate (ECC) from the Director General, DOE.In accordance with the ECR 1997, DOE has classified development interventions based on their potential adverse environmental impacts for the purpose of issuing the ECC. The categories are: (i) green, (ii) orange A, (iii) orange B, and (iv) red.

34. The application for ECC from the DOE has two steps: (i) site clearance certificate is obtained at the initial stage and (ii) the ECC at the advanced stage. ECC is required for all the categories (i.e., green, orange A, orange B, and red). A site clearance and ECC are required for industries/projects in the categories: orange A, orange B, and red. **Appendix 1** gives the complete list of industries according to category.

35. The issuance of ECC by the DOE for Green projects is within 15 days upon receipt of application while for the site clearance of Orange A projects, the issuance will be within 30 days upon receipt of application, then for Orange B and Red categories, it will be 60 days. The ECC of Green projects is valid for three years. Once the site clearance is obtained for Orange A, Orange B, and Red projects, the ECC can be applied. DOE will issue or disapprove the ECC for Orange A projects within 15 days and within 30 days for Orange B projects while for Red category, it will be within 60 working days. The ECC is valid for one year depending on the compliance of the conditions and must be renewed 30 days prior to the expiry date.

36. No environmental study is required for Green industries or projects since they are are considered to be relatively pollution-free. However, a no objection certificate (NOC), normally taken from the local authorities, is required for submission to the DOE including a general information about the project/industry, and a description of the raw materials and finished products.

37. To obtain the site clearance, projects or industries within the Orange A category are required to submit general information, NOC, feasibility report, description of raw materials and finished products, process flow diagram, lay out plan, and effluent disposal system.

38. For Orange B category, the application for site clearance and ECC includes the feasibility report, IEE, environmental management plan (EMP) for existing industry, a NOC, pollution minimization plan, and an outline of relocation plan.

39. The Red category industries/projects are those which may cause significant adverse environmental impacts and therefore, require an EIA. Power projects fall within the Red category. The documents required for site clearance are feasibility report, IEE (the TOR for conducting the EIA is included in the IEE), EMP for existing industry, NOC, a pollution minimization plan including emergency plan for mitigation of adverse environmental impacts, and an outline of relocation plan (where applicable). After the issuance of the site clearance, the proponent can apply for the ECC. **Figure 2.1** presents the process of application for ECC to the DOE including the documents required.

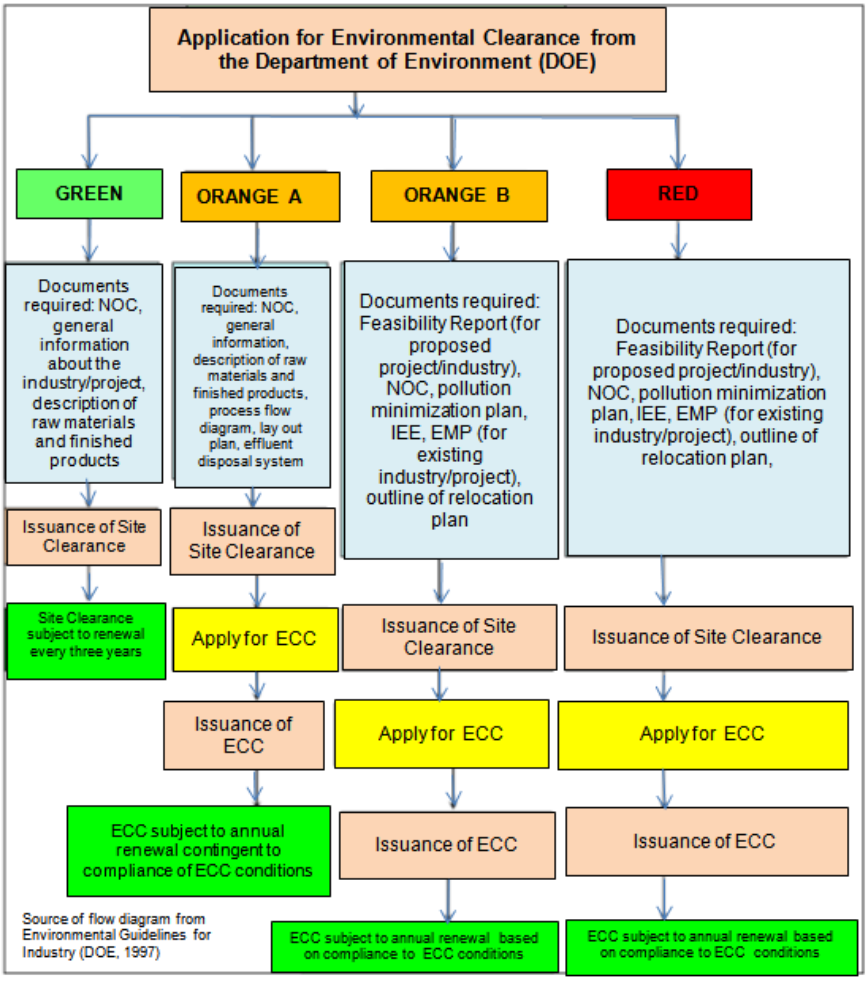


Figure 2.1 DOE Application Process for Securing ECC

40. Other relevant national regulations are as follows:

(i) *Environment Court Act 2000* (amended in 2002) is under the Judiciary and MOEF to ensure the completion of environment-related legal proceedings effectively.

(ii) *Vehicle Act 1927, the Motor Vehicles Ordinance 1983, and Bengal Motor Vehicle Rules 1940* are under the Bangladesh Road Transport Authority which regulates vehicular emissions and noise including road safety.

(iii) *Factories Act 1965 and Bangladesh Labour 2006* are under the Ministry of Labour which provides for the occupational rights and safety of factory workers and the provision of comfortable work environment and reasonable working conditions.

(iv) *The Forest Act 1927 (amended in 1982 and 1989)* is under the MOEF to protect forest resources.

(v) *Energy Policy 1996* is under the MPEMR which underscores the environmental protection by requiring an EIA for any new energy development project.

(vi) *Telegraph Act 1885* isunder the Ministry of Posts and Telecommunication which provides that the GOB can build towers on public land without giving any land compensation

(vii) *Electricity Act 1910* is the law relating to the supply and use of electrical energy, and which allows any person to secure a license to supply energy and to put down or place electrical supply lines for the transmission of energy. Sect 19(1) of the Act provides that the licensee, in the exercise of any of the powers conferred by or under this Act, will cause as little damage, detriment and inconvenience as may be,

and will make full compensation for any damage, detriment or inconvenience caused by him or by any one employed by him.

41. **Appendix 2** and **Appendix 3** present the relevant environmental regulations and environmental quality standards in Bangladesh, respectively.

2.1.3 Relevant International Environmental Agreements

42. The following is a list of applicable international environmental agreements that can provide guidance during the implementation of Tranche 2:

- *Convention Concerning the Protection of the World Cultural and Natural Heritage* (Paris 1972) – this convention was accepted in Bangladesh on 3 August 1983 and ratified on 3 November 1983. This Convention defines and provides for the conservation of the world`s heritage by listing the natural and cultural sites whose value should be preserved. Existing list can be referred to, if available, to avoid impacts in areas with cultural and natural heritage value.
- *Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar 1971)* – ratified on 20 April 1992 and which provides a framework for national action and international cooperation for the conservation and sustainable use of wetlands and their resources. Bangladesh has two Ramsar sites, the Tangauar Haor (Northeast of Bangladesh) and parts of Sundarban Reserved Forest (Southwest of Bangladesh). Tranche 2 avoided these two identified Ramsar sites.
- *Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington 1973)* – also known as CITES was signed on 20 November 1981. This Convention provides a framework for addressing the overharvesting and exploitation patterns that threaten species of flora and fauna. Under the Convention, the governments agree to restrict or regulate trade in species that are threatened by unsustainable patterns. Tranche 2 is not within the habitat areas which are likely to have endangered species of wildlife and flora. The project sites are located in the built-up areas of several districts: Sylhet, Chittagong, Comilla, Manikganj, Narshingdi, Gazipur, Dhaka, Mymensingh, Chandpur, Tangail, and Narayaganj. Nonetheless, the EAs will ensure that Tranche 2will not cause any harvesting and exploitation of wild flora and fauna during construction and operation.
- *Convention on Biological Diversity (1992)* – entered into force on 29 December 1993 and ratified on 20 March 1994. This provides for a framework for biodiversity and requires signatories to develop a National Biodiversity Strategy and Action Plan. Tranche 2will refer to the applicable or relevant National Biodiversity Strategy and Action Plan to ensure that any replacement of cleared vegetation (if any) resulting from the project will be consistent with the objectives and priorities of the Action Plan.
- *Convention on the Conservation of Migratory Species of Wild Animals (Bonn 1979)* – this sets the framework for agreements between countries important to the migration of threatened species. Tranche 2 is not within the areas known or likely to be habitat of migratory species of wild animals.
- *Stockholm Convention on Persistent Organic Pollutants (POPS)* – a global treaty in May 2001which was made effective in May 2004 to protect human health and the environment from chemicals that remain intact for a long time and become widely distributed geographically and accumulate in human and wildlife tissue. GOB signed the Stockholm Convention on POPS on 23 May 2001 and was ratified on 27 March 2007. The treaty requires the Parties to take measures to eliminate or reduce the release of POPS in the environment. The POPS of major concern to power sector projects is the polychlorinated biphenyl (PCB) used before as a transformer oil. PCB is not manufactured in Bangladesh and its international production generally was ended in 1980. Tranche 2 will ensure that management of POPS, if any, from the subprojects will be managed consistent with the Stockholm Convention.

2.2 Environmental Requirements of Asian Development Bank and the Co-financiers

43. This section summarizes the environmental requirements of ADB and the co-financiers.

2.2.1 Asian Development Bank

44. The environmental requirements specified in SPS 2009apply to all projects funded by ADB. SPS 2009 covers three key safeguard areas: environment, involuntary resettlement, and indigenous peoples; and aims to avoid adverse project impacts to both the environment and affected people; minimize, mitigate and/or compensate for adverse project impacts, and help Borrowers to strengthen their safeguard systems and to develop their capacity in managing the environmental and social risks. The environment assessment and review procedures require for the analysis of alternatives, meaningful consultation, timely information disclosure, preparation of environmental management plan and monitoring with appropriate budget, setting up of a grievance redress mechanism, biodiversity conservation and sustainable natural resource management, pollution prevention and abatement, inclusion of occupational and community health and safety, and avoiding damage to physical cultural resources.

45. During identification, screening and scoping of projects, ADB uses a categorization system based on the significance of potential environmental impacts and is determined by the category of its most environmentally-sensitive component, including direct, indirect, cumulative, and induced impacts within the project's area of influence. The project categorization system is as follows:

Category A – an environmental impact assessment (EIA) is required for a project that is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works.

Category B – an initial environmental examination (IEE) is required for a project that is likely to have adverse environmental impacts that are less adverse than those of Category A which are site-specific, few if any of them irreversible and in most cases mitigation measures can be designed more readily than Category A.

Category C – no environmental assessment is required but environmental implications will be reviewed for a project that is likely to have minimal or no adverse environmental impacts.

Category FI – if a project involves investment of ADB funds to or through a financial intermediary.

2.2.2 European Investment Bank

46. In 1996, the European Investment Bank (EIB) adopted an Environmental Statement (revised in 2002 and 2004) to emphasize its commitment to protecting and improving the natural and built environment according to the policy of the European Union (EU). After the Environmental Statement in 1996, it was further developed into the Statement of

Environmental and Social Principles and Standards 2009[4] ("the Statement"), approved on 3 February 2009. The Statementunderlines the environmental and social requirements of EIB for project financing giving greater emphasis than before to its social requirements. Based on these principles, EIB screens and classifies project according to their potential environmental impacts.

47. From the desktop review of available relevant documents such as technical documentation related to pollution control and criteria, planning documents, previously prepared assessment reports, project-related environmental studies, etc., a checklist is used to initially screen the environmental issues. The project classification of EIB is given below:

Categorization	Definition
A	Minimal or no adverse impacts - Low risk
B	Local and short-term negative environmental and associated social impacts and for which effective mitigation measures are readily available - Low to moderate risk
C	Significant adverse environmental and social impacts which are complex, sensitive and diverse, have a wide area of influence or are long-term - Moderate to high risk
D	Not acceptable in EIB terms

48. The EIB aims at high level of environmental protection based on precautionary principle, preventative action that environmental damage be rectified at source taken at an early stage, and on polluter pays principle. Similar to ADB, meaningful consultation is required by EIB and that it will be conducted as early as possible in the project assessment with transparency, and culturally-appropriate to the affected communities.

49. If the projects for financing are located outside of the EU, the national law sets the minimum disclosure, consultation and participation requirements of EIB (para. 63, p20 of Statement). A person affected (or perceived to be affected) by any decision of EIB can file a complaint to its Secretary General, either in writing or through internet and whose complaint(s) is centrally-handled and registered by its Complaints Office.

50. Unlike ADB, the EIB has environmental standards which aim to protect and enhance the natural environment, economic development and social well-being resulting from environmental sustainability. The environmental standards cover emission, ambient, and procedural standards. The requirements for environmental assessment are governed by the EU EIA Directive 85/337/EEC which took effect on 27 June 1985.[5]

51. Aside from the Statement, the EIB has an Environmental and Social Practices Handbook 2010 which provides advice on planning and managing the environmental and social appraisal and monitoring.[6]The Handbook describes the steps to determine the scope of the environmental and social review process throughout the project cycle and the overall internal processes and practices of EIB to ensure that its financing activities are consistent with its environmental policy.

[4]EIB.The EIB Statement of Environmental and Social Principles and Standards 2009.http://www.eib.org/about/news/eib-statement-of-environmental-and-social-principles-and-standards.htm. (Accessed 20 June 2013)
[5]European Commission.Environmental Assessment.http://ec.europa.eu/environment/eia/full-legal-text/85337.htm. (Accessed on 27 June 2013)
[6]EIB.Environmental and Social Practices Handbook 2010.http://www.eib.org/infocentre/publications/all/environmental-and-social-practices-handbook.htm. (Accessed on 20 June 2013)

52. For projects that involve co-financing, the Statement provides that EIB can agree to apply the standards of other international financial institutions if deemed equivalent to their requirements (para. 23, p.9 of the Statement).

2.4.2 Islamic Development Bank

53. In December 1973, the Islamic Development Bank (IDB) was created as an international financial institution to foster economic development and social progress of member countries and Muslim communities.[7]IDB has an operations manual that provides guidance in addressing the environmental issues of projects for financing. The operations manualindicates that the effects of the project on the environment and ecology in the area need to be assessed in all Projects Appraisal together with the measures to minimize any resulting adverse impacts.

54. The IDB is stillin the process of preparing its Statement on Environmental and Social Safeguards Principles, and Commitments to Environmental and Social Responsibility.[8]

2.4.3 l'Agence Française de Développement

55. The l'Agence Française de Développement (AfD) is a bilateral development financial institution created in 1941to provide funds for development projects, on behalf of the French government, based on its policies for overseas development assistance.

56. In January 2007, AfD implemented a reference framework for its social and environmental responsibility procedures as follows:[9]

a) Universal Declaration of Human Rights
b) Conventions of the International Labour Organization
c) Three Rio Conventions
d) Anti-corruption conventions of the Organization for Economic Cooperation and Development and the United Nations including the international anti-money laundering rules.

57. Also in January 2007, the environmental and social risk management (ESRM) policy was adopted by AfDreplacing the previous environmental assessment policy applied to funding since 2000.[10]The new ESRM policy harmonizes the objectives of the environmental and social procedures of official development assistance agencies focusing on aid effectiveness of Paris Declaration. The changes with the introduction of ESRM policy are: (i) social risk assessment and management procedure related to funding; (ii) inclusion of environmental and social risk assessment and management procedures to projects on financial intermediaries; and, (iii) continuous assessment and monitoring of environmental and social impacts from processing to ex post evaluation in financing operations.

[7]IDB.About IDB. http://www.isdb.org/irj/portal/anonymous?NavigationTarget=navurl://24de0d5f10da906da85e96ac356b7af0. (Accessed on 18 June 2013)
[8]IDB.Statement by Dr. Ahmad Mohamed Ali, President, IDB. United Nationas Conference on Sustainable Development (Rio +20), 20-22 June 2012. http://www.isdb.org/irj/go/km/docs/documents/IDBDevelopments/Internet/English/IDB/CM/About%20IDB/President%20IDB%20Group/PS_UN_ConferenceSustainableDevelopment_20June2012.pdf. (Accessed on 21 June 2013)
[9]AfD.Social and environmental responsibility.http://www.afd.fr/lang/en/home/AfD/L-AfD-s-engage/responsabilite-sociale-environnementale-afd. (Accessed on 22 June 2013)
[10]AfD.Environmental and Social Management, http://www.afd.fr/lang/en/home/AfD/L-AfD-s-engage/responsabilite-sociale-environnementale-afd/maitrise-risques.(Accessed on 24 June 2013)

AfDstrengthens its supervision of their Clients/Borrowers on implementation of the measures to mitigate, reduce or compensate the environmental and social impacts identified during the due diligence.

58. **Table 2.1** presents a comparison of the environmental requirements focusing on the ADB, EIB, and GoB.

Table 2.1 Comparison of Environmental Requirements of ADB, EIB and GoB

Project Stage	ADB	EIB	GOB
Screening and Categorization	• Uses sector-specific rapid environmental assessment checklist for screening • assigns categories based on potential impacts: • A - EIA required (irreversible, diverse or unprecedented adverse environmental impacts) • B - IEE required • C - no environmental assessment required but a review of environmental implications is required • FI - ESMS required	• Uses environmental eligibility criteria for financing • Uses Checklist of Environmental and Social Issues for Screening • Project categorization based on potential environmental impacts as follows: •A - minimal or no adverse impacts (Low risk) •B - local and short-term negative environmental and associated social impacts and for which effective mitigation measures are readily available (Low to moderate risk) •C - significant adverse environmental and social impacts which are complex, sensitive and diverse, have a wide area of influence or are long-term (Moderate to high risk) •D - not acceptable in EIB terms	• ECA 1995 and ECR 1997 set screening criteria to classify industries/projects based on potential environmental impacts as follows: Green, Orange A, Orange B and Red. These screening criteria are based on project or industry type and do not consider the scale and location. The category determines the level of environmental assessment.
Environmental Assessment	• Identify potential impacts on physical, biological, physical cultural resources, and socioeconomic aspects in the context of project's area of influence (i.e., primary project site and facilities, and associated facilities)	• Strategic Environmental Assessment (SEA) required for plans and programmes which are likely to have significant effects on environment Requirement for environmental assessment is guided by EU EIA Directive 85/337/EEC (amended by Directives 97/11/EC and 2003/35/EC) • Assess the direct and indirect effects of a project on the following factors: ➢ human beings, fauna and flora, ➢ soil, water, air, climate and the landscape, ➢ the inter-action between the factors mentioned in the first and second	*Industry/project category* *Green* - no environmental assessment required *Orange A* - no IEE or EIA required but must provide process flow, lay-out showing effluent treatment plant, etc. *Orange B* - IEE required *Red* - both IEE and EIA are required

Project Stage	ADB	EIB	GOB
		indents, ➢ material assets and the cultural heritage. • Assessment to include cumulative direct and indirect impacts • Identify and address significant transboundary impacts	
Analysis of Alternatives	For projects with potential significant impacts (i.e., Category A) • Examine alternatives to the project's location, design, and technology • Document rationale for selecting the particular project location, design, and technology • Consider "no project" alternative	• Requires assessment of project alternatives	• Regulations (i.e., ECA 1995 and ECR 1997) do not require specifically the identification and analysis of alternatives
Meaningful Consultation	• Starts early and continues during implementation • Undertaken in an atmosphere free of intimidation • Gender inclusive and responsive • Tailored to the needs of vulnerable groups • Allows for the incorporation of all relevant views of stakeholders	• Nature and magnitude of stakeholder interests should be established • Include how the main concerns of stakeholders will be dealt with in terms of mitigation or compensation measures and how these will be monitored during implementation • Clarify if any legal proceedings are ongoing against the project as part of EIA • Negative campaign on the project should be noted in the Overall Environmental and Social Assessment Form D1 and the Environmental and Data Sheet	• Public consultation and participation are not mandatory based on ECA 1995 and ECR 1997
Information Disclosure	ADB will post in its website the following: • Draft EIA report posted on ADB website at least 120 days prior to Board consideration • Draft EA/EARF prior to appraisal • Final or updated EIA/IEE upon receipt • Environmental monitoring report submitted by borrowers upon receipt	• Makes Non-technical Summary (NTS) of EIA available to public through electronic links in Project List to the Borrower's website at a minimum of 30 days prior to Board consideration • Borrower responsible for making the EIA and NTS publicly available in a language appropriate for consultation	• No requirement for disclosure but DOE posts the Minutes of the Meeting on the application for environmental clearance certificate to its website, http://www.doe-bd.org/minutes.php
Grievance Redress Mechanism	• Establish a mechanism to receive and facilitate resolution of grievances or complaints	• Complaints from affected people are lodged to the Secretary General and dealt with by the Complaints Office that ensures a centralized handling and registration of complaints.	• Grievance redress mechanism is not mentioned in the regulations
Use of Environmental	• Refers to Environmental Health and Safety	• Includes emission, ambient and procedural	• Ambient and emission standards included in

Project Stage	ADB	EIB	GOB
Standards	Guidelines 2007 • If national regulations differ, more stringent will be followed • If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification	standards from the Integrated Pollution Prevention and Control, European Union (EU) directives, and sector Framework Directions	ECA 1995 and ECR 1997 • Occupational health and safety standards included in the Factories Act 1965 and Bangladesh Labour Law 2006
Monitoring and Reporting	• Prepare monitoring reports on the progress of EMP • Retain qualified and experienced external experts or NGOs to verify monitoring information for Category A projects • Prepare and implement corrective action plan if non-compliance is identified • Requires submission of quarterly, semiannual, and annual reports to ADB for review	• Regular progress reports containing results of environmental monitoring, implementation of mitigation measures, record of complaints • Completion Report on compliance to environmental regulations and implementation of mitigation measures, and environmental monitoring	• ECC is subject to annual renewal based on compliance of the conditions set in the ECC.

Source: Ministry of Power, Energy and Mineral Resources. BAN: Power System Expansion and Efficiency Improvement Investment Program Tranche 1, Draft IEE. September 2012.

3.0 PART A – TRANSMISSION NETWORK IMPROVEMENT BY POWER GRID COMPANY OF BANGLADESH LTD.

3.1 Project Description

3.1.1 Objectives and Benefits

59. Ghorasal is a strategic location of power transmission system and a major power generation hub in Bangladesh. Based on the power generation plan of BPDB, about 1,250 MW will be added at Ghorasal from natural gas-fired power plants which would require evacuation.[11]Part A have the following objectives:

(i) To evacuate power from the upcoming power generation plants in the district of Ghorasal, a major power generation hub in Bangladesh;
(ii) To upgrade the 230 kV transmission network in the north-eastern region of Dhaka;
(iii) To meet the growing demand of Greater Dhaka, Sylhet, and Chittagong areas; and,
(iv) To upgrade the existing 132 kV substations.

60. The completion of Part A is expected to provide a more stable and reliable power transmission capacity networks likely to contribute to poverty alleviation through the use of electricity for agricultural production, industrialization, business, education, commercial activities, health, and other employment-generation activities.

3.1.2 Location and Components

61. Part A consists of power transmission improvements in the existing transmission facility of PGCB. It is designed in three different components with a total of 30 subprojects. These components are expected to provide a more stable and reliable power transmission capacity in the north-east and eastern side of Dhaka City, to the north-east of Dhaka in the districts of Gazipur and Narayaganj, and in the core areas of Chittagong and Sylhet.

62. The transmission line for Part A will be double circuit of aluminum alloy conductor material while the supporting towers will be steel of two types – tension and suspension. Tension towers will be installed in angles and suspension towers will be installed along the line as load-bearing support. Disc type insulator will be used in the towers to bear the transmission line. The transmission towers will be double circuit configuration to increase the long-term reliability and capacity of the transmission lines that will evacuate the power over long distances.

63. The substations are mostly gas insulated substation (GIS) except for the substations in Manikganj (132/33 kV upgrade), in Sripur (230/132/33 kV) and in Kodda (132/33 kV) which are air insulated substation (AIS).

64. A GIS substation uses sulfur hexafluouride (SF_6) gas to provide the phase to ground insulation for the switchgear. SF_6 has a dielectric strength higher than air and the phase to phase spacing is reduced resulting to a more compact substation that is particularly advantageous in an urban environment where space is expensive. GIS is generally installed indoor.

[11]Bangladesh Power Development Board.Generation Planning.http://www.bpdb.gov.bd/bpdb/images/Planning/new_generation_planning.pdf. (Accessed on 25 June 2013)

65. An AIS substation uses atmospheric air as the phase to ground insulation for the switchgear of the substation. Main disadvantage of the AIS substation is the overall size making it attractive to locate in the rural areas and they are usually installed outdoor.
Table 3.1, **Table 3.2**, and **Table 3.3** present the subprojects in the three different components while **Figure 3.1** shows the subproject location of Part A.

Table 3.1 Component 1 Subprojects of PGCB

No.		Project	Transmission Line Length (km)
1	1.1	132 kV LILO Fenchuganj-Sylhet (double circuit)	6.0
	1.2	132kV LILO Haripur-Ghorasal (double circuit)	2.0
	1.3	132kV LILO Kaliakoir-Tangail (double circuit)	2.0
	1.4	132kV LILO Madunaghat-Kulshi (double circuit)	6.0
	1.5	132kV Hathazari-Sitakundu transmission line (double circuit)	15.0
	1.6	400 kV Ghorasal-Tongi transmission line to accommodate shifting of Ishurdi-Ghorasal 230 kV transmission line to new 230 kV GIS switchyard (double circuit line) I(initially to be operated at 230kV)	28.0
	1.7	230 kV reconductoring of Ghorasal-Tongi transmission line (double circuit line)	27.0
	1.8	230 kV transmission line to connect Bashundhara-Tongi substations and to re-route existing Ghorasal-Tongi 230 kV line to Tongi switchyard (double circuit lines)	3.0
	1.9	230 kV re-routing of existing Ghorasal- Tongi line (double circuit line)	1.5
	1.10	230 kV LILO Ashuganj- Sirajganj transmission line	6.0
	1.11	132 kV Sripur-Kodda transmission line (double circuit line)	35.0
	1.12	132 kV Sripur-Bhaluka transmission line (double circuit line)	33.0
	1.13	230 kV Basundhara-Tongi transmission line (double circuit)	9.5
	1.14	230 kV Rampura-Ullon underground cable line (double circuit line)	4.0

Table 3.2 Component 2 Subprojects of PGCB

No.		Project	Substation Capacity (MVA)
2	2.1	132/33 kV GIS Substation at Sylhet	2 x 50/75 MVA
	2.2	132/33kV Mirzapur GIS Substation	2 x 50/75 MVA
	2.3	230 kV GIS switching station at Ghorasal	-
	2.4	230/132 kV GIS Substation at Basundhara	2 x 225/300 MVA
	2.5	230/132/33 kV GIS Substation at Ullon (Dhaka)	2 x 225/300 MVA & 2 x 80/120 MVA
	2.6	132/33kV Rupshi GIS Substation (Narayanganj)	2 x 80/120 MVA
	2.7	132/33kV Sholashahar GIS Substation	2 x 80/120 MVA
	2.8	132/33kV Sitakundu GIS Substation	2 x 50/75 MVA
	2.9	132/33kV AIS Substation at Kodda	2 x 50/75 MVA
	2.10	132/33 kV GIS Substation at Rampur (Chittagong)	2 x 80/120 MVA
	2.11	132/33 kV AIS Substation Upgrade at Manikganj (Dhaka Division)	2 x 50/75 MVA
	2.12	230/132/33 kV AIS Substation at Sripur (Gazipur District)	2 x 225/300 MVA & 2 x 50/75 MVA

Table 3.3 Component 3 Subprojects of PGCB

No.		Project	Substation Capacity (MVA)	Transmission Line Length (km)
3	3.1	230/132 kV GIS Substation at Shyampur (Dhaka)	2 x 225/300 MVA	-
	3.2	132/33kV Dhamrai GIS Substation	2 x 50/75 MVA	-
	3.3	230 kV LILO Meghnaghat-Hasnabad at Shampur (double circuit line)	-	4.0
	3.4	132 kV LILO Hasnabad-Shyampur at Shampur (double circuit line)	-	2.0

Figure 3.1 Location map of Part A

3.1.3 Construction Activities of Part A

65. The construction activities associated with Part A include the installation of transmission tower, stringing of the transmission line, and construction of the substations. Some activities include the following:

- Land acquisition for the substation (if needed)
- Land/vegetation clearing along the right-of-way (ROW) and in substation sites
- Determine the requirements for temporary access roads/tracks
- Establish the required areas for material storage and work sites
- Determine if constructions camps for workers will be required
- Move the equipment and materials required to the work sites or storage areas
- Foundation works for substations and transmission towers
- Erection of transmission towers and stringing of transmission lines
- Construction of a three storey building (the foundation is designed for a five-storey building and a basement) to house the gas insulated switchgear (GIS) control room;
- Creation of a security boundary wall and barbed wire fencing to protect the substation;
- Installation of surface drainage and construction of cable trench, covered storage and warehouse/stockroom;
- Laying of gravel for the switchyard with associated civil and electrical works and boundary lighting;
- Setting up of security/sentry post;
- Construction of transformer blast wall, septic tank, and rain water harvesting unit;
- Installation of solar system for grid substation;
- Equipment installation, testing, and commissioning of equipment, and,
- Other miscellaneous tasks needed to complete the works.

