Rural Electricity Transmission and Distribution Project

Environmental and Social Assessment

Environmental and Social Management Framework (ESMF)

Draft Final Report

November 2013

Power Cell, Power Division
Ministry of Power, Energy and Mineral Resources
Government of the People’s Republic of Bangladesh
The Environmental and Social Management Framework (ESMF) has been prepared by Bureau of Research, Testing and Consultation (BRTC), Bangladesh University of Engineering and Technology (BUET), Dhaka.

The ESMF has been prepared based on an overall environmental and social assessment, which includes (i) the general baseline at project's area (ii) evaluation of potential environmental and social impacts of different project components and subcomponents and (iii) assessment of environmental practices in different ongoing and completed projects.

The ESMF provides the guidelines for the preparation of all mitigation plans (such as Environmental Management Plans, Resettlement Action Plans and/or Tribal Peoples Development Plans) to respond to the anticipated project impacts, once the route and specific substation locations are identified.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ABC</td>
<td>Axially Bunded Cables</td>
</tr>
<tr>
<td>AIS</td>
<td>Air Insulated Switchgear</td>
</tr>
<tr>
<td>BDT</td>
<td>Bangladesh Taka</td>
</tr>
<tr>
<td>BMD</td>
<td>Bangladesh Meteorological Department</td>
</tr>
<tr>
<td>BNBC</td>
<td>Bangladesh National Building Code</td>
</tr>
<tr>
<td>BCOS</td>
<td>5-day Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>BRTC</td>
<td>Bureau of Research Testing and Consultation</td>
</tr>
<tr>
<td>BUET</td>
<td>Bangladesh University of Engineering and Technology</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical Oxygen Demand</td>
</tr>
<tr>
<td>DG</td>
<td>Director General</td>
</tr>
<tr>
<td>DoE</td>
<td>Department of Environment</td>
</tr>
<tr>
<td>EAP</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>ECA</td>
<td>Ecologically Critical Area</td>
</tr>
<tr>
<td>ECoP</td>
<td>Environmental Code of Practice</td>
</tr>
<tr>
<td>ECR</td>
<td>Environment Conservation Rules</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMMF</td>
<td>Environmental Management Framework</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>ESA</td>
<td>Environmental and Social Assessment</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environmental and Social Impact Assessment</td>
</tr>
<tr>
<td>ESMF</td>
<td>Environmental and Social Management Framework</td>
</tr>
<tr>
<td>ESU</td>
<td>Environmental and Social Unit</td>
</tr>
<tr>
<td>FGD</td>
<td>Focus Group Discussion</td>
</tr>
<tr>
<td>GIS</td>
<td>Gas Insulated Switchgear</td>
</tr>
<tr>
<td>GPAP</td>
<td>Governance and Accountability Action Plan</td>
</tr>
<tr>
<td>GoB</td>
<td>Government of Bangladesh</td>
</tr>
<tr>
<td>GRC</td>
<td>Grievance Redress Committee</td>
</tr>
<tr>
<td>IDA</td>
<td>International Development Association</td>
</tr>
<tr>
<td>IEE</td>
<td>Initial Environmental Examination</td>
</tr>
<tr>
<td>IEFA</td>
<td>Important Environmental Features</td>
</tr>
<tr>
<td>MoEF</td>
<td>Ministry of Environment and Forests</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Government Organization</td>
</tr>
<tr>
<td>OHS</td>
<td>Occupational Health and Safety</td>
</tr>
<tr>
<td>OP</td>
<td>Operations Policy</td>
</tr>
<tr>
<td>PA</td>
<td>Project Affected Persons</td>
</tr>
<tr>
<td>PS</td>
<td>Palli Bidoy Shomiti</td>
</tr>
<tr>
<td>PCAIP</td>
<td>Public Consultation and Access to Information Plan</td>
</tr>
<tr>
<td>PD</td>
<td>Project Director</td>
</tr>
<tr>
<td>PGCB</td>
<td>Power Generation Company of Bangladesh</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>PM1.5</td>
<td>Particulate Matter with aerodynamic diameter &lt; 2.5 micrometers</td>
</tr>
<tr>
<td>PM10</td>
<td>Particulate Matter with aerodynamic diameter &lt; 10 micrometers</td>
</tr>
<tr>
<td>PMO</td>
<td>Project Management Office</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>RCC</td>
<td>Reinforced Cement Concrete</td>
</tr>
<tr>
<td>REB</td>
<td>Rural Electrification Board</td>
</tr>
<tr>
<td>RoW</td>
<td>Right of Way</td>
</tr>
<tr>
<td>SECO</td>
<td>Special Environmental Clauses</td>
</tr>
<tr>
<td>SA</td>
<td>Social Impact Assessment</td>
</tr>
<tr>
<td>SMF</td>
<td>Social Management Framework</td>
</tr>
<tr>
<td>SNMP</td>
<td>Social Management Plan</td>
</tr>
<tr>
<td>SPM</td>
<td>Suspended Particulate Matter</td>
</tr>
<tr>
<td>TDS</td>
<td>Total Dissolved Solids</td>
</tr>
<tr>
<td>TL</td>
<td>Transmission Line</td>
</tr>
<tr>
<td>TTP</td>
<td>Tribal People Plan</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
</tbody>
</table>
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EXECUTIVE SUMMARY

Background

To meet the growing electricity demand and to meet the goal of universal access by 2020, the GoB has taken a plan to add more than 11,500MWs electricity to the national grid by the year 2015. To evacuate the additional power, enhancements and extensions are needed in the transmission network of the Power Grid Company of Bangladesh (PGCB) and in the rural distribution network of the Palli Biddut Samities (PBSs) under Rural Electrification Board (REB). The proposed “rural electricity transmission and distribution project” involves rehabilitation and augmentation needs of the 33/11 kV network operated by the Palli Biddut Samities (PBSs) under the Rural Electrification Board (REB), transmission enhancement needs of the Power Grid Company of Bangladesh (PGCB), and capacity building of REB, the PBSs and PGCB as well as implementation of the reform action plan for REB/PBSs with the support of World Bank.

The proposed project requires carrying out an Environmental and Social Assessment in accordance with the Environment Conservation Act 1995 (Amended in 2000, 2002 and 2010), the Environment Conservation Rules 1997, and the World Bank Safeguard Policies. However, the exact routes of transmission/distribution lines and substation locations are not identified at this stage. Therefore, a framework approach has been adopted for environmental and social assessment (ESA) of the proposed project. This volume provides Environmental and Social Management Framework (ESMF) part of the assessment.

Policy and legal Framework and Applicability to Project Components

Bangladesh has an environmental legal framework that is conducive to both environmental protection and natural resources conservation. In addition, a wide range of laws and regulations related to environmental and social issues are in place in Bangladesh. Many of these are cross-sectoral and partially related to environmental issues. The ESMF report presents an overview of the major national laws and regulations that are relevant and may apply to activities supported by the project, institutional arrangement and national and sub-national level. The report also discusses the relevant World Bank safeguard policies and their applicability to the proposed project.

Sub-project Categories

The sub-projects to be implemented under the proposed rural electricity transmission and distribution project do not appear to pose risk of significant adverse environmental impacts. Accordingly, the overall project could be classified as a “Category B” project, according to WB project classification (OP 4.01). In accordance with the ECR 1997, certain sub-projects are categorised (e.g., construction/upgradation of power distribution lines) and the EIA requirements of these projects are also clearly spelled out in the ECR 1997. Sub-projects category according to ECR 1997 is shown in the Table E1. However, environmental/social screening of all sub-projects will be carried out first (see Section 4.6), based on which the ESIA requirements will be determined. In general, the environmental/social screening process...
identifies what impacts will be generated and what type of mitigation measures will be required for the sub-projects.

**Table E-1: Classification of sub-projects according to ECR 1997 (GoB, 1997)**

<table>
<thead>
<tr>
<th>Project Component/Sub-projects</th>
<th>Project/Sub-project Category according to ECR 1997</th>
<th>Likely Project/Sub-project Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of 33 kV new power distribution line</td>
<td>Red</td>
<td>—</td>
</tr>
<tr>
<td>Upgradation of 33 kV power distribution line</td>
<td>Red</td>
<td>May be classified as “Orange A” or “Orange B” depending on assessment of potential impact</td>
</tr>
<tr>
<td>Construction of 11 kV new power distribution line</td>
<td>Red</td>
<td>—</td>
</tr>
<tr>
<td>Construction of 132 kV new power transmission line</td>
<td>Not specifically listed</td>
<td>Red</td>
</tr>
<tr>
<td>Re-conductoring/Upgradation of 132 kV lines</td>
<td>Not specifically listed</td>
<td>May be classified as “Orange A” or “Orange B” depending on assessment of potential impact</td>
</tr>
<tr>
<td>Construction of 33/11 kV substation on privately owned land</td>
<td>Not specifically listed</td>
<td>Red</td>
</tr>
<tr>
<td>Construction of 122/33 kV substation on privately owned land</td>
<td>Not specifically listed</td>
<td>Red</td>
</tr>
<tr>
<td>Construction of 33/11 kV substation on Government owned land</td>
<td>Not specifically listed</td>
<td>May be classified as “Orange A” or “Orange B” depending on assessment of potential impact</td>
</tr>
<tr>
<td>Construction of 132/33 kV substation on Government owned land</td>
<td>Not specifically listed</td>
<td>May be classified as “Orange B” or “Red” depending on assessment of potential impact</td>
</tr>
</tbody>
</table>

**Notes:**
1. According to ECR 1997, “power distribution line laying/relaying/extension” projects fall under “Red” category; i.e., Category is designated on the nature of project not the anticipated impact.
2. Proposed rural electricity transmission and distribution project could be classified as “Category B” on the expected impact according to WB OP4.01.

**Environmental Considerations in Project Formulation**

By considering certain issues during project formulation, it is often possible to reduce or eliminate some of the possible adverse environmental impacts during both construction and operational phases of a project. Table E-2 identifies a number of such issues to be considered for substation and power line sub-projects.

**Table E-2: Environmental and social considerations to be included in design to reduce/eliminate the impacts for some major sub-projects**

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Issues to be Considered at Project Formulation Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substation</td>
<td>• Use of government-owned/land or vacant/fallow (non-productive) land for construction of substation, where possible</td>
</tr>
<tr>
<td></td>
<td>• Use of land located at close proximity to existing power lines/load centers, and road network (for easier transportation of material and equipment), where available</td>
</tr>
<tr>
<td></td>
<td>• Avoiding lands that are susceptible to inundation/storm surge 1</td>
</tr>
</tbody>
</table>
Sub-project

Power Line

Issues to be Considered at Project Formulation Stage

- Avoiding ecologically and societally critical areas while selecting land for substations
- Use of Gas Insulated Switchgear (GIS), instead of Air Insulated Switchgear (AIS), in order to reduce land requirement for substations and avoid possible generation of toxic fumes in control building due to flashover inside AIS (especially under high humidity and saline conditions)
- Ensure not to purchase and installation of transformers containing PCB
- Treating PCB contained in old transformers available technologies; namely, super critical oxidation, electro-chemical oxidation, solvated electron technology, chemical reduction method, dehalogenation process, and thermal desorption using pyrolysis, catalyzed dehalogenation and vitrification before disposal
- Designing substations considering maximum flood level, and considering wind speed and earthquake load suggested in the Bangladesh National Building Code (BNBC)
- Avoiding homestead areas, forest, protected areas, game reserve, national park, SCAs (as much as possible) while selecting routes of the power line
- Use of “guard cable” for saving cash-in trees
- Maintenance of adequate clearance for right of way (RoW)
- Use of Axially Bundled Cables (ABC) or insulated cables, instead of conventional separate cables, in order to prevent possible pilferage of power through illegal connection and provide added security against accident
- Keeping layout of power line tower/pole such that they do not interfere with movement of traffic/pedestrian
- Designing power lines considering wind speed suggested in the Bangladesh National Building Code (BNBC)
- Checking structural adequacy of existing power line towers/poles (to accommodate new cables) for sub-projects involving power line re-conductoring/rehabilitation
- Selecting alignment of transmission line avoiding routes of migratory birds, nesting sites, significant bird habitat, and take off/ landing routes of aircrafts
- Keep provisions for using vibratory hammers for pile driving for foundation of tower to produce less impact on Fisheries and Other Aquatic Life
- In order to avoid fire hazards, using technology in power line (and also substations) which trips the line in fraction of seconds

Environmental/Social Screening

All project components or sub-projects to be implemented under the proposed project will be subject to an environmental/social screening in order to prevent execution of projects with significant negative environmental impacts. The environmental/social screening would involve: (i) reconnaissance of the sub-project areas/routes and their surroundings; (ii) identification of the major sub-project activities; and (iii) preliminary assessment of the

Usually, control room buildings are built to a height of 1.5 storey to avoid storm surge (BPDB, 2008)
impacts of these activities on the ecological, physic-chemical and socio-economic environment of the sub-project surrounding areas. Environmental and Social Screening forms for power line and substation are presented in Appendix B (Form 2a and 2b).

Analysis of Alternatives

The primary objective of the "analysis of alternatives" is to identify the location/technology for a particular sub-project that would generate the least adverse impact, and maximize the positive impacts. The analysis of alternatives should be carried out at two different levels: (a) by PGCB/REB/PBS along with environmental/social screening; and (b) during carrying out of IEE/ESIA of a sub-project, if needed (e.g., by the consultant engaged for this purpose). A simple format for analysis of alternatives is presented in Appendix C (Form 3a for Substation, Form 3b for power line).

Guidelines for Carrying out IEE and EIA

Sub-project Influence Area

The ESMF provides guidelines for identification of sub-project specific influence area and defining environmental baseline for different types of sub-projects to be implemented under the proposed project (see Table E-3). Based on the field visits to sub-project sites in Dhaka, Chittagong and Sylhet, it is apparent that the sub-project influence area would depend not only on the type of sub-project (i.e., substation or power line), but also on the nature site/area where it will be implemented.

Table E-3: Guidelines for identifying influence area for different types of sub-projects

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Influence Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>132/33kV and 33/11kV Substations, Switching Stations</td>
<td>Areas and communities within around 1 km surrounding the location of the Substation, who are likely to be affected during construction and/or operation of the substations. Areas on either side (within -15 m) of the access road from the main road to the Substation.</td>
</tr>
<tr>
<td>128kV Transmission Lines and Towers</td>
<td>Areas and communities within the Right of Way (~50 m) of the Transmission line route. Areas on either side (within -15 m) of the access road from the main road to the transmission tower (if any) to be constructed.</td>
</tr>
<tr>
<td>33 and 11kV Distribution Lines and Poles</td>
<td>Areas and communities within the Right of Way (~50 m) of the Distribution line route. Areas on either side (within -15 m) of the access road from the main road to the distribution line poles/tower, which could be affected during construction.</td>
</tr>
</tbody>
</table>

Note: The route of transportation of material/equipment to the sub-project site should also be included under Influence Area.

Environmental Baseline

For proper environmental assessment, it is very important to define the "environmental baseline" against which environmental impacts of a particular sub-project would be subsequently evaluated. For systematic recording of data, the baseline environment is usually classified into physicochemical environment, biological environment, and socio-economic environment; and important features/parameters under each category are
identified and measured/recorded during baseline survey. Tables E-4 and E-5 present
guidelines for collection of primary and secondary data on physicochemical and biological
parameters respectively for different types of sub-projects to be implemented under the
proposed project.

For the sub-projects (construction of substations and power lines), it is important to have a
clear understanding of the baseline socio-economic condition of people, especially those
living within the sub-project influence areas. A common approach for quick assessment of
baseline socio-economic condition is questionnaire survey. The questionnaire used for
socio-economic survey may therefore cover five major themes: (a) Socio-economic
background; (b) Basic services; (c) Education; (d) Economic situation, and (e) Attitude
toward the proposed sub-project.

**Table E-4: Guidelines for collection of sub-project specific physicochemical data/information**

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Data/information from secondary source</th>
<th>Data from primary survey/measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of 132/33kV Substations by PGCB</td>
<td>IEFs; Climate; Geology and soil; hydrology and water resources; and drainage</td>
<td>IEFs; Noise level; Soil; Surface water quality; Site topology; EMF</td>
</tr>
<tr>
<td>Construction of 132kV Transmission Line by PGCB</td>
<td>IEFs; Climate; Topography and drainage; Geology and soil; Hydrology and water resources</td>
<td>IEFs; Noise level; Surface water quality; Traffic; EMF</td>
</tr>
<tr>
<td>Construction of 33/11kV Substations/ Switching Statubs by REB</td>
<td>IEFs; Climate; Geology and soil; Hydrology and water resources; and drainage</td>
<td>IEFs; Noise level; Soil; Surface water quality; Site topology; EMF</td>
</tr>
<tr>
<td>Construction of 33kV &amp; 11kV Distribution Lines by REB</td>
<td>IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources</td>
<td>IEFs; Noise level; Surface water quality; Traffic; EMF</td>
</tr>
<tr>
<td>Upgradation of 132/33kV Substations by PGCB</td>
<td>IEFs; Climate; Geology and soil; Hydrology and water resources; and drainage</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation of 132kV Transmission Line by PGCB</td>
<td>IEFs; Climate; Topography and drainage; Geology and soil; Hydrology and water resources</td>
<td>Surface water quality; Traffic; EMF</td>
</tr>
<tr>
<td>Rehabilitation of 33kV &amp; 11kV Distribution Lines by REB</td>
<td>IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources</td>
<td>Surface water quality</td>
</tr>
</tbody>
</table>

*If water body is located close to the substation site(s)

Table E-5: Guidelines for collection of sub-project specific data/information for describing
biological environment

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Data/information from secondary source</th>
<th>Data from primary survey/measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction/rehabilitation of...</td>
<td>General bio-ecological</td>
<td>Number of trees to be felled;</td>
</tr>
</tbody>
</table>
### Assessment and Prediction of Impacts and Mitigation Measures

The potential environmental impacts during construction and operation phases of sub-projects could be categorized into: (a) ecological impacts; (b) physic-chemical impacts; and (c) socio-economic impacts. The impacts (both general and component-specific) and suggested probable mitigation measures are summarized in Tables E-6 to E-8.

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Data/information from secondary source</th>
<th>Data from primary survey/ measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>132/33kV Substations by PGCB</td>
<td>Features, Wildlife sanctuary, ECA etc.</td>
<td>Area to be cleared of vegetation; Filling up of seasonal wetland (if required)</td>
</tr>
<tr>
<td>Construction/Rehabilitation of 132kV Transmission Line</td>
<td>General bio-ecological features, Wildlife sanctuary, Flora and faunal diversity; ECA</td>
<td>Number of trees to be felled or trimmed; Aquatic flora and faunal diversity'</td>
</tr>
<tr>
<td>By PGCB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction of 33/11kV Substations/</td>
<td>General bio-ecological features, Wildlife sanctuary, ECA</td>
<td>Number of trees to be felled; Area to be cleared of vegetation; Filling up of seasonal wetland (if required)</td>
</tr>
<tr>
<td>Switching Stations by REB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction/Rehabilitation of 33kV &amp; 11kV Distribution lines by REB</td>
<td>General bio-ecological features, Wildlife sanctuary, ECA; Flora and faunal diversity</td>
<td>Number of trees to be felled or trimmed</td>
</tr>
</tbody>
</table>

1'If the proposed transmission line crosses river/wetland

---

ix
### Table E-6: Typical "general impacts" during construction phase of sub-projects and corresponding mitigation and enhancement measures

<table>
<thead>
<tr>
<th>Activity/Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and operation of labor shed for workers</td>
<td>• Generation of sewage and solid waste; water/ environmental pollution • Health of workers • Possible development of labor camp into permanent settlement • Outside labor force causing negative impact on health and social well-being of local people</td>
<td>• Construction of sanitary latrine/septic tank system. • Erection of &quot;no litter&quot; sign, provision of waste bins/cans, where appropriate • Raising awareness about hygiene practices among workers • Availability and access to first-aid equipment and medical supplies. • Contractor to remove labor camp at the completion of contract • Contractor to employ local work force, where appropriate; promote health, sanitation and road safety awareness</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>General construction works for sub-projects</td>
<td>• Drainage congestion and flooding</td>
<td>• Provision for adequate drainage of storm water • Provision of adequate diversion channel, if required • Provision for pumping of congested water, if needed • Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>• Air pollution</td>
<td></td>
<td>• Ensure that all project vehicles are in good operating condition. • Spray water on dry surfaces/ unpaved roads regularly • Maintain adequate moisture content of soil during transportation, compaction and handling • Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates) • Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.</td>
<td></td>
</tr>
<tr>
<td>• Traffic congestion, obstruction to pedestrian movement</td>
<td>• Schedule deliveries of material/equipment during off-peak hours • Depute flagman for traffic control • Arrange for signal light at night</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Noise pollution</td>
<td>• Use of noise suppressors and mufflers in heavy construction equipment • Avoid using of construction equipment producing excessive noise at night • Avoid prolonged exposure to noise (produced by equipment) by workers • Regulate use of horns and avoid use of hydraulic horns in project vehicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity/Issues</td>
<td>Potential Impacts</td>
<td>Proposed Mitigation and Enhancement Measures</td>
<td>Responsible Parties</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>- Water and soil pollution</td>
<td>• Prevent discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/khals/drain</td>
<td>• Install sediment basins to trap sediments in storm water prior to discharge to surface water&lt;br&gt;• Keep noise level (e.g., from equipment) to a minimum level, as certain fauna are very sensitive to loud noise (e.g., during transmission tower construction over river/wetlands)</td>
<td></td>
</tr>
<tr>
<td>- Destruction of aquatic habitat</td>
<td>• Install sediment basins to trap sediments in storm water prior to discharge to surface water&lt;br&gt;• Keep noise level (e.g., from equipment) to a minimum level, as certain fauna are very sensitive to loud noise (e.g., during transmission tower construction over river/wetlands)</td>
<td>• Replant vegetation when soils have been exposed or disturbed&lt;br&gt;• Plantation to replace felled trees&lt;br&gt;• Following standard safety protocol&lt;br&gt;• Environmental health and safety briefing&lt;br&gt;• Provision of protective gears as specified in ECoP&lt;br&gt;• Provision of appropriate protective measures against accidental fall from elevated height (e.g. using body harness, waist belts, secured climbing devices, etc.)&lt;br&gt;• Good housekeeping&lt;br&gt;• Proper handling of lubricating oil and fuel&lt;br&gt;• Collection, proper treatment, and disposal of spills</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>- Felling of trees, clearing of vegetation</td>
<td>• Replant vegetation when soils have been exposed or disturbed&lt;br&gt;• Plantation to replace felled trees&lt;br&gt;• Following standard safety protocol&lt;br&gt;• Environmental health and safety briefing&lt;br&gt;• Provision of protective gears as specified in ECoP&lt;br&gt;• Provision of appropriate protective measures against accidental fall from elevated height (e.g. using body harness, waist belts, secured climbing devices, etc.)&lt;br&gt;• Good housekeeping&lt;br&gt;• Proper handling of lubricating oil and fuel&lt;br&gt;• Collection, proper treatment, and disposal of spills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Accidents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Spills and leaks of oil, toxic chemicals</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Health and Safety**<br><br>- Exposure to physical hazards from use of heavy equipment and cranes; trip and fall hazards;<br>- Exposure to dust and noise, falling objects; work in confined spaces;<br>- Exposure to hazardous materials;<br>- Exposure to electrical hazards from the use of tools and machinery;<br>- A safety observer must be appointed at each subproject site by the contractor before the commencement of work<br>- Only allowing trained and certified workers to install, maintain, or repair electrical equipment<br>- Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines<br>- Proper Personal Protective Equipment (PPE) for all workers and others associated with work<br>- Where rehabilitation is required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined before work
<table>
<thead>
<tr>
<th>Activity/Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>All construction works</td>
<td>• Beneficial impact on employment generation&lt;br&gt;• General degradation of environment&lt;br&gt;• Discovery of historical items and cultural remains</td>
<td>• Employ local people in the project activities as much as possible&lt;br&gt;• Environmental enhancement measures, such as plantation, landscaping, traffic/direction signs&lt;br&gt;• Follow &quot;chance find procedure&quot; (see Appendix G) for protection of cultural resources</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
</tbody>
</table>
Table E-7: "Sub-project specific impacts" during construction phase and corresponding mitigation measures

<table>
<thead>
<tr>
<th>Activity /Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction of Substation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting up and operation of asphalt plant and bitumen preparation area (for Sub-station access road construction), if needed</td>
<td>• Air and noise pollution affecting nearby settlements • Possible water pollution (surface and groundwater) by bitumen and solvents • Possible PCB contamination from dismantling of old transformers with PCB • Cutting down trees to use a fuel wood for heating bitumen</td>
<td>• Locate plant away from residential settlements • Avoid spills; surround plant area with a ditch with a settling pond/oil trap at the outlet • Treat PCB of old transformers following specified methods in ECoP (e.g. dehalogenation, electrochemical oxidation, etc.) • Strictly prohibit use of fuel wood for heating bitumen</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>Sub-station access road construction</td>
<td>• Effect on traffic and pedestrian safety • Water pollution from bituminous products/solvents</td>
<td>• Employ traffic control measures and limit possible disruption to non-construction traffic • Strict control to avoid spills; provision for adequate clean up</td>
<td></td>
</tr>
<tr>
<td><strong>Construction/ Rehabilitation of Transmission Line and Distribution Line</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of poles of transmission / distribution lines adjacent to roadways</td>
<td>• Traffic congestion/traffic problems • Salinity</td>
<td>• Not storing electric poles/transmission tower components over busy roads/highways • Following standard safety protocols while erecting poles and stretching cables • Taking appropriate protective measures against accidental fall from elevated height (e.g. using body harness, waist belts, secured climbing devices, etc.) as specified in ECoP</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>Construction of power line through natural habitat or tree plantation area</td>
<td>• Impact on biodiversity, vegetation and habitat</td>
<td>• If there's no alternative, felling, pollarding, lopping and pruning of trees for electric clearance, whenever necessary, to be done with permission from the local forest office/appropriate authority • Hand-clearing of vegetation • Strict prohibition on use of chemicals for forest clearance/RoW maintenance</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>Activity / Issues</td>
<td>Potential Impacts</td>
<td>Proposed Mitigation and Enhancement Measures</td>
<td>Responsible Parties</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td>--------------------------------------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| Tower Foundation in the Major River | • Impact on Fisheries and Other Aquatic Life in the Major River  
• Collision with water vessels | • Use of existing path/access roads for movement of man and machinery  
• Carrying tower materials into forests by head loads  
• Use a vibratory hammer for pile work  
• Installation of underwater enclosures to minimize sound  
• Use signage and construct fenders (if necessary) | Contractor  
(Monitoring by REB/PGCB) |

Responsible Parties

- Contractor (Monitoring by REB/PGCB)
<table>
<thead>
<tr>
<th>Activity/Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation of drains in the substations</td>
<td>• Pollution of downstream water body</td>
<td>• Stop direction connection from sanitation facilities to storm drain; ensure installation of septic tank in all establishments</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td>• Blockage in the drain due to disposal of solid waste</td>
<td>• Creation of awareness; Improve SWM system, installing cover in open manholes (if any)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular maintenance/cleaning of the drain</td>
<td></td>
</tr>
<tr>
<td>Operation of generators and transformers</td>
<td>• Pollution of water (e.g., from spilled oil, spent oil, other waste)</td>
<td>• Restriction on disposal of spent oil, food and other waste in water; creation of awareness</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Strict control to avoid spill; provision for adequate clean up</td>
<td></td>
</tr>
<tr>
<td>Operation of Substation</td>
<td>• Security</td>
<td>• Ensuring security of Substation in collaboration with law enforcing agencies</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensuring security of Substation by keeping complaint book at Substation for recording of people’s complaints</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Safety, Health</td>
<td>• Ensuring availability of adequate safety gears for Substation operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Keeping clean the conduits used for laying the XLPE cables connecting switchgears and transformers with proper drainage provisions to prevent the growth of disease vectors such as mosquitoes and flies</td>
<td></td>
</tr>
<tr>
<td>Construction/ Rehabilitation of Transmission Line and Distribution Line Sub-project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular maintenance</td>
<td>• Safety</td>
<td>• Regular patrolling along the power lines to identify the need for regular and immediate maintenance operation</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inspection immediately after a major storm/rainfall event</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular cutting and trimming of trees around power lines</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Taking appropriate preventive measures against accidental fall from elevated height during regular maintenance operations (e.g., using body harness, \ waist belts, secured climbing devices, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provision for shutting down of line in case of snapping of line</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular monitoring of power lines to prevent electricity pilferage especially when Axially Bundled Cables (ABC) are used</td>
<td></td>
</tr>
<tr>
<td>Installation of new transformers</td>
<td>• Safety</td>
<td>• Adequate caution should be taken to carry out installation works by personnel at elevated height</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Instrument should be properly anchored with poles</td>
<td></td>
</tr>
<tr>
<td>Activity/Issues</td>
<td>Potential Impacts</td>
<td>Proposed Mitigation and Enhancement Measures</td>
<td>Responsible Parties</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Maintenance of transmission/distribution lines</td>
<td>- Traffic congestion, obstruction to pedestrian movement, safety&lt;br&gt;- Impact on biodiversity, vegetation, habitat</td>
<td>• Depute flagman for traffic control&lt;br&gt;• Arrange for signal light at night&lt;br&gt;• Following standard safety protocol&lt;br&gt;• Felling, pollarding, lopping and pruning of trees for RoW maintenance to be done with permission from the local forest office/appropriate authority</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td>Health and Safety</td>
<td>• Live power lines&lt;br&gt;• Working at height&lt;br&gt;• Electric and magnetic fields&lt;br&gt;• Exposure to chemicals&lt;br&gt;• Exposure to electrical hazards from the use of tools and machinery.</td>
<td>• Only allowing trained and certified workers to maintain, or repair electrical equipment&lt;br&gt;• Taking appropriate protective measures against accidental fall from elevated height during regular maintenance operations (e.g. using body harness, waist belts, secured climbing devices, etc.)&lt;br&gt;• Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines&lt;br&gt;• Proper Personal Protective Equipment (PPE) for all workers and others associated with work&lt;br&gt;• Training of workers in the identification of occupational EMF levels and hazards&lt;br&gt;• Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure&lt;br&gt;• Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment</td>
<td>REB/PGCB</td>
</tr>
</tbody>
</table>

Responsible Parties:
- REB/PGCB
Monitoring Plan

The primary objective of the environmental monitoring is to record environmental impacts resulting from the sub-project activities and to ensure implementation of the “mitigation measures” identified earlier in order to reduce adverse impacts and enhance positive impacts from project activities. Tables E-9 and E-10 present guidelines for monitoring of specific environmental parameters during construction and operation phases of different sub-projects.

Table E-9: Guidelines for monitoring of environmental parameters during construction phase

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Monitoring Parameter and Scenario</th>
<th>Monitoring Frequency</th>
<th>Resource Required and Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of 132/33kV Substations by PGCB; Construction of 33/11kV Substations by REB</td>
<td>Noise level</td>
<td>Once every week, particularly during operation of heavy equipment</td>
<td>Contractor, under the guidance of REB / PGCB</td>
</tr>
<tr>
<td>Construction of 132/33kV Substations by PGCB (near a water body); Construction of 33/11kV Substations by REB (near a water body); Construction of 132 kV transmission line over river/wetland</td>
<td>Water quality (pH, BOD, COD, NH3, PO4)</td>
<td>Once during construction period (at a location downstream of the work area)</td>
<td>Contractor, under the guidance of REB / PGCB</td>
</tr>
<tr>
<td>All sub-projects</td>
<td>Visual observation of drainage congestion, traffic within around sub-project location</td>
<td>Once a week; when drainage/traffic congestion suspected</td>
<td>Contractor, under the guidance of REB / PGCB</td>
</tr>
<tr>
<td></td>
<td>Occupational health and safety of project personnel (also includes general health, water supply and sanitary provision etc.)</td>
<td>Once a week, and as and when needed</td>
<td></td>
</tr>
</tbody>
</table>

Note: The PD depending on the location of specific activities should decide actual monitoring time and location.

Table E-10: Guidelines for monitoring of environmental parameters during operational phase

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Monitoring Frequency</th>
<th>Resource Required and Responsibility</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger Trees</td>
<td>Once every month, and as directed by the Project Engineer</td>
<td>Vehicle with Ladder and cutting accessories; Maintenance team's responsibility</td>
<td>Results to be reported to ESU</td>
</tr>
<tr>
<td>Dielectric strength of Transformers</td>
<td>Once in 6 months, and as directed by the Project Engineer</td>
<td>Testing equipment, Monitoring team</td>
<td></td>
</tr>
<tr>
<td>Parameters</td>
<td>Monitoring Frequency</td>
<td>Resource Required and Responsibility</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------</td>
<td>--------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Tan - δ test</td>
<td>Once in 10 years, and as directed by the Project Engineer</td>
<td>Testing equipment, Monitoring team</td>
<td></td>
</tr>
<tr>
<td>Hazardous Material</td>
<td>Once every three months, and as directed by the Project Engineer</td>
<td>Laboratory facilities; Monitoring teams</td>
<td></td>
</tr>
<tr>
<td>XLPE cables and trenches within the substation boundary</td>
<td>Twice a year to prevent disease</td>
<td>Maintenance Team’s responsibility</td>
<td></td>
</tr>
</tbody>
</table>

**Environmental Code of Practice (ECoP)**


**Special Environmental Clauses (SECs) for Tender Document**

Apart from the provisions under “General Specification” and “Particular Specification” for different sub-project components, the following special environmental clauses (SECs) shall be included in the Tender Document under General/Particular Specification. These clauses are aimed at ensuring that the Contractor carries out his responsibility of implementing the EMP and other environmental and safety measures.

**Overall Social Management Plan**

Figure E-1 shows the social management flow chart for the proposed project. The social management of the proposed project will start with identification/formulation of sub-projects with community involvement. It will be followed by social (as well as environmental) screening of the sub-project. Based on the social (and environmental) screening, the nature of further social assessment would be determined. If a sub-project is found to have no significant social safeguard issues (e.g., loss of land/income, impact on tribal people), only a social safeguard report (SSR) needs to be prepared summarizing the findings of the screening. On the other hand, if the screening identifies social safeguard issues, the sub-project would be categorized as “Red” (according to ECR 1997), requiring social impact assessment (SIA), along with preparation of resettlement action plan (RAP) and tribal people plan (TPP), if needed (in addition to preparation of EIA report). Guidelines for the preparation of SIA and preparation of RAP and TPP have been provided in this ESMF report. After obtaining necessary clearance from DoE (and also WB), the sub-project will proceed to implementation phase, during which the provisions of
the EMP, RAP and TPP will be executed, as prescribed in these documents, with monitoring by REB/PGCB.

Figure E-1: Social management flow chart

Public/Stakeholder Consultation
Consultation and community participation will be undertaken at subproject identification, planning, design, implementation and evaluation stages. Consultation and participation involves communities and other stakeholders, which will take place through interpersonal communications, focused group discussions (FGDs) and small and large community meetings. Additionally, radio broadcast and other media forms may be used to further disseminate information. The PBSs (for REB) will be the platforms for disclosure and consolidate feedback from beneficiary communities and other stakeholders. Appendix K presents guidelines for carrying out public consultations at different stages of a sub-project cycle.
Land requirement and RAP

Certain sub-projects (e.g., a substation) may require land and involve population displacement. Implementing agency ensure that the land will be purchased and the RAPs are designed to ensure that impacts arising from displacement and relocation are mitigated, managed and compensated and livelihoods of displaced persons are restored. Appendix L presents detail guideline for preparation of RAP. It presents a discussion on major issues concerning resettlement: it presents impact mitigation objectives and principles, eligibility for compensation/assistance and principles for providing compensation/assistance.

Tribal People Plan (TPP)

The general sub-project areas in Chittagong and Sylhet division may have small concentration of tribal inhabitants. The project has taken the exclusion criteria to avoid any negative impact on the tribal communities due to undertaking of the project in those areas. The project rather, intends to extend the benefits towards their welfare. However, detail guidelines have been prepared for preparation of TPP (in Appendix M), following the World Bank’s Operational Policy on Indigenous Peoples (OP 4.10), to maximize benefits to the tribal peoples.

Institutional Arrangement and Responsibility

Figures E-2 and E-3 show activities and institutional responsibilities for overall implementation of the Proposed Rural Electricity Transmission and Distribution Project by REB and PGCB. It is noted that REB agreed to set-up a formal Environment and Social Management Unit/Cell with qualified staff in the regular organogram. For an interim measure, REB will set-up a Project specific Environment and Social Management Unit under the PMU. PGCB also is in the process of creating an Environment and Social Unit (ESU) in the regular organogram.
**Activity**

**Responsibility**

**Identification of sub-project and activities**

Prepare/complete:
- Sub-project Description (Form-1)
- Environmental/social Screening (Form-2)
- Analysis of Alternatives (Form-3)

**Review of project documents, including Forms-1, 2 and 3 and Screening/assessment**

- Additional Environmental/Social Assessment (ESA)

**Carry out:** (a) IEE and EMP or (b) full scale ESIA (including RAP, TPP, if needed); following the ESMF

- (1) Review of ESA by REB
- (2) Obtaining necessary environmental clearance from the DoE and WB

**Implementation of EMP/RAP/TPP/ECoP during "construction phase" of project components**

- EMP will implemented by the Contractor and supervised by PBS and periodic monitoring by Supervision Consultant and project ESU. The RAP and TPPs will be implemented by an NGO hired by the client under the supervision of the ESU and in coordination with the Contractor

**Preparation of quarterly progress and monitoring reports**

**Implementation of EMP/SMF during "operational phase" of project components, including monitoring and quarterly reporting**

<table>
<thead>
<tr>
<th>PBS with support from consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Environmental and Social Unit (ESU) and Environment specialist of Supervision Consultant</td>
</tr>
<tr>
<td>Independent consultant</td>
</tr>
<tr>
<td>Project ESU and Environment specialist of Supervision Consultant</td>
</tr>
<tr>
<td>EMP and Social safeguards</td>
</tr>
<tr>
<td>NGO and PBS with support from &quot;Environmental and Social Unit&quot; of REB</td>
</tr>
</tbody>
</table>

*Figure E-2: Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of proposed project by the REB*
<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
</tr>
</thead>
</table>
| Identification of sub-project/project activities. Prepare/complete:  
- Sub-project Description (Form-1)  
- Environmental/social Screening (Form-2)  
- Analysis of Alternatives (Form-3) | Individual Consultant of Power Cell with PGCB field level staff |
| Review of project documents, including Forms-1, 2 and 3 and Screening/assessment | Individual Consultant of project and Environment and Social Unit, PGCB |
| Additional Environmental/ Social Assessment (ESA)  
Carry out: (a) IEE and EMP or (b) full scale ESIA (including RAP, TPP, if needed); following the ESMF | Independent consultant |
| (3) Review of ESA by REB  
(4) Obtaining necessary environmental clearance from the DoE and WB. | Individual Consultant of project and Environment and Social Unit, PGCB |
| Implementation of EMP/RAP/TPP/ECOP during "construction phase" of project components. | The RAP and TPPs will be implemented by an NGO hired by the client under the supervision of the ESU and in coordination with the Contractor. EMP Implemented by the Contractor and Supervised by PGCB's field staff. Periodic monitoring by Individual Consultant and Environment and Social Unit, PGCB |
| Preparation of quarterly progress and monitoring reports | Social safeguard report by the contracted NGO. One Environment report prepared by the Contractor. Another report prepared by Individual Consultant and Environment and Social Unit, PGCB |
| Implementation of EMP/SMF during "operational phase" of project components, including monitoring and quarterly reporting | NGO and PGCB's field staff with supports from Environment and Social Unit, PGCB |

Figure E-3: Institutional set up, including major activities and assignment of responsibility for their execution for implementation of proposed project by the PGCB.
Grievance Redress Mechanism

A GRC will be formed for each sub-project, headed by the Chairman / Mayor of relevant area. Members will be taken to represent the communities and other stakeholders including representative of local administration, school teachers, local NGOs, women and ward level elected representatives. The GRC will be a forum where people will exercise their rights of participation in the project cycle through suggestions and complaints. GRCs will also be para­legal court of the project to address local problems and complaints related to social and environmental impacts. Appendix N provides detail description and operational details of GRM.

Social Accountability

Improving governance is central to the GoB’s development agenda. To this end, a Governance and Accountability Action Plan (GAAP) for the Rural Electricity Transmission and Distribution (T&D) Project outlines a framework for actions, institutional arrangements, and additional specific measures to strengthen supply side of social accountability. Use of ICT based applications to monitor the “process” outlined in RAP will enhance transparency and accountability of the service delivery. This will facilitate “real time” flow of information and enable fair, fast and final disbursement of entitlements to adversely affected people. Moreover, ICT based application will strengthen grievance management related to implementation of RAP.

Training Requirements

Both REB and PGCB will employ individual/supervision/DSM consultant, who would support REB/PGCB in overall environmental management. However, since the overall responsibility of environmental management lies with PBS/REB/PGCB, they need to ensure that the consultants are carrying out their responsibilities properly. For this purpose, it is important that the PBS/REB/PGCB engineers/officials receive advanced training on environmental management and monitoring.

Budget

The tentative cost estimates and the budget for the remaining suggestive activities, covering both EMF and SMF, have been made and presented in Table E-11. The cost estimates for some of the mitigation measures as will be identified in the EMP that are be part of civil works contract.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Amount (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESA Consultants</td>
<td></td>
</tr>
<tr>
<td>• For first year project preparation (PGCB)</td>
<td>10,000</td>
</tr>
<tr>
<td>• Preparation of full ESA, if required for subprojects (REB)</td>
<td>90,000</td>
</tr>
<tr>
<td>• Preparation of full ESA, if required for subprojects (PGCB)</td>
<td>25,000</td>
</tr>
<tr>
<td>Social Accountability</td>
<td>75,000</td>
</tr>
<tr>
<td>Training Requirements</td>
<td></td>
</tr>
<tr>
<td>• REB</td>
<td>150,000</td>
</tr>
<tr>
<td>• PGCB</td>
<td>80,000</td>
</tr>
<tr>
<td>EMP during construction</td>
<td>Will be included in Civil Works</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

1.1 Background

1. To meet the growing electricity demand and to meet the goal of universal access by 2020, the GoB has taken a plan to add more than 11,500 MWs electricity to the national grid by the year 2015. To evacuate the additional power, enhancements and extensions are needed in the transmission network of the Power Grid Company of Bangladesh (PGCB) and in the rural distribution network of the Palli Biddyut Samities (PBSs) under Rural Electrification Board (REB). The proposed “rural electricity transmission and distribution project” involves rehabilitation and augmentation needs of the 33/11 kV network operated by the Palli Biddyut Samities (PBSs) under the Rural Electrification Board (REB), transmission enhancement needs of the Power Grid Company of Bangladesh (PGCB), and capacity building of REB, the PBSs and PGCB as well as implementation of the reform action plan for REB/PBSs.

2. Many of the 33/11 kV substations and distribution lines managed by the REB system are now overloaded. Over the years, many 33/11 kV distribution lines were extended long distances away from the substations resulting in poor voltage profiles and high system losses. The rural grid system therefore needs augmentation and rehabilitation to improve the quality and reliability of power supply and to improve system efficiency, while catering to the growing load. A study under the IDA financed Rural Electrification and Renewable Energy Development (RERED) identified the need for new 33/11 kV lines and substations; the study also developed a low-cost design for 132/33 kV substations to be operated by PGCB to supply to the rural grid of the REB/PBSs. Under the proposed project, the REB plans to implement the augmentation and rehabilitation needs in the eastern part of Bangladesh (Dhaka, Chittagong, and Sylhet Divisions) with the support of the World Bank.

3. The PGCB currently owns and operates 2,600 km of 230 kV lines and 5,800 km of 132 kV lines, and transmits power from the sector’s single-buyer, Bangladesh Power Development Board (BPDB), to the distribution entities including the PBSs under the REB. Under the proposed project, the PGCB also intends to enhance its capacity by constructing and upgrading 132 kV lines and 132/33 kV substations under the proposed project.

4. The major components of the proposed project include the following:

Component A: Rural Grid Augmentation and Rehabilitation

5. The component will support the augmentation and rehabilitation needs of 37 PBSs in the eastern part of Bangladesh (Dhaka, Chittagong, and Sylhet Divisions). The proposed investment will reduce system losses while improving the reliability and quality of supply. The proposed physical targets under the component are summarized in Table 1.1.

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1 Similar project for the western part of Bangladesh (Rajshahi, Khulna and Barisal divisions) are under implementation with support from the Japan International Cooperation Agency (JICA).
Table 1.1: Physical components under Component A of the proposed project

<table>
<thead>
<tr>
<th>Network Item (km)</th>
<th>Dhaka Division</th>
<th>Sylhet and Chittagong Divisions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>33kV lines new &amp; upgrade</td>
<td>2078</td>
<td>1398</td>
<td>3476</td>
</tr>
<tr>
<td>11kV New Line</td>
<td>1530</td>
<td>990</td>
<td>2520</td>
</tr>
<tr>
<td>Total 33kV &amp; 11 kV line (km of Lines)</td>
<td>3608</td>
<td>2388</td>
<td>5996</td>
</tr>
<tr>
<td>Switching Stations (Nos.)</td>
<td>22</td>
<td>11</td>
<td>33</td>
</tr>
<tr>
<td>33/11 kV New Substation(^2) (Nos.)</td>
<td>73</td>
<td>37</td>
<td>110</td>
</tr>
</tbody>
</table>

Component B: Transmission enhancement

6. The 33/11 kV network development study identified 13 grid (230/132/33 kV) substations that will be needed for the rural distribution network in the project areas. Out of these substations, 6 are included in the Project to be implemented by PGCB. One of these substations will be piloted as per the low-cost design suggested under the study. PGCB has also identified a few priority investments in the 132 kV line network to remove the bottlenecks and cater to the growing load in the PBS areas, which will be supported under the proposed Project. The proposed physical targets under the component are summarized in Table 1.2.

Table 1.2: Physical components under Component B of the proposed project

<table>
<thead>
<tr>
<th>132 kV new line (km)(^3)</th>
<th>132 kV Re-conductoring (km)(^4)</th>
<th>New Substation(^5) (Nos.)</th>
<th>Upgradation of Substation(^6)</th>
<th>Power Transformers</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
<td>458</td>
<td>6</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

Component C: Institutional strengthening

7. Various institutional strengthening needs are expected to be supported under the component as when needs arise. The expected support would include, among others: a) tariff study for ensuring financial sustainability of the PBSs; b) energy audit, updating of REB master plan; c) identifying the scope of implementation of the Geographic Information System (GIS); d) upgrade of MIS System (including inventory management, computerization of accounting systems in REB); e) data management systems improvement including support to REB to improve the capturing and reporting of system reliability and quality indicators (SAIDI, SAIFI etc); f) implementation support for REB/PBS reform action plan; g) training on e-GP and other training and capacity building activities for REB and PGCB etc.

\(^2\) While the line lengths and substation numbers have been identified based on network design studies, the exact line routes and substation locations have not been identified yet. Exact line routes and substation locations will be selected based on environment and social screening/assessment as per the ESMF.
\(^3\) The exact locations and types for the substations have not been identified yet, which will be determined based on environment and social screening/assessment as per the ESMF.
Project Cost and Financing

8. The preliminary cost estimates for the proposed Project is as below.

<table>
<thead>
<tr>
<th>Project Components</th>
<th>Project cost</th>
<th>IDA Financing</th>
<th>GoB/PBSS/PGCB Financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Rural Grid Augmentation and Rehabilitation</td>
<td>627</td>
<td>465</td>
<td>162</td>
</tr>
<tr>
<td>B. Transmission Enhancements</td>
<td>160</td>
<td>115</td>
<td>45</td>
</tr>
<tr>
<td>C. Institutional Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. REB</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2. PGCB</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

9. Since the IDA and GoB are the financing sources of the project, the environmental and social assessment of the proposed project should comply with the policies and legislative requirements of the World Bank and the GoB. Thus, the proposed project requires carrying out an Environmental and Social Assessment in accordance with the Environment Conservation Act 1995 (Amended in 2000, 2002 and 2010), the Environment Conservation Rules 1997, and the World Bank Safeguard Policies.

1.2 The ESMF

10. The proposed project will be implemented in the eastern part of Bangladesh (Dhaka, Chittagong, and Sylhet divisions). However, the exact routes of transmission/distribution lines and substation locations are not identified at this stage. Therefore a framework approach has been adopted for environmental and social assessment (ESA) of the proposed project. On behalf of REB and PGCB, the Power Cell has engaged BUET to carry out an Environmental and Social Assessment (ESA) and prepare an Environmental and Social Management Framework (ESMF) of the proposed project to ensure that the proposed infrastructure takes environmental and social concerns into account.

11. In summary, the Environment and Social Management Framework (ESMF) has been prepared based on:

(a) Assessment of environmental practices in the recently completed and ongoing projects of PGCB and REB;
(b) the overall baseline at selected sub-project area
(c) Evaluation of potential environmental and social impacts of different components (or sub-projects) (e.g., transmission/distribution lines, substations) to be implemented under the proposed project;
(d) Development of component or sub-project specific standard mitigation measures (for negative impacts), enhancement measures (for positive impacts), and monitoring plan;
(e) Identification of institutional barriers and capacity needs for environmental and social management of all stakeholder organizations (including PGCB, REB); and
Development of institutional arrangement with assignment of responsibilities for environmental and social management and monitoring of sub-projects.

Focus Group Discussions (FGDs) involving by a wide range of stakeholders.

To carry out "overall environmental and social assessment", a number of existing substations (both 33/11 kV and 132/33 kV) and possible sites of proposed substations were visited in order to obtain first-hand information and insight on typical baseline scenario surrounding the existing and proposed project locations. Route surveys were carried out along proposed routes of new transmission/distribution lines as well as along transmission/distribution lines to be rehabilitated under the proposed project. In addition, social surveys were also carried out at selected project locations in order to gather and document baseline socio-economic conditions of these areas. Informal discussions were held with people living and working in the surrounding areas.

The detail of assessment with baselines study and public consultation has been shown in the Appendix I and Appendix O.

Objectives of ESMF

The ESMF is intended to provide general policies, guidelines and procedures to be integrated into the design and implementation of all components or sub-projects under the proposed project. The REB and PGCB will adopt the ESMF, which lays out the guideline for the environmental and social impact assessment once the line routes and substation locations will be identified. Its overall objective is to assist PGCB and REB to ensure that:

- Project components (i.e., transmission/distribution line, substations) are formulated considering potential environmental and social issues, especially of those people who would be directly benefited or impacted by the proposed project;
- Project components are designed considering unique socio-cultural and environmental situation prevailing at the areas where the specific project component would be implemented;
- Possible environmental and social impacts of subprojects activities during both construction and operational phases are identified during project formulation and design, and appropriate mitigation/enhancement measures are devised and monitoring plan prepared, as a part of the overall environmental and social management plans;
- Environmental Management Plan (EMP), Social Management Plan (SMP) and Environmental Code of Practices (ECoP) are properly followed; and
- Project activities comply with the relevant policies, rules and regulations of the GoB (e.g., Environmental Conservation Rules 1997) and safeguard policies of the WB. The PGCB/REB will also be responsible for getting necessary environmental clearance from the Department of Environment (DoE).
15. In general, the ESMF will be a guiding document for project-component specific:

- Environmental screening;
- Assessment of impacts (both positive and negative);
- Environmental and Social Assessment;
- Public consultation and disclosure;
- Environmental and Social Management Plans (EMP, SMP);
- Implementation of EMP, SMP and ECoP; and
- Monitoring and reporting.
2.0 POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

16. The proposed Bangladesh Rural Electricity Transmission and Distribution Project will be implemented in compliance with applicable environmental laws and regulations. Bangladesh has an environmental legal framework that is conducive to both environmental protection and natural resources conservation. This environmental legal framework applies to the proposed project in addition, a wide range of laws and regulations related to environmental issues are in place in Bangladesh. Many of these are cross-sectoral and partially related to environmental issues. This chapter presents an overview of the major national environmental laws and regulations that are relevant and may apply to activities supported by the project, institutional arrangement and national and sub-national level, and World Bank safeguard policies.

2.1 National Environmental Policies, Laws and Regulations

National Environmental Policy 1992

17. The concept of environmental protection through national efforts was first recognized and declared in Bangladesh with the adoption of the Environment Policy, 1992 and the Environment Action Plan, 1992. The major objectives of Environmental policy are to i) maintain ecological balance and overall development through protection and improvement of the environment; ii) protect country against natural disaster; iii) identify and regulate activities, which pollute and degrade the environment; iv) ensure environmentally sound development in all sectors; v) ensure sustainable, long term and environmentally sound base of natural resources; and vi) actively remain associate with all international environmental initiatives to the maximum possible extent.

Bangladesh Environmental Conservation Act (ECA) 1995 amended 2002

18. This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. It is currently the main legislative framework document relating to environmental protection in Bangladesh, which repealed the earlier Environment Pollution Control ordinance of 1977. The main provisions of the Act can be summarized as:

- Declaration of ecologically critical areas, and restrictions on the operations and processes, which can be carried or cannot be initiated in the ecologically critical area;
- Regulation in respect of vehicles emitting smoke harmful for the environment;
- Environmental Clearance;
- Regulation of industries and other development activities with regards to discharge permits;
- Promulgation of standards for quality of air, water, noises and soils for different areas for different purposes;
- Promulgation of standard limits for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines;
19. The first sets of rules to implement the provisions of the Act were promulgated in 1997 (see below: “Environmental Conservation Rules: 1997”). The Department of Environment (DoE) implements the Act. DoE is headed by a Director General (DG). The DG has complete control over the DoE and the main power of DG, as given in the Act, may be outlined as follows:

- Identification of different types and causes of environmental degradation and pollution;
- Instigating investigation and research regarding environmental conservation, development and pollution;
- Power to close down the activities considered harmful to human life or the environment;
- Power to declare an area affected by pollution as an Ecologically Critical Area. Under the Act, operators of industries/projects must inform the Director General of any pollution incident. In the event of an accidental pollution, the Director General may take control of an operation and the respective operator is bound to help. The operator is responsible for the costs incurred and possible payments for compensation.

20. The Act was amended in 2006 (SRO No. 175-Act/2006 dated August 29, 2006) on collection and recycling of used/non-functional batteries for conservation of environment, improving environmental standard and control and prevention of environmental pollution. According to this amendment, no recycling of battery will be permitted without environmental clearance of DOE. This also restricted the improper disposal of used batteries or any parts of used battery in open place, water bodies, waste bins etc. All used batteries must be sent to the DOE approved battery recycling industry at earliest convenience. No financial transaction was allowed for used/non-functional batteries. However, the act was amended on same issue again in 2008 (SRO No. 29-Act/2008 dated February 11, 2008) to allow financial transaction on mutually agreed fixed cost.


21. These are the first set of rules, promulgated under the Environment Conservation Act 1995. Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc., (ii) requirement for and procedures to obtain Environmental Clearance, and (iii) requirements for IEE/EIA according to categories of industrial and other development interventions.

22. However, the rules provide the Director General a discretionary authority to grant 'Environmental Clearance' to an applicant, exempting the requirement of site/location clearance, provided the DG considers it to be appropriate.

24. The first step of obtaining Environmental Clearance for the project the proponent is to apply for it in prescribed form, together with a covering letter, to the Director/Deputy Director of respective DoE divisional offices. The application should include a project feasibility study report, the EIA report, No Objection Certificate (NOC) of the local authority; Mitigation Plan for minimizing potential environmental impacts; and appropriate amount of fees in 'treasury chalan' (in the present case the amount is BDT 50,000). The DoE authority reserves the right to request additional information, supporting documents, or other additional materials for the proposed project. Under the conditions specified in the Environment Conservation Rules-1997, the DoE divisional authority must issue environmental site clearance certificates within 60 working days from the date of submitting the application, or the refusal letter with appropriate reasons for such refusal. The clearance issued remains valid for a one-year period and is required to be renewed 30 days prior to its expiry date.

25. Environment Conservation Rules-1997 ensures the right of any aggrieved party to appeal against the notice order or decision to the appellate authority. The appeal should be made to the appellate authority with clear justification and the attested copy of the specific notice, order, or decision of the respective DoE office against, which the appeal is to be made. Prescribed fee is to be paid through treasury Chalan and the relevant papers for the appeal must be placed.

26. Rule 7 of Environment Conservation Rules (ECR) has classified the projects into following four categories based on their site conditions and the impacts on the environment; (a) Green, (b) Orange A, (c) Orange B and (d) Red. Various industries and projects falling under each category have been listed in schedule 1 of ECR 1997. According to the Rules, Environmental Clearance Certificate is issued to all existing and proposed industrial units and projects, falling in the Green Category without undergoing EIA. However, for category Orange A and B and for Red projects, require location clearance certificate and followed by issuing of Environmental Clearance upon the satisfactory submission of the required documents. Green listed industries are considered relatively pollution-free, and therefore do not require site clearance from the DoE. On the other hand, Red listed industries are those that can cause 'significant adverse' environmental impacts and are, therefore, required to submit an EIA report. These industrial projects may obtain an initial Site Clearance on the basis of an IEE based on the DoE’s prescribed format, and subsequently submit an EIA report for obtaining Environmental Clearance. Figure 1 shows the process of application leading to environmental clearance for all four categories of projects.
National Land-use Policy, 2001

27. The Government of Bangladesh has adopted national Land-use Policy, 2001. The salient features of the policy objectives relevant to the proposed are as follows:

- To prevent the current tendency of gradual and consistent decrease of cultivable land for the production of food to meet the demand of expanding population;
- To ensure that land use is in harmony with natural environment;
- To use land resources in the best possible way and to play supplementary role in controlling the consistent increase in the number of land less people towards the elimination of poverty and the increase of employment;
• To protect natural forest areas, prevent river erosion and destruction of hills;
• To prevent land pollution; and
• To ensure the minimal use of land for construction of both government and nongovernment buildings.

**Environment Court Act, 2000**

28. The aim and objective of the Act is to materialize the Environmental Conservation Act, 1995 through judicial activities. This Act established Environmental Courts (one or more in every division), set the jurisdiction of the courts, and outlined the procedure of activities and power of the courts, right of entry for judicial inspection and for appeal as well as the constitution of Appeal Court.

**Bangladesh Labor Act, 2006**

29. This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions. In the chapter VI of this law safety precaution regarding explosive or inflammable dust/ gas, protection of eyes, protection against fire, works with cranes and other lifting machinery, lifting of excessive weights are described. And in the Chapter VIII provision safety measure like as appliances of first aid, maintenance of safety record book, rooms for children, housing facilities, medical care, group insurance etc. are illustrated.

**Public Procurement Rule (PPR), 2008**

30. This is the public procurement rules of Bangladesh and this rule shall apply to the Procurement of Goods, Works or Services by any government, semi-government or any statutory body established under any law. The rule includes the adequate measure regarding the “Safety, Security and Protection of the Environment” in the construction works. This clause includes mainly, the contractor shall take all reasonable steps to (i) safeguard the health and safety of all workers working on the Site and other persons entitled to be on it, and to keep the Site in an orderly state and (ii) protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.

**Bangladesh National Building Code**

31. The basic purpose of this code is to establish minimum standards for design, construction, quality of materials, use and occupancy, location and maintenance of all buildings within Bangladesh in order to safeguard, within achievable limits, life, limb, health, property and public welfare. The installation and use of certain equipment, services and appurtenances related, connected or attached to such buildings are also regulated herein to achieve the same purpose.

32. Part-7, Chapter-3 of the Code has clarified the issue of safety of workmen during construction and with relation to this, set out the details about the different safety tools of
specified standard. In relation with the health hazards of the workers during construction, this chapter describes the nature of the different health hazards that normally occur in the site during construction and at the same time specifies the specific measures to be taken to prevent such health hazards. According to this chapter, exhaust ventilation, use of protective devices, medical checkups etc. are the measures to be taken by the particular employer to ensure a healthy workplace for the workers.

33. Chapter-1, part-7 of the Bangladesh National Building Code (BNBC), states the general duties of the employer to the public as well as workers - "All equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, runway, barricade, chute, lift etc. shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them".

34. Chapter -1, Part-7 of the BNBC clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen. According to section 1.2.1 of chapter 1 of part 7, "in a construction or demolition work, the terms of contract between the owner and the contractor and between a consultant and the owner shall be clearly defined and put in writing. These however will not absolve the owner from any of his responsibilities under the various provisions of this Code and other applicable regulations and bye-laws. The terms of contract between the owner and the contractor will determine the responsibilities and liabilities of either party in the concerned matters, within the provisions of the relevant Acts and Codes (e.g.) the Employers' Liability Act, 1938, the Factories Act 1965, the Fatal Accident Act, 1955 and Workmen's Compensation Act 1923". (After the introduction of the Bangladesh Labor Act, 2006, these Acts have been repealed).

35. To prevent workers falling from heights, the Code in chapter 3 of part 7 sets out the detailed requirements on the formation and use of scaffolding. According to section 11.2 of the same chapter, "every temporary floor openings shall either have railing of at least 900 mm height or shall be constantly attended. Every floor hole shall be guarded by either a railing with toe board or a hinged cover. Alternatively, the hole may be constantly attended or protected by a removable railing. Every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides except at entrance to stairway. Every ladder way floor opening or platform shall be guarded by a guard railing with toe board except at entrance to opening. Every open sided floor or platform 1.2 meters or more above adjacent ground level shall be guarded by a railing on all open sides except where there is entrance to ramp, stairway or fixed ladder. The precautions shall also be taken near the open edges of the floors and the roofs".

The Electricity Act, 1910

36. The main objective of this act is to amend the laws relating to the supply and use of electrical energy in Bangladesh. This act comprises of guidelines related to licenses, works, and supply for the supply of energy. It also includes guidelines related to supply, transmission and
use of energy by non-licensees. A licensee is a person authorized by the Government to supply energy in any specified area and permitted to lie down or place electric supply lines for the conveyance and transmission of energy. In Part II of this act, guidelines are provided for carrying out works for the supply of energy. This act includes guidelines related to the execution of any works involved in placing of any infrastructure in, under, over, along or across any street, part of a street, railway, tramway, canal or waterway. Also, information on lying of electric supply lines, aerial lines, or other works near sewers, pipes or other electric supply-lines or works is provided in Part II of the act. According to this act a licensee shall, in exercise of any of the powers conferred by or under this act, cause as little damage, detriment and inconvenience as may be, and shall make full compensation of any damage, detriment and inconvenience caused by him or by any one employed by him. In Part IV of this act, Protective Clauses are provided for protection of railways and canals/waterways, docks, wharves and piers, telegraphic, telephonic and electric signaling lines. Part IV also includes guidelines for occurrences of any criminal offences such as dishonest abstraction of energy, installation of artificial means, malicious wasting of energy or injuring works, theft of line materials, tower members, equipments etc. and subsequent procedures to follow up that criminal offence.

Electricity (Amendment) Act, 2012 (Draft)

37. This act is an amendment to The Electricity Act, 1910. In addition to the guidelines provided in the original act (The Electricity Act, 1910), this act includes more specific instruction relating to obligation on licensee to supply energy. According to section 22A (Sub section 1) of this act: a person authorized by a license, or exempted from the requirement to obtain a license, to generate, transmit, distribute or supply electricity - (a) shall, in generating, transmitting, distributing or supplying electricity, have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and (b) shall do what the person reasonably can to mitigate any effect which such generation, transmission, distribution or supply would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects. In section 22A (Sub-section 2) it is mentioned that, without prejudice to the provisions of Sub- section (1), a person authorized by a license, or exempted from the requirement to obtain a license, to generate, transmit, distribute or supply electricity and/or the Commission shall, in generating, transmitting, distributing or supplying electricity, or as the case may be, in the discharge of the Commission's functions, avoid, so far as reasonably practicable, causing injury to fisheries or to the stock of fish in any waters. Section 22A (Sub-section 3 and 4) of this act also mentions that a generation licensee shall, in circumstances specified by the Commission, be entitled to construct, subject to conditions specified by the commission in consultation with the relevant water authority, water ways and pipelines, and to use water for its licensed activities and the relevant water authority shall not unreasonably deny such right. For this purpose the 'relevant water authority' means such authority, as the Commission shall determine.
2.2 National Social Policies, Laws and Regulations

38. Infrastructure development projects using lands in Bangladesh is designed and implemented under the legislative and regulatory framework to compensate the affected persons due to land acquisition using the power of eminent domain. Whenever it appears to the Government that any property in any locality is needed or is likely to be needed for any public purpose or in the public interest, the property is acquired using existing laws and regulations. Land acquisition is governed by the Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance II of 1982). The ordinance supersedes earlier laws including the Land Acquisition Law of 1894 and others that have been in force between 1947 and 1982. In addition to the Ordinance, acquisition of any land or forest area in Chittagong Hill-Tracts (CHT) districts requires consent under the Chittagong Hill-Tracts (Land Acquisition) Regulation 1958, the CHT Regional Council Act 1998 and the Forest Act (1927). There is no national policy in Bangladesh governing social effects of infrastructure development projects on the project area communities. However, the Constitution of Bangladesh provides some rights to the affected persons, communities and groups those are not upheld in the Ordinance II of 1982 which is the instrument followed for land acquisition. The active instruments under the legislative and regulatory framework in Bangladesh are discussed below:

Constitution of Bangladesh

39. The fundamental rights under the Constitution indicate the general guidelines for a policy on resettlement/rehabilitation of citizens adversely affected (whatever be the mechanism) due to any activity of the State. Article 40 of the constitution states categorically that every citizen has the right to practice any lawful occupation which implies that anything impeding such right (a) should not be done or (b) there should be supplementary measures to make good the losses incurred by the citizen. Resettlement and rehabilitation of adversely affected people due to infrastructure projects very clearly falls within this requirement for supplementary measures. However, as per Article 42, sub-clause 2, no law with provision of compensation for acquisition of land can be challenged in a court on the ground that such compensation has been inadequate. However, under World Bank OP 4.12 Involuntary Resettlement, every affected person will have access to a project specific Grievance Redress Mechanism for dispute resolution before the matter is moved to the courts. Complaints, the resolution process and the outcome will be reviewed by the project proponents as well as the Bank. Until the dispute is resolved the funds for the disputed asset must be held in a escrow account (top-up payments due from the project agency can be held until the project closes; the amount placed with the DC may be held for 10 years or more if necessary).

The Acquisition and Requisition of Immovable Property Ordinance, 1982

40. The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance II of 1982 with amendments up to 1994) and other land laws and administrative manuals relevant to land administration in Bangladesh. According to the Ordinance, whenever it appears to the Government of Bangladesh that any property in any locality is needed or is likely to be needed for any public purpose or in the public interest, the Government can acquire the land provided
that no property used by the public for the purpose of religious worship, graveyard and cremation ground. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Deputy Commissioner (DC) determines (a) market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in the area over the preceding 12 months), and (b) 50% premium on the assessed value (other than crops) due to compulsory acquisition. The 1994 amendment made provisions for payment of crop compensation to tenant cultivators. The law specifies methods for calculation of market value of property based on recorded prices obtained from relevant Government departments such as Registrar (land), Public Works Department (structures), Department of Forest (trees), Department of Agriculture (crops) and Department of Fisheries (fish stock). Given that people devalue land during title transfer to minimize tax payment, compensation for land paid by DC including premium largely remains less than the actual market price.

41. The Ministry of Land (MOL) is authorized to deal with land acquisition. The MOL delegates some of its authority to the Commissioner at Divisional level and to the Deputy Commissioner at the District level. The Deputy Commissioners (DCs) are empowered by the MOL to process land acquisition under the Ordinance and pay compensation to the legal owners of the acquired property. The Deputy Commissioner is empowered to acquire a maximum of 50 standard bigha (6.75 ha) of land without any litigation where the Divisional Commissioner is involved for approval. Acquisition of land more than 50 standard bigha is approved from the central land allocation committee (CLAC) headed by the chief executive of the Government of Bangladesh proposed by the MOL.

42. The land owner needs to establish ownership by producing record-of-rights in order to be eligible for compensation under the law. The record of rights prepared under 4. 143 or 144 of the State Acquisition and Tenancy Act 1950 (revised 1994) are not always updated and as a result legal land owners have faced difficulties trying to "prove" ownership. The affected person (AP) has also to produce rent receipt or receipt of land development tax, but this does not assist in some situations as a person is exempted from payment of rent if the area of land is less than 25 bighas (3.37 ha).

Constitutional Right of the Tribal People

43. The Constitution of Bangladesh does not mention the existence of the cultural and ethnic minorities in Bangladesh. The only protective provision for the ethnic minorities that the policy makers often refer to is Article 28 (4) which states that: Nothing shall prevent the state from making special provision in favour of women and children or for the advancement of any backward 4. of the citizens. The above provision is an ambiguous one and it does not define who or what constitutes "backward". However, the Government recognizes existence of "tribal
peoples" and the need for special attention and in general tribal people are essentially viewed as backward, poor and socio-economically & culturally inferior. Towards this end a special program was initiated in 1996-97 by the Prime Minister's Secretariat aimed at improving the socio-economic situation of the indigenous people of Bangladesh, resident outside the Chittagong Hill Tracts.

The Chittagong Hill Tracts Regulation 1900

44. The Chittagong Hill Tracts Regulation, 1900 (Regulation I of 1900) is the regulatory framework for state sovereignty over the traditional rights of the tribal peoples living in the Chittagong Hill Tracts (CHTs) region. They are governed through Revenue Circle Chiefs who are local revenue collectors vide an amalnama (authorization by the Government). The Deputy Commissioner and the Commissioner from the Central Government reserve the authority to settle land to the hill-men or non-hill residents or lease out land (non-transferable) for rubber plantation or establishing industries in the CHTs. The regulation provides the right to possessing cultivable land up to 5 acres by hill men or non-hill residents. The headman is responsible for the conservation of the resources of his mouza through exercising his authority to (i) prohibit the removal of forest produces by residents of respective mouzas other than for their domestic purposes or by non-residents for any purpose, (ii) exclude any area or areas in his mouzas from the jhuming (shifting cultivation), (iii) prevent new comers from cutting jhums in his mouza, and (iv) prevent a person from grazing cattle in his mouza.

The Chittagong Hill Tracts (Land Acquisition) Regulation, 1958

45. Most of the land in CHT belongs to the Government either as reserve forest or as unclassified state forest. The CHT Regulation I of 1900 was the sole legal instrument for the governance and administration of the Hill Tracts. Under the regulation, the DC could resume land even though settlement of the same might have been given earlier. The rule prescribed payment of compensation for various interests as in the case of land acquisition. In order to expedite the acquisition of land in CHT, the Government made the Chittagong Hill Tracts (Land Acquisition) Regulation, 1958. This regulation has provision for payment of compensation for requisitioned property. The compensation may be fixed by agreement or by rules framed on this behalf.

The Chittagong Hill-Tracts (Land Acquisition) Act, 1998

46. The National Parliament of Bangladesh in 24 May 1998 passed the Peace Accord 1997 as the "Chittagong Hill Tracts Regional Council Act, 1998 (Act 12 of 1998). In addition to re-establishing peace, the Accord recognized the ethnic people’s right to land, culture, language, and religion. The Accord set out detailed provisions for strengthening the system of self-governance in the CHT, and redressing the most urgent land-related problems including resolution of land disputes by a commission on land, the transfer of authority for land administration to the hill district councils (HDCs), the cancellation of lease granted to non-residents during the conflict period, the distribution of land to ethnic or "tribal" villages, and the strengthening of customary land rights. Under this Act, no lands, hills and forests within the control and jurisdiction of the HDCs shall be acquired or transferred by the government without
consultation and consent of the Regional Council. No law will be executed in the region which is not developed and enacted in consultation and agreement with the tribal peoples in CHT. A ministry on CHT Affairs was established by appointing a minister from among the tribal communities of hill districts. An Advisory Council from the CHT region assists this ministry.

2.3 Institutional Arrangements at National and Sub-national Levels

47. As outlined in the National Environment Policy (1992) and National Forest Policy (1994), the Ministry of Environment and Forests (MoEF) acts as the guide and custodian for the conservation and development of the environment and, in the pursuit of that goal, to ensure through appropriate laws and regulations that natural resources, including land, air, water and forests, are exploited and managed in an environmentally sustainable manner. The Department of Environment (DoE), formed in 1989 with a mandate for environmental management later formalized under the Environment Conservation Act, 1995 (ECA'95), acts as the technical arm of the Ministry and is responsible for environmental planning, management, monitoring and enforcement. The DoE is headed by a Director General, with Divisional offices in Dhaka, Chittagong, Bogra, Khulna, Barisal and Sylhet. The Environment Conservation Rules (1997) provide the Director General a discretionary authority to grant 'Environmental Clearance' to an applicant, exempting the requirement of site/location clearance, provided the DG considers it to be appropriate.

48. The mandate of the Department has expanded over time, evolving from an exclusive focus on pollution control to include natural resources and environmental management, now covering:

- monitoring environmental quality;
- promoting environmental awareness through public information programs;
- controlling and monitoring industrial pollution;
- reviewing environmental impact assessments and managing the environmental clearance process; and,
- establishing regulations and guidelines for activities affecting the environment

2.4 World Bank Environmental and Social Safeguard Policies

49. The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. Safeguard policies provide a platform for the participation of stakeholders in project design, and act as an important instrument for building ownership among local populations. The effectiveness and development impact of projects and programs supported by the Bank has substantially increased as a result of attention to these policies. The World Bank has ten environmental, social, and legal safeguard policies which are listed in the following:

**Environmental policies:**

- OP/BP 4.01 Environmental Assessment
- OP/BP 4.04 Natural Habitats
- OP/BP 4.08 Pest Management
50. Operational Policies (OP) are the statement of policy objectives and operational principles including the roles and obligations of the Borrower and the Bank, whereas Bank Procedures (BP) is the mandatory procedures to be followed by the Borrower and the Bank. Apart from these, the IFC guidelines for Environmental Health and safety have been adopted by the World Bank Group which is also relevant for environmental protection and monitoring. In addition to that the Policy on Access to Information of World Bank also relates to environmental safeguard. The environmental safeguard and access to information policy as well as the IFC guidelines are discussed below:

**OP/BP 4.01 Environmental Assessment**

51. This policy is considered to be the umbrella safeguard policy to identify, avoid, and mitigate the potential negative environmental and social impacts associated with Bank lending operations. In World Bank operations, the purpose of Environmental Assessment is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted. The borrower is responsible for carrying out the EA and the Bank advises the borrower on the Bank’s EA requirements. The Bank classifies the proposed project into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts:

- **Category A:** The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

- **Category B:** The proposed project’s potential adverse environmental impacts on human population or environmentally important areas—such as wetlands, forests, grasslands, or other natural habitats—are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than Category A projects.

- **Category C:** The proposed project is likely to have minimal or no adverse environmental impacts.

**OP/BP 4.04 Natural Habitats**

52. The conservation of natural habitats is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats.
and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

**OP/BP 4.09 Pest Management**

53. The aim of the pest management policy is to minimize and manage the environmental and health risks associated with pesticide use and promote and support safe, effective and environmentally sound pest management. The procurement of any pesticide in a Bank-financed project is contingent on an assessment of the nature and degree of associated risks, taking into account the proposed use and the intended user. To manage pests that affect either agriculture or public health, the Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. In Bank-financed projects, the borrower addresses pest management issues in the context of the project’s environmental assessment. In appraising a project that will involve pest management, the Bank assesses the capacity of the country’s regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management.

**OP/BP 4.11 Physical Cultural Resources**

54. Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Their cultural interest may be at the local, provincial or national level, or within the international community. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people’s cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower’s national legislation, or its obligations under relevant international environmental treaties and agreements. The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process.

**OP/BP 4.36 Forests**

55. Forest is defined as an area of land of not less than 1.0 hectare with tree crown cover (or equivalent stocking level) of more than 10 percent that have trees with the potential to reach a minimum height of 2 meters at maturity in situ. A forest may consist of either closed forest formations, where trees of various stories and undergrowth cover a high proportion of the ground, or open forest. The definition includes forests dedicated to forest production, protection, multiple uses, or conservation, whether formally recognized or not. The definition excludes areas where other land uses not dependent on tree cover predominate, such as agriculture, grazing or settlements. In countries with low forest cover, the definition may be
expanded to include areas covered by trees that fall below the 10 percent threshold for canopy density, but are considered forest under local conditions. The Bank’s forests policy recognizes the importance of forests to reduce poverty in a sustainable manner integrates forests effectively in economic development, aims to reduce deforestation, promote afforestation and enhance the environmental contribution of forested areas. The Bank assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services.

**OP/BP 4.37 Safety of Dams**

56. When the World Bank finances new dams, the Policy Safety on Dams requires that experienced and competent professionals design and supervise construction, and that the borrower adopts and implements dam safety measures through the project cycle. The policy also applies to existing dams where they influence the performance of a project. In this case, a dam safety assessment should be carried out and necessary additional dam safety measures implemented.

**OP/BP 4.12 Involuntary Resettlement**

57. This policy is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement. The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects.

**OP 4.10 Indigenous People**

58. The term “Indigenous Peoples” is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees:

- self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
- an indigenous language, often different from official language of the country/region.

59. The Bank provides project financing only where free, prior, and informed consultation results in broad community support to the project by the affected Indigenous Peoples. Such Bank-financed projects include measures to (a) avoid potentially adverse effects on the Indigenous Peoples’ communities; or (b) when avoidance is not feasible, minimize, mitigate, or
compensate for such effects. Bank-financed projects are also designed to ensure that the Indigenous Peoples receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

**OP/BP 7.50 Projects on International Waterways**

60. The World Bank recognizes the issues involving projects in international waterways and attaches importance to the riparians making appropriate agreements or arrangements for the entire waterway, or parts thereof. In the absence of such agreements or arrangements, the Bank requires, as a general rule, that the prospective borrower notifies the other riparians of the project. The Policy lays down detailed procedures for the notification requirement, including the role of the Bank in affected the notification, period of reply and the procedures in case there is an objection by one of the riparians to the project.

**OP/BP 7.60 Projects in Disputed Areas**

61. The World Bank finances projects in disputed areas when either there is no objection from the other claimant to the disputed area, or when special circumstances of case support Bank financing, notwithstanding the objection. The policy details those special circumstances.

**IFC Environmental, Health and Safety Guidelines**

62. The Environmental, Health and Safety (EHS) Guidelines of the World Bank Group (WBG)/International Finance Corporation (IFC), 2008 is the safeguard guidelines for environment, health and safety for the development of the industrial and other projects. They contain performance levels and measures that are considered to be achievable in new facilities at reasonable costs using existing technologies. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

63. The section 4 of EHS Guidelines for “Construction and Decommissioning” provides additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

**World Bank Policy on Access to Information**

64. In addition to the safeguard policies, the Access to Information Policy also relates to safeguards. To promote transparency and facilitate accountability, Bank Access to Information Policy supports decision making by the Borrower and Bank by allowing the public access to information on environmental and social aspects of projects in an accessible place and understandable form and language to key stakeholders. The Bank ensures that relevant project-related environmental and social safeguard documents, including the procedures prepared for
projects involving subprojects, are disclosed in a timely manner before project appraisal formally begins. The policy requires disclosure in both English and local language and must meet the World Bank standards.

2.5 Implications of National Policies and Regulations on the Proposed Project

65. The Environmental Conservation Rules (ECR) 1997 (DoE, 1997) classifies projects into four categories according to potential environmental impacts: (1) Green; (2) Orange A; (3) Orange B; and (4) Red. Green category projects are those with mostly positive environmental impacts or negligible negative impacts; Orange A category projects are those with minor and mostly temporary environmental impacts for which there are standard mitigation measures; Orange B category project are those with moderately significant environmental impacts; while Red category projects are those with significant adverse environmental impacts. Upgradation/rehabilitation of power distribution line also appears to fall under "Red Category", according to ECR 1997. Based on field visits to potential project sites and experience (of PGCB and REB) from implementation of similar projects, it appears that upgradation/rehabilitation of transmission/distribution lines are not likely to generate significant environmental/social impacts. Such projects would not require acquisition of land, and would involve construction works along existing corridors of power lines. Therefore, for such upgrading/rehabilitation works, a thorough "environmental/social" screening should be carried out first (following guidelines presented in the ESMF); if the "screening" exercise does not indicate significant environmental/social impacts, the DoE should be approached for permitting less stringent requirement (e.g., IE and EMP as required for "Orange B" category projects) for obtaining environmental clearance of such upgrading projects. Construction/installation of substations is not specifically listed in the ECR 1997. Depending on the type of substation (132/33 kV or 33/11 kV), and technology employed (e.g., AIS/GIS substation), land requirement for a substation would vary from approximately 0.33 acre for an indoor type 33/11 kV substation to about 5 acres for a 132/33 kV air insulated switchgear (AIS) grid substation. Acquisition of private land usually generates significant socio-economic impacts. Hence, construction of a substation would require land, that land will directly purchased. During field visits to potential projects sites as a part of overall environmental/social assessment, it was learnt that some of the substations under the proposed project would be constructed on Government owned land. For such substations, potential environmental and social impacts are not likely to be significant; these projects could potentially fall under "Orange A" or "Orange B". The DoE should be approached for guidance in this regard, after carrying out a thorough "environmental/social" screening of such projects (following the guideline presented in the ESMF). These issues have been further discussed in section 4.4.

66. The BNBC, PPR 2008, Bangladesh Labor Act 2006 outlines guidelines for ensuring worker's health and safety during construction works which would have direct implications in the proposed project. It would be the responsibilities of the contractors to make sure that these guidelines are followed in the workplace environment.
67. Acquisition and Requisition of Immovable Property Ordinance, 1982 will be followed in order to acquire land for installation of structures related to transmission lines in any areas in Bangladesh except for the Chittagong hill tracts. In land acquisition issues in Chittagong hill tracts, the specific acts and regulations related to Chittagong hill tracts (The Chittagong Hill Tracts (Land Acquisition) Regulation, 1958, The Chittagong Regional Council Act, 1998) needs to be adhered to.

2.6 Implications of World Bank Safeguard Policies on the Proposed Project

68. According to WB Operational Policy (OP 4.01), the nature of environmental assessment to be carried out for a particular sub-project would largely depend on the category of the sub-project. As mentioned earlier, The World Bank Operational Policy (OP) 4.01 classifies projects into three major categories (category A, B and C), depending on the type, location, sensitivity and scale of the project, and nature and magnitude of potential impacts. The rural electricity distribution and transmission project will be a category B project according to World Bank classification, since no large-scale infrastructure investment or major expansion will be implemented under the proposed project. The environmental impacts of the project are expected to be mostly construction related and limited within the project boundaries.

69. It is highly unlikely that any natural habitat formed largely by native plant and animal species will be affected or modified during the construction phase of power transmission and distribution lines. However, the World Bank policy related to conservation of Natural Habitats (OP/BP 4.04) has been triggered as advance precautionary measures. Similarly, the World Bank Policy on Forest (OP/BP 4.36) has also been triggered since some of the transmission and distribution lines may cross the forest area. The possible impact on natural habitats and forest will be addressed through subproject specific environmental screening/assessment and EMP.

70. Since the routes are unknown at this stage, there is possibility that the transmission and distribution lines may pass through areas with physical cultural resources. However, the impacts will be examined as part of the environmental screening/assessment of different subprojects and the criteria for assessment will be provided in the ESMF. In addition, 'Chance find' procedures conforming to local legislation on heritage would be evaluated so that any physical or cultural resources are not impacted. Therefore, OP 4.11 (Physical Cultural Resources) has been triggered as advance precautionary measures.

71. The activities of the project will not involve any pesticide application, include activities in forest areas or relate to protection of dams. Hence, OP/BP 4.09 and OP/BP 4.37 will not be relevant.

72. The transmission and distribution lines and substations may intervene in areas where indigenous people live (specific subproject locations will be determined during implementation). As such, OP 4.10 has been triggered for the project. The ESMF will include an Ethnic/ Tribal Peoples Development Framework, based on which site specific Ethnic/ Tribal Peoples Plan (ETPP) will be developed as and when required.
73. The addition of lines and establishment of new substations will require land; this may be public or private land depending on the routing of the lines and requirements of the substation location. Thus OP 4.12 has been triggered for the project.

74. The project components do not involve any infrastructure development in international waterways or in disputed areas. Therefore the World Bank safeguard policies OP/BP 7.50 and OP/BP 7.60 will not be triggered.

75. The IFC guidelines provide guidance on certain EHS issues, which include standards for environmental parameters (ambient air quality, water and wastewater quality, noise level, waste management), hazard and accident prevention, occupational and community health and safety (during commissioning and decommissioning works) etc. These guidelines will be directly applicable to the proposed project. As a general rule, the IFC guidelines should complement the existing Bangladesh guidelines or standards. In case the Bangladesh guidelines or standards differ from the IFC guidelines, project is expected to follow the more stringent ones.

76. The World Bank access to information policy would be directly followed. The project will make the environmental/social assessment and ESMF documents available to the public by publishing it in their websites. In addition, Hard copies of these documents in English (including a summary in Bengali) will be made available in the local and head offices of the PGCB and REB so that the local stakeholders can gain access to it if they want.
3.0 MAJOR SUB-PROJECT ACTIVITIES

3.1 Construction of 33/11kV Substations:

77. The power distribution system of the country is based on the power generation and transmission through the national grid, which eventually is fed into substations capable of converting 33kV supply into 11kV and feeding the distribution system with the same. Most of the new substations will be of outdoor type, which typically requires about 0.33 acre land. A line diagram of the different units in a 33/11kV substation is shown in Figure 3.2.

![33/11kV Outdoor-type Substation](image)

Figure 3.2: Line diagram showing different units of a 33/11kV Substation

78. Once the selection and acquisition of land for the Substation are done, subsoil investigations have to be carried out to assess the suitability of the soil for construction of the building and other infrastructure. The civil construction works include the construction of the control room (building) along with the construction of the foundations for different equipment, followed by the construction of the boundary wall and the guard room.

79. After manufacturing and shipment of the 33kV auto reclosers, 11kV auto reclosers and the 33/1.732/11/1.732kV single phase transformers, these are installed in the switchyard within the Substation complex. It should be noted that the weight of such transformer may exceed 15 tons. Connectivity with the incoming line and the switchgears and between the switchgears and the transformers and the outgoing lines is achieved by laying 33kV, 11kV and...
0.415kV cables along with the control cables both inside and outside the control building. Lightening arrestors as well as earthing cable need to be installed to prevent damage of equipment due to lightening during a storm event. The Terminal Structures for the 33kV and 11kV lines need to be constructed within the premises of the Substation for final connectivity with the distribution system.

80. In summary, the following specific activities need to be considered for assessing environmental impacts during construction phase of a 33/11kV Substation.

- Acquision of land for Substation;
- Mobilization of material and equipment;
- Civil works, including design and construction of foundation for structures, boundary walls, guard-room, etc;
- Installation of electrical equipment, including 33kV and 11kV Auto reclosers, 33/1.732/11/1.732kV transformers, construction of Terminal structures for 33 and 11kV lines; and
- Testing and commissioning of Substation.

3.2 Construction of 33kV and 11kV Distribution Lines:

81. The first step in constructing the distribution lines is conducting a survey of the probable routes. A topographical survey is often conducted along the selected route to assess the need for ground modification and/or preparation. Spun Prestressed Concrete (SPC) poles are erected along the selected routes at designated intervals. The height of the poles depends on the supply power. Usually, 16m poles are used for 33kV distribution line, which also is used simultaneously to extend the 11kV and 0.415kV lines. H-poles are used to mount the 11/0.415kV transformers from which three phase lines are extended to the domestic users. Figure 3.3 shows a schematic diagram of such an H-pole with the dual lines for 33kV and 11kV power distribution.

82. After procuring, the SPC poles are stacked along the route at designated storage areas beside the road. A hydraulic jack and drilling rig equipped truck is generally used for the installation of the SPC poles. First, the existing short poles are pulled out and the exposed hole is enlarged and deepened by the truck-mounted drilling rig and the 16m SPC poles (with two concrete blocks at the bottom) are inserted with the help of the hydraulic elbow-jack mounted on the truck. Following erection of poles, assortments are installed for extending the 33kV, 11kV and 0.415kV lines. A copper wire is passed through the poles into the ground to secure earthing. Lightening arrester is installed at the top. Drop fuses are mounted on top of the H-poles to prevent short-circuiting.

83. Thus, for the purpose of assessing environmental impact, the following activities related to the construction of 33kV and 11kV lines have been considered in the present study.

- Route survey and analysis of alternative routes for finalizing alignment of distribution lines;
• Mobilization of material and equipment, including procurement of SPC poles, conductor and line materials;
• Construction of distribution lines including erection of the SPC poles using a truck equipped with hydraulic jack and drilling rig; about 45 minutes is required for the erection of a distribution pole;
• Clearing of right of way by cutting/trimming trees where necessary;
• Stretching of cables across poles; and
• Checking, testing and commissioning of distribution.

Figure 3.3: Typical H-Pole Arrangement along 33 kV and 11kV Distribution Lines

3.3 Rehabilitation of 33 kV distribution lines:

REB is using some old 33kV lines of Bangladesh Power Development Board (BPDB). There are some damaged towers, under specified steels poles, concrete poles, pre-stressed concrete poles, under size conductors, insulators, fittings, clamps etc. in the old lines. The old lines are to be replaced with 16m pre-stressed concrete poles, higher size of conductor of size 477MCM, new insulators, clamps, fittings etc. The old lines are to be rerouted. New grounding of each pole is to be carried out. Thus, the major activities involved in the rehabilitation of 33 kV distribution lines include:
• Mobilization of materials including procurement of SPC Poles, Conductor, earth wire and line materials;
• Construction of new distribution line including replacement of damaged towers, under specified poles by SPC, damaged clamps and fittings by new ones and replacement of undersize conductor and earth wire by 477MCM conductor and new earth wire;
• Clearing of right of way by cutting trees where necessary; and
• Testing and Commission.

3.4 Construction of 132 kV transmission lines:

85. The first step in constructing the transmission lines is conducting a survey of the probable three routes. A topographical survey is often conducted along the selected route to assess the need for ground modification and/or preparation. Towers are erected along the selected route at designated intervals. Finally, after completion of construction works, checking, testing and commissioning of the transmission lines are carried out.

86. In summary, the following specific activities need to be considered for assessing environmental impacts during construction phase of 132 kV transmission lines.
• Route survey and analysis of alternative routes for finalizing alignment of distribution lines;
• Mobilization of material and equipment, including procurement of towers components, conductor and line materials;
• Construction of transmissions lines including erection of the towers.
• Clearing of right of way by cutting/trimming trees where necessary
• Stringing of conductor and earth wire after fixing clamps, insulators.
• Checking, testing and commissioning of transmission lines

3.5 Rehabilitation of 132 kV transmission lines:

87. In transmission system of Power Grid Company of Bangladesh, there are old 132KV lines of more than 30 years, feeding power to old 132/33KV Substation. Due to aging, the capacity of the conductors is less than the rated value. The earth wire connected to line is damaged due to aging. The fittings, clamps, insulators, etc are not in good condition due to aging. The groundings of towers need to be replaced. The old conductors need to be replaced by higher size conductors. Old earth wire, old insulators, clamps and fittings, etc are to be replaced by new ones. Thus, the major activities involved in the rehabilitation of 132 kV transmission lines include:
• Detailed survey of existing 132 kV lines;
• Mobilization of materials, including procurement of conductors, earth wire and line materials;
• Replacement of damaged clamps, fittings and insulators by new ones;
• Stringing of higher size conductors by replacing old ones;
• Stringing of new earth wire by replacing old ones;
• Clearing right of way by cutting/trimming trees; and
• Testing and commissioning.
3.6 Construction and installation of 132/33 kV substations (GIS and AIS):

88. Most of the new substations to be constructed under the proposed project will be of Indoor Type (GIS) and Outdoor Type (AIS), which typically requires about 3 acres and 5 acres of land, respectively. However, where adequate land is not available, it is possible to construct such a substation on a smaller piece of land. A line diagram of the different units in an Indoor Type 132/33 kV substation is shown in Fig. 3.4. As shown in Fig. 3.4, the 132 kV and 33 kV switchgears are installed inside a building, which serves as a control center for the substation. The transformers are installed outside in the switchyard.

89. Once the selection and acquisition of land for the substation are carried out subsoil investigations have to be carried out to assess the suitability of the soil for construction of the building and other infrastructure. The civil construction works include the construction of the control room (building) along with the construction of the foundations for different equipment, followed by the construction of the boundary wall and the guard room.

90. For GIS Substation, the 132 kV switchgears, 33 kV switchgears along with the control panels are installed inside the control building. Installation of the 132/33 kV transformers for the distribution system and the 33/0.415 kV transformer for the Substation is done in the switchyard within the Substation complex (Fig. 3.5). It should be noted that the weight of such transformer may exceed 100 tons. Connectivity with the incoming line and the switchgears and between the switchgears and the transformers and the outgoing lines is achieved by laying 132 kV, 33 kV and 0.415 kV cables along with the control cables both inside and outside the

![Diagram of 132/33 kV Indoor-type Substation](image-url)
control building. Lightening arrestors as well as earthing cable need to be installed to prevent damage of equipment due to lightening during a storm event. The Terminal Structures for the 132kV and 33kV lines need to be constructed within the premises of the Substation for final connectivity with the transmission system.

91. Prior to stretching the cables, danger trees are trimmed along the cable route as per the specification in the guidelines. In level terrains, trees, which would reach within 1.524m of a point underneath the outside conductor, are examples of danger trees. As directed by the Engineer-in-Charge, portions of these trees are cut along the right of way so that the movement of trucks and tractors is not hampered by the stumps (Fig. 3.6). Finally, after completion of construction works, checking, testing and commissioning of the distribution lines are carried out. In summary, the following specific activities should be considered for assessing environmental impacts during construction phase of a 132/33kV Substation:

- Acquisition of land for substation
- Mobilization of material and equipment
- Civil works, including design and construction of control room building, boundary walls, guard room, etc.
- Installation of electrical equipment, including 132kV and 33kV switchgears, 132/33kV transformers, 33/0.44kV station service transformer, laying of 132, 33 and 0.415kV power cables and control cables, construction of Terminal structures for 132 and 33kV lines.
- Testing and commissioning of Substation

![Diagram of 132/33kV Outdoor-type Substation](image)

**Figure 3.5:** Line diagram showing different units of a 132/33kV Outdoor Type Substation
### Figure 3.6: Pictorial Guidelines for Trimming Trees

![Diagram showing tree trimming guidelines](image)

#### 3.7 Substations - Operational Phase:

92. The maintenance and operation require monitoring of transformers, which is usually done by performing Acidity tests of transformer oil at regular intervals. Also, Dielectric strength is measured every 6 to 12 months and if breakdown is found (when < 22kV), measures are taken to increase strength by filtering oil and/or by reclaiming mechanical devices. Otherwise, transformer oil is changed as per the regulation. Based on type, the transformer oil is usually a hazardous material requiring appropriate disposal. PCBs do not break down when released into the environment but accumulate in the tissues of plants and animals, where they can have hormone-like effects. When burned, PCBs can form highly toxic products, such as chlorinated dioxins and chlorinated dibenzofurans. The production and new uses of PCBs have been banned due to concerns about the accumulation of PCBs and toxicity of their byproducts. In many countries significant programs are in place to reclaim and safely destroy PCB contaminated equipment. In design consideration section of this ESMF highlighted that PGCB/REB will ensure purchase and installation of PCB-free new transformers. As well as necessary clauses at bid document will be inserted for supplying the PCB-free transformer.

93. Polychlorinated biphenyls were banned in 1979 in the US. Since PCB and transformer oil are miscible in all proportions, and since sometimes the same equipment (drums, pumps, hoses, and so on) was used for either type of liquid, contamination of oil-filled transformers is possible. Today, most transformers use a fluid that achieves a much higher performance level than standard naphthenic mineral oil, with far less risk. Mineral oils invariably have an issue with corrosive sulphur that can render them problematic in service, and attempts to balance...
this out with copper passivators are insufficient compared to readily-available, safer alternatives.

94. Pentaerythritol tetra fatty acid natural and synthetic esters have emerged as an increasingly common mineral oil alternative. They offset all the main risks associated with mineral oil, such as high flammability, environmental impact and poor moisture tolerance. Esters are also non-toxic to aquatic life, readily biodegradable and provide a lower volatility and higher flash point. Additionally, they have a high fire point of over 300°C and K-class fluids such as these are often used in high-risk transformer applications, such as indoors or offshore. They also have a lower pour point, greater moisture tolerance and improved function at high temperatures.

95. Transformer oils are subject to electrical and mechanical stresses while a transformer is in operation. In addition, there is contamination caused by chemical interactions with windings and other solid insulation, catalyzed by high operating temperature. The original chemical properties of transformer oil change gradually, rendering it ineffective for its intended purpose after many years. Oil in large transformers and electrical apparatus is periodically tested for its electrical and chemical properties, to make sure it is suitable for further use. Sometimes oil condition can be improved by filtration and treatment. Tests can be divided into:

1. Dissolved gas analysis
2. Furan analysis
3. PCB analysis
4. General electrical & physical tests:
   o Color & Appearance
   o Breakdown Voltage
   o Water Content
   o Acidity (Neutralization Value)
   o Dielectric Dissipation Factor
   o Resistivity
   o Sediments & Sludge
   o Interfacial Tension
   o Flash Point
   o Pour Point
   o Density
   o Kinematic Viscosity

96. The details of conducting these tests are available in standards released by IEC, ASTM, IS, BS, and testing can be done by any of the methods. The Furan and DGA tests are specifically not for determining the quality of transformer oil, but for determining any abnormalities in the internal windings of the transformer or the paper insulation of the transformer, which cannot be otherwise detected without a complete overhaul of the transformer. Suggested intervals for these tests are:

- General and physical tests - bi-yearly
• Dissolved gas analysis - yearly
• Furan testing - once every 2 years, subject to the transformer being in operation for min 5 years.

For larger transformers Tan δ test is performed every 10 – 12 years and if the test result is too high transformer oil is disposed off following the environmental guidelines.

97. "Oil acidity" is measured in terms of milligrams of standard potassium hydroxide required to neutralize the acid in one gram of the oil. It is a measure of the acid content of the oil. It can be used as an indicator of the presence of contaminants. The neutralization number (Oil Acidity) is most important in indicating chemical change or deterioration of the oil or in chemical change of additives. It serves as a guide for determining when oil should be replaced or reclaimed.

98. The Dielectric Power is the ratio of the power dissipated in the oil in watts to the product of the effective voltage and current in volt-amperes, when tested with a sinusoidal field under prescribed conditions. A high value is an indication of contaminants or deterioration products such as water, oxidation products, metal scrap etc. Dielectric Power Factor (Tan δ) is a convenient check of uniformity of insulating materials like transformer oil. The change in dielectric power factor in service oil is used to determine deterioration due to the moisture, foreign material and mechanical damage and thus to anticipate failure in service.

99. Sometimes in substations the connectivity between the transformers and switchgear room is achieved using XLPE cables. These cables cannot be bent as they may break; they have standard bending radius. Therefore, these cables are laid inside concrete channels. Stagnant water inside this channel following prolonged rain may provide breeding ground for mosquitoes and other disease vectors.

3.8 Power Lines- Operational Phase:

100. The primary objective of the distribution system is to ensure uninterrupted distribution of electricity to the consumers. The main job of the maintenance team is regular patrolling along the power lines to identify the need for regular and immediate maintenance operation. During the process of patrolling care is taken to trim the overgrown trees falling on to the distribution cables and/or extending into the danger zone (regarded as "danger tree"). It is also imperative to clear the fallen trees following storm or heavy rainfall events. In the urban areas of Bangladesh the residential building have been constructed without leaving any clearance for power cables, virtually erected from the edge of the footpath. Therefore, it is likely that sometimes kites, birds or clothes left for drying may get entangled with the cable system.

101. The maintenance operation should also ensure proper placement of dustbins and or trash containers so that these are not placed underneath an H-pole. Domestic wastes attract numerous crows and scavenger birds. Sometimes, these vectors lead to tripping of the circuit and/or short-circuiting.
4.0 ENVIRONMENTAL MANAGEMENT PROCEDURE

4.1 Overview

102. Under the proposed project, the PGCB/REB/PBS will be responsible for identification of sub-projects, preparation of sub-project description, “environmental/social screening” and “analysis of alternatives”. The ESMF presents guidelines (in the form of a simple format) for preparation of description of the sub-projects in chapter 4. The ESMF also presents a simple format for “environmental/social screening” of sub-projects (see section 4.6) and “analysis of alternatives” (see section 4.7), to be carried out by the PGCB/REB/PBS. Based on these and other relevant documents, PGCB/REB/PBS will assess the requirements for subsequent environmental and social assessment (IEE and EMP or ESIA), in consultation with the DoE.

103. The major activities to be carried out for IEE (including EMP) and ESIA include: (i) identification of sub-project influence area; (ii) establishment of “baseline environment” against which impacts of the proposed sub-project would be evaluated; (iii) analysis of alternatives; (iv) identification of major sub-project activities during both construction and operational phases; (v) assessment, prediction and evaluation of impacts of major project activities on the baseline environment; (vi) carrying out public consultations; (vii) preparation of environmental code of practice (ECOP); and (viii) identification of mitigation measures and preparation of environmental management plans (EMP) including monitoring requirements, and social management framework (SMF) including resettlement policy framework, tribal people planning framework, and grievance redress mechanism. The ESMF presents detail guidelines for carrying out each of these major activities.

104. The ESMF also presents occupational health and safety guidelines, and a set of special environmental clauses (SECs) for inclusion in Technical Specification and bidding document. The ESMF also presents institutional framework for environmental management of the proposed project to be implemented by the PGCB and the REB. Finally, the ESMF presents training requirements for ensuring successful environmental management of the proposed rural transmission and distribution project.

105. For convenience, the Environmental Management Procedure and Social Management procedure have been presented separately in this report. Chapter 4 presents the EMF and Chapter 5 present the SMF.

4.2 Implementing Agencies

106. The sub-projects to be implemented by REB and PGCB under the proposed project are listed in Table 4.1.
Table 4.1: Project components to be implemented under REB and PGCB

<table>
<thead>
<tr>
<th>Project Components (Sub-projects)</th>
<th>Implemented By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>REB</td>
</tr>
<tr>
<td>Construction/upgradation of 33 kV line</td>
<td>√</td>
</tr>
<tr>
<td>Construction of 11 kV new line</td>
<td>✓</td>
</tr>
<tr>
<td>Switching Station</td>
<td></td>
</tr>
<tr>
<td>New Substations (33/11 kV)</td>
<td>√</td>
</tr>
<tr>
<td>Construction of 232 kV new line</td>
<td>--</td>
</tr>
<tr>
<td>Re-conductoring/Upgradation of 132 kV lines</td>
<td>√</td>
</tr>
<tr>
<td>New Substations (132/33 kV)</td>
<td></td>
</tr>
<tr>
<td>Up-grading of Substations</td>
<td>√</td>
</tr>
<tr>
<td>Power Transformers</td>
<td>√</td>
</tr>
<tr>
<td>Technical assistance support (e.g., training and capacity building activities; implementation support for reform action plan)</td>
<td>√</td>
</tr>
</tbody>
</table>

4.3 Sub-project Categories

The sub-projects to be implemented under the proposed rural electricity transmission and distribution project do not appear to pose risk of significant adverse environmental impacts. Accordingly, the overall project could be classified as a “Category B” project, according to WB project classification (OP 4.01). In accordance with the ECR 1997, certain sub-projects are categorised (e.g., construction/upgradation of power distribution lines) and the EIA requirements of these projects are also clearly spelled out in the ECR 1997. Sub-projects category according to ECR 1997 is shown in Table 4.2. However, environmental/social screening of all sub-projects will be carried out first, based on which the ESIA requirements will be determined. In general, the environmental/social screening process identifies what impacts will be generated and what type of mitigation measures will be required for the sub-projects.

Table 4.2: Classification of sub-projects according to ECR 1997 (GoB, 1997)

<table>
<thead>
<tr>
<th>Project Component/ Sub-projects</th>
<th>Project/ Sub-project Category according to ECR 1997</th>
<th>Likely Project/Sub-project Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of 33 kV new power</td>
<td>Red</td>
<td>May be classified as “Orange A” or</td>
</tr>
<tr>
<td>distribution line</td>
<td></td>
<td>“Orange B” depending on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>assessment of potential impact</td>
</tr>
<tr>
<td>Upgradation of 33 kV power</td>
<td>Red</td>
<td>May be classified as “Orange A” or</td>
</tr>
<tr>
<td>distribution line</td>
<td></td>
<td>“Orange B” depending on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>assessment of potential impact</td>
</tr>
<tr>
<td>Construction of 11 kV new power</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>distribution line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction of 132 kV new power</td>
<td>Not specifically listed</td>
<td>Red</td>
</tr>
<tr>
<td>transmission line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-conductoring/Upgradation of 132</td>
<td>Not specifically listed</td>
<td>May be classified as “Orange A” or</td>
</tr>
<tr>
<td>kV lines</td>
<td></td>
<td>“Orange B” depending on assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of potential impact</td>
</tr>
<tr>
<td>Construction of 33/11 kV substation</td>
<td>Not specifically listed</td>
<td>Red</td>
</tr>
</tbody>
</table>

34
4.4 Sub-project Description

108. For proper environmental assessment, it is important that each project component or sub-project is clearly described by the project proponent (REB/PGCB). The key information required for describing a particular project component would vary depending on the type of sub-project (i.e., substation or power line). According to ECR 1997, a project proponent is required to apply to the Department of Environment (DoE) for environment clearance or site clearance certificate in a prescribed form (Form 3 of ECR 1997), furnishing key project information. Following the format of the “DoE Form 3”, sub-project Description “Form 1a” (for substations) and “Form 1b” (for power line) has been developed (Appendix A) for documenting description of sub-projects to be implemented under the proposed project. Once a sub-project description is prepared by REB/PGCB using Form 1a/1b, it will be easier to carry out environmental/social screening of the sub-project and to subsequently complete the “DoE Form 3” during submitting application for environmental/site clearance certificate.

109. The location map of a proposed sub-project should cover the entire physical extent of the sub-project and its surrounding areas.

4.5 Environmental and Social Considerations in Project Formulation

110. By considering certain issues during project formulation, it is often possible to reduce or eliminate some of the possible adverse environmental impacts during both construction and operational phases of a project. For example, efforts to avoid, where possible, critical homestead areas or crossing of rivers/hills/bamboo groves along the route of power lines could greatly reduce adverse impacts during construction and operational phases. Similarly, use of “guard cables” could save cash-in trees along the route of power lines. Such considerations at the project formulation stage could greatly reduce adverse impacts and facilitate proper environmental management of a project. Table 4.3 identifies a number of such issues to be considered for substation and power line sub-projects. These issues should be adequately addressed during the project formulation stage, as a part of overall environmental management.
Table 4.3: Environmental and social considerations to be included in design to reduce/eliminate the impacts for some major sub-projects

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Issues to be Considered at Project Formulation Stage</th>
</tr>
</thead>
</table>
| Substation  | • Use of government-owned land or vacant/fallow (non-productive) land for construction of substation, where possible  
• Use of land located at close proximity to existing power lines/load centers, and road network for easier transportation of material and equipment, where available  
• Avoiding lands that are susceptible to inundation/storm surge  
• Avoiding ecologically and socially critical areas while selecting land for substations  
• Use of Gas Insulated Switchgear (GIS) instead of Air Insulated Switchgear (AIS), in order to reduce land requirement for substation and avoid possible generation of toxic fumes in control building due to flashover inside AIS (especially under high humidity and saline conditions)  
• Ensuring purchase and installation of PCB free new transformers  
• Treating PCB contained in old transformers available technologies; namely, super critical oxidation, electro-chemical oxidation, solvated electron technology, chemical reduction method, dehalogenation process, and thermal desorption using pyrolysis, catalyzed dehalogenation and vitrification before disposal  
• Designing substations considering maximum flood level, and considering wind speed and earthquake load suggested in the Bangladesh National Building Code (BNBC)  
• Avoiding forest, protected areas, game reserve, national park, ECAs.  
• Avoiding as much as possible the homestead areas and sensitive infrastructures (schools, hospital etc.)  
• Avoiding crossing of rivers/hills/bamboo groves/cash-in trees, as much as possible. Use of "guard cable" for saving cash-in trees  
• Maintenance of adequate clearance for right of way (RoW)  
• Use of Axially Bundled Cables (ABC) or insulated cables, instead of conventional separate cables, in order to prevent possible pilferage of power through illegal connection and provide added security against accident  
• Keeping layout of power line tower/pole such that they do not interfere with movement of traffic/pedestrian  
• Designing power lines considering wind speed suggested in the Bangladesh National Building Code (BNBC)  
• Checking structural adequacy of existing power line towers/poles (to accommodate new cables) for sub-projects involving power line re-conductoring/rehabilitation  
• Selecting alignment of transmission line avoiding routes of migratory birds, nesting sites, significant bird habitat, and take off/landing routes of aircrafts  
• Keep provision for using vibratory hammers for pile driving for foundation of tower to produce less impact on fisheries and Other Aquatic Life |
| Power Line   | • Avoiding forest, protected areas, game reserve, national park, ECAs.  
• Avoiding as much as possible the homestead areas and sensitive infrastructures (schools, hospital etc.)  
• Avoiding crossing of rivers/hills/bamboo groves/cash-in trees, as much as possible. Use of "guard cable" for saving cash-in trees  
• Maintenance of adequate clearance for right of way (RoW)  
• Use of Axially Bundled Cables (ABC) or insulated cables, instead of conventional separate cables, in order to prevent possible pilferage of power through illegal connection and provide added security against accident  
• Keeping layout of power line tower/pole such that they do not interfere with movement of traffic/pedestrian  
• Designing power lines considering wind speed suggested in the Bangladesh National Building Code (BNBC)  
• Checking structural adequacy of existing power line towers/poles (to accommodate new cables) for sub-projects involving power line re-conductoring/rehabilitation  
• Selecting alignment of transmission line avoiding routes of migratory birds, nesting sites, significant bird habitat, and take off/landing routes of aircrafts  
• Keep provision for using vibratory hammers for pile driving for foundation of tower to produce less impact on fisheries and Other Aquatic Life |
Sub-project | Issues to be Considered at Project Formulation Stage
--- | ---
| Safety features in towers constructed over rivers against damage due to collision with water vessels | In order to avoid fire hazards, using technology in power line (and also substations) which trips the line in fractions of seconds

(Usually, control room buildings are built to a height of 1.5 storey to avoid storm surge (BPDB, 2008))

Landuse of Transmission Line ROW

111. Landuse along the transmission line has a potential to impact the safety of the transmission line. Though no land acquisition is required for ROW of transmission lines, it is recommended that PGCB/REB should enter into an agreement with the landowners owning limited rights of ROW for O&M uses and restricting certain use of land that are detrimental to the safety of the transmission lines. The following uses are considered to have “major impact” and must be coordinated by the PGCB/REB:

- Driveways, access roads, utility crossings
- Fish ponds
- Recreational grounds such as parking, playgrounds, cemeteries, swimming pools
- Gravel pits, quarries, fill, berms, and retaining walls
- Any activity involving elevation or grade changes more than 0.5 metres
- Sewage disposal fields, detention/retention ponds, watercourse relocation
- Portions of non-habitable buildings (e.g. garages, animal sheds)
- Highways, roads and major pipelines parallel to and/or within the ROW
- Street lamps and other lighting equipment
- Any activity involving any type of mechanized equipment (e.g. excavators, bulldozers, irrigation systems)

4.6 Environmental/Social Screening

112. All project components or sub-projects to be implemented under the proposed project will be subject to an environmental/social screening in order to prevent execution of projects with significant negative environmental impacts. The purpose of “environmental/social screening” is to get a preliminary idea about the degree and extent potential environmental impacts of a particular sub-project, which would subsequently be used to assess the need for further environmental/social assessment. The sub-projects will be identified by PGCB/REB/PBS; after selection of a sub-project, the environmental/social screening will be integral part of the sub-project planning and implementation.

113. As noted earlier, PGCB/REB/PBS will be responsible for carrying out environmental/social screening. The environmental/social screening would involve: (i) reconnaissance of the sub-project areas/routes and their surroundings; (ii) identification of the major sub-project activities (see Section 4.7.3 for typical sub-project activities); and (iii) preliminary assessment of the impacts of these activities on the ecological, physico-chemical and socio-economic environment of the sub-project surrounding areas (as discussed below).
114. The responsible PGCB/REB/PBS engineers/officials (see institutional arrangement for project implementation in 4.4.13) would carry out a reconnaissance survey surrounding the sub-project areas/routes in order to identify important environmental features (e.g., human settlements, educational/religious/historical establishments, water bodies) close to the sub-project location/route. The PGCB/REB/PBS would carry out the “environmental/social screening” of sub-projects with a preliminary idea about the nature of the sub-project location and sub-project activities by filling in the “Environmental/Social Screening Form 2a (for substation)/2b (for power line)” presented in Appendix B.

115. As shown in Form 2a/2b (Appendix B), the potential impacts of a sub-project have been divided into: (A) impacts during construction phase; and (B) impacts during operational phase. For each phase, the impacts have been further categorized into ecological impacts, physico-chemical impacts and socio-economic impacts. A number of parameters have been identified for each of these categories. With few exceptions, the potential impact with respect to each parameter has to be classified as “significant”, “moderate” and “insignificant” or “none”. The following section provides guidelines for environmental screening of sub-projects; guidelines for carrying out social screening using the same forms are presented in Chapter 4 (section 4.1).

Ecological Impacts:

116. Substation: For substations, three parameters have been considered for screening of ecological impacts during construction phase (Form 2a); these include felling of trees, clearing of vegetation, and impact on aquatic (water) habitat. If construction of a substation involves felling/clearing of significant number of trees/vegetation, the impact would be classified as “significant”; if it involves felling/clearing of few trees/vegetation, the impact could be classified as “moderate”, while if felling/clearing of trees/vegetation is not involved, the impact would be “insignificant” or “none”. If there is a water body (e.g., khal pond) located close to the proposed substation location, then construction of the substation could generate adverse impact (e.g., through discharge of waste/wastewater from sub-project activities, spills and leaks of oil/chemical) on the aquatic habitat (in the absence of any mitigation/management). The nature of impact would be classified as “significant” or “moderate” or “insignificant”, depending on the proximity of the proposed substation location to the water body, and the nature of the water body (i.e., whether it is an important habitat for aquatic flora/fauna). Operation of a substation is not likely to generate any significant adverse ecological impacts.

117. Power Line: For power lines, four parameters have been considered for screening of ecological impacts during construction phase (Form 2b); these include (i) presence of forest/protected areas/game reserve/national park/ ecologically sensitive areas (ECAs) along the power line route; (ii) felling of trees, (iii) clearing of vegetation, and (iv) possible impact on aquatic ecology (for power lines to be constructed on river/wetland). If the proposed route of the power line passes through biodiversity areas, then a detail analysis of alternative routes would be carried out (as noted in Form 2b) to identify possible route(s) that would eliminate/reduce risk to biodiversity, vegetation and habitat. If it is not possible to completely avoid such sensitive areas, then possible impact on biodiversity must be addressed as outlined
in the ESMF (see Section 4.9.3). In such cases, necessary permission needs to be taken from relevant authority (e.g., Forest Department/ local forest officer) for construction/maintenance of power line. If construction of the power line involves felling/clearing of significant number of trees/vegetation along its route, the impact would be classified as “significant”; if it involves felling/clearing of few trees/vegetation, the impact could be “moderate”, while if felling/clearing of trees/vegetation is not involved, the impact would be “insignificant” or “none”. Construction of power line towers in river/wetland could aggravate the aquatic ecology, thereby affecting aquatic flora and fauna, during construction phase. Operation of a power line is not likely to generate any significant adverse ecological impacts.

Physico-chemical Impacts:

118. **Substation:** The parameters considered for screening of physico-chemical impacts during construction phase of a substation include noise and air pollution, and water/ environmental pollution, and drainage congestion (Form 2a). If construction of the substation involves use of equipment/machines producing significant noise (e.g., generators, pile driver), and if the proposed substation site is located close to human settlements/ schools/ hospitals, noise pollution would be significant (in the absence of mitigation measures). Similarly, use of stone crushers, excavation works and movement of vehicle would generate air pollution. Possible air pollution from activities involved in substation construction is not likely to be significant, and may be classified as “minor”, unless the substation site is located very close to human settlements. If there is a water body (e.g., khal, pond) located close to the proposed substation location, then the potential adverse impact (e.g., through discharge of waste/wastewater from sub-project activities, spills and leaks of oil/ chemical) on water quality (in the absence of any mitigation/management) could be classified as “significant” or “moderate” or “insignificant”, depending on the proximity of the proposed substation location to the water body. If the location of the proposed substation site is such that it obstructs the flow of natural drainage water, then it could generate “significant” drainage congestion/water logging (in the absence of mitigation measures) during both construction and operational phases of the substation; otherwise impact on drainage would most likely be “minor”. Operation of a substation is not likely to generate any significant adverse physico-chemical impact, except drainage congestion as noted above.

119. **Power line:** For construction of power line, three parameters have been considered for screening of physico-chemical impacts during construction phase (Form 2b); these include noise pollution, air pollution, and water pollution. For installation of 33 kV and 11 kV distribution lines, air and noise pollution resulting from the operation of truck mounted drilling rig (used for installation of SPC poles) is not likely to be significant; and resulting air and noise pollution impacts could be categorized as “minor”. On the other hand, construction of 132 kV transmission line towers could involve heavy equipment (e.g., pile driver for foundation of transmission tower), and could generate noise and air pollution, affecting nearby human settlements. For construction of 132 kV transmission line, air and noise pollution impacts could be categorized as “significant”, “moderate” and “minor”, depending on the nature of construction works (e.g., whether pile driving would be necessary) and proximity of human settlements. As noted above, construction of power line towers in river/wetland could
aggravate the water quality during construction phase. Operation of a power line is not likely to generate any significant adverse physic-chemical impacts.

**Socio-economic Impacts:**

120. **Substation:** The parameters considered for screening of socio-economic impacts during construction phase of a substation include loss of land; loss of income; impact on tribal population, archaeological/historical sites; traffic congestion; and employment generation. Guidelines for addressing loss of land/income and impact on tribal population have been presented in Chapter 4 (under social management framework, Section 4.4.1). If the proposed substation site is located close to a busy road/highway, then transportation and storage of construction materials could aggravate traffic congestion (especially in the absence of mitigation measures). Operation of a substation is not likely to generate any adverse socio-economic impacts; both construction and operation of a substation would generate employment opportunities.

121. **Power Line:** The parameters considered for screening of socio-economic impacts during operational phase of a power line include impact on tribal population, archaeological/historical sites, loss of income, traffic/pedestrian movement, safety, and employment. Guidelines for addressing loss of income and impact on tribal population have been presented in Chapter 5 (under social management framework, Section 5.4.1); other parameters have been addressed in this 4. Construction of power lines along busy highways or along narrow roads could generate traffic congestion and interfere with pedestrian movement (in the absence of mitigation measures). Both construction and operation/maintenance of power lines would generate employment opportunities. Operation of power line is not likely to generate any adverse socio-economic impacts.

4.7 **Analysis of Alternatives**

122. The primary objective of the "analysis of alternatives" is to identify the location/technology for a particular sub-project that would generate the least adverse impact, and maximize the positive impacts. The analysis of alternatives should be carried out at two different levels: (a) by PGCB/REB/PBS along with environmental/social screening; and (b) during carrying out of IEE/ESIA of a sub-project, if needed (e.g., by the consultant engaged for this purpose).

123. In general, for any sub-project, the analysis of alternative should focus on:
   (a) Alternative location (for substation) or route (for power line);
   (b) Alternative design and technology;
   (c) Costs of alternatives and
   (d) No sub-project scenario.

124. A simple format for analysis of alternatives is presented in Appendix C (Form 3a for substation, Form 3b for power line). The REB-PBS/PCCB authority will carry out screening at all proposed alternative routes of the power line based on the screening form 2b. Then the
environment and social details of these alternatives will be listed in the table provided in Appendix-C. Important considerations include avoiding homestead areas, as much as possible; avoiding crossing of rivers/hills/bamboo groves/cash-in trees, as much as possible. If the homestead areas (or other sensitive infrastructure) are not avoidable in any of the options, the REB-PBS/PGCB will consult with the owner/respective authority and collect their no objection for the construction of transmission and distribution lines in written. On the other hand, use of a government-owned land for construction of substation would significantly reduce adverse socio-economic impacts. If that is not possible efforts should be made to avoid ecologically or socially critical areas for construction of substation. Among alternative technologies, use of Gas Insulated Switchgear (GIS) instead of Air Insulated Switchgear (AIS) would reduce land requirement for substation and avoid possible generation of toxic fumes in control building due to flashover inside AIS (especially under high humidity and saline conditions). Under humid/saline environment, the switchgears and electrical accessories of the “Outdoor type” substations undergo considerable stress reducing their operating life, which could be avoided using Indoor type substation. For power lines, use of Axially Bundled Cables (ABC) or insulated cables instead of the conventional separate cables would prevent pilferage of power through illegal connections. The outcome of the “analysis of alternatives”, for example, with respect to location/route of sub-project, technology (e.g., type of substation, type of cables) should be included in the sub-project description Form 1a/1b.

125. Subsequently, if a particular sub-project requires further environmental assessment (IEE/ESIA), the analysis of alternatives should be carried out in more details (by the consultant engaged for this purpose), including quantitative estimates for some parameters (e.g., cost of different technologies). Based on the outcome of this detailed “analysis of alternatives”, the sub-project location/route, technology may have to be modified.

126. Based on the guideline presented in the ESMF, the PGCB/REB/PBS engineers/official would carry out the “analysis of alternatives” of sub-projects by filling Form 3a/3b. However, as discussed in 4.4.15, the capabilities of the PGCB/REB engineers in carrying out these activities could be greatly improved through imparting training on environmental/social assessment and management.

4.8 Nature and Extent of Environmental and Social Assessment (ESA)

127. In general, the environmental/social screening process identifies what impacts will be generated and what type of mitigation measures will be required for the sub-projects. Also the screening will help in determining whether a proposed sub-project should follow the Environmental Code of Practices (ECoP) to mitigate/avoid the impacts or need further detail assessment with preparation of separate environmental/social management plan. The level of environmental and social assessment (ESA) of a sub-project would primarily depend on the class/category of the sub-project according to OP 4.01 and ECR 1997. According to WB OP4.01 proposed rural electricity transmission and distribution project has been classified as “Category B” on the expected impact. As noted earlier According to ECR 1997, category is designated on the nature of project not the anticipated impact. For “Orange A” Category sub-projects, no
further environmental assessment would be required, but some additional information would be required; for “Orange B” category sub-projects Initial Environmental Examination (IEE) and Environmental Management Plan (EMP) would be required; while for Red Category sub-projects, full-scale EIA (including SIA) may be required. Based on a review of the sub-project description (i.e., Form 1a/1b) and environmental screening (i.e., Form 2a/2b), PGCB/REB will determine the need for further environmental assessment (i.e., carrying out IEE/ESIA, including EMP).