66. The substations will be equipped with safety measures such as fire-fighting equipment, first aid kits, and property boundary wall/fence with trained security personnel.

3.1.3.1 Pre-construction phase

67. Pre-construction activities are summarized below:

- Study of distribution systems, feasibility study and load flow study including the preparation of development plan;
- Prepare the engineering design and as-built drawings to update the system as appropriate;
- Prepare the required bid documents for the construction of substations as well as its associated works;
- Establish the temporary access tracks;
- Establish the areas for material storage and work sites;
- Establish the construction camps for workers, as needed.

3.1.3.2 Construction phase

3.1.3.2.1 Civil Construction Works

68. *Earth works for the foundation* Earthworks and excavation are needed for the foundation of the substations and ancillary buildings as well as the transmission towers at

required depth. The excavated earth and other spoils are kept temporarily in borrow areas nearby and after the earthworks for the foundation, backfilling of the excavated area will be done and finishing with sand.

69. *Foundation Treatment* Geotechnical investigations of the foundation area will be undertaken. Results of geotechnical investigations help in designing the appropriate foundation of the structures as well as in determining if treatment of the foundation is required. The appropriate treatment such as bulla piling, precast reinforced concrete cement (RCC) piling or in-situ concrete piling, sand piling, and removal of peat or loose soil will be determined after the geotechnical investigations.

70. *RCC works* The RCC works are needed for the roof, columns, beams, floor, foundation of transformers, circuit breaker and steel structures, and other structures.

71. *Brick works up to plinth level and superstructure* Brick works will be done for the construction of the substation building using First Class bricks and, coarse sand and cement up to the roof level.

72. *Sand backfilling* Backfilling by sand will be done in the excavated areas for the foundation and floor of the building.

73. *Plastering and finishing (electric wiring, distemper or plastic paints)* Concealing of the electrical wiring with wires of proper size and good quality will be done and bulbs and switchboards will be provided. Plastering of the walls inside and outside of the building and its roof will be undertaken accordingly with curing work carried out for at least three weeks. After this time, plastic paint distemper will be done on the walls and the roof of the building.

74. *Wood/Thai aluminum for doors and windows, and glass fittings* Wood/Thaialuminum works with glass fittings will be done on the door shutters and windows of the building.

75. *Sanitary works* Sanitary works include laying down of sewerage pipelines either with polyvinyl chloride PVC or RCC, and installation, fitting, and fixing of toilet accessories (British Industry Steel Frame).

76. *Water supply system* Existing water supply system, if available, will be used as water supply source for the substation. In places where there is no supply system, tube wells will be installed for the workers and staff at the substation.

77. *Boundary fencing with concrete pillars and barbed wires* To protect the substations from encroachment and unauthorized entry from the public, the area will be fenced with either a six feet-high boundary wall or with concrete pillars 3-meters apart fitted with barbed wire.

3.1.3.2.2 Electrical Works

78. Once the substation building is completed, all the equipment (transformer, circuit breaker, isolator, lightening arrester, panel board, batteries and battery charger, etc.) will be installed (outdoor and indoor) according to specifications and standards. Most of the material for the substations will have to be procured abroad. Thus, there will be limited domestic resource utilization for the project. Construction materials such as bricks, sand cement, rods, etc. will be locally purchased.

79. *Testing and commissioning of equipment* After the outdoor and indoor installation of all the equipment required, they will be tested according to specifications and standards. Once all the tests have been successfully completed, the substations will be commissioned.

3.1.3.2.3 Erection of the transmission towers

80. Steel lattice towers are transported to designated locations from the nearest road access point then carried manually to locations where access by vehicle is difficult. After the foundation strength is complete, the towers are erected manually using pulleys, wrenches, etc.

81. The towers will be constructed to bear the load of the tower, cables, accessories including wind load and earthquake load. In areas of paddy fields, the towers will have proper clearance at the sag (lowest point on line) and in homesteads,the sag will be above the canopy. It is estimated that about 511 transmission towers need to be erected for Part A.

3.1.3.3 Post-construction phase

82. Post construction phase will cover final installation of the safety measures in the substations and transmission towers such as fire-fighting equipment system following the appropriate specifications, and the emergency first aid kits installed at strategic locations within the substations. Trained security personnel will be deployed to ensure peace and security within the property perimeter.

3.1.3.4 Reconductoring

83. One of the suprojects will involve reconductoring of about 27 km double circuit 230kV Ghorasal -Tongi transmission line. Reconductoring will involve the replacement of existing conductor with heavier duty to allow an increase in current carrying capacity. In reconductoring, towers are accessed with truck-mounted aerial bucket or by climbing, removing the old insulator strings, and installing new ones. Reconductoring usually takes 4 to 6 months and workers would occupy each pull and tension site for about 3 days.

3.1.3.4 Availability of construction equipment and work schedule

84. Equipment and materials required for the construction of the substation such as poles, conductors, conductor joining material, cable, indoor termination kit, insulator, distribution transformer accessories, transformer protection equipment, hardware materials for transmission system etc. will be procured from abroad. Construction materials such as bricks, sand, cement, rods, etc. will be acquired locally from domestic suppliers.

85. Project implementation is expected to begin with contract award in April 2014 and completion by October 2017.

3.2 Analysis of Alternatives

86. At the planning stage for Part A, the following general criteria were considered in selecting the substation sites and the transmission line routes other than power load and demand forecasts:

- consider open agricultural land and away from areas with forests, protected, or sanctuaries
- distance from connecting road should be 1 km or less
- avoidance of river crossings and other waterbodies, built-up urban areas, and settlements
- avoidance of existing utility services such as water or telecommunications, schools, hospitals, house of prayer, and other establishments

- avoidance of structures or monument with archeological, cultural or historical importance
- consider the existing power distribution line and the substation

87. For new substations, the primary consideration for site selection is the avoidance of land acquisition. In some subprojects, alternatives involve location and/or technology as follows:

a) 132 kV double circuit line in-line out (LILO) Fenchuganj-Sylhet at Sylhet (6 km)

Alternatives	
Site 1	Site 2
• East side of Dhaka-Sylhet Railway • will require backfilling of about 132 ft^2 • Fallow land • Requires railroad crossing	• West side of Dhaka-Sylhet Railway • will require backfilling of about 72 ft^2 • Single crop agricultural land
Site 2 is preferred to avoid railroad crossing and more backfilling.	

b) 130/132 kV GIS substation at Shyampur

Alternatives		
Option 3	Option 2	Option 1
• 15 acre • located in built-up area	• 3.5 acre • located in built up area • about 300 m from 230 kV LILO Meghnaghat-Hasnabad at Shyampur	• 3.5 acre • located in built-up area • adjacent to Dhaka-Narayaganj Link Road • will require backfilling to increase ground level up to 3 m
Initial plan was to put up an AIS substation in Shyampur but since the area is built-up and to cover a big area will be a challenge, AIS was changed to GIS (i.e., compact and requires smaller area) and Option 2 is preferred over Option 1 due to the proximity of Option 1 to main road (see **Figure 3.2**).		

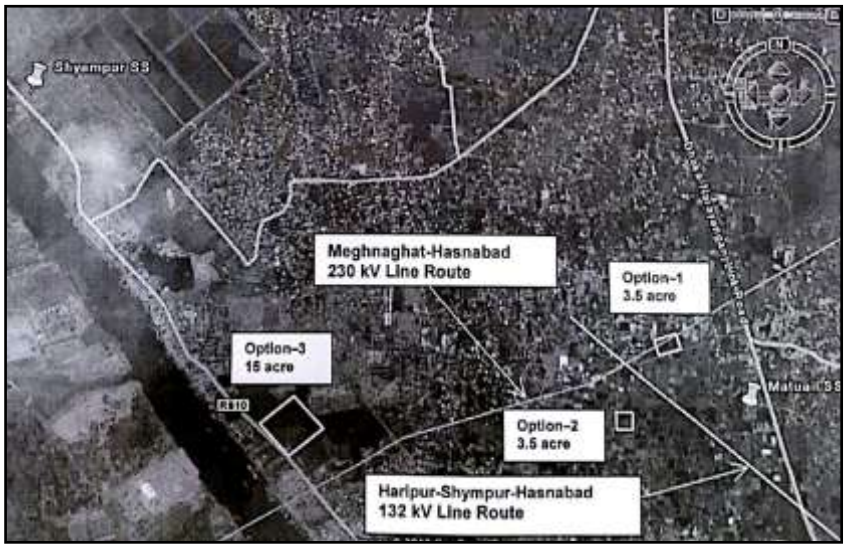


Figure 3.2 Site selection for Shyampur substation

3.3 Description of the Existing Environment

88. A total of 30 subprojects for Part A are within the divisions of Dhaka, Chittagong and Sylhet and the administrative units is given in **Table 3.4**. The project area of influence considered in the assessment covers the substation sites and the right-of-way (ROW) of the

transmission line. There are 16 subprojects involving transmission line and 13 subprojects on substation and a subproject on switching station. The ROW for 132 kV transmission line is 20 m along the center line, 30 m for 230 kV transmission line and 50 m for the 400 kV transmission line.

Table 3.4 Administrative units within the project area of influence

Division	District	Upazila/Subdistrict
Dhaka	Dhaka	Ullon, Shyampur, Dhamrai, Dumni, Rampura
	Norshingdi	Palash
	Narayanganj	Rupshi, Bhulta
	Tangail	Mirjapur
	Manikganj	Sadar
	Gazipur	Gazipur Sadar, Sripur, Tangi
	Mymengsingh	Bhaluka
Chittagong	Chittagong	Sholashahar, Rampur, Sitakundu, Madunaghat, Kalurgaht, Halishahar, Hathazari
	Comilla	Sadar Dakkhin
	Chadpur	Kachua Sadar
Sylhet	Sylhet	Dakkhin Shurma

Source: PGCB. Development Project Proposal.400/230/132 kV Grid Network Development Project Proposal. April 2013.

3.3.1 Natural Hazards

89. **Flooding** Bangladesh has three types of flooding: (i) seasonal monsoon flood, (ii) tidal flood, and (iii) flash flood which cause loss of lives and damage to properties. The flooding season generally starts in May until November. **Figure 3.3** shows the flood-prone areas in Bangladesh.

90. Most part of Dhaka experiences the annual monsoon flooding while Chittagong faces mostly flash flooding. In Sylhet, the area experiences both flash flooding and monsoon flooding. The 132 kV Hathazari-Sitakundu transmission line (15 km) will traverse areas that are prone to flash floods while the 132 kV LILO double circuit (DC) Fenchuganj-Sylhet transmission line (6 km) will go across areas that are prone to monsoon flooding. Appropriate measures will included in the design, operation & maintenance to reduce the risks of flooding impacts to the transmission lines.

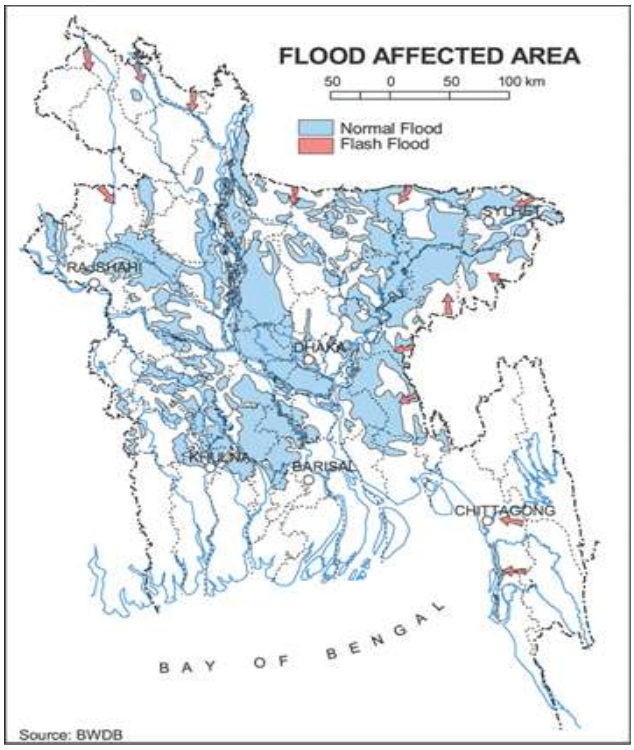


Figure 3.3 Flood-prone Areas in Bangladesh

91. **Seismicity** Bangladesh is divided into three seismic zones: Zone I – Severe (Seismic Factor, 0.08g), Zone II – Moderate (Seismic Factor, 0.05g), and Zone III – Minor (Seismic Factor, 0.04g). **Figure 3.4** shows the seismic zones of Bangladesh. Subprojects of Part A lie within Zone I and Zone II. Thus, the design of towers and substations should withstand ground acceleration equivalent to 0.08g and 0.05g during earthquake.

Figure 3.4 Seismic Zones of Bangladesh

92. **Cyclone** Seasonal storms known as Nor'westers (*Kalbaishakhi*) usually reach the maximum in April, low in May and minimum in March. Based on the historical records of the Bangladesh Meteorological Department (BMD), one of the major cyclones categorized as severe cyclonic storm of hurricane intensity occurred on 15 November 2007 with maximum wind speed of 223 kph and a tidal surge height of 15 ft. The center of the occurred in Khulna-Barisal coast near the Baleshwar River and has affected 30 disricts leaving about 3,500 people dead and 9 million people homeless. Nor'westers affect the entire country and are generally associated with tornadoes and its impacts to transmission towers should be incorporated in the detailed design.

3.3.2 Meteorology

93. The climate in Bangladesh is characterized by tropical monsoon with significant varying rainfall and temperature throughout the country. The main seasons are: summer (pre-monsoon) from March to May, rainy (monsoon) from June to October, and winter season from November to February. Meteorological data from BMD recorded within 2008-2010 were used to describe the meteorological conditions within the project's area of influence.

94. In 2010, Chittagong received the highest annual rainfall at 2,405 mm followed by Sylhet at 1,523 mm and Dhaka with 1,409 mm. Average monthly relative humidity ranges from 56% (Dhaka) to as high as 89% (Sylhet). February and March has the lowest relative humidity and the highest in June. The relative humidity in Dhaka ranges from 56% to 79%, 59% to 89% in Sylhet and 59% to 86%.

95. December to January are coldest months with the lowest temperature at 23.8^{o}C and warmest in March to May at 35.5^{o}C. Dhaka is warmest during summer compared to Sylhet and Chittagong. In contrast, Chittagong is coldest during winter season compared to Dhaka and Sylhet.

3.3.3 Agricultural Resources

96. The lands traversed by all the transmission line routes are intensively used for agriculture planted to high yield variety (HYV) Boro rice, Aus and T. Aman rice variety, and other crops such as onions, potatoes, jute, eggplant, bitter gourd, etc. which are grown vastly in the area.

3.3.4 Terrestrial Ecology

97. The areas that will be traversed by the transmission lines are mainly agricultural land used for winter paddy boro and planted to other crops such as potato, onions, potato, vegetables, etc. The lower part of the cultivated field is used for Aman cultivation and the upper part for other varieties of rice.

98. Most common plants are coconut (*Cocos nucifera*), "Aam" (*Mangifera indica*), "Kamranga" (*Averrhoa carambola*), jack fruit (*Artocarpus heterophyllus*), mahogany (*Swietenia mehogany*), guava (*Psidium guajava*), banana (*Musa sapientum*), "Taal" (*Borassus flabellifer*), blackberry (*Syzgium cumini*), "Supari" (*Areca catechu*), "Jujube" (*Zizyphus mauritiana*), Neem (*Azadirachta indica*), "Segun" *(Tectona grandis),* "Boroi" *(Zizyphus maurtiana))* etc. Some shrubs and herbs include bamboo (Bambusa tulda), prickly chaff-flower (*Achyranthes aspera*), "Biskantali" (*Polygonum sp.*), "Dhol Kolmi" (*Ipomoea carnea*), "shon" (Imperata cylindrica) while weed species are "Durba Gnash" (*Cynodon sp*.), "Kachuripana" (*Eichornia crassipes*), duckweed (*Lemna sp.*), etc.

99. Terrestrial birds in the area include house crow (*Corvus splendens*), Asian Pied Starling (Sturnus contra), Black Kite (*Milvus migrans*), red vented vulvul (*Pynonotus cafer)*, common myna (*Acridotheres tristis*), spotted dove (Stertopelia chinensis), grey-headed fish eagle (*Ichthyophaga ichthyaetus*), etc.

3.3.5 Aquatic Ecology

100. Aquatic flora consists of submerged plants, free flaoting plants, rooted floating plants, and sedges. Some aquatic flora include Helencha (Ceratophyllum Sp.), "Shapla" (Nymphaea pubescens), "Kachuripana" (*Pontederia Sp*.), "Kolmi" (*Ipomoea aquatica*), "Biskantali" (*Polygonum sp*), duckweed (*Lemna Sp*).

101. Some aquatic birds are common Pochard (*Aythya ferina*), wood sandpier (*Tringa glareola*), Little Cormorant (*Phalacrocorax niger),* common snipe (*Gallinago gallinago*), little egret (*Egretta garzetta*).

3.3.6 Socioeconomic Profile

102. **Population** Based on the 2011 Population and Housing Census of Bangladesh Bureau of Statistics, the total population of Dhaka, Chittagong and Sylhet is about 82 million representing 59% of the total population in Bangladesh. Dhaka has about 2.6 million households, Chittagong has 5.6 million and Sylhet has approx. 1.8 million. Dhaka is the most dense with population density of 1,502 person per square km (person/km^2) followed by Chittagong at 831 person/km^2 and Sylhet at 779 person/km^2. About 28% of the total population are in the 18-29 years age group. Female population is a little higher (50.4%) compared to the male population (49.6%). However, 85% represents male headed households compared to female headed households at 15%. Chittagong has more female headed households (19.6%) compared to Dhaka and Sylhet.

103. **Water supply and sanitation** Tubewellis the main source of drinking water in Dhaka at 82%, in Chittagong at 89% and in Sylhet at 86%. Aside from tubewell, tap water is used in Dhaka (17.5%) and less than 10% in Chittagong and Sylhet. Less than half of the population in Dhaka (36.2%), in Chittagong (31.8%), and Sylhet (29%) have sanitary toilet with water seal.

104. **Access to electricity** More than half of the population in the three divisions have acess to energy: in Dhaka (76%), in Chittagong (74.2%), and in Sylhet (66%). Other source of light is kerosene: Dhaka (21.8%), Chittagong (23%) and Sylhet (30.3%).

105. **Type of cooking fuel** Almost half of the population in Chittagong (44.4%) and in Sylhet (43.7%) use wood for cooking and only 24. 2% in Dhaka. Gas/LPG is used next to wood for cooking in Dhaka (40.3%), Chittagong (28.3%), and Sylhet (28%).

106. **Waste disposal** Unmanaged dumpsite is the major way of waste disposal in Dhaka (44.6%), in Chittagong (54.8%) and in Sylhet (54.2%) followed by managed dustbin.

3.4 Anticipated Environmental Impacts and Mitigation Measures

107. The overall objective of route selection is to find the best and suitable alignment that will have the least environmental impacts. The iImpacts of transmission line projects are localized within the ROW where clearing of vegetation will occur. While good engineering practice and appropriate survey approach have been applied in selecting the best alignment, residual impacts cannot be entirely avoided due to varying terrain and demography of the area that will be traversed by the transmission line.The impacts of substations are site

specific. An environmental management plan (EMP) including an environmental monitoring plan will ensure that these residual impacts are minimized and contained.

3.4.1 Pre-construction and Design Phase

Selection of transmission line route and substation

108. As discussed in Sect. 3.2 (Analysis of Alternatives), a set of general criteria guide the selection of transmission line route and substation. Aside from these general criteria, the substation site selection and transmission line route followed the relevant provisions in the EARF and Schedule 4 of the Framework Financing Agreement approved in December 2012 for the Investment Program.

109. Walkover survey/transect will involve the setting up of temporary access tracks to determine the type and number of trees and plants that may be affected, type of settlements and shops within the ROW, and natural physical features and public utilities that may be traversed by the transmission line. These may cause temporary disturbance and/or inconvenience to local people within the ROW.

110. Retiring or upgrading the existing lower voltage transmission circuits can be considered to allow for construction of higher voltage on existing ROW. Informal consultations with local people can help in selecting the best route with the least impacts.

Land acquisition for the substations

111. Out of the 13 substation sites included in Part A, six sites require land acquisition and these are in Sylhet, Mirzapur, Rupshi (Narayaganj), Dhamrai, Shyampur and Sripur.[12]Consultations with the owners are ongoing and the process of land acquisition will comply with the 1982 Acquisition and Requisition of Immovable Properties, and SPS 2009.

3.4.2 Construction Phase

112. There will be clearing of ROW, setting up of temporary access tracks, setting up of materials storage areas along the route and work sites, transport of material and equipment to the site, excavation for substation and tower foundation, cementing/concreting of tower foundation, erection of the towers, and conductor stringing. The PMU-PGCB will ensure that the Contractor's contract will include the obligation to compensate for any temporary damage, loss or inconvenience as result of the project during the construction phase (Sect. 19 of Electricity Act 1910, 1982 Acquisition and Requisition of Immovable Properties, SPS 2009).

Preparation of construction management workplan to minimize impacts

113. Construction management plan will help in smooth implementation of earth-moving works, civil and electrical works to avoid any impact of unplanned activities by the Contractor(s). The workplan will include the temporary pedestrian and traffic management, materials and waste management, noise and dust control (as appropriate), and community and safety plan.

[12] BAN: Power System Expansion and Efficiency Improvement Investment-Tranche 2. Draft Resettlement Plan. July 2013.

Recruitment and orientation of workers

114. There will be opportunities for local people to engage in non-agricultural employment during construction. The presence of workers may become small-scale and temporary business opportunity to provide services such as food, temporary lodging, etc. Potential conflict may occur during recruitment when migrant workers are favoured over local people.To avoid potential conflict, Contractor(s) will be directed to give priority to local people in hiring.

115. PMU-PGCB will conduct briefing for Contractor(s) on the EMP, records management, and reporting. Orientation of PMU-PGCB to Contractor(s) and workers will provide an understanding of their responsibility in implementing the EMP and an agreement on the critical areas to be monitored. Part of the orientation and briefing to Contractor(s) and workers will be on awareness about socially transmitted disease such as HIV/AIDS to prevent potential incidence.

Clearing of vegetation and land within the ROW and substation sites

116. Clearing of land, excavation and earthmoving will be done at the tower foundation sites for the transmission lines including the substation sites. Vegetation clearing will be done at the ROW. Transmission line routes will traverse mainlyagricultural land. No protected area, sanctuary or forest will be affected.Construction works will not be scheduled during harvest time to minimize damage to cash crops. Trees and crops that will be cleared and any temporary damage to affected persons within the ROW will be compensated. This draft IEE will be updated and submitted to ADB to incorporate the number and type of trees (if any) that will be cleared along the ROW of the 16 subprojects on transmission line once the walk-over survey is completed.

117. Replanting of trees will be done at all substations in Dhaka, Chittagong and Sylhet and in other areas (as appropriate) identified in consultation with the Department of Forests (DOF). Species of trees that are medium height with high productivity such as lemon, mango, guava, etc. are preferred. The replanting activities will be monitored by PMU-PGCB, DOF and local authorities.

118. To minimize impact to wildlife in Sylhet and Chittagong area, schedule of work will avoid the breeding season and destruction of nests will be prohibited. In some areas, loss of habitat due to stringing of conductors and reconductoring will naturally regenerate in about 2-3 years.

119. Earthmoving for transmission line will be isolated to tower sites only. Tower foundations involve small-scale excavations and the excavated topsoil will be used for backfilling. Slope modifications (if any) will be known during the contractors' survey. Adequate measures will be done to prevent erosion in areas located in sloping terrain. Where necessary, downhill slopes will be provided with revetments, retaining walls or sow soil binding grass around the sites to contain soil erosion.

120. Only the exact amount of construction materials (i.e., sand, gravel, concrete, etc.) will be brought on-site at the transmission towers so that stockpiling will be avoided and inconvenience to local people minimized.At substation sites, adequate storage for materials needed for construction works will be provided.

Potential increase in dust level, noise and vibration

121. Potential increase in suspended particulate matter and vehicular emissions due to land clearing, transport of construction materials, and use of construction vehicles are not

expected during the installation of towers and reconductoring but may slightly increase at the construction of the substations such as for the 230/132/33 kV AIS substation in Sripur at Gazipur district where backfilling will be required. Water will be sprayed to any exposed or opened land area at the substations sites to suppressed dust level particularly during the summer season. Contractor(s) will be required to maintain construction vehicles regularly to minimize the contribution of vehicular emissions. Construction vehicles transporting materials that generate dusts will be covered and dust-generating activities particularly in the substation sites will be temporarily enclosed to contain dispersion.

122. Local people may be inconvenienced by potential increase in noise level and ground vibration from construction vehicles. Noise-generating activities will be scheduled at daytime to reduce nuisance to nearby residents. If the duration of noise-generating construction works is long that could annoy nearby residents, temporary enclosure will be provided to reduce the noise level. Contractor(s) shall take adequate measures to minimize noise level and nuisance in the vicinity of transmission tower sites and substations by following the traffic management plan and construction schedule.

Accumulation of debris and scrap materials

123. Reconductoring of 230 kV Ghorasal-Tongi transmission line will involve replacement of existing conductors and insulators while some substations will require dismantling of structures and equipment. Debris and scrap materials from these activities will be transported to PGCB's warehouse in Tongi, where there are 8 storage yards, for resale and auction.

Land affected by the ROW and tower footings

124. A four- legged steel lattice type transmission towers will be used.The ROW for 132 kV transmission line is 30 m from the centreline, 40 m for 230 kV and 50 m for 400 kV. Some agricultural land will be lost permanently at the base of the transmission towers.

125. Installation of the 400 kV transmission line will involve about 94 towers, approx. 80 towers for the 230 kV transmission line, and 337 towers for the 132 kV transmission line. Thus, an estimated total of 511 towers will be erected for Part A. Reconductoring of the 230 kV Ghorasal-Tongi transmission line may not requireadditional towers. With the 16 subprojects on transmission line, a total of 438 ha will be affected by the ROW and about 0.0414 ha (or 414 m^2) lost to tower footings. **Table 3.5**gives a summary of the land affected by the ROW and tower footings.

Table 3.5 Summary of land affected by ROW and tower footings

Subcomponent	Area affected by ROW (ha)	Area permanently affected by base of transmission towers (ha)	Total (ha)
400 kV transmission line	140	0.0076	140.0076
230 kV transmission line	96	0.0065	96.0065
132 kV transmission line	202	0.0273	202.0273

126. Crops and plants that are less than 3 m tall such as sugarcane, corn, rice, etc. will remain along the buffer area of the ROW. Agricultural activities within the ROW will be allowed after construction but with restrictions to height of vegetation.

Erection of towers and stringing of conductors

127. No access roads will be constructed but access tracks will be created to reach the location of the towers. The access tracks created for bringing in the tower components will remain tracks and would just be wide enough to accommodate the machinery needed to erect the towers and to maintain them.

128. The erection of towers and poles as well as stringing of conductors may interfere with road crossings which may pose safety risks to the public and construction workers. To minimize the risks, adequate danger and clearly visible warning signs will be posted at designated sites while scaffoldings will be placed over road crossing points. Contractor(s) will be required to instruct drivers of construction vehicles to strictly follow road regulations. Security personnel will be assigned to prevent trespassing and accidents. If necessary, tower erection sites will be fenced. Surrounding area within the tower sites will be kept clean.

129. Site engineers will look for the location of the nearest hospital to make arrangements in case of accidents in the worksites. First aid treatment will be set up within the construction sites and field offices. Workers will be provided with hard hats, safety shoes, and safety belts while designated staff will be provided with communication devices. The Contractor(s) will comply with relevant safety measures required by law and best engineering practices.

3.4.3 Operation Phase

Presence of transmission towersand substations

130. Presence of transmission towers may obstruct ground surface but this will be confined to the area of tower footings which is about 15 m from each other. Transmission lines generally run above 8 m from ground level and the chance of disturbance and obstruction to passage of wildlife is remote.

131. There is potential that the presence of substations and transmission towers may lower the real estate property values. However, the availability of a stable and reliable power supply will attract and promote local economic development, thus, enhancing property values.

Potential exposure to electric and magnetic fields

132. There is continuing concerns about potential risks of cancer from exposure to electric and magnetic field from overhead transmission lines and substations.In the Philippines, the Bureau of Health Devices and Technology of the Department of Health measured on 19 April 2004 the strength of electric and magnetic field generated by a 138 kV double circuit transmission line and from transformers in the substations as follows:[13]

Type of Exposure	138 kV Transmission Line		International Commission on Non-Ionizing Radiation Protection (ICNRP) limit of exposure for the general public
	Centerline	Conductors	
Electric field, kV per meter	1.76	1.503	4.17
Magnetic field, milliGauss (mG)	0.813	0.823	833

[13] National Transmission Corporation, Negros-Panay Overhead Transmission Line and Substation Expansion Project, IEE Checklist of Cebu-Negros-Panay Interconnection Updating Project, Annex 8, September 2004.