4.9 Guidelines for Carrying Out IEE and EIA

128. Since the exact locations of the substations and the routes of the transmission and distribution lines (i.e., the sub-projects) are still unknown, the guideline for environmental assessment presented here cover both IEE and EIA (including EMP). As noted earlier, Chapter 4 of this report presents the Social Management Framework (SMF), including detail guideline for carrying out SIA (as well as RAP and TPP, if needed). Both IEE and EIA would cover the same elements. However, the level of details would be different; a full-scale ESIA would present more detailed and quantitative (where appropriate) analysis of impacts. The level of details would be determined through “scoping” at the onset of the environmental assessment process, considering the nature of the sub-project (Form 1a/1b) and level of anticipated impacts (Form 2a/2b).

129. The major activities involved in carrying out environmental assessment (IEE and EIA) include the following:

(a) Identification of sub-project influence area;
(b) Establishment of “baseline environment” within the sub-project influence area, against which impacts of the proposed sub-project would be evaluated;
(c) Identification of major sub-project activities/processes during construction phase and operational phase;
(d) Assessment and evaluation of impacts of major project activities on the baseline environment during construction phase and operational phase;
(e) Carrying out public consultations;
(f) Identification of mitigation measures for reducing/eliminating adverse impacts and enhancing positive impacts;
(g) Development of environmental management plan (EMP), including monitoring requirements, and estimation of cost of EMP (see Section 4.10.3) and
(h) Identification of environmental code of practice (ECoP), including cost of ECoP (see Section 4.11).

130. As described in Section 4.13 (Institutional Arrangement and Responsibility), the IEE/EIA will be carried out by REB (by Supervisor Consultant/ hired consultant/ Environment Unit to be set up in future) or by PGCB (by DSM consultant/ Environmental Unit to be set up in future). The following section presents detail guidelines and processes for carrying out each of these major activities.
4.9.1 Sub-project Influence Area

131. For properly carrying out IEE and EIA, it is important to have a clear understanding about the "sub-project influence area" and "baseline environment". The ESMF provides guidelines for identification of sub-project specific influence area and defining environmental baseline. In order to establish a sub-project influence area, the activities to be carried out and processes that would take place during both construction phase and operational phase of the sub-project need to be carefully evaluated. Based on the field visits to sub-project sites in Dhaka, Chittagong and Sylhet, it is apparent that the sub-project influence area would depend not only on the type of sub-project (i.e., substation or power line), but also on the nature site/area where it will be implemented.

132. For construction of substations, influence area primarily include: (a) the areas surrounding the substation site; (b) the area along the access road to the substation; (c) routes of transportation of construction materials (or construction wastes) to (or away from) the sub-project site; and (d) areas of material storage, and labor shed for sub-project works.

133. For construction/rehabilitation of transmission and distribution lines, areas within the right of way (RoW) along the length of the route of the transmission/distribution line will experience impacts (e.g., traffic congestion, noise and air pollution, damage to crops), and therefore should be considered as the sub-project influence area.

134. Based on field visits and discussions with PGCB officials, it was found that the 132 kV transmission lines will be strung on steel towers, a number of which will be constructed in rural areas (e.g., paddy fields). Construction of these towers is likely to affect the surrounding environment (e.g., ecology, land use, crops). Therefore, the areas surrounding the towers should be considered as sub-project influence area during the construction phase. Construction of access roads to these tower construction sites is likely to cause environmental impact (e.g., damage to crop, dust pollution, noise pollution, and alter/obstruct cross drainage). Therefore, the areas along the access roads to the tower site should be considered influence areas.

Table 4.4 provides general guidelines for identification of influence area for different types of sub-projects to be implemented under the proposed project.

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Influence Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>132/33 kV and 33/11 kV Substations, Switching Stations</td>
<td>Areas and communities within around 1 km surrounding the location of the Substation, who are likely to be affected during construction and/or operation of the Substations. Areas on either side (within ~15 m) of the access road from the main road to the Substation.</td>
</tr>
<tr>
<td>132 kV Transmission Lines and Towers</td>
<td>Areas and communities within the Right of Way (~52 m) of the Transmission line route. Areas and communities surrounding the new transmission tower (if any) to be constructed. Areas on either side (within ~15 m) of the access road from the main road to the transmission tower (to be constructed).</td>
</tr>
</tbody>
</table>
### Sub-project Influence Area

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Influence Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>33 and 11kV Distribution Lines and Poles</td>
<td>Areas and communities within the Right of Way (~27m) of the distribution line route. Areas on either side (within ~15 m) of the access road from the main road to the distribution line poles/tower, which could be affected during construction.</td>
</tr>
</tbody>
</table>

*Note: The routes of transportation of material/equipment to the sub-project site should also be included under influence area.*

### 4.9.2 Environmental Baseline

135. For proper environmental assessment (as a part of IEE and EIA), it is very important to adequately define the "environmental baseline" against which environmental impacts of a particular sub-project would be subsequently evaluated. The characteristics of "environmental baseline" would depend on:

- Nature of the sub-project location,
- Nature/extent of a sub-project and its likely impact,
- Level of environmental assessment (e.g., screening versus full scale EIA).

136. For example, ambient air quality and noise level are important parameters for describing baseline scenario for a substation sub-project, because these parameters are likely to be impacted by the project works. However, these parameters are not likely to be important for sub-projects like "Construction of 132kV Transmission line or 33 or 11kV Distribution line". Similarly, ecological parameters (e.g., diversity of flora and fauna) are not likely to be critical for a power line to be constructed along the main road or through the commercial area, but these could be important for a power line that crosses a river or marshy land, where aquatic floral and faunal habitat could be impacted by the project activities. Obviously the depth of baseline information required for IEE/EIA of a "red" sub-project would be different from those required for an "orange B" category sub-project.

137. For systematic recording of data, baseline environment is usually classified into physicochemical environment, biological environment, and socio-economic environment; and important features/parameters under each category are identified and measured/recorded during baseline survey. The important features/parameters would depend on the nature of sub-project location, category of sub-project, and level of environmental assessment. The following sections provide guideline on identification of important features/parameters and collection of sub-project specific environmental baseline data.

#### 4.9.2.1 Physicochemical Environment

138. The important physicochemical parameters for defining baseline include:

- Important Environmental Features (IEFs),
- Climate,
- Topography and drainage,
- Geology and soil,
• Hydrology and water resources,
• Air quality,
• Noise level,
• Water quality, and
• Traffic
• Electro-Magnetic Field (EMF)

IEFs and Maps:
139. Typical Important Environmental Features (IEFs) include human settlements, educational institutions (school, college, madrassa, university), health care facilities (hospitals, clinics), commercial/recreational establishments (markets, restaurants, parks, offices), religious establishments (mosques, temples, churches), major utility infrastructure (water/wastewater treatment plants, water mains, sewers, power plants, sub-station, gas/electricity transmission/distribution lines), landfills, major ponds/khals and rivers, and historical archaeological establishments, ecologically critical area (ECA), wildlife sanctuary, game reserve, protected area, and national park.

140. Under most circumstances, it is sufficient to identify IEFs based on a survey covering the sub-project influence area (see Table 4). Thus, a rapid physical survey of each sub-project will be required to identify the IEFs within the sub-project influence area. It should be noted that many of the IEFs (e.g., historical/archaeological sites, wildlife sanctuary, and national park) should already be identified and recorded in available maps of the relevant areas. These maps could be utilized during identification of IEFs. For a full-scale EIA, it may be necessary to identify the IEFs through a detailed survey and record their positions (GPS coordinates).

141. The sub-project layout and the identified IEFs within the sub-project influence area should be presented in a suitable map. For this purpose, the sub-project layout and IEF locations should be superimposed on the GIS maps (e.g., land-use maps) or Google images of project area and their surroundings.

Climate:
142. It is important to have a general idea about the climate of the area where the sub-project would be implemented. Important climatic parameters include precipitation, temperature, relative humidity, wind speed and direction. These data should be collected from secondary sources (e.g., from the nearest station of Bangladesh Meteorological Department, BMD); the climatic data of the BMD station closest to the sub-project site should be used. In fact, the required climatic data have already been collected from the Bangladesh Meteorological Department (BMD) and presented in Annex-1. These climatic data could be readily used for environmental assessment of any sub-project, as required.

Topography and drainage:
143. Data and information on topography are important for the design of the sub-projects to be implemented by the REB and PGCB. Information on the topography is essential in fixing the
alignment of the Transmission and Distribution lines. Similarly, construction of each Substation is dependent on the topography of the site and the surrounding area. For example, it is important to know whether the area where the substation would be constructed suffers from water-logging or inundation problems, which could endanger the equipment and operation of the substation. For the design of these sub-projects, it may be necessary to carry out topographic survey in the sub-project area. However, for environmental assessment (IEE and EIA), secondary information on topography and drainage should be sufficient.

Geology and soil:
144. Characteristics of soil could be important if a particular sub-project involves significant excavation/earthworks, because wind-blown dust from these activities could contribute to air pollution. In such cases, characteristics of soils (particularly heavy metal content) are often determined as a part of baseline survey. However, considering the nature and scale of the structures to be constructed in the sub-projects to be implemented under the REB and PGCB, geology and soil characteristics do not appear to be critical for environmental assessment.

Hydrology and water resources:
145. For the design of the sub-project involving the construction of substations and construction of steel towers for the 132 kV Transmission lines, information such as water level/highest flood level are important. Information on surface and groundwater levels and their seasonal variation are important in assessing possible impacts due to accidental spillage of lubricants and/or transformer oil. For environmental assessment (IEE and EIA), information on hydrology (e.g., river network, flow, highest water level) and water resources (e.g., discharge, surface and groundwater levels) may be collected from secondary sources (e.g., from Bangladesh Water Development Board, BWDB). The format used in the "overall environmental/social assessment" could be followed for presentation of necessary data/information on hydrology and water resources.

Air quality:
146. Data on ambient air quality is not likely to be available in the areas where the REB and PGCB sub-projects will be implemented. Particulate matter (particularly PM_{10} and PM_{2.5}) is the most important air quality parameter from health perspective. However, measurement of air quality is relatively expensive and facilities for air quality measurement are not widely available. Therefore, baseline air quality data (PM) may be collected only for carrying out detailed environmental assessment (EIA).

Noise level:
147. Noise is typically generated from operation of machines and equipment (e.g., pile drivers, excavators, concrete mixing machine), and movement of vehicles. Noise is of particular importance if the sub-project component (e.g., substation, transmission tower) is located close to sensitive installations such as educational institutions, health care facilities, religious establishments, and human settlements. Activities to be carried out during construction phase of the sub-projects would generate noise. For these sub-projects, baseline noise level should be measured and recorded, so that these could be compared with those generated during
construction/operation phase of the sub-projects. The location and frequency of baseline noise level measurements would depend on physical extent of project, and presence of sensitive installations within sub-project influence area, as noted above. The consultant engaged for carrying out IEE/EIA should be responsible for measurement of baseline noise level at location(s) within the sub-project influence area. Both day-time and night-time noise levels should be measured, using a calibrated noise level meter.

**Water quality:**

148. A number of activities during the implementation of sub-projects could have impacts on water quality. These include construction of substations and 132kV transmission towers. Accidental spillage of gasoline, transmission oil, transformer oil, etc. may contaminate surface and/or ground water-bodies. Stagnation resulting from obstruction of cross drainage pattern in rural areas following construction of access roads and substations may result in deterioration in the areas surrounding these sites. For these sub-project activities, baseline water quality of the relevant water body should be measured, as a part of baseline survey (by the consultant engaged for carrying out IEE/EIA).

149. With respect to water quality, the dry season is the critical period, and hence water samples for water quality characterization should be collected during the dry season. Important water quality parameters include pH, TDS, TSS, ammonia, nitrate, phosphate, BOD, and COD.

**Traffic:**

150. Storage of construction materials, power cables (conductors), SPC poles of distribution lines, steel members of the 132kV transmission tower, transformers, etc. on the adjacent roads are likely to cause traffic congestion. Similarly, movement of additional vehicles carrying construction and power transmission equipment along public roads are likely to increase traffic congestion. For all the sub-projects, it would be necessary to collect traffic data from primary survey, as a part of carrying out IEE/EIA (by the consultant engaged for this purpose); both number and composition of traffic are important.

**Electro-Magnetic Fields (EMF):**

151. Health concerns over exposure to EMF are often raised when a new transmission line is proposed. To date the research has not been able to establish a cause and effect relationship between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to EMF could cause disease. Rehabilitation of existing power lines is unlikely to increase EMF but new lines may induce EMF. However, this issue needs to be addressed while conducting a comprehensive impact assessment. Thus, measurement of existing EMF along the selected routes of the existing and new Transmission and Distribution lines and around the Substation sites would be necessary, as a part of carrying out IEE/EIA (by the consultant engaged for this purpose).

152. Table 4.5 presents guidelines for collection of primary and secondary data on physicochemical environmental parameters for different types of sub-projects to be implemented under the proposed project.
### Table 4.5: Guidelines for collection of sub-project specific physicochemical data/information

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Data/information from secondary source</th>
<th>Data from primary survey/measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of 132/33kV Substations by PGCB</td>
<td>IEFs; Climate; Geology and soil; Hydrology and water resources; and drainage</td>
<td>IEFs; Noise level; Soil; Surface water quality; Site topography; EMF</td>
</tr>
<tr>
<td>Construction of 132kV Transmission Line By PGCB</td>
<td>IEFs; Climate; Topography and drainage; Geology and soil; Hydrology and water resources</td>
<td>IEFs; Noise Level; Surface water quality; Site topography; EMF</td>
</tr>
<tr>
<td>Construction of 33/11kV Substations/ Switching Stations by REB</td>
<td>IEFs; Climate; Geology and soil; Hydrology and water resources; and drainage</td>
<td>IEFs; Noise level; Soil; Surface water quality; Site topography; EMF</td>
</tr>
<tr>
<td>Construction of 33kV &amp; 11kV Distribution Lines by REB</td>
<td>IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources</td>
<td>IEFs; Noise level; Surface water quality; Traffic, EMF</td>
</tr>
<tr>
<td>Upgradation of 132/33kV Substations by PGCB</td>
<td>IEFs; Climate; Geology and soil; Hydrology and water resources; and drainage</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation of 132kV Transmission Line By PGCB</td>
<td>IEFs; Climate; Topography and drainage; Geology and soil; Hydrology and water resources</td>
<td>Surface water quality; Traffic, EMF</td>
</tr>
<tr>
<td>Rehabilitation of 33kV &amp; 11kV Distribution Lines by REB</td>
<td>IEFs; Climate; Geology and soil; Topography and drainage; Hydrology and water resources</td>
<td>Surface water quality;</td>
</tr>
</tbody>
</table>

*If water body is located close to the substation site(s)*

*If the power line passes over or close to khal/river/wetland land:*

#### 4.9.2.2 Biological environment:

153. Important parameters for description of biological environment include:

- General bio-ecological features of the sub-project area and its surroundings (e.g., bio-ecological zone, rivers, wetlands, hills, agricultural lands)
- Wildlife sanctuary, protected area, park, ecologically critical area (ECA)
- Floral habitat and diversity (terrestrial and aquatic)
- Faunal (including fish) habitat and diversity (terrestrial and aquatic)
- Threatened flora and fauna

154. It should be noted that all the sub-projects (namely, Construction of Substations, Construction of Transmission and Distribution Lines) to be carried out by REB and PGCB are likely to have minor ecological impacts. In most cases, the most significant direct impact would result from felling/cutting of trees/vegetation within the substation sites and along the route of the new transmission/distribution lines. If the alignment of a new power line crosses...
river/wetland, then construction of tower could generate some adverse impact on water quality and aquatic ecology. However, these may not have any significant ecological impacts, thus, general bio-ecological description of the sub-project area would be sufficient for description of baseline biological environment. Table 4.6 provides guidelines for collection and presentation of data for biological environment for the sub-projects to be implemented by REB and PGCB.

Table 4.6: Guidelines for collection of sub-project specific data/information for describing biological environment

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Data/information from secondary source</th>
<th>Data from primary survey/measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction/rehabilitation of 132/33kV Substations by PGCB</td>
<td>General bio-ecological features, Wildlife sanctuary, ECA etc.</td>
<td>Number of trees to be felled; Area to be cleared of vegetation; Filling up of seasonal wetland (if required)</td>
</tr>
<tr>
<td>Construction/Rehabilitation of 132kV Transmission Line By PGCB</td>
<td>General bio-ecological features, Wildlife sanctuary, Floral and faunal diversity; ECA</td>
<td>Number of trees to be felled or trimmed; No of pond affected; Aquatic flora and fauna diversity*</td>
</tr>
<tr>
<td>Construction of 33/11kV Substations/ Switching Stations by REB</td>
<td>General bio-ecological features, Wildlife sanctuary, ECA</td>
<td>Number of trees to be felled; Area to be cleared of vegetation; Filling up of seasonal wetland (if required)</td>
</tr>
<tr>
<td>Construction/Rehabilitation of 33kV &amp; 11kV Distribution Lines by REB</td>
<td>General bio-ecological features, Wildlife sanctuary, ECA; Floral and faunal diversity</td>
<td>Number of trees to be felled or trimmed</td>
</tr>
</tbody>
</table>

*If the proposed transmission line crosses river/wetland

4.9.2.3 Socio-economic environment

155. The socio-economic baseline should be established following the social management framework (SMF), presented in Chapter 5. This section provides a brief overview of the important aspects of socio-economic baseline for the sub-projects (construction of substations and power lines). It is important to have a clear understanding to the baseline socio-economic condition of people, especially those living within the sub-project influence areas. A common approach for quick assessment of baseline socio-economic condition is questionnaire survey. The primary objectives of a questionnaire survey are:

(a) to understand people’s socio-economic condition;
(b) to understand extent of people’s access to basic services; and
(c) to understand people’s perception regarding the sub-project.

The questionnaire used for socio-economic survey may therefore cover five major themes:

(a) Socio-economic background
(b) Basic services
4.9.3 Assessment and Prediction of Impacts

4.9.3.1 Potential Significant Environmental Impacts during Construction Phase

156. After identification of the sub-project activities during construction phase, the next step in the IEE/EIA involves assessment/prediction of the impacts of these activities on the baseline environment. The potential environmental impacts during construction phase of sub-projects could be categorized into: (a) ecological impacts; (b) physic-chemical impacts; and (c) socio-economic impacts.

**Ecological Impacts:**

157. Based on primary assessment of the nature and scale of the proposed sub-projects (Construction of substations and power lines) and assessment of sub-project locations (based on field visits), it appears that ecological impacts of most sub-projects would be limited to loss of trees/vegetation, and possible adverse impact on aquatic habitat located close to the project location. However, construction of transmission line/tower across rivers/wetland could generate some short-term adverse impacts on aquatic habitat and associated aquatic flora and fauna. Assessment of ecological impacts of the sub-projects should therefore focus on loss of vegetation/trees and aquatic habitat. In general, the ecological impact should focus on:

(a) Impact on flora (aquatic and terrestrial);

(b) Impact on fauna (aquatic and terrestrial) including fish;

158. If the proposed route of the power line passes through areas that are rich in biodiversity (e.g., tree plantation, game reserve, national park, ECAs), then special measures are needed to reduce/eliminate possible adverse impacts. These include the following:

(a) For movement of tension stringing equipment, a 3 m width is usually needed below each conductor; and trees on such strip need to be felled during construction phase (i.e., stringing). After completion of stringing operation, regeneration of natural vegetation should be encouraged along the strip.

(b) Felling, pollarding, lopping and pruning of trees for electric clearance, whenever necessary, should be done with permission from the local forest office/appropriate authority; hand clearing (instead of machine clearing) to be considered to minimize damage to vegetation and habitat; use of chemicals for forest clearance/RoW maintenance should be strictly prohibited.

(c) Existing path/access roads (with up-gradation, if needed) should be used, wherever possible, for movement of man and machinery; tower materials should be transported into forests by head loads (instead of vehicles) to reduce adverse impacts on vegetation/habitat.

159. Commonly, the significance of an ecological impact is determined by: (i) Ecological "consequence" of the activity, (ii) "Likelihood of occurrence" of the activity, and (iii) Calculating
the product of these two parameters. Consequence and likelihood of ecological impacts resulting from project activities are discussed below.

160. Table D-1 of Appendix D (Criteria for assessment of ecological impacts) presents the criteria for estimating "consequence" of any particular "sub-project" activity. As shown in Table E-1, for adverse/negative ecological impacts, the "consequence" has been divided into six categories (critical, major, moderate, minor, low, and none), with corresponding numerical ranking ranging from 5 (for "critical") to 0 (for "none"). If a sub-project activity falls into multiple categories, it is assigned the highest-ranking category for assessment of ecological impact.

161. Table D-2 of Appendix D presents criteria for "likelihood of occurrence" of an activity/impact. The likelihood of each identified impact is determined by estimating the probability of the activity occurring. The likelihood is divided into five categories (almost certain, very likely, likely, unlikely, and very unlikely), with corresponding ranking ranging from 5 (for "almost certain") to 1 (for "very unlikely").

162. The "significance" of ecological impact for a particular sub-project activity is determined by multiplying the "consequence ranking" and the "likelihood ranking" of the sub-project activity, as follows: \[ \text{Significance} = \text{Consequence} \times \text{Likelihood} \]

### Table 4.7: Ecological impact significance rankings

<table>
<thead>
<tr>
<th>Significance (Consequence x Likelihood)</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;16</td>
<td>Critical</td>
</tr>
<tr>
<td>9-16</td>
<td>High</td>
</tr>
<tr>
<td>6-8</td>
<td>Medium</td>
</tr>
<tr>
<td>2-5</td>
<td>Low</td>
</tr>
<tr>
<td>&lt;2</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

163. Table 4.7 shows "significance" ranking of ecological impacts and Table 4.8 shows a risk assessment matrix that could be used for estimating "significance" and "risk", respectively of ecological impacts for a particular sub-project activity. Table D-3 of Appendix D presents examples of estimating ecological impacts of some typical sub-project activities.

### Table 4.8: Risk assessment matrix

<table>
<thead>
<tr>
<th>Likelihood Frequency</th>
<th>Consequence Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Minor</td>
</tr>
<tr>
<td>Moderate</td>
<td>High</td>
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<tr>
<td>Major</td>
<td>Extreme</td>
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<tr>
<td>Critical</td>
<td>Extreme</td>
</tr>
<tr>
<td>Almost certain</td>
<td>High</td>
</tr>
<tr>
<td>Very Likely</td>
<td>Moderate</td>
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<tr>
<td>Likely</td>
<td>High</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Low</td>
</tr>
<tr>
<td>Very Unlikely</td>
<td>Low</td>
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<tr>
<td></td>
<td>Moderate</td>
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<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Extreme</td>
</tr>
</tbody>
</table>

51
Example: A 33/11kV Substation will be constructed near a tree planted area. The construction activities are unlikely to damage of adjacent biological environment and the result will be low-level impacts. From the problem Consequence is Low with ranking 1 (Table D-1) and the Likelihood of occurrence is Unlikely with ranking 2 (Table D-2), the “Significance” of ecological impact of this sub-project activity will be as follows:

Significance = Consequence × Likelihood

Significance = 1 × 2 = 2

So, the Significance Level is Low (Table 4.7) and the Risk is Low (Table 4.8).

Physicochemical impacts:

164. Possible Physicochemical impacts from the sub-project activities to be carried out in different locations may include the following:

- Drainage congestion,
- Noise pollution,
- Air pollution,
- Water pollution,
- Environmental pollution from solid/construction waste

Drainage congestion:

165. During execution of civil engineering projects, temporary drainage congestion often results from obstruction to natural flow of drainage water due to the storage of materials, piled up excavated material/soil, and temporary embankments constructed to keep the work area dry. Such congestion is particularly important at the project sites adjacent to low-lying areas. Drainage congestions could create significant discomfort to people living in project-surrounding areas.

Noise pollution:

166. Noise pollution could result from a wide range of construction activities, including movement of vehicles (carrying equipment/material to and from site), operation of construction equipment and generators. Significant noise is generated from operation of pile drivers, bulldozers, dump trucks, compactors, mixing machines, and generators, etc. (which could be used for construction of substations and transmission towers). Demolition activities, if required, also generate noise. Such noise may cause discomfort to the people living in the surrounding areas at close proximity of the sub-project site, especially if such activities are continued during the night. Noise pollution is particularly important for sensitive establishment e.g., hospitals, educational/religious institutions.

167. Among noise generating activities, operation of pile drivers produces the most significant noise. For full-scale EIA (if needed), noise level predictions may be made for pile drivers and other major equipment used in the sub-project works, and used to assess noise pollution impacts in areas surrounding the sub-project site. Noise produced by Auger Drill Rig used for installation of electric poles for distribution lines is relatively low, and not likely to generate significant noise pollution.
**Air pollution:**

168. During construction phase, air pollution may result from emissions from machines and equipment (e.g., drilling rig, mixing machines, generators) used for different sub-project activities (e.g., substation and transmission tower construction), and movement of vehicles (carrying material and equipment) to and from the site. However, for the proposed sub-projects, adverse impacts of air pollution are likely to be limited to the areas surrounding the sub-project sites.

**Water pollution:**

169. Water pollution may result from discharge of wastewater (e.g., liquid waste from labor sheds), spills and leaks of oils/chemical into nearby water bodies (e.g., drain, pond, khal, drain, river). The presence and existing use of water bodies surrounding the sub-project site would determine the level of impact. For example, if a pond located close to a sub-project site is being used for washing/bathing or for fish culture, pollution of the pond from sub-project activities would generate significant adverse impacts. Construction of transmission lines/towers across rivers/wetland could also generate some water pollution during construction phase.

**Environmental pollution from solid/construction waste:**

170. In some sub-projects, construction debris is likely to be generated from different sub-project activities. Solid wastes will also be generated from labor sheds. Improper management of construction debris and solid waste could cause blockage of drainage line/path and environmental pollution.

**Impact on Fisheries and Other Aquatic Life in the Major River:**

171. Some of the power transmission line will have to cross some major River like Buriganga, Daleshhari river. The foundation of each tower requires installation of piles of large diameter to a depth of significant length. Pile driving activities generate very high under water noise levels and have potential impact on the aquatic life. Piles are usually driven into the substrata using one of two types of hammers — impact hammers and vibratory hammers. Impact hammers consist of a heavy weight that is repeatedly dropped onto the top of the pile, driving it into the substrata. Vibratory hammers utilize a combination of a stationary, heavy weight and vibration, in the plane perpendicular to the long axis of the pile, to force the pile into the substrata. The type of hammer used depends on a variety of factors, including pile material and substrate type. Impact hammers may be more harmful than vibratory hammers for two reasons: First they produce more intense pressure waves, and second, the sounds produced do not elicit an avoidance response in fishes, which will expose them for longer periods to those harmful pressures.

172. It can be concluded that noise levels from vibratory pile driving are limited to near the vicinity of piles and have comparatively lesser impacts on fisheries and other aquatic life than impact drivers.
Socio-economic impacts:

173. The most significant potential socio-economic impact from the proposed project would be loss of land and loss of income due to acquisition of land for construction of substations. Possible impact on indigenous population is also an important consideration. The social management framework (SMF) presented in Chapter 4 addresses the land acquisition and resettlement issues, and impact on indigenous population. This section addresses the other possible socio-economic impacts, which include the following:

- traffic congestion,
- health and safety,
- employment and commercial activities,
- impact on archaeological and historical sites, and safeguarding physical cultural resources (PCR), and

Traffic congestion:

174. During construction phase of sub-projects, traffic congestion may result from stockpiling of material by the sides of roads, increased movement of people and vehicles carrying material and equipment. Construction of substation and distribution lines in densely populated areas, and construction of distribution lines along busy highway could aggravate the existing traffic problem during construction phase. This should be addressed with proper traffic management, and avoiding stockpiling of materials in a way that could hamper traffic movement.

Health and safety:

175. Safety is an important issue during construction phase. General construction activities pose safety risks, which should be addressed as part of occupational health and safety plan. Section 4.10 provides guideline on occupational health and safety issues.

Employment and Commercial Activities:

176. During construction phase, some beneficial impact at local level would come in the form of employment in sub-project related works, which would depend on the nature and extent of the sub-project. For example, labor-intensive sub-project works (e.g., manual excavation) could generate employment for considerable number of semi-skilled workforce. This in turn would induce some positive impacts on some other parameters including commercial activities in the sub-project areas.

Impact on archaeological and historical sites:

177. Archaeological and historical sites are protected resources. Damage of such sites by digging, crushing by heavy equipment, uprooting trees, exposing sites to erosion, or by making the sites more accessible to vandals are of particular concern. A guideline for archaeological impact assessment is presented in Appendix E.
Safeguarding physical cultural resources (PCR):

178. Since the exact locations of the sub-projects to be implemented are not known at this moment, a guideline for identification of physical cultural resources (PCR) and determination of the suitability of the sub-projects from the perspective of PCR is provided in Appendix F. The likely impacts to PCR for typical activities of the sub-projects are also discussed in Appendix F. The “Chance Find” procedure for protection of cultural property is presented in Appendix G, following the World Bank Operational Policy OP 4.11 (Physical cultural resources).

179. For convenience, the potential significant impacts during construction phase of the proposed sub-projects (substations and power lines) may be presented in a tabular form; the format is presented in Table 4.9.

<table>
<thead>
<tr>
<th>Environmental Parameter</th>
<th>Positive Impact</th>
<th>No Impact</th>
<th>Adverse Impact</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological Parameters</td>
<td>Loss/cutting of tree/vegetation</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Impact on wetland/aquatic habitat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physico-chemical Parameters</td>
<td>Drainage congestion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noise pollution</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Air pollution</td>
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<td></td>
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<tr>
<td></td>
<td>Water pollution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental pollution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio-economic Parameters</td>
<td>Loss of land</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Loss of income</td>
<td></td>
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<tr>
<td></td>
<td>Impact on indigenous population</td>
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<tr>
<td></td>
<td>Traffic congestion</td>
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<td></td>
<td>Health and safety</td>
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<tr>
<td></td>
<td>Employment</td>
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<tr>
<td></td>
<td>Archaeological/historical sites</td>
<td></td>
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<tr>
<td>Physical cultural resources</td>
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</tbody>
</table>

*To be assessed following the guidelines provided in SMF (Chapter 4).

4.9.3.2 Potential Significant Environmental Impacts during Operational Phase

180. After identification of the activities/processes that would take place during operational phase, the potential impacts of these activities/processes on the baseline environment need to be assessed. The potential environmental impacts could also be categorized into: (a) ecological impacts; (b) physico-chemical impacts; and (c) socio-economic impacts. In general, the potential adverse impacts of the sub-projects during operational phase are not likely to be significant.
**Ecological impacts:**

177. During operational phase, the possible impact of the sub-project activities on the biological environment would be insignificant. Some of the sub-projects could cause a change in the habitation characteristics of aquatic/terrestrial fauna in the vicinity of the sub-project locations. Accidental spillage of transformer/generator fuel could have adverse impact on the surrounding aquatic/terrestrial floras or faunas.

**Physicochemical impacts:**

181. Depending on the type of sub-projects a number of physico-chemical parameters could experience both positive and negative impacts during operation phase of the sub-projects. Important issues and parameters include:

- Drainage and water/environmental pollution,
- Air quality and noise level, and
- Environmental pollution from solid waste

**Drainage and water/environmental pollution:**

182. Based on field visits of existing similar projects, the proposed sub-projects involving construction of substations (by PGCB or REB) might have office and residential facilities within the project compound with new approach road. Proper management of solid and liquid wastes generated in these substations is very important to safeguard proper drainage and prevent environmental pollution in the surrounding areas. Poor quality of discharge water from the substations could cause pollution to the final receiving water body.

**Air quality and noise level:**

183. During operational phase, the generators running within the newly constructed substations by PGCB/REB could impact air quality and noise level in the surrounding areas. Emissions from the generators can deteriorate the air quality in the adjacent areas.

**Socio-economic impacts:**

184. This section provides an overview of the possible socio-economic impacts of the sub-projects during operational phase that are not covered under the social management framework (SMF).

**Power supply:**

185. The proposed project is aimed at increasing penetration and the reliability of power supply. Thus, operations of the substations and power lines under the proposed project would significantly improve reliability of power supply, thereby inducing a wide range of socio-economic benefits.

**Public health and safety:**

186. Health concerns over exposure to EMF are often raised when a new transmission line is proposed. To date the research has not been able to establish a cause and effect relationship
between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to EMF could cause disease. The health and safety concern related to such exposures should be assessed.

187. Live fallen lines are a safety concern. Transmission lines are designed to trip out (turn off) if they fail or contact trees. This is not necessarily true for distribution lines. However, efforts should be made to make sure that the safety issues are properly addressed in the design phase.

188. Safety of transmission line tower constructed over rivers is an important consideration. The towers should be designed and constructed with safety features such that these are not damaged by collision with water vessels.

**Employment and commercial activities:**

189. Construction of new substations will create new employment opportunities for some people. From field visit it was observed that existing substations include office, housing, and rest house facilities within the compound. This will attract opportunities of other commercial activities for vendors, shop owners, etc. in the vicinity of the newly constructed substations.

**Property Values:**

190. Property values of an area may be affected due to close proximity to a new power line. Once the proposed power line is constructed, certain land use restrictions may be placed on all land within the right of way (ROW). Urban or industrial land capability/value may be reduced due to restriction on building of certain types of structures. On the contrary, the new power lines (and also substations) will improve power supply and its reliability in the relevant project areas, which in turn may contribute to increase in land value.

**Airports and Airstrips:**

191. Transmission and distribution lines sometimes are a potential hazard to aircraft during takeoff and landing. However, available information suggests that this is not an issue of concern for the proposed project.

**Implantable Medical Devices:**

192. Two types of implantable medical devices, pacemakers and implantable cardiovascular defibrillators (ICDs), have been associated with problems arising from interference caused by EMF, which is often referred to as electromagnetic interference, EMI. EMI can cause inappropriate triggering of a device or inhibit the device from responding appropriately. Proper monitoring is required to detect such occurrences, if any, so that proper warning could be given to people for taking appropriate precautions, if required.
Radio, Television and Mobile Phone Reception:

193. Distribution lines do not usually interfere with mobile phone, television and radio reception. In some cases, interference is possible at locations close to the right of way (RoW) due to weak broadcast signals or poor receiving equipment.

4.10 Environmental Management Plan (EMP)

194. The primary objective of the environmental management plan (EMP) is to record environmental impacts resulting from the sub-project activities and to ensure implementation of the identified "mitigation measures", in order to reduce adverse impacts and enhance positive impacts. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operational phases of the sub-projects.

195. The EMP should clearly lay out: (a) the measures to be taken during both construction and operation phases of a sub-project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels; (b) the actions needed to implement these measures; and (c) a monitoring plan to assess the effectiveness of the mitigation measures employed.

196. The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as a sub-project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. For all sub-projects to be implemented under Proposed Rural Electricity Transmission and Distribution Project, the EMP should be a part of the Contract Document.

197. The major components of the EMP include:
- Mitigation and enhancement measures
- Monitoring plan
- Estimation of cost of EMP
- Institutional arrangement for implementation of EMP

4.10.1 Mitigation and Enhancement Measures

Construction Phase:

198. The overall impact assessment of the proposed sub-projects (substations and power lines) reveals that most of the adverse impacts could be minimized or eliminated by adopting standard mitigation measures; there is also scope to enhance some of the beneficial impacts to be generated from the proposed sub-projects. This section describes the mitigation and enhancement measures that could be applied to the sub-project under the Proposed Rural Electricity Transmission and Distribution Project.

199. In order to identify mitigation/enhancement measures, the potential impacts have been categorized into: (a) "general impacts", which are typical common impacts to be experienced in
most sub-projects, and (b) "sub-project specific impacts". Table 4.10 shows typical activities to be carried out under different sub-projects, corresponding "general impacts" and suggested mitigation and enhancement measures. It also assigns responsibility for implementation of mitigation and enhancement measures. Obviously all sub-projects would not generate all the impacts listed in Table 4.10 at the same level/magnitude. Table 4.10 provides general guidelines of mitigation and enhancement measures for the most significant "general impacts". Table 4.11 shows "sub-project specific" impacts and corresponding mitigation/enhancement measures. In devising the mitigation/enhancement measures.

Operational Phase:

200. During the operational phase, the REB/PGCB will be responsible for the operation and maintenance of the infrastructure to be developed under the Proposed Rural Electricity Transmission and Distribution Project. Apart from regular operation and maintenance, a number of issues would require special attention for reducing/avoiding possible adverse environmental impacts. These include regular maintenance and management of storm drains in the substations, to reduce risk of water pollution.

201. With respect to storm drains, utmost efforts must be made to keep it operational (i.e., flowing) by restricting discharge of solid wastes into it and by periodically cleaning the drain. Adequate monitoring is also needed to make sure that the storm drain does not receive direct discharge of toilet wastewater from the office, residential quarters located within the substation area. Such discharges would contaminate the drainage water and eventually the receiving water body (river or khal), and would bring about a wide range of adverse environmental and health outcomes.

202. Accidental spillage of transformer/generator fuel into the drainage system is also a serious concern, which can cause environmental pollution. Spilled fuel from transformer/generator, if not properly disposed, could bring about adverse health and environmental impacts.

203. Proper management of traffic and pedestrian movement could often minimize increased risks of accidents during the maintenance of transmission lines/distribution lines sub-project by REB or PGCB near the roadways. Movement of heavy vehicles (loaded trucks) in local roads is a common cause of road damage at many sub-project sites. Table 4.12 shows some important sub-project specific impacts during operational phase and corresponding mitigation measures.
Table 4.10: Typical "general impacts" during construction phase of sub-projects and corresponding mitigation and enhancement measures

<table>
<thead>
<tr>
<th>Activity/Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and operation of labor shed for workers</td>
<td>Generation of sewage and solid waste, water/ environmental pollution</td>
<td>Construction of sanitary latrine/septic tank system</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td></td>
<td>• Health of workers</td>
<td>Raising awareness about hygiene practices among workers</td>
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<td></td>
<td>• Possible development of labor camp into permanent settlement</td>
<td>Contractor to remove labor camp at the completion of contract</td>
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<td></td>
<td>• Outside labor force causing negative impact on health and social well-being of local people</td>
<td>Contractor to employ local workforce where appropriate; promote health, sanitation and road safety awareness</td>
<td></td>
</tr>
<tr>
<td>General construction works for sub-projects</td>
<td>Drainage congestion and flooding</td>
<td>Provision for adequate drainage of storm water</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td></td>
<td>• Air pollution</td>
<td>• Provision of adequate diversion channel, if required</td>
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<td></td>
<td></td>
<td>• Provision for pumping of congested water, if needed</td>
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<td>• Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season</td>
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<td>Ensure that all project vehicles are in good operating condition</td>
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<td>Spray water on dry surfaces/ unpaved roads regularly</td>
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<td>Maintain adequate moisture content of soil during transportation, compaction and handling</td>
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<td></td>
<td></td>
<td>• Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates)</td>
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<td>• Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter</td>
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<td>• Schedule deliveries of material/equipment during off-peak hours</td>
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<td>• Depute flagman for traffic control</td>
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<td>• Arrange for signal light at night</td>
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<td></td>
<td></td>
<td>• Use of noise suppressors and mufflers in heavy construction equipment</td>
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<td></td>
<td>• Avoid using of construction equipment producing excessive noise at night</td>
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<td></td>
<td>• Avoid prolonged exposure to noise (produced by equipment) by workers</td>
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<td></td>
<td></td>
<td>• Regulate use of horns and avoid use of hydraulic horns in project vehicles</td>
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</tr>
</tbody>
</table>

58
<table>
<thead>
<tr>
<th>Activity/Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water and soil pollution</td>
<td>Prevent discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/khals/drain</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td></td>
<td>Destruction of aquatic habitat</td>
<td>Install sediment basins to trap sediments in storm water prior to discharge to surface water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keep noise level (e.g., from equipment) to a minimum level, as certain fauna are very sensitive to loud noise (e.g., during transmission tower construction over river/wetlands)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Felling of trees, clearing of vegetation</td>
<td>Replant vegetation when soils have been exposed or disturbed.</td>
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<tr>
<td></td>
<td>Accidents</td>
<td>Following standard safety protocol. Environmental health and safety briefing. Provision of protective gears as specified in ECoP 20. Provision of appropriate protective measures against accidental fall from elevated height (e.g., using body harness, waist belts, secured climbing devices, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spills and leaks of oil, toxic chemicals</td>
<td>Good housekeeping. Proper handling of lubricating oil and fuel. Collection, proper treatment, and disposal of spills.</td>
<td></td>
</tr>
<tr>
<td>Health and Safety (see details in ECoP20)</td>
<td>Exposure to physical hazards from use of heavy equipment and cranes; trip and fall hazards; Exposure to dust and noise; falling objects; work in confined spaces; Exposure to hazardous materials; Exposure to electrical hazards from the use of tools and machinery.</td>
<td>A safety observer must be appointed at each subproject site by the contractor before the commencement of work. Only allowing trained and certified workers to install, maintain, or repair electrical equipment. Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines; Proper Personal Protective Equipment (PPE) for all workers and others associated with work. Where rehabilitation is required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined before work.</td>
<td></td>
</tr>
<tr>
<td>Activity/Issues</td>
<td>Potential Impacts</td>
<td>Proposed Mitigation and Enhancement Measures</td>
<td>Responsible Parties</td>
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</tbody>
</table>
| All construction works | * Beneficial impact on employment generation  
* General degradation of environment  
* Discovery of historical items and cultural remains | * Employ local people in the project activities as much as possible.  
* Environmental enhancement measures, such as plantation, landscaping, traffic/direction signs  
* Follow "chance find procedure" (see Appendix G) for protection of cultural resources | Contractor  
(Monitoring by REB/PGCB) |
### Table 4.11: "Sub-project specific impacts" during construction phase and corresponding mitigation measures

<table>
<thead>
<tr>
<th>Activity/Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction of Substation</strong>&lt;br&gt;Setting up and operation of asphalt plant and bitumen preparation area (for sub-station access road construction), if needed</td>
<td>• Air and noise pollution affecting nearby settlements&lt;br&gt;• Possible water pollution (surface and groundwater) by bitumen and solvents&lt;br&gt;• Possible PCB contamination from dismantling of old transformers with PCB&lt;br&gt;• Cutting down trees to use a fuel wood for heating bitumen</td>
<td>• Locate plant away from residential settlements&lt;br&gt;• Consider use of emulsified bitumen&lt;br&gt;• Avoid spills; surround plant area with a ditch with a settling/ oil trap at the outlet&lt;br&gt;• Treat PCB of old transformers following specified methods in ECoP (e.g. dehalogenation, electrochemical oxidation, etc.)&lt;br&gt;• Strictly prohibit use of fuel wood for heating bitumen</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td><strong>Construction/ Rehabilitation of Transmission Line and Distribution Line</strong>&lt;br&gt;Installation of poles of transmission / distribution lines adjacent to roadways</td>
<td>• Traffic congestion/ traffic problems&lt;br&gt;• Safety&lt;br&gt;• Not storing electric poles/transmission tower components over busy roads/ highways&lt;br&gt;• Following standard safety protocols while erecting poles and stretching cables&lt;br&gt;• Taking appropriate protective measures against accidental fall from elevated height (e.g. using body harness, waist belts, secured climbing devices, etc.) as specified in ECoP</td>
<td>• Employ traffic control measures and limit possible disruption to non-construction traffic&lt;br&gt;• Strict control to avoid spills; provision for adequate clean up&lt;br&gt;• If there's no alternative, felling, pollarding, lopping and pruning of trees for electric clearance, whenever necessary, to be done with permission from the local forest office/appropriate authority;&lt;br&gt;• Hand clearing of vegetation</td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>Construction of power line through natural habitat or tree plantation area</td>
<td>• Impact on biodiversity, vegetation and habitats</td>
<td></td>
<td>Contractor (Monitoring by REB/PGCB)</td>
</tr>
<tr>
<td>Activity/Issues</td>
<td>Potential Impacts</td>
<td>Proposed Mitigation and Enhancement Measures</td>
<td>Responsible Parties</td>
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<td>---------------------</td>
</tr>
<tr>
<td>Tower Foundation in the Major River</td>
<td>• Impact on Fisheries and Other Aquatic Life in the Major River • Collision with water vessels</td>
<td>• Strict prohibition on use of chemicals for forest clearance/RoW maintenance. • Use of existing path/access roads for movement of man and machinery; • Carrying tower materials into forests by head loads • Use a vibratory hammer for pile work • Installation of underwater enclosures to minimize sound • Use signage and construct fender (if necessary)</td>
<td>Contractor (Monitoring by REb/PGCB)</td>
</tr>
</tbody>
</table>


Table 4.12: "Sub-project specific impacts" during operational phase and corresponding mitigation measures

<table>
<thead>
<tr>
<th>Activity/Issues</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation and Enhancement Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation of drains in the substations</td>
<td>• Pollution of downstream water body</td>
<td>• Stop direction connection from sanitation facilities to storm drain; ensure installation of septic tank in all establishments</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td>• Blockage in the drain due to disposal of solid waste</td>
<td>• Creation of awareness; improve SWM system, installing cover in open manholes (if any)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular maintenance/cleaning of the drain</td>
<td></td>
</tr>
<tr>
<td>Operation of generators and transformers</td>
<td>• Pollution of water (e.g., from spilled oil, spent oil, other waste)</td>
<td>• Restriction on disposal of spent oil, food and other waste in water; creation of awareness</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Strict control to avoid spills; provision for adequate clean up</td>
<td></td>
</tr>
<tr>
<td>Operation of Substation</td>
<td>• Security</td>
<td>• Ensuring security of Substation in collaboration with law enforcing agencies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Safety, Health</td>
<td>• Keeping complaint book at Substation for recording of people's complaints</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensuring availability of adequate safety gears for Substation operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensuring availability of adequate safety gears for Substation operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Keeping clean the conduits used for laying the XLPE cables connecting switchgears and transformers with proper drainage provisions to prevent the growth of disease vectors such as mosquitoes and flies</td>
<td></td>
</tr>
<tr>
<td><strong>Construction/ Rehabilitation of Transmission Line and Distribution Line Sub-project</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular maintenance</td>
<td>• Safety</td>
<td>• Regular patrolling along the power lines to identify the need for regular and immediate maintenance operation</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inspection immediately after a major storm/rainfall event</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular cutting and trimming of trees around power lines</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Taking appropriate protective measures against accidental fall from elevated height during regular maintenance operations (e.g. using body harness, waist belts, secured climbing devices, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provision for shutting down of line in case of snapping of line</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular monitoring of power lines to prevent electricity pilferage especially when Axially Bundled Cables (ABC) are used</td>
<td></td>
</tr>
<tr>
<td>Installation of new transformers</td>
<td>• Safety</td>
<td>• Adequate caution should be taken to carry out installation works by personnel at elevated height</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Instrument should be properly anchored with poles</td>
<td></td>
</tr>
<tr>
<td>Activity/Issues</td>
<td>Potential Impacts</td>
<td>Proposed Mitigation and Enhancement Measures</td>
<td>Responsible Parties</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Maintenance of</td>
<td>Traffic congestion, obstruction to pedestrian movement, safety</td>
<td>Depute flagman for traffic control</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td>transmission/</td>
<td>Impact on biodiversity, vegetation, habitat</td>
<td>Arrange for signal light at night</td>
<td></td>
</tr>
<tr>
<td>distribution lines</td>
<td></td>
<td>Following standard safety protocol</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Felling, pollarding, lopping and pruning of trees for RoW maintenance to be done with permission from the local forest office/appropriate authority</td>
<td></td>
</tr>
<tr>
<td>Health and Safety</td>
<td>Live power lines</td>
<td>Only allowing trained and certified workers to maintain, or repair electrical equipment</td>
<td>REB/PGCB</td>
</tr>
<tr>
<td></td>
<td>Working at height</td>
<td>Taking appropriate protective measures against accidental fall from elevated height during regular maintenance operations (e.g. using body harness, waist belts, secured climbing devices, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electric and magnetic fields</td>
<td>Dechaffing and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exposure to chemicals</td>
<td>Proper Personal Protective Equipment (PPE) for all workers and others associated with work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exposure to electrical hazards from the use of tools and machinery.</td>
<td>Training of workers in the identification of occupational EMF levels and hazards</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment</td>
<td></td>
</tr>
</tbody>
</table>
4.10.2 Monitoring Plan

The primary objective of the environmental monitoring is to record environmental impacts resulting from the sub-project activities and to ensure implementation of the "mitigation measures" identified earlier in order to reduce adverse impacts and enhance positive impacts from project activities.

Monitoring during Construction Phase:

During implementation of all sub-projects, the REB/PGCB will be responsible to monitor and make sure that the environmental mitigation/enhancement measures (including health and safety measures) outlined in the EMP for the particular sub-project are being implemented in accordance to the provisions of the Tender Document.

Apart from general monitoring of mitigation/enhancement measures and health and safety protocols (as outlined in the ESMF and Tender Document), important environmental parameters to be monitored during the construction phase of the sub-projects include noise level, water quality, drainage congestion, and traffic problems. However, the requirement and frequency of monitoring would depend on the type of sub-project and field situation. For certain sub-projects (e.g., rehabilitation of existing transmission line/distribution line), monitoring of these parameters is not critical; while monitoring of some of these parameters (e.g., noise level) would be needed only if significant pollution is suspected. Table 4.13 presents guidelines for monitoring of specific environmental parameters during construction phase of different sub-projects. In addition of Table 4.13, The routine monitoring work will be done by PBS/REB/PGCB to ensure that:

- All personnel at work sites shall be provided with protective gears like helmets, goggles, boots, etc. so that injuries to personnel are avoided or minimized.
- Workforce, likely to be exposed to noise levels beyond regulatory stipulated limits, shall be provided with protective gears like ear plugs etc and regularly rotated.
- Dust suppression measures like sprinkling of water shall be ensured at all operations areas.
- The construction camps shall have health care facilities and all construction personnel shall be subjected to routine vaccinations and other preventive/healthcare measures.
- The work and campsites shall have suitable facilities for handling any emergency situation like fire, explosion, electrocution, etc.
- All areas intended for storage of hazardous material shall be quarantined and provided with adequate facilities to combat emergency situations. All required permits for storage of inflammable/hazardous materials are to be obtained.
- The construction workers, supervisors and engineers shall be properly trained and with sufficient experience.
- The operational areas shall be access controlled and entry shall be allowed only under authorization.
- The construction camps shall have in-house community/common entertainment facilities.
Table 4.13: Guidelines for monitoring of environmental parameters during construction phase

<table>
<thead>
<tr>
<th>Sub-project</th>
<th>Monitoring Parameter and Scenario</th>
<th>Monitoring Frequency</th>
<th>Resource Required and Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of 132/33kV Substations by PGCB; Construction of 33/11kV Substations REB</td>
<td>Regular monitoring</td>
<td>Once every week, particularly during operation of heavy equipment</td>
<td>Contractor, under the guidance of REB/PGCB</td>
</tr>
<tr>
<td>Construction of 132/33kV Substations by PGCB (near a water body); Construction of 33/11kV Substations by REB (near a water body); Construction of 132 kV transmission line over river/wetland</td>
<td>Noise level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All sub-projects</td>
<td>Visual observation of drainage congestion, traffic within and around project location; Occupational health and safety of project personnel (also includes general health, water supply and sanitary provision etc.)</td>
<td>Once a week, when drainage/traffic congestion suspected</td>
<td>Contractor, under the guidance of REB/PGCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Once a week, and as and when needed</td>
<td></td>
</tr>
</tbody>
</table>

Note: Depending on the location of specific activities should decide actual monitoring time and location.

Monitoring during Operational Phase

207. During operational phase, monitoring of environmental parameters would be required for the sub-projects. Table 4.14 presents guidelines for monitoring of specific environmental parameters during operational phase of selected sub-projects.

Table 4.14: Guidelines for monitoring during operational phase

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Monitoring Frequency</th>
<th>Resource Required and Responsibility</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger Trees</td>
<td>Once every month, and as directed by the Project Engineer</td>
<td>Vehicle with Ladder and cutting accessories; Maintenance team's responsibility</td>
<td>Results to be reported to ESU</td>
</tr>
<tr>
<td>Dielectric strength of Transformers</td>
<td>Once in 6 months, and as directed by the Project Engineer</td>
<td>Testing equipment, Monitoring team</td>
<td></td>
</tr>
<tr>
<td>Tan-δ test</td>
<td>Once in 10 years, and as directed by the Project Engineer</td>
<td>Testing equipment, Monitoring team</td>
<td></td>
</tr>
</tbody>
</table>

64
Hazardous Material
- Once every three months, laboratory facilities; and as directed by the Monitoring team's responsibility

XLPE cables and trenches within the substation boundary
- Twice a year to prevent disease
- Maintenance responsibility

4.10.3 Method for Estimation of Cost of EMP

Cost of implementing environmental management plan (EMP) including monitoring activities needs to be estimated as a part of the preparation of EMP. Many of the activities to be carried out as a part of EMP would not involve any additional direct cost e.g., employing local work force, where appropriate; keeping sub-project vehicles in good operating condition; scheduling deliveries of materials/ goods in off-peak hours; good housekeeping, avoiding spills; prohibiting use of fuel wood for heating bitumen; etc. On the other hand, a number of activities would require additional cost. Environmental monitoring during both construction and operational phases would involve direct cost. At the same time, a number mitigation measures (including health and safety measures) would also require additional cost; these include installation of septic tank/sanitary latrines/portable toilets, installation of health and safety signs, awareness documents (signs/ posters), water sprinkling on aggregates and unpaved surfaces, traffic control (e.g., deputing flagman), traffic light, plantation, and protective gear. Table 4.15 provides basis/ method of estimation of costs of different items of EMP. Similar approach should be followed for estimation of cost of additional measures, if required.

<table>
<thead>
<tr>
<th>Table 4.15: Method/ basis of estimation of cost of Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring Item</td>
</tr>
<tr>
<td>Noise level</td>
</tr>
<tr>
<td>Water quality (pH, BOD5, or COD, NH3, PO4)</td>
</tr>
<tr>
<td>Installation of septic tank/sanitary latrine/portable toilets</td>
</tr>
<tr>
<td>Health/safety signs (size and number to be estimated)</td>
</tr>
<tr>
<td>Water sprinkling on aggregate</td>
</tr>
<tr>
<td>Traffic control (estimate number of flagman and duration of work)</td>
</tr>
<tr>
<td>Traffic light</td>
</tr>
<tr>
<td>Protective gear</td>
</tr>
<tr>
<td>Plantation (including protection/ fencing and conservation during project period)</td>
</tr>
</tbody>
</table>

* Depending on availability of facility for measurement
4.10.4 Institutional Capacity for Implementation of EMP

209. **Rural Electrification Board (REB):** REB has prior experience in implementing IDA-funded RERED project where construction and rehabilitation of lines and substations were supported. To institutionalize the environment and social safeguards, REB agreed to set-up a formal Environment and Social Management Unit/Cell with qualified regular staff. This will need revision of the REB’s regular organogram. Since the establishment of the Unit/Cell would require several administrative clearances, as an interim measure, REB will set-up a Project specific Environment and Social Management Unit under the PMU. The project specific “Environmental and Social Unit” under the leadership of a Superintending Engineer, will assist the Project Management Unit (PMU) of REB on issues related to environmental management. The “Environmental and Social Unit” with support from relevant Palli Bidyut Samities (PBSs) will carry out “Environmental/Social Screening” and “Analysis of Alternatives” of sub-projects, following the guidelines contained in the Environmental and Social Management Framework (ESMF). The environmental and social assessment (ESA) of the sub-project will be carried out by supervision consultant or individual consultant hired by REB. The PMU of REB will be responsible for implementation of EMP and preparation of quarterly reports, with support from “Environmental and Social Unit” and supervision consultant. Section 4.13 shows activities and institutional responsibilities for overall implementation of the Proposed Rural Electricity Transmission and Distribution Project by REB.

210. The REB developed “checklists” for environmental and social compliance for substation and power line construction, building construction and environmental impact mitigation; and also has health and safety protocols. However, there is need for capacity building of the REB and Palli Bidyut Samities (PBSs) for environmental management in more systematic way proposed in the current ESMF. Special attention should be provided on the alternative analysis and occupational health and safety.

206. **Power Grid Company of Bangladesh (PGCB):** PGCB has been implementing the Siddhirganj-Maniknagar 230kV Transmission Line component under IDA-financed SPPP. PGCB is in the process of creating an Environment and Social Unit (ESU) in the regular organogram and the ESU is expected to be set-up under the leadership of a Deputy General Manager will be responsible for overall environmental management of sub-projects to be implemented under the proposed project. The team will be assisted by individual consultant to be hired by PGCB during project/sub-project formulation stage; while the ESU will be responsible for overseeing implementation of EMP/ECoP as outlined in the ESMF and preparation of quarterly reports. Section 4.14 shows activities and institutional responsibilities for overall implementation of the Proposed Rural Electricity Transmission and Distribution Project by PGCB.

207. However, there is need for capacity building of the PGCB, REB and Palli Bidyut Samities (PBSs) for environmental management in more systematic way proposed in the current ESMF. Special attention should be provided on the alternative analysis and occupational health and safety.
208. The institutional strengthening component of the Project includes provisions for short and long-term training courses of their concerned officials on environmental and social management.

4.11 Environmental Code of Practice (ECoP)

211. The design, construction and installation of electricity works shall take into consideration environmental issues and concerns. Factors to consider include, but are not limited to:

- the promotion of energy efficiency,
- the efficient use of non-renewable resources,
- the use of renewable resources,
- the social impact of new projects, and community concerns,
- the minimization of environmental damage, including visual impacts,
- tree management programs,
- a reduction in and the correct disposal of waste products, and
- the consideration of Electromagnetic Field (EMF) issues.

212. The Environmental Code of Practice (ECoP) is prepared as a guideline for environment management of different parts of the project, namely, i) Construction of Substation, ii) Construction of Transmission/Distribution Lines, and iii) Rehabilitation of Transmission/Distribution Lines; to be implemented by the REB and PGCB. The main objective of an ECoP is to manage construction operations in harmony with the environment in an effort to contribute to the well-being of the community and the environment by:

- Minimizing pollution
- Sustaining eco-systems
- Conserving cultural heritage
- Enhancing amenity

213. The ECoP is designed to be used during the construction of the substations, rehabilitation of the transmission/distribution cable, and construction of the new transmission/distribution lines by the PGCB and REB. The Code is also applicable to water supply and solid and hazardous waste management systems where management of minor construction activities, such as the substation and towers, is addressed. The purpose of the Code of Practice is to ensure that construction activities are conducted in a manner that minimizes impacts on the environment. It promotes awareness and use of best practice in environmental management. ECoP is applicable to the construction sites and associated activities such as stockpile sites, disposal sites for clean excavated materials, etc. Responsibility lies with all the people involved in any given project to adopt environmentally responsible work practices. Best environmental management practice requires environmental awareness, and appreciation of one’s environmental responsibilities. Measures taken to prevent environmental impacts are preferred to those designed to control the impact.

214. The Environmental Code of Practice (ECoP) includes a list of activities associated with construction of the substations, rehabilitation of the transmission/distribution cable, and

215. A particular sub-project may involve all or some of these issues. Appendix H presents the ECoPs and the Table 4.16 (for REB) and Table 4.17 (for EGCB) outlines applicability of different ECoP activities for different sub-projects to be implemented under the proposed project.
Table 4.16: Possible Application of ECoP relating to different types of sub-projects to be implemented by REB

<table>
<thead>
<tr>
<th>Different activities related to ECoP</th>
<th>Rural Electrification Board (REB)</th>
<th>Construction of 13/11kV Substation</th>
<th>Construction of 33kV Distribution Line</th>
<th>Rehabilitation of 33kV Distribution Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Planning and Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Route Selection</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pole Erection</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Overhead Power Cable Installation</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Installation of Transformer on H-Pole</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Substation Site Preparation</td>
<td>✓</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Construction Camps</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Topsoil Salvage, Storage and Replacement</td>
<td></td>
<td>✓</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Borrow Areas</td>
<td>✓</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Land Reclamation</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Waste Management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Waste Quality</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Public Health and Safety</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Electromagnetic Field</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Material Storage, Transport &amp; Handling</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cutting of Trees</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Natural Habitats</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Community Health and Safety</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

✓ = ECoP required; □ = ECoP may be required depending on the site/route condition.
Table 4.17: Possible Application of ECoP relating to different types of sub-projects to be implemented by PGCB

<table>
<thead>
<tr>
<th>Different activities related to ECoP</th>
<th>Construction/Upgrade of 132/33kV Substation</th>
<th>Construction of 132kV Transmission Line</th>
<th>Rehabilitation of 132kV Transmission Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Planning and Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Route Selection</td>
<td>✓</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>Tower Erection</td>
<td>–</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>Overhead Power Cable Installation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Installation of Transformer on H-Pole</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Substation Site Preparation</td>
<td>✓</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Construction Camps</td>
<td>–</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>Topsoil Salvage, Storage and Replacement</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Borrow Areas</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Land Reclamation</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Waste Management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Water Bodies</td>
<td>–</td>
<td>❄️</td>
<td>❄️</td>
</tr>
<tr>
<td>Water Quality</td>
<td>–</td>
<td>❄️</td>
<td>❄️</td>
</tr>
<tr>
<td>Public Health and Safety</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Electromagnetic Field</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Material Storage, Transport &amp; Handling</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Cutting of Trees</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Natural Habitats</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Community Health and Safety</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PCB Waste Management</td>
<td>✓</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

∗ = ECoP required; ❄️ = ECoP may be required depending on the site/route condition.

4.12 Occupational Health and Safety Guidelines

216. In general, the objectives of occupational health and safety (OHS) plan are: (a) To develop, in the workplace, a collaborative approach to managing Occupational health and Safety between management and workers; (b) To provide and maintain safe working procedures and operations; (c) To ensure awareness of all potential work related risks and hazards and to develop preventive strategies against these risks and hazard; (d) To provide appropriate training to all concerned to work safely and effectively; (e) To maintain a constant and continuing interest in the improvement of occupational health and safety performance and to provide the required resources necessary for the implementation and maintenance of the OHS plan.