Type of Exposure	138 kV Transmission Line		International Commission on Non-Ionizing Radiation Protection (ICNRP) limit of exposure for the general public
	Centerline	Conductors	
	Substations		
	150 MVA transformer	50 MVA transformer	
Electric field, kV per meter	1.891	0.148	4.17
Magnetic field, mG	15.75	4.71	833

133. The National Grid Corporation of the Philippines measured the electric and magnetic field for their 230 kV Sucat-Araneta-Balintawak transmission line as 0.04 kV/m and 3.15 mG, respectively.[14] They also measured the 500 kV Tayabas-San Manuel-San Jose transmission line as 1.15 kV/m (electric field) and 6.04 mG. Given these results, the electric and magnetic fields of the 36 subprojects of PGCB will not be expected to exceed the limits set by the International Commission on Non-Ionizing Radiation Protection(ICNRP) which is 4.17 kV/m for electric field and 833 mG for magnetic field. Thus, the substations, power transmission and distribution lines will not pose health risks to the public. Substations will be fenced and security staff will be assigned to prevent public access.

Fugitive emissions from SF_6 handling equipment

134. SF_6 is used as an insulator and electric arc arrestor in electrical equipment such as lightning arrester, high voltage circuit breakers, transformers, and switches/switchgears. Aside from being a potent greenhouse gas (i.e., global warming potential is 23,900 times compared to CO_2), SF_6 is an inorganic, non-toxic gas that may be an occupational safety concern due to possible asphyxiation if it is not used in a well-ventilated areas. There is potential for SF_6 to leak during the operation phase and its decomposition byproducts may pose a risk to occupational exposure of workers. Given its global warming potential, release or leakage of SF_6 into the atmosphere should be minimized and monitored.

135. Sources of gas leak may potentially come from losses due to poor gas handling practices and equipment installation and maintenance, and leakage from SF_6-handling equipment. Leak sources will be identified in a timely manner using handheld leak detector and monitoring of SF_6 level will be monitored regularly. To determine the baseline concentration, data on existing SF_6 containing equipment being used will be collected in an annual inventory. Monitoring of SF_6 level will improve the preventative maintenance procedures in PGCB facilities and will enhance awareness of staff to potential sources of GHG emissions.

136. As part of the operating procedures, the operators of the 10 GIS substations will provide information annually on the number of purchased and consumed SF_6-containing cylinders. The inventory will be continuously updated upon purchase and retirement of these cylinders and equipment in order to track the movement of SF_6 in and out of the GIS substations. As part of the inventory, the following will be reported:

(i) Start of the year – the number of fully-charged cylinders (not equipment) and the amount of SF_6 contained in each cylinder; and
(ii) End of the year – the number of fully-charged cylinders (not equipment) and the amount of SF_6 contained in each cylinder.
(iii) Monthly purchases and acquisitions of SF_6– includes purchases of cylinders and equipment with SF_6 within the equipment, and SF_6 returned for off-site

[14]National Grid Corporation of the Philippines. Electric and Magnetic Fields (EMF) Frequently Asked Question. Manila.

recycling (i.e., the supplier receipts and QA/QC certificates will be the basis of the amount of SF_6 (in kg) entering the substation)

(iv) Sale and Disbursements of SF_6 – includes those sold and disposed cylinders and equipment (if any) with residual SF_6 contained within the equipment, and SF_6 sent for off-site recycling

(v) Change in equipment nameplate capacity – the nameplate capacities of retired and new equipment will recorded

Failure of power transmission line system

137. Accidental failure of transmission lines may expose wildlife and the public to the danger of electrocution hazards. Transmission line system is designed with a protection system that shuts off during power overload or similar emergencies. Regular maintenance program will ensure the safety and integrity of the power transmission system. Regular trimming of vegetation or lopping of trees monitoring and maintenance will ensure the safety and integrity of towers and transmission lines. PGCB will conduct information and education campaign to local people on awareness to transmission line safety practices.

Clearing of vegetation within the ROW

138. Local residents will not be allowed to plant large trees higher than 3 m within the ROW to keep the integrity within the ROW will be done to ensure the required vertical spacing between the conductors and the vegetation is maintained for safety reasons.

139. A service road for vehicles will be established underneath the transmission line but will be used only to maintain the towers and the conductors. The services road will not be maintained and will remain aaccess tracks.

Encroachment to ROW

140. Encroachment to ROW is potentially dangerous to both people and the power transmission system. To prevent encroachment, land use practices and any other infrastructure that will have negative impact to the power transmission system will be restricted. PGCB will conduct informal briefing sessions to residents on safety of living near the transmission line during their operation and maintenance work.

3.5 Information Disclosure, Consultation, and Participation

141. Initial consultations were done for Part A from June 5-19, 2013 and a total of 48 persons were consulted. Formal consultations will be done during the preparation of the environmental impact assessment (EIA) required by DOE to secure the ECC. Some concerns are load shedding, lack of transparency and clarity in electricity charges and how these are calculated, and land acquisition.

142. Consultations aim to provide information about the concept of the project, temporary problems or inconvenience associated with the project during the walk-over survey and construction stage, and the mitigation or solutions to these associated problems to minimize the effects.Consultation with key project stakeholders in varying degree will continue throughout the life of the project. This draft IEE will be updated to include the results and findings of stakeholders' consultation.

143. Also, this draft IEE will be posted to the websites of ADB and PGCB as required by SPS 2009 and Public Communications Policy 2011. A project factsheet or a frequently asked questions flyer in Bangla will be made available at the PGCB office.

3.6 Grievance Redress Mechanism

144. PGCB will ensure that local people will have the opportunity to express their legitimate grievance or file a complaint about the project by establishing a process to address the issues raised. This can be achieved by careful implementation of the EMP, continuing consultation and communication with stakeholders (as appropriate) during implementation by the Project Management Unit (PMU), PGCB, Contractor(s), and local government authorities. Contact details of the PMU for filing complaints will be posted in the project areas.

145. A grievance redress committee (GRC) at the union level (where there are subprojects) will be set up by PGCB as soon as the project commence and will ensure equal representation of women in the members of GRC. **Figure 3.5** shows the organization of the GRC.

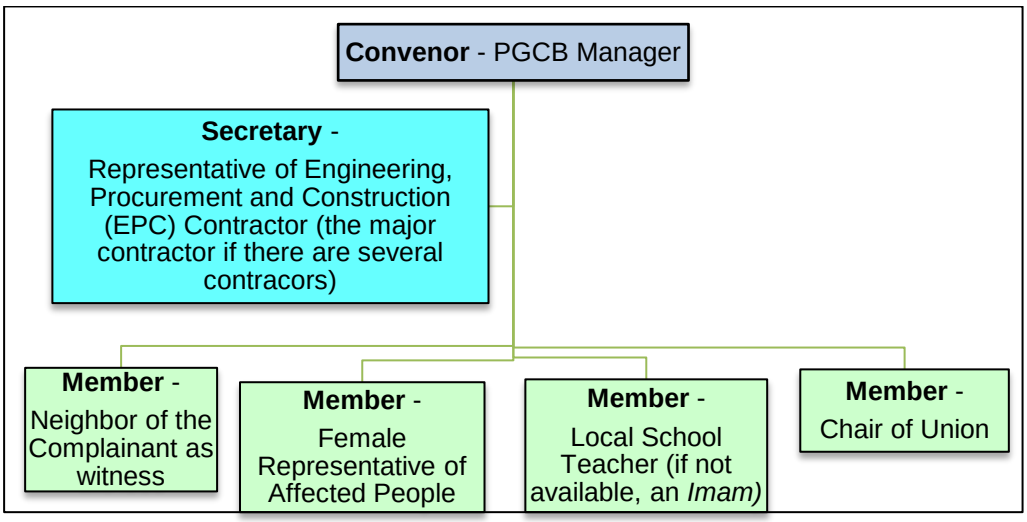


Figure 3.5 Grievance Redress Committee of Part A

146. GRC will convene twice in a month and will keep a record of the grievances, classify, prioritize, and provide the solution(s) within 30 days from the date of the complaint. The record will include the contact details of the complainant, date the complaint was received and the nature of the complaint, agreement on corrective actions and the date it was enforced, and the final outcome. All complaint-related documentation such as minutes of the meeting and decisions will be summarized and become part of the semi-annual monitoring report submitted to ADB.

147. The GRC will report to the complainant(s) about the developments regarding their grievances and the decisions of the GRC. If the grievance is not addressed, the complainant can seek legal redress of the grievance in the appropriate Courts.

148. The grievance redress mechanism is generally integrated in the compensation process for temporary damages and land acquisition (if any) in the Resettlement Plan (RP). As such, the cost of implementing the grievance redress mechanism will be taken from the administration cost which is part of the total cost of the RP for the project. In the event that the administration cost is not sufficient, the budget for the GRC will be taken from the contingency cost also included in the RP. The GRC will continue to function during the life of the Project.

Briefly, the process is described below:

Step 1 Displaced persons (DPs) are informed of their losses and entitlements in writing by PGCB (or PGCB-designated representative such as an NGO supporting the implementation of RP) or through a face-to-face meeting on resettlement and compensation issues. If the DPs are satisfied with the terms of the entitlements, they can claim for payments from the PGCB. If there are disagreements, the DPs can approach PGCB (or PGCB-designated representative such as an NGO supporting the implementation of RP) for clarification about their queries and concerns. If the DPs are satisfied with the outcome, they can proceed with claims for compensation of their entitlements.

Step 2 If the issue(s) remains unresolved, the DPs can go to the GRC assisted by PGCB (or PGCB-designated representative such as an NGO supporting the implementation of RP) who will refer the case with written documentation. The GRC will conduct hearing and resolve the issue within 30 days from the receipt of the complaint.The DPs must be present during the hearing of the complaint and the Minutes will be documented and made available to the DPs. PGCB Manager approves the Minutes and the decision sent to the DPs. If an agreement is reached and the DPs are satisfied with the decision, compensation can be claimed from PGCB.

Step 3 If still the issue(s) remains unresolved, the case is referred by the GRC to the appropriate court of law for settlement.

3.7 Environmental Management Plan

3.7.1 Mitigation

149. **Table 3.6** presents the environmental impacts and mitigation measures with cost estimates. The EMP will be updated before the start of civil works, and as needed to accommodate any change in the condition of the site, performance of Contractor(s), and feedback from local people or other stakeholders.

3.7.2 Monitoring

150. Environmental monitoring during construction will be a day-to-day process to ensure that any departure or non-compliance to the EMP are avoided or immediately addressed so that any unforeseen impacts are quickly discovered and remedied.

151. Regular monitoring and maintenance of the power transmission system during operation will help ensure the integrity and safety of the structures and components, thus, minimizing safety risks to the public. **Table 3.7** presents a summary of the environmental monitoring plan.

3.7.3 Implementation Arrangements

152. Management and general supervision of project implementation will be done by the PMU headed by the Project Director from PGCB. The overall implementation of the EMP will be carried out under the supervision of the Project Director, PMU. An environmental staff (or a firm that will be retained during implementation), who will be primarily responsible for ensuring that the EMP is properly implemented, will be recruited for the project prior to award of the civil works contract. Aside from this, he/she will coordinate and interact with Project

Director, PMU on compliance to ADB requirements, relevant government agencies and local authorities on environmental issues and clearances, update and finalize the IEE, and will prepare environmental monitoring reports for submission to ADB at least twice a year during construction and annually during operation phase.

153. The Contractor(s) will be informed of their responsibility to comply with the EMP and the requirements of ADB. There are specific responsibilities for EMP compliance during construction phase that will rest with the Contractor who will be monitored by the environmental staff of the project.

3.8 Conclusion and Recommendation

154. The sites selected for the substation and transmission have been selected following the SPS 2009, the EARF, and Schedule 5 of the Framework Financing Agreement prepared for the MFF and approved by ADB in December 2012. Appropriate tools and relevant primary and secondary data have been used in selecting the best route avoiding settlements and ecologically sensitive areas, and will generally traverse agricultural paddy areas and crop fields.

155. The subprojects of Part A will contribute to the reliability of power transmission within the areas of Dhaka, Chittagong, and Sylhet. Informal consultations with local people along the transmission line showed their keen interest in the project and are optimistic of the potential employment opportunities due to the project.

156. Part A will not cause significant adverse environmental impacts during construction and operation. The adverse impacts of vegetation and land clearing within the ROW during the installation of transmission towers, stringing of conductors, reconductoring, and construction of new substations can be easily mitigated by proper planning, best practices in construction engineering, and implementation of and compliance to the EMP.

157. Seasonal variations will be incorporated in scheduling and in carrying out the construction works to accommodate cropping/harvesting of local people directly affected by the ROW and the breeding of wildlife and other animals. People, whose crops, trees and other plants will be affected and damaged, will be compensated based on the entitlements identified in the draft Resettlement Plan for Part A.

158. Measures for mitigation and monitoring have been included in the EMP with cost estimates (where appropriate). The transmission towers will be erected and the line will be installed under expert supervision of the Engineering, Procurement, and Construction Consultants and monitored by PGCB. The contractor will be required to comply with the EMP and the relevant national regulations on environment, labour, and occupational health and safety. As well, the contractor(s) will be directed to give priority to local hiring.The components of Part A will have long-term positive impacts arising from improved quality and reliability of power transmission.

159. PGCB will secure the necessary environmental clearance from the DOE prior to any civil works. The IEE will be posted to the websites of ADB and PGCB as required by SPS 2009 and Public Communications Policy 2011. A project brief or factsheet in Bangla will be made available to the public at the field offices of PGCB.

Table 3.6 Environmental Management Plan - PGCB

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
Pre-Construction and Design Phase					
• Selection of transmission line route • Preparation of feasibility study • Land acquisition	• Land and people	• Desktop review is not expected to cause impact • Walk-over survey may result to temporary and some disturbance to localized area • Six substation sites require land acquisition	• Study topographical and geotechnical information, forest and environmental data, etc, and integrate with engineering design and consultation with local people • Consultation with private land owner(s) and ensure compliance with SPS 2009, and ARIPO 1982 on the process of land acquisition	Included in the Project costs *Cost of land acquisition will be borne by PGCB	Design or survey engineers and PMU-PGCB
Construction Phase					
Orientation for contractor and workers	• People	• Workers not aware of environmental requirements during construction • Contractors' not familiar with EMP implementation and compliance	• Conduct briefing for Contractor on the EMP, records management, and reporting • Agreement on critical areas to be monitored and the required mitigation measures • Create awareness of sexually-transmitted diseases like HIV/AIDS	Included in the Project costs	PMU-PGCB
Prepare construction management plan to control impacts of construction impacts	• People • Land • Air Quality and Noise • Water Quality	• Avoid impacts of Contractors' unplanned activities • Smooth work implementation	• Temporary pedestrian and traffic management plan • Materials management plan • Waste management plan • Noise and dust control plan • Community and Safety plan	Included in Project costs	Contractor(s), PMU-PGCB
Hiring of project staff and workers	• People	• Conflict due to potential workers' migration • Lack of local support to the project • Opportunity to engage in non-agricultural employment	• Use local labour for manual work and eligible local workforce for clerical and office jobs • Direct Contractor(s) to strictly enforce priority for local hiring	---	Contractor(s), PMU-PGCB
• Presence of construction workers at substation sites and transmission lines	• People	• Presence of workers may become small-scale and temporary opportunity to provide rental housing, food and other services	None required	---	---

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
		• Potential for increase in demand for services.			
Site preparation, vegetation and land clearing, excavation and earthmoving works	• Land	• For transmission lines, land clearing and topsoil removal will be done only at the tower sites • Only the exact amount of construction material (i.e., sand, gravel, etc) will be located in the tower sites (impact will be temporary and insignificant). • Earthmoving will be done during excavation of tower foundation and in the substations. • Dismantling of structure(s) and equipment from existing substations	• Civil works guidelines and/or construction management plan • Vegetation within the ROW that are less than 3m in height will be allowed to grow. • Civil works guidelines will be strictly implemented by the Contractor. • Tower foundations involve small-scale excavations and excavated topsoil will be used for backfilling. • Loss of agricultural land due to tower footings is minimal. Agricultural activities for crops lower than 3 m with the ROW will be allowed after construction.	Soil erosion and soil quality measures – 28 Local drainage measures - 14	Contractor(s), PMU-PGCB
	• Air quality	• Potential for increased suspended particulate matter and vehicular emissions from opened land area	• Stringing of conductors is not expected to cause deterioration of ambient air quality • Construction vehicles will be maintained to minimize vehicular emissions.	80	
	• Noise	• Potential increase in noise level and ground vibration from construction vehicles	• Contractor shall take adequate measures to minimize noise level and nuisance in the vicinity of transmission line sites by following traffic management plan and construction schedule	Included in the cost for air quality	
Provision of temporary quarters and field office at project site	• Land • Water Quality	• Contractor shall provide temporary facilities for workers including field office and warehouse requirements	• Temporary construction camps will not be needed for installation of transmission line only. In the event, it will be absolutely needed, location will be selected in consultation with PMU-PGCB and local authorities.	Included in the Project cost	Contractor(s)

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
			• Local hiring will be a priority but if construction camps will be required, sanitary facilities and amenities will be provided.		
Clearing of vegetation at the ROW	• Land	• Loss of habitat. • No wetland vegetation will be affected. • Vegetation at the tower foundation will be cleared and only trees that grow taller than 3 m at maturity within the ROW will be permanently cleared. • Low-type of vegetation may be affected and crushed during conductor stringing.	• Compensation to affected land owners of their damaged crops, plants and trees. • Crops and plants that are less than 3 m in height such as sugarcane, corn, rice, etc will be maintained along the ROW. ➢ Planting of trees at substations and at other suitable sites identified in consultation with DOF. Species of trees that are of medium height with high productivity such as lemon, dwarft mango, guava, etc are preferred.	14 covers wildlife and flora protection, and vegetation enhancement	DOF, Contractor(s), PMU-PGCB
		• Loss of some habitat which may affect wildlife • Less sedentary wildlife may be affected by clearing of vegetation	• Avoid breeding season and destruction of wildlife nests and habitat • Revegetation program will help restore the loss habitat of some wildlife • In some areas, loss of habitat due to stringing of transmission line will naturally regenerate in 2-3 years.		DOF, Contractor(s), PMU-PGCB
• Erection of towers and stringing of transmission line • Reconductoring of transmission line • Construction of substations	• People • Land	• Interference with road crossings	• Danger and clearly visible warning signs will be posted at designated sites • Scaffoldings will be placed over road crossing points	Included in the costs of Contractor(s)	Contractor(s), PMU-PGCB
		• Construction waste left by workers	• Appropriate signs will be installed for public safety • Surrounding area within tower sites and substations will be kept clean	14	Contractor(s), PMU-PGCB
		• Potential safety risks to public	• Maintain necessary fence or barricade (as appropriate), sufficient lights, signs and danger signals, and	70	Contractor(s), PMU-PGCB

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
			take all required precautions for public safety • Assign security personnel to prevent accidents and trespassing • Require Contractor to direct drivers of construction vehicles to strictly follow road regulations		
		• Potential safety risks to workers	• Study prepared safety plan before start of construction • Provide every workers with hard hat, safety shoes and belts • Set up first aid treatment within construction sites and field office • Observance and compliance with relevant safety measures required by law and best engineering practices • Provide communication devices to designated workers	Included in the costs of Contractor(s)	Contractor(s), PMU-PGCB
Hazards due to accidental failure of transmission lines	• People and wildlife	• Electrocution hazards will occur only if someone comes too close or in contact with the transmission line cable	• A protection system that shuts off during power overload or similar emergencies will be installed • Transmission lines are insulated (or covered) to minimize impacts to birds and bats • Regular monitoring and maintenance to ensure safety and integrity of towers and power lines • As part of corporate social responsibility initiatives, conduct information and education campaign to local people to enhance awareness on transmission line safety practices.	Included in the O&M costs	PGCB and/or Contractor (if this service is outsourced)
Encroachment to	• People	• Potential danger to both people	• Periodic inspection and maintenance	Included in the O & M costs	PGCB and/or

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost (Lahk Taka)	Responsible agency/unit
ROW		and power transmission structures	of ROW • Restrict landuse practices and any other infrastructure that will negatively affect power transmission system		Contractor (if this service is outsourced)
Clearing of vegetation within the ROW (i.e., pruning of vegetation higher than 3 m)	• Land	• Restriction of planting large trees within the ROW to keep integrity of power transmission system	• Regular trimming to maintain adequate distance between the top of tree and the conductors	Included on the O&M costs	PGCB and/or Contractor (if this service is outsourced)
Presence of overhead transmission line and substations	• People	• Potential exposure to electromagnetic radiation	• Electric and magnetic field from the 132 kV overhead transmission line and 75 MVA transformers are expected to be way below the limits set by ICNRP of 4.17 kV/m for electric field and 833 mG for magnetic field • Substations will be fenced and security staff assigned to prevent public access • Information and education campaign will be conducted to local people to create awareness on safety practices	Included on the O&M costs	PGCB and/or Contractor (if this service is outsourced)
Use of SF_6 handling equipment	• People • Air	• Fugitive emissions from SF_6 handling equipment • SF_6 is a potent GHG	• Leaks will be monitored in a timely manner • SF_6 level will be recorded as an inventory to determine consumption	Included on the O&M costs	PGCB and/or Contractor (if this service is outsourced)

Table 3.7 Environmental Monitoring Planfor Part A (PGCB)

Project Stage	Parameter/Indicator	Location	Frequency	Responsibility (Implementation and Supervision)
Pre-Construction	Soil sampling	Tower sites	Once before construction	PMU-PGCB, Contractor
	Loss in crop production	Along the alignment	Monthly	District Commissioner`s staff, PMU-PGCB, Contractor
	Preparation of approach roads	Along the alignment and substations	Once before construction	PMU-PGCB, Contractor
	Local recruitment of workers and staff	Tower sites and substations	Monthly	PMU-PGCB, Contractor
Construction	Spraying of water to exposed land and before movement of construction vehicles	Along the alignment and substations	• Weekly at alignment • Every day at substation sites	Contractor, PMU-PGCB
	Solid waste management	Along the alignment and substations	Every week	Contractor, PMU-PGCB
	Danger and warning signs for safety of workers and the public	Along the alignment and substations	Once a month	Contractor, PMU-PGCB
	Announcement to the public of works schedule	Along the alignment and substations	As needed	Contractor, PMU-PGCB
Operation	Failure of transmission towers	Along the alignment	Every month	PGCB
	Trimming of vegetation or lopping of trees	Along the alignment ROW	Quarterly	PGCB
	Inventory of SF_6	Substations and T/L	Semiannual	PGCB
	Pilferage of cables	Along the alignment	Quarterly	PGCB

4.0 PART B – SOUTH DHAKA DISTRIBUTION IMPROVEMENT BY DHAKA POWER DISTRIBUTION COMPANY LTD.

4.1 Project Description

4.1.1 Objectives and Benefits

160. The current maximum demand for electricity within the service areas of Dhaka Power Distribution Company Ltd (DPDC) is about 1,280 MW. Given an annual load growth of 8.8%, it is estimated that by 2014, the maximum demand will be 1,700 MW.

161. The existing operating capacity of DPDC can only accommodate 1, 250 MW of electricity distributed through 11 substations of 132/33 kV capacity, 34substations of 33/11 kV capacity, and 9,900 distribution transformers of 11/0.4 kV capacity for about800,000 customers of DPDC.

162. In excess of these capacities, there are unspecified distribution lines in the system which would require expansion and augmentation to meet the demand for distribution. Aside from the demand for electricity, the 2020 vision of GOB for industrialization is for DPDCto provide electricity at 2,000 MW in 2013 and 3,000 MW by 2015. To meet these requirements, an overall build-up and strengthening of DPDC's capacity would be needed which could be addressed by the subprojects proposed for Part B.

163. Thus, the overall objective of Part B is to meet the increasing growth of the demand for power through the implementation of the subprojects. Specific objectives include:

- To ensure quality of services to DPDC customers; and,
- To improve the reliability of distribution systems, minimize and reduce local load shedding, and decrease systems losses.

164. The completion of Part B will reduce the power distribution constraints currently being experienced within the service areas of DPDC and, is expected to improve the system voltage and reliability. At the same time, the upgrade due to Part B will meet the distribution requirements of DPDC up to 2016 for the 33 kV and by 2021 for the 132 kV.

4.1.2 Location and Components

165. Part Bgenerally covers additional capacity to the existing substations of DPDC to meet the increasing demand for electricity. An additional 600 MVA of electricity can be distributed at 132 kV level,420 MVA at 33 kV level, and 320 MVA at 11 kV level upon completion of the subprojects in Part B. **Table 4.1**, **Table 4.2**, **Table 4.3** and **Table 4.4** give the different subprojects for Part B while**Figure 4.1** shows the subproject location.

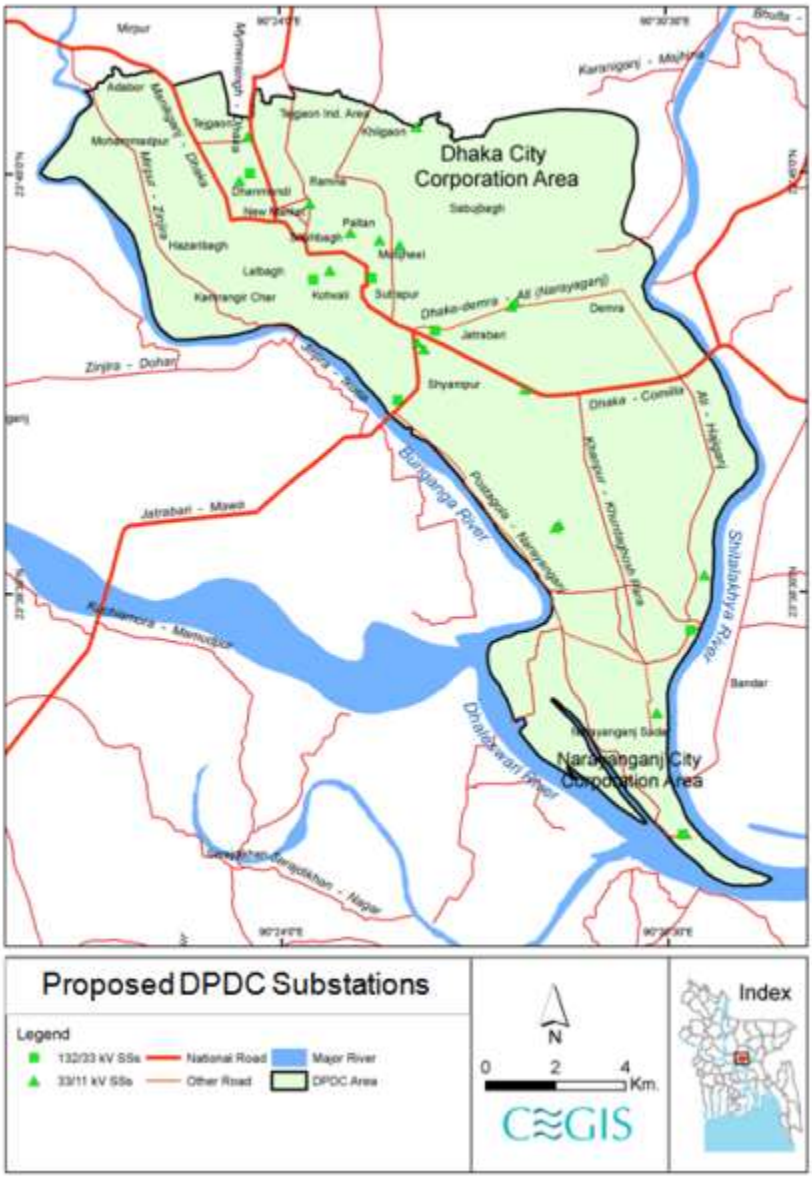


Figure 4.1 Location map of Part B subprojects

Table 4.1 Component 4 subprojectsof DPDC (132/33 kV substation)

No.		Subproject	Substation Capacity (MVA)
4	4.1	132/33 kV GIS Substation at Mohtijheel	80/120
	4.2	132/33 kV GIS Substation at Kazla	80/120
	4.3	132/33 kV GIS Substation at Charsayedpur	80/120
	4.4	132/33 kV GIS Substation at New Ramna	80/120
	4.5	132/33 kV GIS Substation at Fatullah	80/120
	4.6	132/33 kV GIS Substation at Postogola	80/120
	4.7	132/33 kV GIS Substation at Zigatola with 132 kV U/G cable and O/H transmission line	80/120

Table 4.2 Component 5 subprojects of DPDC (33/11 kV substation)

No.		Project	Substation Capacity (MVA)
5	5.1	33/11kV Substation at B. S. Mujib Medical University (BSMMU)	28/35
	5.2	33/11kV Substation at P & T	28/35
	5.3	33/11kV Substation at Monipuripara	28/35
	5.4	33/11kV Substation at B. B. Avenue	28/35
	5.5	33/11kV Substation at Green Road Dormitory	28/35
	5.6	33/11kV Substation at Dhaka Udyan	28/35
	5.7	33/11kV Substation at Segunbagicha with 33 kV U/G cable	28/35

Table 4.3 Component 6 subprojects of DPDC (33/11 kV substation)

No.		Project	Substation Capacity (MVA)
6	6.1	33/11kV Substation at Banasree	28/35
	6.2	33/11kV Substation at Mugdapara Hospital	28/35
	6.3	33/11kV Substation at Dhapa (Fatullah)	28/35
	6.4	33/11kV Substation at Dhaka Medical College (DMC)	28/35
	6.5	33/11kV Substation at Kamalapur Railway Hospital	28/35
	6.6	33/11kV Substation at Mondalapara	28/35
	6.7	33/11kV Substation at Nandalapur	28/35
	6.8	33/11kV Substation at Laxminarayan Cotton Mill (LNCM)with 33 kV U/G cable	28/35

Table 4.4 Component 7 subprojects of DPDC

No.		Subproject	Substation Capacity (MVA)	Distribution Line Length (km)
7	7.1	11 kV Feeders and Distribution Transformers – North Zone	120 MVA	11 kV overhead line – 120 km
	7.2	11 kV Feeders and Distribution Transformers – South Zone	200 MVA	11 kV overhead line – 330 km

4.1.3 Construction Activities for Part B

166. Associated construction activities in the installation of the substations consist of pre-construction, construction and post construction. The installation of the substations generally requires the following activities:

- Construction of a three storey building (the foundation is designed for a five-storey building and a basement) to house the gas insulated switchgear control room;
- Creation of a security boundary wall and barbed wire fencing to protect the substation;
- Construction of approach and/or internal road for easier access;
- Installation of surface drainage and construction of cable trench, covered storage and warehouse/stockroom;
- Laying of gravel for the switchyard with associated civil and electrical works and boundary lighting;
- Setting up of security/sentry post;

- Construction of transformer blast wall, septic tank, and rain water harvesting unit;
- Installation of solar system for grid substation;
- Transport of materials and equipment to substation sites;
- Equipment installation, testing, and commissioning of equipment, and,
- Other miscellaneous tasks needed to complete the works.

4.1.3.1 Pre-construction phase

167. Pre-construction activities are summarized below:

- Study of distribution systems, feasibility study and load flow study including the preparation of development plan;
- Prepare the engineering design and as-built drawings to update the system as appropriate;
- Prepare the required bid documents for the construction of 132/33 kV and 33/11 kV substation as well as its associated works;
- Establish the temporary access tracks;
- Establish the areas for material storage and work sites;
- Transport of materials and equipment to site; and,
- Establish the construction camps for workers, as needed.

4.1.3.2 Construction phase

4.1.3.2.1 Civil Construction Works

168. *Earth works for the foundation* Earthworks and excavation are needed for the foundation of the substations and ancillary buildings at required depth.The excavated earth and other spoils are kept temporarily in borrow areas nearby and after the earthworks for the foundation, backfilling of the excavated area will be done and finishing with sand.

169. *Foundation Treatment* Geotechnical investigations of the foundation area will be undertaken. Results of geotechnical investigations help in designing the appropriate foundation of the structures as well as in determining if treatment of the foundation is required. The appropriate treatment such as bulla piling, precast reinforced concrete cement (RCC) piling or in-situ concrete piling, sand piling, and removal of peat or loose soil will be determined after the geotechnical investigations.

170. *RCC works* The RCC works are needed for the roof, columns, beams, floor, foundation of transformers, circuit breaker and steel structures, and other structures.

171. *Brick works up to plinth level and superstructure* Brickworks will be done for the construction of the substation building using First Class bricks and, coarse sand and cement up to the roof level.

172. *Sand backfilling* Backfilling by sand will be done in the excavated areas for the foundation and floor of the building.

173. *Plastering and finishing (electric wiring, distemper or plastic paints)* Concealing of the electrical wiring with wires of proper size and good quality will be done and bulbs and switchboards will be provided. Plastering of the walls inside and outside of the building and its roof will be undertaken accordingly with curing work carried out for at least three weeks. After this time, plastic paint distemper will be done on the walls and the roof of the building.

174. *Wood/Thai aluminum for doors and windows, and glass fittings* Wood/Thai aluminum works with glass fittings will be done on the door shutters and windows of the building.

175. *Sanitary works* Sanitary works include laying down of sewerage pipelines either with polyvinyl chloride PVC or RCC, and installation, fitting, and fixing of toilet accessories (British Industry Steel Frame).

176. *Water supply system* Existing water supply system, if available, will be used as water supply source for the substation. In places where there is no supply system, tube wells will be installed for the workers and staff at the substation.

177. *Boundary fencing with concrete pillars and barbed wires* Toprotect the substations from encroachment and unauthorized entry from the public, the area will be fenced with either a six feet-high boundary wall or with concrete pillars 3-meters apart fitted with barbed wire.

4.1.3.2.2 Electrical Works

178. Once the substation building is completed, all the equipment (transformer, circuit breaker, isolator, lightening arrester, panel board, batteries and battery charger, etc.) will be installed (outdoor and indoor) according to specifications and standards. Most of the material for the substations will have to be procured abroad. Thus, there will be limited domestic resource utilization for the project. Construction materials such as bricks, sand cement, rods, etc. will be locally purchased.

179. *Testing and commissioning of equipment* Afterthe outdoor and indoor installation of all the equipment required, they will be tested according to specifications and standards. Once all the tests have been successfully completed, the substations will be commissioned.

4.1.3.3 Post-construction phase

180. Post construction phase will cover final installation of the safety measures in the substations such as fire-fighting equipment system following the appropriate specifications, and the emergency first aid kits installed at strategic locations within the substations. Trained security personnel will be deployed to ensure peace and security within the property perimeter.

4.1.3.4 Availability of construction equipment and work schedule

181. Equipment and materials required for the construction of the substation such as poles, conductors, conductor joining material, cable, indoortermination kit, insulator, distribution transformer accessories, transformer protection equipment,hardware materials for distribution system etc. will be procuredfrom abroad. Construction materials such as bricks, sand, cement, rods, etc. will be acquired locally from domestic suppliers.

182. Project implementation is expected to be three years (or 36 months) after approval of financing.

4.2 Analysis of Alternatives

183. The analysis of alternatives for substations was based on the availability of land within the city area as there is a scarcity of land forthe installation of new substations and expansion of existing ones.

4.2.1 Suitability of the DPDC area

184. Sixteen existing sites owned by DPDC were considered but only 14 sites were suitable in terms of demarcation and readiness for equipment installation.The 14 existing sites have adequate space to accommodate construction, expansion or any additional equipment (if required). Two existing sites, Jatrabari PDB colony and Narayanganj DPDC office campuswere not considered suitable since they are within the residential area for 4th class employees of BPDB, DPDC,and PGCB. The Narayanganj DPDC office campus is also not considered suitable because it is within the residential area for DPDC officers. At the same time, there are some old aged fruit-bearingtrees such as mango tree, jack fruit tree, etc. which would have to be cleared during construction of the substation. **Table 4.5** shows the different sites owned by DPDC considered during the substation site selection.

Table 4.5 Proposed sites owned by DPDC

No.	Substation	Type of Substation	Land Requirement (m^2)	Land Ownership	Suitability
1	New Ramna	Existing	1,214	DPDC	Suitable
2	Postagola	Existing	648	DPDC	Suitable
3	Kazla	Existing	648	DPDC	Suitable
4	Char Sayedpur	Existing	648	DPDC	Suitable
5	Motijheel	Existing	648	DPDC	Suitable
6	P & T	Existing	258	DPDC	Suitable
7	Monipuripara	Existing	405	DPDC	Suitable
8	Banasree	Existing	324	DPDC	Suitable
9	Green Road Dormitory	Existing	252	DPDC	Suitable
10	B. B. Avenue	Existing	295	DPDC	Suitable
11	Dhaka Uddyan	Existing	294	DPDC	Suitable
12	Mugdapara Hospital	Existing	292	DPDC	Suitable
13	Mondalapara	Existing	324	DPDC	Suitable
14	Laxminarayan Cotton Mill	Existing	373	DPDC	Suitable
15	Jatrabari PDB Colony	Existing	324	DPDC	Not suitable (residential area)
16	Narayanganj	Existing	971	DPDC	Not suitable (residential area)

185. Six sites other than those owned by DPDC were also considered. Out of these six sites, only one was considered suitable as no agreement was reached between DPDC and other agencies of GOB or the private owner. The private land in Nandalapur was considered suitable as this is vacant with no settlements, structures or trees that may be affected during construction. Land acquisition is required.**Table 4.6** presents the sites considered that are not owned by DPDC.

Table 4.6 Sites not owned by DPDC

No.	Substation	Type of Substation	Land Requirement (m^2)	Land Ownership	Suitability
1	Dhaka Officers Club	New	275	Dhaka Officers Club	Not suitable due to lack of understanding among authorities
2	Nandalapur	New	971	Private (to be acquired)	Suitable
3	Maa O Shishu Kallyan Kendra, Matuail	New	324	Maa O Shishu Kallyan Kendra, Matuail	Not suitable due to lack of understanding among authorities
4	Panthapath	New	971	Owned by BWDB	Not suitable due to lack of understanding among authorities

No.	Substation	Type of Substation	Land Requirement (m^2)	Land Ownership	Suitability
5	Konapara	New	324	Private land	Not suitable due to lack of agreement with the owner
6	Kamalapur Railway Hospital	New	324	Owned by Bangladesh Railway (BR)	Not suitable due to lack of understanding among authorities

186. Given that there are sites considered not suitable for proposed substations, sixmore sites were looked into for their suitability (**Table 4.7**).

Table 4.7 Alternative sites considered for DPDC substations

No.	Alternative Site	Proposed Site	Land Requirement (m^2)	Ownership of Alternative Site	Suitability
1	Dhapa, Fatullah	Maa O Shishu Kallyan Kendra, Matuail	324	Private	Suitable
2	Segunbagicha	Jatrabari PDB colony	324	Owned by Public Works Department	Suitable
3	Kamalapur Railway Hospital (different site)	Kamalapur Railway Hospital	324	Owned by BR	Suitable
4	Jhikatola opposite site of Medinova	Panthapath	971	Owned by DPDC	Suitable
5	Fatullah	Narayaganj	971	Owned by DPDC	Suitable
6	Dhaka Medical College (DMC)	Konapara	324	Owned by DMC	Suitable

187. Out of the sites considered suitable, two are privately-owned which would require land acquisition.

4.3 Description of the Existing Environment

4.3.1 Meteorology

188. **Climate** The DPDC service area is within the monsoon climate characterized by rainy season that is hot and humid, winter that is predominantly cool and dry while the summer is hot and dry interrupted by occasional heavy rainfall.

189. Part B subprojects are located in the North Central region of Bangladesh where monsoon comes in July and decreases by late October. Meteorological data recorded from 1988-2011 by the Bangladesh Meteorological Department (BMD)at the Dhaka station were used to describe rainfall, temperature, humidity and evaporation.

190. **Rainfall** The maximum monthly rainfall recorded in Dhaka occurred in September 2004 at 839 mm. Historical rainfall data from 1988 to 2008 shows that the average maximum monthly rainfall is in July at about 400 mm while dry months start in November until March.

191. **Temperature** Based on historical data from 1991 to 2011, the maximum temperature recorded was 36.44^{o}C in April 1995 while the lowest temperature during this period occurred in January 1995 at 11.33^{o}C. Monthly temperature ranges from about 12^{o}C to as high as 37^{o}C.
192.

193. **Humidity** Recordsshow that June, July, August, September and October are most humid months with relative humidity ranging from 79% to 83%. Low humidity is experienced from January to April where the relative humidity ranges from 61% to 71%.

4.3.2 Natural Hazards

194. **Flooding** Bangladesh has three types of flooding: (i) seasonal monsoon flood, (ii) tidal flood, and (iii) flash flood which cause loss of lives and damage to properties. The flooding season generally starts in May until November. **Figure 3.3** shows the flood-prone areas in Bangladesh.

195. Most part of Dhaka experiences the annual monsoon flooding while Chittagong faces mostly flash flooding. In Sylhet, the area experiences both flash flooding and monsoon

196. **Seismicity** According to the seismic zone map of Bangladesh (see **Figure 3.4**), Part B is located within Zone II (Moderate – 0.05g seismic factor). The design of the substations will incorporate a ground acceleration equivalent to 0.05g.

197. **Cyclone** Seasonal storms known as Nor'westers (*Kalbaishakhi*) usually reach the maximum in April, low in May and minimum in March. Nor'westers affect the entire country and are generally associated with tornadoes and its impacts to transmission towers should be incorporated in the detailed design.

4.3.3 Terrestrial Ecology

198. The areas within Part B are already built-up. There are no endangered, threatened or protected species.

4.3.3.1 Flora

199. The vegetation is common and the composition is similar all over the project area which consists of herbs and shrubs. Dominating cultivated plants are "Aam" (*Mangiferaindica*), "Khathal"(*Artocarpusheterophyllus*), "Nim" (*Azadirachtaindica*) etc., while other tree species include"Payara"(*Psidiumguajava*), "Narikal" (*Cocos nucifera*), "Kola" (*Musa sp*), "Paypay" (*Carica papaya*), "Ulatkambal"(*Abroma august*), Baroi (*Zizyphusmauritiana)* etc. Herbs such as Tridhara (*Tridexprocumbens*), Bondona (*Scorpiadulkis)*, Teetbagun (*Solanumnigram*), Note sak (*Amaranthussp*), Dhakishak (*Petrissp*), etc. were also observed. **Table 4.8** presents the status of vegetation in some subproject sites.

Table 4.8 Plant composition in some DPDC project sites

No.	Location	Capacity	Vegetation
1	New Ramna	132/33 kV	Nim (*Azadirachtaindica*)
2	Postogola	132/33 kV	Ulatkambal (*Abroma augusta*), Mutha (*Cyperus ssp*), Durba(*Cynodondactylon*)
3	Kazla	132/33 kV	Amra (*Spondiasdulcis*),Payara (*Psidiumguajava*), Mahogoni (*Swietenia mahagoni*)
4	Char Sayedpur	132/33 kV	Baroi(*Zizyphusmauritiana*), Durba (*Cynodondactylon*).
5	Motijheel	132/33 kV	Aam(*Mangiferaindica*), Nim(*Azadirachtaindica*),Narikal(*Cocos nucifera*), Khathal(*Artocarpusheterophyllus)*,Rabar(*Ficuselastica*);
6	P & T	33/11 kV	None
7	Monipuripara	33/11 kV	Dhakishak(*Pterissp*)
8	Banasree	33/11 kV	Mankachu (*Colocasia sp*),Bondona(*Scorpia dulcis*), Dhakishak(*Pteris sp*), Papaya (*Carica papaya*), Note sak (*Amaranthus ssp*).

No.	Location	Capacity	Vegetation
9	Green Road Dormitory	33/11 kV	Mahogoni (*Swieteniamahagoni*), Karoi(*Albizia procera*).
10	B. B. Avenue	33/11 kV	Payara(*Psidium guajava*), Khathal(*Artocarpusheterophyllus*),Ulatkambal (*Abromaaugust*),Talakucha(*Cephalandra sp*)
11	Dhaka Udyan	33/11 kV	None
12	Mugdapara Hospital	33/11 kV	Mutha (*Cyperus ssp*), Durba(*Cynodon dactylon*),Hathisur(*Heliotropium indicum*),HaldaMutha(*Cyperus sp*)
13	Mondalapara	33/11 kV	Kathal(*Artocarpusheterophyllus*), Baroi (*Zizyphusmauritiana*), Jamrul(*Syzygiumsamarerngense)*, Nim(*Azadirachtaindica*),Dawya(*Artocarpuslacucha*), Kola(*Musa sp*)
14	Nandalapur	33/11 kV	Nim (*Azadirachta indica*)
15	Laxminarayan Cotton Mill	33/11 kV	Narikal(*Cocos nucifera*),Telachuca (*Cephalandra sp)*, Durba (*Cynodon dactylon*)

4.3.3.2 Fauna

200. Given the low density of vegetation within the areas of Part B, terrestrial fauna population is very low. The terrestrial fauna observed include the common house rat (*Rattusrattus*), grey musk shrew (*Suncusmurinus*) and the small Indian Mongoose (*Herpestes auropunctatus*).

4.3.3.3 Birds

201. Large-billed crow (*Corvus macrorhynchos*), house crow (*Corvus splendens*), Bank myna (*Acridotheresginginianus*) and house sparrow (*Passer domesticus*) are the common bird species observed.

4.3.4 Aquatic Ecology

202. The sites are within the urban areas and there are no aquatic habitats. However, in Nandalapur (33/11 kV substation site), there is a lower depression with marginal aquatic life forms. Common aquatic plants observed are Kachuripana(*Eichhorniacrassipes*)**,** Topapana(*Pistia stratiotes*), Helencha (*Enhydrafluctuans*), Kesherdam(*Ludwigia hyssopifolia*), and Azola (*Azollapinnata*). **Figure 4.2** shows the aquatic habitat in Nandalapur.

Figure 4.2 Aquatic habitat in Nandalapur

4.3.5 Socioeconomic Profile

203. **Population** Based on the 2012 estimates of the Bangladesh Bureau of Statistics, the totalnumber of households is 1,078,577 or a total population of 6,451,717 with a ratio of 121 male per 100 female. Average household size is 5.98persons. More than half of the population (69%) belong to the age working group (15-59 years old).

204. **Employment** More than half of the population (53%) is engaged in some kind of employment and is dominated by male (39%) and only 14% is represented by female. Most of the people are employed in services (69%), industrial work (27%) and only 9% are engaged in agricultural activities.

205. **Household income and expenditure** About 65% of the population have monthly income ranging from BDT5,000 to BDT20,000. Expenditure is represented by household consumption (45%), investment (30%), housing (15%) and buying land (8%).

206. **Education** About 71% of the population is literate. The literacy rate of men is higher (73%) compared to women (68%). Given that the project areas are within the national capital and highly urban, there is more opportunity to receive better quality of education.

207. **Housing** More than half (or 56%) of the households have pucca housing, semi-pucca(25%), and kutcha (17%).

208. **Water supply and sanitation** Drinking water supply is good with more than half of the population (69%) getting water from piped sources provided by Dhaka Water Supply and Sewerage Authority and only 29% source water from tube wells. About 92% of the population have sanitary toilet facilities where 54% is water sealed facilities and 38% with non-water sealed facility.

209. **Access to electricity** Majority of the households (99%) is covered by grid electricity.

4.4 Anticipated Environmental Impacts and Mitigation Measures

4.4.1 Pre-construction and Design Phase

210. Some activities to be conducted prior to construction include the feasibility study and other in-house study undertaken by designated technical staff and/or consultants (if required), assessment of the values of land needed for acquisition, negotiation with affected land owners, implementation of land acquisition and securing of relevant environmental clearance.These activities are not expected to cause adverse environmental impacts are they only involve desktop planning and no physical intervention.

Land acquisition

211. Only the Nandalapur site (33/11 kV substation) will require land acquisition of about 971 m^2 and the process is ongoing and will ensure compliance with SPS 2009.

4.4.2 Construction Phase

212. The PMU-DPDC will ensure that the Contractor(s) contract will include the responsibility ofcompensating for any temporary damage, loss or inconvenience as result of the project during construction phase (Sect. 19 of Electricity Act 1910, 1982 Acquisition and Requisition of Immovable Properties, SPS 2009).

Prepare a construction management work plan

213. Theworkplan will help ensure the smooth implementation of construction activities giving emphasis to the substation sites mostly located in urban areas. Organizing the construction activities giving consideration to seasonal variations, economic activities, and location of substations will avoid any impacts of unplanned activities by the Contractor(s). The workplan will include the temporary pedestrian and traffic management, materials and waste management, noise and dust control (as appropriate), and workers and community safety plan.

Hiring of project staff and orientation of workers

214. Construction phase will be an opportunity for local people to venture in small-scale and temporary business to provide services such as food, temporary lodging, etc. Priority for local hiring of eligible persons will be required. Contractor(s) will be directed to use local labour for manual work and eligible local workforce for clerical and office jobs. DPDC will monitor the Contractor(s) to ensure that local hiring is given priority.

215. DPDC will provide briefing for Contractor(s) and workers as well on the environmental management plan (EMP), records management, and reporting so they would know their responsibility for compliance. Part of the orientation will be on awareness about sexually transmitted diseases such as HIV/AIDS to prevent potential incidence.

Site preparation and vegetation clearing

216. Only the Nandalapur substation site (33/11 kV) in Narayaganj requires acquisition. All the seven locations for the 132/33 kV substations and the 15 sites for the 33/11 kV substations will be done within the land owned by DPDC or donated and/or transferred by other government agencies such as Bangladesh Railway, Public Works Department, and Dhaka Medical College. There will be minimal vegetation clearing since most of the sites are in urban areas and vegetation is not dense.

217. Site preparation will involve dismantling of existing structure(s) and equipment. For B. B. Avenue site, the existing switching station will be dismantled and the old building will be demolished. Debris will be properly disposed of in designated landfill and/or controlled dumpsites. Usable and/or recyclable materials and equipment will be transported to the warehouse/storage of DPDC in Tongi for resale or auction (see **Figure 4.3**). The Tongi warehouse is used by DPDC for storing scrap materials and bulky equipment of substations (e.g., transformers, AVR, insulators, cables, etc.). Scraps are auctioned/sold on a regular basis. The warehouse is divided according to divisions of DPDC (e.g., Division-1, Division-2, Shaymoly-Division, etc.). Management of the Tongi warehouse is headed by an Executive Engineer.

Figure 4.3 DPDC warehouse in Tongi

218. Dismantling of existing structure(s) and old equipment may give rise to the possibility of being polychlorinated biphenyl (PCB)-contaminated. While it is understood that recently imported equipment for substations are PCB-free, some older equipment may not be.[15]Electrical equipment used in the power sector is a major source of PCB in Bangladesh. The PCB from the power sector may come from the transformer oil within in-service transformer (both in power transmission and distribution), capacitors, and oil circuit breakers.[16]Bangladesh has no institutional and legislative policies focusing on persistent organic pollutants (POPS) where PCB is part on the 12 POPS within the purview of Stockholm Convention on POPS signed by 150 countries in May 2001 and enforced in May 2004. Bangladesh ratified the Stockholm Convention on POPS in March 2007.

219. Workers assigned in the dismantling of structures and equipment from existing substations will be provided and will be required to wear personal protective equipment or appropriate gadgets to ensure their safety. Equipment (particularly transformers and capacitors) being dismantled from existing substations will be classified based on nameplates/labels in order to isolate those suspected to contain PCB. In the event that an equipment being dismantled is known to contain PCB, PMU-DPDC will collaborate with BPDB on the management and disposal (if required) of such equipment. BPDB maintains a central transformer maintenance facility where transformers and capacitors are repaired, overhauled, dismantled or retrofilled, and transformer oil physically regenerated using centrifuges.[17,18]Moreover, PMU-DPDC will coordinate with the DOE on the management of such equipment in relation to DOE's project on environmentally-sound management and disposal of PCBs. These measures will ensure that suspected and potentially PCB-contaminated equipment are dealt with properly.

[15]The World Bank Office Dhaka.Bangladesh Country Environmental Analysis. Bangladesh Development Series Paper No. 12. September 2006. http://siteresources.worldbank.org/BANGLADESHEXTN/Resources/295759-1173922647418/complete.pdf. (Accessed on 1 May 2013)

[16]Department of Environment.United Nations Development Programme Bangladesh.Persistent Organic Pollutants Management in Bangladesh.nda. http://www.undp.org.bd/library/publications/Persistent%20organic%20Pollutants%20(POPs%20Management%20in%20Bangladesh).pdf. (Accessed on 1 May 2013)

[17]Ibid.

[18]Global Environment Facility.Project Identification Form. Environmentally Sound Management ofand Disposal of PCBs and Medical Waste in Bangladesh. 31 January 2013. http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/POPs/Bangladesh%20-%20(4858)%20-%20Environmentally-sound%20Management%20and%20Disposal%20of%20P/02-01-2013%20rev%20ID4858%20rv%20PIF.pdf. (Accessed on 1 May 2013).

220. After dismantling of existing structures and equipment, excavation and earth moving works will be required for the construction of the substations. The Nandalapur site may require backfilling as it is located in a low-lying area. Adequate measures will be done to prevent erosion at the sites. Temporary warehouse/storage will be provided within the sites for construction materials needed to reduce the number of trips for transporting vehicles.

221. Once the construction and installation of the equipment in the substations are completed, landscaping will be done to improve aesthetics. Species of trees that are medium height with high productivity such as lemon, guava, mango, etc. will be considered for replanting. Replanting activities will be monitored by DPDC.

222. The underground cable needed to connect one substation to another substation will follow the road easements.Laying of cables will be done mostly in the evening to minimize disruption to traffic, street shops and other livelihood activities of local people.

Air quality and noise

223. Potential increase in suspended particulate matter and vehicular emissions due to land clearing and use of construction vehicles may occur at the substation sites. Water will be sprayed to any exposed or opened land area at the substations sites to suppress dust level particularly during the summer season. Trucks that will transport construction materials will be covered to minimize dust dispersion. Where appropriate, construction sites may be enclosed with temporary fencing of cloth or any suitable material to contain the dust levels. Contractor(s) will be required to maintain construction vehicles regularly to minimize the contribution of vehicular emissions.

224. Local people may be inconvenienced by the potential increase in noise level and ground vibration from construction vehicles such as in the sites for B.B. Avenue and Green Road Dormitory. Construction activities that generate high level noise will be done during daytime. Contractor(s) shall take adequate measures to minimize the noise level and nuisance in the vicinity of substation construction sites by following the traffic management plan and construction schedule. Residents near the construction substation sites will be informed if construction works will generate high level noise and vibration so they can prepare and adjust.

Safety risks to community and workers

225. Construction of substations and laying of cables may interfere with road crossings which may pose safety risks to the public and construction workers. To minimize the risks, adequate danger and clearly visible warning signs will be posted at designated sites while scaffoldings will be placed over road crossing points. Contractor(s) will be required to instruct drivers of construction vehicles to strictly follow road regulations. Security personnel will be assigned to prevent trespassing and accidents. Access to the substation sites for truck traffic will be restricted outside of normal construction hours.

226. Construction engineers will look for the location of the nearest hospital and will make prior arrangements to ensure that in the event of accident that require treatment, there is a mechanism for immediate medical service. First aid treatment kits will be set up within the construction sites and field office. A medical staff or nurse will be employed to provide assistance and will make weekly rounds to the substation construction sites. Workers will be provided with hard hats, safety shoes, and safety belts while designated staff will be provided with communication devices. The Contractor(s) will comply with relevant safety measures required by GOB and best engineering practices.

Generation of waste at substation construction sites

227. Given the easy access of substation sites (i.e., Dhaka and Narayaganj) and the scale of construction, there may not be a need to provide for construction camp sites. Workers will come to the sites in the morning and leave after completion of the required daily working hours. There is adequate labor force within Dhaka and Narayaganj and local hiring will be a priority. Security personnel will remain in the construction sites to ensure order and deter pilferage. The Contractor(s) will ensure that solid waste management will be part of the Construction Management Plan. Sanitary facilities with washing area will be provided at the construction sites including safe drinking water and garbage bins. Good housekeeping will be observed at all times in the construction sites and field offices.

4.4.4 Operation Phase

Generation of employment

228. A total of 62 positions will be required during the operation phase of Part B. These new positions will be an opportunity for eligible local people.

Potential depreciation of land values due to substations and distribution lines

229. The presence of substations and distribution lines in urban areas may cause depreciation of land or property values adjacent to the facility. However, the increased availability and reliability of power supply from these structures will trigger more economic development and is expected to improve the standard of living of local residents.

Generation of noise at the substations

230. Transformers may generate unusual noise which may be due to loss of core-bolts, core plates, coil clamps, loose external fittings, and other mechanical forces as a result of short circuit. The Green Road Dormitory is near to school and offices. Background noise level may be higher in this area already and the operation of a substation may potentially contribute to the increased noise level. Maintenance of transformers and other equipment will be conducted to ensure that they are working properly and generation of noise is avoided. Monitoring of noise level will be done. Noise-generating equipment will be enclosed to reduce the noise level.

Use of mineral oil in transformers

231. All mineral oil received at the substations will be required to have a material safety data sheet and as a precaution, be certified that it is dioxin and polychlorinated biphenyl (PCB) - free. Used or unused mineral oil may be taken as toxic (for safety measure) and will be disposed of according to the relevant national laws and international best practice. A transformer oil manufactured by theAmerican Hi-Tech Petroleum & Chemicals, Inc.sold as Duralife Transformer Oil - All Gradesindicates that the product "does not contain any components with OSHA or ACGIH exposure limits."[19]

232. Storage areas for drums of mineral oil will be constructed with oil catchment structures to avoid spillage.In case of accidental spill, mineral oil spilled will be prevented from entering sewers, storm drains or other drainage systems and natural waterways. To prevent accident spills, transfer and loading of mineral oil will be done only in storage areas where oil catchment structures are installed.

[19]Amtecol.Material Safety Data Sheet.Duralife Transformer Oil-All Grades. 9 August 2010.