217. For the sub-projects to be implemented by REB and PGCB, the occupational health and safety primarily focuses on work equipment and protective gear. The following section
provides guidelines/directives for: (a) work equipment, (b) protective gear, and (c) safety and health signs.

4.12.1 Suggested Safety Directives for Work Equipment

218. It is employer's (contractor) obligation that every possible measure is taken to ensure the safety of the work equipment made available to workers. During the selection of the work equipment the employer shall pay attention to the specific working conditions which exist at the workplace, especially in relation of safety and health of the workers. A brief list of work equipment safety issues is given below:

- Work equipment control devices which affect safety must be clearly visible and identifiable and appropriately marked where necessary.
- Work equipment presenting hazards due to emissions of gas, vapor, liquid or dust must be fitted with appropriate containment and/or extraction devices near the sources of the hazard.
- Where there is a risk of mechanical contact with moving parts of work equipment which could lead to accidents, those parts must be provided with guards or devices to prevent access to danger zones or to halt movements of dangerous parts before the danger zones are reached.
- Work equipment may be used only for operations and under conditions for which it is appropriate.
- Work equipment must bear the warnings and markings essential to ensure the safety of workers.
- All work equipment must be appropriate for protecting workers against the risk of the work equipment catching fire or overheating, or of discharges of gas, dust, liquid, vapor or other substances produced, used or stored in the work equipment.
- All work equipment must be appropriate for preventing the risk of explosion of the work equipment or of substances produced, used or stored in the work equipment.
- All work equipment must be appropriate for protecting exposed workers against the risk of direct or indirect contact with electricity.
- Mobile work equipment such as Bulldozer or Road Rollers with ride-on workers must be designed to restrict, under actual conditions of use, the risks arising from work equipment roll-over.
- Fork-lift trucks carrying one or more workers must be adapted or equipped to limit the risk of the fork-lift truck overturning.
- Self-propelled work equipment, such percussion drills, which may, when in motion, engender risks for persons must have facilities for unauthorized start-up.
- Machinery for lifting loads, such as Crane, must be clearly marked to indicate its nominal load, and must where appropriate be fitted with a load plate giving the nominal load for each configuration of the machinery.
- Work equipment must be erected or dismantled under safe conditions, in particular observing any instructions which may have been furnished by the manufacturer.

4.12.2 Safety Directives for Protective Gears

219. Personal protective equipment is suggested for use when the risks cannot be avoided or sufficiently limited by technical means. All personal protective equipment must be appropriate for the risks involved, without itself leading to any increased risk and correspond to existing conditions at the workplace.
220. The Contractor shall organize orientation to use of personal protective equipment. Workers shall be informed of all measures to be taken. Consultation and participation shall take place on the matters related to the use of the protective equipment. A partial list of protective gears to be worn by the workers at designated work areas is given below; Table 17 presents the list in tabular form.

221. **Head Protection:** Protective helmets will be put on at all times mainly at the building and bridge construction sites, under scaffolds, erection and stripping of formworks, etc., where there are possibilities of head injuries from falling/flying objects.

222. **Hearing Protection:** Ear plugs or ear muffs should be worn in areas where exposure to high noise level is expected. Examples of such activities include percussion drill, bolt driving, etc.

223. **Eye and Face Protection:** Spectacles, Goggles, Face Shield or Arc-welding Mask with Hand Masks, whichever is appropriate, should be worn at times when percussion drilling, spray painting, welding or similar activities are in progress at the field.

224. **Respiratory Protection:** In work areas such as septic tanks, dump sites, sewers etc., where exposure to harmful or toxic gases is likely the workers should wear gas masks, dust filters, or insulating appliances with air supply, whichever is appropriate.

225. **Hand and Arm Protection:** In the work involving piercing, cutting or vibration. For protection against toxic chemicals special chemical resistant gloves should be worn. Over sleeves must be worn to protect ones arms.

226. **Foot Protection:** In road and bridge constructions, working on or under scaffolds, roof works, formwork erection and dismantling safety shoes/boots are essential protective measures.

4.12.3 Safety and Health Signs

227. Safety signs, health signs, prohibition sign, warning sign, mandatory sign, emergency escape sign, first-aid sign, information sign, signboard, supplementary signboard. safety color, symbol, pictogram, illuminated sign, acoustic signal, verbal communication and hand signal are essential tools for preventing accidents by providing information in advance.

228. When working on or with overhead lines the provisions of the paragraphs shall be complied with:
- Prior to climbing poles, ladders, scaffolds, or other elevated structures, an inspection shall be made to determine that the structures are capable of sustaining the additional or unbalanced stresses to which they will be subjected.
- Where poles or structures may be unsafe for climbing, they shall not be climbed until made safe by guying, bracing, or other adequate means.
• Before installing or removing wire or cable, strains to which poles and structures will be subjected shall be considered and necessary action taken to prevent failure of supporting structures.
• When setting, moving, or removing poles using cranes, derricks, gin poles, A-frames, or other mechanized equipment near energized lines or equipment, precautions shall be taken to avoid contact with energized lines or equipment, except in bare-hand live-line work, or where barriers or protective devices are used.
• Unless using suitable protective equipment for the voltage involved, employees standing on the ground shall avoid contacting equipment or machinery working adjacent to energized lines or equipment.
• Lifting equipment shall be bonded to an effective ground or it shall be considered energized and barricaded when utilized near energized equipment or lines.
• Pole holes shall not be left unattended or unguarded in areas where employees are currently working.
• Tag lines shall be of a nonconductive type when used near energized lines.

Table 4.18: Brief list of protective gears to be worn during the use of some equipment

<table>
<thead>
<tr>
<th>Works / Equipment Use</th>
<th>Safety Measures for Workers and/or Work Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Construction Works</td>
<td>HH, STB, HG</td>
</tr>
<tr>
<td>Earth-works</td>
<td>HH, STB, HG</td>
</tr>
<tr>
<td>Electric-works</td>
<td>IB, HG</td>
</tr>
<tr>
<td>Cables and Wires</td>
<td>HG, EG, HH</td>
</tr>
<tr>
<td>Yard-works</td>
<td>HH, STB, HG</td>
</tr>
<tr>
<td>Road Paving</td>
<td>HH, STB, HG, BP, FM</td>
</tr>
<tr>
<td>Cranes</td>
<td>HH, STB, HG, WB</td>
</tr>
<tr>
<td>Pile Driver</td>
<td>HH, STB, HG, EP, Wb</td>
</tr>
<tr>
<td>Arc Welder</td>
<td>HH, JV, HG</td>
</tr>
<tr>
<td>Bull Digger</td>
<td>HH, STB, Wb</td>
</tr>
<tr>
<td>Auger Drill</td>
<td>HH, STB, HG, WB</td>
</tr>
<tr>
<td>Concrete Mixer</td>
<td>HH, STB, HG, WB</td>
</tr>
<tr>
<td>Fork Lift</td>
<td>HH, HG, STB, WB</td>
</tr>
<tr>
<td>Elbow Jack</td>
<td>HH, STB, HG</td>
</tr>
<tr>
<td>Sledge / Pick Hammer</td>
<td>HH, STB, HG, WB</td>
</tr>
<tr>
<td>Vibrator</td>
<td>HH, STB, HG, WB</td>
</tr>
<tr>
<td>Pick Axe</td>
<td>HH, STB, HG, WB</td>
</tr>
<tr>
<td>Electric Saw</td>
<td>HG, EG, EM</td>
</tr>
<tr>
<td>Working on Poles, Towers</td>
<td>HH, STB, HG, WB</td>
</tr>
</tbody>
</table>

When working in unstable material provision shall be made for cleaning out auger-type footings without requiring an employee to enter the footing unless shoring is used to protect the employee.

Section A designated employee shall be used in directing mobile equipment adjacent to footing excavations.

No one shall be permitted to remain in the footing while equipment is being spotted for placement.

Where necessary to assure the stability of mobile equipment the location of use for such equipment shall be graded and leveled.

Tower assembly shall be carried out with a minimum exposure of employees to falling objects when working at two or more levels on a tower.

Guy lines shall be used as necessary to maintain sections or parts of sections in position and to reduce the possibility of tipping.

Members and sections being assembled shall be adequately supported.

230. The construction of transmission towers and the erecting of poles, hoisting machinery, site preparation machinery, and other types of construction machinery shall conform to following applicable requirements:

- No one shall be permitted under a tower which is in the process of erection or assembly, except as may be required to guide and secure the section being set.
- When erecting towers using hoisting equipment adjacent to energized transmission lines, the lines shall be de-energized when practical. If the lines are not de-energized, extraordinary caution shall be exercised to maintain the minimum clearance distances required by PGCB.
- Erection cranes shall be set on firm level foundations and when the cranes are so equipped outriggers shall be used.
- Tag lines shall be utilized to maintain control of tower section being raised and positioned, except where the use of such lines would create a greater hazard.
- The load-line shall not be detached from a tower section until the section is adequately secured.
- Except during emergency restoration procedures erection shall be discontinued in the event of high wind or other adverse weather conditions which would make the work hazardous.
- Equipment and rigging shall be regularly inspected and maintained in safe operating condition.
- Adequate traffic control shall be maintained when crossing highways and railways with equipment as required.
- A designated employee shall be utilized to determine that required clearance is maintained in moving equipment under or near energized lines.

231. For Stringing of Conductors: Conductors being strung in or removed shall be kept under positive control by the use of adequate tension reels, guard structures, tielines, or other means to prevent accidental contact with energized circuits.

- Guard structure members shall be sound and of adequate dimension and strength, and adequately supported.
- Catch-off anchors, rigging, and hoists shall be of ample capacity to prevent loss of the lines.
• The manufacturer's load rating shall not be exceeded for stringing lines, pulling lines, sock connections, and all load-bearing hardware and accessories.
• Pulling lines and accessories shall be inspected regularly and replaced or repaired when damaged or when dependability is doubtful.
• Conductor grips shall not be used on wire rope unless designed for this application.
• While the conductor or pulling line is being pulled (in motion) employees shall not be permitted directly under overhead operations, nor shall any employee be permitted on the cross-arms.
• A transmission clipping crew shall have a minimum of two structures clipped in between the crew and the conductor being sagged. When working on bare conductors, clipping and tying crews shall work between grounds at all times. The grounds shall remain intact until the conductors are clipped in, except on dead end structures.
• Except during emergency restoration procedures, work from structures shall be discontinued when adverse weather (such as high wind or strong rain or storm) makes the work hazardous.
• Stringing and clipping operations shall be discontinued during the progress of an electrical storm in the immediate vicinity.
• Reel handling equipment, including pulling and braking machines, shall have ample capacity, operate smoothly, and be leveled and aligned in accordance with the manufacturer's operating instructions.
• Reliable communications between the reel tender and pulling rig operator shall be provided.
• Each pull shall be snubbed or dead ended at both ends before subsequent pulls.

232. The Contractor will provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced. Workers and their representatives must be informed of all the measures taken concerning health and safety signs at work and must be given suitable instruction about these signs.

4.12.4 Implementation and Supervision of Health and Safety Guidelines

233. Occupational health and safety are very important issues, especially for the construction/rehabilitation phase of power lines and substations. Section 4.11 presents detail guideline on occupational health and safety issues. In addition, a detailed ECoP has been developed on health and safety issues (see Section 4.11). Besides, a number of Special Environmental Clauses (SECs) on “health and safety” and “disposal and pollution” have been included in the ESMF for inclusion in the Tender Document.

234. The Contractor will be responsible for implementation of the provisions of the health and safety guidelines, as outlined in the EMP and ECoP (which would form part of the Tender Document). For projects/sub-projects to be implemented by REB, the Environmental and Social Unit (ESU) and Supervision Consultant (to be hired by REB) will be responsible for overseeing proper enforcement of the health and safety guidelines. For projects/sub-projects to be implemented by PGCB, the Environment and Social Unit (ESU) of PGCB will be responsible for compliance with the health and safety guidelines outlined in the ESMF.
4.13 Special Environmental Clauses (SECs) for Tender Document

235. Apart from the provisions under "General Specification" and "Particular Specification" for different sub-project components, the following special environmental clauses (SECs) shall be included in the Tender Document under General/Particular Specification. These clauses are aimed at ensuring that the Contractor carries out his responsibility of implementing the EMP and other environmental and safety measures. Further, the special clause must be included for prohibiting the purchase and installation of transformers containing PCB.

236. To perform the work the contractor must hire at least one environment, health and safety supervisor for each subproject. Depending on the size of the subproject, REB/PGCB may recommend more than one supervisors in the bidding document.

237. Environmental Management Plan (EMP): The Contractor shall carry out all mitigation and enhancement measures (including those related to mitigation of air/noise/water pollution; drainage/traffic congestion) as specified in the Environmental Management Plan (EMP) annexed to this Contract.

238. Temporary Works: The Contractor shall make sure that all equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run away, barricade, chute, lift, etc. are substantially constructed and erected, so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them.

239. Health and Safety: All contractors are responsible to:

- Maintain standards of Health and Safety towards all of his employees not less than those laid down by the national standards or statutory regulations.
- Be in compliant with all Health and Safety Terms and Conditions described in ECoP 20 and 21;
- Ensure that all of its workers entering the worksite comply with the Occupational Health and Safety. The Contractor shall provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, belts, harnesses and lines shall be provided by the contractor. The "safety directives for work equipment" and "safety directives for protective gears", as specified in the Occupational Health and Safety Guidelines (attached) shall be followed.
- The Contractor shall supply and install PCB free transformers so as to prevent possible exposure to hazardous chemicals.
- Provide and maintain in prominent and well-marked positions all necessary first-aid equipment, medical supplies and other related facilities. A sufficient number of trained personnel will be required to be available at all times to render first aid.
- Provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced.
• Report to the Engineer promptly and in writing particulars of any accident or unusual or unforeseen occurrences on the site, whether these are likely to affect progress of the work or not.
• Safety Orientation prior to working at the work-site;
• Unless otherwise agreed to in writing by the REB/PGCA/PBS Project Contact Person, supply all necessary equipment and tools, including but is not limited to ladders, scuffles, man-lifts, forklifts, and others required in completing the work;
• Ensure that all equipment and tools, including PPE, used on the work-site are in good working condition, properly maintained;
• Ensure that equipment is operated only by those workers who have been properly trained and are skilled in the operation of the equipment;
• Have available for reference a manufacturer's operating manual for all the equipment and tools brought to the work-site;
• Use appropriate authorization to facilitate access to the project site as permitted.
• Ensure good accommodation, water supply and sanitation facilities for all workers

240. Disposal and Pollution:
• The Contractor shall not dispose any waste, rubbish or offensive matter in any place not approved by the Engineer or Statutory Authority having jurisdiction. The Contractor shall not discharge into any watercourse oil, solids, noxious or floating materials.
• The Contractor shall, where required, treat PCB contained in old transformers available technologies; namely, super critical oxidation, electro-chemical oxidation, solvated electron technology, chemical reduction method, dehalogenation process, and thermal desorption using pyrolysis, catalyzed dehalogination and vitrification before disposal.
• The Contractor shall take all reasonable precautions to keep public or private roads clean of any spillage or droppings from his vehicles or equipment. Any spillage or droppings which accrue shall be cleaned without delay to the satisfaction of the Engineer.
• The Contractor shall construct sanitary latrine or septic tank system or install portable cabin toilet for disposal of human waste in the site office and temporary labor sheds for workers/employees; the Contractor shall provide waste bins/cans for collection of solid waste at appropriate locations (as directed by the Engineer), and ensure proper transfer/disposal of solid waste.

4.14 Institutional Arrangement and Responsibility

Contractor:

241. In addition of Contractor's general arrangement to continue the construction and rehabilitation work under the transmission line project, contractor must hire at least one environment, health and safety supervisor for each subproject before the commencement of work. The Contractor/Subcontractor shall abide by the rules of regulation of the Occupational health and safety as stipulated in the Labour Act-2006 and BNBC codes of Bangladesh. The contractor shall also abide by the clauses of health and safety in the clauses at General Condition and subsequent Particular Condition of the bid document.
242. Role of environment, health and safety supervisor: Primary role is to monitor the movement of people, workers and equipment, give timely warnings of any risk or non-compliance with safe work procedures and, where necessary, stop work if a risk situation escalates or cannot be minimized as well as look the potential environmental issues (air pollution, noise level, water quality, waste management etc.).

243. The tasks of environment and safety supervisor include the following:

- Ensure first aid facilities and personal protective equipment (PPE) for workers at the site.
- Provide orientation to workers before start of the subproject activities.
- Warn the workers of any imminent or deteriorating risk situation that could result in an accident, and instruct when it is safe to proceed.
- Ensure restrain from undertaking any other tasks that may distract the workers focus on the work, mainly, work on or near live overhead conductors, work on transmission and communication towers.
- Stop the work, if necessary safety would not be ensured.
- Pause the work while the safety observer changes position.
- Ensure special safety during elevated work platform work or crane operations on or near live conductors.
- Ensure proper collection and disposal of solid wastes within the construction site.
- Ensure proper infrastructure facilities, water supply and sanitation facilities for all workers.

244. The contractor will prepare a monitoring report on environment and safety for each subproject at every month during the construction/rehabilitation of transmission line or substation.

Rural Electrification Board (REB):

245. REB has agreed to set-up a permanent Environment and Social Management Unit/Cell with qualified staff in their regular organogram. Since the establishment of the Unit/Cell would require several administrative clearances, as an interim measure, REB will set-up a Project specific Environment and Social Unit (ESU). This ESU under the leadership of a Superintending Engineer will assist the Project Management Unit (PMU) of REB on issues related to environmental and social management. The organogram for project "Environmental and Social Unit" as shown below.
246. Relevant Palli Biddyut Samities (PBSs) with support from the individual consultant as engaged by the Power Cell will carry out "Environmental and Social Screening" and "Analysis of Alternatives" of first year sub-projects, following the guidelines contained in the Environmental and Social Management Framework (ESMF).

247. Further onwards environmental and social assessment (ESA) of the sub-project, as required, will be carried out by Relevant Palli Biddyut Samities (PBSs) with support of supervision consultant or individual consultant hired by REB. The ESU of REB will review these documents and be responsible for implementation of EMP (as well as RAP and TPP) and preparation of quarterly reports, with support from and supervision consultant. REB will hire an NGO with requisite experience in implementing resettlement programs and working in tribal areas and issues for the field level implementation of the RAPs and TPPs, under the direct supervision of the ESU and in close coordination with the contractor. The supervision consultant will have environmental as well as social specialists in its team. Figure 4.8 shows activities and institutional responsibilities for overall implementation of the Proposed Rural Electricity Transmission and Distribution Project by REB. All mitigation Plans such as RAPs TPPs and EMPs will have to be cleared by the Bank before they are translated into Bangla and disclosed locally as well as at the Bank's InfoShop.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of sub-project and activities.</td>
<td>PBS with support from consultant</td>
</tr>
<tr>
<td>Prepare/complete:</td>
<td></td>
</tr>
<tr>
<td>• Sub-project Description (Form-1)</td>
<td>Project Environmental and Social Unit (ESU) and Environment specialist of Supervision Consultant</td>
</tr>
<tr>
<td>• Environmental/social Screening (Form-2)</td>
<td></td>
</tr>
<tr>
<td>• Analysis of Alternatives (Form-3)</td>
<td>Independent consultant</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Review of project documents, including</td>
<td></td>
</tr>
<tr>
<td>Forms-1, 2 and 3 and Screening/assessment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional Environmental/Social Assessment (ESA)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Carry out: (a) EIE and EMP or (b) full scale ESA (including RAP, TPP, if needed); following the ESF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Review of ESA by REB</td>
<td></td>
</tr>
<tr>
<td>(6) Obtaining necessary environmental clearance from the DoE and WB</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation of EMP/RAP/TPP/ECoP during &quot;construction phase&quot; of project components</td>
<td>EMP will implemented by the Contractor and supervised by PBS and periodic monitoring by Supervision Consultant and project ESU. The RAP and TPPs will be implemented by an NGO hired by the client under the supervision of the ESU and in coordination with the Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of quarterly progress and monitoring reports</td>
<td>One monitoring report by PBS based on monitoring report as prepared by contractor. Another by Supervision Consultant and ESU. And the NGO for social safeguards</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation of EMP/SMF during &quot;operational phase&quot; of project components, including monitoring and quarterly reporting</td>
<td>NGO and PBS with support from &quot;Environmental and Social Unit&quot; of REB</td>
</tr>
</tbody>
</table>

Figure 4.8: Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of proposed project by the REB
Power Grid Company of Bangladesh (PGCB):

248. PGCB is in the process of creating an Environment and Social Unit (ESU) in the regular organogram and the ESU is expected to be set-up before commencement of implementation stage of the project. Environment and Social Unit of PGCB under the leadership of Deputy General Manager will be responsible for taking care of issues related to environmental and social management. In addition, PGCB will hire an individual consultant for safeguard management of the project. He will review the environment screening/assessment report and do the period supervision of EMP implementation. The organogram for the proposed Environment and Social Unit, as shown below:

249. The Unit will be responsible for overall environmental and social management of sub-projects to be implemented under the proposed project. The PGCB field level staff will carry out "Environmental and Social Screening" and "Analysis of Alternatives" of sub-projects with the support from individual consultant for first year and onward, following the guidelines contained in the Environmental and Social Management Framework (ESMF).

250. Further environmental and social assessment (ESA) will be carried out by the unit or individual consultant to be hired by PGCB. The PGCB ESU will review the documents and be responsible for implementation of EMP (as well as RAP and TPP) and preparation of quarterly reports. PGCB will hire an NGO with requisite experience in implementing resettlement programs and working in tribal areas and issues for the field level implementation of the RAPs and TPPs, under the direct supervision of the ESU and in close coordination with the contractor. Figure 4.9 shows activities and institutional responsibilities for overall implementation of the Proposed Rural Electricity Transmission and Distribution Project by PGCB.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of sub-project/project activities.</td>
<td>Individual Consultant of Power Cell with PGCB field level staff</td>
</tr>
<tr>
<td>Prepare/complete:</td>
<td></td>
</tr>
<tr>
<td>- Sub-project Description (Form-1)</td>
<td></td>
</tr>
<tr>
<td>- Environmental/social Screening (Form-2)</td>
<td></td>
</tr>
<tr>
<td>- Analysis of Alternatives (Form-3)</td>
<td></td>
</tr>
<tr>
<td>Review of project documents, including Forms-1, 2 and 3 and Screening / assessment</td>
<td>Individual Consultant of project and Environment and Social Unit, PGCB</td>
</tr>
<tr>
<td>Additional Environmental/Social Assessment (ESA)</td>
<td>Independent consultant</td>
</tr>
<tr>
<td>Carry out: (a) IEE and EMP or (b) full scale ESAs (including RAP, TPP, if needed); following the ESMF</td>
<td></td>
</tr>
<tr>
<td>(7) Review of ESA by REB</td>
<td>Individual Consultant of project and Environment and Social Unit, PGCB</td>
</tr>
<tr>
<td>(b) Obtaining necessary environmental clearance from the DoE and WB</td>
<td></td>
</tr>
<tr>
<td>Implementation of EMP/RAP/TPP/ECoP during &quot;construction phase&quot; of project components</td>
<td>The RAP and TMPs will be implemented by an NGO hired by the client under the direct supervision of the ESU and in coordination with the Contractor. EMP implemented by the Contractor and supervised by PGCB's field staff. Periodic monitoring by Individual and Environment and Social Unit, PGCB</td>
</tr>
<tr>
<td>Preparation of quarterly progress and monitoring reports</td>
<td>Social safeguard report by the contracted NGO. One Environment report prepared by the Contractor. Another report prepared by Individual Consultant and Environment and Social Unit, PGCB.</td>
</tr>
<tr>
<td>Implementation of EMP/SMF during &quot;operational phase&quot; of project components, including monitoring and quarterly reporting</td>
<td>NGC and PGCB's field staff with supports from Environment and Social Unit, PGCB</td>
</tr>
</tbody>
</table>

**Figure 4.9:** Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of proposed project by the PGCB.

82
4.15 Capacity Building and Training Requirements

251. As a part of the "overall environmental and social assessment", existing environmental practices in recently completed and ongoing projects and capacities of REB and PGCB have been evaluated through analysis of organizational set up and interviewing officials/ engineers. Details of the evaluation are presented under "Overall Environmental Assessment". It appears that the engineers at the REB and PGCB have limited exposure to environmental/social assessment and management. As discussed above, REB (with support from PBS officials) and PGCB will be responsible for carrying out "environmental/social screening" and "analysis of alternatives", and guidelines have been provided in the ESMF for carrying out these activities. However, basic training on regulatory requirements, environmental impacts, and environmental assessment and management would greatly improve the capability of relevant REB and PGCB engineers and experts in carrying out their responsibilities under the proposed project. Training for the PBS officials may be arranged in phased manner, i.e., PBSs where sub-project would be initiated immediately would receive training first, others would gradually receive training as project work progresses. From logistic point of view, the trainings may be organized on a regional basis.

252. Both REB and PGCB will employ individual supervision/DSM consultant, who would support REB/PGCB in overall environmental/social management. However, since the overall responsibility of environmental management lies with REB/PGCB, they need to ensure that the consultants are carrying out their responsibilities properly. For this purpose, it is important that the REB/PGCB engineers/officials receive advanced training on environmental management and monitoring. Such training will assist them in properly overseeing the activities of the consultant engaged in environmental management of the proposed project, following the ESMF.

253. During the implementation of the project, both REB and PGCB will develop their own organizational environment and occupational health & safety strategy and guidelines for their regular development work.

254. Table 4.19 summarizes the training requirements of PBSs, REB and PGCB. It is also advised to provide the basic training for key personnel on regulatory requirements, environmental impacts, and environmental assessment and management in home or abroad. It may be mentioned that cost of training and capacity building is included in the project resources under component 3.

<table>
<thead>
<tr>
<th>Training Type/ Contents</th>
<th>Participants</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>General environmental awareness, regulatory requirements, ESMF frameworks for project, environmental impacts and mitigation, analysis of alternatives, environmental management</td>
<td>Relevant engineers/ officials of REB/PGCB/PBSs</td>
<td>Prior to commencement of sub-project activities</td>
</tr>
<tr>
<td>Advanced training on environmental assessment, management (EMP, RAP, TPP, ECoP), monitoring, including details on ESMF framework</td>
<td>Participants from: (a) Environment Unit of REB, (b) Relevant Engineers/ officials of PGCB</td>
<td>Immediately after project commencement</td>
</tr>
</tbody>
</table>
4.16 Budget Estimates

255. Cost estimates are prepared for all the mitigation and monitoring measures proposed in the EMF. The cost estimates for some of the mitigation measures will be identified in the EMF that are to be part of civil works contract. The tentative cost estimates and the budget for the remaining suggestive activities, covering both EMF and SMF, are given in the Table 4.20.

<table>
<thead>
<tr>
<th>Table 4.20: Tentative cost estimates for environmental and social management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activities</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Budget for ESA Consultants</td>
</tr>
<tr>
<td>• For first year project preparation (PGCB)</td>
</tr>
<tr>
<td>• Preparation of full ESA, if required for subprojects (REB)</td>
</tr>
<tr>
<td>• Preparation of full ESA, if required for subprojects (PGCB)</td>
</tr>
<tr>
<td>• Social Accountability</td>
</tr>
<tr>
<td>Training Requirements</td>
</tr>
<tr>
<td>• REB</td>
</tr>
<tr>
<td>• PGCB</td>
</tr>
<tr>
<td>Preparation of Environment and Occupational Health and Safety Strategy and Guidelines</td>
</tr>
<tr>
<td>• REB</td>
</tr>
<tr>
<td>• PGCB</td>
</tr>
<tr>
<td>EMP during construction</td>
</tr>
</tbody>
</table>

256. The Development Project Proposal (DPP) of GoB for the proposed rural electricity transmission and distribution project should reflect the above activities with budget for successful environmental management of the project.
5.0 SOCIAL MANAGEMENT FRAMEWORK

257. The Social Management Framework (SMF) presented here provides guidelines to identify and address the potential social concerns and impacts of the proposed rural electricity transmission and distribution project, right from the planning stage to its implementation and operational phase. The SMF provides the principles, processes and guidelines for social screening, social impact assessment and preparation of Resettlement Action Plans (RAPs) and Tribal People Planning (TPPs), where necessary. It includes detailed guidelines for carrying out environmental/social screening, guidelines for consultation and participation at different stages of project implementation (Appendix K), guidelines for social impact assessment (SIA) and preparation of RAP (Appendix L), a Grievance Redress Mechanism (GRM) (Appendix M), and a tribal people planning framework, including guidelines for preparation of tribal people plan (TPP) (Appendix M). A number of other socio-economic issues/parameters (e.g., health and safety, traffic congestion, employment) to be included in ESA have been addressed under EMF presented in Chapter 4.

5.1 Objectives of the SMF

258. The SMF is designed to ensure that the social development principles are mainstreamed into the project design. The objectives of the SMF are the following:

- Enhance social development outcomes of the activities to be implemented under individual sub-projects;
- Promote transparency in project implementation through the use of extensive stakeholder consultation and disclosure procedures;
- Avoid, minimize, and mitigate adverse social impacts including loss of livelihood, if any;
- Identify and compensate for unavoidable adverse social impacts that sub-projects might cause on people, including protection against loss of livelihoods;
- Ensure compliance with the relevant GoB policies and those of the World Bank on social safeguards and other social issues; and
- Strengthen social management capacity within REB and PGCB.

- Provide guidelines for preparation of all mitigation plans, such as RAPs and TPPs.

5.2 Social Management Principles

5.2.1 Inclusion

259. The vulnerable sections of the communities including the very poor, women, tribal people, minority communities, and the marginalized and/or, disabled people, etc., are to get benefit from the sub-projects and the SMF.

5.2.2 Participation

260. The communities are empowered with an opportunity to decide, implement and monitor the development programs. Accordingly, the focus should be to promote participatory processes throughout the sub-project cycles.
5.2.3 Transparency
261. Stakeholders can exercise their rights to access information on the proposed development project. The REB and PGCB are to disclose project information in public domain. This creates an enabling environment to develop trust among implementing partners and builds in checks and balances to strengthen the system. Sub-project information will be disclosed in public domain including the environmental/social screening/assessment reports and resettlement action plan, where applicable.

5.2.4 Social Accountability
262. Social accountability tools are to be implemented to improve peoples' participation and transparency. Steps to strengthen transparency and accountability includes strengthening of supply and demand side of Social Accountability for which ICT based monitoring and grievance management systems will be developed "real time" flow of information and "real time" decision making and taking corrective measures. On the supply side, it will cover geo-refencing and uploading the data from the site of the "processes" followed from screening to preparation of RAP and its implementation. On the demand side, the focus will be on grievance management for a help line service will be piloted to redress complaints related to social safeguard management.

5.2.5 Social Safeguards
263. The guiding principle for this SMF, to be followed and incorporated in all mitigation plans such as RAPs and TPPs when they are prepared are the following:

- All project affected people (PAPs) will be compensated for losses resulting from project interventions regardless of title to land (encroachers will be eligible for entitlements mentioned specifically in the entitlement matrix in Annex L).
- All compensation will be at replacement value (current market price at which the asset can be replaced) without deducting depreciation and salvage value.
- The cut-off date will be publicly announced by the project and will determine who are to be included as PAPs. The consultation and communication component will be an ongoing activity of the project.
- A Grievance Redress Mechanism will be developed and implemented to respond to all complaints.

264. Legal and policy framework provides guidelines for acquisition of land and assets and compensation measures for the assets acquired. The project is to be designed to avoid or minimize, to the extent possible, the adverse impacts caused by displacement associated with the implementation of sub-projects. The REB and PGCB are to prepare subproject proposals based on the following principles, which are to be mainstreamed by adopting appropriate process for social impact assessment and mitigation of impacts:

- Acquisition of private and public lands causing physical displacement of people will be avoided or minimized to the extent possible.
- In unavoidable circumstances, if land is vitally needed, REB/PGCB may seek voluntary contribution from the concerned land owners, and/or explore alternatives to voluntary contribution without coercion or threat of sanctions. However, voluntary contribution should not be considered for lands more than 1 (one) decimal in size. Besides, owner's socio-economic background and land use pattern (e.g., if the land
in question is his/her primary source of income. If the land is vacant/fallow, it should be considered when valuing voluntary contributions. Nature of the transfer must be well documented and verifiable.

- REB/PGCB may also opt to purchase the required lands directly through negotiation and get them in exchange of similar lands or on contribution against compensation.
- REB/PGCB may purchase land directly from private owners via the Land Purchase Committees; but the process has to be transparent, a verifiable reasonable benchmark of market price has to be established for each area, purchase price should be at current market price and the price should include the costs of taxes and transfers, and copies of deeds is to be shared with the WB. In case of direct purchase of land, RAP will not be required.
- In case of direct purchase or accepting voluntary donation REB and PGCB ESU (individual consultant may be hired to assist the Land Purchase Committees) will undertake brief social assessments and surveys to establish profiles of the seller/donor, the type of land and land use pattern including whether or not there are any encumbrances on the land and other anticipated impacts (for example on community owned infrastructure or obstruction to common property use etc). These will be submitted as part of the sub-project proposal and will include documented evidence of adequate consultation, willingness on the part of the seller/donor and signed MOUs. The ESU will review and approve the documents before sending these to the Bank for further clearance.
- Compensation for all affected structures will be done at replacement value plus its shifting cost.
- All impacts on income and livelihoods will be compensated for, and livelihood restoration programs will be undertaken.
- Lands owned by tribal people will be avoided in all circumstances and lands owned by any other vulnerable groups will be considered in exceptional circumstances, if no other feasible alternatives are available.
- Displaced people will be compensated and assisted for livelihood restoration, and demolished physical structures will be replaced or compensated commensurate to ground situations.

5.2.6 Communication Strategy

Strategic communications approach is a social process of dialogue, negotiation, and consensus building through the use of a variety of methods. Based on principles of inclusion, transparency and accountability, the IEC and communication strategy aims to enhance the ability of stakeholders to engage, influence local level institutions and hold them accountable for their work. The communications model is a community owned communication strategy that encourages civic engagement, where the community is part of the planning and monitoring process of the schemes. This is a long-term process of continued dialogue, clarifying issues under discussions and finding solutions to matters of common concern. Through engagement, a space is created where issues can be openly discussed, compromises can be negotiated and solutions acceptable to the majority are accepted and ratified. This strategy seeks to foster social, political, and institutional changes at different levels by building trust among implementers and the users, promoting a two-way communication, exchanging knowledge and skills for a sustainable change in both
availability of services and behavior that is consistent with fact on the ground. The best technically designed project can fail or have weak results if decision makers and the beneficiaries are not duly consulted, informed and mobilized.

5.2.7 Grievance Response

266. The proposed project is to establish a Grievance Redress Mechanism (GRM) to answer to queries, receive suggestions and address complaints and grievances about any irregularities in application of the guidelines adopted in the ESMF, and assessment and mitigation of environmental/social impacts. The mechanism will assist in resolving issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal action. The mechanism will however not deprive a person of his/her right to go to the courts of law. Grievance response focal points are to be available at the project level; a Grievance Redress Committee (GRC) is to be formed.

5.2.8 Approval and Access to Information

267. Environmental/social screening (Appendix B) of each sub-project and IEE/ESIA/RAP wherever required, are to be subject to review and clearance by the Bank. Whenever requested, REB/PCCB will provide the Bank with copies of the filled out environmental/social screening forms for all sub-projects to be implemented by REB/PCCB.

268. All summary of all safeguard documents including the ESMF, ESIA, RAPs, TPPs and other social plans are to be translated into Bangla (local language) and disclosed locally and the English versions disclosed through the Bank’s Info-shop. The REB and PCCB are to upload the ESMF in their official websites along with a Bangla translation of the summary.

5.3 Social Management Procedure

5.3.1 Overall Social Management Plan

269. Figure 5.1 shows the social management flow chart for the proposed project. The social management of the proposed project will start with identification/formulation of sub-projects with community involvement. It will be followed by social (as well as environmental) screening of the sub-project. Based on the social (and environmental) screening, the nature of further social assessment would be determined. If a sub-project is found to have no significant social safeguard issues (e.g., loss of land/income, impact on tribal people), only a social safeguard report (SSR) needs to be prepared summarizing the findings of the screening. On the other hand, if the screening identifies social safeguard issues, the sub-project would be categorized as “Red” (according to ECR 1997), requiring social impact assessment (SIA), along with preparation of resettlement action plan (RAP) and tribal people plan (TPP), if needed (in addition to preparation of EIA report, as explained in 4.4.6 (Chapter 3). The SIA and preparation of RAP and TPP will be carried out following the guidelines presented in this Chapter. Guidelines for carrying out EIA have been presented in Chapter 3 (4.4.6). After obtaining necessary clearance from DoE (and also WB), the sub-project will proceed to implementation phase, during which the provisions of the EMP, RAP and TPP will be executed, as prescribed in these documents, with monitoring by REB/PCCB.
5.3.2 Environmental/Social Screening

270. As noted earlier, sub-projects to be implemented will be identified by REB/PGCB through community engagement. Appendix J presents guideline for "consultation and participation" at different stages of project cycle, including project identification/formulation stage. As discussed in Chapter 3, PGCB/REB/PBS will be responsible for carrying out environmental/social screening of sub-projects. The environmental/social screening would involve: (i) reconnaissance of the sub-project areas/routes and their surroundings; (ii) identification of the major sub-project activities (see section 4.7.3 for typical sub-project activities); and (iii) preliminary assessment of the impacts of these activities on the ecological, physico-chemical and socio-economic environment of the sub-project surrounding areas. Section 4.4 provides guideline for carrying out environmental/social screening (by filling out Form 2a/2b, presented in Appendix B) focusing on the ecological and physico-chemical parameters. This section provides guideline for environmental/social screening, focusing on social parameters, including loss of land/income, and impact on indigenous population.

Substation:

271. The parameters considered for screening of social impacts during construction phase of a substation include loss of land, loss of income, and impact on tribal population; other socio-economic parameters for environmental/social screening have been addressed in section 4.4 (Chapter 4). If acquisition of private land is required, then it could generate "significant" adverse impact. As noted earlier, land requirement for a substation would vary from approximately 0.33 acre for an indoor type 33/11 kV substation to about 5 acres for an 132/33 kV air insulated switchgear (AIS) grid substation. If the proposed site for substation is currently being used for income generating activities (e.g., agriculture), then construction of substation would result in loss of income. Depending on the nature of income generating activities, the impact could be "significant", "moderate" or "minor". As a part of screening, it would be identified whether the project activities are likely to affect tribal population. Operation of a substation is not likely to generate any adverse social impacts.
272. The parameters considered for screening of social impacts during operational phase of a power line include possible loss of income, and impact on tribal population; other socio-economic parameters for environmental and social screening have been addressed in Section 4.4 (Chapter 3). Loss of income may result from temporary disruption of commercial activities at structures/entities (e.g., shops) located very close to the routes of the proposed power line (e.g., on footpaths close to the power line alignment). Presence of tribal population within/surrounding project areas and possible adverse impact of project activities on tribal population will be identified during social screening. Operation of power line is not likely to generate any adverse social impacts.

273. The environmental and social screening process will determine the nature of ESA that should be subsequently undertaken. The environmental/social screening will provide a rapid assessment of the project characteristics, its beneficiaries, the socio-economic dimensions of the area, and its potential environmental/social impacts and risks. As noted in Chapter 3, results of the environmental/social screening will determine whether or not a sub-project requires further ESA, including Environmental Impact Assessment (EIA), Social Impact Assessment (SIA) and Resettlement Action Plan (RAP).
Subproject Exclusion Criteria:
274. To ensure that the subprojects meet the main objectives of the project, legal requirements and safeguards, a set of exclusion criteria will be applied during social screening including the following:

- Subprojects requiring land acquisition or population displacement that cannot be compensated for or resettled;
- Subproject affecting mosques, temples, graveyards and cremation grounds, and other places/objects of religious, cultural and historical significance;
- Subprojects threatening cultural tradition and way of life of tribal peoples; severely restrict their access to common property resources and livelihood activities;
- Subproject interventions with objections from communities on social and environmental issues that cannot be resolved through design alternatives.

275. In addition to the planning level social screening for exclusion factors, a subproject will be dropped from investment at implementation level, if any social and environmental grievances raised from the community cannot be resolved to the satisfaction of the aggrieved persons or community groups.

5.3.3 Nature of Social Assessment Required
276. The level of environmental and social assessment (ESA) of a sub-project would primarily depend on the class/category of the sub-project according to OP 4.01 and ECR 1997. As noted earlier (section 4.8), some of the sub-projects to be implemented under the proposed project would fall under "Red" category (e.g., construction of new power lines), while others are not specifically listed in ECR 1997. Sub-project with social safeguard issues (i.e., loss of land, loss of income, impact on tribal population), identified during environmental/social screening, would also fall under "Red" category. For such sub-projects, SIA (as well as IIA) as well as RAP and TPP, if needed, will be required. Sub-projects without safeguard issues could fall under “Orange A” or “Orange B” category, depending on the level of anticipated impacts, which would be identified during environmental/social screening. For such sub-projects (without social safeguard issues), a social screening report (SSR) may be prepared summarizing the findings of the social assessment. As explained in section 4.8, for “Orange A” Category sub-projects, no further ESA assessment would be required, but some additional information would be required; while for “Orange B” category sub-projects Initial Environmental Examination (IEE) and Environmental Management Plan (EMP) would be required.

277. The guidelines for carrying out IEE and EIA and preparation of EMP have been presented in Chapter 4 under environmental management framework (EMF). The guidelines for carrying out SIA and preparation of RAP and TPP are presented in this Chapter under social management framework (SMF).

5.3.4 Guideline for Carrying out SIA and Preparation of RAP and TPP
278. The principal objectives of the SIA are to identify viable alternatives (route analysis should take into account the entire right of way including that under the transmission lines and cables, not just the placement for towers and substations, when assessing potential impacts and impact minimization); identify potential social impacts, including direct or
indirect, permanent or temporary, physical or economic; assessing their significance; design least-cost mitigation measures; develop RAPs and monitoring requirements; develop TPP; formulate institutional arrangements; and ensure meaningful public consultation and information disclosure procedures. The SIA will identify and estimate impacts, risks and opportunities and suggest measures to avoiding or minimizing, mitigating and managing, and compensating adverse social impacts.

279. The major activities carried out for the Social Impact Assessment (SIA) are summarized below.

- Baseline social surveys covering areas in and around the proposed locations/routes of substations/power lines;
- Identification and scoping of possible social impacts of the proposed sub-project activities, and selection of parameters for social impact assessment;
- Prediction and evaluation of social impacts and suggestion of mitigation measures to offset adverse impacts;
- Analysis of alternatives;
- Public/stakeholder consultations, including Focus Group Discussions (FGDs) and interviews;
- Preparation of SIA report;
- Preparation of RAP, if needed;
- Preparation of TPP, if needed.

5.3.4.1 Socio-economic baseline

280. For carrying out SIA, it is important to have a clear understanding to the baseline socio-economic condition of people, especially those living within the sub-project influence areas (see Table 4.4 for typical sub-project influence areas). A common approach for quick assessment of baseline socio-economic condition is questionnaire survey. The primary objectives of a questionnaire survey are:

(a) to understand people's socio-economic condition;
(b) to understand extent of people's access to basic services; and
(c) to understand people's perception regarding the sub-project.

281. A sample questionnaire for carrying out baseline socio-economic survey is presented in Appendix J. The questionnaire covers five major themes:

(a) Socio-economic background
(b) Basic services
(c) Education
(d) Economic situation, and
(e) Attitude toward the proposed sub-project.

5.3.4.2 Project activities and parameters for SIA

282. As discussed earlier, the proposed project involves construction of substations (132/33 kV by PGC; and 33/11 kV by REB), and construction/rehabilitation of power lines (132 kV by PGC; 33 kV and 11 kV by REB). The ESMF provides detail description of activities during construction and operational phases of these sub-projects. These activities should be considered for assessment of social impacts of these sub-projects.
283. The typical socio-economic impacts from implementation of these sub-projects include loss of land (for substations); loss of income; impact on tribal population; impact on archaeological/historical sites; traffic congestion; and employment generation. This SMF presented in this Chapter provides guidelines for assessment of social impacts focusing on:

- Loss of land and income, and associated resettlement; and
- Impact on tribal population.

284. The guidelines for addressing the other socio-economic parameters are presented in Chapter 4. Guidelines for carrying out "analysis of alternatives" are also presented in Chapter 4.

5.3.4.3 Public/stakeholder consultation

285. The objectives of consultation and participation process are to inform, consult, engage, collaborate and empower the communities and other local stakeholders in the sub-project cycle at the field level. Consultation and community participation will be undertaken to achieve the following specific objectives at subproject identification, planning, design, implementation and evaluation stages:

- Identification – to sensitize the community about the sub-project and their role and identify inclusive ground needs;
- Planning – to ensure transparency of the planning process, reflect community expectations in project design, acceptable work schedule and procedures; ensure identification of adverse impacts and measures to mitigate them;
- Implementation – to ensure that benefit accrues to the targeted beneficiaries inclusive of all groups including the very poor and vulnerable groups and the quality of works are satisfactory to the communities.
- Review and evaluation – to evaluate the beneficiary satisfaction and outcomes of the subprojects for intended benefits to targeted beneficiaries.

286. Involvement of communities is not limited to interactions with them but also disclosing relevant information pertaining to the project tasks and targets. Consultation and participation involves communities and other stakeholders, which will take place through interpersonal communications, focused group discussions (FGDs) and small and large community meetings. Additionally, radio broadcast and other media forms may be used to further disseminate information. The PBSs (for REB) will be the platforms for disclosure and consolidate feedback from beneficiary communities and other stakeholders. Appendix K presents guidelines for carrying out public consultations at different stages of a sub-project cycle.
5.3.4.4 RAP

287. The project approach discourages acquisition of private lands and displacement of people for project purpose. However, certain sub-projects (e.g., a substation) may require acquisition of private land and involve population displacement. Once it is determined through the social screening that a sub-project will require land, involve population displacement or loss of livelihoods, a Resettlement Action Plan (RAP) needs to be prepared.

288. RAPs are designed to ensure that impacts arising from land acquisition, displacement and relocation are mitigated, managed and compensated and livelihoods of displaced persons are restored. The RAP focuses on people affected by land acquisition, relocation and restriction of access, and defines a strategy for formalizing arrangements and responsibilities for mitigating impacts caused due to physical and economic displacements.

289. Appendix L presents detail guideline for preparation of RAP. It presents a discussion on major issues concerning land acquisition and resettlement; it presents impact mitigation objectives and principles, eligibility for compensation/assistance and principles for providing compensation/assistance. Appendix L provides detail description of land acquisition process, and processes for preparation and implementation of sub-project specific RAP. It presents a method for market price survey, and a compensation and entitlement matrix. It also presents a format/form for voluntary donation of land.

5.3.4.5 Tribal People Plan (TPP)

290. The general sub-project areas in Chittagong and Sylhet division may have small concentration of tribal inhabitants. The project has taken the exclusion criteria (see Section 5.4.2) to avoid any negative impact on the tribal communities due to undertaking of the project in those areas. The project rather, intends to extend the benefits towards their welfare. OP 4.10 is triggered when a project engages with, touches on or impacts tribal people in any way, positive or negative. Detail guidelines have been prepared for preparation of TPP, following the World Bank’s Operational Policy on Indigenous Peoples (OP 4.10), to maximize benefits to the tribal peoples. The guidelines presented in Appendix M will apply where sub-projects will be proposed in areas inhabited by tribal peoples.

5.3.4.6 Access to Information

291. Summary of the ESMF report and impact mitigation measures will be translated into Bengali language and disseminated locally. Copies of the full report (in English) and the summary (in Bengali) will be sent to all the concerned offices of REB/PGCB, and will be made available to the public. The draft ESA (two volumes) will also be uploaded in the website of REB/PGCB and in the Bank InfoShop before appraisal completion.

292. In addition a national workshop has been planned for presenting the EMF and SMF to the key stakeholders including field level staff of the implementing agencies (REB, PGCB), community representatives, NGOs, civil society etc. The comments and the findings from the workshop and other public meetings will be reviewed and incorporated in the final ESA report.
During the implementation stage of project, the sub-project specific screening/assessment report will periodically be posted in the REB/PGCB website before the bidding process.

5.3.5 Project Management
5.3.5.1 Institutional Arrangement

Institutional arrangement for implementation of SMF is the same as that for EMF. The institutional arrangement is presented in Chapter 3, and summarized below.

Rural Electrification Board (REB):

For sub-projects to be implemented by REB, an "Environmental and Social Unit" under the leadership of a Superintending Engineer, will assist the Project Management Unit (PMU) of REB on issues related to environmental management. The "Environmental and Social Unit" with support from relevant Palli Bidyut Samities (PBSs) will carry out "Environmental/Social Screening" and "Analysis of Alternatives" of sub-projects, following the guidelines contained in the Environmental and Social Management Framework (ESMF). REB will be responsible through its Palli Bidyut Samitis to draw up a verifiable and "real" market price for land in the areas where the sub stations will be to arrive at a benchmark to be followed during direct purchase of land. The process for arriving at this price has to be transparent and discussed in detail.

Further environmental and social assessment (ESA) of the sub-project, as required, will be carried out by supervision consultant or individual consultant hired by REB. The PMU of REB will be responsible for implementation of EMP (as well as RAP and TPP) and preparation of quarterly reports, with support from "Environmental and Social Unit" and supervision consultant. The supervision consultant will have environmental as well as social specialists in its team. Figure 3.13 (Chapter 3) shows activities and institutional responsibilities for overall implementation of the Proposed Rural Electricity Transmission and Distribution Project by REB.

Power Grid Company of Bangladesh (PGCB):

The Environment and Social Unit of PGCB under the leadership of Deputy General Manager will be responsible for overall environmental management of sub-projects to be implemented under the proposed project. The unit will carry out "Environmental/Social Screening" and "Analysis of Alternatives" of sub-projects, following the guidelines contained in the Environmental and Social Management Framework (ESMF).

Further environmental and social assessment (ESA) will be carried out by individual consultant to be hired by PGCB. The PGCB project team with support from Environment and Social Unit will be responsible for implementation of EMP (as well as RAP and TPP) and preparation of quarterly reports. Figure 4.13 (Chapter 3) shows activities and institutional responsibilities for overall implementation of the Proposed Rural Electricity Transmission and Distribution Project by PGCB.
5.3.5.2 Grievance Redress Mechanism

299. Grievance Redress Mechanism (GRM) is a valuable tool, which will allow affected people to voice concerns regarding environmental and social impacts of the proposed project. A Grievance Redress Committee (GRC) will be formed to address grievances. The GRC will be a forum where people will exercise their rights of participation in the project cycle through suggestions and complaints. GRCs will also be para-legal courts of the project to address local problems and complaints related to social and environmental impacts. A GRC will be formed for each sub-project related to Upazilla/Thana, headed by the Chairman/Mayor of relevant area. Members will be taken to represent the communities and other stakeholders, including representatives of local administration, school teachers, local NGOs, women and ward level elected representatives. Members of the GRC will be nominated by the Chairman/Mayor. The Chairman/Mayor will form the GRC and forward the composition to the Project Director (PD) of the sub-project. Table 5.1 shows the composition of the GRC. Appendix N provides detailed description and operational details of GRM.

### Table 5.1: Structure of Grievance Redress Committee (GRC)

<table>
<thead>
<tr>
<th>Chairman</th>
<th>Upazilla Chairman / Mayor</th>
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<tbody>
<tr>
<td>Member-Secretary</td>
<td>Director (Technical and Environment) of REB/ Director, Technical of PGCB</td>
</tr>
<tr>
<td>Member</td>
<td>Representative from local administration</td>
</tr>
<tr>
<td></td>
<td>Representative of civil society</td>
</tr>
<tr>
<td></td>
<td>Female ward councilor (relevant area)</td>
</tr>
<tr>
<td></td>
<td>Representative of religious society or well-respected individual (e.g., Imam or school headmaster)</td>
</tr>
<tr>
<td></td>
<td>Representative of tribal society, if any</td>
</tr>
<tr>
<td></td>
<td>Representative of PBS (for REB), Representative of REB</td>
</tr>
</tbody>
</table>

300. The GRC will ensure proper presentation of complaints and grievances, as well as impartial hearings and transparent decisions. The sub-project-affected persons can register their grievances at the complaint cell. The GRCs will meet periodically to discuss the merit of each case and fix a date for hearing and notify the PAP to submit necessary documents in proof of her/his claim/case, resolve grievances within one month of receipt of complaint. Additional details regarding the functioning of the GRC is presented in the SMF.

5.3.5.3 Capacity Building and Training Requirements

301. The capacity of REB and PGCB in carrying out environmental/social management of the proposed project and training requirements for capacity building have been discussed in Chapter 3. As discussed in Section 4.15, REB and PGCB engineers/officials have limited exposure to environmental/social assessment and management. REB (with support from PBS officials) and PGCB will be responsible for carrying out “environmental/social screening” and “analysis of alternatives” following the ESMF. Therefore, basic training on regulatory requirements, environmental impacts, and environmental assessment and management would greatly improve the capability of relevant REB and PGCB engineers and experts in carrying out their responsibilities.

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302. Both REB and PGCB will employ individual/supervision/DSM consultant, who would support REB/PGCB in overall environmental/social management. However, since the overall responsibility of environmental management lies with REB/PGCB, they need to ensure that the consultannts are carrying out their responsibilities properly. For this purpose, it is important that the REB/PGCB engineers/officials receive advanced training on environmental management and monitoring. Such training will assist them in properly overseeing the activities of the consultant engaged in environmental management of the proposed project, following the ESMF. Table 3.19 (Chapter 3) summarizes the training requirements of PBSs, REB and PGCB. It may be mentioned that cost of training and capacity building is included in the project resources under component 3.

5.3.5.4 Monitoring and Evaluation

303. Monitoring and Evaluation (M&E) of sub-projects for social development and safeguard issues are critical activities in order to identify implementation problems and develop solutions. Monitoring is a periodic assessment of planned activities providing midway inputs, facilitating changes and giving necessary feedback on the activities and the directions on which they are going; whereas evaluation is a summing up activity at the end of the project assessing whether the activities have actually achieved their intended goals and purposes.

304. Social development will be monitored using following indicators. Data regarding these indicators will be collected periodically and will be analyzed to find the outcomes of the processes. However, these indicators will be reviewed at the subproject preparation stage and customized for specific subprojects.

| Inclusiveness | • Access to vulnerable communities considered in subproject identification, with special focus on tribal people |
|              | • Consultation and communication strategy takes into account accessing vulnerable people and incorporates their feedback into the project design |
|              | • Consultation strategy for Tribal People is tailored and focused, culturally acceptable, implemented in local dialects and emphasizes achieving broad community support for the project |
|              | • The specific needs and concerns of tribal people are considered and incorporated in the mitigation plans and implemented in a culturally acceptable manner |

| Participation | • Representation of women, tribal and vulnerable groups, occupational groups, men and women in consultation process |
|              | • Representation of women, tribal group members and leaders (where relevant), and vulnerable groups in GRCs |
|              | • Beneficiary options reflected in subproject design and implementation |

| Transparency | • Disclosure of project information SMF/RAP/TPP |
|             | • Community awareness about the subproject and the social management issues and policies |

| Social accountability | • Feedback from communities considered and incorporated for design and implementation |
|                      | • Grievance petitions received and cases resolved via the GRM |
|                      | • Representation of community peoples in the GRCs and monitoring process (including wide community representation in tribal areas) |
Indicators for Monitoring Land Acquisition

The following indicators will be used to monitor status of major tasks involved in land acquisition and preparation and implementation of resettlement activities. Once the route is finalized and the substation, tower locations determined, land acquisition needs will be identified. The following activities and outcome indicators will be assessed:

<table>
<thead>
<tr>
<th>Land Acquisition</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of finalization of land acquisition proposals (LAPs)</td>
<td>Date of Compensation Estimates submitted by DCs to ULBs</td>
</tr>
<tr>
<td>Date LAPs submitted to the Deputy Commissioners (DCs)</td>
<td>Date REB/PGCB reviewed the Compensation Estimates</td>
</tr>
<tr>
<td>Date Notice-3 issued by DCs</td>
<td>Date REB/PGCB placed the compensation funds with DCs</td>
</tr>
<tr>
<td>Date Notice-6 issued by DCs</td>
<td>Date Notice-7 issued by DCs</td>
</tr>
<tr>
<td>Date Compensations submitted by DCs to ULBs</td>
<td>Date the DCs start CUI payment</td>
</tr>
</tbody>
</table>

**Impact**

- % of land paid compensation for
- % of affected persons compensated
- Number of complaints received through the GRM related to land acquisition and compensation process
- Number of complaints handled by the GRCs and resolved via those
- Number of cases which were not resolved

**Outcomes**

- Usage of compensation money
- Number of people displaced from community/area and present location
- Changes in livelihood pattern due to land acquisition
- Increase/decrease in marginalization/vulnerability due to land acquisition
- Tracking the unresolved complaints and their impact on the project

Indicators for Monitoring RAP

<table>
<thead>
<tr>
<th>Resettlement</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Census of project affected persons and assets, and fixing of the cut-off dates for squatters</td>
<td>Preparation of Compensation Budgets for squatters and others (displaced business and other activities) and top-ups for titleholders</td>
</tr>
<tr>
<td>Survey of replacement costs and market prices of affected lands and other assets</td>
<td>Preparation of the individual entitlement files for different PAP groups</td>
</tr>
<tr>
<td>Disclosure and consultation process</td>
<td>Approval of the Compensation Budget</td>
</tr>
<tr>
<td>Formation of the Grievance Redress Committees (GRCs)</td>
<td>Payment of resettlement assistance and relocation</td>
</tr>
<tr>
<td>Preparation of Compensation Budgets for squatters and other (displaced business and other activities) and top-ups for titleholders</td>
<td>Implementation of the livelihood restoration plans</td>
</tr>
<tr>
<td>Preparation and submission of RAPs for IDA review and clearance</td>
<td>Continuing monitoring and reporting progress in payment</td>
</tr>
<tr>
<td>Preparation of the individual entitlement files for different PAP groups</td>
<td>% of PAPs compensated</td>
</tr>
</tbody>
</table>

**Impact**

- % of PAPs compensated
- Number of complaints received through the GRM and successfully
Outcome

- Number of cases that remain unresolved
- Effectiveness of compensation/relocation
- Number of people displaced
- Increase/decrease in vulnerability/marginalization after resettlement completion
- Effectiveness of livelihood restoration measures - were skills marketable, were PAPs earning more/less through the alternative measures, were alternative livelihood measures culturally acceptable?
- Impact of unresolved cases/complaints on the project

Voluntary land donation

- Voluntary donations executed with proper documentation and as per process described in the SMF

Contribution against compensation/Direct Purchase

- Legal process is followed and documented in obtaining private lands through these process as per the SMF

306. Monitoring is an ongoing process and there may be indicators which come to light as the process of land acquisition, RAP/TPP preparation evolves and progresses. Additional indicators will be added as and when required.

5.3.5.4 Budget

307. Cost estimates have been prepared for all the mitigation and monitoring measures proposed in the EMF (Chapter 3). The cost estimates for some of the mitigation measures as will be identified in the EMP that are be part of civil works contract. The tentative cost estimates and the budget for the remaining suggestive activities, covering both EMF and SMF, have been made and presented in Table 4.20 (Chapter 4).
References

BPDB (2008), Personal communication with officials of Bangladesh Power Development Board.


APPENDIX A

Form 1a: Sub-project Description: Substation
(to be completed by REB/PGCB)

(1) Name of Substation :

(2) Location of Substation :

(3) Local REB/PBS/PGCB office :

(4) Location/layout of proposed Substation :

(attach location map/layout map)

(5) Ownership of sub-project land :

(a) Government owned (acre) :

(b) Private land (reel acquisition) (acre) :

(c) Partly private/Partly Government owned:

(6) Brief description of proposed Substation site:

(Indicate the information on present land use, HFL for last 30 years and important Environmental Features (IEFs) adjacent to the site)

(7) Brief information of environment within sub-project influence area:

(human settlement, tribal people, water body, flora, fauna, historical or culturally important sites, traffic)

(8) Key activities of sub-project :

(see 4.4.9.3 of ESMF for typical sub-project activities)

(9) Estimated cost of sub-project :

(M/1 BDT)

Educational institutions, health-care, pond, canal, river, utility infrastructure, park, green area etc.

Follow Table 3.4 of EMF for influence area.
(20) Schedule of implementation:
(a) Sub-project duration (months):
(b) Tentative start date:
(c) Tentative completion date:

(21) Potential benefit from sub-project:
(including estimated number of people benefited)

Prepared by: (Name, designation, mobile number, signature, date) 

Reviewed by: (Name, designation, mobile number, signature, date)
APPENDIX A

Form 1b: Sub-project Description: Power Line
(to be completed by REB/PGCB)

(1) Name of Power Line Subproject:

(2) (a) Total Length (km):
(b) Type of Line:
(c) Start/End Point:

(3) Local REB/PRB/PGCB office:

(4) Layout of proposed Power Line:
(attach layout map)

(5) Ownership of sub-project land:
(d) Government owned:
(e) Private land (need acquisition) (acre):
(f) Partly private/Partly Government owned:

(6) Brief information of surrounding environment along power line influence area:
(a) Characteristics of route of power line:
   .... % paddy/crop field; .... % along road/highway; .... % village/human settlement;
   .... % industrial area; .... % forest; .... % wetland/river; .... % other (specify);
(b) Information on IEs, human settlement, industrial/commercial establishments, tribal people, water body, flora, fauna, historical or culturally important sites, ecologically sensitive areas, traffic:

(7) Key activities of sub-project:
(see 4.4.9.3 of ESMF for typical sub-project activities)

(8) Estimated cost of sub-project:
(Mil BDT)

*Follow Table 3.4 of ESMF for influence area.
(9) Schedule of implementation:
   (d) Sub-project duration (months): 
   (e) Tentative start date: 
   (f) Tentative completion date: 

(10) Potential benefit from sub-project:
     (including estimated number of people benefited)

Prepared by: (Name, designation, mobile number, signature, date)

Reviewed by: (Name, designation, mobile number, signature, date)
### Form 2a: Environmental/Social Screening: Substation

(to be completed by REB/PGCB following Guideline in 4.4.6 and 5.4.2 of ESMF)

<table>
<thead>
<tr>
<th>Name of Substation</th>
<th>Location of Substation</th>
<th>Local REB/PGCB office</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Potential Environmental impact during Construction Phase:

**Ecological impacts:**

- Felling of trees
  - Significant □
  - Moderate □
  - Minor □
  - Number of trees

- Clearing of vegetation
  - Significant □
  - Moderate □
  - Minor □

- Potential impact on aquatic (i.e., water) habitat (adjacent water body, if any)
  - Significant □
  - Moderate □
  - Minor □

- Presence of forest, protected area, key biodiversity area along the route of power line
  - Yes □
  - No □

**Physicochemical impacts:**

- Noise pollution
  - Significant □
  - Moderate □
  - Insignificant □

- Air pollution
  - Significant □
  - Moderate □
  - Insignificant □

- Drainage congestion/water logging
  - Very likely □
  - Likely □
  - Unlikely □

- Water pollution
  - Significant □
  - Moderate □
  - Insignificant □

- Pollution from solid/construction waste
  - Significant □
  - Moderate □
  - Insignificant □

**General Socio-economic impacts:**

- Traffic congestion
  - Very likely □
  - Likely □
  - Unlikely □

- Health and safety
  - Significant □
  - Moderate □
  - Insignificant □

- Impact on archaeological and historical
  - Significant □
  - Moderate □
  - Insignificant □

- Employment generation
  - Significant □
  - Moderate □
  - Insignificant □

**Social impacts related to acquisition of land, tribal people:**

1) Acquisition of private land needed
   - Yes □
   - No □

2) Amount of private land to be acquired:
   - □

3) Presence of tribal population in project surrounding areas
   - Yes □
   - No □

**Assessment of social impacts**

- Loss of land
  - Significant □
  - Moderate □
  - Insignificant □
• Loss of income: Significant □ Moderate □ Insignificant □
• Impact on tribal people (if applicable) Significant □ Moderate □ Insignificant □

2) Potential Environmental Impact during Operational Phase: No significant adverse impact anticipated that cannot be addressed by routine O&M activities, and no such impacts are expected that could potentially affect nature of subsequent ESA.

3) Summary of possible environmental/social impacts of the subproject:
[mention overall nature of impacts, and mention if social safeguard issues (e.g., land acquisition, impact on tribal people) have been identified]

4) Category of sub-project: (follow Table 4.2 of EMF)
(a) According to ECR 1997: Green / Orange A / Orange B / Red / Not Listed
[if "social safeguard issues (e.g., land acquisition, impact on tribal people) identified, likely category "RED"]
(b) According to WB classification: Category B

5) Proposed mitigation measure: (Follow Appendix H or Tables 4.10 - 4.12 of ESMF as appropriate)

6) Overall Comments:

Prepared by: (Name, designation, mobile number, signature, date)--------------------------------------

Reviewed by: (Name, designation, mobile number, signature, date)-----------------------------------
# APPENDIX B

**Form 2b: Environmental/Social Screening: Power Line**

(to be completed by REB/PGCB following Guideline in 4.4.6 and 5.4.2 of ESMF)

<table>
<thead>
<tr>
<th>Name of Power Line Subproject</th>
<th>Total Length (km)</th>
<th>Type of Line</th>
<th>Start/End Point</th>
<th>Local REB/PBS/PGCB office</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) **Potential Environmental Impact during Construction Phase:**

   (e) Ecological Impacts:

   - Felling of trees
     - Significant □ Moderate □ Minor □ Number of area
   - Clearing of vegetation
     - Significant □ Moderate □ Minor □
   - Potential impact on aquatic (i.e., water) habitat (esp. if power line is to be constructed over river/wetland)
     - Significant □ Moderate □ Minor □
   - Presence of forest, protected area, key biodiversity area along the route of power line
     - Yes □ No □

   Note: If answer to the above question is "Yes", then a detail analysis of alternative routes would be carried out to identify possible route(s) that would eliminate/reduce risk to biodiversity, vegetation, habitat. If it is not possible to completely avoid such sensitive areas, then possible impact on biodiversity must be addressed as outlined in the ESMF.

   (f) Physicochemical Impacts:

   - Noise pollution
     - Significant □ Moderate □ Insignificant □
   - Air pollution
     - Significant □ Moderate □ Insignificant □
   - Water pollution
     - Significant □ Moderate □ Insignificant □
   - Pollution from solid/construction waste
     - Significant □ Moderate □ Insignificant □

   (g) General Socio-economic impacts:

   - Traffic congestion
     - Very likely □ Likely □ Unlikely □
   - Health and safety
     - Significant □ Moderate □ Insignificant □
   - Impact on archaeological and historical
     - Significant □ Moderate □ Insignificant □
   - Employment generation
     - Significant □ Moderate □ Insignificant □
   - Impact on tribal people (if applicable)
     - Significant □ Moderate □ Insignificant □

2) **Potential Environmental Impact during Operational Phase:** No significant adverse impact anticipated that cannot be addressed by routine O&M activities, and no such impacts are expected that could potentially affect nature of subsequent ESA.
3) **Summary of Possible environmental/social impacts of the subproject:**

(mention overall nature of impacts, and mention if social safeguard issues (e.g., impact on tribal people) have been identified)

4) **Category of sub-project**

   : (follow Table 4.2 of ESMF)

   (c) According to ECR 1997: Green / Orange A / Orange B / Red / Not Listed

   (if "social safeguard issues (e.g., land acquisition, impact on tribal people) identified, likely category "RED")

   (d) According to WB classification: Category B

5) **Proposed mitigation measure**

   (follow Appendix H or Tables 4.16-4.12 of ESMF as appropriate)

6) **Overall Comments:**

   Prepared by: (Name, designation, mobile number, signature, date) ____________________________

   Reviewed by: (Name, designation, mobile number, signature, date) ____________________________
APPENDIX C

Form 3a: Analysis of Alternatives: Substation
(to be completed by REB/PGCB)

Name of Substation: :
Local REB/PBS/PGCB office: :
Brief description of Sub-project: :

(a) Analysis of alternative locations:

Note: The REB-PBS/PGCB authority will carry out screening at all proposed alternative locations of substation based on the screening form 2a. Then the environmental and social details for these alternatives will be listed in the following table. Important considerations include ownership of land (Government-owned land are to be given priority), location of ecologically sensitive areas, human settlement, proximity to communication network, load centre. Based on the assessment the relative advantages and disadvantages, a location for the sub-project will be proposed.

<table>
<thead>
<tr>
<th>Key Environment and Social Issues</th>
<th>Alt-1</th>
<th>Alt-2</th>
<th>Alt-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land (Government-owned land are to be given priority)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural/cropping pattern</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of village affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of family affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of Common properties affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of Tree cut (approx.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecologically sensitivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tribal population</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterway-affected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Proposed Location (will be selected from above comparison):

(b) Analysis of alternative technologies/designs:

Note: Use of Gas Insulated Switchgear (GIS) instead of Air Insulated Switchgear (AIS) would reduce land requirement for substation and avoid possible generation of toxic fumes in control building due to flashover inside AIS (especially under high humidity and saline conditions). Under humid/saline environment, the switchgears and electrical accessories of the "Outdoor type" substations undergo considerable stress reducing their operating life, which could be avoided using Indoor type substation.

<table>
<thead>
<tr>
<th>Design Issues</th>
<th>Alt-1</th>
<th>Alt-2</th>
<th>Alt-3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Selected Technology/Design:

(c) No Sub-project Scenario: Briefly mention the difficulties the REB/PBSs/PGCB will face if the sub-project is not implemented

(d) Conclusion: On selected method/design/technology and route/location of sub-project.
APPENDIX C

Form 3b: Analysis of Alternatives: Power Line
(to be completed by REB/PGCB)

<table>
<thead>
<tr>
<th>Name of Power Line Sub-project</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate Total Length (km)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(could vary among alternative routes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start/ End Point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local REB/PPS/PGCB office</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) Analysis of alternative routes:

Note: The REB-PBS/PGCB authority will carry out screening at all proposed alternative routes of the power line based on the screening form 2b. Then the environment and social details of these alternatives will be listed in the following table. Important considerations include avoiding homestead areas, as much as possible; avoiding crossing of rivers/hills/bamboo groves/cash-in trees, as much as possible. If the homestead areas (or other sensitive infrastructure) are not avoidable in any of the options, the REB-PBS/PGCB will consult with the owner/respective authority and collect their no objection for the construction of transmission and distribution lines in written. Based on the assessment the relative advantages and disadvantages, a location for the sub-project will be proposed.

Key Environmental and Social Issues

<table>
<thead>
<tr>
<th>Important Features along the route</th>
<th>Alt-1</th>
<th>Alt-2</th>
<th>Alt-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land (Government-owned land to be given priority)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture/cropping pattern</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of village affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of family affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of common properties affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of trees cut (approx.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecologically sensitive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tribal population</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterway affected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Proposed Route (will be selected from above comparison):

(b) Analysis of alternative technologies/designs:

Note: For power lines, use of Axially Bundled Cables (ABC) or insulated cables instead of the conventional separate cables would prevent siphoning of power through illegal connections. For rehabilitation of power lines, the structural capacity of existing towers could put restriction on the type of cables to be used.

Selected Technology/Design:

(c) No Sub-project Scenario: Briefly mention the difficulties the REB/PBSs/PGCB will face if the sub-project is not implemented.

(d) Conclusion: On selected method/design/technology and route/location of subproject.
## APPENDIX D:

### Criteria for Assessment of Ecological Impacts

### Table D-1: Categories and definition of "Consequence" levels for ecological impacts

<table>
<thead>
<tr>
<th>Category</th>
<th>Ranking</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>5</td>
<td>- Very serious environmental effects with impairment of ecosystem function.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Long-term, widespread effects on significant environment (e.g. habitat, national park).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Habitat restitution time &gt; 100 years and requiring extreme substantial intervention.</td>
</tr>
<tr>
<td>Major</td>
<td>4</td>
<td>- Serious environmental effects with some impairment of ecosystem function (e.g. displacement of species).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Relative widespread medium-long term impacts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Habitat restitution time &gt; 10 years and requiring substantial intervention.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Potential for continuous non-compliance with environmental regulations.</td>
</tr>
<tr>
<td>Moderate</td>
<td>3</td>
<td>- Moderate effects on biological environment but not affecting ecosystem function.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Moderate short-medium term widespread impacts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Habitat restoration time 1-5 years (possible limited and local areas up to 10 years) with potential for full recovery and limited intervention required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Potential for short to medium term noncompliance with environmental regulations and/or company policy.</td>
</tr>
<tr>
<td>Minor</td>
<td>2</td>
<td>- Minor effects on biological environment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Minor short-medium term damage to small area of limited significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Full recovery in &lt; 1 year without intervention required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Any potential non-compliance with environmental regulations and/or company policy would be minor and short-term.</td>
</tr>
<tr>
<td>Low</td>
<td>1</td>
<td>- No existing effect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Low-level impacts on biological environment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Limited damage to minimal area of low significant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Compliance with environmental regulations and/or company policy at all times.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Possible beneficial effect or ecosystem improvement.</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>- No impact on ecosystem damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- No compliance required for environmental regulations and/or company policy at all times.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Possible beneficial effect or ecosystem improvement.</td>
</tr>
<tr>
<td>Limited Positive</td>
<td>+</td>
<td>- Some beneficial improvement to ecosystem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Benefits to specific flora and/or fauna.</td>
</tr>
<tr>
<td>Model Positive</td>
<td>++</td>
<td>- Moderate beneficial improvement to ecosystem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Medium benefits to specific flora and/or fauna.</td>
</tr>
<tr>
<td>Significant Positive</td>
<td>+++</td>
<td>- Major beneficial improvement to ecosystem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Large-scale benefits to specific flora and/or fauna.</td>
</tr>
<tr>
<td>Impact Likelihood</td>
<td>Ranking</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Almost Certain (80 - 100%)</td>
<td>5</td>
<td>The activity will occur under normal operating conditions.</td>
</tr>
<tr>
<td>Very Likely (60 - 80%)</td>
<td>4</td>
<td>The activity is very likely to occur under normal operating conditions.</td>
</tr>
<tr>
<td>Likely (40 - 60%)</td>
<td>3</td>
<td>The activity is likely to occur at some time under normal operating conditions.</td>
</tr>
<tr>
<td>Unlikely (20 - 40%)</td>
<td>2</td>
<td>The activity is unlikely to occur, but may occur at some time under normal operating conditions.</td>
</tr>
<tr>
<td>Very Unlikely (0 - 20%)</td>
<td>1</td>
<td>The activity is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.</td>
</tr>
</tbody>
</table>
Table D-3: Example of estimating ecological impacts of typical sub-project activities

<table>
<thead>
<tr>
<th>Potential Impacts Source / Project Activities</th>
<th>Impact Description</th>
<th>Ecological Receptor Type</th>
<th>Likelihood</th>
<th>Consequence</th>
<th>Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material storage or placement</td>
<td>Habitat destruction of terrestrial flora (herb and shrub) and disturbance in movement of terrestrial fauna (amphibia, reptile and mammal)</td>
<td>Flora and Fauna</td>
<td>Likely</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Vehicle movement</td>
<td>Impairment of terrestrial flora (herb and shrub), terrestrial fauna (amphibia, reptile &amp; mammal)</td>
<td>Flora and Fauna</td>
<td>Likely</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Soil excavation</td>
<td>Habitat destruction of aquatic flora (herb, shrub) and movement disturbance / habitat destruction of terrestrial (burrow) fauna (amphibia, reptile, bird and mammal)</td>
<td>Flora and Fauna</td>
<td>Unlikely</td>
<td>Minor</td>
<td>Low</td>
</tr>
<tr>
<td>Noise disturbance</td>
<td>Disturbance of terrestrial faunal livelihood (movement, foraging, breeding) (amphibia, reptile, bird and mammal)</td>
<td>Fauna</td>
<td>Unlikely</td>
<td>Minor</td>
<td>Low</td>
</tr>
<tr>
<td>Exhaust from generators</td>
<td>Disturbance in movement of terrestrial fauna (e.g. aves)</td>
<td>Fauna</td>
<td>Unlikely</td>
<td>Minor</td>
<td>Low</td>
</tr>
</tbody>
</table>
APPENDIX E

Guideline for Archaeological Impact Assessment

Bangladesh has long cultural history right from 3rd century BC onwards. Enormous major and minor historical records are scattered in different parts of the country. The features of these antiquities have separated values and identities. During implementation of large-scale infrastructural development work/s an archaeologist needs to be present to rescue or recover any cultural resources present at the site.

To reduce the possibility of damaging archaeological objects, in case they are found while undertaking excavation works for different types of constructions, an authorized archaeological unit or at least an archaeologist should be asked to monitor the site periodically. The archaeologist, according to the Rules and Regulation of the Government of Bangladesh will study, make inventory and record it for the future.

Tasks:

(i) Conduct archaeological impact assessment for development projects.
(ii) Execute sampling excavation and assess the significance of the materials found, propose mitigation measures to safeguard buried archaeology or erected/surface remains and suggest future research activity.
(iii) Assess risks to these archaeological materials by the proposed infrastructure and suggest changes to the infrastructural works.
(iv) Identify suitable mitigation measures and prepare environmental management plan.

Investigation

Archaeological impact assessment in the project area and its vicinity to identify impacted sites/remains in relation to the infrastructural work proposed. A team of experts need to conduct an extensive study and survey at the sub-project areas. The objective of this survey will also be to develop proposal of appropriate mitigation measures to be undertaken to safeguard the buried or surface archaeology. The other objective is to suggest for changes, if any, to the proposed infrastructure works which could better assure the safeguarding of archaeological materials of cultural and historical significance and also suggest for future archaeological research and excavation of the buried archaeology.

The team can adopt three different methods for this purpose.

a. Examination of available cartographic and other photographic records.
b. Review of available literature, reports of archaeological researches and explorations conducted at project areas.
c. Combing the city block by block or lane by lane through site inspection to unveil the historical facts.
d. On-site interaction with local people and to investigate clues if any in their traditions and legends.
APPENDIX F

Impact Screening and Assessment Guideline for Physical Cultural Resources (PCR)
(Ref: Physical Cultural Resources Safeguard Policy Guidebook, World Bank, 2009)

As stated in the World Bank PCR Safeguard Policy Guidebook, the PCR policy applies to projects having any one or more of the following three features:
(i) Projects involving significant excavations, demolition, movement of earth, flooding or other major environmental changes
(ii) Projects located within or in the vicinity of a recognized PCR conservation area or heritage site
(iii) Projects designed to support the management or conservation of PCR

The sub-projects under the proposed project will involve significant excavation works, movement of earth and temporary flooding. The Pourashavas and City Corporations have religious institutions (mosques, temples, Buddhist temples), few sites of archaeological importance, public libraries, cinema halls, community centers, which can be considered PCRs. However, the sub-project area of influence may or may not intersect these regions (since the sub-projects are generic in nature, actual locations of most of them still undetermined). Therefore a generic impact assessment of Physical Cultural Resources is outlined in this 4.

Guidance on identification of PCR
In the context of the proposed project, the probable examples of PCR may be the following:
1. Human made: Religious buildings such as temples, mosques, churches, exemplary indigenous or vernacular architecture Buildings, or the remains of buildings of architectural or historic interest, Historic or architecturally important townscapes Archaeological sites (unknown or known, excavated or unexcavated), Commemorative monuments
2. Natural: Historic trees, natural landscapes of outstanding aesthetic quality
3. Combined man-made or natural: Sites used for religious or social functions such as weddings, funerals, or other traditional community activities (community centers, burial grounds, family graves, cultural landscapes
4. Movable: registered or unregistered artifacts in temples or mosques, paintings, statues of important historical figures, religious artifacts, cultural artifacts etc.

Assessment of probable impacts due to activities:
Below is a list of project activities or features under the context of the proposed project, which may commonly give rise to negative impacts on PCR, divided into two periods: construction phase and operational phase.

Construction phase:
1. Establishment of work camps:
   - Vandalism, theft and illegal export of movable PCR, and of pieces of monumental PCR accessible directly or indirectly to migrant laborers,
   - Desecration of sacred sites.
2. Excavation, construction and soil compaction:
   - Direct physical damage to natural, manmade and buried PCR on site
3. Construction traffic:
   - Vibration, soil, air and water pollution causing damage to natural or manmade PCR on site.
   - Noise pollution can interfere with the use and enjoyment of PCR such as tourist destinations, historic buildings, religious establishments and cemeteries.

4. Mobilization of heavy construction equipment:
   - Damage to natural or manmade PCR on site
   - Soil compaction, damaging buried PCR (archaeological) onsite, and damaging pipelines and drains serving built PCR in the vicinity.

5. Flooding and inundation:
   - Submergence or destruction of human-made, natural or burned PCR.
   - Barrier to access of all types of PCR.
   - Raised water table can lead to damage to all types of PCR.
   - Damage to aesthetics of scenic landscapes.

6. Waste disposal or landfill:
   - Burial or damage to natural, burned or underwater PCR.

Operation phase:

1. New and upgraded Roads:
   - Increased human traffic enjoying improved access to PCR of public interest leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and breakable PCR.
   - New highways cutting off access to living-culture PCR by residents of settlements on other side of the highway.
   - Increased air pollution and vibration from traffic causing damage to man-made PCR, particularly monuments and buildings.
   - Increased noise pollution interfering with enjoyment of people in tourist destinations, historic buildings, religious establishments and cemeteries.
   - In scenic areas, obtrusive highways having a negative visual impact on the landscape.
   - Roads and bridge which themselves constitute PCR being damaged by increased traffic.
   - Positive impacts may also occur through the discovery of hitherto unknown sites and artifacts and generation of tourism.

2. Induced development:
   - Induced development leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and breakable PCR, and damage to the aesthetics of scenic landscapes and townscapes.

3. Urban development:
   - Changes in demography or settlement patterns leading to decay of inner cities and abandonment and neglect of older residential areas containing built PCR such as vernacular architecture.
   - Developments which are out-of-character with their surroundings diminishing the aesthetic value of the townscapes, decline in property values and ultimately, neglect of built PCR in the area.
   - Damage to the aesthetics of scenic landscapes and townscapes.

Guidelines for ToR for the PCR component:

In case of a sub-project which is not expected to have any impacts on PCR, it may be sufficient to include procedures for chance finds (Appendix H). In case of Category “B” project where there may be a likely impact on PCR due to activities carried out under any of the sub-projects, the ToR may be tailor-made to the specific requirements. The ToR is expected to include potential major PCR issues, the likely impacts
on PCR, the PCR impact areas, which will set boundaries for collecting the PCR baseline data along with any specialized PCR knowledge or skills required. In projects such as the proposed project, since the subproject locations are not yet determined, it will not be possible at this stage to identify the PCR impact areas and the type of PCR data that should be collected. In such cases, the ToR should require the EA team to establish these parameters at the beginning of the assignment, and propose provisions for identifying and managing PCR during project implementation. The EA report for the corresponding sub-projects should be modified accordingly to incorporate the issues related to PCR in those cases. The investigations and findings with respect to PCR should form an integrated part of the EA report since OP 4.11 does not call for a separate report. Therefore the ToR for consultants for the generic EA assessment of sub-projects would still be valid with a few additional assignments on behalf of the consultants with respect to PCR:

- Regulatory environment: (identification of any regulations and guidelines which will govern the conduct of the assessment) This should also list any relevant national acts or regulations pertaining to the safeguarding of PCR
- Background information: (description of the physico-chemical, ecological and socioeconomic environment) All registered and unregistered, movable or immovable PCRs in the sub-project areas need to be identified in this part preferably using visual identification, consulting with local people. The report should have descriptions and visual illustrations of the PCRs.
- Impact assessment: (the consultant will identify the likely biophysical and social impacts in sufficient detail to be able to design suitable mitigation measures) Impacts on all types of PCR should be considered, both natural and man-made, registered and unregistered, movable and immovable.
- Analysis of alternatives: (the consultant will include PCR aspects when considering alternative projects or project locations)
- Environmental Management Plan, including institutional arrangement for implementation and monitoring: (The ToR should state that mitigating measures arising from PCR impacts should be agreed to by the concerned and affected parties before they are submitted as recommendations in the EMP.)
- Public Participation (The ToR should point out the importance of the consultative process for the physical cultural resources component)
APPENDIX G

Chance Find Procedures

Works could impact sites of social, sacred, religious, or heritage value. "Chance find" procedures would apply when those sites are identified during the design phase or during the actual construction period and the related activity will not be eligible for financing under the project.

1. Cultural property includes monuments, structures, works of art, or sites of significant points of view, and are defined as sites and structures having archaeological, historical, architectural, or religious significance, and natural sites with cultural values. This includes cemeteries, graveyards and graves.

2. The list of negative subproject attributes which would make a subproject ineligible for support includes any activity that would adversely impact cultural property.

3. In the event of finding of properties of cultural value during construction, the following procedures for identification, protection from theft, and treatment of discovered artifacts should be followed and included in standard bidding document:
   (a) Stop the construction activities in the area of the chance find;
   (b) Delineate the discovered site or area;
   (c) Secure the site to prevent any damage or loss of removable objects;
   (d) Notify the supervisory Engineer who in turn will notify the responsible local authorities;
   (e) Responsible local authorities and the relevant Ministry would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures;
   (f) Decisions on how to handle the finding shall be taken by the responsible authorities and the relevant Ministry. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance), conservation, restoration and salvage.
   (g) Implementation of the authority decision concerning the management of the finding shall be communicated in writing by the relevant Ministry.
   (h) Construction work could resume only after permission is given from the responsible local authorities and the relevant Ministry concerning safeguard of the heritage.

4. These procedures must be referred to as standard provisions in construction contracts. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered.

5. Relevant findings will be recorded in World Bank Supervision Reports and Implementation Completion Reports will assess the overall effectiveness of the project's cultural property mitigation, management, and activities, as appropriate.
APPENDIX H

Environmental Code of Practice (ECoP)

The Environmental Code of Practice (ECoP) is a guideline for reduce or eliminate environment risk due to various activities associated with the construction of substations, construction and rehabilitation of 132kV Transmission Lines of PGCB and 33kV Distribution Lines of REB.

**ECoP 1.0: Planning and Design Phases of a Project**

1.1 General
This code of practice details the factors to be considered during project preparation to avoid/address environmental concerns through modifications in project design and incorporation of mitigation measures.

1.2 Compliance to legal Requirements
The bid document shall include the various applicable clearances pertaining to environmental management and shall contain the necessary procedures for compliance of the same.

**ECoP 2.0: Route Selection**

2.1 Selection and Finalization of Alignment/Project Location
- Adequate consultations with the communities to identify the concerns and preferences need to be taken up during selection of the alignment of the Transmission/Distribution lines.
- Alignment shall conform to the natural topography as far as possible to avoid excessive cut and fill.
- Special care should be taken to align the routes along the hills, which is stable and where cutting on hillside causes least disturbance.
- Consultations with the local communities are to be conducted to obtain their suggestions and incorporate their concerns to address the potential environmental impacts.
- Selection of site for substations should be done in consultation with the local communities addressing the environmental as well as social issues so as to cause least possible adverse impacts.
- In case of flood prone areas and/or areas with very flat slopes, hydrological surveys have to be conducted before alignment finalization.

**ECoP 3.0: Tower/Pole Erection**

3.1 General
Erection of poles/towers for installation of 33kV/132kV power distribution/transmission lines of the REB/PGCB involves:
- i. informing the local community about the installation schedule;
- ii. Marking and clearance of the designated locations for installation/replacement of SPC poles/Steel tower. Scope of this ECoP includes only the measures to address environmental concerns expected during the Pole erection process.

3.2 Pole/Tower Erection Activities by REB/PGCB
- informing the community and local city/village councils about the likely schedule of erection;
- After obtaining the consent of the community REB/PGCB shall be responsible to stake out the designated locations.

3.3 Pole/Tower Erection Activities by the Contractor
- The contractor shall submit the schedules and methods of operations for various items during the Pole/Tower erection operations to the REB/PGCB for approval.
• The clearance of sites shall involve the removal of all materials such as trees, bushes, shrubs, stumps, rocks, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures:
  • To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed.
  • In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.
  • The disposal of wastes shall be in accordance with the provisions of ECOP 11.0, "Waste Management".

River Crossing Towers
• All regulatory clearances shall be obtained before actual start of work. River Crossing Towers are very high electric towers specially designed to cross large rivers. Tower construction for river crossing will require proper protective measures against bank collapse. Sheet-Piling or Shore protection measures should be ensured while laying the foundation of the tower near the river bank or in the river bed. Pre-cast piles should be driven in with extreme care so as to expose the workers to the least possible danger.
• The disposal of wastes shall be in accordance with the provisions of ECOP 11.0, "Waste Management".

ECOP 4.0: Overhead Power Cable Installation
4.1 General
Installation of 33kV/132kV power distribution/transmission lines of the REB/PGCB involves:
 i. Informing the local community about the installation schedule;
 ii. Marking and clearance of the designated routes for installation/rehabilitation of overhead power lines. Scope of this ECOP includes only the measures to address environmental concerns expected during the power cable installation process.

4.2 Overhead Distribution/Transmission Cable Installation Activities by REB/PGCB
• Informing the community and local city/village councils about the likely schedule of installation;
• After obtaining the consent of the community REB/PGCB shall be responsible to stake out the designated route.

4.3 Overhead Distribution/Transmission Cable Installation Activities by the Contractor
• The contractor shall submit the schedules and methods of operations for various items during the overhead power cable installation/rehabilitation operations to the REB/PGCB for approval.

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The clearance of sites shall involve the removal of all materials such as trees, bushes and rubbish. Towards this end, the Contractor shall adopt the following measures:

- To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works, if any, shall be removed.
- The disposal of wastes shall be in accordance with the provisions of ECoP 11.0, "Waste Management".
- All regulatory clearances shall be obtained before actual start of work.

ECoP 5.0: Installation of Transformers on H-Pole

5.1 General

Installation of Transformers on H-Poles along the route:

i. Informing the local community about the installation schedule;
ii. Marking and clearance of the designated locations for installation of transformers on H-poles.

Scope of this ECoP includes only the measures to address environmental concerns expected during the power cable installation process.

5.2 Activities Involved in Transformer Installation on H-Pole by REB/PGCB

- Informing the community and local city/village councils about the likely schedule of installation;
- After obtaining the consent of the community REB/PGCB shall be responsible to stake out the designated locations.

5.3 Activities Involved in Transformer Installation on H-Pole by the Contractor

- The contractor shall submit the schedules and methods of operation for various items during the installation operations of the transformers on H-Pole to the REB/PGCB for approval.
- The clearance of sites shall involve the removal of all materials such as trees, bushes and rubbish. Towards this end, the Contractor shall adopt the following measures:
  - To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works, if any, shall be removed.
  - The disposal of wastes shall be in accordance with the provisions of ECoP 7.0, "Waste Management".
  - All regulatory clearances shall be obtained before actual start of work.

ECoP 6.0: Site Preparation for Substations

6.1 General

The preparation of site for construction of electrical substations involves:

i. Marking and clearance of the required project area of all encroachments by the REB/PGCB prior to mobilization of Contractor;
ii. Informing the local community about construction schedule; and
iii. Site preparation by the contractor prior to commencement of construction. Scope of this ECoP includes only the measures to address environmental concerns expected during the site preparation.

2.2 Site Preparation Activities by the REB/PGCB

- Informing the community and local village councils about the likely schedule of construction
- After obtaining the consent of the community the REB/PGCB shall be responsible to stake out the substation locations and boundary.

7.3 Site Preparation Activities by the Contractor

- The contractor shall submit the schedules and methods of operations for various items during the construction operations to the REB/PGCB for approval.
The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures:

- To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed.
- In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.
- The disposal of wastes shall be in accordance with the provisions of ECoP 11.0, "Waste Management".
- All regulatory clearances shall be obtained before actual start of work.

ECoP 7.0: Construction Camps

7.1 General
ECoP 7.0 provides guidelines on the selection, development, maintenance and restoration of construction camp sites in order to avoid or to mitigate against significant adverse environmental effects, both transient and permanent.

7.2 Construction Camp Location
During planning of the works consideration shall be given to the location of construction camps for the field implementation of the project. Construction camps and areas identified that may be suitable for the development of such camps shall be selected in consultation with the Engineer of the REB/PCCB. Areas which are not suitable for reasons such as environmental, cultural or social sensitivity shall also be identified. Wherever possible, construction camps shall be planned in areas that will have minimal adverse environmental effects. In identifying such areas particular care shall be taken to evaluate the adverse effects on water, noise and air pollution, which, although transient, will preclude the use of some areas as construction camp sites. The contractor shall consult with the local community in selecting the location of the construction camp. It should be ideally in a distant location from the community so that the regular day-to-day activities of the communities are not disturbed due to the construction camps.

Construction camp sites shall be located such that permanent adverse environmental effects can be avoided or mitigated against and transient adverse environmental effects are minimized. Camp sites shall not be located in areas identified during the planning stage as unsuitable for such use. The site or sites shall be selected such that mitigation measures stipulated in this ECoP can be implemented with reasonable facility.

7.3 Private Land
Where construction camps are to be located on land outside the road reserve the contractor shall obtain the approval of the landowner to establish the camp site on such land and pay agreed compensation as per the Resettlement and Rehabilitation Framework. Environmental protection measures established by this ECoP shall apply to all land regardless of ownership.

7.4 Construction Camp Facilities
The construction camp shall be provided with the following minimum facilities:

- A perimeter security fence at least 2.5m in height constructed from appropriate materials.
- Ablution block with a minimum of one water closet toilet or Pota-cabin, one urinal and one shower for personnel engaged either permanently or temporarily on the project. Pota-cabin or separate toilet and wash facilities shall be provided for male and female employees.
- A sickbay and first aid station.
• Areas for the storage of fuel or lubricants and for a maintenance workshop. Such an area shall be bounded and have a compacted/impervious floor to prevent the escape of accidental spillage of fuel and or lubricants from the site. Surface water drainage from bounded areas shall be discharged through purpose designed and constructed oil traps. Empty fuel or oil drums may not be stored on site.
• Storm water drainage system to discharge all surface run off from the camp site to a silt retention pond which shall be sized to provide a minimum of 20 minutes retention for storm water flow from the whole site that will be generated by a 20 year return period rainfall having a duration of at least 15 minutes. The run-off coefficient to be used in the calculation of the silt pond volume shall be 0.9. Silt ponds shall be maintained in an efficient condition for use throughout the construction period with trapped silt and soil particles being regularly removed and transported and placed in waste material disposal areas as per ECoP 11.0.
• All discharge from the silt retention pond shall be channelled to discharge to natural water via a grassed swale at least 10 meters in length with suitable longitudinal gradient.
• All camp facilities shall be maintained in a safe clean and or appropriate condition throughout the construction period.

7.4.1 Construction Camp Development Plan
A development plan of the construction camp shall be prepared describing the following:
• Perimeter fence and lockable gates
• Workshop
• Accommodation
• Ablutions
• Water supply
• Wastewater disposal system
• Bounded fuel storage area
• Proposed power supply
• Proposed all weather-surfaced areas.

7.5 Site Restoration
At the completion of the construction work, all construction camp facilities shall be dismantled and removed from the site and the whole site restored to a similar condition to that prior to the commencement of the works or to a condition agreed to with the owner of the land. All oil or fuel contaminated soil shall be removed from the site and transported and buried in waste soil disposal areas.

ECoP 8.0: Topsoil Salvage, Storage and Replacement
8.1 General
Loss of topsoil will be a long-term impact along the process of construction of substations, installation or rehabilitation of the overhead power cables by the REB/PGCB due to:

i. Site clearance and excavation for temporary road, substation, protective embankment, etc.
ii. Development of borrow areas
iii. Temporary construction activities as material storage locations, diversion routes, etc.
Scope of this ECoP includes removal, conservation and replacement of topsoil.

8.2 Pre-construction Stage
The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner shall include the conservation/preservation of topsoil.

8.3 Construction Stage
8.4 Post-construction Stage

- The topsoil shall be re-laid on the area after taking the borrow earth to maintain fertility of the agricultural field, finishing it to the required levels and satisfaction of the farmer.
- All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material.

ECoP 9.0: Borrow Areas

9.1 General
In general transmission line will pass over the agrituaral land, low lying area. A high level temporary access may be required for tower foundation or mobilization of equipment and vehicles. Embankment or filling material, if needed, is to be procured from borrow areas designated for the purpose. The scope of this ECoP extends to measures that need to be incorporated during borrow area identification, material extraction and rehabilitation with regard to environment management.

9.2 Pre-construction Stage
The contractor shall identify the borrow area locations in consultation with the owners, after assessing the suitability of the material. The suitable sites shall be selected and finalized in consultation with REB/PGCB.

9.3 Construction Stage
The contractor should adopt the following precautionary measures to minimize any adverse impacts on the environment:

i. Borrow pits situated less than 0.5 km (if unavoidable) from villages and settlements should not be dug for more than 30 cm after removing 15cm of topsoil and should be drained.

ii. The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation.

iii. In case the borrow pit is on agricultural land, the depth of borrow pits shall not exceed 45 cm and may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.

iv. In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstand.

3.4 Post-construction Stage
It needs to be ensured that all reclamation has been carried out in accordance with the restoration plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction". The final payment shall be made after the verification by the REB/PGCB.

ECoP 10.0: Slope Stability and Erosion Control

10.1 General
Stability of slopes is a major concern in hill areas and locations of high embankment.
• Soil erosion is consequent to high runoff on hill slopes, high wind velocities cause erosion of embankments made up of cohesion-less sandy soils.
• Embankments made up of silty and sandy soils are eroded, in the absence of vegetative cover, when the slopes are steep, say more than 20 degrees.
• Erosion control is provided to prevent soil damage done by moving water.
• The scope of this ECoP includes measures to minimize the adverse environmental impacts on slope stability and soil erosion due to the construction of embankments. The adverse environmental impact can be:
  i. damage to adjacent land,
  ii. silting of ponds and lakes disturbing the aquatic habitat
  iii. erosion of rich and fertile top layer of soil
  iv. contamination of surface water bodies and
  v. reduction in road formation width due to erosion of shoulders/berms.

10.2 Pre-construction Stage
• Interceptor ditches are constructed in hill areas to protect the road bench and hillside slope from erosion due to heavy rainfall and runoff.
• Interceptor ditches are very effective in the areas of high intensity rainfall and where the slopes are exposed.

10.3 Construction Stage
• The vegetative cover should be planted in the region where the soil has the capacity to support the plantation and at locations where meteorological conditions favor vegetative growth.
• On side slopes in hills, immediately after cutting is completed and debris is removed, vegetative growth has to be initiated by planting fast growing species of grass.
• In regions of intensive rainfall, locations of steep slopes, regions of high soil erosion potential and regions of short growing seasons, erosion control matting should be provided.
• Adequacy of drainage for erosion control

10.4 Post-construction Stage
All the exposed slopes shall preferably be covered with vegetation using grasses, bushes etc. Locally available species possessing the properties of (i) good growth (ii) dense ground cover and (iii) deep root shall be used for stabilization.

ECoP 11.0: Waste Management

11.1 General
This code of practice describes procedures for handling, reuse and disposal of waste materials during construction of the substations, rehabilitation of the existing substations/transmission or distribution lines. The waste materials generated can be classified into
  i. Construction Waste;
  ii. Domestic waste;
  iii. Discarded conductors from rehabilitated power lines; and
  iv. Discarded switchboxes, bus-bars, transformers, etc. from rehabilitated substations.

11.2 Pre-construction Stage
• The contractor shall identify the activities during construction that have the potential to generate waste and work out measures for the same in the construction schedule.
• The Contractor shall educate his workforce on issues related to disposal of waste, the location of disposal site as well as the specific requirement for the management of these sites.

11.3 Construction Stage
• The contractor shall either re-use or dispose the waste generated during construction depending upon the nature of waste.
• The contractor shall dispose of wastes that could not be re-used safely.
• The waste management practices adopted by the Contractor shall be reviewed by REB/PGCB during the progress of construction.
• Discarded conductors resulting from the rehabilitation of power lines should be recycled under the guidance of REB/PGCB.
• Discarded transformers should be properly disposed of as per the guidelines of REB/PGCB so as to minimize environmental pollution.
• The old transformers may contain hazardous chemicals such as PCB which should be handled as per the national/international hazardous waste management guidelines. However, the more recent transformers do not contain such hazardous oil. Therefore, such non-hazardous oil should be discarded following the waste disposal guidelines as stipulated in ECR '97. Therefore, during the substation rehabilitation process the old transformers containing PCB should be discarded following available technologies; namely, supercritical oxidation, electro-chemical oxidation, solvated electron technology, chemical reduction method, dehalogenation process, and thermal desorption using pyrolysis, catalyzed dehalogenation and vitrification. (see also ECoP 22.0)
• The waste generated from the discarded switchgears, bus-bars, etc. following the rehabilitation process should be handled as per the guidelines for E-waste management specified in ECR '97.

11.4 Post-construction Stage
• After decommissioning of construction sites, the Contractor shall hand over the site after clearing the site of all debris/wastes to REB/PGCB.
• In case of disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction".

ECoP 12.0: Water Bodies
12.1 General
Water bodies may be impacted when the infrastructure development project activities are adjacent to it or the runoff to the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the ecology of the area:
   i. Earth moving
   ii. Removal of vegetation
   iii. Waste disposal from construction works
12.2 Pre-Construction Stage
When there is interruption to regular activities of the inhabitants near water body due to construction or rehabilitation work, following are the Contractor's responsibilities:
   i. Restriction on use of water during construction, if any, should be intimated to the community in advance.
   ii. Alternate access to the water body is to be provided in case there is interruption to use of exiting access.
   iii. If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.
12.3 Construction Stage
• It should be ensured by the contractor that the runoff from construction site entering the water body is generally free from sediments.
• Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated.

ECc)P 12.0: Water Bodies
Cutting of embankment reduces the water retention capacity and also weakens it, hence:

i. The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.

ii. Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and consequences arising out of embankment failure shall be the responsibility of the contractor. The REB/PGCB shall monitor regularly whether safe construction practices near water bodies are being followed.

- Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body.
- Movement of workforce shall be restricted around the water body, and no waste from construction sites shall be disposed into it.

12.4 Post-construction Stage

- The zones of the water body have to be left clean and tidy with the completion of construction.
- Engineers of REB/PGCB will check if drainage channels of adequate capacity have been provided for the impacted water body.

ECoP 13.0: Water Qualities

13.1 General

- Construction of the substations, small-scale access road construction and small-scale embankment construction may affect the aquatic environment, by lowering or raising water levels, and decreasing water quality.
- Deterioration of water quality and disturbance of aquatic environment by lowering or rising of water levels.

13.2 Pre-construction Stage

Following measures are to be undertaken by the contractor prior to the commencement of construction:

- Base line data of the water quality is necessary.
- In addition, the availability of enough water during the lean season needs to be assessed as part of the baseline data collection.

13.3 Construction Phase

- Improper disposal of solid and liquid waste including excreta generate from sites will pollute the water quality and proper prevention measure should be taken.
- Wastewater and toxic chemicals disposal, sanitation/latrines may have positive cumulative effects on human health, but if not properly implemented may affect ground and surface and ground water quality; the contractor should give proper attention on it during construction stage.
- Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers.

13.4 Post-construction Phase

- Inspection of water quality shall be done regularly.
ECoP 14.0: Drainage

14.1 General

- Drainage is designed for temporary access roads to direct surface or subsurface flow away to a safe outfall without damage to the structure, adjoining property or agricultural fields.

14.2 Pre-construction Stage

- Following measures are to be undertaken by the contractor prior to the commencement of construction:
  
  i. The downstream as well as upstream user shall be informed one month in advance
  
  ii. The contractor shall schedule the activities based on the nature of flow in the stream while constructing the substations and access roads.
  
  iii. The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by REB/PGCB.
  
  iv. All the safety/warning signs are to be installed by the contractor before start of construction

- In case of utilization of water from the stream, for the construction, the contractor has to take the consent from the concerned department.

14.3 Construction Phase

- Temporary drainage at construction site shall be provided at the earliest to ensure proper compaction

- In hill areas sub-surface drains, if required, shall be provided immediately after cutting the slopes and forming the roadbed (sub grade).

- Safety devices and flood warning signs to be erected while working over streams and canals.

14.4 Post-construction Phase

- Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow.

- Temporary structures constructed during construction shall be removed before handing over to ensure free flow through the channels.

ECoP 15.0: Electromagnetic Field (EMF)

15.1 General

Electromagnetic Field during the rehabilitation of the existing transmission or distribution lines may be a cause of concern. Thus, appropriate protective measures should be adopted during the implementation phase.

Electric and magnetic fields (EMF) are invisible lines of force emitted by and surrounding any electrical device (e.g. power lines and electrical equipment). Electric fields are produced by voltage and increase in strength as the voltage increases. Electric field strength is measured in volts per meter (V/m). Magnetic fields result from the flow of electric current and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G) or tesla (T), where 1T equals 10,000G.

Electric fields are shielded by materials that conduct electricity, and other materials, such as trees and building materials. Magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease rapidly with distance. Power frequency EMF typically has a frequency in the range of 50 – 60 Hertz (Hz), and is considered Extremely Low Frequency (ELF). Although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from...
exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern. Recommendations applicable to the management of EMF exposures include: Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure. Considering sited new facilities so as to avoid or minimize exposure to the public. Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices), should be avoided. If EMF levels are confirmed or expected to be above the recommended exposure limits, application of engineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers. Examples of these techniques include:

- Shielding with specific metal alloys
- Burying transmission lines
- Increasing height of transmission towers
- Modifications to size, spacing, and configuration of conductors

15.2 Post Construction:
- During the Post-construction phase REB/PGCB should monitor the EMF around the substations and under the Distribution/Transmission lines on a regular basis.
- Construction of residential buildings and/or small households should only be allowed ensuring the safe distance as specified in the Code.

ECOP 16.0: Public Health and Safety
16.1 General
The safety and health of the public is impacted due to the hazards created during the construction period. This code of practice describes the measures that need to be taken to mitigate the impacts.

16.2 Pre-construction Phase
- In order to incorporate public health and safety concerns, REB/PGCB and the Contractor shall disseminate the following information to the community:
  i. Location of project activities,
  ii. Borrow areas,
  iii. Extent of work
  iv. Time of construction
  v. Involvement of local labors in the construction
  vi. Health issues - exposure to dust, communicable diseases etc.

16.3 Construction Phase
- The Contractor shall schedule the construction activities, such as:
  i. Sowing of crops
  ii. Harvesting
  iii. Local hindrances such as festivals, etc.
  iv. Availability of labor during particular periods
- Proper safety/warning signs are to be installed by the contractor to inform the public of potential health and safety hazard situations during the construction phase in the vicinity of the project.
• The REB/PGCB shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per this ECOP.

16.3 Post-construction Phase

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and users. During operation phase (especially during regular maintenance) following issues should be addressed:

• Regular patrolling along the power lines to identify the need for regular and immediate maintenance operation.
• Inspection immediately after a major storm/rainfall event
• Regular cutting and trimming of trees around power lines.
• Provision for shutting down of line in case of snapping of line.
• Regular monitoring of power lines to prevent electricity pilferage especially when Axially Bundled Cables (ABC) are used which may lead to accident.
• No temporary/permanent shops underneath the H-Pole to be allowed
• No Dumpster to be allowed underneath the H-Pole.

ECOP 17.0: Material Storage, Transport and Handling

17.1 General

Activities related to materials storage, handling, and transfer that are considered to potentially have negative environmental effects include:

• Transportation, storage, handling and transfer of construction materials;
• Storage, handling and transfer of petroleum, oil, and lubricant (POL) products;
• Application of asphaltic concrete and asphalt binder;
• Storage and handling of hazardous materials other than POL products; and
• Storage and application of transformer oil.

Some materials used during implementation of projects may have potentially hazardous effects on the environment if not properly stored and handled.

17.2 Transportation, Handling and Storage of Cement and Aggregates

• The Contractor shall be responsible for ensuring that all trucks and carriers are clean and dry prior to loading them with cement or aggregates. All trucks and carriers for transporting cement/aggregates shall be equipped with weather proof closures on all openings.
• All cement/aggregates that will be brought to the site shall be kept free from contact with deleterious matter.
• All cement/aggregates shall be placed on impervious mat spread over the storage area to prevent direct contamination of top soil in the storage area. Stockpiling of cement/aggregates should be limited to minimum space and should be covered with weatherproof closures.
• Stockpiles shall be built up in horizontal or gently sloping layers. Overlap of different materials shall be prevented by suitable walls of ample distance between stockpiles.
• The Engineer shall approve the site for the storage of all aggregates.
• The Engineer shall approve the methods of handling aggregates and the equipment used.

17.3 Environmental Concerns with Materials used for Construction and Maintenance of Infrastructure Development Projects. Concerns are related to accidental releases into the environment, such as spills, refueling losses, and leakage from equipment that could result in contamination of soil, groundwater, or surface waters.

Groundwater may transport the contaminants off-site to down-gradient aquifers or water supplies, or discharge them into surface waters. Therefore, release of potential contaminants on the ground surface could have significant environmental impacts that could ruin groundwater (well supplies).

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17.3.1 Petroleum, Oil, Lubricants and Transformer Oil

The toxic effect of a petroleum product in the aquatic environment varies considerably due to the different chemical composition of each petroleum product. The toxicity of petroleum products is related largely to its solubility in water. Petroleum pollution from accidental spills may affect aquatic birds, fish and vegetation. The effect of oil on birds’ feathers (loss of insulation) is an important cause of death. Oil polluting the water may also be toxic to birds if they ingest it. Plants in marshes or in wetlands (haor, baor, ponds and others) and steams may die off for short periods. Long-term impacts of spilled petroleum products are associated with the portion, which sinks and becomes incorporated into bottom sediments. This causes the petroleum products to degrade very slowly and they may persist for many years.

Petroleum products can stick to the gills of fish and interfere with normal respiration. Under relatively mild pollution, fish may produce mucus as a defensive mechanism to remove the oil. However, in heavy pollution, this mechanism is inefficient and the oil tends to accumulate on the gills and smother the fish. Petroleum products contain soluble materials, which can be ingested by fish. The flavor of the fish flesh may, therefore, become tainted, or if ingested in enough quantity, may become lethal. Groundwater sources contaminated with petroleum products may have potentially toxic effects on consumers.

17.3.2 Asphalt Products

Environmental concerns with tack asphalt binder, and asphaltic concrete are also related to the hydrocarbon components, which are toxic to aquatic life, wildlife, and humans. As mentioned above, if these materials sink to the bottom, they may destroy the fish’s source of food supply and smother the eggs or emerging fry.

17.3.3 Other Hazardous Materials

The following hazardous materials are likely to be generated in construction, rehabilitation or maintenance activities of substation and power lines and have potential environmental concerns:

- Paints;
- Solvents;
- Transformer Oil; and
- Fresh concrete and admixtures.

Paint materials, which are lead – or oil-based, may affect aquatic life if significant amounts enter a watercourse. Specific concern exists with lead, as this compound may have a direct toxic effect on young fish. Toxins can accumulate over time in aquatic fish, bugs, and plants. Upon consumption by animals such as birds and small mammals, some metals could be transferred to the consumer and affect their health.

Some solvents used for cleaning purposes may contain components, which are toxic to aquatic life, wildlife, and humans. If solvents enter a watercourse/water supply, and significant concentrations occur in the water, this could be harmful to users.

Concrete, which is typically made up of aggregates, cement, water, and possibly admixtures, is very alkaline because of its calcium (lime) content. If concrete enters a watercourse in significant amounts, the pH of the water may be affected locally over the short-term. If the pH of the receiving water is altered, this may cause physiological stress in fish, which may result in death. When a power line (Transmission and/or Distribution) is re-conducted the old conductors are discarded. Recycling of these metal conductors should be practiced to reduce waste generation. The old transformers contained transformer oil which is hazardous to the human and environment.

17.4 Storage, Transport and Handling of POL Products

Care must be taken with the storage, transfer, handling of POL products to prevent potential environmental damage. All empty containers and drums shall be returned to the maintenance depot.
shall be ensured that all drums and containers are closed and not tipped over and all waste oil, lubricants, and solvents shall be stored in closed containers.

17.4.1 Storage
Any container, drum, or tank that is dented, cracked, or rusted will probably eventually leak. Make sure all containers, drums, and tanks that are used for storage are in good condition. Check for leakage regularly to identify potential problems before they occur. The proper storage of materials will greatly reduce the risk of accidental spills or discharges into the environment.

For temporary outdoor storage, put containers and drums in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area should preferably slope or drain to a safe collection area in the event of a spill. Tanks should have appropriate secondary containment (i.e. double-walled or surrounded by a dyke) that will collect spilled material in case of a leak. Permanent storage areas for containers or drums should be on an impermeable floor that slopes to a safe collection area in the event of a spill or leak.

17.4.2 Transport and Handling
At all times when products are being handled or transported, care must be taken to prevent any product from being spilled, misplaced, or lost and possibly entering and contaminating the soil or a natural waterway. When equipment and vehicle maintenance or repair is required in the field, it should be undertaken at least 30 m away from any watercourse. Minimize the potential for entry of hydraulic fluids or oil into a watercourse by using sorbent materials to collect spilled petroleum products. Return all used sorbent materials to the appropriate storage yards for safe disposal. Also return all diesel or fuel used to wash asphalt emulsion pumps to the maintenance depot for safe storage or disposal. Return all solvents used to wash spray-painting or other equipment to the appropriate storage yards for safe disposal.

Wash equipment in maintenance areas equipped with oil/water separators so that any petroleum products can be removed prior to discharge of the wastewater. Oil/water separators are only effective if they are properly maintained. At sites without oil/water separators, minimize the amount of wash water used and wash in areas where the potential for entry of wash water into a waterway is minimized by proper grading or curbing. Tankers should not be washed near watercourses. Wash out should be done in places where proper grading or curbing minimizes the potential for entry of wash water into a waterway. Re-fuelling or servicing of equipment and vehicles to be done at least 30 m away from any watercourse. Re-fuelling over liner material with an absorbent pad (e.g. sand bed) will help to contain potential spills. If re-fuelling is done from a bulk tanker, the hose/nozzle assembly should be replaced to its proper position upon completion.

17.5 Spills and Spill Cleanup
Quick action in the event of a spill of hazardous materials is important in order to prevent environmental damage. Things to do when a spill occurs:

1. Identify the material involved and make a quick assessment:
   - How extensive is the spill?
   - Are there any watercourses nearby?
   - Are the watercourses down gradient from the spill?
   - Are there drainage systems down gradient from the spill, which lead to a nearby watercourse?
2. Stop the flow of product, if it can be done safely.
3. Notify the Engineer and Authorities immediately.
4. Control and contain spilled product until expert help arrives, if it can be done safely.

17.5.1 How to Control and Contain a Spill
When a limited oil spill occurs on level land, scoop up the affected soil and dispose at a site approved by the Engineer and the Department of Environment. When an extensive oil spill occurs on level land, dig sump hole and pump excess oil into a temporary container. The remaining contaminated soil must be scooped up and disposed of at a site approved by the Engineer and the Department of Environment. When an extensive spill occurs on a slope or hillside, a trench can be dug downhill from the spill to intercept the spill material. Should petroleum products reach a watercourse, several temporary spill containment measures can be sued to help stop the spreading of products.

17.5 Storage and Handling of Dangerous Materials
Workers may be at risk from exposure to dust particles or toxic fumes from chemicals used in road works and materials testing. Specific measures to reduce risks include limiting time of exposure to dust particles, chemicals and noise; enhancing safety and inspection procedures; and improving materials safe handling.

ECOP 18.0: Vegetation Management
18.1 General
- Besides improving aesthetics and ecology of the area, the vegetation provide fuel wood, act as noise barriers, provide visual screen for sensitive areas and also generate revenue by sale of its produce.
- This code of practice elaborates on the approach towards planting trees. Emphasis has been laid on a greater involvement of communities in planting and maintenance of trees.

18.2 Project Planning and Design Phase
- During alignment of transmission line finalization, due consideration shall be given to minimize the loss of existing tree cover.
- Tree felling, if unavoidable, shall be done only after compensatory plantation of at least two sapings for every tree cut is done.
- The species shall be identified in consultation with officials of forest department/local community, giving due importance to local flora, preferably same species as cut. It is recommended to plant mixed species in case of both avenue or cluster plantation.
- Design of plantation of fruit bearing trees and other suitable trees.
- It should be ensured that plantation is carried out only in areas where water can be made available during dry seasons and the plant can be protected during the initial stages of their growth.

18.3 Post-construction Phase
- During the operational phase regular trimming of trees along the route REB/PGCB personnel may become essential to prevent accidents due to over-growth onto the power lines. However, his activity should be conducted with minimal damage to the existing vegetation.

The project proponents would take up the planting of fruit bearing and other suitable trees, on both sides of the roads or other infrastructure development projects location from their own funds.
ECoP 19.0: Natural Habitats

19.1 General

- The activities associated with construction of a transmission line through or along the edge of natural habitat areas may destroy and degrade the habitat. The activities can have impacts on the number, health, and survival of interior native plant and animal species, many of which are rare.
- The code of practice envisages measures to be undertaken during implementation of the proposed subprojects by the REB/PGCB near natural habitats. These measures shall be undertaken in addition to the measures laid down in the other ECOPs.
- As per the World Bank OP 4.04, the conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. A precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development has been adopted for the project.

19.2 Main features of the Bank's Natural Habitats Policy (OP 4.04)

The policy on natural habitats contains two major provisions with respect to biodiversity conservation and EA. Firstly, it prohibits Bank involvement in projects, which involve significant conversion or degradation of critical natural habitats. These include: existing protected areas and adjoining or linked areas or resources (such as water sources) on which the protected areas depend; and sites identified as meriting protection. Secondly, where natural habitats outside protected areas are within a project's area of influence, the project must not convert them significantly unless:

- There are no feasible alternatives
- The EA demonstrates that benefits substantially outweigh the costs
- Mitigation measures acceptable to the Bank are implemented, which would normally include support for one or more compensatory protected areas that are ecologically similar to, and no smaller than, the natural habitats adversely affected by the project.

19.3 Project Planning and Design

Proper line route selection, appropriate timing of operations and proper construction and maintenance of the development of the transmission line can ensure that terrestrial, riparian and aquatic habitat values and fish and wildlife populations are protected from the adverse impacts. Following issues should be considered in Project Planning and Design stage.

- A detailed inventory of ecological features along the proposed rural road shall be prepared with the help of experts and the nature and type of impact on natural habitats shall be identified.
- Avoid concentrations of wildlife, areas of high value wildlife habitat and/or rare plant communities, when determining locations and routes for transmission line. A biologist or ecologist specialized in the discipline of concern must be retained to identified and assess such areas of concern.
- In areas of continuous high value habitat, consider not developing the project or determine an alternative routing, if feasible.
• Adjusting pole placement and span length to minimize the impacts;

19.4 Pre-construction Phase
• Contractor in consultation with local expert or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.
• No Construction Camps, Stockyards, Concrete Batching or Hot Mix Plants shall be located within the natural habitat or within 500m from its boundary.

19.5 Construction Phase
• Collection of any kind of construction material from within the natural habitat shall be strictly prohibited.
• In the event that concentrations of wildlife species are present in the proposed construction area, consider re-scheduling construction and maintenance activities until such time when the numbers of animals present are reduced or absent from the worksite.
• When removing vegetation from right of ways, workspaces etc., featheredge the cut to ensure that line of site and cover (both security and thermal protection) issues are addressed.
• No water resources within the natural habitat shall be disturbed.
• During construction, prevent human disturbance and ecosystem impacts on sensitive areas adjacent to projects by using temporary fencing or flag off area to restrict travel to construction zones, right of ways and workspaces.
• Disposal of construction waste within the natural habitat shall be strictly prohibited.

19.6 Post-construction Phase
• The infrastructure development projects near the natural habitat shall be declared as a silence zone.
• Allowing tree and shrub species that reach heights of 12 to 15 feet to grow within the ROW, which may control to trespassing and vandalism;
• Compensatory tree plantation within the project area shall be done.
• The REB/PGCB must ensure maintenance of drainage structure as per EGoP 14.0.
Most occupational health and safety issues during the construction, operation, maintenance, and decommissioning of electric power distribution projects are common to those of large industrial facilities, and their prevention and control is discussed in the General EHS Guidelines. These impacts include, among others, exposure to physical hazards from use of heavy equipment and cranes; trip and fall hazards; exposure to dust and noise; falling objects; work in confined spaces; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery.

Occupational health and safety hazards specific to electric power transmission and distribution projects primarily include:

- Live power lines
- Working at height
- Electric and magnetic fields

**Live Power Lines**

Workers may be exposed to occupational hazards from contact with live power lines during construction, maintenance, and operation activities. Prevention and control measures associated with live power lines include:

- Only allowing trained and certified workers to install, maintain, or repair electrical equipment;
- Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines;
- Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards. Qualified or trained employees working on transmission or distribution systems should be able to achieve the following:
  - Distinguish live parts from other parts of the electrical system
  - Determine the voltage of live parts
  - Understand the minimum approach distances outlined for specific live line voltages
  - Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system
- Workers should not approach an exposed energized or conductive part even if properly trained unless:
  - The worker is properly insulated from the energized part with gloves or other approved insulation; or,
  - The energized part is properly insulated from the worker and any other conductive object; or,
  - The worker is properly isolated and insulated from any other conductive object (live-line work).

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ECoP 20.0: Occupational Health and Safety

Most occupational health and safety issues during the construction, operation, maintenance, and decommissioning of electric power distribution projects are common to those of large industrial facilities, and their prevention and control is discussed in the General EHS Guidelines. These impacts include, among others, exposure to physical hazards from use of heavy equipment and cranes; trip and fall hazards; exposure to dust and noise; falling objects; work in confined spaces; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery.

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  - The worker is properly insulated from the energized part with gloves or other approved insulation; or,
  - The energized part is properly insulated from the worker and any other conductive object; or,
  - The worker is properly isolated and insulated from any other conductive object (live-line work).

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IFC Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution
Where maintenance and operation is required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined in a health and safety plan. Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities; Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.

Working at height on poles and structures
Workers may be exposed to occupational hazards when working at elevation during construction, maintenance, and operation activities. Prevention and control measures for working at height include:

- Testing structures for integrity prior to undertaking work;
- Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;
- Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point;
- Installation of fixtures on tower components to facilitate the use of fall protection systems;
- Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached;
- Hoisting equipment should be properly rated and maintained and hoist operators properly trained;
- Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;
- When operating power tools at height, workers should use a second (backup) safety strap;
- Signs and other obstructions should be removed from poles or structures prior to undertaking work;
- An approved tool bag should be used for raising or lowering tools or materials to workers on structures.