233. Oil-water separator will be installed in the substations, and fire extinguishers will be kept readily available in the warehouse for mineral oil.

Potential exposure to electric and magnetic fields

234. Concerns remain on the potential risks of cancer from exposure to electric and magnetic fields (EMF) from substations and transmission lines. The EMF considered strong in the substations are from the power transmission lines coming in and leaving the substations because the strength of EMF within the substations coming from transformers, capacitor banks, etc., decreases as distance increases.[20]On 19 April 2004, the Bureau of Health Devices and Technology of the Department of Health in the Philippines measured the strength of EMF fromsubstations as follows:[21]

Type of Exposure	Substations		International Commission on Non-Ionizing Radiation Protection (ICNRP) limit of exposure for the general public
	150 MVA transformer	50 MVA transformer	
Electric field, kV per meter	1.891	0.148	4.17
Magnetic field, milliGauss (mG)	15.75	4.71	833

235. Given the results above, the substations of Part B with maximum capacity of 120 MVA transformersare not expected to pose health risks to the public. After 25 years of research on whether exposure to EMF might adversely affect human health, there has been no conclusive evidence and scientists continue debating.[22] To minimize unauthorized public access, substations will be fenced and security staff will be assigned to prevent public access. DPDC will include information, education and communications on safety of living next to distribution substations as part of continuing public consultations.

Fugitive emissions from SF_6 handling equipment

236. With Part B, DPDC will manage several equipment insulated with SF_6 gas. SF_6 gas is used as an insulator and electric arc arrestor in electrical equipment such as lightning arrester, high voltage circuit breakers, transformers, and switches/switchgears. Aside from being a potent greenhouse gas (i.e., global warming potential is 23,900 times compared to CO_2), SF_6 is an inorganic, non-toxic gas that may be an occupational safety concern due to possible asphyxiation if it is not used in a well-ventilated areas. There is potential for SF_6 to leak during the operation phase of substations and exposure to its decomposition by-products may pose occupational health risks to workers. Also, given its global warming potential, release or leakage of SF_6 into the atmosphere should be monitored and reduced.

237. Sources of gas leak may potentially come from losses due to poor gas handling practices and equipment installation and maintenance, and leakage from SF_6-handling equipment. Gas circuit breakers will be installed properly with sealed system that will remain gas-tight. The level of SF_6 gas in the equipment will be continuously monitored through pressure gauges.To check for potential leak, handheld leak detectors can be used during regular maintenance of switchgear, and also when the pressure gauge indicator shows a low pressure in equipment with SF_6 pressure gauges. To reduce emission of SF_6 from an environmental and operational standpoint, an annual inventory and monitoring checklist will be prepared to track the use, purchase and losses of SF_6 gas.

[20]National Grid Corporation of the Philippines.Environmental Management Division.*Electric and Magnetic Fields Frequently Asked Questions.*

[21]National Transmission Corporation, Negros-Panay Overhead Transmission Line and Substation Expansion Project, IEE Checklist of Cebu-Negros-Panay Interconnection Updating Project, Annex 8, September 2004.

[22] National Institute of Environmental Health Sciences.*EMF Questions and Answers*. June 2002. http://www.niehs.nih.gov/emfrapid. (Accessed on 15 June 2013)

Failure of distribution line system

238. Accidental failure of distribution lines will expose the public to the danger of electrocution. The distribution line system is designed with a protection system that shuts off during power overload or similar emergencies. Regular maintenance program will ensure the safety and integrity of distribution line system. DPDC will include information and education on awareness to distribution line safety practices during public consultations.

4.5 Information Disclosure, Consultation, and Participation

Consultation and Participation

239. Initial consultations with the local people were undertaken by the Social Team of the Center for Environmental and Geographic Information Services (CEGIS), contracted by DPDC to prepare the IEE in May 2013 for securing the site clearance from DOE. During these consultations, questions/issues were raised and facilitators from CEGIS took notes and provided response to the issues raised. Below is a summary of the people's perceptions while **Appendix 4** presents the attendance during the consultation:

Positive perceptions

- That the project should ensure uninterrupted supply of power and must meet the growing demand for electricity within the city area; and,
- They expect that with the project, more industries will develop creating jobs to help local and national economic growth.

Negative perceptions

- Concerns on the temporary impacts during construction period such as clogging of drainage, traffic and disruptions from movement of heavy vehicles, and risks when dismantling the existing buildings; and,
- DPDC to provide safety nets to minimize risks, accidents, and disruptions of economic activities during construction phase.

Recommendations/suggestions

- Ensure the safety of workers and the public during construction
- Ensure that drainage system will not be affected during construction activities and to avoid delays to minimize the temporary adverse impacts of construction; and,
- Access to electricity by the public at the earliest possible time.

240. Public consultations will continue during construction and throughout the operating life of the project. Project brief or flyers about Part B will be translated to Bengali and made available at the PMU-DPDC Office and also posted in DPDC website.

4.6 Grievance Redress Mechanism

241. The DPDC will continue to engage local people and they will have the opportunity to express their legitimate grievance or file a complaint about the project by establishing a process to address the issues raised. Continuing consultation and communication with stakeholders (as appropriate) during implementation by PMU-DPDC, DPDC, Contractor(s), and local government authorities will facilitate in addressing the concerns of project affected persons. Contact details of PMU-DPDC for filing complaints will be posted in the project areas.

242. A grievance redress committee (GRC) will be set up by DPDC as soon as the project commence (at the union level) where DPDC has subprojects. DPDC will ensure the representation of women in the GRC. The local people will be informed about the process to address grievance. The flyer or project brief in Bangla will include the grievance process. **Figure 4.4** shows the organization of the GRC.

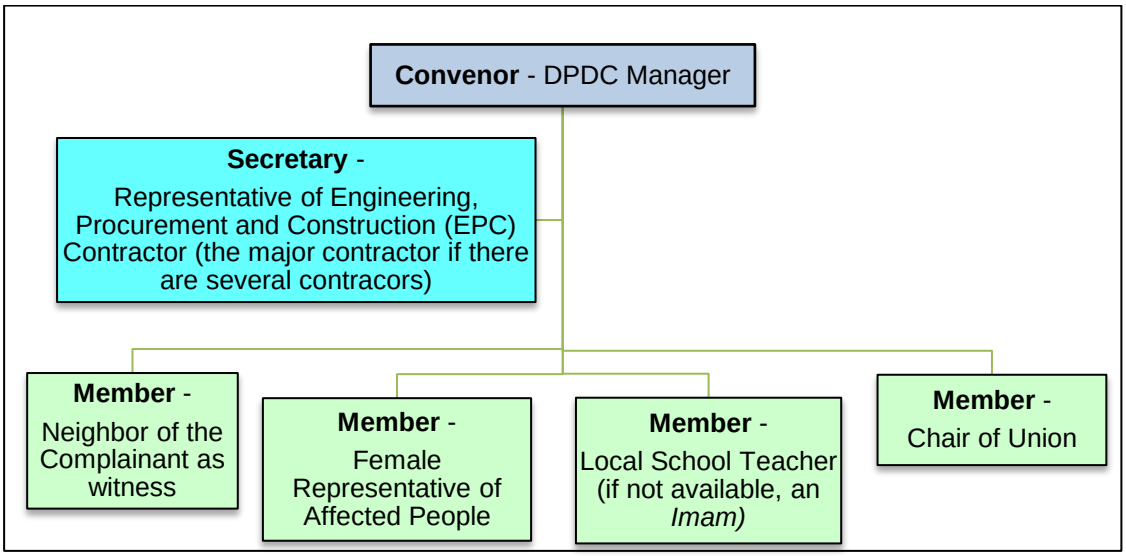


Figure4.4 Grievance Redress Committee of Part B

243. Briefly, the grievance process is as follows:

Step 1 Displaced persons (DPs) will be informed of their losses and entitlements in writing by PMU-DPDC (or DPDC-designated representative such as an NGO supporting the implementation of RP) or through a face-to-face meeting on resettlement and compensation issues. If the DPs are satisfied with the terms of the entitlements, they can claim for payments from PMU-DPDC. If there are disagreements, the DPs can approach PMU-DPDC (or DPDC-designated representative such as an NGO supporting the implementation of RP) for clarification about their concerns. If the APs are satisfied with the outcome, they can claim for compensation of their entitlements.

Step 2 If the issue(s) remains unresolved, the DPs can go to the GRC assisted by PMU-DPDC (or DPDC-designated representative such as an NGO supporting the implementation of RP) who will refer the case with written documentation. The GRC will conduct hearing and resolve the issue within 30 days from the receipt of the complaint.The DPs must be present during the hearing of the complaint and the Minutes will be documented and made available to the DPs. PMU-DPDC Manager approves the Minutes and the decision sent to the APs. If an agreement is reached and the DPs are satisfied with the decision, compensation can be claimed from DPDC.

Step 3 If still the issue(s) remains unresolved, the case is referred by the GRC to the appropriate court of law for settlement.

244. The GRC will meet twice a month to review complaints, if any, and will keep a record of these complaints, classify, prioritize, and provide the solution(s) within 30 days from the date of the complaint. The record will include the contact details of the complainant, date and nature of complaint, agreement on corrective actions and the date it was enforced, and the

final outcome. All complaint-related documentation such as minutes of the meeting and decisions will be summarized and become part of the semi-annual monitoring report submitted to ADB.

245. The GRC will report to the complainant(s) about the status of their grievances and the decisions of the GRC. If the grievance is not addressed, the complainant can seek legal redress in the appropriate Courts.

246. Since most of the grievance is on compensationfor temporary damages during construction and land acquisition (if any), the mechanism is integrated in the Resettlement Plan (RP) and the cost of its implementation will come from the administration cost which is part of the total cost of the RP for the project. In the event that the administration cost is not sufficient, the budget for the GRC will be taken from the contingency cost also included in the RP. The GRC will continue to function during the life of the Project.

4.7 Environmental Management Plan

4.7.1 Mitigation

247. **Table 4.7** presents the environmental management plan (EMP) with cost estimates The EMP will be updated before the start of civil works and as needed, to accommodate any change in the condition of the site, performance of Contractor(s), and feedback from local people or other stakeholders. The revised/updated EMP will be incorporated in the draft IEE and submitted to ADB.

4.7.2 Monitoring

248. During the construction phase, environmental monitoring will be done daily to ensure that non-compliance to the EMP, if any, is avoided or immediately addressed and unforeseen impacts quickly discovered and remedied.

249. During the operation phase, regular monitoring and maintenance of the power transmission system will help ensure the integrity and safety of the structures and components.**Table 4.8** presents the monitoring plan.

4.7.3 Implementation Arrangements

250. The management and general supervision of project implementation will be undertaken by the PMU-DPDC while the EMP implementation will be carried out under the supervision of Head, PMU-DPDC. An environmental staff (or a firm that will be retained during implementation), who will be primarily responsible for ensuring that the EMP is properly implemented, will be recruited for the project prior to award of the civil works contract. Aside from this, he/she will coordinate with Head, PMU-DPDC on compliance to ADB requirements, relevant government agencies and local authorities on environmental issues and clearances, update and finalize the IEE, and will prepare environmental monitoring reports for submission to ADB at least twice a year during construction and annually during operation phase.

251. The Contractor(s) will be informed of their responsibility to comply with the EMP and the requirements of ADB. During construction, specific responsibilities by Contractor(s) for EMP compliance will be monitored by the environmental staff for the project.

4.8 Conclusion and Recommendation

252. Sites for substations were selected to minimize land acquisition and potential environmental impacts. Of the 24 subprojects for Part B, only one site (Nandalapur for 33/11 kV substation) requires land acquisition. Physical interventions will be limited to the areas within the existing sites owned by DPDC or donated/transferred by other agencies of the Government. Where required, dismantling of structure(s) and equipment will be done following best practice in construction engineering given the challenge of being located in highly-urbanized areas in Dhaka and Narayaganj. Any suspected or potentially PCB-contaminated equipment from dismantling of existing substation (if any) will be managed in collaboration with BPDB and DOE. Usable scrap materials from dismantling will be stored in the warehouse of DPDC in Tongi for resale and auction.

253. Part B is not expected to cause significant adverse environmental impacts during construction and operation. Any residual impacts can be easily mitigated by proper planning and best practices in construction engineering. Seasonal variations will be incorporated in scheduling and in carrying out the construction works to minimize disruptions and inconvenience to local people in the urban areas.

254. Mitigation measures and monitoring have been incorporated in the EMP with cost estimates (where appropriate). Contractor(s) will be required to comply with the EMP and relevant national regulations on environment, labour, and occupational health and safety. Local hiring will be given priority. The project will have long-term beneficial impacts due to improved stability and reliability of power distribution systems in the North and South Zone service areas of DPDC within the districts of Dhaka and Narayaganj.

255. DPDC will obtain the required environmental clearance from the DOE prior to any civil works and will post the IEE in their website as part of information disclosure required by ADB's SPS 2009 and Public Communications Policy 2011.

Table 4.9 Environmental Management Plan of Part B (DPDC)

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
Pre-Construction and Design Phase					
• Preparation of feasibility study and other desktop technical and engineering study • Land acquisition	• Land and people	• Mainly desktop review • Walk-over survey may cause temporary and minimal disturbance to localized area • One substation site in Kamalapur requires transfer from Bangladesh Railway to DPDC	• Study topographical and geotechnical information, environmental and socioeconomic data, etc, and integrate with engineering design and consultation with local people • Consultation with private land owner(s) and ensure compliance with SPS 2009 on the process of land acquisition	Included in the Project Costs *Cost of land acquisition is borne by DPDC and not included in Contrcator(s) costs	Design or survey engineers/Consultants, DPDC, District Commissioner Office
Construction Phase					
Orientation for contractor and workers	• People	• Awareness of workers on the environmental requirements during construction and their responsibility as part of the team • Contractors' understanding of their responsibility in implementing the EMP	• Conduct briefing and training for Contractor on the EMP, records management, and reporting • Consensus about the critical areas to be monitored and the required mitigation measures • Create awareness of sexually-transmitted diseases such as HIV/AIDs	Included in the costs of Contractor(s)	PMU-DPDC
Prepare construction management workplan to control construction-associated impacts	• People • Land • Air Quality and Noise • Waste	• Avoid effects of Contractors' unplanned activities • Smooth work implementation	• Temporary pedestrian and traffic management plan • Materials management plan • Waste management plan • Noise and dust control plan • Community and Safety plan	Included in costs of Contractor(s)	Contractor(s), PMU-DPDC
Hiring of project staff and workers	• People	• Conflict due to potential workers' migration • Lack of local support to the project • Opportunity for local people to engage in non-agricultural employment and small-scale business	• Use local labour for manual work and eligible local workforce for clerical and office jobs	---	Contractor(s), PMU-DPDC

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
Presence of construction workers at substation sites	• People	• Potential for increase demands in services such as food, temporary housing, etc. • Presence of construction workers may become small-scale and temporary opportunity to provide services such as food, temporary housing, etc.	None required	---	---
Site preparation, vegetation and land clearing	• Land • Vegetation	• Dismantling of structure(s) and equipment from existing substations • Dismantled equipment may be suspected or potentially-PCB contaminated • Excavation and earth moving works for the construction of substations	• Civil works guidelines and/or construction management plan will be strictly implemented by the Contractor • Minimal vegetation in the substation sites • Debris disposed of in designated landfill/dumpsites • Scrap materials stored in DPDC warehouse in Tongi for resale/auction • Use of proper safety clothes/equipment in dismantling structure(s) and equipment • Coordinate with BPDB and DOE for management or disposal of suspected or potentially PCB-contaminated equipment • Erosion-control measures will be implemented • Landscaping will be done after completion of construction works • Laying of underground cable will be done at nighttime to reduce disruption to economic activities of local people	Soil erosion and soil quality – 29 Drainage – 14.5 Revegetation and landscaping – 14.5	Contractor(s), PMU-DPDC

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
	• Air quality	• Increase in dust levels and vehicular emissions	• Construction vehicles will be maintained to minimize vehicular emissions • Temporary enclosure of construction sites to contain dust dispersion • Provision of warehouse for construction materials in the sites to reduce trips of construction vehicles • Direct Contractor(s) to maintain construction vehicles and heavy equipment machineries • Spray water to exposed areas or sources of dusts • Cover trucks transporting materials to reduce dust dispersion	65	Contractor(s), PMU-DPDC
	• Noise	• Potential increase in noise level from construction works and ground vibration from construction vehicles	• Observance of low speed by vehicles to reduce noise • Noise-generating works done at daytime • Observe/Comply with traffic management plan	Included in air quality cost	Contractor(s), PMU-DPDC
Construction of substations and installation of required equipment	• People • Land	• Interference with road crossings	• Danger and clearly visible warning signs will be posted at designated sites • Scaffoldings will be placed over road crossing points • Construction vehicles to strictly follow road regulations	110	Contractor(s), PMU-DPDC
		• Potential safety risks to community	• Maintain necessary fence or barricade (as appropriate), sufficient lights, warning signs and danger signals, and take all required precautions for public safety • Assign security personnel to prevent accidents, trespassing, and pilferage • Require Contractor to direct drivers		Contractor(s), PMU-DPDC

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
			of construction vehicles to strictly follow road regulations		
		• Potential health and safety risks to workers	• Provide sanitary facilities and wash areas • Provide safe drinking water and garbage bins • Enforce good housekeeping at all times • Study safety plan before start of construction • Provide workers with hard hat, safety shoes and belts • Coordinate with nearest hospital for arrangements in case of accidents • Assign nurse or medical staff to make weekly rounds at substation sites • Set up first aid treatment within construction sites and field office • Observance and compliance with relevant safety measures required by law and best engineering practices • Provide communication devices to designated workers	14.5	Contractor(s), PMU-DPDC
Operation Phase					
Hazards due to accidental failure of distribution lines	• People • Birds	• Electrocution hazards will occur only if someone comes too close or in contact with the transmission line cable	• A protection system that shuts off during power overload or similar emergencies will be installed • Distribution lines entering and leaving the substations are insulated (or covered) to minimize impacts to birds • Regular monitoring and maintenance to ensure safety and integrity of distribution lines and substations • As part of corporate social	Included in the O & M costs of Project	DPDC

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
			responsibility initiatives, conduct information and education campaign to local people to enhance awareness on safety practices of living near substations		
Use of mineral oil for transformers	• People • Land • Water	• Accidental spillage that would contaminate land and water • Occupational health risks to workers due to exposure	• Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free • Provision of oil-water separator • Fire extinguishers readily available in storage areas for mineral oil • Provide for oil containment structure	Included in the O&M costs	DPDC
Presence of substations in urban areas	• People • Land	• Potential depreciation of land property values near or adjacent to substations	• Availability of stable and reliable power will trigger economic development in the area	---	---
	• Noise	• Noise generated by equipment in the substations	• Periodic maintenance of equipment such as transformers and capacitors to minimize noise generation • Provide enclosure of noise-generating equipment • Monitor ambient noise levels	Included in the O&M costs	DPDC
	• People	• Generation of employment	• A total of 62 positions will be created during the operation of Part B	---	---
	• People	• Potential exposure to electric and magnetic fields (EMF)	• Electric and magnetic field from the subprojects of Part B are not expected to pose public health risks and will be way below the limits set by ICNRP of 4.17 kV/m for electric field and 833 mG for magnetic field. • Substations will be fenced and security staff assigned to prevent unauthorized public access • Information and education campaign will be conducted to local people to create awareness on	Included in the O&M costs	DPDC

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
			safety practices		
Use of SF_6 handling equipment	• People • Air	• Fugitive emissions from SF_6 handling equipment • SF_6 is a potent GHG • Occupational hazards of exposure to fugitive emissions of SF_6 gas	• Regular monitoring of SF_6 through pressure gauges • Use of handheld leak detectors to monitor leaks • Prepare annual inventory checklist of SF_6consumption, purchase, and losses to track emissions	Included in the O&M costs	DPDC

Table 4.8 Environmental Monitoring Plan for Part B (DPDC)

Project Stage	Parameter/Indicator	Location	Frequency	Responsibility (Implementation and Supervision)
Pre-Construction	Soil sampling	Substation sites (particularly those with existing structure and equipment dismantled)	Once before construction	PMU-DPDC, Contractor(s)
	Local recruitment of workers and staff	Substations	Monthly	PMU-DPDC, Contractor(s)
Construction	Spraying of water to exposed land and before movement of construction vehicles	Substations and road easements when laying of underground cable to connect substations	• Weekly at road easements (or as needed) • Every day at substation sites during dry season and as needed during monsoon season	Contractor(s), PMU-DPDC (Environmental staff)
	Solid waste management	Substations	Every week	Contractor(s), PMU-DPDC (Environmental staff)
	Danger and warning signs for safety of workers and the public	Substations and road easements affected by laying of underground cable	Once a month	Contractor(s), PMU-DPDC (Environmental staff)
	Announcement to the public of works schedule	Along the road easement affected by laying of cables and substations	As needed	Contractor(s), PMU-DPDC
	Erosion control measures such as silt traps	Substations	Once a month	Contractor(s), PMU-DPDC (Environmental staff)
	Smoke belching construction vehicles	Substations	Weekly	Contractor(s), PMU-DPDC (Environmental staff)
	Dust and noise level	Substations	Twice a month	Contractor(s), PMU-DPDC (Environmental staff)
	Housekeeping	Substations	Weekly	Contractor(s), PMU-DPDC (Environmental staff)
Operation	Failure of transmission towers	Along the alignment	Every month	DPDC
	Maintenance of landscape	Substations	Quarterly	DPDC
	Housekeeping	Substations	Monthly	DPDC
	Waste Management (i.e., oil, garbage, etc.)	Substations	Monthly	DPDC
	Inventory of SF_6	Substations	Annual	DPDC
	Pilferage of cables	Along distribution lines	Quarterly	DPDC

5.0 PART C – NORTH DHAKA DISTRIBUTION IMPROVEMENT OF DHAKA ELECTRICITY SUPPLY COMPANY LTD.

5.1 Project Description

5.1.2 Objectives and Benefits

256. At present, the maximum demand for electricity within the service areas of DESCO has reached 1,000 MW. With an annual load growth of about 12%, the maximum demand by 2015 will reach 1,260 MW.

257. The vision of GOB for industrialization is for DESCO to provide about 1,500 MW of electricity by 2015 and 2,000 MW in 2020. To advance this vision and to meet the increasing demand for electricity, expansion and development of their transmission and distribution networks would be required. While DESCO has taken some initiatives to expand their distribution systems by constructing new lines, installing new substations, and rehabilitating the existing substations to provide new connections to the incoming consumers, more needs to be done. With Part C, an additional 1,120 MVA will be added to the existing system of DESCO.

258. The main objectives of Part C include the following:

(i) To meet the increasing demand for electricity within the service areas;
(ii) To overcome the load shedding problem being experienced at present in the service areas;
(iii) To minimize the associated socioeconomic impacts of load shedding;
(iv) To overcome the low voltage problem of the existing system due to overloading;
(v) To minimize the technical systems losses; and,
(vi) To facilitate new connections to upcoming customers and to support the vision of GOB for industrialization.

259. The availability of stable and reliable supply of electricity will promote the creation of employment opportunities for men and women. The upgrading of the distribution system will reduce the systems losses, thus, increasing the revenue for DESCO.

5.1.3 Location and Components

260. Part C consists of five 132/33/11 kV substations, 24 substations of 33/11 kV capacity and some feeder augmentation. **Table 5.1** and **Table 5.2** show the features of the subprojects for Part C.**Figure 5.1** shows the location of the the subprojects for Part C.

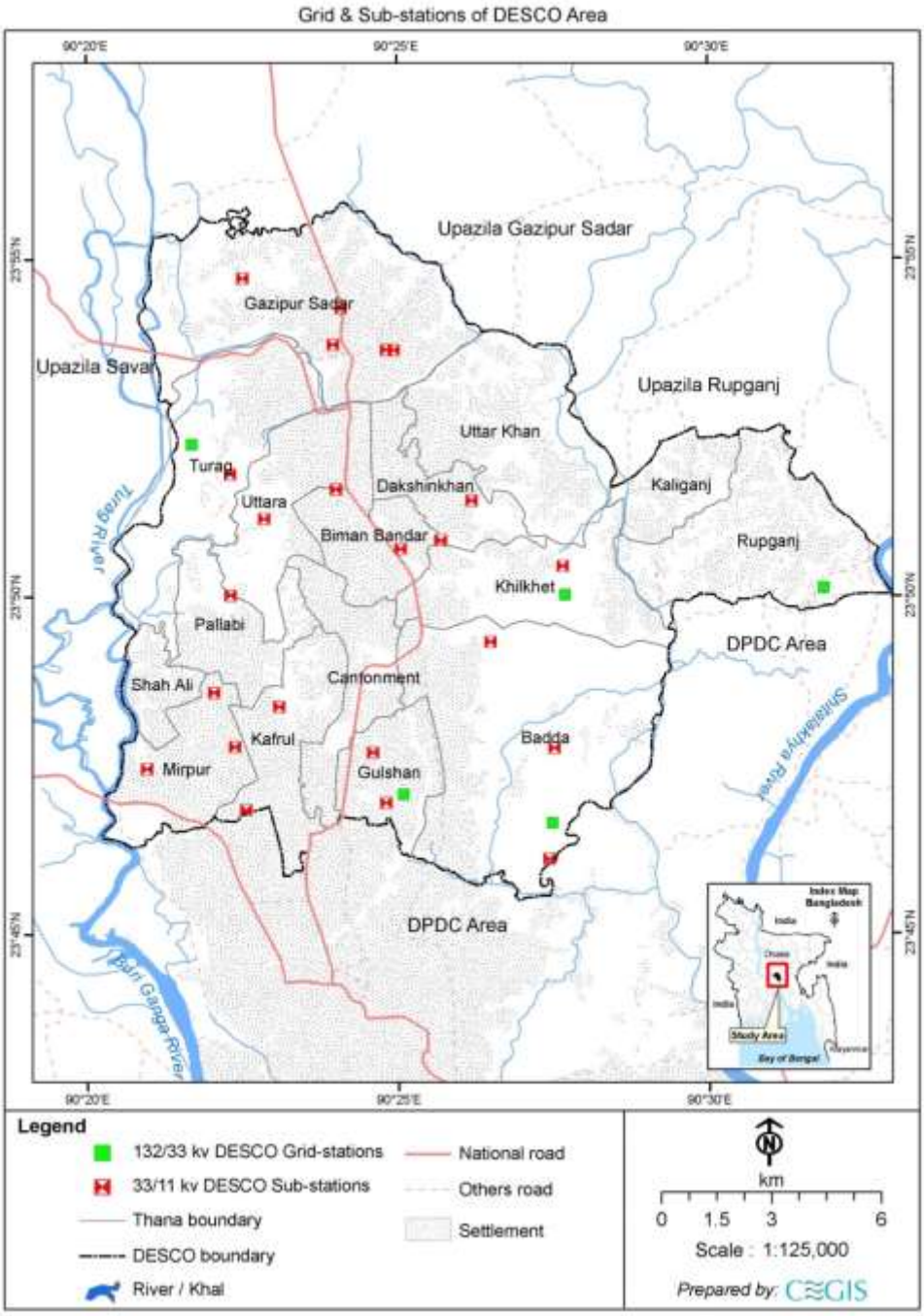
Table 5.1 Component 8 subprojectsof DESCO

No.		Subproject	Substation Capacity (MVA)	Distribution Line Length (km)
8	8.1	132/33/11 kV GIS Substation at Dumni	2x80/120	-
	8.2	132/33/11 kV GIS Substation at Aftabnagar	2x80/120	-
	8.3	132/33/11 kV GIS Substation at Uttara 3rd Phase	2x80/120	-
	8.4	132/33/11 kV GIS Substation at Gulshan-Banani	2x80/120	-
	8.5	132/33/11 kV GIS Substation at Purbachal	2x80/120	-
	8.6	132 kV transmission lines (double circuit line) for the source of above substations		42.90 circuit km
	8.7	33/11kV New Substation at Kazipara	3x20/28	-

No.		Subproject	Substation Capacity (MVA)	Distribution Line Length (km)
	8.8	33/11kV New Substation at Mazazr	3x20/28	-
	8.9	33/11kV New Substation at Kalshi	3x20/28	-
	8.10	33/11kV New Substation at DOHS – 2	3x20/28	-
	8.11	33/11kV New Substation at Lake City Concord	3x20/28	-
	8.12	33/11kV New Substation at Aftabnagar – 2	3x20/28	-
	8.13	33/11kV New Substation at Satarkul	3x20/28	-
	8.14	33/11kV New Substation at Barua	3x20/28	-
	8.15	33/11kV New Substation at Gulshan – 3	3x20/28	-
	8.16	33/11kV New Substation at Bashundara Block – G	3x20/28	-
	8.17	33/11kV New Substation at Solahati	3x20/28	-
	8.18	33/11kV New Substation at Banani – 3	3x20/28	-
	8.19	33/11kV New at Dakshinkhan-2	3x20/28	-
	8.20	33/11kV New Substation at Tongi – 27	3x20/28	-
	8.21	33/11kV Substation at Agargaon (Rehabilitation)	20/28	-
	8.22	33/11kV DOHS (Mirpur) (Rehabilitation)	20/28	-
	8.23	33/11kV Substation at Mirpur – 6 (Rehabilitation)	20/28	-
	8.24	33/11kV Substation at Tongi – 1 (Rehabilitation)	20/28	-
	8.25	33/11kV Substation at Tongi – 2 (Rehabilitation)	20/28	-
	8.26	33/11kV Substation at CAAB (Aviation Authority) (Rehabilitation)	20/28	-
	8.27	33/11kV Substation at Baunia (Rehabilitation)	3x20/28	-
	8.28	33/11kV Substation at Tongi – 3 (Rehabilitation)	3x20/28	-
	8.29	33/11kV Substation at Tongi (BSCIC) (Rehabilitation)	3x20/28	-
	8.30	33/11kV Substation at ADA (Rehabilitation)	3x20/28	-

Table 5.2 Component 9 subprojects of DESCO

No.		Subproject	Substation Capacity (MVA)	Distribution Line Length (km)
9	9.1	33kV Underground Cables	-	70 circuit-km
	9.2	11kV and 0.415kV OH Lines	300	• 11 kV and 0.415 kV overhead line - 500km • 11 kV underground – 200 circuit-km



Source: Draft IEE for the proposed construction of five 132/33 kV Grid Substation in DESCO Area. CEGIS. 20 May 2013.