Electric and magnetic fields
Electric and magnetic fields (EMF) are described earlier. Electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines. Occupational EMF exposure should be prevented or minimized through the preparation and implementation of an EMF safety program including the following components:

- Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities; A 1994 study estimated the average exposure of electrical workers (including jobs in electric utilities and other industries) in Los Angeles, California to be 9.6 milligauss (mG), compared to 1.7 mG for
workers in other fields (S. J. London et al., 1994). Although detailed studies of workplace exposure to EMF in the United States, Canada, France, England, and several Northern European countries have found no conclusive link or correlation between typical occupational EMF exposure and adverse health effects, some studies have identified a possible association between occupational exposure to EMF and cancer, such as brain cancer (U.S. National Institute of Environmental Health Sciences 2002) indicating there is evidence to warrant limited concern.

- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
- Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE). Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.

**ECoP 21.0: Community Health and Safety**

Community health and safety impacts during the construction and decommissioning of transmission and distribution power lines are common and in addition to occupational health and safety standards code of practices, the operation of live power distribution lines and substations may generate the following industry-specific impacts:

- Electrocution
- Electromagnetic interference
- Visual amenity
- Noise and Ozone
- Aircraft Navigation Safety

**Electrocution**

Hazards most directly related to power transmission and distribution lines and facilities occur as a result of electrocution from direct contact with high-voltage electricity or from contact with tools, vehicles, ladders, or other devices that are in contact with high-voltage electricity. Recommended techniques to prevent these hazards include:

- Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment;
- Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock.

**Electromagnetic Interference**

The corona of overhead transmission line conductors and high frequency currents of overhead transmission lines may result in the creation of radio noise. Typically, transmission line rights-of-way and conductor bundles are created to ensure radio reception at the outside limits remains normal. However,
periods of rain, sleet or freezing rain sharply increases the streaming corona on conductors and may affect radio reception in residential areas near transmission lines.

Visual Amenity
Power transmission and distribution are necessary to transport energy from power facilities to residential communities, but may be visually intrusive and undesirable to local residents. To mitigate the visual impact of power distribution projects, the following mitigation measures should be implemented:

- Extensive public consultation during the planning of power line and power line right-of-way locations;
- Accurate assessment of changes in property values due to power line proximity;
- Siting power lines, and designing substations, with due consideration to landscape views and important environmental and community features;
- Location of high-voltage transmission and distribution lines in less populated areas, where possible;
- Burying transmission or distribution lines when power must be transported through dense residential or commercial areas.

Noise and Ozone
Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Ozone, a colorless gas with a pungent odor, may also be produced. Neither the noise nor ozone produced by power distribution lines or transformers carries any known health risks. The acoustic noise produced by transmission lines is greater with high voltage power lines (400-800 kilovolts [kV]) and even greater with ultra-high voltage lines (1000 kV and higher). Noise from transmission lines reaches its maximum during periods of precipitation, including rain, sleet, snow or hail, or as the result of fog. The sound of rain typically masks the increase in noise produced by the transmission lines, but during other forms of precipitation (e.g. snow and sleet) and fog, the noise from overhead power lines can be troubling to nearby residents. Measures to mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors, to the extent possible. Use of noise barriers or noise canceling acoustic devices should be considered as necessary.

Aircraft Navigation Safety
Power transmission towers, if located near an airport or known flight paths, can impact aircraft safety directly through collision or indirectly through radar interference. Aircraft collision impacts may be mitigated by:

- Avoiding the siting of transmission lines and towers close to airports and outside of known flight path envelopes;
- Consultation with regulatory air traffic authorities prior to installation;
- Adherence to regional or national air traffic safety regulations;
- Use of buried lines when installation is required in flight sensitive areas.
**ECOP 22.0: Polychlorinated biphenyl (PCB)**

**General:**
Polychlorinated biphenyl, otherwise known as PCB, is a synthetic chemical that is widely used for industrial and commercial use as dielectric fluid in transformers and capacitors because of its high resistance to decomposition, low electrical conductivity, low flammability and high heat capacity. Extensive scientific researches have shown that these substances are toxic, bio accumulative and persistent, thus, posing risks to health and the environment. PCBs are linked to chronic reproductive effects, gastric disorders, and skin lesions in laboratory animals and are suspected human carcinogen. Direct exposure to PCBs such as inhalation and skin contact could lead to serious headaches, drowsiness and skin irritation. The most common signs of exposure to PCBs are chlor-acne and elevation of liver enzymes increasing concern over health risks posed by PCBs and their undesirable environmental effects has resulted in the banning of the manufacture, processing, and distribution in commerce. Thus, PCBs is one of the initial twelve chemical substances or groups classified as POPs under the Stockholm Convention.

Transformer repair, reconditioning and retro-filling facilities are the major industry sectors that contribute to the spread of PCB contamination. The retro-filling of transformer involves draining of oil, rewinding of the transformer coil and refilling of dielectric fluid. The dielectric fluid may either be the same oil, which was from the transformer but filtered or it may be substitute dielectric oil, such as silicones, synthetic hydrocarbons, and ester-based materials.

With the wider recognition of the perceived risks and hazards associated with PCBs, the use of PCB-contaminated equipment is diminishing but PCB wastes will continue to be generated for many years from the gradual phase-out of existing PCB-contaminated and retro-filled equipment.

**Types of PCB Wastes**
PCB wastes are discarded materials that contain PCB or have been contaminated with PCBs and that are without any commercial, industrial, or economic use. For the purpose of this Code of Practice, PCB wastes are classified as follows:

- **Liquid PCB wastes**
  - PCB-based dielectric fluids removed from transformers and other equipment
  - PCB-based heat transfer and hydraulic fluids
  - PCB-contaminated solvents
  - Leakages, spillages and splashes of PCB-based fluids due to mishandling or accidents
  - Laboratory wastes with PCBs

- **Non-metallic solid wastes**
  - Material used in cleaning PCB equipment or absorbing the spillages such as rags, sawdust, clothing, gloves, gaskets, etc.

- **Metallic solid wastes**
  - PCB equipment such as capacitors, transformers, switchgears, circuit breakers, heat transfer systems, etc.
✓ Contaminated components removed from electrical equipment such as windings; PCB-contaminated containers and equipment such as metal drums, tanks, pumps, metal filters, etc.

Packaging and Labeling of PCB Wastes
The generator is required to maintain an inventory of registered equipment with reference to the location of each item. PCB waste generators, transporters, and owners of TSD facilities should ensure proper packaging, labeling, and storage of PCB waste prior to transportation to disposal facilities. PCB equipment should have distinct markings on the intended use and the corresponding PCB content.

A. Packaging
- Containers of PCB wastes should be durable, corrosion resistant, leak-free, in good condition and free from damage and shall follow the UN standard drums.
- PCB liquid from transformers should be drained prior to any transport activity. Liquid PCB wastes should be stored in sealed, new or in good condition 200-litre steel drums or high density polyethylene (HDPE) drums, and fitted with double bung fixed ends. The steel drum should be treated or painted to prevent oxidation and rusting. There should be 7 to 10 cm airspace left at the top of the drum to allow liquid expansion. The liquid PCB wastes should be placed in heavy duty steel or HDPE drums, with removable lids and a gasket made of PCB resistant material such as nitrile rubber, cork, or Teflon. The drum should have a clear and visible label, in compliance with this Code of Practice.
- Combustible PCB contaminated solid wastes such as materials used for cleaning PCB equipment; cleaning or absorbing of spillage such as sawdust, rags, etc.; PCB contaminated PPEs such as gloves, gaskets or clothing; and used PCB test kits should be packed in heavy duty and leak-proof polyethylene bags. The bags should then be placed in steel or HDPE drums in good condition and fitted with removable lids. The drum should also have a clear and visible label, in compliance with this Code of Practice.
- The drum should be packed with absorbent material so that any leaks would be absorbed.

B. Labeling of PCB Equipment
The following label marking are prescribed:
- Transformers and capacitors containing concentration of PCBs ≥ 50 ppm
- Electric motors using PCB-containing coolants
- Hydraulic systems using PCB-containing fluids
- Heat transfer systems using PCBs
- PCB packaging stored for treatment or disposal
- Vehicles that carry PCB equipment and wastes
- Equipment removed from service containing total concentration of PCBs ≥ 2 ppm
- PCB articles and containers
- PCB storage tanks, filter presses, tools and equipment used to service electrical articles
- Discarded bushings, insulator caps, and cables.
Further to include the following information in the label is recommended:
- CCO registration number
- Serial number of the unit
- Other identifying information
- Total weight and volume of PCB waste
- Name and address of the waste generator
- Contact person and telephone number.

Storage
- Storage facility should have good ventilation, dry surfaces, and has impermeable floor made of chemical resistant epoxies or resins.
- All drummed wastes and PCB contaminated equipment should be kept in a bunded area adequate to contain any spill or leak.
- PCB equipment and PCB waste materials should be stored separately from other chemicals. In cases that PCBs are to be stored with other materials, a partition must be installed or sufficient space separation must be ensured to prevent mixing of chemicals in case of leak or spill. For solvents or flammable materials, these chemicals should be separated by a fire-proof barrier, or separated adequately.
- Roof-water drainage should be directed away from the inside of the containment facility to prevent a build-up and possible runoff of contaminated water. Drain spouts should not be incorporated into the base of concrete curbing to drain PCB oil collected inside the containment area as these spouts can leak and will certainly allow spillage onto the ground during drainage.
- PCB handling equipment such as pumps, hoses, and tools intended for future use should be stored separately from waste and must be stored with spares until they expire or are discarded.
- Drummed PCB waste should be placed on pallets. Drums should be stored in rows, maximum of four (4) drums on a pallet, with a minimum of four (4) feet aisle space between rows for inspection, response to leaks and fire control. The storage area should have sufficient space for internal access i.e., access for forklifts and other machineries and movement of large equipment.
- Other provisions to be observed in the storage area or warehouse are as follows:
  ✓ Place or provide metal drip trays under drain spouts of transformers.
  ✓ Keep first aid and safety equipment handy.
  ✓ Keep spill clean-up kits handy and display emergency cleanup procedures.
  ✓ Provide appropriate fire-fighting equipment and install smoke detectors to warn of fire.
  ✓ Keep a record of all materials entering and leaving the storage area.

Transport of PCB Wastes
- Transport of PCB wastes must be done carefully with the required permit from REB/PGCB.
- Transport of PCB wastes should be under the supervision of trained and experienced personnel that have undergone the training required for the registration of PCB waste transporters.
- Transport vehicles should have drop-side on both sides, with a canopy.
• Transport vehicles should have hazard warning panels clearly marked with black indelible ink against yellow retro-reflective background. The panels should be displayed at the front and rear of the vehicle in a position that does not conceal any lights, license plates or other legally required signs or markings.

• The Manifest must be kept on the driver's cabin or in the driver's side door compartment at all times.

• Transport Vehicles must be equipped with safety equipment, including appropriate fire extinguisher(s) for emergency use, and a spill cleanup kit.

• The precautions to be observed during the transport shall include the following:
  ✓ All materials to be transported shall be packaged and labeled in accordance to this Code of Practice.
  ✓ All liquid wastes shall be transported in closed transport vehicle or van.
  ✓ All loading and unloading operations should be carried out with care to avoid any damage which may result in leakage and spillage.
  ✓ The drums or the PCB contaminated equipment must be loaded and fastened securely so that they are in an upright position and do not move about or fall off the vehicle.

Health & Safety Requirements and Procedures

A. Personal Protective Equipment (PPE)

Workers should eliminate risk of exposure to PCBs by utilizing the following personal protective equipment or proven equivalent measures.

• Coveralls (Tyvek jumpsuit) with hood
• Protective boot covers
• Full-face respirator
• Protective gloves
• Heavy duty gauntlets or ductile taping of pant’s ankles to boot covers, and wrists to gloves
• Hard hat for overhead dangers and head protection
• Goggles for eye protection

The main danger when handling liquids with high PCB concentrations is skin absorption. Careful consideration must be given to the selection of protective clothing including coveralls, boots or boot covers, gloves and eye protection. Clothing and footwear must be resistant against splash and spills. For major spill clean-up operations, a full suit of non-porous material is appropriate. Disposable coveralls and PCB resistant knee length safety boots shall be used.

Eye protection against liquid splashes is necessary. Goggles are adequate for this purpose. Chemical safety, goggles face shield, or safety glasses with side shields are satisfactory. Working with hot fluid must be avoided since fumes may be generated when PCB fluids are heated above 55°C. Protective equipment must also be worn to prevent inhalation of fumes. A full-face respirator fitted with a cartridge suitable for PCBs shall be used and ventilation of the working area must be sufficient to dispose the generated vapors. If the respirator becomes slightly contaminated or clogged, wipe the
respirator with a paper towel and kerosene. If the respirator becomes heavily contaminated, it shall be disposed of in accordance with this code of practice.

PCBs will penetrate most materials, but certain materials including natural rubber are particularly permeable to PCBs and are thus unsuitable for use as protective clothing. Chemical resistant fluorinated rubbers or elastomers are more suitable and laminated materials offer the best protection against PCBs. For continuous handling of PCB, resistant Nylon, polyethylene, butyl rubber, nitrile rubber or neoprene gloves shall be used. No material is completely impervious to PCBs and therefore it is necessary to make certain that arrangements are in place to regularly change all PPE. The equipment supplier will normally provide details on the rate at which PCBs permeate protective equipment. This information will be useful in estimating, for each task, the time it takes for PCBs to penetrate through the protective equipment. This is known as the breakthrough time. This will depend on the frequency and duration of contact of the protective equipment and clothing with PCBs and may vary from one task to the next. The supplier should be able to provide typical breakthrough times for the different applications and advise if there is a need to reduce this time to allow for other factors such as abrasion. If rubber boots are used, the boots need to be regularly discarded. The foot protection reinforced by the use of disposable boot covers. For laboratory work, laboratory coats and suitable disposable gloves are necessary for protection against skin contact. If there is a danger of dust or fume formation (for example by heating) then the use of a fume hood is recommended. It will be necessary to treat all potentially contaminated protective equipment as PCB waste and dispose of it accordingly and decontamination and reuse is not allowed.

Safety Procedures:
Preference should be given to the use of disposable protective clothing due to difficulty in decontamination. Contaminated protective clothing should be promptly removed and the area of skin contaminated with PCBs should be washed with or rinsed immediately. Level C PPE respirators must be worn. For work at normal temperatures, a suitable type is a full face-piece respirator with an appropriate cartridge. For high temperature or work in confined space, Level B PPE that includes a self contained breathing apparatus (SCBA) is required. Workers should be trained before they are allowed to use this type of breathing apparatus. If the respirators do not have eye protection, the chemical type goggles must be worn. Hands must be washed after handling PCBs (even if wearing full protection) before eating, drinking, smoking or using toilet facilities initially with waterless hand cleaners and paper towels, which shall then be disposed of in accordance with this code of practice.

Management of Spills and Contingency Plans:
- The Emergency Contingency Plan to be prepared and implemented by generators, transporters and TSD facilities as prescribed in the Implementing Rules and Regulations of RA 6969 shall include the following:
  - If a spill or leakage occurred during transport, emergency response procedures must be carried out immediately.
  - As soon as it is practical to do so, the driver's supervisor or responsible official from the generator and TSD facility should be notified.
  - The vehicle should not be left unattended until the spill or leak is contained.
  - If the operator of the vehicle is incapacitated, the emergency services must rely on the (Manifest) shipping papers to identify the type of quantities of PCB material being transported.
  - Cleanup must be initiated immediately.
• All personnel engaged in the cleanup must be properly trained.
• All trained personnel handling the PCB or engaged in the cleanup must wear required PPEs to avoid contamination of garments and skin exposure.
• PCB articles and PCB containers and their contents must be transferred immediately and must be properly marked.
• The PCB containing equipment should be contained and cleaned up immediately.
• PCB liquid must be prevented from reaching storm drains, sewers, drainage systems and other water bodies. Every available option must be employed to contain the spill, including temporary diversion or bunding (use of retaining walls). Flow of water to the contaminated area should be prevented from sources such as sprinkler systems, rain, and street gutter runoff.
• If in case the PCB liquid reach flowing water, storm sewers or any inaccessible area, the first employee arriving at the spill area should initiate notification procedures immediately and initiate measures to prevent additional PCB liquid reaching the water bodies or lands.
• Barricades, caution tape, and signs should be put up around the contaminated area to prevent pedestrians, animals and vehicles from entering until the spill material is cleaned up and removed. Strict security of the area must be ensured and admittance to the site should be only upon authorization.
• In most cases, oil absorptive material is a useful cleanup tool. It should be spread on the contaminated area and should be left in place for at least one hour, or as long as necessary to ensure that all PCB fluids have been absorbed. The absorbent may need to be physically scrubbed or pressed into the contaminated surfaces.
• The common sorbent materials for spill clean-ups are the following:
  ✓ Activated charcoal
  ✓ Absorbent pads
  ✓ Local indigenous adsorbent materials
• After the spilled liquids have been absorbed, the absorptive material, along with any contaminated soils, should be placed in steel containers provided for disposal purposes. If PCB penetration or permeation cannot be determined, at least 15 cm of soil depth should be removed.
• All surfaces exposed to the spilled liquid should be decontaminated with swabs containing an efficient solvent.
• Any contaminated steel structures, wood racks, cable trays (all types), and contaminated items such as tools, boots, full face respirator (unless severely contaminated) and other equipment should be washed down with perchloroethylene. All equipment on these structures that may be contaminated by a PCB spill, but will not be removed, must also be similarly cleaned. Use perchloroethylene with caution to prevent further contamination of equipment, vehicles etc. in the spill area.
• Large spills in populated areas, the spill area will be continuously manned until the spilled PCB oil and all clean-up materials have been removed from the site, secured in drums, or treated.
In case of fire, the fire department should be notified immediately and informed that the fire involves PCBs. Foam or dry chemicals must be used to extinguish the fire, rather than water to minimize contaminated runoff.

PCB contaminated soil need to be remediated to background levels (i.e., detection limits), where practicably attainable, of any PCB spill.

Spills into small pools of water may be cleaned up by bailing or pumping the contaminated water and sediment into secured drums.

Spills into water bodies could pose a difficult clean-up and require special consideration. Since PCBs are heavier than water, it will settle to the bottom and dredging of contaminated sediment will be necessary in the area of the spill.

For Transporters, Spill report shall be submitted to the PGCB/REB, Concerned Government Agencies.

The spill report shall contain the following information:

- Source of the PCBs
- Quantity of waste involved
- Time and duration of the incident
- Cause of the spill
- Estimated size and location of the affected area
- Nature or visible effects e.g., fish kill, toxic cloud, discoloration of receiving water
- Corrective measures taken or planned and the implementation schedule of such activities
- Spill Prevention Control and Countermeasures (SPCC), or contingency plans in effect
- Persons notified (including name, organization, date and time)
- Name(s) of cleanup personnel
- Description of medium affected by release (porous/non-porous surface, drains, soil, water, air)

**Disposal**

Methods of disposal for PCB must meet the destruction efficiency of 99.9999% and must be consistent with best available techniques (BAT) and best environmental practices (BEP) enjoined by the Stockholm Convention on POPs.

**The Cost Estimation of ECoPs**

Some activities included in ECoPs have certain monetary involvement. The generic method of determining the cost of the ECoP is outlined below:

- The Engineer of the REB/PGCB will carry out a survey of the intended project site to identify appropriate locations and also identify sites unsuitable in terms of topography, proximity to water courses, and environmental sensitive areas such as forests, wetlands, or other sensitive area.
- Survey and monitoring works must be carried out by Engineer appointed by the REA/PGCB authorities, throughout the pre-construction, construction, and post-construction phases to make sure the items and specifications (e.g. low cost sanitation facilities, top soil management...
waste disposal, tree plantation, storm water drainage, etc.) provided in this ECoP are properly addressed and estimated the cost.
APPENDIX - I
Sample Baseline and Preliminary Assessment

Introduction

The ESMF was prepared based on the preliminary assessment carried on the few selected existing and proposed substations and power line routes in three districts. The objectives of the preliminary assessment were to understand the possible environmental impacts and to have an idea on the existing baseline conditions. The team of consultants visited 6 substation locations in Dhaka, Sylhet and Chittagong. Among the 6 locations, 3 were earmarked for new substations while the rest were locations where substations were already operational and in need of rehabilitation. In addition, the consultant team performed reconnaissance surveys on 4 power line routes in Dhaka, Sylhet and Chittagong division. The GPS coordinates, dates of visit of the existing and proposed substation locations are summarized in Table 1.1. The dates of visit, location and other particulars of the three power line routes are summarized in Table 1.2. During the field visits, information was gathered regarding the physical environment of areas surrounding the substations and power lines routes. Informal discussions were also held with REB officials and people living and working in the surrounding areas.

Table 1.1: Locations of the substations surveyed for environmental and social baseline study

<table>
<thead>
<tr>
<th>Location</th>
<th>Date Visited</th>
<th>District</th>
<th>Division</th>
<th>Type of Substation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zimira, Keraniganj</td>
<td>11 and 19 September, 2013</td>
<td>Dhaka</td>
<td>Dhaka</td>
<td>33/11 Substation</td>
<td>Existing indoor substation is not working properly, it needs to be upgraded to outdoor substation. Concrete poles &amp; wires are in poor condition.</td>
</tr>
<tr>
<td>Chittagong, Beside Chittagong-Cox's Bazar Highway</td>
<td>02 October, 2013</td>
<td>Cox's Bazar</td>
<td>Chittagong</td>
<td>33/11 Substation</td>
<td>The proposed site is under water and it remains underwater during wet season.</td>
</tr>
<tr>
<td>Kadalantoli, Golaganj</td>
<td>08 October, 2013</td>
<td>Sylhet</td>
<td>Sylhet</td>
<td>33/11 Substation</td>
<td>Currently it is unused land. The proposed site is a low land covered by green grass and herbs</td>
</tr>
<tr>
<td>Basila, Keraniganj</td>
<td>11 and 19 September, 2013</td>
<td>Dhaka</td>
<td>Dhaka</td>
<td>33/11 Substation</td>
<td>The site is underwater and it remains underwater during wet season.</td>
</tr>
<tr>
<td>Gorokghata, Moreshkhai</td>
<td>01 October, 2013</td>
<td>Cox's Bazar</td>
<td>Chittagong</td>
<td>33/11 Substation</td>
<td>The area of this proposed site is 1.72 acre.</td>
</tr>
<tr>
<td>Vadeshwar, Golapganj</td>
<td>08 October, 2013</td>
<td>Sylhet</td>
<td>Sylhet</td>
<td>33/11 Substation</td>
<td>The proposed site is a low land covered by green grass and herbs</td>
</tr>
</tbody>
</table>
Table 1.2: Locations of the power line routes surveyed for environmental and social baseline study

<table>
<thead>
<tr>
<th>Location</th>
<th>Date Visited</th>
<th>District</th>
<th>Division</th>
<th>Type of Power Line</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Konakhola, Zinzira, Kalurbag, Norondi</td>
<td>19 September, 2013</td>
<td>Dhaka</td>
<td>Dhaka</td>
<td>11 kV</td>
<td>Along the 6.5 km 11 kV line from Zinzira, 33/11kV Substation to Kalurbag, Norondi High School.</td>
</tr>
<tr>
<td>Moheshkhal-Chokoria road</td>
<td>01 October, 2013</td>
<td>Cox's</td>
<td>Chittagong</td>
<td>33 kV</td>
<td>The survey of 33kV line was carried out about 19 km from Bodorhali Bridge Moheshkhal to Chokoria and about 17km at ChokorsUpazilla from Kalarbil village to Fhulchori village.</td>
</tr>
<tr>
<td>Sylhet-Golapganj</td>
<td>08 October, 2013</td>
<td>Sylhet</td>
<td>Sylhet</td>
<td>33 KV</td>
<td>The survey was undertaken along the 13 km 33 kV line from Kuchai to Golabganj, which goes from the Sonaia Substation to Golabganj Substation.</td>
</tr>
<tr>
<td>Haripur to Ghorashal</td>
<td>22 October, 2013</td>
<td>Narshingi</td>
<td>Dhaka</td>
<td>132 KV</td>
<td>The survey was undertaken along the 44 km 132 KV line from Haripur to Ghorashal. Re-conductoring and renovation would be required for this transmission line.</td>
</tr>
</tbody>
</table>

Physical Environment

*Physical Environment Surrounding Substations*

**Proposed Substation at Basila, Keraniganj**

The proposed 33/11kV power Sub-station is located at Basila, Keraniganj Upazilla, Dhaka (Figure: 1.1). This site belongs to REB. The Keranigonj Upazilla Health Complex (Government hospital) is about 500m far from the proposed substation location. The approach road to the site is named Zinzira road which is paved, about 7m wide and a large amount of sand-filled land on both sides of the roads probably for housing development projects. The road goes through a suburban area with light to occasional heavy traffic but the traffic is expected to increase in future with the progress of development projects. A 230kV transmission line (Figure: 1.2) from Hasnabad substation to Aminbazar Substation runs very close (~250 m) to the proposed site. Several residential houses were found directly below the 230 kV transmission line.

During the time of visit, the site was underwater. Since the proposed site is low-land areas, the site is expected to be underwater during the wet season. Fishery is very common during wet season in this proposed site while rice cultivation is common during the dry season. The proposed site will require land filling for the construction of the substation. A large number of trees were found on both sides of the approach road.
Figure I.1: Area around proposed site of 33/11kV Sub-station at Basila, Keraniganj, Dhaka
Proposed Substation at Gorokghata, Moheshkhali

The propose site (Figure: 1.3) at Gorokghata Union under Moheshkhali Upazilla, Cox’s Bazar is located inside the REB Office premises near the bazar of the Gorokghata union. The width of the approach Road is almost 6m, and there is hardly any vacant space beside the road because of encroachment by different kind of shops. Some of these temporary shops may have to be moved a few meters during construction of distribution lines. At present there is a pond (Figure: 1.4), which is covered by water hyacinth and other aquatic plants. A small single story building owned by the REB is also situated at the site. The building is currently not in use. The area of this proposed site is 1.73 acre. Since the proposed area is under the REB office, there is no need for land acquisition. There are several planted trees in proposed site, which may be affected due to construction of the substation.
Figure 1.4: (left) A pond (filled up with water hyacinth and other aquatic plants) located at proposed site of Gorokghata substation in Moheshkhali, Cox’s Bazar; (right) BUET team visiting proposed site at Gorokghata, Moheshkhali, Cox’s Bazar
Proposed Substation at Vadeshwar, Golapganj

The proposed site at Vadeshwar is located on the left hand side of the road that goes to Vadeshwar Bazar from Golapganj, Sylhet (Figure: 1.5). The site, which is currently an unused land covered by green grass and herbs, is about 60 m away from the road. REB owns this site. There is a mosque (Figure: 1.5) on the right side of the site and a pond just in front of the proposed site. Vadeshwar Govt. High School is also located near proposed substation site. A natural canal originated from Kushiara river runs near the proposed substation site.

Existing Substation at Keranigonj

This 33/11 kV Substation is located on Zimzira road at Zimzira, Keranigonj, Dhaka. This road is relatively wide, having average width of 6 to 7m. The substation is under the Keranigonj PBS Office. Figure 1.6 shows the location of this Substation. This is a ‘regular outdoor’ type Substation having 3 feeders. The transformer oil is centrifuged in Dhaka every year. At present there is a three-storied office building and a switch station (Figure: 4.7) inside the substation.
area. The total substation area is covered by green grass. Plantation has been carried around the site.

Figure 1.6: Existing site location of 33/11kV Sub-station at Zinzira, Keraniganj, Dhaka

Figure 1.7: (left) Existing site of 33/11kV Sub-station at Zinzira, Keraniganj, Dhaka and (right) a view of transformer at the substation

Cox’s Bazar 33/11 KV Substation

This 33/11 kV Substation is located on Chittagong-Cox’s Bazar highway (Fig. 4.8). This road is relatively wide, having average width of 10 to 12m. The substation is under the ‘Cox’s Bazar Palli Bidyut Samity’. Figure 1.8 shows the location of this Substation. This is a ‘regular outdoor’ type Substation having 4 number of feeders. The transformer oil is centrifuged in Dhaka in
every year. At present there is a two-storied office building (Figure 1.9), a rest house and a few single storied building structures are inside the substation area. The total substation area is covered by green grass. A number of small planted trees have been found to be present around the site.

![Figure 1.9: Existing site of 33/11kV Sub-station at Cox's Bazar](image1)

![Figure 1.9: Existing site of 33/11kV Sub-station at Cox's Bazar](image2)

**Existing 33/11 kV Substation at Golapganj**

This substation is installed in 1990 and located at Kadamtoli under Golapganj Upazilla in Sylhet. Formerly this 33/11 kV substation was under PDB, but now it is under REB. This substation serves 11 unions under Golapganj Upazilla. The existing indoor substation is not working properly, so it needs to be upgraded to outdoor substation as per standard. Concrete poles and
wires are also in poor condition. Transformer oil centrifuge facilities are available at this Substation. The substation is located about 130 m away from the Union Parishad Road and about 140 m away from the highway. The Union Parishad road is relatively narrow, having an average width of 4 to 5 m; the access road to the Substation is also narrow, having a width of 3 to 4 m. There is a large ditch in front of the substation and a single storied building behind this. There are a few trees near the substation.

Figure 1.10: Existing site of 33/11kV Sub-station at Golapganj, Sylhet

Figure 1.11: (left) A view of the transformer at 33/11kV Substation of Golapganj, Sylhet and (right) A view approach road of the existing substation at Golapganj
Physical Environment along Power Lines

Keraniganj 11 kV Line

The survey was undertaken along the 6.5 km-long 11 kV power line from Zinzira 33/11kV Substation to Norondi High School at Kalurbag (Figure 1.12). The existing line goes along the Zinzira road and a new 11kV line will be installed following the Zinzira road on the other side of the road.

The surveyed line route area is very close to the Dhaka City and part of the surveyed area included the densely populated city fringes while some part covered the rather remote village areas where the population was not that high. The survey work started at Zinzira, which is densely populated with buildings as well as a few semi pucca residential installations. Shops and houses were along both sides of the road and in a few places the lines were very close to these houses and shops (Figure 1.13).
Figure 1.12: (above) Existing 11kV line alignment on Keraniganj Upazilla Map and (below) a Google map view of the surveyed 11kV line at Basila

Figure 1.13: (left) A view of 11kV power line at Zinzira which are located very close the shops and (right) a view of the 230 kV transmission line that crosses Zinzira road at South Brammankitta

Figure 1.14: Power line route overlay on image across Zinzira Road at Kalindi Village

Amirabag bus stop is located at Kalindi village along the survey route. The Kalindi village is much less populated than Zinzira area with tin-sheds houses and a few semi pucca buildings. A number of paddy fields and low-lying lands were observed in this area. Private housing projects (e.g., Sonar Bangla housing) are seen in this area. There were also empty lands where sand filling is being carried out and this is an indication that housing or industrial development
projects will probably be emerging very soon. A few small industries were found on both sides of the road (Figure: 1.14 and 1.16). At south Brammankitta and Malancha village on the surveyed route, there were a few educational institutions (e.g. Madrasa), government service setups (e.g. fire service, Keraniganj Upazila Health Complex, water supply reservoir) and religious institutions (e.g. temple, mosque) and residential installations. The 230 kV transmission line crosses the survey route at south Brammankitta (Figure: 1.13). From the Google map image, it was observed that some residential installations were right below the 230 kV high voltage transmission line route (Figure: 1.15). Along the surveyed route lots of trees are noticed both side of the roads. In some places the power line just over the houses and shops creating an unsafe place for living. In a few locations, there were huge sags in 11 kV lines and at some places the 11 kV poles were dangerously inclined which indicated poor maintenance of power line.
Chakoria-Moheshkali 33 kV Line

For the proposed 89.5 km power line from Jhilonja to Moheshkali up-gradation, re-conducting and renovation would be required. The existing line will be upgraded to Low Loss Thermal ACSR conductor with same weight and diameter class but about two times carrying capacity of ACSR Grosbeak. The survey was undertaken along the 37 km 33 kV line from Chokoria to Moheshkali (Figure 1.18).

The surveyed 33kV line route follows the existing road network of Chittagong- Cox's bazar highway and Moheshkali-Chokoria road. The survey of 33kV line was carried out along a 19 km stretch from Bodorkhali Bridge Moheshkali to Chokoria and about 17km stretch from Kalarbil village to Fhulchori village at ChokoriaUpazilla. The surveyed area is in coastal region and Bodorkhali bridge is over Moheshkali channel, a downstream tributary of Matamuhuri river. The power line goes over the houses and shops in some places and crosses Moheshkali-Chokoria road near the bridge area. (Figure: 1.19).
In the coastal region, salinity in soil and the salty air is a major issue for power line polls/tower due as corrosion is aggravated in these conditions. There are lots of salt fields in this area and the power lines have been found to go through these salt fields (Figure: 1.20).
Figure 1.20: Power lines near the salt fields at Illishia, Monesknai, Cox's Bazar.

Figure 1.21: Power line at Illishia, Monesknai, Cox's Bazar.
The power line crosses through the field area at Dorbeskata bazar area of the surveyed route (Figure: 1.22). This area is very small village with tin shed houses and a few semi-pucca buildings. Although the power line mostly goes through the agricultural fields in this area, in a few places the power line is just over the houses (Figure: 1.22). Power line crosses the Moheshkali-Chokoria road through the village residential area (Figure: 1.23).
Figure 1.24: Power line at Chokoria, Cox’s bazar

Figure 1.25: Power line going over residential areas (left) and paddy fields (right) at Chokoria, Cox’s bazar

Sylhet-Golapganj 33 kV Line

The survey was undertaken along the 13 km 33 kV line (Figure: 1.26), which goes from the Sonadia Substation to Golabganj Substation. The existing power line requires upgrading and
renovation works to Low Loss Thermal ACSR conductor with same weight and diameter class but about two times carrying capacity of ACSR Grosbeak with power line tower replacing.

![Figure 1.26: Existing 33kV line alignment in Sylhet Map](image)

The power line goes along the side of the road from Kuchai to Sylhet bypass road and crosses the Sylhet bypass road (Figure: 1.27). Along the road lots of shops and houses are found in.

![Figure 1.27: Power line crossing over the Sylhet bypass road](image)
Kuchal market area. Sometimes paddy fields are also seen along the survey power line. In some places the shops are situated very close to the power line.

The power line eventually crosses over the 20m wide Sylhet-Golapganj road near golapganj (Figure: 1.28). The power line is often found 15 feet to 20 feet high from the ground surface in
several locations. Some towers were found without earthing. At Golapganj the power line goes over houses and shops at several locations towards the 33/11kV substation.

Figure 1.30: Power line running through the village areas at Hatimganj (left) and over the houses at Golapganj (right).

Narsingdi-Haripur-Ghorashal 132 kV Transmission Line

The survey was undertaken along the 44 km 132 kV transmission line from Haripur to Ghorashal in several segments. The first surveyed segment is along the road leading towards Pachrukhi village from the Dhaka-Sylhet highway. This area is densely populated with tin-shed houses and also with a few semi pucca buildings. The area surrounding this power line route is mostly a low lying area with stagnant water (Figure: 1.32). In a few places the power line is just over the houses (Figure 1.33).

The second surveyed segment is along the road towards Sonapara village. The average width of this road is about 4 to 5m. Here, the power line is passing through the 'Purbachal Prabashi Palli' land area. The land was covered by herbs at the time of survey. There is no house near this power line particularly in this segment only except a site office of the 'Prabashi Palli' group.
The third surveyed segment is at Shatgram Village. The area surrounding the route is mostly a lush green area with large numbers of tall and juvenile trees. A number of paddy fields and low-lying lands have been observed in this area. The average width of the nearby road is about 4m to 5m.

Along Narshingdi-Arahazar highway there are two parallel 132 KV and 230 KV transmission lines. The transmission line passes through the green area. The paddy fields and low lying lands have been observed also in this area. There is no house near the transmission line covered in this segment.
The last segment is at Kataber village near Palash. The line passes across the Kataber road. The average width of the road is about 5m to 6m. There are lots of trees at both sides of the road. The clear height of the transmission line is comparatively lower in this segment. In some places the transmission line is only about 20 feet to 25 feet high from the ground surface.
Figure 1.35: Power line route overlay on image in Shatgram village.

Figure 1.36: Power line route overlay on image along Narshingdi-Araihajar highway.
Figure 1.37: Power line route overlay on image across Kataber village road near Palash.

Figure 1.38: Power line passing through Purbachal Prabashipalli (left) and through a crop field (right) in Narsingdi.
Figure 1.39: Two 132 and 230 kV line passing parallel near Narayanganj-Araihajar Highway (left) and Transmission line only 20 feet above the ground surface (right)

General Climate

Bangladesh is located at the central part within the Asiatic monsoon region where the climate is tropical. Relatively small size of the country and generally low-lying area cause moderate spatial variation of temperature, precipitation, relative humidity, wind speeds and other climatic variables. However, the climate of Bangladesh exhibits pronounced temporal variability. This is because of the moisture-laden monsoon winds flowing predominantly from the south-west during summer and the comparatively dry and colder north-western winds during winter.

Three seasons are generally recognized: a hot, muggy summer from March to June; a hot, humid and rainy monsoon season from June to November during which more than 85% of the total annual rainfall occurs; and a moderately cool, dry winter from December to February. The beginning of the rainy season vary from year to year; heavy rains may commence anywhere between mid-April and early June and may end anywhere between the end of September and mid-November. Usually winter season is dry with occasional rains. The early summer season is considered from March-April. During summer the air becomes hot with very low humidity. Early summer is also dominated by Baishaki cyclone and rains.

The Bangladesh Meteorological Department monitors different climatic variables from 35 stations in Bangladesh. Among them 4 stations can represent the 5 locations visited as shown in Table 1.3. Different meteorological data like rainfall, temperature, relative humidity, evaporation, and solar radiation measured in these stations during the period 2001 – 2012 are summarized in Tables 1.4 (a) – (f).

Table 1.3: The meteorological stations representing the locations visited in this study.

<table>
<thead>
<tr>
<th>Substation/Power line Location</th>
<th>District</th>
<th>Nearest BMD Weather Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Konakhola, Keraniganj (existing and</td>
<td>Dhaka</td>
<td>Dhaka</td>
</tr>
</tbody>
</table>

172
proposed substation, 11kV line

Golapganj (existing substation and 33kV line)
Vadeshwar (proposed substation)

Gorokghata, Moheshkhali (proposed substation and 33kV line)

Chokoria (existing substation) and 33 kV line from Chokoria to Moheshkhali

132 kV transmission line from Haripur to Ghonshal

Table 1.4(a): Monthly averages of climatic variables at the Mymensingh BMD station, 2001-2012

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
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<td>190</td>
<td>16</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Temp (°C)</td>
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<td>31.8</td>
<td>31.6</td>
<td>31.9</td>
<td>31.5</td>
<td>30.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Temp (°C)</td>
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<td>31.6</td>
<td>31.9</td>
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</tr>
<tr>
<td>Min Temp (°C)</td>
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<td>18.0</td>
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<td>24.0</td>
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<tr>
<td>Humidity (%)</td>
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<td>75</td>
<td>80</td>
<td>81</td>
<td>86</td>
<td>87</td>
<td>86</td>
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</tr>
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<td>Sunshine (Hours)</td>
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<td>4.7</td>
<td>4.5</td>
<td>6.3</td>
<td>7.2</td>
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</tr>
<tr>
<td>Solar Radiation (Cal/cm²/min)</td>
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</tr>
<tr>
<td>Evaporation (mm/d)</td>
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<td>3.9</td>
<td>3.7</td>
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</table>

Source: Bangladesh Meteorological Department

Table 1.4(b): Monthly averages of climatic variables at the Cox’s Bazar BMD station, 2001-2012

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<th>Month</th>
<th>Jan</th>
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<td>335</td>
<td>711</td>
<td>423</td>
<td>257</td>
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<td>Mean Temp (°C)</td>
<td>20.5</td>
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<td>28.9</td>
<td>28.5</td>
<td>28.0</td>
<td>27.6</td>
<td>27.7</td>
<td>27.5</td>
<td>25.1</td>
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<td>Max Temp (°C)</td>
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<td>34.6</td>
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<td>18.0</td>
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<td>23.8</td>
<td>24.0</td>
<td>23.7</td>
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<td>17.1</td>
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<td>73</td>
<td>76</td>
<td>79</td>
<td>86</td>
<td>88</td>
<td>87</td>
<td>86</td>
<td>83</td>
<td>77</td>
<td>74</td>
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<tr>
<td>Sunshine (Hours)</td>
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<td>8.3</td>
<td>8.6</td>
<td>9.0</td>
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<td>7.3</td>
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Table 1.4(c): Monthly averages of climatic variables at the Dhaka BMD Station, 2001-2012

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<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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<td>324</td>
<td>350</td>
<td>290</td>
<td>316</td>
<td>155</td>
<td>19</td>
<td>13</td>
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<tr>
<td>Mean Temp (°C)</td>
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<td>34.8</td>
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</tr>
<tr>
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<td>22.7</td>
<td>23.9</td>
<td>24.0</td>
<td>23.7</td>
<td>20.6</td>
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<td>59</td>
<td>68</td>
<td>72</td>
<td>83</td>
<td>81</td>
<td>80</td>
<td>80</td>
<td>76</td>
<td>70</td>
<td>71</td>
</tr>
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<td>Sunshine (Hours)</td>
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<td>7.5</td>
<td>7.7</td>
<td>6.8</td>
<td>3.4</td>
<td>4.0</td>
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<td>4.2</td>
<td>5.7</td>
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<td>175</td>
<td>189</td>
<td>192</td>
<td>172</td>
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<td>Evaporation (mm/d)</td>
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<td>5.5</td>
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<td>3.6</td>
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Source: Bangladesh Meteorological Department. Note: Solar radiation and Evaporation not measured in this station

Table 4.4(d): Monthly averages of climatic variables at the Sylhet BMD Station, 2001-2012

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<th>Month</th>
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<th>Apr</th>
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<th>Oct</th>
<th>Nov</th>
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<tr>
<td>Rainfall (mm)</td>
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<td>542</td>
<td>780</td>
<td>721</td>
<td>613</td>
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<td>204</td>
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<td>7</td>
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<td>Mean Temp (°C)</td>
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</tr>
<tr>
<td>Max Temp (°C)</td>
<td>20.8</td>
<td>24.8</td>
<td>27.6</td>
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<td>29.2</td>
<td>29.4</td>
<td>30.0</td>
<td>30.4</td>
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<td>28.8</td>
<td>25.4</td>
<td>22.3</td>
</tr>
<tr>
<td>Min Temp (°C)</td>
<td>10.0</td>
<td>11.8</td>
<td>15.3</td>
<td>17.8</td>
<td>20.0</td>
<td>22.0</td>
<td>22.9</td>
<td>24.3</td>
<td>23.2</td>
<td>19.9</td>
<td>15.8</td>
<td>11.6</td>
</tr>
<tr>
<td>Humidity (%)</td>
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<td>64</td>
<td>75</td>
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<td>86</td>
<td>86</td>
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<td>84</td>
<td>81</td>
<td>76</td>
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<td>4.6</td>
<td>4.8</td>
<td>6.5</td>
<td>7.8</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Source: Bangladesh Meteorological Department. Note: Solar radiation and Evaporation not measured in this station

Precipitation

The general pattern of precipitation (which consists entirely of rain) follows the monsoon pattern with the cooler, drier months of November to March, increasing rains in April and May and highest rainfall in the summer months of June to September when the prevailing wind direction from the southwest brings moisture-laden air from the Bay of Bengal. The winter period (November to February) is dry with very little rainfall. Even though the temporal pattern of rainfall is pretty much similar throughout the country, there is pronounced spatial variation. Among the places visited, Golapganj and Yadeshwar substation areas under Sylhet districts, which are represented by Sylhet BMD station, fall within the highest rainfall regions in the country. Chokoria and Maheshkhali substation locations, represented by Cox’s bazar BMD station, also experience reasonably high amount of rainfall during monsoon. Keraniganj and
Narshingdi are within moderate rainfall regions. Figure 4.40 shows the locations of the proposed and existing substation on the rainfall map of Bangladesh.

Figure 1.40: The locations of existing and proposed substations visited on the rainfall map of Bangladesh (map source: www.banglapedia.org).

**Relative Humidity**

The spatial and temporal variation of Relative Humidity throughout the year is very low in Bangladesh. The relative humidity varies from 69% to 88%.
Ambient Air Temperature
The temperature of the country is related to the period of rainfall. In general, cool seasons coincide with the period of lowest rainfall. Tables 1.4(a) – (d) shows the monthly average mean, maximum and minimum temperature of in the regions of the selected municipalities. Maximum average temperature over the year is usually observed in July - August and minimum average temperature in January.

Solar Radiation and Evaporation
The average incident solar radiation is comparatively higher during the period between February to May than the other months of the year. Consequently the amount of evaporation is also higher during that period.

Geology, Soils and Seismicity
Geology of Bangladesh is generally dominated by poorly consolidated sediments deposit over the past 10,000 to 15,000 years (Holocene age). It is mostly characterized by the rapid subsidence and filling of a basin in which a huge thickness of deltaic sediments were deposited as a mega-delta out built and progressed towards the south. The delta building is still continuing into the present Bay of Bengal and a broad fluvial front of the Ganges-Brahmaputra-Meghna river system gradually follows it from behind.

Soil Characteristics
The soil formation in Bangladesh is remarkably homogeneous in appearance, both vertically and laterally. It comprises layer of unconsolidated clay, about 10m thick near Dhaka, but apparently thinner to the east and possibly much thicker in the west of the Rajshahi district. The sand mineralogy in this area is broadly similar to that of the tertiary hill sediments. Mineral contents of the soil are high in quartz, relatively low in feldspar and mica, and with zircon, tourmaline, kyanite, staurolite, sillimanite, and epidote dominating the heavy mineral fractions. The content of easily weatherable minerals ranges from 4 to 9%. The soil of Bangladesh can broadly be classified into seven tracts: (1) Madhupur Tract or Red Soil Tract, (2) Barind Tract, (3) Tista Silt, (4) Brahmaputra Alluvium, (5) Gangetic Alluvium, (6) Coastal Saline Tract, and (7) Hill Tracts. Figure 1.41 shows of existing and proposed substations visited on the soil tract map of Bangladesh.
Figure 1.41: Map showing the locations of existing and proposed substations visited on the seven soil tracts of Bangladesh (map source: www.banglapedia.org)

The soil formation of the substation and power line locations at Keraniganj, Narshingdi and Sylhet falls under the Brahmaputra floodplain. The dominant soil texture is sandy loam. The soils are acidic in character and the pH ranges from 5.5 to 6.8. The soils are naturally fertile and are recharged every year by fresh deposition by the floodwaters. The Maheshkhali and Chokoria locations are in the flat low-lying areas along the coastal belt and the estuarine islands. The soils are saline and the pH values are neutral to slightly alkaline. The soils are well supplied with potash and phosphates.

To assess the heavy metal contents of the natural soil in the study area several soil samples were collected from Narshingdi, Keraniganj and Sylhet (see Table 1.5 for sampling locations) from
about 0.15 m below the top of the original soil layer, using a split spoon. A total extraction of heavy metal from soil samples following the USEPA guidelines has been performed to determine the selected heavy metal contents as well as salinity of the topsoil (see Table 1.6). The average concentrations of different heavy metals usually found in the natural soils along with their ranges are given in Table 1.6. A comparison of Table 1.6 and Table 1.7 suggest that the heavy metal contents of soil are within usual limits of such metals found in natural soil. Soil having electrical conductivity ranging from 0 to 2 mS/cm is considered to have negligible salinity effects. (Ref: USDA Handbook no 60, Diagnosis and improvement of saline and alkali soils) The electric conductivity of all the soil samples tested were found to be less than 1 mS/cm. Therefore there are not salinity issues in these areas.

### Table 1.5: Geo-coordinates of three locations from where soil samples were collected along the route of the trunk sewer line within Jahurul Islam City (Atebnagar)

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>GPS Location</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS1</td>
<td>E 90°36'34.6&quot; N 23°49'57.1&quot;</td>
<td>Shonapara village near probashipara, Narsingdi</td>
</tr>
<tr>
<td>SS2</td>
<td>E 90°38'23.7&quot; N 23°51’41.5&quot;</td>
<td>Beside road at Shatgram, Narsingdi</td>
</tr>
<tr>
<td>SS3</td>
<td>E 90°41'16.6&quot; N 23°53'23.3&quot;</td>
<td>BaghataTekpara, Naringdi</td>
</tr>
<tr>
<td>SS4</td>
<td>E 90°39'47.4&quot; N 23°57'30.1&quot;</td>
<td>Kataber, Narsingdi</td>
</tr>
<tr>
<td>SS5</td>
<td>E 90°21'00.1&quot; N 23°41'55.6&quot;</td>
<td>Konakhola proposed substation, Keranganj</td>
</tr>
<tr>
<td>SS6</td>
<td>E 92°1'41.43&quot; N 24°46'38.15&quot;</td>
<td>Proposed substation location at Vadeshwar, Sylhet</td>
</tr>
</tbody>
</table>

### Table 1.6: Heavy metal content of the soil samples collected from three locations along the route of the trunk sewer line within Jahurul Islam City (Atebnagar)

<table>
<thead>
<tr>
<th>SL No.</th>
<th>Parameters</th>
<th>Unit</th>
<th>SS1</th>
<th>SS2</th>
<th>SS3</th>
<th>SS4</th>
<th>SS5</th>
<th>SS6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td></td>
<td>5.6</td>
<td>6.6</td>
<td>6.5</td>
<td>6.8</td>
<td>6.5</td>
<td>6.5</td>
</tr>
<tr>
<td>2</td>
<td>Chloride, Cl</td>
<td>%</td>
<td>0.0084</td>
<td>0.004</td>
<td>0.0082</td>
<td>0.0036</td>
<td>0.0064</td>
<td>0.0032</td>
</tr>
<tr>
<td>3</td>
<td>Electrical</td>
<td>μS/cm</td>
<td>230</td>
<td>277</td>
<td>395</td>
<td>105</td>
<td>205</td>
<td>261</td>
</tr>
<tr>
<td></td>
<td>conductivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Lead, Pb</td>
<td>mg/kg</td>
<td>49.3</td>
<td>44.2</td>
<td>66.8</td>
<td>42.4</td>
<td>51.1</td>
<td>42.4</td>
</tr>
<tr>
<td>5</td>
<td>Chromium, Cr</td>
<td>mg/kg</td>
<td>33</td>
<td>23.7</td>
<td>40.3</td>
<td>21.8</td>
<td>41.8</td>
<td>12.6</td>
</tr>
</tbody>
</table>
### Table 1.7: Typical Heavy metal contents of natural soil

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameter</th>
<th>Unit</th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cadmium, Cd</td>
<td>mg/kg</td>
<td>0.1 – 0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>2</td>
<td>Chromium, Cr</td>
<td>mg/kg</td>
<td>1 – 1000</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Lead, Pb</td>
<td>mg/kg</td>
<td>2 – 200</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Copper, Cu</td>
<td>mg/kg</td>
<td>2 – 190</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>Zinc, Zn</td>
<td>mg/kg</td>
<td>100 – 300</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Mercury, Hg</td>
<td>mg/kg</td>
<td>0.01 – 0.30</td>
<td>0.03</td>
</tr>
</tbody>
</table>


---

**Seismicity**

In the north and northeast of Bangladesh, there are areas of high seismic activity and some of the major earthquakes originating in these areas have affected the adjacent regions of the country. The whole of Bangladesh is divided into three seismic zones. The northern part of the country that includes the greater districts of Rangpur, Mymensingh, and Sylhet are in the Zone-I where earthquake shock of maximum intensity of IX of the Modified Mercalli Scale is possible. The Zone-II includes the greater districts of Dinajpur, Bogra, Dhaka and Chittagong and the shocks of intensity of VIII are possible. The southern part of the country, the least active region, where the maximum intensity is not likely to exceed VII, is in the Zone-III. The Golapganj and Vadeswar locations within the Sylhet district fall within the highly active Zone I, while the locations in Narshingdi, Keraniganj and are located in Zone II. Figure 1.42 shows these locations in the seismic map of Bangladesh.
Figure 1.42: The locations of existing and proposed substations visited on the seismic map of Bangladesh (map source: www.banglapedia.org)

Flood Prone Areas

Bangladesh is prone to the natural disaster of flooding due to being situated on the Ganges Delta and the many tributaries flowing into the Bay of Bengal. The coastal flooding as well as the bursting of Bangladesh’s river banks is common and severely affects the landscape of the country. 75% of Bangladesh is less than 10m above sea level and 80% is flood plain, therefore rendering Bangladesh a nation very much at risk of further widespread damage. Flooding normally occurs during the monsoon season from June to September during the monsoon. The convectional rainfall of the monsoon is added to by relief rainfall caused by the Himalayas. Melt-water from the Himalayas is also a significant input and flood every year. Figure 1.43 shows the positions of existing and proposed substations visited over the flood risk map of
Bangladesh. It can be observed that Keraniganj, Narshingdi and Sylhet are in low to moderate level river flooding zone. Maheshkhali and Chokoria are in regions, which may be affected by tidal surges.

Figure 1.43: The locations of existing and proposed substations visited on the flood risk map of Bangladesh (map source: BARC)

Noise Level

As a part of the baseline study, noise level measurements were made at different locations around the proposed/existing substations and power lines. Noise measurements were performed during daytime with a calibrated noise level meter (CEM-DT-8850). 5-minute continuous noise level measurements were carried out at the selected locations, and the
equivalent noise levels (Leq) as well as the maximum noise levels (Lmax) were determined. Table 1.8 shows the summary of noise level measurements carried out in different municipalities. Table 1.9 shows the Bangladesh noise level standards during daytime and nighttime for various types of areas.

Table 1.8 shows that noise levels at a few locations are often high during daytime (Chinishpur in Narsingdi, KonakholaNorondimour at Keraniganj) with Leq exceeding 70 dBA though the maximum noise level did not exceed 80 dBA in any of these locations. This is due to noise associated with vehicular movement and dense gathering of people. On the other hand, in the absence of vehicular movement, noise levels have been found to be relatively low as can be seen in the rest of the measurement locations.

Table 1.8: Noise level measurements during daytime at selected locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise level measurement locations</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Equivalent Noise level (dBA)</th>
<th>Maximum Noise level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shanpara</td>
<td>N 23°59'57.7'' E 90°36'32.8''</td>
<td>Leq 61.0</td>
<td>Lmax 68.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shagram</td>
<td>N 23°51'41.5'' E 90°38'23.7''</td>
<td>Leq 53.7</td>
<td>Lmax 58.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BaghataTeegara</td>
<td>N 23°53'23.3'' E 90°41'15.4''</td>
<td>Leq 59.2</td>
<td>Lmax 65.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chinishpur</td>
<td>N 23°56'9.8'' E 90°41'50.7''</td>
<td>Leq 68.4</td>
<td>Lmax 74.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kataber</td>
<td>N 23°57'30.7'' E 90°39'49''</td>
<td>Leq 57.8</td>
<td>Lmax 64.1</td>
<td></td>
</tr>
<tr>
<td>Sylhet</td>
<td>Golapganj (Existing Substation)</td>
<td>N 24°51'13.7'' E 92°00'36.1''</td>
<td>Leq 52.2</td>
<td>Lmax 57.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vadeshwar (Proposed location of Substation)</td>
<td>N 24°46'38.15'' E 92°1'41.43''</td>
<td>Leq 63.2</td>
<td>Lmax 68.5</td>
<td></td>
</tr>
<tr>
<td>Cox'sBazar</td>
<td>Jibongali (Existing Substation)</td>
<td>N 21°23'31.3'' E 92°01'10.3''</td>
<td>Leq 54.8</td>
<td>Lmax 59.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chakaria</td>
<td>N 21°45'28.7'' E 92°04'24.7''</td>
<td>Leq 62.3</td>
<td>Lmax 70.2</td>
<td></td>
</tr>
<tr>
<td>Keraniganj</td>
<td>konakhola(NorondiMcur)</td>
<td>N 23°42'19.5'' E 90°29'39.3''</td>
<td>Leq 73.1</td>
<td>Lmax 79.3</td>
<td></td>
</tr>
</tbody>
</table>

(Note: The equivalent level is the level (L_{eq}) of a hypothetical steady sound that would have the same energy i.e. the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level represents the time average of the fluctuating sound pressure and is close to the maximum level observed during the measurement period. For the fluctuating noise scenario the equivalent noise level (Leq) is generally used for more complete noise sample and is calculated as follows:

$$L_{eq} = 10 \log_{10} \left( \sum_{i=1}^{n} p_i \cdot 10^{L_i/10} \right)$$

where $p_i$ is the probability of the noise level lying in the $i$-th measurement interval and $L_i$ is the mid-point of that interval.)
Table 1.9: Bangladesh standards for sound level (GoB, 2006)

<table>
<thead>
<tr>
<th>Locations</th>
<th>Noise level (dBA) at day</th>
<th>Noise level (dBA) at night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silent zone</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>Residential area</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>Mixed area</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Commercial area</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>Industrial area</td>
<td>75</td>
<td>70</td>
</tr>
</tbody>
</table>

(Ref: Noise Pollution Control Rules, 2006)

Water Quality

Groundwater quality

Groundwater samples were collected from different study locations (the sample collection locations are shown in Table 1.10). Samples were collected from deep tubewells of the localities and tested for selected water quality parameters. Table 1.11 shows the characteristics of the groundwater at the different locations tested. The groundwater has been found to be contaminated with Manganese in all locations except Narsingdi. Iron concentration has been found high in all locations with Vadeshwar, Sylhet being the highest. The color of the sample in most cases exceeded the Bangladesh Standards probably due to the high iron and manganese content. Any kind of arrangement of drinking water using groundwater in these regions would require treatment for Iron and/or Manganese.

Table 1.10: Groundwater sampling locations

<table>
<thead>
<tr>
<th>District/Division</th>
<th>GW Sampling Location</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narshingdi/Dhaka</td>
<td>Deep tubewell at Utaranchandra</td>
<td>N23° 56' 43.2&quot;</td>
<td>E90° 40' 31.1&quot;</td>
</tr>
<tr>
<td>Dhaka/Dhaka</td>
<td>Deep tubewell at Zinzira, Keraniganj</td>
<td>23°41' 57.57&quot;N</td>
<td>90°23' 5.14&quot;E</td>
</tr>
<tr>
<td>Sylhet/Sylhet</td>
<td>Deep tubewell at Vadeshwar</td>
<td>24°46' 38.15&quot;N</td>
<td>92° 1 41.43&quot;E</td>
</tr>
<tr>
<td>Cox’sbazar/Chittagong</td>
<td>Deep tubewell at Gorokghata, Moheshkhali</td>
<td>21°31'10.87&quot;N</td>
<td>91°59'2.13&quot;E</td>
</tr>
</tbody>
</table>
Table 1.11: Analysis of drinking water samples collected at different locations in the study areas

<table>
<thead>
<tr>
<th>Sampling locations</th>
<th>pH</th>
<th>Color</th>
<th>Turbidity</th>
<th>Total Hardness as CaCO₃</th>
<th>Iron, Fe</th>
<th>Manganese, Mn</th>
<th>Arsenic, As</th>
<th>Chloride, Cl⁻</th>
<th>Total Dissolved Solids, TDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PT Co-Unit</td>
<td>NTU</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>Narshingdi</td>
<td>6.97</td>
<td>8</td>
<td>2.56</td>
<td>122</td>
<td>0.47</td>
<td>0.013</td>
<td>18</td>
<td>276</td>
<td></td>
</tr>
<tr>
<td>Koraniganj</td>
<td>7.87</td>
<td>28</td>
<td>5.67</td>
<td>202</td>
<td>0.56</td>
<td>0.7</td>
<td>82</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Vadeshwar</td>
<td>5.97</td>
<td>21</td>
<td>107</td>
<td>55</td>
<td>11</td>
<td>0.47</td>
<td>&lt;1</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Gorokghata</td>
<td>7.63</td>
<td>12</td>
<td>2.29</td>
<td>96</td>
<td>0.52</td>
<td>0.48</td>
<td>3</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>WHO drinking water guidelines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangladesh drinking water standards (ECR '97)</td>
<td>6.5 - 8.5</td>
<td>15</td>
<td>5</td>
<td>500</td>
<td>0.3</td>
<td>0.4</td>
<td>10</td>
<td>250</td>
<td>1000</td>
</tr>
</tbody>
</table>
Surface Water Quality

The main surface water environment in the study area includes khaals, ponds, lowlands and ditches. Rivers and khaals serve the natural drainage of storm water. Pond water is often used for drinking in rural areas while it serves other purposes (washing, bathing etc.) due to longer periods of water retention. In order to assess any domestic or industrial pollution in nearby areas, surface water can be a good indicator. In order to assess the water quality of ponds, ditches, lowlands and canals in the study area, several water samples were collected and analyzed in the laboratory for selected parameters. The sample collection locations are summarized in Table 1.12 and the results of the laboratory analysis are presented in Table 1.13. The results indicate that there is no significant organic pollution in any of the surface water resources as the BOD, COD, Ammonia and Nitrate values are relatively low. The sampling was carried out during the monsoon season, which may be another reason for good quality surface water as the surface water becomes increasingly diluted due to high rainfall. The water sample from the coastal region of Moheshkhali showed very high TDS and Sulphate concentration. This is because this particular lowland is a salt field and high concentrations of dissolved solids (and salinity) are expected here. Construction of power line towers in this region will require special considerations to counteract the effects of corrosion.