Figure 5.1 Location map of Part C subprojects

5.1.3 Construction Activities for Part C

261. Associated construction activities in the installation of the substations consist of pre-construction, construction and post construction. The installation of the substations generally requires the following activities:

- Construction of a three storey building (the foundation is designed for a five-storey building and a basement) to house the gas insulated switchgear (GIS) control room;

- Creation of a security boundary wall and barbed wire fencing to protect the substation;
- Construction of approach and/or internal road for easier access;
- Installation of surface drainage and construction of cable trench, covered storage and warehouse/stockroom;
- Laying of gravel for the switchyard with associated civil and electrical works and boundary lighting;
- Setting up of security/sentry post;
- Construction of transformer blast wall, septic tank, and rain water harvesting unit;
- Installation of solar system for grid substation;
- Transport of materials and equipment to substation sites;
- Equipment installation, testing, and commissioning of equipment, and,
- Other miscellaneous tasks needed to complete the works.

5.1.3.1 Pre-construction phase

262. Pre-construction activities are summarized below:

- Study of distribution systems, feasibility study and load flow study including the preparation of development plan;
- Prepare the engineering design and as-built drawings to update the system as appropriate;
- Prepare the required bid documents for the construction of 132/33/11 kV and 33/11 kV substation as well as its associated works;
- Establish the temporary access tracks;
- Establish the areas for material storage and work sites;
- Transport of materials and equipment to site; and,
- Establish the construction camps for workers, as needed.

5.1.3.2 Construction phase

5.1.3.2.1 Civil Construction Works

263. *Earth works for the foundation* Earthworks and excavation are needed for the foundation of the substations and ancillary buildings at required depth. The excavated earth and other spoils are kept temporarily in borrow areas nearby and after the earthworks for the foundation, backfilling of the excavated area will be done and finishing with sand.

264. *Foundation Treatment* Geotechnical investigations of the foundation area will be undertaken. Results of geotechnical investigations help in designing the appropriate foundation of the structures as well as in determining if treatment of the foundation is required. The appropriate treatment such as bulla piling, precast reinforced concrete cement (RCC) piling or in-situ concrete piling, sand piling, and removal of peat or loose soil will be determined after the geotechnical investigations.

265. *RCC works* The RCC works are needed for the roof, columns, beams, floor, foundation of transformers, circuit breaker and steel structures, and other structures.

266. *Brick works up to plinth level and superstructure* Brick works will be done for the construction of the substation building using First Class bricks and, coarse sand and cement up to the roof level.

267. *Sand backfilling* Backfilling by sand will be done in the excavated areas for the foundation and floor of the building.

268. *Plastering and finishing (electric wiring, distemper or plastic paints)* Concealing of the electrical wiring with wires of proper size and good quality will be done and bulbs and switchboards will be provided. Plastering of the walls inside and outside of the building and its roof will be undertaken accordingly with curing work carried out for at least three weeks. After this time, plastic paint distemper will be done on the walls and the roof of the building.

269. *Wood/Thai aluminum for doors and windows, and glass fittings* Wood/Thai aluminum works with glass fittings will be done on the door shutters and windows of the building.

270. *Sanitary works* Sanitary works include laying down of sewerage pipelines either with polyvinyl chloride PVC or RCC, and installation, fitting, and fixing of toilet accessories (British Industry Steel Frame).

271. *Water supply system* Existing water supply system, if available, will be used as water supply source for the substation. In places where there is no supply system, tube wells will be installed for the workers and staff at the substation.

272. *Boundary fencing with concrete pillars and barbed wires* To protect the substations from encroachment and unauthorized entry from the public, the area will be fenced with either a six feet-high boundary wall or with concrete pillars 3-meters apart fitted with barbed wire.

5.1.3.2.2 Electrical Works

273. Once the substation building is completed, all the equipment (transformer, circuit breaker, isolator, lightening arrester, panel board, batteries and battery charger, etc.) will be installed (outdoor and indoor) according to specifications and standards. Most of the material for the substations will have to be procured abroad. Thus, there will be limited domestic resource utilization for the project. Construction materials such as bricks, sand cement, rods, etc. will be locally purchased.

274. *Testing and commissioning of equipment* After the outdoor and indoor installation of all the equipment required, they will be tested according to specifications and standards. Once all the tests have been successfully completed, the substations will be commissioned.

5.1.3.3 Post-construction phase

275. Post construction phase will cover final installation of the safety measures in the substations such as fire-fighting equipment system following the appropriate specifications, and the emergency first aid kits installed at strategic locations within the substations. Trained security personnel will be deployed to ensure peace and security within the property perimeter.

5.1.3.4 Availability of construction equipment and work schedule

276. Equipment and materials required for the construction of the substation such as poles, conductors, conductor joining material, cable, indoor termination kit, insulator, distribution transformer accessories, transformer protection equipment, hardware materials for distribution system etc. will be procured from abroad. Construction materials such as bricks, sand, cement, rods, etc. will be acquired locally from domestic suppliers.

277. Start of Part C is scheduled in July 2013 and expected completion is June 2017. Physical targets include:

- Preparation of final technical drawings/design - January 2014 to December 2015
- Recruitment and/or deployment of personnel - June 2015
- Procurement of required machine and equipment - December 2015
- Completion of civil and other construction works - June 2017
- Installation of transformers - June 2017

5.2 Analysis of Alternatives

278. Site selection for the 132/33/11 kV substations was based on suitability, i.e., adequate space for the required equipment, potential environmental impacts, avoidance of land acquisition and disruption to settlements and economic activities.

279. Five sites were selected where three sites are owned by Dhaka City Corporation planned for housing, one site owned by DESCO and another site located in a private land. Aftabnagar Housing Society has given the land to DESCO for construction of new substation. Therefore, there was no need for alternative sites since all the five sites initially selected has been confirmed suitable and no land acquisition is required. **Table 5.3** presents the five locations considered suitable for 132/33/11 kV substation.

Table 5.3 Proposed sites for new DESCO 132/33 kV substations

No.	Substation	Land Requirement (m^2)	Ownership	Suitability
1	Uttara 3rd Phase	4,046	Dhaka City Corporation	Suitable
2	Purbachal	4.046	Dhaka City Corporation	Suitable
3	Dumni	4,046	DESCO	Suitable
4	Banani-Gulshan	4,046	Dhaka City Corporation	Suitable
5	Aftabnagar	2, 428	Private	Suitable

280. For the sites of the 33/11 kV substations, existing substations were first considered followed by new sites. Nineexisting substations and 10 new sites were selected. **Table 5.4** presents the sites selected.

Table 5.4 Site Selection for 33/11 kV Substations of DESCO

No.	Substation	Status	Type of Substation	Land Requirement (m^2)	Ownership	Suitability
1	Civil Aviation Authority of Bangladesh (CCAB)	Existing	Augmentation	1,336	DESCO	Suitable
2	Baunia	Existing	Replacement and Augmentation	1,336	DESCO	Suitable
3	Tongi 3	Existing	Augmentation	1,336	DESCO	Suitable
4	Tongi 2	Existing	Augmentation	1,336	DESCO	Suitable
5	ADA	Existing	Replacement and Augmentation	1,336	DESCO	Suitable
6	Mirpur 6	Existing	Augmentation	1,336	DESCO	Suitable
7	BSCIC	Existing	Replacement and Augmentation	1,336	DESCO	Suitable
8	Tongi 1	Existing	Augmentation	1,336	DESCO	Suitable
9	Agargaon	Existing	Augmentation	1,336	DESCO	Suitable

No.	Substation	Status	Type of Substation	Land Requirement (m^2)	Ownership	Suitability
10	Kazipara	New	---	1,336	DESCO	Suitable
11	Mazazr	New	---	1,336	DESCO	Suitable
12	Tongi 27	New	---	1,336	DESCO	Suitable
13	DOHS 2	New	---	1,336	DOHS but transferred to DESCO	Suitable
14	Kalshi	New	---	1,336	Rakeen Development Housing Society	Suitable
15	Lake City Concord	New	---	1,336	Lake City Concord Housing Society	Suitable
16	Bashundhara Block G	New	---	1,336	Bashundhara Housing Society	Suitable
17	Satarkul	New	---	1,336	BDDL Housing Society	Suitable
18	Aftabnagar 2	New	---	1,336	EHL	Suitable
19	Solahati	New	---	1,336	Dhaka City Corporation	Suitable

5.3 Description of Existing Environment

5.3.1 Meteorology

281. **Climate** The DESCO service area is within the monsoon climate characterized by rainy season that is hot and humid, winter that is predominantly cool and dry while the summer is hot and dry interrupted by occasional heavy rainfall.

282. Part C subprojects are located in the North Central region of Bangladesh where monsoon comes in July and decreases by late October. Meteorological data recorded from 1988-2011 by the Bangladesh Meteorological Department (BMD) at the Dhaka station were used to describe rainfall, temperature, humidity and evaporation.

283. **Rainfall** The maximum monthly rainfall recorded in Dhaka occurred in September 2004 at 839 mm. Historical rainfall data from 1988 to 2008 shows that the average maximum monthly rainfall is in July at about 400 mm while dry months start in November until March.

284. **Temperature** Based on historical data from 1991 to 2011, the maximum temperature recorded was 36.44^{o}C in April 1995 while the lowest temperature during this period occurred in January 1995 at 11.33^{o}C. Monthly temperature ranges from about 12^{o}C to as high as 37^{o}C.

285. **Humidity** Recordsshow that June, July, August, September and October are most humid months with relative humidity ranging from 79% to 83%. Low humidity is experienced from January to April where the relative humidity ranges from 61% to 71%.

5.3.2 Natural Hazards

286. **Flooding** Bangladesh has three types of flooding: (i) seasonal monsoon flood, (ii) tidal flood, and (iii) flash flood which cause loss of lives and damage to properties. The flooding

season generally starts in May until November. **Figure 3.3** shows the flood-prone areas in Bangladesh.

287. Most part of Dhaka experiences the annual monsoon flooding while Chittagong faces mostly flash flooding. In Sylhet, the area experiences both flash flooding and monsoon

288. **Seismicity** According to the seismic zone map of Bangladesh (see **Figure 3.4**), Part C is within seismic zone II (moderate - 0.05g seismic factor). Substations and other land-based structures will be designed to incorporate and withstand ground movement of 0.05g to reduce the risks of structural failure due to earthquake.

289. **Cyclone** Seasonal storms known as Nor'westers (*Kalbaishakhi*) usually reach the maximum in April, low in May and minimum in March. Nor'westers affect the entire country and are generally associated with tornadoes and its impacts to substations and distribution lines should be incorporated in the detailed design.

5.3.3 Land Type

290. In Bangladesh, land type is classified based on depth of inundation during monsoon season caused by normal flooding on agricultural land. The land type recognized by the Soil Resource Development Institute is given in **Table 5.5**.

Table 5.5 Bangladesh Classification of Land Type

Land Type	Characteristic of Inundation
High land (F0)	This class has been subdivided into two classes (i) land which is above normal flood level (ii) normally flooded from 0-30 cm deep
Medium highland (F1)	Land which is normally flooded between 30-90 cm deep during the flood season
Medium lowland (F2)	Land which is normally flooded up to between 90 cm and 180 cm deep during the flood season
Lowland (F3)	Land which is normally flooded between 180 cm and 275 cm deep during the flood season
Very lowland (F4)	Land which is normally flooded deeper than 275 cm during flood season

291. Part C subprojects are within the land type, highland (more than 95%), a small part within the medium highland, and small patches of land within medium lowland and lowland (see **Figure 5.2**).

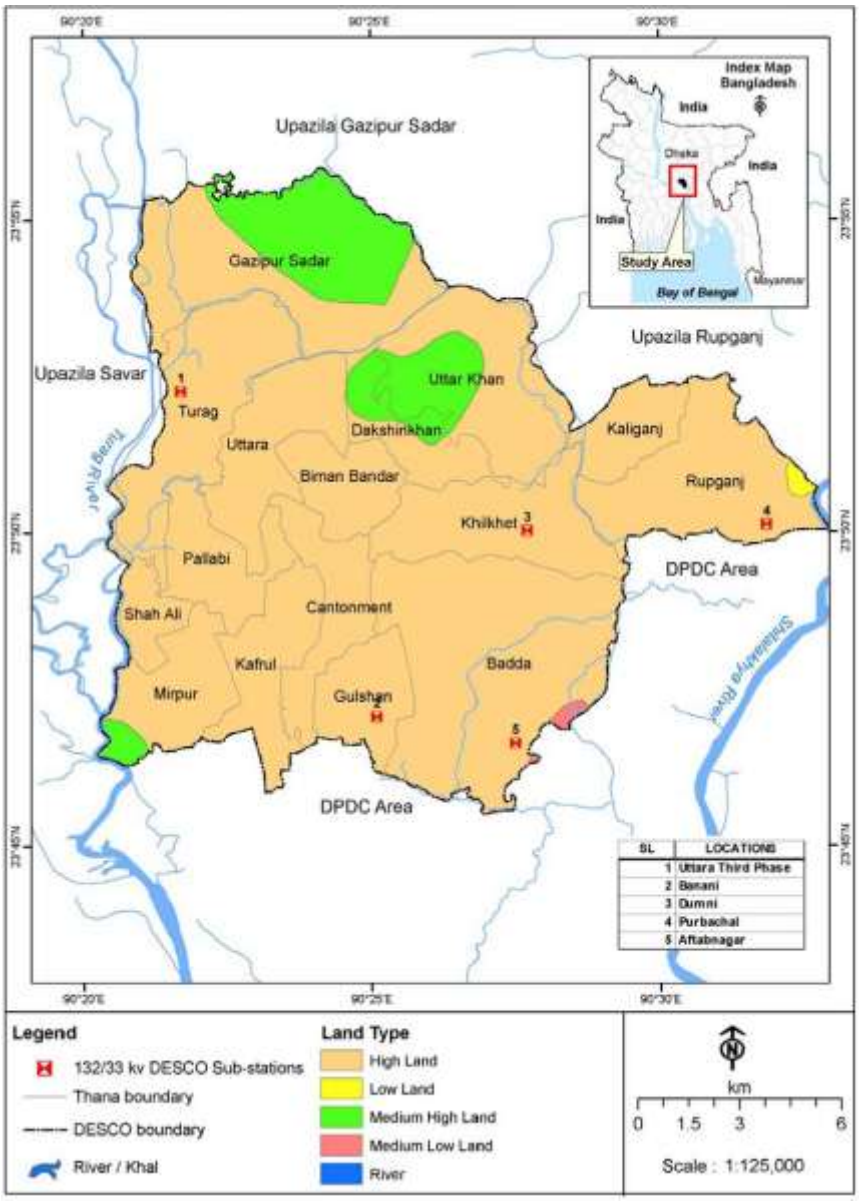


Figure 5.2 Land type within the area of Part C

5.3.4 Terrestrial Ecology

292. The areas within Part C are already built-up. There are no endangered, threatened or protected species in both flora and fauna.

5.3.4.1 Flora

293. The vegetation is common and the composition is similar all over the project area which consists of herbs and shrubs. Common species cultivated are Aam (*Mangiferaindica*), Khathal (*Artocarpusheterophyllus*), Raintree (*Albizia lebbeck*) and Kola (*Musa sp*). Other types of marginal herbs found include Tridhara (*Tridexprocumbens*), Bondona (*Scorpiadulkis)*,Teetbagun (*Solanumnigram*), *Pteris*, *Dropteris*, *Polygonum sp*., and *Cyperus Enhydra flactuans*. **Table 5.6** presents the major species in the project area while **Figure 5.3** and **Figure 5.4** show the vegetation in a 132/33/11 kV substation and 33/11 kV substation, respectively.

Table 5.6 Major terrestrial flora in the project area of Part C

Species Name	Type of Species	Abundance
Aam *(Mangifera indica)*	Tree	L
Kola (*Musa sp*)	Shrub	L
Kathal (*Artocarpus heterophyllus*)	Tree	L
Raintree (*Albizia lebbeck*)	Tree	L
Neem (*Azadirachta indica*)	Tree	L
Boroi (*Zizyphus mauritiana*)	Tree	L
Kamranga (*Averrhoa carambola*)	Tree	L
Peara (*Psdiium guajava*)	Tree	L
Lichu (*Litchi chinensis*)	Tree	L
Nayantara (*Vitex nejundo*)	Herb	L
Lojjaboti (*Mimosa pudica*)	Herb	L
Cyperus (*Cyperus rotundus*)	Herb	M
Bantamak (*Nicotiana tobacum*)	Herb	L
Jaba (*Hibiscus rosa sinensis*)	Shrub	L
Bonbagun (*Solanum torvum*)	Herb	L
Mathkolmi (*Ipomea sp*.)	Herb	L
Sethdrone*(Leucas aspera)*	Herb	M
Kolabati*(Musa sp.)*	Shrub	L
Kashoti*(Elipta protrata)*	Herb	M
Tridara*(Tridex procumbens)*	Herb	H
Fern *(Dropteris sp.)*	Herb	H
Bondona*(Scorpia dulkis)*	Herb	H
Teetbagun*(Solanum nigram)*	Shrub	H
Labu *(Citrus sp.)*	Tree	L
Amrul shak*(Oxalis europia)*	Herb	M
Akondo*(Calotropis gigantia)*	Shrub	L
Premkata*(Andropogon paniculata)*	Herb	M
Muktajuri*(Acalypha indica)*	Herb	M
Bagun*(Solanum tuberasum)*	Shrub	L
Arjun(*Teminalia arjuna*)	Tree	L
Tulshi *(Ocimum sp.)*	Shrub	M
Apang (*Achyranthes aspera*)	Herb	M
Zau(*Thuza oficinalis*)	Shrub	L

Figure 5.3 Vegetation in Aftabnagar Site (132/33 kV substation)

Figure 5.4 Vegetation in Kalshi and CAAB Sites (33/11 kV substation)

5.3.4.2 Fauna

294. The type of vegetation in the project area cannot sustain big mammals. Faunal species observed in the project area include the small Indian Mongoose (*Herpestes auropunctatus*), common house rat (*Rattus rattus*), Irrawaddy squirrel/Badami Kathbirali (*Callosciurus pygerythrus*), greater short-nosed fruit bat (*Cynopterus sphinx*), and Indian Pipistrelle (*Pipistrellus coromandra*).

295. Some amphibian species are common toad(*Duttaphrynus melanostictus*), Asian brown tree frog (*Polypedates leocomystax*), and cricket frog(*Fejervarya* Sp.). **Table 5.7** gives the species of fauna observed in the project area.

Table 5.7 Major terrestrial fauna in the project area of Part C

Species name	Scientific name	Family	Class	Abundance
Baji (CommonMongoose)	*Herpestes edwardsi*	Herpestidae	Mammalia	L
Raktochusa (Common Garden Lizard)	*Calotes versicolor*	Agamidae	Reptilia	L
Kadhbirali (Irrawaddy Squirrel)	*Cllosciurus pygerythrus*	Sciuridae	Mammalia	L
Dhorasap (CheckeredKeelback)	*Xenochrophis piscator*	Natricidae	Reptilia	L
Mete sup (OliveKeelback)	*Atretium schistosum*	Natricidae	Reptilia	L
Big Rat (Bandicot Rat)	*Bandicota indica*	Muridae	Mammalia	L
Indur (Common HouseRat)	*Rattus rattus*	Muridae	Mammalia	M
Khudi chamchika(IndianPipistrelle)	*Pipistrellus coromandra*	Vespertilionidae	Mammalia	L
Badur (Short- nosed Bat)	*Cynopterus sphinx*	Pteropodidae	Mammalia	L
Salik H Kuno bang (CommonToad)	*Bufo melanostictus*	Bufonidae	Amphibia	L
Cricket frog	*Fejervarya Sp*	Bufonidae	Amphibia	M

5.3.4.3 Birds

296. Bird species in the project area are Black Drongo (*Dicrurus macrocercus*),Crested Serpent Eagle (*Spilornis cheela*), Brahminy Kite (*Heliastur indus*), Common Kingfisher(*Alcedo atthis*), White breasted Kingfisher (*Halcyon smyrnensis*), Pied Kingfisher (*Ceryle rudis*), Brown Fish Owl (*Ketupa zeylonensis*), Rufous Treepie (*Dendrocitta vagabunda*), common Myna (*Acridotheres tristis*), Asian Pied Starling(*Sturnus contra*), Red Vented Bulbul (*Pycnonotus cafer*), Oriental Magpie Robin (*Copsychussaularis*), Spotted Dove (*Streptopelia chinensis*), Blue Rock Pigeon (*Columba livia*), Coppersmith Barbet (*Megalaima haemacephala*), Jungle Babbler (*Turdoides striata*), black-hooded oriole (*Oriolus*

xanthornus), and common Hoopoe (*Upupa epops*). **Table 5.8** shows the bird species in the project area.

Table 5.8 Bird species found in the project area of Part C

Name of Species	Scientific Name	Abundance
Common Hoopoe	*Upupa epops*	M
Charui	*Passer domestica*	M
Common Kingfisher	*Alcedo atthis*	L
Common Myna	*Acridotheres tristis*	M
Asian Koel	*Eudynamys scolopacea*	M
Spotted Dove	*Streptopelia chinensis*	L
Red Vented Bulbul	*Pycnonotus cafer*	L
PatiKak	*Corvus splemdens*	H
Dar kak	*Corvus macrorhynchos*	M

5.3.5 Aquatic Ecology

297. Free floating and rooted floating hydrophytes found in the project area are water hyacinth*(Eicchornia crassipes)*, water lettuce *(Pistia sp)*, water fern *(Azolla Salvinia sp.)*, and Helencha *(Enhydra flactuans).* Skipper frog (*Euphlyctis cyanophlyctis*) and Cricket Frog (*Fejervarya* sp) are common in the project area. **Figure 5.5** presents the aquatic vegetation in Dumni site (132/33 kV substation).

Figure 5.5 Aquatic vegetation in Dumni site

5.3.6 Socioeconomic Profile

298. **Population** According to the 2011 Census Report of Bangladesh Bureau of Statistics, the total number of householdswithin the area of Part C is 904,592 and a population of 4,055,982. The male population is 2,202,142 while the femaleis 1,853,841 or a ratio of 1:1. The average household size is 4.2.

299. **Employment** More than half of the population (58%) is economically employed. Employment in the services account for 64% followed by industry (32%) and a very small part of the population (4%) engage in agriculture.

300. **Education** The overall literacy rate is 54% (i.e., Dhaka, Gazipur). The men are generally more literate than women (e.g., Dhaka - men 78%; women 70%).

301. **Housing** Less than half of the households (46%) have pucca housing, semi-pucca(32%), and kutcha (19%). Ownership of the house is low at 25% with rental housing at 70% and rent-free at 5%.

302. **Water supply and sanitation** Drinking water supply is good with more than half of the population (73%) getting water from piped sources provided by Dhaka Water Supply and Sewerage Authority, 24% source water from tube wells while 3% get their water from rain harvesting and open water sources such as ponds. About 90% of the population have sanitary toilet facilities.

303. **Fishery resources** The project is within highly urbanized areas but in Solahati (33/11 kV substation), there is about 668 m^2 of ditch used for fish culture during the monsoon season when the area is filled with rainwater and connected to the adjacent canal. This will be affected by the construction of the substation.

304. **Access to electricity** Majority of the households (96%) have electric connection.

5.4 Anticipated Environmental Impacts and Mitigation Measures

5.4.1 Pre-construction and Design Phase

305. Some activities to be conducted prior to construction include the feasibility study and other in-house study undertaken by designated technical staff and/or consultants (if required), assessment of the values of land needed for acquisition, negotiation with affected land owners, implementation of land acquisition and securing of relevant environmental clearance. These activities are not expected to cause adverse environmental impacts are they only involve desktop planning and no physical intervention.

5.4.2 Construction Phase

306. The PMU-DESCO will ensure that the Contractor's contract will include the responsibility of compensating for any temporary damage, loss or inconvenience as result of the project during construction phase (Sect. 19 of Electricity Act 1910, 1982 Acquisition and Requisition of Immovable Properties, SPS 2009).

Prepare a construction management work plan

307. The work plan will help ensure the smooth implementation of construction activities giving emphasis to the substation sites mostly located in urban areas. Organizing the activities giving consideration to seasonal variations, economic activities, and location of substations will avoid any impacts of unplanned activities by the Contractor(s). The work plan will include the temporary pedestrian and traffic management, materials and waste management, noise and dust control (as appropriate), and workers and community safety plan.

Hiring of project staff and orientation of workers

308. Construction phase will be an opportunity for local people to venture in small-scale and temporary business to provide services such as food, temporary lodging, etc. Priority for local hiring of eligible persons will be required. Contractor(s) will be directed to use local labour for manual work and eligible local workforce for clerical and office jobs. DESCO will monitor the Contractor(s) to ensure that local hiring is given priority.

309. DESCO will provide briefing for Contractor(s) and workers as well on the environmental management plan (EMP), records management, and reporting so they would know their responsibility for compliance. Part of the orientation will be on awareness about sexually transmitted diseases such as HIV/AIDS to prevent potential incidence.

Site preparation and vegetation clearing

310. All the five sites for the 132/33/11 kV substations and the 24 sites for the 33/11 kV substations will be done within the land owned by DESCO or transferred by other agencies such as RAJUK, Rakeen Development Housing Society, Lake City Concord Housing Society, Bashundhara Housing Society, and BDDL Housing Society.There will be minimal vegetation clearing since most of the sites are in urban areas and vegetation is not dense.

311. Site preparation will involve some dismantling of existing structure(s) and equipment. For the 33/11 kV substation, 10 sites are within the existing substation needed for rehabilitation. Interventions will involve replacement of old 10/14 MVA transformers and/or augmentation with 20 MVA to 40 MVA capacity. Fourteen sites will be construction of new substations (33/11 kV).

312. Debris from dismantling or demolition (if any) will be properly disposed of in designated landfill and/or controlled dumpsites. Usable and/or recyclable materials and equipment will be transported to the central storage of DESCO in Mirpur for resale or auction. The central storage is divided into 11 warehouses and materials or equipment are stored according to use (see **Figure 5.6**).Scraps are auctioned/sold on a regular basis.

Figure 5.6 DESCO central storage in Mirpur

313. Dismantling of existing structure(s) and old equipment may give rise to the possibility of being polychlorinated biphenyl (PCB)-contaminated. While it is understood that recently imported equipment for substations are PCB-free, some older equipment may not be. [23] Electrical equipment used in the power sector is a major source of PCB in Bangladesh. The PCB from the power sector may come from the transformer oil within in-service transformer (both in power transmission and distribution), capacitors, and oil circuit breakers. [24] Bangladesh has no institutional and legislative policies focusing on persistent organic pollutants (POPS) where PCB is part on the 12 POPS within the purview of Stockholm Convention on POPS signed by 150 countries in May 2001 and enforced in May 2004. Bangladesh ratified the Stockholm Convention on POPS in 2007.

[23] The World Bank Office Dhaka.Bangladesh Country Environmental Analysis. Bangladesh Development Series Paper No. 12. September 2006. http://siteresources.worldbank.org/BANGLADESHEXTN/Resources/295759-1173922647418/complete.pdf. (Accessed on 1 May 2013)

[24] Department of Environment.United Nations Development Programme Bangladesh.Persistent Organic Pollutants Management in Bangladesh.nda. http://www.undp.org.bd/library/publications/Persistent%20organic%20Pollutants%20(POPs%20Management%20in%20Bangladesh).pdf. (Accessed on 1 May 2013)

314. Workers assigned in the dismantling of structures and equipment from existing substations will be required to wear personal protective equipment or appropriate gadgets to ensure their safety. Equipment (particularly transformers and capacitors) being dismantled from existing substations will be classified based on nameplates/labels in order to isolate those suspected to contain PCB. In the event that an equipment being dismantled is known to contain PCB, PMU-DESCO will collaborate with BPDB on the management and disposal (if required) of such equipment. BPDB maintains a central transformer maintenance facility where transformers and capacitors are repaired, overhauled, dismantled or retrofilled, and transformer oil physically regenerated using centrifuges.[25,26] Moreover, PMU-DESCO will coordinate with the DOE on the management of such equipment in relation to DOE's project on environmentally-sound management and disposal of PCBs. These measures will ensure that suspected and potentially PCB-contaminated equipment are dealt with properly.