Table 1.12: Surface water sampling locations

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>SW Sampling Location</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW-1</td>
<td>Ditch near the Konakhola proposed substation location in Basilia, Keraniganj, Dhaka</td>
<td>23°41'55.6&quot;N</td>
<td>90° 21'10.1&quot;E</td>
</tr>
<tr>
<td>SW-2</td>
<td>Pond near proposed substation in Vadejihwar, Sylhet</td>
<td>24°46'38.15&quot;N</td>
<td>92° 1'41.43&quot;E</td>
</tr>
<tr>
<td>SW-3</td>
<td>Roadsides lowland beside power line in Maheshkhali, Cox'sbazar</td>
<td>21°5'6.56&quot;N</td>
<td>91° 50'58.54&quot;E</td>
</tr>
<tr>
<td>SW-4</td>
<td>Ditch in Shonapara village near probashipara, Narshingdi</td>
<td>23°49'57.1&quot;N</td>
<td>90° 36'34.6&quot;E</td>
</tr>
<tr>
<td>SW-5</td>
<td>Pond beside road near power line in Narshingdi</td>
<td>23°51'41.5&quot;N</td>
<td>90° 38'23.7&quot;E</td>
</tr>
<tr>
<td>SW-6</td>
<td>Ditch/canal in BaghataTekpara in Narshingdi</td>
<td>23°53'23.3&quot;N</td>
<td>90° 41'16.6&quot;E</td>
</tr>
<tr>
<td>SW-7</td>
<td>Pond/Ditch in Kataber in Narshingdi</td>
<td>23°57'30.1&quot;N</td>
<td>90° 39'47.4&quot;E</td>
</tr>
</tbody>
</table>
Table I.13: Analysis of surface water samples collected at different pourashavas and city corporations

| Location | pH | Color | Turbidity | Dissolved Oxygen | Chemical Oxygen Demand (COD) | Biochemical Oxygen Demand (BOD) | Nitrate-Nitrogen (NO₃⁻N) | Ammonia-Nitrogen (NH₄⁺N) | Phosphate (PO₄) | Total Dissolved Solids, TDS | Total Suspended Solids, TSS | Sulphate, SO₄₀
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt. Co</td>
<td>7.1</td>
<td>58</td>
<td>4.88</td>
<td>2.67</td>
<td>11</td>
<td>1</td>
<td>0.3</td>
<td>0.65</td>
<td>0.17</td>
<td>100</td>
<td>8</td>
<td>&lt;1</td>
</tr>
<tr>
<td>SW-1</td>
<td>6.36</td>
<td>293</td>
<td>129</td>
<td>4.48</td>
<td>6</td>
<td>0</td>
<td>0.4</td>
<td>0.95</td>
<td>0.087</td>
<td>57</td>
<td>102</td>
<td>1.2</td>
</tr>
<tr>
<td>SW-2</td>
<td>7.49</td>
<td>72</td>
<td>69</td>
<td>6.48</td>
<td>4</td>
<td>0.6</td>
<td>0.3</td>
<td>0.62</td>
<td>0.072</td>
<td>1974</td>
<td>71</td>
<td>175</td>
</tr>
<tr>
<td>SW-3</td>
<td>6.42</td>
<td>79</td>
<td>11.6</td>
<td>1.83</td>
<td>6</td>
<td>2</td>
<td>0.2</td>
<td>0.535</td>
<td>0.077</td>
<td>62</td>
<td>13</td>
<td>&lt;1</td>
</tr>
<tr>
<td>SW-4</td>
<td>7.25</td>
<td>28</td>
<td>31.1</td>
<td>4.50</td>
<td>7</td>
<td>3</td>
<td>0.5</td>
<td>1.086</td>
<td>0.051</td>
<td>38</td>
<td>28</td>
<td>&lt;1</td>
</tr>
<tr>
<td>SW-5</td>
<td>7.43</td>
<td>87</td>
<td>24.7</td>
<td>2.50</td>
<td>22</td>
<td>4</td>
<td>0.6</td>
<td>2.171</td>
<td>0.476</td>
<td>270</td>
<td>46</td>
<td>19.5</td>
</tr>
<tr>
<td>SW-6</td>
<td>7.35</td>
<td>29</td>
<td>50.1</td>
<td>2.09</td>
<td>9</td>
<td>2.6</td>
<td>1</td>
<td>1.807</td>
<td>0.131</td>
<td>203</td>
<td>54</td>
<td>2</td>
</tr>
</tbody>
</table>

Notes:
- Units: pH - Unit, Color - Unit, Turbidity - NTU, Dissolved Oxygen - mg/L, Chemical Oxygen Demand (COD) - mg/L, Biochemical Oxygen Demand (BOD) - mg/L, Nitrate-Nitrogen (NO₃⁻N) - mg/L, Ammonia-Nitrogen (NH₄⁺N) - mg/L, Phosphate (PO₄) - mg/L, Total Dissolved Solids, TDS - mg/L, Total Suspended Solids, TSS - mg/L, Sulphate, SO₄₀ - μS/cm.
Electromagnetic Fields (EMF)

Both the high-voltage power lines (230 kV, 132 kV) and the neighborhood distribution lines on wooden poles (33 kV, 11kV), transformers and electrical panels emit a type of low-frequency electromagnetic radiation termed as Electromagnetic Fields (EMF). Studies suggest that EMFs may be linked to a variety of health problems including leukemia, lymphoma, brain and nervous system cancers, melanoma, breast cancer, miscarriage, birth defects, Alzheimer’s disease, Lou Gehrig’s disease, expression and suicide. There are three basic kinds of EMF- Magnetic fields, Electric Fields and Radio Frequency (RF). Magnetic fields are the EMF component most often linked to serious health effects in the scientific research literature (e.g., between power lines and childhood leukemia). For magnetic fields, the lowest level linked to childhood cancer in the power line studies is 7.0 milligauss (mG). International Commission on Non-Ionizing Radiation Protection (ICNIRP) has set a 2 milligauss limit on occupational time-varying EMF exposure for 60 Hz frequency, which is the frequency of the electromagnetic radiation of power lines (ICNIRP, 2008). In this study, 60 Hz EMF levels were measured at several locations in the study areas using Alpha Model UHS Milligaussmeter and the results are summarized in Table 1.14. It can be seen that in open areas, far from the power lines the EMF readings are lower (<2 milligauss). However beneath the 132 kV lines and also near the towers, the EMF readings are significantly higher. The highest recorded EMF was 38.22 milligauss at Kataber, Narsingdi near a transmission tower. The readings below the 132 kV transmission lines also register EMF values in similar ranges. Human activity in these regions for prolonged periods may affect them physiologically and should be prohibitive. In the reconnaissance survey, it was observed in several places that residential installations were directly below the existing 230 kV power lines (Konakhola, Figures 1.14-1.15) as well as 33 kV distribution lines (Cox’sbazar, Figure 1.19-1.24; Sylhet, Figures 1.27-1.28). Any future expansion or rehabilitation of transmission/distribution lines should take into account steps to minimize the possibility of human exposure to electromagnetic radiation.

Table 1.14: Electromagnetic Field (EMF) measurements during daytime at selected locations

<table>
<thead>
<tr>
<th>District</th>
<th>EMF measurement locations</th>
<th>Latitude</th>
<th>Longitude</th>
<th>EMF Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pachrokhi, beside road</td>
<td>N 23° 45' 22.7&quot; E 90° 35' 54.1&quot;</td>
<td>1.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shanpara, beside road</td>
<td>N 23° 49' 57.5&quot; E 90° 36' 32.8&quot;</td>
<td>2.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shatgram, beside road near 132 kV line</td>
<td>N 23° 51' 36.5&quot; E 90° 38' 28.4&quot;</td>
<td>3.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baghata Tekpara, below 132 kV line and just near Transmission Tower</td>
<td>N 22° 59' 21.2&quot; E 90° 43' 15.8&quot;</td>
<td>34.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinishpur 132 kV sagged line</td>
<td>N 23° 54' 40.2&quot; E 90° 40' 24.1&quot;</td>
<td>27.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kataber near tower</td>
<td>N 23° 57' 30.3&quot; E 90° 39' 49&quot;</td>
<td>36.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposed substation at Sylhet</td>
<td>N 34° 46' 38.35&quot; E 97° 1' 41.43&quot;</td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>District</td>
<td>EMF measurement locations</td>
<td>Latitude</td>
<td>Longitude</td>
<td>EMF Reading</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Vadeshwar</td>
<td>Existing Substation at Kadamtoli, Golapganj</td>
<td>N 24°51'13.7&quot;</td>
<td>E 92°00'36.1&quot;</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Gorokghata proposed substation location at Moheshkhali</td>
<td>N 21°45'6.59&quot;</td>
<td>E 91°58'9.94&quot;</td>
<td>1.2</td>
</tr>
<tr>
<td>Cox'sBazar</td>
<td>Cox’sBazar 33kV/11kV substation</td>
<td>N 21°25'31.3&quot;</td>
<td>E 92°04'10.3&quot;</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Dorbeskata bazar, Chokoria</td>
<td>N 21°44'43.08&quot;</td>
<td>E 91°58'14.23&quot;</td>
<td>0.34</td>
</tr>
</tbody>
</table>

**Ecological Environment**

Ecology is the scientific study of the distribution and abundance of living organisms, and how the distribution and abundance are affected by interactions between the organisms and their environment. Generally, ecological environment includes all (micro to macro) living organisms that exist in a study site. For the proposed 'Rural Electricity Transmission and Distribution' project the baseline ecological study was carried out at three selected sites under three divisions of Bangladesh where the proposed project will be implemented. This macro level ecological study was conducted in daytime during September - October 2013. Ecological information has been collected through field research, consultation with local people, and literature review. The specific objectives of the baseline study were to gather information on the existing biological environment of the areas in and around the proposed sub-project sites. The baseline ecological survey primarily focused on identifying floral and faunal diversity and their distribution and abundance as well as their biological status in Bangladesh. The possible impacts of the sub-project activities have subsequently been evaluated against the baseline conditions and mitigation measures have been identified for reducing/eliminating adverse impacts. This Section describes the existing ecological environment of the selected three study sites based on the survey carried out in three divisions of Bangladesh.

**Dhaka Division - Keraniganj**

Bio-ecologically the Keraniganj under Dhaka Division (proposed project's sub-project site) falls under the Brahmaputra-Jamuna Floodplain (IUCN Bangladesh, 2002). On the other hand, agro-ecologically the area falls under the Young Brahmaputra-Jamuna Floodplain (BARC/UNDP/FAO, 1995). The non-calcareous gray / dark gray floodplain soil provide suitable environment for growing various types of floral species, and also provide supportive habitat for various types of fauna including varieties of fish species. General ecological features of the sub-project site of the proposed project are given below:

**Terrestrial ecology:** It has two major component namely terrestrial fauna (mammal, bird, reptile and amphibial) and terrestrial flora (tree, herb and shrub). Both components are generally distributed in a site as per its carrying capacity and most of them are distributed in
and around the semi-urban homesteads, fallow lands, along the road, market and building sites, in open areas, and besides water bodies (pond, canals, rivers) of the study area.

**Terrestrial Fauna:** Faunal species require both terrestrial and aquatic environment. Terrestrial environment dependent fauna are referred to as terrestrial fauna, and aquatic environment dependent fauna are referred to as aquatic fauna. The study site has both terrestrial and aquatic environment that supports various species of terrestrial and aquatic fauna. Most of the terrestrial faunal species found here are fairly common (see Fig. 4.44) in comparison to other plain districts of Bangladesh. Faunal species that are adapted in altered semi urban habitat are commonly seen in the study sites. The common terrestrial faunal species are:


**Terrestrial Flora:** Flora can grow naturally or artificially in terrestrial and aquatic environment, if the natural conditions are favorable. Common natural vegetation (terrestrial and aquatic) grows naturally in plenty in the rainy season. Most of the flora, particularly the trees, are planted in the study site for economic purposes by the local inhabitants and are fairly common, and distributed in scattered way, and have similarity in comparison to other plain districts of Bangladesh. The study site has vast low land where aquatic flora grows in plenty in the rainy season. Some important plant species were observed in the surveyed areas like medicinal plant e.g. Chatim-Alstonia scholaris, part of which is generally used as a traditional medicine. The existing terrestrial floral diversity makes a complex ecosystem in which some wildlife has direct relationship through their ecological niche. The names of common terrestrial floral species (see Fig. 4.45) are given below:

**Tree:**
- Jackfruit - Artocarpus heterophylla,
- Rain tree/Rendi - Samanea saman,
- Mango - Mangifera indica,
- Megahini - Swietenia mahagoni,
- Banyan tree - Ficus religiosa,
- Teak/Segun - Tectona grandis,
- Bori/Kul - Zizyphus mauritiana,
- B. heart/Sharifa - Annona reticulate,
- Coconut - Cocos nucifera,
- Eucalyptus - Eucalyptus citriodora,
- Krishnachura - Delonix regia,
- Mango - Mangifera indica,
- Mehagini - Swietenia mahagoni,
- Banyan tree - Ficus religiosa,
- B. heart/Sharifa - Annona reticulate,
- Coconut - Cocos nucifera,
- Eucalyptus - Eucalyptus citriodora,
- Krishnachura - Delonix regia,
- Banana - Musa sapientum,
- Komranga - Averrhoa carambola,
- Kadam - Anthocephalus chinensis,
- Tal/Palm - Borassus flabellifer,
- Date palm/Khejur - Phoenix sylvestris,
- Betel nut/Supari - Areca catechu

**Herb and Shrub:**
- Natural floral species (herb and shrub) primarily includes: Danda Kalash - Leucus aspera,
- Assamalite - Mikania scandens,
- Bhex - Cereolandum viscossom,
- Matisur - Heliotropium indicum,
- Dhokalimi - Ipomoea fistulosa,
- Sheyalmutra - Blumea lacera,
- Telakucha - Coccinia indica,
- Reri/Venna - Ricinus communis,
- Durbaghas - Cynodon dactylon,
- Kash - Saccharum officinarum,
- Thankuni - Phragmites sp.,

![Figure 1.44: Terrestrial fauna observed at Keraniganj: (a) M. Robin at REB office premises, (b) B. H. Shrike, (c) S. Dove & (d) A. P. Starling - all sitting on a live electric line.](image-url)
Mimosa invisa, Lazzaboti - Mimosa pudica, Bishkatali - Polygonum hydropiper, Fern - Drynaria quercifolia, Kantanotey - Amaranthus spinosus, etc.

Figure 1.45: Terrestrial flora observed at Keraniganj: (a) Coconut & Banana trees; (b) Orborol tree with fruits.

Aquatic Ecology: It has also two major components, namely aquatic fauna (mammal, bird, reptile and amphibia) and aquatic flora (tree, herb and shrub). Both components are inter- and intra-liked and create a harmonic environment where both floral and faunal species get benefits from each other.

Aquatic Fauna: The study site has vast low land that acts as a seasonal wetland during monsoon and support varieties of aquatic fauna. Some aquatic fauna used these vast lands as their temporary habitat, while others as permanent habitat. In the rainy season, the native fish species breed here in plenty. The common aquatic faunal species (see Figure 1.46) are:

**Amphibian:** Skipper frog - *Euphlyctis cyanophylaxis.*


**Mammal:** No mammal


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Figure 1.46: Aquatic fauna observed at Keraniganj: (a) A flock of Egret searching food in a wetland, (b) Pond Heron waiting beside a wetland for catching fish, (c) Seasonal fisherman catching fish by a local fishing gear from a small canal, (d) variety of native fish catch from the wetland, (e) Paddy Ell fisherman carrying handmade specialized ell catcher and (f) native small fish gear put as submerge state in a seasonal wetland to catch fish.

Aquatic Flora: Due to the vast amount of low land, the study site has various types of aquatic flora (tree, herb and shrub), most of which are distributed in and around the water bodies (pond, canal, river, ditch etc). In rainy season, the aquatic flora get favorable condition that helps them to grow in plenty, Aquatic flora plays an important role for biodiversity conservation. Aquatic flora grow in rivers, ponds, canals, ditches and low lying cultivated fields as submerge, free-floating and rooted floating states. The common aquatic floral species (see Fig. 4.47) are:

**Tree:** Barun/Banny - *Crataeva nurvala*, Keshordam - *Ludwignia adscendense*,

Figure 1.147: Aquatic flora observed at Keraniganj: (a) Water Lily in a seasonal wetland (b) Kalmi in a seasonal wetland (c) Vast lowland / seasonal wetland with various aquatic flora and (d) Water Hyacinth in a low seasonal wetland.

Threatened flora and fauna: No threatened flora and fauna were identified at the proposed project site at Keraniganj.

Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:

Protected area (PA): Protect area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e. PA is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposed study area.

National Park (NP): It is a reserved land, usually declared and owned by a national government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed project site.

Game reserve (GR): It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the proposed project site.

Wildlife Sanctuary (WS): It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at or near the study area.

Ecologically Critical Area (ECA): It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995,
where ecosystem is considered to be threatened to reach a critical state. Dholeshori River, an ECA exist within the 10 km radius of the study area.

Chittagong Division — Cox’s Bazaar — Chokoria - Moheshkhali

Bio-ecologically the Chokoria and Moheshkhali of Cox’s Bazaar of Chittagong Division (proposed project’s sub-project site) fall under the Coastal Plain as well as Chittagong Hills and CHTs (IUCN Bangladesh, 2002). On the other hand, agro-ecologically the areas fall under the Chittagong Coastal Plain as well as Northern and Eastern Hills (IARC/UNDP/FAO, 1995). The non-calcareous grey floodplain soil (non saline) as well as the brown hill soil supports the growth of diverse types of floral species, and also provides habitat for diversified coastal and hill fauna. Therefore, the coastal water provides habitat for various fish species that depend on brackish and marine water of Cox’s Bazaar. The general ecological features of this sub-project site are given below:

Terrestrial Ecology: Various types of terrestrial fauna (mammal, bird, reptile and amphibia) and terrestrial flora (tree, herb and shrub) are the main component of terrestrial ecology. Chokoria and Moheshkhali sites have vast amount of coastal low land that are inundated twice in a day by the tidal water; hence ecological features are somewhat different from other parts of the country. A remarkable number of floral species are planted in the villages (plain land) as well as small hillocks. These are distributed in and around the homesteads, fallow lands, along the road, market and building sites, in open areas, and besides water bodies (pond, canals, rivers). Common natural terrestrial vegetation grows naturally in plenty in the rainy season that are used by certain types of faunal species as their temporary habitat or permanent habitat. Most of the flora particularly the trees are planted for economic purposes and are fairly common, and distributed in scattered way. The common terrestrial faunal species (see Fig. 4.48) are given below:

Terrestrial fauna: Four major types of faunal diversity exist in this sub project site. These are:


Mammal: Irrawaddy Squirrel - Collosciurus pygerythrus, Grey Must Shrew - Suncus murinus, Flying Fox - Pteropus gigantius, Jackal - Vulpes bengalensis, House Mouse - Mus musculus, Indian Pipistrelle - P. coromandus, Indian Field Mouse - Mus booduga, Small Indian Mongoose - Herpestes auropunctatus.

Terrestrial Flora:

Tree: Teak/Segun - Tectona grandis, Rendi - Samanea saman, Mehagani - Swietenia mahogani, Krishnachura - Delonix regia, Coconut tree - Coco nucifera, Date Palm/Khejur - Phoenix sylvestris, Kadum - Anthocephalus chinensis, Jackfruit - Artocarpus heterophylla, Banyan tree - Ficus religiosa, Betel nut/Supari - Areca catechu, Mango - Mangifera indica, Banana - Musa sapientum, Eucalyptus - Eucalyptus citriodora, Bamboo - Bambusa sp Babla - Acacia nilotica, Jhav - Casuarinas equsionfolie, Jagadumur - Ficus religiosa, Sissoo - Dalbergia sissoo, Agle - Aegle marmelos, Chatim - Alstonia scholaris, Fig/ Bot - Ficus benghalensis, Korai - Albizia procera, Mundar - Erythrina variegata, Temarinf/Tetul - Tamarindus indica, Boroj/Kul - Zizyphus mauritiana, Neem - Azadirachta indica, Eucalyptus - Eucalyptus citriodora etc.

Aquatic Ecology: It consists of diversified aquatic flora (tree, herb and shrub) and aquatic fauna (mammal, bird, reptile, amphibian and fish). Most of these are distributed in and around the brackish / marine and fresh water bodies (pond, canal, river, ditch, bay of Bengal etc). Common natural aquatic vegetation grows naturally in the rainy season. Aquatic flora plays an important role for biodiversity conservation. Aquatic flora grows in river, pond, canal, ditch and low lying cultivated field as submerge, free-floating and rooted floating states. These aquatic floras also provide habitat for certain type of faunal species.

Aquatic Fauna: The common aquatic faunal species (Fig. 1.50) including fishes are:

**Amphibia:** Skipper frog - *Euphlyctis cyanophlyctis*,
Bird: Fantail Snipe *Gallinago gallinago*, White-throated Kingfisher - *Halcyon smyrnensis*,
Mammal: No mammal.

Figure 1.50: Aquatic fauna observed at Moheshkali and Chokoria: (a) Large Egret and Wagtail searching food beside an aquatic habitat, (b) Little Cormorant taking rest, (c) White-throated Kingfisher looking for food (d) House crow flock standing in an active electric line, (e) Marine fish ready to sale, (f) Marine fish in a local market for sale, (g) string ray catches from marine water, (h) Marine prawn accumulated for sale in a local market.


Aquatic Flora: The common freshwater aquatic floral species are: Water Hyacinth / Kachuripana - *Eichhornia crassipes*, Khudipana - *Lemna perpusilla*, Topipana - *Pistia*

Threatened flora and fauna: A total of 5 threatened fauna (Vulnerable state) have been identified at the proposed project sites at Moheshkali and Chokoria. These species are threatened for entire Bangladesh. No threatened flora identified from the study site.

Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:

Protected area (PA): Protect Area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e. PA is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposed study area.

National Park (NP): It is a reserved land, usually declared and owned by a national government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed project site, but Bangabandhu Safari Park (not national park) exists not far away from the sub project study site (see Figure 1.51).

Wildlife Sanctuary (WS): It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at the study area but Chunati WS exist not far away from the sub project study site (see Figure 1.51).

Figure 1.51: (a) The gate of Bangabandhu Safari Park at Chokoria, and (b) Chittagong – Cox’s bazaar highway run inside the Fashiakhali Wildlife Sanctuary.
**Game reserve (GR):** It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the study area.

**Ecologically Critical Area (ECA):** It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is considered to be threatened to reach a critical state. No ECA exists at or near the study area.

**Sylhet Division – Golapganj**

Bio-ecologically the Golapganj of Sylhet division (proposed sub project site) falls under the Surma - Kushiya Floodplain (IUCN Bangladesh/2002). On the other hand, agro-ecologically the areas fall under the Eastern Surma - Kushiya Floodplain (BARC/UNDP/FAO, 1995). The non-calcareous gray floodplain soil provides dynamic environment for growth of diverse types of floral species, and also provide supportive habitat for numerous types of fauna.

**General ecological features of this subproject sites are given below:**

**Terrestrial Ecology:** This sub project site has various types of terrestrial flora (tree, herb and shrub) and fauna (mammal, bird, reptile and amphibia). Most of the floral and faunal species are distributed in and around the urban homesteads, fallow lands, along the road, market and building sites, in open areas, and besides water bodies (pond, canal, rivers). Common natural terrestrial vegetation grows in plenty in the rainy season and certain type of fauna as their temporary or permanent habitat uses some of the vegetations. Most of the flora particularly the trees are planted here for economic purposes and are fairly common, and distributed in scattered way, and have similarity in comparison to other districts of Bangladesh. Golapganj is a plain land area beside the Surma River without hillocks.

**Terrestrial Fauna:** Most terrestrial faunal species (Figure 1.52) are fairly common in comparison to other districts of Bangladesh. The common terrestrial faunal species are:

- **Mammal:** Jackal - *Vulpes bengalensis*, Small Indian Mongoose - *H. auropunctatus*, Indian Pipistrelle - *P. coromandra*, Flying Fox - *Pteropus giganteus*.
Figure 1.52: Terrestrial fauna observed at Golapganj: (a) Brahminy Kite taking rest on a live electric line, (b) C. House Lizard on under a roof tin of a house, (c) Black Drongo sitting on a stick to catch insect and (d) Rock Pigeon taking food from a house yard.

Terrestrial Flora: The common terrestrial floral species (Figure 1.53) are:


Aquatic Ecology: Diverse type of aquatic flora (tree, herb and shrub) and fauna (mammal, bird, reptile, amphibian and fish) are the main component of aquatic environment. Most of the aquatic floral and faunal species are distributed in and around the semi-urban water bodies (pond, canal, river, ditch etc) and are common in comparison to other plain land areas of Bangladesh.
Aquatic fauna: The common aquatic faunal species (Figure 1.54) including fishes are:

**Amphibia:** Skipper frog - *Euphlyctis cyanophlyctis.*


**Mammal:** No Mammal


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**Figure 1.53:** Terrestrial flora observed at Golapganj: (a) Betel nut tree/Supari tree with its fruits, (b) terrestrial flora beside a road, (c) Fern beside a road and (d) Jhau tree inside a local office.

Figure 1.54: Aquatic fauna observed at Golapganj: (a) Skipper frog in a ditch, (b) paddy Eel in a tub, (c) Eel fish with fisherman, (d) Big Catla fish catches from a local river, (e) Fish culture in a village pond and (f) cultured fish sale in a market.

Figure 1.55: Aquatic flora observed at Golapganj: (a) Water Hyacinth / Kathuripana in a local pond and (b) Katchu cultivation in a wetland.

Threatened flora and fauna: No threatened flora and fauna identified from this sub project site.

Protected areas, wildlife sanctuaries, game reserves and ecologically critical areas:

Protected area (PA): Protect Area (PA) refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means i.e. PA is predominantly a natural area established and managed in perpetuity, through legal or
customary regimes, primarily to conserve their natural resources (IUCN, 1990). No PA exists at or near the proposed study area.

**National Park (NP):** It is a reserved land, usually declared and owned by a national government, protected from most human development and pollution (IUCN, 1990). No NP exists at or near the proposed project site.

**Game reserve (GR):** It is an area of land set aside for maintenance of wildlife for tourism or hunting purposes (IUCN, 1990). No GR exists at or near the study area.

**Wildlife Sanctuary (WS):** It is an area that assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment, where these require specific human manipulation for their perpetuation (IUCN, 1990). No WS exists at or near the study area.

**Ecologically Critical Area (ECA):** It is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is considered to be threatened to reach a critical state. No ECA exists at or near the study area.

### Socio Economic Baseline Study

A socio-economic baseline study was carried out in and around the selected three sub project sites of 'Rural Electricity Transmission and Distribution' project of Power Cell of GoB. The sites were Keraniganj under Dhaka Division, Moheshkhali-Chokoria of Cox's Bazaar under Chittagong Division and Golapganj under Sylhet Division. Specific objectives of the social baseline study were to gather information on the existing social environment surrounding the proposed sub project sites. This section describes the existing social environment of areas in and around the proposed sub project sites, separately. The baseline socio-economy survey primarily focused on identifying status of important economic and social factors / circumstances / attributes of the sub project areas. Possible impacts of the proposed project activities have to be evaluated against these baseline socio-economic attributes, and later, mitigation measures also have to be suggested based on identified social impacts, if any.

### Approach and Methodology

An assessment was carried out to evaluate the current baseline of socio-economic conditions / attributes of the areas surrounding the proposed sub project sites. It covers areas more than 5 to 10 km radius surrounding the proposed sub project sites. Efforts were made to identify the socio-economic attributes that may be impacted due to the proposed sub project activities. The main purposes of the baseline socio-economic study were

(a) to understand people’s socio-economic condition;
(b) to understand extent of people’s access to basic services; and
(c) to understand people’s perception regarding the proposed sub projects.
The survey was conducted in between September – October 2013. To collect first hand information on socio-economic attributes, the members of social baseline team (Fig. 1.56) visited the selected sub project sites and conducted field study through questionnaire survey, meetings (both formal and informal) and focus group discussions (FGDs). More than 350 people have been directly interacted with the team during the study; the questionnaire survey covered 236 respondents; 89 people participated in the 3 FGDs and others participated in meetings. The questionnaire used for the socio-economic survey covered five major themes. These included:

(a) Socio-economic background: The parameters considered under socio-economic conditions included gender, age and marital status of respondents as well as family size, occupational pattern, and duration of living in the area. These parameters provide an understanding of people’s background in areas surrounding the project sites and their lives and livelihood.

(b) Basic services: The parameters considered under "basic services" included access to electricity, fuel for cooking, water, sanitation / sewerage system, and health services.

(c) Education, transport system and religious and social establishments: The parameters considered under this theme included respondents’ education, educational facilities, educational institution, religious establishments and social organizations.

(d) Economic situation: The parameters considered under this theme included income and associated issues.

(e) Attitude toward the proposed sub project in their locality: Overall socio-economic environment, population trend and people’s perception regarding the proposed sub project site were considered under this theme.

Socio-economic Perspective of the Study Areas

Dhaka Division - Keraniganj: Agro-ecologically the Keraniganj sub project site of Dhaka Division falls under the Young Brahmaputra-Jamuna Floodplain (BARC/UNDP/FAO, 1995). The site is very near to the Capital City – Dhaka, hence the local economy as well as socio-culture is mixed and quite dynamic. The study area has still vast amount of low land which gets inundated during monsoon. Some of these lands are being filled by sand/soil to with
the purpose of being sold as a residential/commercial plot by the developers. Soil inside the proposed sub project site is very fertile, which helps the growth of agro-product in plenty. Local people use the area for cultivation in winter season. In monsoon season, most of it are fully inundated and people practice carp fish culture in some areas. Over generations, the local fishermen catch fish that are naturally bred inside the seasonal wetland during monsoon. Highland are used for vegetables cultivation, cattle rearing, poultry farming, and those products are traded in the local markets as well as nearby capital city - Dhaka. Agricultural product, cattle rearing and wetland fish are one of the prime economic assets to the local people. Some industries are seen to be emerging in the site as well. Some social aspects of the study site are shown in Figure 1.57.

Chittagong Division - Moheshkhali - Chokoria (Cox’s Bazaar): Agro-ecologically this sub project site falls under the Chittagong Coastal Plain as well as Northern and Eastern Hills (BARC/UNDP/FAO, 1995). The coastal area is famous for natural brackish / marine water dependent fish culture. People cultivate paddy in the non-saline and high land, and most of the other low lands are used for salt production and some for prawn cultivation. It has a low-dynamic and mixed socio-economic environment. Economy is slowly growing here. Most area are inundated twice a day by the tidal water. Road communication is not so good in most areas. Speed / country boat is the prime option to reach the study site from Cox’s Bazaar, the nearby city. Some villages have one storied buildings (brick made), which is indicative of slowly growing socio-economic condition, though most of the villages have tin/straw made houses. Thousands of people having diverse occupations (day laborer to Government service holder) live in the area. Women were mostly found to stay home. Muslim population dominates the study area. A couple of village exists at Moheshkhali with Rakhain - a tribal community. They are a women-dominated society and their primary occupation is business. Educational facilities are available and the number of educated people is gradually increasing. A religious establishment named Adinath Mondir was observed here. Drainage condition, health services etc. exist here in poor condition. The study site is a cyclone prone area and people suffer from natural calamities every year. Figure: 1.58 shows some social aspect of the study site.
Figure 1.57: Some social aspects of Keraniganj sub project site: (a) Low land act as a seasonal wetland in Monsoon and as Agricultural land in winter (b) Cattle rearing in a village of the study area, (c) Poultry Farming in a village of study area, and (d) Fishing practice in a canal of the study area.

Figure 1.58: Some social aspects of Moheshkhali-Chokoria sub project site: (a) Cyclone centre used during natural calamities, (b) Land inundated by tidal water, (c) Salt farmer going to the salt field, (d) Gate of Adinath Mondir – a religious and tourism place (e) Fishing boat ready to sail in the Bay of Bengal for fishing, and (f) Speed boat ready to carry passengers from Moheshkhali to Cox’s Bazaar.

**Sylhet Division - Golapganj**: Agro-ecologically the area fall under the Eastern Surma-Kushiyara Floodplain (BARC/UNDP/FAO, 1995). This sub project site is not far away from the Sylhet city. Road communication is good; people practice primarily agriculture but occasionally cultivate vegetables, and those are traded in the local markets. Small
businesses like shops are increasing. The economic condition of the people in the study area seems to be improving. Educated people are increasing and old educational institutions were observed. Muslim dominates the area. Some modern facilities are available such as clinic, bank, silo (rice), whole sale fish market etc. Figure 1.59 shows some social aspect of the study site.

Figure 1.59: Some social aspect of Golapganj sub project site: (a) Good road communication to reach to the nearby City, (b) Paddy cultivation near a village, (c) Modern building – symbol of improving economic condition, (d) An old educational institutions – first established in 1924 and renovated in 1996.

Figure 1.60: Questionnaire finding in Keraniganj, Dhaka: Respondents (a) type by gender, (b) Age structure, (c) Religion and (d) Marital Status.
Baseline Socio-Economic Characteristics

Dhaka Division – Keraniganj

Theme #1: Socio-economic background: Male dominates participation in the questionnaire survey due to willingness and social custom. All respondents are Bengali, no tribal respondent found here to participate in the questionnaire survey. From the point of view of religion, Muslims dominate the study area followed by Hindus. Most of the respondents’ ages are in between 25 – 34 years and are married with family size varying from 2 to 4, which indicates that the family planning program is highly accepted by the local community.

Figure 1.61: Some social aspect in the study site at Keraniganj, Dhaka: (a) Muslim religious institution, (b) Hindu religious structure, (c) Fodder collection for cattle rearing and (d) local markets.

Figure 1.62: Questionnaire finding from Respondents around project site at Keraniganj.
regarding (a) Reason for migration and (b) Occupation pattern

Three forth respondents are living in the area for a very long time, exceeding 25 years. As majority of respondents have been staying in the area for a long period of time, it means that they have most likely developed many kinds of social and economic ties with other people living in that area. Therefore, any displacement would affect not only their income but also other social and economic relationships. One forth respondents are migrated from various parts of the country. Occupation varies among the respondents and majority of them are engaged in small businesses. According to the respondents, the Local population is increasing slowly. The area is not a natural disaster prone area. Most respondents have experience of one earthquake (last year) though it happened here occasionally. During earthquake / natural calamities, they stay inside their home due to non-availability of cyclone shelter.

Theme # 2: Basic Services: Except electricity, most respondents have no access to the essential basic services, such as gas, water and sanitation. The national grid covers the area and most respondents have access to electric supply though they suffer from frequent load shedding, especially during the summer. At that time, most electricity-dependent activities are hampered seriously. Limited natural gas supply is available in the area for cooking or other uses. Most respondents use wood / cow-dung for everyday cooking. Most respondents have their own tube wells, which they use to derive drinking water. The study area does not seem to be arsenic contaminated area though few tube-wells have been found to be arsenic contaminated.

![Figure 4.63: Questionnaire findings from Respondents around the project site at Keraniganj regarding (a) Source of light, (b) Source of water and (c) access to gas connection for cooking. (d) Cow-dung drying in front of a house for cooking](image)

Among the respondents, most have modern toilet or slab / RCC toilet, which indicates that respondents are habituated with the modern sanitation system. Poor people also use pit
latrine with fence. More than 50% respondents or their immediate family members have suffered from common diseases (e.g. fever, diarrhea) within the last six months. Access to pure drinking water, good health and hygiene practice, ability to avail better treatment have significant implications for the overall health and nature of diseases. It appears that the respondents think quite rationally about the reasons for suffering (different kinds of diseases), which means that the respondents are aware about the causes of disease. During health problems, most respondents preferred to go to the nearby Government hospital followed by local pharmacy shop which is known to them. Most respondents reported that they are aware of the availability of getting health-care from Government Hospital, though it is not satisfactory to them all. In case of emergency, most respondents prefer to go to the nearby reputed government hospital of Dhaka city. Most respondents or their immediate family members did not fall in an accident in the last six months.

![Figure 4.64: Questionnaire findings from Respondents around the project site at Keraniganj regarding (a) Disease pattern, and (b) Health services availed during health problems](image)

Theme # 3: Education, transport system and religious and social establishments: Areas surrounding the project site have schools, madrasas and colleges. Most respondents are quite happy with the overall quality of educational facilities available in their localities. Education level varies among the respondents. More than one third of all respondents reported completing secondary level education. All respondents who have children reported that their children are admitted into the local schools.

![Figure 4.65: Questionnaire findings from Respondents around the project site at Keraniganj regarding (a) Education level of respondents and (b) road condition in the study area](image)
Road transportation is available in the study area. Most respondents are quite happy with road networks, while others think that road expansion is a necessity. Some village roads still need to be carpeted. There are mosques and a few clubs in all areas surveyed; no temple, pagoda, church were identified within the survey area. No historical establishment has been observed in the study areas.

**Theme # 4: Economic Situation:** In general, economic condition of the respondents appears to be relatively good compared to other areas of Bangladesh, but not good if compared with Dhaka city. Respondents have mixed income range. Two third respondents reported income in between Taka five to fifteen thousand from where they can save some money. They have access to bank account. They also borrow money from local business institution for expansion of business.

![Income Pattern - Monthly](image)

**Figure 4.66:** Income pattern of the respondents in the study area

Most respondents are not involved with agro-cultivation. Rather they are primarily involved with other types of income generating profession such as businesses. Respondents who are involved with cultivation preferred to cultivate paddy in winter season and in monsoon, they prefer fishing. Cattle rearing and poultry farming is a good source of income. In the low laying areas, fodders are available throughout the year. Cattle rear within the house premises for both domestic & commercial purposes. Milk is the prime product of cattle that is sold in Dhaka city everyday. Rearing of domestic fowl and duck is a common practice in the study areas. Few commercial poultry firms were observed.

![Supportive Reasons](image)

**Figure 1.67:** Cause of supportive attitude by respondents for the proposed sub project.

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Theme # 5: Attitude towards the sub project: All respondents expressed their supportive attitude for the proposed subproject project if it does not bring any harmful or deadly situation. Reasons for their support included development of the area and facilities.

Chittagong Division – Moheshkali – Chokoria (Cox’s bazaar)

Theme # 1: Socio-economic background: Male dominates participation in the questionnaire survey due to willingness and social custom. Female generally stay inside the house and very religious. Most respondents are Bengali and Muslim followed by Hindus. Most of the respondents’ ages are in between 25 – 34 years and are married with family size varying from 5 to 6, which indicates that the family planning program is moderately accepted by the local community.

![Questionnaire finding: Respondents](image1)

Fig. 4.68: Questionnaire finding: Respondents (a) type by gender, (b) Age structure, (c) Religion and (d) Marital Status.

![Some social aspect in the study site](image2)

Figure 1.69: Some social aspect in the study site: (a) Country boat in the Moheshkali canal (b) Market – a small business center owned by Rakhain – a tribal community.

Most respondents are living in the area for a very long time. About ten percent respondents are migrated from various parts of the country. Reason from migration was economic.
Occupation varies among the respondents and majority of them are engaged in small businesses though their second occupation is farming (salt and paddy).

Figure 1.70: Questionnaire finding from Respondents around project site at Cox’s Bazar regarding (a) Reason for migration and (b) Occupation pattern

Also, local population is increasing moderately. The area is natural disaster prone area. Most respondents have experience of earthquake in their lifetime. During natural calamities, they go to the cyclone shelter centre.

Figure 4.71: Questionnaire finding from Respondents around project site at Cox’s Bazar regarding (a) Earthquake experience and (b) Behavior during natural calamities.

Theme # 2: Basic Services: Except electricity, most respondents have no access to the essential basic services, such as gas, water and sanitation. The area is covered by the national grid and about seventy five percent respondents have access to electric supply though they suffer from frequent load-shedding, especially during the summer. At that time, most electricity-dependent activities are hampered seriously. No natural gas supply is available in the area for cooking or other uses. Most respondents use wood for everyday cooking. No drinking water supply is available here. All respondents have own tube well water.

Among the respondents, most have modern toilet or slab/RCC toilet, which indicates that respondents are habituated with the modern sanitation system. Poor people also use pit latrine with fence. The study area has no sewerage system.
More than 50% respondents or their immediate family members have suffered from common diseases (e.g. fever, diarrhea) within the last six months. It appears that the respondents think quite rationally about the reasons for suffering (different kinds of diseases), which means that the respondents are aware about the causes of disease. During health problems, most respondents preferred to go to the nearby Christian Missionary owned Charitable hospital followed by Government hospital. Special women treatment facilities in those hospitals are available but not satisfactory to them at all. In case of emergency, most respondents prefer to go to the nearby reputed government hospital of Cox’s Bazaar.

Theme # 3: Education, transport system and religious and social establishments: Areas surrounding the project site have schools, madrasas and colleges. Most respondents are quite happy with the overall quality of educational facilities available in their localities. Education level varies among the respondents and about sixty percent have secondary and higher secondary level education. All respondents who have children reported that their children are admitted into the local schools. All respondent have national ID and cast their vote during the last election indicates that they are aware regarding their responsibility and right to the nation.
Road transportation is not good in the study area. Most village roads still need to be carpeting. To carry human and goods from one place to another, their preference is (a) from Chokoria to Moheskhali – by road) and (b) Cox’s Bazaar to Moheskhali – by speed / country boat.

There are some mosques, few temple and pagoda in the area surveyed; no church was identified within the survey area. No historical establishment has been observed in the study areas though an ancient landlord house and pond exist.

Figure 1.75: (a) Questionnaire findings regarding respondents opinion on religious structures in the study area of Cox’s bazar and (b) a religious structure in the study area

Theme # 4: Economic Situation: In general, economic condition of the respondents appears to be relatively good compared to other areas of Bangladesh, but not good if compared with Cox’s Bazar city. Respondents have mixed income range. Half of all respondents reported income in between Taka five to fifteen thousand from where they can save some money. They have access to bank account. Some respondents borrow money from local business institutions, primarily from bank, for expansion of business.

Most respondents are involved with agro-cultivation though they are secondarily involved with other types of income generating professions such as small businesses, fishing, and salt production. Respondents who are involved with cultivation prefer to cultivate paddy primarily in winter season. Cattle rearing and house hold small poultry farming is a good source of income. Milk is the prime product of cattle that they sell in local market. Rearing
of domestic fowl and duck is a common practice in the study areas. The egg and meat of these animals supply nutrition to the local community.

**Figure 1.76:** Questionnaire findings regarding respondents monthly income in the study area of Cox's Bazar

**Theme #5: Attitude towards the sub project:** According to the respondents, the surrounding environment is very bad during monsoon as people cannot move from one place to another with comfort. Local population is increasing moderately though the economy is slowly growing. All respondents expressed their supportive attitude for the proposed subproject project without condition. Reasons for their supportive attitude involve the possibility of less electric load shedding.

**Figure 1.77:** Questionnaire findings regarding respondents cause of supportive attitude towards the proposed project in the study area of Cox’s Bazar

However, the prime local problem is the interrupted supply of electricity, limited gas and pure drinking water supply followed by unemployment and low salary. Respondents believe that these problems could be solved through the initiative of Government in association with local community. For this sub project, respondents are willing to provide land, if required, for implementing the sub project here.
Sylhet Division – Golapganj

Theme # 1: Socio-economic background: One forth participants were female in the questionnaire survey. All respondents are Bengali, no tribal respondents were found here to participate in the questionnaire survey. From the point of view of religion, Muslims dominate the study area followed by Hindus. Most of the respondents’ ages are in between 25 – 34 years and are married with family size varying from 2 to 4, which indicates that the family planning program is moderately accepted by the local community.

![Diagram](a:Respondent Pattern, b:Age Structure, c:Religion, d:Marital Status)

Figure 1.78: Questionnaire finding: Respondents (a) type by gender, (b) Age structure, (c) Religion and (d) Marital Status.

![Diagram](a:Migration Reason, b:Occupation pattern)

Figure 1.79: Questionnaire finding from Respondents around project site at Sylhet regarding (a) Reason for migration and (b) Occupation pattern

Three forth respondents are living in the area for a very long time, exceeding 30 years. Few respondents are migrated from various parts of the country due to lack of job in their
previous localities. Occupation varies among the respondent and majority of them are engaged in small businesses.

According to the respondents, the overall environment of the study area is very good. Local human population is increasing slowly. The area is not natural a disaster prone area. Most respondents have experience of one earth quake (last year) though it happened here occasionally. During earthquake / natural calamities, they stay inside their home due to non-availability of cyclone shelter.

**Theme #2: Basic Services:** Except electricity, most respondents have limited access to the essential basic services, such as gas, water and sanitation. The area is covered by the national grid and most respondents have access to electric supply though they suffer from frequent load-shedding and most electricity-dependent activities are hampered seriously. Limited natural gas supply is available in the area for cooking or other uses. Most respondents use wood for everyday cooking. No drinking water supply is available here. All respondents have own tube well water. The study area does not seem to be an arsenic contaminated area though a few tube-wells have been found to be contaminated with arsenic.

![Figure 1.80: Questionnaire findings from Respondents around the project site at Sylhet regarding (a) Source of light, (b) Source of energy for cooking. Some social aspects - (c) A view of a tubewell with no arsenic and (d) a view of fuel wood for cooking](image)

Among the respondents, most have modern toilet or slab / RCC toilet, which indicates that respondents are habituated with the modern sanitation system. Poor people also use pit latrine with fence. The study area has very limited sewerage system and the respondents are satisfied to the local authority for getting such facility.
Figure 1.81: Questionnaire findings from Respondents around the project site at Sylhet regarding (a) toilet type used. (b) A picture of a typical pit latrine used in the study area

Less than fifty respondents or their immediate family members have suffered from common diseases (e.g., fever, diarrhea) within the last six months. Access to pure drinking water, good health and hygiene practice, ability to avail better treatment has significant implications for the overall health and nature of diseases. It appears that the respondents think quite rationally about the reasons for suffering (different kinds of diseases), which means that the respondents are aware about the causes of disease. During health problems, most respondents preferred to go to the nearby pharmacy shop which is known to them. Most respondents reported that they are aware of the availability of getting health-care from Government Hospital, though it is not satisfactory to them at all. In case of emergency, most respondents prefer to go to the nearby reputed government hospital of Sylhet city. Most respondents or their immediate family members did not fall in an accident in the last six months.

Figure 1.82: Questionnaire findings from Respondents around the project site at Sylhet regarding (a) Disease pattern, and (b) health service availed during health problems

Theme # 3: Education, transport system and religious and social establishments: Areas surrounding the project site have schools, madrasas and colleges. Most respondents are quite happy with the overall quality of educational facilities available in their localities. Education level varies among the respondents. More than two third of all respondents reported completing secondary level education. All respondents who have children reported that their children are admitted into the local schools.
Figure 1.83: Questionnaire findings from Respondents around the project site at Sylhet regarding (a) educational status of the people, and (b) road condition of the area.

Road transportation is available in the study area. Most respondents are quite happy with the existing road networks, while others think that some village roads needed carpeting and/or expansion. There are mosques and few club in all areas surveyed; no temple, pagoda, church were identified within the survey area. No historical establishment has been observed in the study areas.

Theme #4: Economic Situation: Respondents have mixed income range. More than one forth respondents reported income in between Taka fifteen - twenty thousand from where they can save some money. They have access to bank account. They also borrow money from local business institution for expansion of business.

Figure 1.84: Questionnaire findings from Respondents around the project site at Sylhet regarding their income pattern.

Most respondents are not involved with agro-cultivation. Rather they are primarily involved with other types of income generating profession such as businesses. Respondents who are involved with cultivation preferred to cultivate paddy both in winter and in monsoon season. Cattle rearing and poultry farming is a good source of income. Milk is the prime product of cattle that is sold in the local market. Rearing of domestic fowl and duck is a common practice in the study areas. The egg and meat of these animals supply nutrition to the local community. No commercial poultry firms were observed.

Theme #5: Attitude towards the sub project: According to the respondents, the surrounding environment is very good. Current local population is increasing slowly due to the slow growth of family planning program. All respondents expressed their supportive
attitude for the proposed subproject project if it does not bring any harmful situation. Reasons for their support attitude involve the hope of less electric load-shedding.

<table>
<thead>
<tr>
<th>Reason for Supportive Attitude</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Area Development</td>
<td>28%</td>
</tr>
<tr>
<td>Increase Employment</td>
<td>18%</td>
</tr>
<tr>
<td>Decrease Load-Shedding</td>
<td>12%</td>
</tr>
<tr>
<td>New Industry will open</td>
<td>10%</td>
</tr>
<tr>
<td>Decrease Electricity crisis</td>
<td>6%</td>
</tr>
<tr>
<td>Communication will be developed</td>
<td>4%</td>
</tr>
</tbody>
</table>

Figure 1.85: Questionnaire findings regarding respondents’ cause of supportive attitude towards the proposed project in the study area of Sylhet.

However, the prime local problem is the interrupted supply of electricity, limited gas and pure drinking water supply followed by unemployment and low salary. Respondents believe that these problems could be solved through the initiative of Government in association with local community.

Preliminary Environmental Assessment

After establishing the baseline environment and identification of the sub-project activities during construction phase, the next step in the IEE/ESIA involves assessment/prediction of the impacts of these activities on the baseline environment. The potential environmental impacts during construction phase of sub-projects could be categorized into: (a) ecological impacts; (b) physical-chemical impacts; and (c) socio-economic impacts. This chapter identifies and describes the generic potential significant environmental impacts during construction and operational phases of different sub-projects under the Proposed Rural Electricity Transmission and Distribution Project. The impacts during construction and operational phases have been discussed separately.

Potential Significant Impacts during Construction Phase

Ecological impacts

Based on assessment of the nature and scale of the proposed sub-projects (Construction of substations and power lines) and assessment of baseline environment at different sub-project locations (based on field visits), it appears that ecological impacts of most sub-projects would be limited to loss of trees/vegetation, and possible adverse impact on aquatic habitat located close to the project location. However, construction of transmission line/tower across rivers/wetlands could generate some short-term adverse impacts on aquatic habitat and associated aquatic flora and fauna. Assessment of ecological impacts of
the sub-projects should therefore focus on loss of vegetation/trees and aquatic habitat. In general, the ecological impact should focus on:
(c) Impact on flora (aquatic and terrestrial);
(d) Impact on fauna (aquatic and terrestrial) including fish;

Physico-chemical impacts
Possible physico-chemical impacts from the sub-project activities to be carried out in different locations may include the following:
• Drainage congestion,
• Noise pollution,
• Air pollution,
• Water pollution,
• Environmental pollution from solid/construction waste

Drainage congestion:
During execution of civil engineering projects, temporary drainage congestion often results from obstruction to natural flow of drainage water due to the storage of materials, piled up excavated material/soil, and temporary embankments constructed to keep the work area dry. Such congestion is particularly important at the project sites adjacent to low-lying areas. Drainage congestions could create significant discomfort to people living in project-surrounding areas.

Noise pollution:
Noise pollution could result from a wide range of construction activities, including movement of vehicles (carrying equipment/material to and from site), operation of construction equipment and generators. Significant noise is generated from operation of pile drivers, bulldozers, dump trucks, compactors, mixing machines, and generators, etc. (which could be used for construction of substations and transmission towers). Demolition activities, if required, also generate noise. Such noise may cause discomfort to the people living in the surrounding areas at close proximity of the sub-project site, especially if such activities are continued during the night. Noise pollution is particularly important for sensitive establishments e.g., hospitals, educational/religious institutions. The construction work of transmission and distribution lines and substations will take place inside the community and likely to be in close proximity to the residential and highly populated areas. Therefore, a large number of people may be exposed to high levels of noise during construction.

Among noise generating activities, operation of pile drivers produces the most significant noise. For full-scale EIA (if needed), noise level predictions may be made for pile drivers and other major equipment used in the sub-project works, and used to assess noise pollution impacts in areas surrounding the sub-project site. Noise produced by Auger Drill Rig used for installation of electric poles for distribution lines is relatively low, and not likely to generate significant noise pollution.

Air pollution:
During construction phase, air pollution may result from exhaust emissions (containing carbon monoxide (CO), sulfur dioxide (SO2), oxides of nitrogen (NOx), and particulate matter (PM)) from machines and equipment (e.g., drilling rig, mixing machines, generators) used for different sub-project activities (e.g., substation and transmission tower construction), and movement of vehicles (carrying material and equipment) to and from the site. Furthermore, construction activities such as excavation, levelling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions. However, for the proposed sub-projects, adverse impacts of air pollution are likely to be limited to the areas surrounding the sub-project sites.

**Water pollution:**
Water pollution may result from discharge of wastewater (e.g., liquid waste from labor sheds), spills and leaks of oils/chemicals into nearby water bodies (e.g., drain, pond, khal, drain, river). The presence and existing use of water bodies surrounding the sub-project site would determine the level of impact. For example, if a pond located close to a sub-project site is being used for washing/bathing or for fish culture, pollution of the pond from sub-project activities would generate significant adverse impacts. Construction of transmission lines/towers across rivers/wetland could also generate some water pollution during construction phase.

**Environmental pollution from solid/construction waste:**
In some sub-projects, construction debris is likely to be generated from different sub-project activities. Solid wastes will also be generated from labor sheds. The contractors' workshops will generate oily water, waste oils, oily rags, and other similar wastes. The stores and warehouses will generate solid waste such as empty cement bags, cardboards, and wooden crates. Improper disposal of these waste streams can potentially contaminate the soils of the area. Soil contamination can potentially have negative impacts on the local community, natural vegetation, agriculture, and biological resources of the area including aquatic flora and fauna. Improper management of construction debris and solid waste could cause blockage of drainage line/path and environmental pollution. Some of the sites surveyed near Dhaka and Cox's Bazar do not have adequate solid waste disposal facilities; rather the solid waste is dumped in nearby lowlands. It would be important to establish formal solid waste management strategy to properly handle the solid waste generated in these sites.

**Socio-economic impacts**
This Section provides an overview of the possible major socio-economic impacts of the Rural Electricity Transmission and Distribution Project during construction phase, and presents guidelines for identification and protection of physical cultural resources (PCR). Possible socio-economic impacts from the sub-project activities to be carried out in different locations may include the following:
- loss of land,
- loss of income and displacement,
- traffic congestion,
- health and safety,
- employment and commercial activities,
• impact on archaeological and historical sites, and safeguarding physical cultural resources (PCR).

Loss of land:
Acquisition of private land is often necessary for implementation of projects, and loss of land is one of the most significant socio-economic impacts. However, based on field visits carried out so far, it appears that significant land acquisition will not be required for construction of the transmission and distribution lines sub-projects to be implemented under the Proposed Rural Electricity Transmission and Distribution Project. Mostly the sub-projects involving construction of sub-stations will require land acquisition activity. From field visit at Maheshkhali, Cox's Bazar, it was observed that in the land area required for construction of sub-station is owned by the REB authorities. Hence no land acquisition will be required for construction of substation in this case. However, if significant land acquisition becomes necessary for construction of substations, the issue should be addressed in light of the Government regulations and relevant WB operational guideline OP 4.12: Involuntary Resettlement (World Bank, 2001), following the framework currently being developed for social impact assessment of the Proposed Rural Electricity Transmission and Distribution Project.

Loss of income and displacement:
Loss of income may result from inability to use a particular piece of land/ establishment (e.g., footpaths) during the construction phase for income generation activity. Some of the proposed sub-projects may cause temporary displacement of people. For example, during construction/ rehabilitation of a section of transmission or distribution line, roadside vendors or small temporary shops on footpaths may not be able to operate for a period of time. However, considering the extent and scale of the sub-projects, it appears that such impacts would not be significant; for example, in most cases, the affected road-side vendors or footpath shops would be able to operate by just moving a short distance away from the sub-project site. Nonetheless, such impacts should be carefully assessed following the framework currently being developed for social impact assessment (SIA) of the Proposed Rural Electricity Transmission and Distribution Project.

Traffic congestion:
During construction phase of sub-projects, traffic congestion may result from stock piling of material by the sides of roads, increased movement of people and vehicles carrying material and equipment. Construction of substation and distribution lines in densely populated areas, and construction of distribution lines along busy highway could aggravate the existing traffic problem during construction phase. This should be addressed with proper traffic management, and avoiding stockpiling of materials in a way that could hamper traffic movement.

Health and safety:
Safety is an important issue during construction phase. General construction activities pose safety risks, which should be addressed as part of occupational health and safety plan. Section 3.10 provides guideline on occupational health and safety issues.

Employment and Commercial Activities:
During construction phase, some beneficial impact at local level would come in the form of employment in sub-project related works, which would depend on the nature and extent of the sub-project. For example, labor-intensive sub-project works (e.g., manual excavation) could generate employment for considerable number of semi-skilled workforce. This in turn would induce some positive impacts on some other parameters including commercial activities in the sub-project areas.

**Impact on archeological and historical sites:**
Archeological and historical sites are protected resources. Damage of such sites by digging, crushing by heavy equipment, uprooting trees, exposing sites to erosion, or by making the sites more accessible to vandals are of particular concern. While there are archeological and historical sites located near many of the field visit sites, none of these would be directly affected by the sub-project activities. A guideline for archeological impact assessment is nevertheless needed.

**Safeguarding physical cultural resources (PCR):**
Since the exact locations of the sub-projects to be implemented are not known at this moment, a guideline is needed for identification of physical cultural resources (PCR) and determination of the suitability of the sub-projects from the perspective of PCR.

**Potential Significant Impacts during Operational Phase**

**Ecological impacts**

During operational phase, the possible impact of the sub-project activities on the biological environment would be insignificant. Some of the sub-projects could cause a change in the habitation characteristics of aquatic/terrestrial fauna in the vicinity of the sub-project locations. Accidental spillage of transformer/generator fuel could have adverse impact on the surrounding aquatic/terrestrial floras or faunas.

**Physico-chemical impacts**

Depending on the type of sub-projects a number of physico-chemical parameters could experience both positive and negative impacts during operation phase of the sub-projects. Important issues and parameters include:

- Drainage and water/environmental pollution,
- Air quality and noise level, and
- Environmental pollution from solid waste

**Drainage and water/environmental pollution:**

Based on field visits of existing similar projects, the proposed sub-projects involving construction of substations (by PGCB or REB) might have office and residential facilities within the project compound with new approach road. For example, in Cox’s Bazar REB substation site separate rest house, office, and residential facilities were observed within the substation area. Proper management of solid and liquid wastes generated in these substations is very important to safeguard proper drainage and prevent environmental pollution in the surrounding areas. Poor quality of discharge water from the substations could cause pollution to the final receiving water body.

**Air quality and noise level:**
During operational phase, the generators running within the newly constructed substations by PGCB/REB could impact air quality and noise level in the surrounding areas. From field visit of different substations located in Dhaka, Cox's Bazar and Sylhet, separate generators were observed in every substation. Emissions from the generators can deteriorate the air quality in the adjacent areas.

Environmental pollution from solid waste:
Solid waste generated from the sub-project activities may contribute to the risk of clogging of drains by solid waste. However, as mentioned before, proper solid waste management facilities should be provided in the sub-project areas.

Socio-economic impacts
This Section provides an overview of the possible socio-economic impacts of the sub-projects during operational phase. Important socio-economic parameters that are likely to experience impacts due to implementation of the sub-projects include:

- power supply,
- public health and safety,
- employment and commercial activities,
- property values,
- airports and airstrips,
- implantable medical devices,
- radio, television and mobile phone reception.

Power supply:
The proposed project is aimed at increasing penetration and the reliability of power supply. Thus, operations of the substations and power lines under the proposed project would significantly improve reliability of power supply, thereby inducing a wide range of socio-economic benefits.

Agriculture:
With increased power supply, irrigating crops would become easier and cost-effective. This will have a significant positive impact on agriculture.

Public health and safety:
Health concerns over exposure to EMF are often raised when a new transmission line is proposed. To date the research has not been able to establish a cause and effect relationship between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to EMF could cause disease. The health and safety concern related to such exposures should be assessed. It was observed from the field visits that EMF readings nearby the transmission lines are much higher than those measured at a distance. Also the EMF readings within the existing substation locations (i.e. in substation offices, and surrounding area) are consistently higher.

Live fallen lines are a safety concern. Transmission lines are designed to trip out (turn off) if they fall or contact trees. This is not necessarily true for distribution lines. However, efforts should be made to make sure that the safety issues are properly addressed in the design phase.
Safety of transmission line tower constructed over rivers is an important consideration. The towers should be designed and constructed with safety features such that these are not damaged by collision with water vessels.

**Employment and commercial activities:**

Construction of new substations will create new employment opportunities for some people. From field visit it was observed that existing substations include office, housing, and rest house facilities within the compound. This will attract opportunities of other commercial activities for vendors, shop owners, etc. in the vicinity of the newly constructed substations.

**Property Values:**

Property values of an area may be affected due to close proximity to a new power line. Once the proposed power line is constructed, certain land use restrictions may be placed on all land within the right of way (RoW). Urban or industrial land capability/value may be reduced due to restriction on building of certain types of structures. On the contrary, the new power lines (and also substations) will improve power supply and its reliability in the relevant project areas, which in turn may contribute to increase in land value.

**Airports and Airstrips:**

Transmission and distribution lines sometimes are a potential hazard to aircraft during takeoff and landing. However, available information suggest that this is not an issue of concern for the proposed project.

**Implantable Medical Devices:**

Two types of implantable medical devices, pacemakers and implantable cardiovascular defibrillators (ICDs), have been associated with problems arising from interference caused by EMF, which is often referred to as electromagnetic interference, EMI. EMI can cause inappropriate triggering of a device or inhibit the device from responding appropriately. It was observed from the field visits that the EMF readings within the existing substation locations (i.e. in substation offices, and surrounding area) are consistently higher. Proper monitoring is required to detect such occurrences, if any, so that proper warning could be given to people for taking appropriate precautions, if required.