315. After dismantling of existing structures and equipment, excavation and earth moving works will be required for the construction of the substations. The Nandalapur site may require backfilling as it is located in a low-lying area. Adequate measures will be done to prevent erosion at the sites. Temporary warehouse/storage will be provided within the sites for construction materials needed to reduce the number of trips for transporting vehicles.

316. Once the construction and installation of the equipment in the substations are completed, landscaping will be done to improve aesthetics similar to what has been done in the Uttara and Nikunja DESCO substations. Species of trees that are medium height with high productivity such as lemon, guava, mango, etc. will be considered for replanting. Replanting activities will be monitored by DESCO.

317. The underground cable needed to connect one substation to another substation will follow the road easements.Laying of cables will be done mostly in the evening to minimize disruption to traffic, street shops and other livelihood activities of local people.

Air quality and noise

318. Potential increase in suspended particulate matter and vehicular emissions due to land clearing and use of construction vehicles may occur at the substation sites. Water will be sprayed to any exposed or opened land area at the substations sites to suppress dust level particularly during the summer season. Trucks that will transport construction materials will be covered to minimize dust dispersion. Where appropriate, construction sites may be enclosed with temporary fencing of cloth or any suitable material to contain the dust levels. Contractor(s) will be required to maintain construction vehicles regularly to minimize the contribution of vehicular emissions.

319. Local people may be inconvenienced by potential increase in noise level and ground vibration from construction vehicles. Construction activities that generate high level noise will be done during daytime. Contractor(s) shall take adequate measures to minimize noise level and nuisance in the vicinity of substation construction sites by following the traffic management plan and construction schedule.

[25] Ibid.

[26] Global Environment Facility.Project Identification Form. Environmentally Sound Management ofand Disposal of PCBs and Medical Waste in Bangladesh. 31 January 2013. http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/POPs/Bangladesh%20-%20(4858)%20-%20Environmentally-sound%20Management%20and%20Disposal%20of%20P/02-01-2013%20rev%20ID4858%20rv%20PIF.pdf. (Accessed on 1 May 2013).

Safety risks to community and workers

320. Construction of substations and laying of cables may interfere with road crossings which may pose safety risks to the public and construction workers. To minimize the risks, adequate danger and clearly visible warning signs will be posted at designated sites while scaffoldings will be placed over road crossing points. Contractor(s) will be required to instruct drivers of construction vehicles to strictly follow road regulations. Security personnel will be assigned to prevent trespassing and accidents. Access to the substation sites for truck traffic will be restricted outside of normal construction hours.

321. Construction engineers will look for the location of the nearest hospital and will make prior arrangements to ensure that in the event of accident that require treatment, there is a mechanism for immediate medical service. First aid treatment kits will be set up within the construction sites and field office. A medical staff or nurse will be employed to provide assistance and will make weekly rounds to the substation construction sites. Workers will be provided with hard hats, safety shoes, and safety belts while designated staff will be provided with communication devices. The Contractor(s) will comply with relevant safety measures required by GOB and best engineering practices.

Generation of waste at substation construction sites

322. Given the easy access of substation sites (i.e., Dhaka, Gazipur, Mirpur, etc.) and the scale of construction, there may not be a need to provide for construction camp sites. Workers will come to the sites in the morning and leave after completion of the required daily working hours. There is adequate labor force within DESCO service areas and local hiring will be a priority. Security personnel will remain in the construction sites to ensure order and deter pilferage. The Contractor(s) will ensure that solid waste management will be part of the Construction Management Plan. Sanitary facilities with washing area will be provided at the construction sites including safe drinking water and garbage bins. Good housekeeping will be observed at all times in the construction sites and field offices.

5.4.4 Operation Phase

Generation of employment

323. A total of 116 positions will be required for the implementation of Part C. These new positions will be an opportunity for eligible local people.

Potential depreciation of land values due to substations and distribution lines

324. The presence of substations and distribution lines in urban areas may cause depreciation of land or property values adjacent to the facility. However, the increased availability and reliability of power supply from these structures will trigger more economic development and is expected to improve the standard of living of local residents.

Generation of noise at the substations

325. Transformers may generate unusual noise which may be due to loss of core-bolts, core plates, coil clamps, loose external fittings, and other mechanical forces as a result of short circuit. Background noise level may be higher in this area already and the operation of a substation may potentially contribute to the increased noise level. Maintenance of transformers and other equipment will be conducted to ensure that they are working properly and generation of noise is avoided. Monitoring of noise level will be done. Noise-generating equipment will be enclosed to reduce the noise level.

Use of mineral oil in transformers

326. All mineral oil received at the substations will be required to have a material safety data sheet and as a precaution, be certified that it is dioxin and polychlorinated biphenyl (PCB) - free. Used or unused mineral oil may be taken as toxic (for safety measure) and will be disposed of according to the relevant national laws and international best practice. A transformer oil manufactured by theAmerican Hi-Tech Petroleum & Chemicals, Inc.sold as Duralife Transformer Oil - All Gradesindicates that the product "does not contain any components with OSHA or ACGIH exposure limits."[27]

327. Storage areas for drums of mineral oil will be constructed with oil catchment structures to avoid spillage. Oil-water separator will be installed in the substations and fire extinguishers will be kept readily available in the storage area for mineral oil.

Potential exposure to electric and magnetic fields

328. Concerns remain on the potential risks of cancer from exposure to electric and magnetic fields (EMF) from substations and transmission lines. The EMF considered strong in the substations are from the power transmission lines coming in and leaving the substations because the strength of EMF within the substations coming from transformers, capacitor banks, etc., decreases as distance increases.[28] On 19 April 2004, the Bureau of Health Devices and Technology of the Department of Health in the Philippines measured the strength of EMF from substations as follows:[29]

Type of Exposure	Substations		International Commission on Non-Ionizing Radiation Protection (ICNRP) limit of exposure for the general public
	150 MVA transformer	50 MVA transformer	
Electric field, kV per meter	1.891	0.148	4.17
Magnetic field, milliGauss (mG)	15.75	4.71	833

329. Given the results above, the substations of Part C with maximum capacity of 120 MVA transformers are not expected to pose health risks to the public. After 25 years of research on whether exposure to EMF might adversely affect human health, there has been no conclusive evidence and scientists continue debating.[30] To minimize unauthorized public access, substations will be fenced and security staff will be assigned to prevent public access. DESCO will include information, education and communications on safety of living next to distribution substations as part of continuing public consultations.

Fugitive emissions from SF_6 handling equipment

330. With Part C, DESCO will manage several equipment insulated with SF_6 gas. SF_6 gas is used as an insulator and electric arc arrestor in electrical equipment such as lightning arrester, high voltage circuit breakers, transformers, and switches/switchgears. Aside from being a potent greenhouse gas (i.e., global warming potential is 23,900 times compared to CO_2), SF_6 is an inorganic, non-toxic gas that may be an occupational safety concern due to possible asphyxiation if it is not used in a well-ventilated areas. There is potential for SF_6 to

[27] Amtecol.Material Safety Data Sheet.Duralife Transformer Oil-All Grades. 9 August 2010.
[28] National Grid Corporation of the Philippines.Environmental Management Division.*Electric and Magnetic Fields Frequently Asked Questions.*
[29] National Transmission Corporation, Negros-Panay Overhead Transmission Line and Substation Expansion Project, IEE Checklist of Cebu-Negros-Panay Interconnection Updating Project, Annex 8, September 2004.
[30] National Institute of Environmental Health Sciences.*EMF Questions and Answers*. June 2002. http://www.niehs.nih.gov/emfrapid. (Accessed on 15 June 2013)

leak during the operation phase of substations and exposure to its decomposition by-products may pose occupational health risks to workers. Also, given its global warming potential, release or leakage of SF_6 into the atmosphere should be monitored and reduced.

331. Sources of gas leak may potentially come from losses due to poor gas handling practices and equipment installation and maintenance, and leakage from SF_6-handling equipment. Gas circuit breakers will be installed properly with sealed system that will remain gas-tight. The level of SF_6 gas in the equipment will be continuously monitored through pressure gauges. To check for potential leak, handheld leak detectors can be used during regular maintenance of switchgear, and also when the pressure gauge indicator shows a low pressure in equipment with SF_6 pressure gauges. To reduce emission of SF_6 from an environmental and operational standpoint, an annual inventory and monitoring checklist will be prepared to track the use, purchase and losses of SF_6 gas.

Failure of distribution line system

332. Accidental failure of distribution lines will expose the public to the danger of electrocution. The distribution line system is designed with a protection system that shuts off during power overload or similar emergencies. Regular maintenance program will ensure the safety and integrity of distribution line system. DESCO will include information and education on awareness to distribution line safety practices during public consultations.

5.5 Information Disclosure, Consultation, and Participation

Consultation and Participation

333. Initial consultations with the local people were undertaken by the Social Team of the Center for Environmental and Geographic Information Services (CEGIS), contracted by DESCO to prepare the IEE in May 2013 for securing the site clearance from DOE. During these consultations, questions/issues were raised and facilitators from CEGIS took notes and provided response to the issues raised. Below is a summary of the people's perceptions while **Appendix 4** presents the photo documentation and attendance during the consultation:

Positive perceptions

- That the project should ensure uninterrupted supply of power and must meet the growing demand for electricity within the DESCO city service area;
- Housing and real estate business will be developed in DESCO service area with the reliable and stable supply of electricity; and,
- They expect that with the project, more industries will develop creating jobs to help local and national economic growth.

Negative perceptions

- Concerns on the temporary impacts during construction period such as clogging of drainage; traffic and disruptions from movement of heavy equipment and construction vehicles; and risks when dismantling the existing substations; and,
- DESCO to provide safety nets to minimize risks, accidents, and disruptions of economic activities during construction phase.

Recommendations/suggestions

- Ensure the safety of workers and the public during construction
- Ensure that drainage system will not be affected during construction activities and to avoid delays to minimize the temporary adverse impacts of construction; and,
- Access to electricity by the public at the earliest possible time.

334. Public consultations will continue during construction and throughout the operating life of the project. Project brief or flyers about Part C will be translated to Bengali and made available at the PMU-DESCO Office and also posted in DESCO website.

335. A summary sheet in Bangla containing relevant project information will be made available by DESCO at their office in Dhaka and in the field offices. Once accepted by ADB, the IEE will be posted in DESCO website as required by ADB's SPS 2009 and Public Communications Policy 2011. Consultation with key project stakeholders in varying degree will continue throughout the life of the project.

5.6 Grievance Redress Mechanism

336. DESCO will continue to engage local people and they will have the opportunity to express their legitimate grievance or file a complaint about the project by establishing a process to address the issues raised. Consultation and communication with stakeholders (as appropriate) will continue during implementation and PMU-DESCO, Contractor(s), and local government authorities will facilitate addressing the concerns of project affected persons. Contact details of PMU-DESCO for filing complaints will be posted in the field offices.

337. A grievance redress committee (GRC) will be set up by DESCOat the union level where DESCO has subprojects as soon as the project commence. DPDC will ensure the representation of women in the GRC. The local people will be informed about the process to address grievance. The flyer or project brief in Bangla will include the grievance process. **Figure 5.7** shows the organization of the GRC.

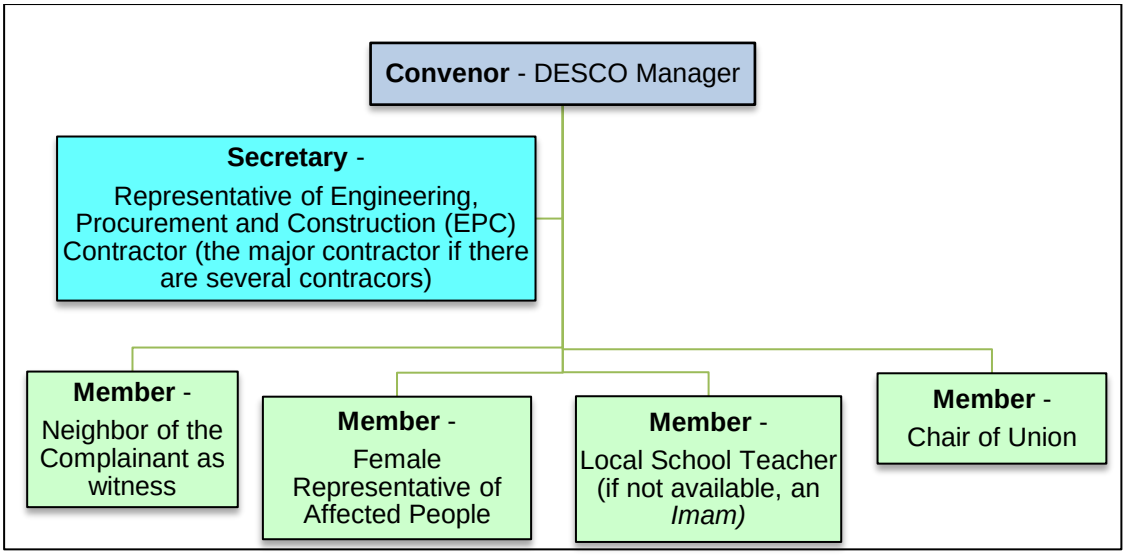


Figure 5.7 Grievance Redress Committee of Part C

338. Briefly, the grievance process is as follows:

Step 1 Affected persons (APs) will be informed of their losses and entitlements in writing by PMU-DESCO (or DESCO-designated representative such as an NGO supporting the implementation of RP) or through a face-to-face meeting on resettlement and compensation issues. If the APs are satisfied with the terms of the entitlements, they can claim for payments from PMU-DESCO. If there are disagreements, the APs can approach PMU-DESCO (or DESCO-designated representative such as an

NGO supporting the implementation of RP) for clarification about their concerns. If the APs are satisfied with the outcome, they can claim for compensation of their entitlements.

Step 2 If the issue(s) remains unresolved, the APs can go to the GRC assisted by PMU-DESCO (or DESCO-designated representative such as an NGO supporting the implementation of RP) who will refer the case with written documentation. The GRC will conduct hearing and resolve the issue within 30 days from the receipt of the complaint.The APs must be present during the hearing of the complaint and the Minutes will be documented and made available to the APs. PMU-DESCO Manager approves the Minutes and the decision sent to the APs. If an agreement is reached and the APs are satisfied with the decision, compensation can be claimed from DESCO.

Step 3 If still the issue(s) remains unresolved, the case is referred by the GRC to the appropriate court of law for settlement.

339. The GRC will meet twice a month to review complaints, if any, and will keep a record of these complaints, classify, prioritize, and provide the solution(s) within 30 days from the date of the complaint. The record will include the contact details of the complainant, date and nature of complaint, agreement on corrective actions and the date it was enforced, and the final outcome. All complaint-related documentation such as minutes of the meeting and decisions will be summarized and become part of the semi-annual monitoring report submitted to ADB.

340. The GRC will report to the complainant(s) about the status of their grievances and the decisions of the GRC. If the grievance is not addressed, the complainant can seek legal redress in the appropriate Courts.

341. Since most of the grievance is on compensation for temporary damages during construction and land acquisition (if any), the mechanism is integrated in the Resettlement Plan (RP) and the cost of its implementation will come from the administration cost which is part of the total cost of the RP for the project. In the event that the administration cost is not sufficient, the budget for the GRC will be taken from the contingency cost also included in the RP. The GRC will continue to function during the life of the Project.

5.7 Environmental Management Plan

5.7.1 Mitigation

342. **Table 5.9** presents the environmental management plan (EMP) with cost estimates The EMP will be updated before the start of civil works and as needed, to accommodate any change in the condition of the site, performance of Contractor(s), and feedback from local people or other stakeholders. The revised/updated EMP will be incorporated in the draft IEE and submitted to ADB.

5.7.2 Monitoring

343. During the construction phase, environmental monitoring will be done daily to ensure that non-compliance to the EMP, if any, is avoided or immediately addressed and unforeseen impacts quickly discovered and remedied.

344. During the operation phase, regular monitoring and maintenance of the power transmission system will help ensure the integrity and safety of the structures and components. **Table 5.10** presents the monitoring plan.

5.7.3 Implementation Arrangements

345. The management and general supervision of project implementation will be undertaken by the PMU-DESCO while the EMP implementation will be carried out under the supervision of Head, PMU-DESCO. An environmental staff (or a firm that will be retained during implementation), who will be primarily responsible for ensuring that the EMP is properly implemented, will be recruited for the project prior to award of the civil works contract. Aside from this, he/she will coordinate with Head, PMU-DESCO on compliance to ADB requirements, relevant government agencies and local authorities on environmental issues and clearances, update and finalize the IEE, and will prepare environmental monitoring reports for submission to ADB at least twice a year during construction and annually during operation phase.

346. The Contractor(s) will be informed of their responsibility to comply with the EMP and the requirements of ADB. During construction, specific responsibilities by Contractor(s) for EMP compliance will be monitored by the environmental staff for the project.

5.8 Conclusion and Recommendation

347. Sites for substations were selected to minimize land acquisition and potential environmental impacts. Of the 32 subprojects for Part C, almost all (29 sites) which involve substations are within the existing sites of and/or owned by DESCO. Physical interventions will be limited to the areas within the existing sites owned by DESCOand/or transferred by other agencies such as Dhaka City Corporation. Where required, dismantling of structure(s) and equipment will be done following best practice in construction engineering given the challenge of being located in highly-urbanized areas in Dhaka, Tongi, Gazipur, and Mirpur. Any suspected or potentially PCB-contaminated equipment from dismantling of existing substations (if any) will be managed in collaboration with BPDB and DOE. Usable scrap materials from dismantling will be stored in the central storage of DESCO in Mirpur for resale and auction.

348. Part C is not expected to cause significant adverse environmental impacts during construction and operation. Any residual impacts can be easily mitigated by proper planning and best practices in construction engineering. Seasonal variations will be incorporated in scheduling and in carrying out the construction works to minimize disruptions and inconvenience to local people in the urban areas.

349. Mitigation measures and monitoring have been incorporated in the EMP with cost estimates (where appropriate). Contractor(s) will be required to comply with the EMP and relevant national regulations on environment, labour, and occupational health and safety. Local hiring will be given priority. The project will have long-term beneficial impacts due to improved stability and reliability of power distribution systems in Dhaka Metropolitan Area (North), Tongi and Purbachal Model Town of Gazipur. The availability of a stable and reliable electricity is expected to create more jobs and increased economic development.

350. DESCO will obtain the required environmental clearance from the DOE prior to any civil works and will post the IEE in their website as part of information disclosure required by ADB's SPS 2009 and Public Communications Policy 2011.

Table 5.9 Environmental Management Plan - DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
Pre-Construction and Design Phase					
• Preparation of feasibility study and other desktop technical and engineering study • Land acquisition	• Land and people	• Mainly desktop review • Walk-over survey may cause temporary and minimal disturbance to localized area	• Study topographical and geotechnical information, environmental and socioeconomic data, etc, and integrate with engineering design and consultation with local people • No land acquisition required of land acquisition	Included in the Project Costs	Design or survey engineers/Consultants, DESCO, District Commissioner
Construction Phase					
Orientation for contractor and workers	• People	• Awareness of workers on the environmental requirements during construction and their responsibility as part of the team • Contractors' understanding of their responsibility in implementing the EMP	• Conduct briefing and training for Contractor on the EMP, records management, and reporting • Consensus about the critical areas to be monitored and the required mitigation measures • Create awareness of sexually-transmitted diseases such as HIV/AIDs	Included in the costs of Contractor(s)	PMU-DESCO
Prepare construction management workplan to control construction-associated impacts	• People • Land • Air Quality and Noise • Waste	• Avoid effects of Contractors' unplanned activities • Smooth work implementation	• Temporary pedestrian and traffic management plan • Materials management plan • Waste management plan • Noise and dust control plan • Community and Safety plan	Included in costs of Contractor(s)	Contractor(s), PMU-DESCO
Hiring of project staff and workers	• People	• Conflict due to potential workers' migration • Lack of local support to the project • Opportunity for local people to engage in non-agricultural employment and small-scale business	• Use local labour for manual work and eligible local workforce for clerical and office jobs	---	Contractor(s), PMU-DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
Presence of construction workers at substation sites	• People	• Potential for increase demands in services such as food, temporary housing, etc. • Presence of construction workers may become small-scale and temporary opportunity to provide services such as food, temporary housing, etc.	None required	---	---
Site preparation, vegetation and land clearing	• Land • Vegetation	• Dismantling of structure(s) and equipment from existing substations • Dismantled equipment may be suspected or potentially-PCB contaminated • Excavation and earth moving works for the construction of substations	• Civil works guidelines and/or construction management plan will be strictly implemented by the Contractor • Minimal vegetation in the substation sites • Debris disposed of in designated landfill/dumpsites • Scrap materials stored in central storage of DESCO in Mirpur for resale/auction • Use of proper safety clothes/equipment in dismantling structure(s) and equipment • Coordinate with BPDB and DOE for management or disposal of suspected or potentially PCB-contaminated equipment • Erosion-control measures will be implemented • Landscaping will be done after completion of construction works • Laying of underground cable will be done at nighttime to reduce disruption to economic activities of local people	Soil erosion and soil quality – 33 Drainage – 16.5 Revegetation and landscaping – 16.5	Contractor(s), PMU-DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
	• Air quality	• Increase in dust levels and vehicular emissions	• Construction vehicles will be maintained to minimize vehicular emissions • Temporary enclosure of construction sites to contain dust dispersion • Provision of warehouse for construction materials in the sites to reduce trips of construction vehicles • Direct Contractor(s) to maintain construction vehicles and heavy equipment machineries • Spray water to exposed areas or sources of dusts • Cover trucks transporting materials to reduce dust dispersion	71	Contractor(s), PMU-DESCO
	• Noise	• Potential increase in noise level from construction works and ground vibration from construction vehicles	• Observance of low speed by vehicles to reduce noise • Noise-generating works done at daytime • Observe/Comply with traffic management plan	Included in the air quality cost	Contractor(s), PMU-DESCO
Construction of substations and installation of required equipment	• People • Land	• Interference with road crossings	• Danger and clearly visible warning signs will be posted at designated sites • Scaffoldings will be placed over road crossing points • Construction vehicles to strictly follow road regulations	140	Contractor(s), PMU-DESCO
		• Potential safety risks to community	• Maintain necessary fence or barricade (as appropriate), sufficient lights, warning signs and danger signals, and take all required precautions for public safety • Assign security personnel to prevent accidents, trespassing, and pilferage • Require Contractor to direct drivers of construction vehicles to strictly		Contractor(s), PMU-DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
			follow road regulations		
		• Potential health and safety risks to workers	• Provide sanitary facilities and wash areas • Provide safe drinking water and garbage bins • Enforce good housekeeping at all times • Study safety plan before start of construction • Provide workers with hard hat, safety shoes and belts • Coordinate with nearest hospital for arrangements in case of accidents • Assign nurse or medical staff to make weekly rounds at substation sites • Set up first aid treatment within construction sites and field office • Observance and compliance with relevant safety measures required by law and best engineering practices • Provide communication devices to designated workers	16.5	Contractor(s), PMU-DESCO
Operation Phase					
Hazards due to accidental failure of distribution lines	• People • Birds	• Electrocution hazards will occur only if someone comes too close or in contact with the transmission line cable	• A protection system that shuts off during power overload or similar emergencies will be installed • Distribution lines entering and leaving the substations are insulated (or covered) to minimize impacts to birds • Regular monitoring and maintenance to ensure safety and integrity of distribution lines and substations • As part of corporate social responsibility initiatives, conduct	Included in the O & M costs of Project	DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
			information and education campaign to local people to enhance awareness on safety practices of living near substations		
Use of mineral oil for transformers	• People • Land • Water	• Accidental spillage that would contaminate land and water • Occupational health risks to workers due to exposure	• Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free • Provision of oil-water separator • Fire extinguishers readily available in storage areas for mineral oil • Provide for oil containment structure	Included in the O&M costs	DESCO
Presence of substations in urban areas	• People • Land	• Potential depreciation of land property values near or adjacent to substations	• Availability of stable and reliable power will trigger economic development in the area	---	---
	• Noise	• Noise generated by equipment in the substations	• Periodic maintenance of equipment such as transformers and capacitors to minimize noise generation • Provide enclosure of noise-generating equipment • Monitor ambient noise levels	Included in the O&M costs	DESCO
	• People	• Generation of employment	• A total of 62 positions will be created during the operation of Part B	---	---
	• People	• Potential exposure to electric and magnetic fields (EMF)	• Electric and magnetic field from the 120 MVA transformers are expected to be way below the limits set by ICNRP of 4.17 kV/m for electric field and 833 mG for magnetic field • Substations will be fenced and security staff assigned to prevent unauthorized public access • Information and education campaign will be conducted to local people to create awareness on safety practices	Included in the O&M costs	DESCO

Project Activity	Environmental Component Likely to be Affected	Description of Potential Impact	Mitigation/Enhancement Measures	Estimated Cost* (Lahk Taka)	Responsible agency/unit
Use of SF_6 handling equipment	• People • Air	• Fugitive emissions from SF_6 handling equipment • SF_6 is a potent GHG • Occupational hazards of exposure to fugitive emissions of SF_6 gas	• Regular monitoring of SF_6 through pressure gauges • Use of handheld leak detectors to monitor leaks • Prepare annual inventory checklist of SF_6 consumption, purchase, and losses to track emissions	Included in the O&M costs	DESCO

Table 5.10 Environmental Monitoring Plan - DESCO

Project Stage	Parameter/Indicator	Location	Frequency	Responsibility (Implementation and Supervision)
Pre-Construction	Soil sampling	Substation sites (particularly those with existing structure and equipment dismantled)	Once before construction	PMU-DESCO, Contractor(s)
	Local recruitment of workers and staff	Substations	Monthly	PMU-DESCO, Contractor(s)
Construction	Spraying of water to exposed land and before movement of construction vehicles	Substations and road easements when laying of underground cable to connect substations	• Weekly at road easements (or as needed) • Every day at substation sites during dry season and as needed during monsoon season	Contractor(s), PMU-DESCO (Environmental staff)
	Solid waste management	Substations	Every week	Contractor(s), PMU-DESCO (Environmental staff)
	Danger and warning signs for safety of workers and the public	Substations and road easements affected by laying of underground cable	Once a month	Contractor(s), PMU-DESCO (Environmental staff)
	Announcement to the public of works schedule	Along the road easement affected by laying of cables and substations	As needed	Contractor(s), PMU-DESCO
	Erosion control measures such as silt traps	Substations	Once a month	Contractor(s), PMU-DESCO (Environmental staff)
	Smoke belching construction vehicles	Substations	Weekly	Contractor(s), PMU-DESCO (Environmental staff)
	Dust and noise level	Substations	Twice a month	Contractor(s), PMU-DESCO (Environmental staff)
	Housekeeping	Substations	Weekly	Contractor(s), PMU-DESCO (Environmental staff)
Operation	Failure of transmission towers	Along the alignment	Every month	DESCO
	Maintenance of landscape	Substations	Quarterly	DESCO
	Housekeeping	Substations	Monthly	DESCO
	Waste Management (i.e., oil, garbage, etc.)	Substations	Monthly	DESCO
	Inventory of SF_6	Substations	Annual	DESCO
	Pilferage of cables	Along distribution lines	Quarterly	DESCO

Appendix 1

Department of Environment
Classification of industrial units or projects based on its location and impact on environment

Schedule 1 - Environment Conservation Rules 1997
[See Rule 7(2)]

(A) GREEN CATEGORY

1. Assembling and manufacturing of TV, Radio, etc.
2. Assembling and manufacturing of clocks and watches.
3. Assembling of telephones.
4. Assembling and manufacturing of toys (plastic made items excluded).
5. Book-binding.
6. Rope and mats (made of cotton, jute and artificial fibers).
7. Photography (movie and x-ray excluded).
8. Production of artificial leather goods.
9. Assembling of motorcycles, bicycles and toy cycles.
10. Assembling of scientific and mathematical instruments (excluding manufacturing).
11. Musical instruments.
12. Sports goods (excluding plastic made items).
13. Tea packaging (excluding processing).
14. Re-packing of milk powder (excluding production).
15. Bamboo and cane goods.
16. Artificial flower (excluding plastic made items).
17. Pen and ball-pen.
18. Gold ornaments (excluding production) (shops only).
19. Candle.
20. Medical and surgical instrument (excluding production).
21. Factory for production of cork items (excluding metallic items).
22. Laundry (excluding washing).

Foot Notes:

(a) Units of all kinds of cottage industries other than those listed in this Schedule shall remain outside the purview of Environmental Clearance Certificate (Unit of cottage industry means all industrial units producing goods or services in which by full-time or part-time labour of family members are engaged and the capital investment of which does not exceed Taka 5 (five) hundred thousand).
(b) No industrial unit listed in this Schedule shall be located in any residential area.
(c) Industrial units shall preferably be located in areas declared as industrial zones or in areas where there is concentration of industries or in vacant areas.
(d) Industrial units likely to produce sound, smoke, odor beyond permissible limit shall not be acceptable in commercial areas.

(B) ORANGE-A CATEGORY

1. Dairy Farm, 10 (ten) cattle heads or below in urban areas and 25 cattle heads or below in rural areas.
2. Poultry (up to 250 in urban areas and up to 1000 in rural areas).
3. Grinding/husking of wheat, rice, turmeric, pepper, pulses (up to 20 Horse Power).
4. Weaving and handloom.
5. Production of shoes and leather goods (capital up to 5 hundred thousand Taka).
6. Saw mill/wood sawing.
7. Furniture of wood/iron, aluminum, etc.,(capital up to 5 hundred thousand Taka).
8. Printing Press.
9. Plastic & rubber goods (excluding PVC).
10. Restaurant.

11. Cartoon/box manufacturing/printing packaging.
12. Cinema Hall.
13. Dry-cleaning.
14. Production of artificial leather goods (capital up to 5 hundred thousand Taka).
15. Sports goods.
16. Production of salt (capital up to 10 hundred thousand Taka).
17. Agricultural machinery and equipment.
18. Industrial machinery and equipment.
19. Production of gold ornaments.
20. Pin, U Pin.
21. Frames of spectacles.
22. Comb.
23. Production of utensils and souvenirs of brass and bronze.
24. Factory for production of biscuit and bread (capital up to 5 hundred thousand Taka).
25. Factory for production of chocolate and lozenge. (capital up to 5 hundred thousand Taka).
26. Manufacturing of wooden water vessels.

(C) ORANGE-B CATEGORY

1. PVC items.
2. Artificial fiber (raw material).
3. Glass factory.
4. Life saving drug (applicable to formulation only).
5. Edible oil.
6. Tar.
7. Jute mill.
8. Hotel, multi-storied commercial & apartment building.
9. Casting.
10. Aluminum products.
11. Glue (excluding animal glue).
12. Bricks/tiles.
13. Lime.
14. Plastic products.
15. Processing and bottling of drinking water and carbonated drinks.
16. Galvanizing.
17. Perfumes, cosmetics.
18. Flour (large).
19. Carbon rod.
20. Stone grinding, cutting, polishing.
21. Processing fish, meat, food.
22. Printing and writing ink.
23. Animal feed.
24. Ice-cream.
25. Clinic and pathological lab.
26. Utensils made of clay and china clay/sanitary wares (ceramics).
27. Processing of prawns & shrimps.
28. Water purification plant.
29. Metal utensils/spoons etc.
30. Sodium silicate.
31. Matches.
32. Starch and glucose.
33. Animal feed.
34. Automatic rice mill.
35. Assembling of motor vehicles.
36. Manufacturing of wooden vessel.
37. Photography (activities related to production of films for movie and x-ray).
38. Tea processing.
39. Production of powder milk/condensed milk/dairy.
40. Re-rolling.

41. Wood treatment.
42. Soap.
43. Repairing of refrigerators.
44. Repairing of metal vessel.
45. Engineering works (up to 10 hundred thousand Taka capital.)
46. Spinning mill.
47. Electric cable.
48. Cold storage.
49. Tire re-treading.
50. Motor vehicles repairing works (up to 10 hundred thousand Taka capital).
51. Cattle farm: above 10 (ten) numbers in urban area, and above 25 (twenty five) numbers in rural area.
52. Poultry: Number of birds above 250 (two hundred fifty) in urban area and above 1000 (one thousand) in rural area.
53. Grinding/husking wheat, rice, turmeric, chilly, pulses – machine above 20Horse Power.
54. Production of shoes and leather goods, above 5 (five) hundred thousand Taka capital.
55. Furniture of wood/iron, aluminum, etc., above 5 (five) hundred thousand Taka capital.
56. Production of artificial leather goods, above 5 (five) hundred thousand Taka capital.
57. Salt production, above 10 (ten) hundred thousand Taka capital.
58. Biscuit and bread factory, above 5 (five) hundred thousand Taka capital.
59. Factory for production of chocolate and lozenge, above 5 (five) hundred thousand Taka capital.
60. Garments and sweater production.
61. Fabric washing.
62. Power loom.
63. Construction, re-construction and extension of road (feeder road, local road).
64. Construction, re-construction and extension of bridge (length below 100 meters).
65. Public toilet.
66. Ship-breaking.
67. G.I. Wire.
68. Assembling batteries.
69. Dairy and food.

Foot Notes:

(a) No industrial unit included in this list shall be located in any residential area.
(b) Industrial units shall preferably be located in areas declared as industrial zones or in areas where there is concentration of industries or in vacant areas.
(c) Industrial units likely to produce sound, smoke, odor beyond permissible limit shall not be acceptable in commercial areas.

(D) RED CATEGORY

1. Tannery
2. Formaldehyde
3. Urea fertilizer
4. T.S.P. Fertilizer
5. Chemical dyes, polish, varnish, enamel
6. Power plant
7. All mining projects (coal, limestone, hard rock, natural gas, mineral oil, etc.)
8. Cement
9. Fuel oil refinery
10. Artificial rubber
11. Paper and pulp
12. Sugar
13. Distillery
14. Fabric dying and chemical processing
15. Caustic soda, potash
16. Other alkalis
17. Production of iron and steel

18. Raw materials of medicines and basic drugs
19. Electroplating
20. Photo films, photo papers and photo chemicals
21. Various products made from petroleum and coal
22. Explosives
23. Acids and their salts (organic or inorganic)
24. Nitrogen compounds (Cyanide, Cyanamid, etc.)
25. Production of plastic raw materials (PVC, PP/Iron, Polyesterin etc.)
26. Asbestos
27. Fiberglass
28. Pesticides, fungicides and herbicides
29. Phosphorus and its compounds/derivatives
30. Chlorine, fluorine, bromine, iodine and their compounds/derivatives
31. Industry (excluding nitrogen, oxygen and carbon dioxide)
32. Waste incinerator
33. Other chemicals
34. Ordnance
35. Nuclear power
36. Wine
37. Non-metallic chemicals not listed elsewhere
38. Non-metals not listed elsewhere
39. Industrial estate
40. Basic industrial chemicals
41. Non-iron basic metals
42. Detergent
43. Land-filling by industrial, household and commercial wastes
44. Sewage treatment plant
45. Life saving drugs
46. Animal glue
47. Rodenticide
48. Refractories
49. Industrial gas (Oxygen, Nitrogen & Carbon-dioxide)
50. Battery
51. Hospital
52. Ship manufacturing
53. Tobacco (processing/cigarette/Biri-making)
54. Metallic boat manufacturing
55. Wooden boat manufacturing
56. Refrigerator/air-conditioner/air-cooler manufacturing
57. Tyre and tube
58. Board mills
59. Carpets
60. Engineering works: capital above 10 (ten) hundred thousand Taka.
61. Repairing of motor vehicles: capital above 10 (ten) hundred thousand Taka
62. Water treatment plant
63. Sewerage pipe line laying/relaying/extension
64. Water, power and gas distribution line laying/relaying/extension
65. Exploration/extraction/distribution of mineral resources
66. Construction/reconstruction/expansion of flood control embankment, polder, dike, etc.
67. Construction/reconstruction/expansion of road (regional, national & international)
68. Construction/reconstruction/expansion of bridge (length 100 meter and above)
69. Murate of Potash (manufacturing)

Foot Notes:

(a) No industrial unit included in this list shall be allowed to be located in any residential area.
(b) Industrial units shall preferably be located in areas declared as industrial zones or in areas where there is concentration of industries or in vacant areas.

(c) Industrial units likely to produce sound, smoke, odor beyond permissible limit shall not be acceptable in commercial areas.
(d) After obtaining location clearance on the basis of Initial Environment Examination (IEE) Report, the Environmental Impact Assessment (EIA) Report in accordance with the approved terms of reference along with design of ETP and its time schedule shall be submitted within approved time limit.

Appendix 2

Relevant Environmental Standards from Environmental Conservation Rules 1997

Schedule 2
Standards for Air
[See Rule 12]

Density in microgram per cusec meter

Sl. No.	Categories of Area	Suspended Particulate Matter (SPM)	Sulphur dioxide	Carbon Monoxide	Oxides of Nitrogen
a.	Industrial and mixed	500	120	5000	100
b.	Commercial and mixed	400	100	5000	100
c.	Residential and rural	200	80	2000	80
d.	Sensitive	100	30	1000	30

Notes:

(1) At national level, sensitive area includes monuments, health center, hospital, archeological site, educational institution, and government designated areas (if any).

(2) Industrial units located in areas not designated as industrial areas shall not discharge pollutants which may contribute to exceeding the standard for air surrounding the areas specified at Sl. nos. c and d above.

(3) Suspended Particulate Matter means airborne particles of a diameter of 10 micron or less.

Schedule 3
Standards for Water
[See Rule 12]

(A) Standards for inland surface water

Best Practice basedclassification	Parameter			
	pH	BOD mg/L	DO mg/L	TotalColiform number/100
a. Source of drinking water for supply only afterdisinfecting:	6.5-8.5	2 or less	6 orabove	50 or less
b. Water usable forrecreational activity :	6.5-8.5	3 or less	5 of more	200 or less
c. Source of drinking water for supply afterconventional treatment :	6.5-8.5	6 or less	6 of more	5000 or less
d. Water usable by fisheries:	6.5-8.5	6 or less	5 of more	---
e. Water usable by various process and cooling industries :	6.5-8.5	10 or less	5 of more	5000 or less
f. Water usable for irrigation:	6.5-8.5	10 or less	5 of more	1000 or less

Notes:

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

(B) Standards for drinking water

Sl No.	Parameter	Unit	Standard
1	Aluminum	mg/L	0.2
2	Ammonia (NH3)	"	0.5
3	Arsenic	"	0.05
4	Barium	"	0.01

Sl No.	Parameter	Unit	Standard
5	Benzene	“	0.01
6	BOD5 20°C	“	2.0
7	Boron	“	1.0
8	Cadmium	“	0.005
9	Calcium	“	75
10	Chloride	“	150-600*
11	Chlorinated alkanes Carbontetrachloride	“	0.01
	1.1 dichloroethylene	“	0.001
	1.2 dichloroethylene	“	0.03
	1.2 dichloroethylene	“	0.03
	trichloroethylene	“	0.09
12	Chlorinated phenols	“	
	- pentachlorophenol	“	0.03
	- 2.4.6 trichlorophenol	“	0.03
13	Chlorine (residual)	“	0.2
14	Chloroform	“	0.09
15	Chromium (hexavalent)	“	0.05
16	Chromium (total)	“	0.05
17	COD	“	4.0
18	Coliform (fecal)	n/100 ml	0
19	Coliform (total)	n/100 ml	0
20	Color	Hazen unit	15
21	Copper	mg/L	1
22	Cyanide	“	0.1
23	Detergents	“	0.2
24	DO	“	6
25	Fluoride	“	1
26	Hardness (as CaCO3)	“	200 – 500
27	Iron	“	0.3 – 1.0
28	Kjeldhl Nitrogen (total)	“	1
29	Lead	“	0.05
30	Magnesium	“	30 – 35
31	Manganese	“	0.1
32	Mercury	“	0.001
33	Nickel	“	0.01
34	Nitrate	“	10
35	Nitrite	“	<1
36	Odor	“	Odorless
37	Oil and grease	“	0.01
38	pH	---	6.5 – 8.5
39	Phenolic compounds	mg/L	0.002
40	Phosphate	“	6
41	Phosphorus	“	0
42	Potassium	“	12
43	Radioactive materials (gross alpha activity)	Bq/l	0.01
44	Radioactive materials (gross beta activity)	Bq/l	0.1
45	Selenium	mg/L	0.01
46	Silver	“	0.02
47	Sodium	“	200
48	Suspended particulate matters	“	10
49	Sufide	“	0
50	Sulfate	“	400
51	Total dissolved solids	“	1000
52	Temperature	“	20-30
53	Tin	“	2
54	Turbidity	JTU	10
55	Zinc	mg/L	5

Schedule 4
Standards for Sound
[See Rule 12]

Sl No	Category of areas	Standards determined at dBa unit	
		Day	Night
a.	Silent zone	45	35
b.	Residential area	50	40
c.	Mixed area (mainly residential area, and alsosimultaneously used for commercialand industrial purposes)	60	50
d.	Commercial area	70	60
e.	Industrial area	75	70

Notes:

1. The time from 6 a.m. to 9 p.m. is counted as daytime.
2. The time from 9 p.m. to 6 a.m. is counted as night time.
3. Area up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

Schedule 5
Standards for Sound originating from Motor Vehicles or Mechanized Vessels
[See Rule 12]

Category of Vehicles	Unit	Standards	Remarks
*Motor Vehicles (all types)	dBa	85	As measured at a distance of7.5 meters from exhaust pipe.
		100	As measured at a distance of0.5 meter from exhaust pipe.
Mechanized Vessels	dBa	85	As measured at a distance of7.5 meters from the vesselwhich is not in motion, notloaded and is at two thirds ofits maximum rotating speed.
		100	As measured at a distance of0.5 meter from the vesselwhich is in the same condition as above.

* At the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows:-

(a) Diesel engine – maximum rotating speed.
(b) Gasoline engine –at two thirds of its maximum rotating speed and without any load.
(c) Motorcycle – If maximum rotating speed is above 5000 rpm; two thirds of the speed, and if maximum rotating speed is less than 5000 rpm, three-fourth of the speed.

Schedule 6
Standards for Emission from Motor Vehicles
[See Rule 12]

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit(HSU)	65
Carbon Monoxide	gm/km	24
	percent area	04
Hydrocarbon	gm/km	02
	ppm	180
Oxides of Nitrogen	gm/km	02
	ppm	600

* As measured at two thirds of maximum rotating speed.

Schedule 10

Standards for Waste From Industrial Units or Projects Waste

[See Rule 13]

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Seweragesystem connectedto treatment atsecond stage	IrrigatedLand
1	Ammonical nitrogen (as elementary N)	mg/L	50	75	75
2	Ammonia (as free ammonia)	mg/L	5	5	15
3	Arsenic (as As)	mg/L	0.2	0.05	0.2
4	BOD_5 at 20^oC	mg/L	50	250	100
5	Boron	mg/L	2	2	2
6	Cadmium (as Cd)	mg/L	0.5	0.05	0.05
7	Chloride	mg/L	600	600	600
8	Chromium (as total Cr)	mg/L	0.5	1.0	1.0
9	COD	mg/L	200	400	400
10	Chromium (as hexavalent Cr)	mg/L	0.1	1.0	1.0
11	Copper (as Cu)	mg/L	0.5	3.0	3.0
12	Dissolved oxygen (DO)	mg/L	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	micromho/cm	1200	1200	1200
14	Total dissolved solids	mg/L	2100	2100	2100
15	Flouride (as F)	mg/L	2	15	10
16	Sulfide (as S)	mg/L	1	2	2
17	Iron (as Fe)	mg/L	2	2	2
18	Total kjeldahl nitrogen (as N)	mg/L	100	100	100
19	Lead (as Pb)	mg/L	0.1	1	0.1
20	Manganese (as Mn)	mg/L	5	5	5
21	Mercury (as Hg)	mg/L	0.01	0.01	0.01
22	Nickel (as Ni)	mg/L	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/L	10.0	Not yet set	10
24	Oil and grease	mg/L	10	20	10
25	Phenolic compounds (as C_6H_5OH)	mg/L	1.0	5	1.0
26	Dissolved phosphorus (as P)	mg/L	8	8	15
27	Radioactive substance	(to be specified by Bangladesh Atomic Energy Commission)			
28	pH	----	6-9	6-9	6-9
29	Selenium (as Se)	mg/L	0.05	0.05	0.05
30	Zinc (as Zn)	mg/L	5	10	10
31	Temperature	^oC (summer) ^oC (winter)	40 45	40 45	40 45
32	Suspended solids (SS)	mg/L	150	500	200
33	Cyanide (as Cn)	mg/L	0.1	2.0	0.2

Notes:

(1) These standards shall be applicable to all industries or projects other than those specified under the heading “Standards for sector wise industrial effluent or emission.”

(2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a project starts operation.

(3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.

(4) Inland Surface Water means drains/ponds/tanks/water bodies/ ditches, canals, rivers, springs and estuaries.

(5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.

(6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.

(7) Inland Surface Water Standards shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 5 and 6 above.

Schedule 11

Standards for Gaseous Emission from Industries or Projects

[See Rule 13]

Sl.No.	Parameters	Standard present in a unit ofmg/Nm^3
1.	Particulate	
(a)	Power plant with capacity of 200Megawatt or above.	150
(b)	Power plant with capacity less than 200Megawatt.	350
2.	Chlorine	150
3.	Hydrochloric acid vapor and mist	350
4.	Total Fluoride F	25
5.	Sulfuric acid mist	50
6.	Lead particulate	10
7.	Mercury particulate	0.2
8.	Sulfur dioxide	kg/ton acid
(a)	Sulfuric acid production (DCDA*process)	4
(b)	Sulfuric acid production (SCSA*process)	20
	(*DCDA: Double Conversion, Double Absorption;SCSA: Single Conversion, Single Absorption.)	
	Lowest height of stack for dispersion of sulfuric acid (in meter)	
(a)	Coal based power plant	
	(1) 500 Megawatt or above	275
	(2) 200 to 500 Megawatt	220
	(3) Less than 200 Megawatt	$14(Q)^{0.3}$
(b)	Boiler	
	(1) Steam per hour up to 15 tons	11
	(2) Steam per hour more that 15 ton	$14(Q)^{0.3}$
	[Q = Emission of Sulfur dioxide (kg/hour)].	
9.	Oxides of Nitrogen	
(a)	Nitric acid production	3 kg/ton acid
(b)	Gas Fuel based Power Plant	
	(1) 500 Megawatt or above	50ppm
	(2) 200 to 500 Megawatt	40ppm
	(3) Below 200 Megawatt	30ppm
(c)	Metallurgical oven	200ppm
10.	Kiln soot and dust	mg/Nm^3
(a)	Blast Furnace	500
(b)	Brick Kiln	1000
(c)	Coke oven	500
(d)	Lime Kiln	250

Appendix 3

Relevant Environmental Laws and Regulations in Bangladesh

Title	Responsible Agency	Key Features
The Environment Conservation Act, 1995 and subsequent amendments in 2000 and 2002	Department of Environment, Ministry of Environment and Forest	• Declaration of Ecologically Critical Areas; • Obtaining Environmental Clearance Certificate; • Regulation with respect to vehicles emitting smoke harmful for the environment; • Regulation of development activities from environmental perspective; • Promulgation of standards for quality of air, water, noise, and soils for different areas and for different purposes; • Promulgation of acceptable limits for discharging and emitting waste; • Formulation of environmental guidelines relating to control and mitigation of environmental pollution, conservation and improvement of environment
Environment Conservation Rules, 1997 and subsequent amendments in 2002 and 2003	Department of Environment, Ministry of Environment and Forest	• Declaration of Ecologically Critical Area; • Requirement of Environmental Clearance Certificate for various categories of projects; • Requirement for IEE/EIA according the appropriate category of the project; • Renewal of the environmental clearance certificate within 30 days after the expiry; • Provides standards for quality of air, water & sound and acceptable limits for emission/discharges from vehicles and other sources
The Factories Act, 1965 Bangladesh Labour Law 2006	Ministry of Labour	This Act relates to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions.
The Building Construction Act 1952 and subsequent amendments	Ministry of Works	An Act to provide for the prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh
The Vehicle Act, 1927; The Motor Vehicles Ordinance, 1983;The Bengal Motor Vehicle Rules, 1940	Bangladesh Road Transport Authority	Exhaust emission; Vehicular air and noise; Road safety
Water Supply and Sanitation Act, 1996	Ministry of Local Government, Rural Development and Cooperatives	Management and Control of water supply and sanitation in urban areas.
The Ground Water Management Ordinance 1985	Upazila Parishad	Management of ground water resources; Tube well shall not be installed in any place without the license granted by Upazila Parishad
The Private Forests Ordinance Act, 1959	Regional Forest Officer, Forest Department	Conservation of private forests and for the afforestation on wastelands
The Protection and Conservation of Fish Act 1950 and subsequent amendments in 1982	Ministry of Fishery	Protection and Conservation of fish in Government owned water bodies
Natural Water Bodies Protection Act 2000	Rajdhani Unnayan Kartipakkha/Town Development Authority/Municipalities	According to this Act, the character of water bodies i.e. rivers, canals, tanks, or floodplains identified as water bodies in the master plans or in the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of concerned ministry.
Antiquities Act 1968	Ministry of Cultural Affairs	Governs the preservation of national cultural

Title	Responsible Agency	Key Features
		heritage, protects and controls ancient monuments, regulates antiquities as well as the maintenance, conservation and restoration of protected sites and monuments, controls planning, exploration and excavation of archaeological sites.
Bangladesh Wild Life (Preservation) Act 1974	Ministry of Environment and Forest Bangladesh Wild Life Advisory Board	The wildlife law provides for the protection of wildlife as well as the habitats. The Act defines various protected areas in the form of game reserve, national park and wildlife sanctuary and aims at preserving wildlife of those protected areas. The wildlife sanctuary regime also requires undisturbed breeding ground for the protection of wildlife as well as all natural resources in the sanctuary.
The Forest Act 1927 and subsequent amendments in 1982 and 1989	Ministry of Environment and Forest	This Act aims to consolidate the laws relating to forests, and duty leviable on timber and other forest-produce. The law was mainly enacted to generate revenues from forest products. The Act empowers the Government to declare portions of its forests as Reserved or Protected and by doing that it may take measures for in situ conservation of biodiversity. Any acts or omission detrimental to the natural resources of reserved and protected forests are prohibited and are punishable offences. Among them, the more serious ones include making fresh clearing of forest lands, removing timbers, setting fires, felling or otherwise damaging trees, clearing or breaking up any land for cultivation or any other purpose. The Act was amended in 2000 to accommodate provisions to establish social forestry involving local community participation in the management regime. Following the Act, social forestry rules are under preparation by the Forest Department.
Environment Court Act, 2000 and subsequent amendments 2002	Judiciary and Ministry of Environment & Forest	This Act has been enacted in order to establish environmental courts in each administrative division of Bangladesh. Under this Act, the court has concurrent jurisdiction, i.e. to try both civil and criminal cases. The basis for instituting a case is a violation of the “environmental law”, meaning the Bangladesh Environment Conservation Act, 1995 and Rules made thereunder. In particular the environment court is empowered to: • Impose penalties for violating court orders; • Confiscate any article, equipment and transport used for the commission of the offence; • Pass any order or decree for compensation; • Issue directions to the offender or any person (a) not to repeat or continue the offence; (b) to take preventive or remedial measures with relation to any injury, specifying the time limit and reporting to the DOE regarding the implementation of the directions. Under this Act the Director General of the DOE has the power to impose heavy penalties to industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated Effluent Treatment Plants.
The Embankment and	Ministry of Water Resources	This Act consolidates the laws relating to

Title	Responsible Agency	Key Features
Drainage Act 1952	and Flood Control and Drainage (FCD)	embankment and drainage and to make better provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion and other damage by water. In particular the Act is empowered to impose: • penalty for obstructing persons in exercise of powers under this Act • penalty for unauthorised interference and abuttment thereof • penalty for injuring embankment, etc • penalty for diverting rivers or grazing cattle on embankments Removal of obstruction and repair of damage

Appendix 4

A. Consultation Meetings for Part A - PGCB

B. Consultation Meetings for Part B - DPDC

List of attendees during consultation

No.	Name of Sub-station	Name of respondents	Contact no.	Date of consultation
1	Officers club	Md. Mofajjol Hosen	-	1/4/2013
2		Md. Habib	-	1/4/2013
3		Md. Jaynal	-	1/4/2013
4	B.B Avenue	Md. Hosen Bhuiya	02-9559939	1/4/2013
5		Md. Mostafiz	-	1/4/2013
6	New Ramna	Md. Mofijur Islam	01828622133	1/4/2013
7		Md. Tofazzal	-	1/4/2013
8		Md. Tarek Hasan	-	1/4/2013
9		Md. Mosharaf Hossain	-	1/4/2013
10	Motijheel	Md. Masud Rana	-	1/4/2013
11		AKM Parvez	-	1/4/2013
12		Md. Dudu Mia	-	1/4/2013
13		Md. Jalal Uddin	-	1/4/2013
14	Kajla	Md. Kader Mia	017303305280	1/4/2013
15		Md. Helel Uddin	-	1/4/2013
16		Md. Jafor Ali	-	1/4/2013
17		Shekh Farid	-	1/4/2013
18	Postogola	Md. Najrul Islam	02-7453401	1/4/2013
19		Md. Ferdaus	-	1/4/2013
20		Md. Soharb Hossen	-	1/4/2013
21	Char Sayedpur	Mr. Subroto Saha	01717342846	4/4/2013
22		Md. Kasem Ali	-	4/4/2013
23		Md. Goldar Ali	-	4/4/2013
24	Mondal Para	Mr. Topon Ch. Das	0-1720958265	4/4/2013
25		Md Farajul	-	4/4/2013
26	Narayanganj	Mr. Soikat Ch. Halder	01730320329	4/4/2013
27		Md. Khurshi Alam	-	4/4/2013
28		Md. Rajib Hasan	-	4/4/2013
29	P&T	Md. Abul Meer	01730320314	4/4/2013
30		Md. Hasan	-	4/4/2013
31		AKM Fazlul Karim	-	4/4/2013
32	Monipuripara	Abdul Hamid	-	4/4/2013
33		Md. Surat Ali	-	4/4/2013
34		Md. Pappu	-	4/4/2013
35	Banasree	Abdur Rahman	-	12/4/2013
36		Md. Hekmat Ali	-	12/4/2013

No.	Name of Sub-station	Name of respondents	Contact no.	Date of consultation
37		Md. Hasanat	-	12/4/2013
38	Green road Dormitory	Md. Motin Mia	-	12/4/2013
39		Md. Eklas Mollah	-	12/4/2013
40	Konapara	Md. Rahamatullah khan	-	12/4/2013
41		Md. Jamal ullah	-	12/4/2013
42		Md. Hasmat ullah	-	12/4/2013
43	Mondal para	Mr. Tushar Dey	-	12/4/2013
44		Md. Lal Mia	-	12/4/2013
45		Md. Kamrul	-	12/4/2013
46		Md. Rashid	-	12/4/2013
47	Nandalalpur	Mr. Ratan Saha	-	12/4/2013
48		Md. Suman	-	12/4/2013
49	Laxminarayan Cotton Mill	Md. Monjurul Islam	-	12/4/2013
50		Md. Enayet Ali	-	12/4/2013
51		Md. Mozammel Ali	-	12/4/2013
52	Dhaka Uddyan	Md. Monirul Islam	-	28/4/2013
53	Mugdapara Hospital	Md. Sohel Ali	01818126048	28/4/2013
54		Md. Mehedi	-	28/4/2013
55		Md. Taj Uddin	-	28/4/2013
56	Maa O Shishu, Matuail	Akkasur Rahman	-	28/4/2013
57		Md. Feroj	-	28/4/2013
58		Md. Sukur Mia	-	28/4/2013
59	Jatrabari PDB Colony	Hamidur Rahman	01912468553	28/4/2013
60		Md. Rehat Ullah	-	28/4/2013
61	Kamalapur Railway Hospital	Md. Jafar Ali	-	28/4/2013
62		Md. Gofran Ali	-	28/4/2013
63		Md. Gedu mai	-	28/4/2013

C. Consultation Meetings for Part C - DESCO

List of attendees during consultation

No.	Name	Designation/Location	Mobile Number
1.	M.M. Sarifuzzaman	Sub-Divisional Engineer, DESCO	01755637545
2.	Md. Mohiuddin	Asst. Engineer , DESCO	01717130304
3.	Mr. Jubaer	Asst. Engineer , DESCO	01730794810
4.	A.B.M. Rafiqul Islam Khan	Project Director , United city	01914001421
5.	Mr. Abul Hayat	Project Engineer, DESCO	01819833887
6.	Mr. Abdul Jalil	Senior Supervisor	01718029885
7.	Md. Nizamuddin	Senior Supervisor	-
8	Mr. Ekramul Reza Chowdhury	Project Officer	01914001429
9.	Md. Jahir Pasha	Executive Officer	-
10.	Md. Idris Shekh	Dumni, Khilkath	-
11.	--	Project Director, Uttara 3rd phase	01552313583
12.	Md. Mamunur Rashid	Uttara 3rd phase	-
13.	Md.Lathiful Alom	Pachim Kazipara Road, Mirpur 2	-
14.	Md. Liakoth Ali	Dumni, Khilkath	01718595838
15.	Mr, Abul Kashem	Lake city, Concord, Khilkath	01913468828
16.	Mr. Surangan Roy	Lake city, Concord, Khilkath	-
17.	Md. Kamruzzaman	PD, Eastern Housing,Badda	01732123212
18.	Major (Rtd.) Md. Mahobubur	General Manager,Swadesh (Sarnali)	01926688781
19.	Major (Rtd.) Md. Habib Hossain	General Manager (Admin.)	-
20.	Md. Mokhlacur Rahaman	General Manager (Account.)	-
21.	Mr. Sykat Mishra	Manager (Town planner)	-
22.	Engineer Mridul Hasan	Executive Engineer	01714161931
23.	Engineer Balaet Hossain	Project Manager, RakeenDevelopment	01755563398
24.	Md. Nazem Uddin	DM, Estate, DESCO, Mirpur DOHS.	01713039648