**Radio, Television and Mobile Phone Reception:**

Distribution lines do not usually interfere with mobile phone, television and radio reception. In some cases, interference is possible at locations close to the right of way (RoW) due to weak broadcast signals or poor receiving equipment.
APPENDIX J:
Questionnaire for Socio-economic Baseline Survey

এনভায়রনমেন্টাল এন্ড সোসাল এসেসমেন্ট এন্ড ম্যানেজমেন্ট
ফ্রেমওয়ার্ক

রুমাল ইলেকট্রিফিকেশন বোর্ড, বাংলাদেশ
এবং
পাওয়ার জেনারেশন কোম্পানী অফ বাংলাদেশ

আর্থ-সামাজিক তথ্য-উপাত্ত সংগ্রহ

পরিবার প্রধানদের জন্য প্রশ্নাত্ত

ID No
ID Point
ভূমিকা

আপনাকে অভিন্ন। আমি একজন সাধারণ ব্যক্তি।

<table>
<thead>
<tr>
<th>মূল নাম</th>
<th>ভূমিকা</th>
</tr>
</thead>
<tbody>
<tr>
<td>ঐকান</td>
<td>শাসনামল</td>
</tr>
</tbody>
</table>
### A: সাধারণ প্রশ্ন/ প্রস্তাব (পরিষদের মাধ্যমে)

<table>
<thead>
<tr>
<th>প্রশ্ন</th>
<th>জবাব</th>
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</thead>
<tbody>
<tr>
<td>A19</td>
<td>আপনার আগে কয়েক ছয়ের/ শুধু বাংলা আছে কি ? (পরিষদের)</td>
</tr>
<tr>
<td>A20</td>
<td>কি হবে আগের / কুইন্স বাংলা আছে (পরিষদের)</td>
</tr>
<tr>
<td>A21</td>
<td>আপনার বাংলার/ একজন আরো দিয়েন কত জিনিস আছে কি ?</td>
</tr>
<tr>
<td>A22</td>
<td>আপনার সাধারণ বাঙালির জিনিস কি ?</td>
</tr>
<tr>
<td>A23</td>
<td>আপনার পরিষদের কাজের সময় সময় করে?</td>
</tr>
<tr>
<td>A24</td>
<td>বিবাহ সময় আপনার তথ্য সাধারণের ? (একজন)</td>
</tr>
<tr>
<td>A25</td>
<td>কোন যা পরিষদের কাজের সময় যদিও কোন আর কার (একজন)</td>
</tr>
<tr>
<td>A26</td>
<td>আপনি কেটার হয়েছেন কি ?</td>
</tr>
<tr>
<td>A27</td>
<td>আপনি কেটার সাধারণ কি ?</td>
</tr>
</tbody>
</table>

### B: উপজাতীয়/ সাধারণ ভিত্তিক সম্পর্কিত জান ?

<table>
<thead>
<tr>
<th>প্রশ্ন</th>
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</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>আপনি কি হতীর আগের (একজন বা দায়িত্ব) হয়েছে এই একজনের পরিষদের হয়ে এলেন/নেন?</td>
</tr>
<tr>
<td>B2</td>
<td>আপনার কেন অবস্থানের অনেকের ?</td>
</tr>
<tr>
<td>B3</td>
<td>প্রশ্ন সময় আলাদাভাবের অনেকাংশের কি পরিবর্তন হয়েছে ?</td>
</tr>
</tbody>
</table>

### C: উপজাতীয়/ সাধারণ পরিষদের সম্পর্কিত জান ?

<table>
<thead>
<tr>
<th>প্রশ্ন</th>
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</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>আপনার মানিকচনা পরিষদের কোন ?</td>
</tr>
<tr>
<td>C2</td>
<td>আপনার একজন কি সাধারণ মানিকচনা রূপে চালিত ?</td>
</tr>
<tr>
<td>C3</td>
<td>ধারণায় মুদ্রণের সময় প্রতিযোগিতার সময় ?</td>
</tr>
<tr>
<td>C4</td>
<td>আপনার সাধারণ কি পতি দুই বছর মুদ্রণ হয়েছে ?</td>
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</tbody>
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231
<table>
<thead>
<tr>
<th>2-3 বছরের মধ্যে</th>
<th>1</th>
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<th>2 বছর</th>
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<th>3 বছর</th>
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<th>4 বছর</th>
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<th>5-7 বছর পর</th>
<th>8</th>
<th>8-10 বছর পর</th>
<th>9</th>
<th>11-13 বছর পর</th>
<th>10</th>
<th>14 বছর পর</th>
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</table>

### D: খাবার ও খাবার সেবা সম্পর্কিত তথ্য

#### D1
<table>
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<td>২</td>
<td>চালিত ফলের বাদাম</td>
<td>৫</td>
<td>৬</td>
<td>খাবার/ফলের বাদাম</td>
<td>তথ্যসূত্র</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>D11</th>
<th>কোন দিকের হয় তাই দেখা হচ্ছে?</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>সকল পাদ যাদাহল</td>
</tr>
<tr>
<td>4</td>
<td>একধরণ শাহ দেখা</td>
</tr>
<tr>
<td>7</td>
<td>মিলিটারি হয়ে দেখা</td>
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<tr>
<td>10</td>
<td>পাদটির হয়ে দেখা</td>
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</tbody>
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<table>
<thead>
<tr>
<th>D12</th>
<th>দিকের দেখা না পাওয়া</th>
<th>করান</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>সকল পাদ যাদাহল</td>
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<td>5</td>
<td>কোন কোন না আড়াল</td>
<td>6</td>
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</table>

E: এলাকার মূল সেবাভাবুক সম্পর্কে উল্লেখযোগ্য/সমর্থন মাথার মাধ্যম সম্পর্কিত তথ্য।

<table>
<thead>
<tr>
<th>E1</th>
<th>পরিবারের আকার উপর কি হচ্ছে?</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<th>E2</th>
<th>আলাদা বাসায় পাইন পাওয়ার সম্পর্কে অজানা কি?</th>
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<tr>
<td>1</td>
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<table>
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<th>E3</th>
<th>মোকাফার না হলে কোন দিকের হয়ে দেখা সম্পর্কে আলাদা হচ্ছে কি?</th>
</tr>
</thead>
<tbody>
<tr>
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<table>
<thead>
<tr>
<th>E4</th>
<th>আলাদা বাসায় সমর্থন পাওয়ার সম্পর্কে অজানা কি?</th>
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<th>E5</th>
<th>মোকাফার না হলে পাইন পাওয়ার সম্পর্কে আলাদা হচ্ছে কি?</th>
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<tbody>
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<thead>
<tr>
<th>E6</th>
<th>আলাদা দিকাগাঁর পাইনের সম্পর্কে অজানা কি? (নটী, মোকাফার সমর্থন করা পাইন)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<table>
<thead>
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<th>E7</th>
<th>আলাদা দিকাগাঁর পাইনের সম্পর্কে অজানা কি?</th>
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<th>E8</th>
<th>কোন সম্পর্কে পাইন না হলে হচ্ছে কি সম্পর্কিত?</th>
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<th>E10</th>
<th>আলাদা দিকাগাঁর পাইনের সম্পর্কে অজানা কি?</th>
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<th>E11</th>
<th>বাসারের অন্যান্য সম্পর্কে অজানা কিনা?</th>
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<th>আলাদা দিকাগাঁর পাইনের সম্পর্কে অজানা কিনা?</th>
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<th>৪</th>
<th>৫</th>
<th>৬</th>
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<tr>
<td>F1</td>
<td>আপনার বাবা একটি ব্যাংকে করা কি?</td>
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<td>২</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>F2</td>
<td>পিত্ত ১ অ্যারিয়েল আপনি রান্না করেন কি?</td>
<td>১</td>
<td>২</td>
<td></td>
<td></td>
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<tr>
<td>F3</td>
<td>রান্না করেন?</td>
<td>১</td>
<td>আদিত্য পাক</td>
<td>২</td>
<td>একটি / একটি সামার</td>
<td>৩</td>
</tr>
<tr>
<td>F4</td>
<td>এমনি পুরুষ করেন?</td>
<td>১</td>
<td>মহিলা</td>
<td>২</td>
<td>বৃত্ত</td>
<td>৩</td>
</tr>
<tr>
<td>F5</td>
<td>আপনা ওষুধে আপনি কি বিভিন্ন হলে পুরুষ মানুষ করেন?</td>
<td>১</td>
<td>২</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>F6</td>
<td>মহিলা ওষুধের উপর আপনি কি বিভিন্ন হলে পুরুষ মানুষ করেন?</td>
<td>১</td>
<td>২</td>
<td>৩</td>
<td>৪</td>
<td>৫</td>
</tr>
<tr>
<td>F7</td>
<td>আপনি কি আপনি কি বিভিন্ন হলে পুরুষ মানুষ করেন?</td>
<td>১</td>
<td>২</td>
<td>৩</td>
<td>৪</td>
<td>৫</td>
</tr>
</tbody>
</table>

G: প্রস্তাবিত বিমুখ সাধারণ লাইন/সারসেন্স কেন্দ্রের প্রবেশ সম্পর্কে উন্নয়ন/পার্শ্ববর্তী মাধ্যমে সংশ্লিষ্ট ভাব

| G1     | এমনি কি আপনি বি,বি / কি,কি,কি,কি,কি এর বিবৃতি সাধারণ লাইন/সারসেন্স কেন্দ্র নিযুক্ত বিষয় থাকে, তাহলে আপনি কি তা সংশ্লিষ্ট করেন? | ১ | ২ |
| G2     | এমনি না হলে, তাহলে কি সংশ্লিষ্ট করতেন? | ১ | এমনি উত্তর হবে | ২ | অনন্য উত্তর হবে | ৩ | ওয়ার্ল্ড ক্রিকেট কেন্দ্র এবং আমেরিকা বিভিন্ন | ৪ | আমেরিকার বিভিন্ন শিশুলে হবে | ৫ | আমেরিকার বিভিন্ন শিশুলে হবে | ৬ | অজাজ হবে | ৭ | অজাজের উত্তর হবে | ৮ | অজাজের উত্তর হবে |
| G3     | এমনি না হলে, তাহলে কি সংশ্লিষ্ট করতেন? | ১ | এমনি উত্তর হবে | ২ | অনন্য উত্তর হবে | ৩ | ওয়ার্ল্ড ক্রিকেট কেন্দ্র এবং আমেরিকা বিভিন্ন | ৪ | আমেরিকার বিভিন্ন শিশুলে হবে | ৫ | আমেরিকার বিভিন্ন শিশুলে হবে | ৬ | অজাজ হবে | ৭ | অজাজের উত্তর হবে | ৮ | অজাজের উত্তর হবে |

H: বিভিন্ন ধরনের ধর্মীয় এবং ঐতিহাসিক সংশ্লিষ্ট ভাব

| H1     | আপনার এমনি / কি কি / ধর্মীয় | ১ | ২ | ৩ | ৪ |

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<table>
<thead>
<tr>
<th>রাজিক</th>
<th>চেষ্টা পদ্ধিতি</th>
<th>প্রাঙ্গণ</th>
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<tbody>
<tr>
<td>1</td>
<td>চেষ্টা</td>
<td>2</td>
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<td>5</td>
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<tr>
<td>13</td>
<td>বিল</td>
<td>9</td>
</tr>
<tr>
<td>14</td>
<td>মূর্তি কর (সূচনা)</td>
<td>13</td>
</tr>
<tr>
<td>15</td>
<td>বাসনা অর্জন (সূচনা)</td>
<td>17</td>
</tr>
<tr>
<td>16</td>
<td>মস্তিষ্ক</td>
<td>22</td>
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<td>17</td>
<td>মার্ফত</td>
<td>26</td>
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<td>18</td>
<td>কর্মজীবন</td>
<td>30</td>
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<td>19</td>
<td>বিশ্লেষণ</td>
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<tr>
<td>100</td>
<td>হাজির অধিবিদ্যা</td>
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<td>111</td>
<td>বিশ্লেষণ</td>
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<tr>
<td>113</td>
<td>বিশ্লেষণ</td>
<td>50</td>
</tr>
<tr>
<td>114</td>
<td>পণ্য সরবরাহ কর্ম</td>
<td>54</td>
</tr>
<tr>
<td>115</td>
<td>বিপণন</td>
<td>58</td>
</tr>
<tr>
<td>116</td>
<td>সামাজিক সমাজ</td>
<td>62</td>
</tr>
</tbody>
</table>

*: (দুই প্রাঙ্গিকের অগ্নিযুগ, পরবিষ্কারণ সময়, অসামাজিক অখ্যাতি, আইনের উপঙ্কনায়ের অবস্থাবিদ্যা)

<table>
<thead>
<tr>
<th>রাজিক</th>
<th>চেষ্টা পদ্ধিতি</th>
<th>প্রাঙ্গণ</th>
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<tbody>
<tr>
<td>1</td>
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<td>চেষ্টা</td>
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<td>জায়গা</td>
<td>বিষয়</td>
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</tr>
<tr>
<td>J3</td>
<td>জন্মকাল</td>
<td>১৬</td>
</tr>
<tr>
<td>J4</td>
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<td>J6</td>
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<td>J17</td>
<td>জন্মকাল বর্গ</td>
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</tbody>
</table>

K: উপরন্তু সাপেক্ষে বিভিন্ন সময়কালের মতো কোন অবস্থার অন্তর্ভুক্ত করা যায়?

<table>
<thead>
<tr>
<th>দেরীয় বিষয়</th>
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<th>সাপেক্ষে</th>
<th>সাপেক্ষে</th>
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</tbody>
</table>

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A. Consultation at Different Stages of Sub-project Implementation:

Identification Stage
Subproject identification will be started by Palli Bidayt Samiti members in consultation with REB. Dissemination of the project information to the community and relevant stakeholders is to be carried out by the PBS representatives at the identification stage. The communities shall be made aware of the scope of subproject interventions including guiding principles and policies and participation in the project cycle through necessary feedbacks. This should include the process being followed for prioritization of the identified subprojects. Intended beneficiaries and other stakeholders should be involved in the decision making to the extent possible. The PBSs will facilitate to inform and consult the communities for identification of subproject for added benefits to the diverse communities equitably. Information generated at this stage should be documented.

Subproject Planning and Design Stage
Subproject information will be disseminated amongst the beneficiaries towards increasing their awareness and their roles and responsibilities. Planning stage is intended to be an interactive process with the intended beneficiaries at least in two stages. Initially while carrying out feasibility study and second at the finalization of the subproject. This would be the joint responsibility of the PBSs and the REB/PGCB engineering staffs facilitated by the ward councilor and the consultant. In case of voluntary land donation, direct land purchase, displacement and involuntary land taking, consultation with the beneficiaries and affected persons and their profiling are mandatory as per the requirements of the SIA and preparation of RAP. This needs to be done as socioeconomic and census surveys as part of the RAP preparation. Consultation with respect to cultural aspects are to be carried out as part of the SA for the subprojects.

Implementation Stage
Consultations as part of the implementation stage would be direct interactions of the REB/PGCB with the beneficiaries and affected persons, if any. These would comprise of consultations towards the role of beneficiaries in subproject implementation, establishments of CBOs (pilot), PBSs, grievance mechanism, compensation for income or asset loss, relocation of project affected persons and/or cultural properties, and towards addressing impacts on common property resources.

Review and Evaluation Stage
Stakeholders will participate in the subproject workshops at mid-term and at the end of the subproject implementation. The independent social reviewer will make use of the consultation and participation process and involve the communities in addition to the PBSs (for REB) and CBOs. Communities will be consulted for their views on implementation process, social management measures for inclusion, participation, transparency, and impacts of resettlement, livelihood restoration and grievance response. At every stage of the consultation and communication process the relevant stakeholders have to be identified, the entire consultation process (including methodology and approach)
must be documented showing when and where the consultations were held (participants list for consultations carried out for the purpose of this ESMF are annexed); the issues and topics discussed as well as responses, feedback and suggestions must be documented and incorporated in the ESMF as well as all other mitigation plans (RAPs, TPPs) when those are prepared.

B. Consultation Checklist

The following checklist will be the guiding tool for carrying out consultation and enhance participation of stakeholders in a subproject cycle.

<table>
<thead>
<tr>
<th>INFORM</th>
<th>CONSULT</th>
<th>ENGAGE</th>
<th>COLLABORATE</th>
<th>EMPOWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal:</td>
<td>Goal:</td>
<td>Goal:</td>
<td>Goal:</td>
<td>Goal:</td>
</tr>
<tr>
<td>Promote stakeholder understanding of issues, problems, alternatives, opportunities and solutions through balanced and objective information</td>
<td>Obtain feedback on analysis of alternatives and decisions</td>
<td>Work directly with stakeholders to ensure that their concerns and aspirations are understood and considered</td>
<td>Stakeholders become partners in each aspect of the decision, including development of alternatives and identification of preferred solutions</td>
<td>Final decision-making in the hands of stakeholders</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Commitment</th>
<th>Commitment</th>
<th>Commitment</th>
<th>Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep the stakeholders informed</td>
<td>Listen and acknowledge stakeholders concerns and expectations</td>
<td>Ensure that stakeholders' concerns/aspirations are directly reflected in subproject design and appraise them how their input influenced the decision</td>
<td>Value stakeholders' advice and innovations in devising solutions and incorporate their advice and recommendations to the maximum extent</td>
</tr>
</tbody>
</table>

Techniques
- Fact sheets
- Briefings
- Open meetings
- Websites

Techniques
- Public comment
- Focus groups
- Surveys
- Public meetings

Techniques
- Meetings with communities/TBOs
- Workshops

Techniques
- Participatory decision making
- Citizen committees (WLCC)

Techniques
- Citizen Juries
- Delegated decisions
Guideline for Preparation of RAP

A. Land Acquisition and Resettlement Issues

Involuntary resettlement issues are expected to arise where subprojects require additional lands and where subproject activities induce permanent or temporary displacement of people. Where expansion of existing land boundary of any infrastructure is a critical part of development to materialize expected benefits, the REB/PGCB will use the following guidelines to obtain public and private lands.

- **Public Lands.** Where they are in use by well-off persons and stoppage of further use would be socioeconomically inconsequential, the REB/PGCB and communities may persuade the users to relinquish occupancy of the lands and look for alternative lands, if they refuse. Where these lands are currently used for living and/or livelihood by the poor and vulnerable, the REB/PGCB and beneficiaries can obtain them by offering socioeconomic rehabilitation measures acceptable to the affected persons. However, the current users will have the option to refuse to relinquish occupation of the lands without the fear of any adverse consequences. RAP will be prepared and implemented for compensation and livelihood restoration of the affected persons.

- **Private Land on 'Voluntary Contribution'.** If a small parcel or strip of land is required for a subproject intervention, the concerned land owner, if persuaded, may elect to contribute the lands without compensation. This method will be followed only for small amount of lands (less than one decimal) and the REB/PGCB will ensure that,
  - The contributions are voluntary;
  - There are no encumbrances on the contributed lands;
  - The contributions do not affect the livelihood of vulnerable persons and, if it does, the REB/PGCB and community devise and implement mitigation measures acceptable to the affected persons;
  - The affected persons/contributors are made aware of the grievance redress mechanism described at Appendix N.
  - The contributors give up all claims on the lands and the titles are transferred to the recipient through the legal process in the country; and
  - The contributions are documented through an MOU.

- **Private Land on 'Direct Purchase or Exchange or contribution against compensation':** Lands are valuable and contributory to livelihoods of residential population. Voluntary contributions are seen more feasible where the landowners are well-off and they are very few in number. Contributions for grid tower, electric pole and substation may involve a small to medium number of landowners - some of whom might be quite marginal and vulnerable. In such cases, the REB/PGCB can offer to purchase the lands on willing buyer and willing seller basis. Alternately, the owners may opt to provide the lands on contribution against compensation or in exchange of similar lands elsewhere. The landowners, in any circumstances, will have the right to negotiate the price of the lands or refuse sale/contribution of the lands without the fear of any adverse consequences. REB/PGCB may purchase land directly from private owners via the Land Purchase Committees; but the process has to be transparent, a verifiable reasonable benchmark of market price has to be established for each area, purchase price should be at current market price and the price should include the costs of taxes and transfers.
and copies of deeds is to be shared with the WB. In case of direct purchase of land, RAP will not be required.

- **Private Land on 'Acquisition Using the Power of Eminent Domain'**: In cases where voluntary contribution or direct purchase could not be initiated, but the land in question is a critical part of the proposed project, the REB/PGCB may go for acquisition of the land using legal system. The World Bank Operational Policy on Involuntary Resettlement (OP 4.12) will apply and RAP will be prepared and implemented. Land acquisition process will be initiated in advance for timely implementation of subprojects requiring acquisition of lands.

- **Existing Lands with Formal Users**: Certain project activities like grid tower establishment in a dense area may involve temporary relocation of existing individual/family/community. Special measures will be included in RAPs to identify these displaced persons/family, allow them to continue their livelihood at alternative locations arranged by the REB/PGCB or compensated for the duration of the construction until when they will be returned to their previous sites. Open consultation will be conducted with general public and special consultation will be carried out with the APs for identification of options for their relocation and livelihood restoration.

In cases of voluntary contribution the REB/PGCB will (i) ensure that landowners and communities are made fully aware of their rights and obligations; (ii) verify that contributions are truly voluntary; and (iii) that the contributors are the legitimate owners of the lands being obtained and there are no outstanding issues of taxes or any dispute over ownership.

**B. Impact Mitigation Objectives**

The principles and guidelines provided in this framework are to avoid or minimize adverse impacts on private landowners and public land users, mitigate the impacts that are unavoidable, and assist to improve, or at least restore, their living standards and income earning or production capacity to pre-project levels. To achieve the objectives, REB/PGCB will adhere to the following strategic guidelines.

- Avoid or minimize displacement of persons/households who may have been using public lands for residential and livelihood purposes;
- Establish guidelines and procedures to ensure that private land contributions are voluntary and sought and accepted in transparent manners without causing unacceptable adverse impacts on the owners.
- Collectively decide on impact mitigation measures (PBS meeting with the affected persons) where private lands are required for critical project works.

**C. Impact Mitigation Principles**

Where physical activities affect persons/households on public or private lands, REB/PGCB will adhere to the following principles to avoid/minimize adverse impacts and adopt appropriate mitigation measures:

- As a first step toward mitigating adverse impacts, REB/PGCB will always try to avoid adversely affecting persons/households who are socioeconomically vulnerable.
- Where adverse impacts are absolutely unavoidable, the REB/PGCB will ensure that the affected persons/households are economically rehabilitated with measures acceptable to them.
- Where displacement of public land users is unavoidable, REB/PGCB will assist the affected persons/households to relocate on available public lands in the vicinity.
• Where businesses are displaced, REB/PGCB will assist them to relocate in the vicinity to ensure that they remain operational and do not lose income.
• Where private land is unavailable on voluntary contribution, direct purchase will be attempted and acquisition will be considered as the last resort, when all efforts fail.

RAP will be prepared following the guidelines and principles contained in this SMF in the case that use of private lands or public lands from private uses could not be avoided. The REB/PGCB will implement the RAP once the subproject is accepted for finance and implemented before receiving the funds.

D. Eligibility for Compensation/Assistance
The persons/households affected directly and indirectly by the physical activities under a subproject are eligible for compensation and assistance. The most likely eligible groups are:

- **Private Landowners:** Persons who have legal rights to the affected lands and other assets, such as houses/structures, trees, etc. built and grown on them.
  Compensation will be at replacement cost for loss of lands and additional transitional allowance when the loss is more than 20% of land holding or the remaining land is not economically viable for current use.

- **Squatters:** Persons/households who do not have legal rights to the affected lands, but use them for residential and livelihood purposes constructing structures on the lands. "Squatters" are persons who occupy/possess and assess without legal title.
  Squatters will not be entitled for compensation for lands but the structures and assets developed on it. They will be entitled for relocation and livelihood restoration assistance in addition to compensation for structures following the entitlement matrix.

- **Encroachers:** Persons/households who do not have legal rights to the affected lands attached to their own titled land, but encroach them for agricultural or other productive purpose with or without any construction. "Encroachers" are those owners of land adjacent to public property, who have illegally extended their land holdings or structures into public land.
  Like the squatters, the encroachers will not be entitled for compensation for lands but the structures and assets developed on it. They will be entitled for relocation and livelihood restoration assistance in addition to compensation for structures following the entitlement matrix.

- **Tenants/Lease holder (Public or private land):** Persons/households who do not have legal title to the affected lands but rent or lease it in for agricultural, residential or commercial purposes.
  Compensation will be replacement value of gross harvest for one year (for agricultural land) or the remaining lease period whichever is higher.
  In case of commercial and residential lands, the compensation will be equivalent to three months’ rent or for the remaining lease period, whichever is higher.

- **Tenants of affected structures:** Persons/households renting in affected structures for residential or commercial use.
  Affected tenants of structures will be assisted with cash compensation equivalent to 3 months’ rent of the affected structure, transfer/shifting allowance and in finding out alternative rental accommodation.

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• Market traders: Affected shop owners and operators displaced due to undertaking of project works for rehabilitation or improvement of a business center. Compensation will be transition allowance for the permanent loss of business, incomes & wages equivalent to the loss of income/wages for a period of 6 months for each affected members of households. In case of temporary relocation and temporary loss of business incomes, compensation will be wages equivalent to closure period OR alternative business site for continued income stream.

E. Compensation/Assistance Principles
Depending on an affected person’s preference, REB/PGCB may consider using both financial and material forms of compensation and assistance. REB/PGCB will ensure delivery of the agreed compensation/assistance in a timely and transparent manner. Compensation for the affected assets will be according to the following principles:
- Replacement cost for an equal amount of land of same productive quality.
- Replacement cost of houses/structures at the current prices of same building materials, plus the current cost of labor to build them. Depreciation and value of the salvageable building materials will not be deducted while computing the compensation.
- Current market prices of trees that are to be felled (owners will retain ownership of un-felled trees).
- Other acceptable in-kind compensation.
- Compensation in cash will be made in public.

In case of land acquisition, part of the replacement cost will be paid by the Deputy Commissioner (DC) as compensation under law. If compensation under law is less than the replacement cost determined by REB/PGCB and approved by the project (Power Cell), the remaining amount will be directly paid by the REB/PGCB to the affected land owners.

F. Consultation
Consultations will be inclusive of all stakeholders and used as a two-way communication strategy to provide information about the project and solicit support and agreements on the mitigations proposed. In addition to general consultation about the benefits and feasibility of specific physical activity, REB/PGCB will make certain that the users of the required lands (with and without legal rights) are consulted very early in the subproject preparation process. Consultations will focus on the issue of land availability and the conditions under which they could be used for subprojects. In cases where the would-be affected persons are tribal or women, REB/PGCB will arrange culturally appropriate or separate consultations.
Community consultation process during project implementation is discussed in more detail at Appendix K.

REB/PGCB will prepare consultations minutes, indicating dates, venues, compensation issues discussed, and the details of the agreements reached. The affected persons will be provided with copies of the minutes signed by the affected persons and the REB/PGCB. Copies of all such signed minutes will be kept by REB/PGCB and will be made available for review by REB/PGCB and the World Bank.

G. Land Acquisition Process
The REB/PGCB with the assistance of the consultant and in-house resources will prepare land acquisition proposals when exact ground locations of the required lands will be identified. The acquisition will be decided once the options for voluntary donation or direct
purchase failed. The land acquisition proposal will include a land plan with layout of subproject design on cadaster maps, land schedule determining the amount of land, and other supporting documents as per requirement of the Deputy Commissioner’s (DC) land acquisition (LA) 4. The DC’s LA 4 will process and complete land acquisition in favor of the REB/PGCB. The DC will assess the quantity of assets to be acquired and determine market price of the land and assets on it and prepare budget for compensation under law with 50% premium on the market prices. However, the REB/PGCB will place funds with the DC within 60 days of fund request. The DC will make compensation payment in another 60 days to complete the land acquisition. The entire procedure may take about a year.

H. Preparation of Subproject RAP

The REB/PGCB will carry out Inventory of Losses (IoL) and census of affected persons and establish cut-off date for recognition of structures for compensation and assistance. Temporary or permanent displacement of traders for project works will be included in the census. The end date IoL/Census will be will be cut-off date for recognizing losses for resettlement assistance. In case of acquisition, the Deputy Commissioner will carry out joint on site verification of affected assets jointly with the REB/PGCB and the date of service of notice under 4. 3 of the ARIPO 1982 will be the cut-off date for compensation for physical assets as per types recognized in the joint verification.

The REB/PGCB and the landowners will jointly determine the replacement costs of land based on the most recent transactions made in the same or adjacent localities, in view of the land type, productive quality and accessibility. Current prices of other assets, such as building materials, trees, etc. will be in accord with those in the local markets. The REB/PGCB will review the rates and approve through council resolution. The valuation process has been discussed in more detail at Appendix L(b).

Following the SIA, Census of affected persons and joint verification data available from the DC, the REB/PGCB will prepare RAP for the subproject following this SMF. A typical RAP will contain information, on the amount of land required from private and public ownerships, details of the impacts/losses and the number of land owners and other being affected, the alternatives considered to minimize displacement, review of the application of legal and policy framework, mitigation measures and an entitlement matrix, detailed budget, time schedule, arrangement for implementation and monitoring and evaluation. The RAP preparation process will seek active participation of the communities including the PBS and where available the CBOs. An eligibility and entitlement matrices and outlines of RAP are given at Appendix L(c).

REB/PGCB will document the impacts and affected persons/households, mitigation measures agreed with them, and verifiable evidence that the agreed measures have been implemented.

The cases of voluntary private land contributions and direct purchase will also be documented with appropriate evidence and will remain open to verification by REB/PGCB, the World Bank and others interested in the project.

I. Implementation of RAP

The REB/PGCB will forward the subproject RAP (where required) for review and approval from the relevant branch of the GoB (). REB/PGCB will submit the RAP to the Bank for review and clearance before allowing REB/PGCB to implement on site. REB/PGCB upon approval from the Bank and the GoB, will implement the RAP with assistance from the
consultants and the REB/PGCB staff including the Executive Engineer, Assistant Engineers, Surveyors and Overseers. Individual payment plan will be prepared for each affected persons and mitigation plans including replacement of affected physical structures by the REB/PGCB will be also be documented as a reference for future tracking. All declarations and agreements as per SMF will be executed before taking over land through voluntary contribution, direct purchase or exchange and disclosed for the public.
### FORM 2: FORMAT FOR VOLUNTARY DONATION OF LAND

**Voluntary Donation of Land**

**On a Tk. 300/- Stamp Paper**

1. This deed of voluntary donation is made and executed on the .................... day of...................... between Mr/Ms ..........................................................S/o W/o............................. Age............ Occupation ........................................... resident of............................................................. herein after called the “Title holder” on one part. This expression shall mean and include his/her legal representatives, successors – in interest, heirs, assignees, nominees, and the like.

AND

Mr/Ms. S/o Aged .......... .. Designation .... : ............................. herein after called the “Recipient” which term denotes to “for and on behalf of the ...................................... REB/PGCB” on the other part and shall mean and include his/her official successors –in-office, nominees and assignees, etc.

2. Whereas, the details of the Location of the, land are given below:

<table>
<thead>
<tr>
<th>Location Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mauza</td>
</tr>
<tr>
<td>Mahalla</td>
</tr>
<tr>
<td>Road</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title Holder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Title Holder</td>
</tr>
<tr>
<td>Father/ Husband’s Name of Title Holder</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Gender</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schedule - Land Details/Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land in Question</td>
</tr>
<tr>
<td>Area</td>
</tr>
<tr>
<td>Location</td>
</tr>
<tr>
<td>North Boundary</td>
</tr>
<tr>
<td>East Boundary</td>
</tr>
<tr>
<td>West Boundary</td>
</tr>
<tr>
<td>South Boundary</td>
</tr>
</tbody>
</table>

**Note:** Detailed Map to the scale is appended.

3. Whereas the Title Holder is presently holds the transferable right of the above mentioned piece of land at the location mentioned above.

4. Whereas the Title Holder testifies that the land is free of encumbrances and not subject to other claims/claimants.

5. Whereas the Title Holder hereby voluntarily surrenders the land/structure without any type of pressure, influence or coercion what so ever directly or indirectly and hereby surrender all his/her subsisting rights in the said land with free will and intention. The title to the land so donated will be transferred to the REB/PGCB in due course before award of project works contract.
6. Whereas the Recipient shall construct and develop urban infrastructure and take all possible precautions to avoid damage to adjacent land/structure/other assets and compensate any physical assets on the subject land at full replacement cost to the owner of the physical assets and take liability to rehabilitate the incumbent for livelihood restoration.

7. Whereas both the parties agree that the infrastructure so constructed/developed shall be for the public purpose.

8. Whereas the provisions of this agreement will come into force from the date of signing of this agreement.

<table>
<thead>
<tr>
<th>Signature of Title Holder</th>
<th>Signature of Local Revenue Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Title Holder</td>
<td>Name of the Local Revenue Collector</td>
</tr>
<tr>
<td>Date</td>
<td>Date</td>
</tr>
<tr>
<td>Identified by 1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Witnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signature of PBS Chairman</td>
</tr>
<tr>
<td>PBS Chairman Name</td>
</tr>
<tr>
<td>Signature of Chairman (Upazila) / Mayor (Urban)</td>
</tr>
<tr>
<td>Name of the Chairman / Mayor</td>
</tr>
<tr>
<td>Signature of Local NGO Representative</td>
</tr>
<tr>
<td>Name of the NGO Representative</td>
</tr>
</tbody>
</table>

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In line with the proposed compensation principles, REB/PGCB assisted by the consultants, will conduct market price surveys to determine the replacement costs of acquired lands, houses/structures and other replaceable assets and market prices of irreplaceable assets by using the methods suggested below.

**Lands of All Kinds**
The surveys will explicitly take into account the quality of the lands under acquisition. Quality will take into account current uses, cropping intensity and value of crops produced, accessibility from the existing roads, and any other characteristics that influence the lands’ market value. The survey will be conducted on the following three groups of respondents:

- A random sample of 10-15 landowners in the mouza in which a subproject is located and in those adjacent to it;
- As many of most recent buyers and sellers of similar lands can be found in the same and adjacent mouzas; and
- Deed writers, as many can be found and agree for interviews, at the land registration offices, who recently handled transactions in the same or adjacent mouzas. (They will be asked about the actual prices, not those written in the deeds.)

Market value of the lands will be determined in the following manners:

- If variations in average prices reported by the three respondent groups are insignificant (or, are 10% or less), current value of the land will be fixed at the average of the prices reported by the three groups.
- In cases of significant differences (more than 10%), the current price will be negotiated in open consultations with the affected and other landowners, community leaders, CBOs/NGOs and the like.

Replacement cost will equal the market value, plus the registration cost or stamp duty. The registration cost will be calculated on the current market price.

**Houses and Other Built Structures**
Replacement costs will be based on the current prices of various building materials, labor and other cost items in the local markets. The costs of building materials, such as bricks, cement, steel, sand, bamboo, timber, GI sheet, roofing materials like straw, golpata, etc., and labor will be based on:

- Survey of current prices of different types of materials with five or so dealers/manufacturers in the local markets.
- The replacement cost of the house/structure will be based on the lowest quoted price for each type of material, plus their carrying costs to the sites.
- The current costs of labor with different skills will be determined by interviewing local contractors, assigned Upazila engineers, or local construction workers.

Replacement costs of any other items will be determined based on the current prices of materials, labor, etc. As and when required, REB/PGCB will seek technical assistance of assign Upazila engineers and the project consultants for estimates of materials and labor for particular structures.
Trees & Other Irreplaceable Assets
Current market price of trees will be determined based on (a) Net Present Value or (b) Current age, life span, productivity and current market price of output. Market prices of different varieties of trees will be determined by surveying the prevailing prices paid by five or so timber and fuel-wood traders in the local markets. The compensation for trees will be fixed at the highest prices offered by a trader. Compensation for all other irreplaceable assets will also be based on survey of their prevailing prices with dealers/traders in the local markets.

Fruits and Other Crops
Compensation will be fixed at the harvest prices of the fruits and other crops. Harvest prices of different varieties of fruits and crops will be collected from a sample of 7-10 dealers in the local markets. The compensation for each type of fruit and crop will be fixed at the highest price offered by trader.

The market price surveys will begin as soon as locations of the required acquisitions (or lands obtained through other means) are identified on the ground. REB/PGCB will document the replacement costs and market prices of various affected assets and make them available as and when asked for review by REB/PGCB and WB.
## Compensation and Entitlement Matrixes

### Appendix L(c)

<table>
<thead>
<tr>
<th>Matrix</th>
<th>Type of Loss</th>
<th>Application</th>
<th>Entitled</th>
<th>Compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M - 1</strong></td>
<td>Arable land (public and private)</td>
<td>Less than 20% of land holding lost, the remaining land is economically viable</td>
<td>Titleholder (private)</td>
<td>- Cash compensation for lost land at replacement cost.</td>
</tr>
<tr>
<td></td>
<td>More than 20 percent of land holding lost OR where less than 20% holding lost but the remaining land becomes economically unviable</td>
<td>Titleholder (private)</td>
<td>Cash compensation at replacement cost.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tenant/lease holder (private / public)</td>
<td>Cash compensation equivalent to the replacement value of gross harvest for one year or for the remaining period of tenancy agreement, whichever is greater.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agricultural labor (private / public)</td>
<td>Cash compensation equivalent to 6 months' wage and assistance in getting alternative employment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Squatter/encroacher (private / public)</td>
<td>Relocation assistance equivalent to one year's cash return from the land they occupy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>M - 2</strong></td>
<td>Residential/commercial land (public and private)</td>
<td>Less than 20% of land holding lost and remaining land viable for present use</td>
<td>Titleholder (private)</td>
<td>Compensation in cash at replacement cost.</td>
</tr>
<tr>
<td></td>
<td>More than 20% holding affected OR where less than 20% holding affected but the remaining area becomes smaller than minimally accepted under the zoning laws and enviable for continued use</td>
<td>Titleholder (private)</td>
<td>Compensation at replacement cost.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tenant/leaseholders (private / public)</td>
<td>Cash compensation equivalent to the three months' rent or for the remaining period of tenancy/lease agreement, whichever is greater.</td>
<td></td>
</tr>
<tr>
<td><strong>M - 3</strong></td>
<td>Structures on acquired land or affected on existing land vacated for project purpose (permanently or temporarily)</td>
<td></td>
<td>Owner with valid title to land or with valid lease deed for the land</td>
<td>Compensation in cash for affected portion of the structure and other fixed assets at replacement cost, and Assistance in restoration of the remaining structure Repair Allowance, minimum 20% of compensation</td>
</tr>
<tr>
<td></td>
<td>Structures partially affected but the remaining structure viable for continued use</td>
<td>Squatters</td>
<td>Compensation in cash for affected</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Matrix</th>
<th>Type of Loss Application</th>
<th>Entitled</th>
<th>Compensation</th>
</tr>
</thead>
</table>
| temporarily) | | | portion of the structure  
• Transfer/shifting allowance.  
• Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity. |
| Tenants | | | • Cash compensation equivalent to 3 months' rental allowance  
• Transfer/shifting allowance  
• Assistance in alternate rental accommodation. |
| Encroachers | | | • Early notice on the demolition  
• Technical advice in demolition, relocation and repainting of affected structure  
• Payment for repairing only those damages to structure resulting from demolition, if required  
• Transfer/shifting allowances, if required  
• Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity. |
| Entire structure affected OR where structures partially affected such that the remaining structure is unviable for continued use | Owner with valid title to land or with valid lease deed for the land | | • Compensation in cash for entire affected structure and other fixed assets (wells, electric and water connections, etc.) at replacement cost, without depreciation.  
• Transfer/shifting allowance.  
• Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity. |
| Encroachers | Tenants | | • Cash compensation equivalent to 3 months' rental allowance  
• Transfer/shifting allowance  
• Assistance in alternate rental accommodation. |
| Squatters | | | • Compensation in cash for affected structure  
• Transfer/Shifting allowance  
• Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity.  
• Early notice for eviction and demolition  
• Technical advice in demolition or repairing of affected structures |
| Encroachers | | | • Early notice on the demolition before at least 60 days.  
• Technical advice in demolition, relocation and repainting of affected structure  
• Payment for repairing only those damages to structure resulting from demolition, if required  
• Transfer/shifting allowances  
• Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity. |
<table>
<thead>
<tr>
<th>Matrix</th>
<th>Type of Loss</th>
<th>Application</th>
<th>Entitled</th>
<th>Compensation</th>
</tr>
</thead>
</table>
| M - 4  | Loss of business /income or employment due to displacement | Temporary or permanent loss of business/ incomes/ employment | Affected individuals (titled/non-titled) | Employment in reconstructed enterprise or package for re-employment or starting business for affected employee. 
• Transition allowance for the permanent loss of business, incomes & wages equivalent to the loss of income/wages for a period of 5 months for each affected member of households. 
• In case of temporary relocation and temporary loss of business incomes, compensation will be wages equivalent to closure period or Alternative business site for continued income stream. 
• Re-allocation of market corners or shops after construction to the original market trader. |
<p>| M - 5  | Standing crops on affected lands | Crops affected by temporary acquisition/ easement | Owner of affected crops(titled/non-titled) | Compensation in cash at market value. |
| M - 6  | Trees on affected lands | Trees lost | Owner of affected trees(titled/non-titled) | Compensation in cash calculated on the basis of type, age and productive value of affected trees. |
| M - 7  | Loss of public infrastructure | Infrastructures (electric water supply, sewerage &amp; telephone lines; public health center; public water tanks) | Relevant agencies | Compensation in cash at replacement cost to respective agencies or restoration of affected assets. |
| M - 8  | Unforeseen Losses | As identified | As identified | Appropriate mitigation measures as determined to meet the objectives of this policy framework. |</p>
<table>
<thead>
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<th>Appendix L(d)</th>
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</thead>
<tbody>
<tr>
<td><strong>Outline of RAP</strong></td>
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<tr>
<td><strong>Resettlement Action Plan (RAP)</strong></td>
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</tbody>
</table>

**Project Background**  
Brief introduction about the project, description of project interventions and areas of jurisdiction of REB/PGCB, description of project components causing resettlement, scope of resettlement, an account of the alternatives considered to avoid and/or minimize the adverse impacts.

**Census and Socioeconomic Surveys**  
Identify all categories of PAP and their vulnerability, identify all categories of impacts (loss of property and assets, loss of livelihood; impacts on groups and communities, impact on physical cultural resources). An account of impacts by gender and vulnerability due to project and the special assistance that is to be provided.

**Participation and Consultation**  
An account of the disclosure of SMF and consultations with the project affected people/households about the mitigation measures and implementation procedure.

**Legal and policy framework**  
Analysis of the legal framework for compensation, applicable legal and administrative procedures, gaps between local laws and the Bank's resettlement policy, and the mechanisms to bridge such gaps.

**Compensation Entitlements**  
Description of compensation and other resettlement assistance that will be provided according to the principles and guidelines adopted in this SMF.

**Relocation and Livelihood Restoration**  
Description of resettlement sites and programs for improvement or restoration of livelihoods and standards of living.

**Grievance redress mechanism**  
Describe specific arrangement and procedure for receiving and resolution of complaints and grievances from the PAP and their community.

**Resettlement Budget**  
Resettlement budget with breakdowns by loss categories and the number of persons entitled to compensation/assistance. Specific compensation rates and standard of entitlements and EPs/households for different types of losses.

**Implementation Arrangement**  
Institutional arrangement and management of preparation and implementation of resettlement activities, grievance resolution, property assessment and valuation, and implementation time schedule.

**Monitoring and Evaluation**  
Describe monitoring arrangement involving PMO and REB/PGCB and mechanism for independent review and evaluation as well as reporting.

**Abbreviated RAP**

| **Project Background and Impacts** | Description of project interventions, assessment of land needs (private and public lands, including REB/PGCB own) for the civil works in each polder, screening of physical cultural resources, a census survey of PAP, and valuation of the affected assets. |
| **Legal and policy framework** | Analysis of the legal framework for compensation, applicable legal and administrative procedures, gaps between local laws and the Bank's resettlement policy, and the mechanisms to bridge such gaps. |
| **Compensation Entitlements** | Description of compensation and other resettlement assistance that will be provided according to the principles and guidelines adopted in this SMF. |

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<table>
<thead>
<tr>
<th>Participation and Consultation</th>
<th>An account of the consultations with the displaced persons/households about acceptable alternatives;</th>
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</thead>
<tbody>
<tr>
<td>Grievance-redress mechanism</td>
<td>Describe specific arrangement and procedure for receiving and resolution of complaints and grievances from the PAP and their community.</td>
</tr>
<tr>
<td>Budget and Implementation Schedule</td>
<td>A resettlement budget with breakdowns by loss categories and the number of persons entitled to compensation/assistance, and an implementation schedule;</td>
</tr>
<tr>
<td>Monitoring and Evaluation</td>
<td>Describe monitoring arrangement involving PMO and REB/PGCB and mechanism for independent review and evaluation as well as reporting.</td>
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</table>
1. Objectives of the Tribal Peoples Plan
Depending on the presence of tribal peoples (TP) in the subproject areas, divisional REB/PGCB will prepare their subprojects with the following strategic objectives:

- Select subproject interventions and determine their scopes to avoid impacts on tribal peoples.
- Ensure free, prior and informed consultation with the tribal peoples where subproject identifies tribal peoples among the beneficiaries.
- Ensure project benefits are accessible to the tribal community living in the subproject area.
- Ensure tribal peoples participation in the entire process of identification, planning, and implementation of subprojects.
- Wherever possible, adopt measures to reinforce and promote any available opportunities for socioeconomic development of the tribal communities.

2. Identifying the Tribal Peoples
Although the tribal peoples in Bangladesh are well recognized locally, REB/PGCB will examine the following characteristics to make formal identification:

- Self-identification as members of a distinct tribal cultural group and recognition of this identity by others;
- Collective attachment to geographically distinct habitats or ancestral territories in the subproject area and to the natural resources in these habitats and territories;
- Customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and
- Tribal language, often different from the official language of the country or region.

3. TP Consultation Strategy
In order to hold free, prior and informed consultations, REB/PGCB will provide TP with all information related to the subproject interventions, need for lands, and intended benefits, including those on potential adverse impacts. In accordance with WB OP 4.10, to operate in tribal areas, it is required to garner broad community support for the project and all activities to be carried out under it from the tribal people who are potentially going to be affected (positively or negatively). Therefore the consultation strategy for TP has to be tailored and focused and formulated in a culturally acceptable manner and delivered in local dialects. The issues of impact identification - enhancing positive impacts and minimizing/mitigating for negative impacts have to be clearly communicated, discussed and agreed upon in a participative and inclusive manner. The incorporation of community feedback, suggestions and recommendations into the mitigation plans is of critical importance. REB/PGCB will ensure that PBSs include tribal representatives in wards with presence of tribal peoples. To facilitate consultations REB/PGCB will:

- Prepare a time-table for TP consultations leading to selection, design and implementation of the subprojects, and consult them in manners so that they can express their views and preferences freely.
- In addition to the community in general, consult TP organizations, community elders/leaders and others with adequate gender and generational representation; and civil society organizations like NGOs and groups knowledgeable of TP issues.
- Garner community support for the project via implementing an effective and participative communication strategy.

In addition to the choice of alternative subproject design and locations, consultations will concentrate on the adverse impacts, if any, perceived ways to avoid those impacts, as well as
exploring additional development activities that could be promoted under the subproject. This will provide the inputs necessary to prepare and implement a TPP for a subproject in an area inhabited tribal peoples. REB/PGCB will keep minutes of these consultation meetings and make them available for review by the World Bank and other interested groups and persons.

5. Preparation of a TPP
In order to prepare a TPP, the following steps will be taken:

- Social screening to establish the presence of tribes in the subproject area or have collective attachment to the subproject area
- Based on a detailed social assessment establish a socioeconomic baseline data on the tribal people in the subproject area
- Review laws and policy guidelines applicable to the tribal communities
- Demonstrate measures to avoid negative impacts to the tribal people
- Identify areas for improvement of tribal settlement and extending benefits of the subproject to them
- Disclose the TPP locally and in Bank Infoshop before award of project works contract.

The TPP will primarily aim at avoid potential adverse impacts, and reinforcing and promoting any existing opportunities. The TPP will basically consist of TP profile and baseline information, consultation and participation strategy, benefits enhancement measures, implementation arrangement including institutional and financial and a monitoring and evaluation plan. The draft outline of the TPP is given below.

<table>
<thead>
<tr>
<th>Outline of Tribal People’s Plan</th>
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<tr>
<td><strong>Baseline and TP Profile</strong></td>
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<td><strong>Consultation and Participation Strategy</strong></td>
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<td><strong>Subproject benefits and enhancement areas</strong></td>
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<td><strong>Enhancement measures and activities</strong></td>
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<td><strong>Implementation Arrangements</strong></td>
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<td><strong>Monitoring and evaluation</strong></td>
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APPENDIX N

Grievance Response Mechanism (GRM)

A. Background and Purpose

The proposed rural electricity transmission and distribution project of Power Cell (PC) for the beneficiary organizations the REB/PGCB may cause displacement of people from private and public lands, and cause change in land use and construction activities may induce environmental concerns. Development activity of any project may have a complicated situation due to the density of settlement in some areas. It is very likely that communities will have questions and complaints and in some cases suggestions on alternative options for routes and locations. The likely affected persons due to acquisition of additional lands and vacating existing REB/PGCB lands for project purpose may have issues of recognition of losses and the compensation process applied for them. The current legislative framework has limitations in addressing such claims and complaints and there is no mechanism to hear and redress grievances of non-titled persons affected by displacement for project purpose. Considering the context, the project will establish a Grievance Response Mechanism (GRM) to answer to queries, receive suggestions and address complaints and grievances about any irregularities in application of the guidelines adopted in this framework for project design, and assessment and mitigation of social and environmental impacts. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal action. The procedure will however not pre-empt a person’s right to go to the courts of law.

B. Grievance Focal Points

Grievance response focal points will be available at the local and project level within REB/PGCB. The PBS (for REB) at the Thana/town/ward level will be the first focal point on project GRM and the Grievance Redress Committee (GRC) at the REB/PGCB level will be authorized to deal with all suggestions and complaints at the subproject level. REB/PGCB will ensure that communities are fully informed about the GRM and their rights to offer suggestions and make complaints, and the different mechanisms through which they can do so, including grievances related to the physical displacement. The Secretariat for each GRC will be at the Upazila/Chairman/Mayoral office. GRM focal points and the case record management are shown in flow diagram at Figure-1. The membership of the GRCs will ensure proper presentation of complaints and grievances as well as impartial hearings and investigations, and transparent resolutions. Where tribal peoples are among the beneficiaries or affected persons, the membership composition of the GRCs will take into account any traditional conflict resolution arrangements that tribal communities may practice. The GRC Chairman will call the concerned Chairman of the Upazilla/Thana Council from which the complaint was received for hearing. If the aggrieved person is a female, REB/PGCB will ask the concerned female Chairman of the Upazilla/Thana/ULB Council to participate in the hearings. Structure and membership of GRC is given in a Chapter 5.

To ensure that grievance redress decisions are made in formal hearings and in a transparent manner, the GRC Chairman will apply the following guidelines:

- Reject a grievance redress application with any recommendations written on it by a GRC member or others such as politicians and other influential persons.
- Remove a recommendation by any person that may separately accompany the grievance redress application.
- Disqualify a GRC member who has made a recommendation on the application or separately before the formal hearing.
- Where a GRC member is removed, appoint another person in consultation with the Project Director.

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The GRC Chairmen will also ensure strict adherence to the guidelines of social management and impact mitigation policies adopted in this framework and the mitigation standards, such as compensation rates established through market price surveys.

Figure 1: GRM Institution and Focal Points
C. GRM Policy Guidelines

The GRM focal points at the local REB/PGCB level will be established before approval of the subprojects at the Central REB/PGCB level for financing. GRC at the field REB/PGCB level will meet at least once before commencement of a project and have an orientation on their mandate, functions and working procedures. Within the context of this proposed project, for the proposed GRM to work effectively, the following issues will be taken into account.

1. Sensitization and Dissemination of GRM: The REB/PGCB will disclose project related information including subproject interventions with location, provision of GRM with scope and procedures, and rights of the communities of accessing the GRM with limitations through subproject launching meeting. As part of the subproject launching program, a session with PBSs, GRC, REB/PGCB officer bearers and administrative and engineering staff is to be organized on the GRM provision including functions of GRC, PBSs, and rights and responsibility of the communities. Exact addresses for lodging complaints and providing suggestions to the project team will be disclosed in the meeting and subsequently in leaflets distributed among the beneficiaries.

2. Social Inclusion and Safeguards: REB/PGCB must ensure effective implementation of OP 4.10 and 4.12 of WB. REB/PGCB will appoint Designated Social Management Specialists and project level personnel helping the REB/PGCB in social management including land purchase and resettlement of project affected persons. Specifically, REB/PGCB will ensure that local REB/PGCB implement project EMF and SMF in their full meaning and requirements.

3. Setting up GRM Data Bank: REB/PGCB will set up a central Data Bank on all complaints received and handled segregated by types of complaints. The data base should be accessible by all key project staff with the PMU, REB/PGCB. They will send quarterly GRM report to the World Bank. This report will provide detailed information on number and types of complaints received by districts followed by status of resolutions. The World Bank will have access to the GRM Data Bank, if required. The REB/PGCB will be able to access their own data in the GRM Databank. The project Design, Supervision and Management Consultant will help the project to set up and maintain such database. Setting up this databank will include developing and administering necessary computer software and networking with the project supported REB/PGCB.

4. Independent M&E of GRM Implementation: An independent Monitoring and Evaluation (M&E) and associated sanction measures will ensure check and balance of the GRM of the project. The M&E report on GRM will be prepared against a set of indicators developed at the time of implementation and included in the RAP.

D. Scope of GRM

Suggestions and complaints to be addressed through GRM include, not limited to the following:

- Location/alignment of subproject interventions
- Use of additional private lands
- Temporary and permanent displacement of people
- Compensation and assistance issues against displacement of people
- Environmental concerns and construction safety
- Gender and vulnerability based discriminations
- Quality of works

All other complaints will be first dealt at the PBS (for REB) level. If a specific complaint cannot be resolved by the PBSs, they will be referred to the SRCs.

There will be two primary channels for an aggrieved person for lodging a complaint or sending a suggestion related to a subproject.
a) Electronic submission: The project will develop (i) an interactive complaint mechanism in the REB/PGCB websites and (ii) a valid email address of the REB/PGCB to follow up complaints lodged. In the website, there will be draw-down buttons with pop-up windows to launch a complaint. A complainant will receive a unique Case Number for future tracking.

b) Paper-based submission: This mechanism will provide a Drop Box, accept Postal mail and walk in submission to GSC secretariat or to the President, PBS (for REB). Each complaint received will be assigned a unique Case Number so that the status of cases can be tracked. REB/PGCB will operationalize the GRM channels at loan effect and the local REB/PGCB will establish GRM focal points, GRC and channels for accepting suggestions and complaints at least 30 days before bidding process.

E. Grievance Petition and Resolution Process

A GRM Information Leaflet will be developed in local Bangla language and distributed among the communities in the subproject beneficiary areas. REB/PGCB consultants will assist in preparation and printing of this leaflet for the participating local REB/PGCB. The steps for submission of complaints and suggestions and their resolution at GRCs will be the following:

Step One: All complaints will first be received with the PBS through the ward councilor. The PBS will review and sort the cases in terms of nature of grievance and urgency of resolution. If the complaints are about any misconception or wrong understanding on policy and measures, the PBS will clarify and if the aggrieved person is satisfied, will close the case at the entry level keeping a case record. The complaints and suggestions designated after scrutiny will be forwarded to the GRC at local REB/PGCB.

Step Two: The aggrieved persons may also lodge the complaints and send suggestions directly through postal mail, e-mail, websites or drop the written complaint in the REB/PGCB drop box. The REB/PGCB will disclose the addresses of these portals to the communities before submission of their subprojects to REB/PGCB for approval and financing.

Step Three: The complaints and suggestions received through various designated channels will be documented through paper based registers and in computerized Data Bank with unique Case Numbers. The Member Secretary of the GRC will scrutinize the mens and produce the cases to the GRC’s Monthly Sessions. Attendances, minutes of the meeting and the decisions will be instantly noted in the resolution book and entered into the GRM Databank with a resolution ID number. All complaints will be resolved in a maximum of 4 weeks after receiving the cases.

Step Four: If the resolution attempt at the local level fails, the GRC will refer the complaint with the minutes of the hearings to the PMU, REB/PGCB, as the case may be, for further review. With active assistance from the Social Management Specialist, the Project Directors will make a decision and communicate it to the concerned GRC. The decisions on unresolved cases at this stage will be communicated to the GRC within one week of the complaint receipt. If a decision at this level is again found unacceptable by the aggrieved person(s), the REB/PGCB will advise the concerned local REB/PGCB to drop the subproject or the concerned component from the investment.

A decision, agreed by the complainant at any stage of the GRM process, will be binding upon the REB/PGCB concerned.

F. GRM Documentation

To ensure impartiality and transparency, hearings on complaints at the GRC level will remain open to the public. The GRCs will record the details of the complaints and their resolution in a register.
including intake details, resolution process and the closing procedures. REB/PGCB will maintain the following three GRM Books:

**Registration Book:** (1) Serial no., (2) Date of receipt, (3) Name of complainant, (4) Gender, (5) Father or husband, (6) Complete address, (7) Main objection (loss of land/property or entitlements), (8) Complainants' story and expectation with evidence, and (8) Previous records of similar grievances.

**Resolution Book:** (1) Serial no., (2) Case no., (3) Name of complainant, (4) Complainant's story and expectation, (5) Date of hearing, (6) Date of field investigation (if any), (7) Results of hearing and field investigation, (8) Decision of GRC, (9) Progress (pending, solved), and (10) Agreements or commitments.

**Closing Book:** (1) Serial no., (2) Case no., (3) Name of complainant, (4) Decisions and response to complainants, (5) Mode and medium of communication, (6) Date of closing, (7) Confirmation of complainants' satisfaction, and (8) Management actions to avoid recurrence.

Grievance resolution will be a continuous process during subproject implementation. The REB/PGCB will keep records of all resolved and unresolved complaints and grievances (one file for each case record) and make them available for review as and when asked for by WB and any other interested persons/entities. The REB/PGCB will also prepare periodic reports on the grievance resolution process and publish these on their websites. REB/PGCB will consolidate reports from the local REB/PGCB on GRM and post in their websites.
APPENDIX O
Public Consultation in Proposed Subprojects Areas

Introduction
As a part of the overall environmental and social assessment, efforts were made to identify the key stakeholders and to document and record their opinions on different aspects of the proposed project to be implemented by REB and PGCB. Three focus group discussions (FGDs) and several formal and informal discussion sessions have been carried out for assessment of socio-economic impacts of the proposed project. In the FGDs, the participants expressed their opinions regarding different issues, including their knowledge about the sub-projects of the proposed project, socio-economic condition of people in their localities, possible impact of the proposed sub-project activities on the local environment (physical, biological and social) and in their localities, and also provided suggestions of mitigation measures. This Chapter summarizes the major findings from the FGDs.

Methodology
As a part of the socio-economic study of the proposed rural electricity transmission and distribution project, three Focus Group Discussions (FGDs) were conducted during September-October 2013, covering each of the three divisions (Dhaka, Chittagong and Sylhet) where the project will be implemented. Table 6.1 shows the details (location, time and number of participants) of the FGDs. As shown in Table 6.1, more than 89 people participated in the three FGDs. A wide range of stakeholders (e.g. farmer, businessman, land owner, house owner, laborer, teacher, student etc) participated in the FGDs (see Fig. 6.1 - 6.4). Members of the ESA team lead by socio-economic coordinator, and representatives from REB and PGCB participated in the FGDs. In addition, several formal and informal discussions were carried out; the study team interacted with more than 50 people during these information discussion sessions.

Table 6.1: Locations and other details of FGDs

<table>
<thead>
<tr>
<th>FGD No</th>
<th>Location</th>
<th>Date and Time</th>
<th>Number of Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dhaka Division – Keraniganj</td>
<td>20-09-13, 10.30 am – 11.30 am</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Chittagong Division – Cox’s Bazaar – Moheshkhali</td>
<td>02-10-13, 11.00 am – 12.00 pm</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Sylhet Division – Golapganj</td>
<td>08-10-13, 11.00 am – 12.00 pm</td>
<td>34</td>
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<tr>
<td></td>
<td></td>
<td>Total</td>
<td>89</td>
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Figure 0.1: FGD-1 and formal meeting at Keraniganj, Dhaka: (a) REB and PGCB representatives of the area participated in the FGD, (b) Participants from different occupation attended in the FGD, (c) Formal meeting with REB manager at Keraniganj and (d) Formal meeting with PGCB manager at Hasnabad.

Figure 0.2: FGD-2 at Moheshkhali of Cox's in Chittagong Division: (a) REB Manager of Moheshkhali and Ex-Mayor of Moheshkhali participated in the FGD, (b) Participant from different occupation attended in the FGD.
Figure 0.3: Formal meeting at Moheshkhali of Cox's in Chittagong Division: (a) Formal meeting with REB manager at Cox's Bazaar and (b) Formal meeting with REB manager at Moheshkhali.

Figure 0.4: FGD-3 and formal meeting at Golapganj in Sylhet Division: (a) REB Manager from Golapganj participated in the FGD, (b) Participant from different occupation attended in the FGD, and (c) Formal meeting with REB Manager at Golapganj.

Findings from FGDs

In the FGDs, the participants expressed their opinions regarding different issues, including their knowledge about the proposed project, socio-economic condition of people in their localities, possible impact of the proposed project on the environment (social, ecological, physical, etc) and in their localities, and suggestions of mitigation measures. The major findings of the FGDs and meetings are summarized below.
FGD-1: Keraniganj in Dhaka Division

- Participants are not aware about the proposed project to be implemented by REB and PGC.
- Most participants are supportive for the proposed project to be implemented at their locality.
- Local (Keraniganj) land is in high demand for industry. Participants are willing to donate / sell their land, if required; but suggested that land acquisition should be carried out if absolutely needed.
- Some agricultural land may be lost, but the nation as well as the Keraniganj will be benefited by the proposed project.
- Minor disturbances may be acceptable during the construction of new electric line and new Substation.
- Keraniganj will be immensely benefited sectors if the area gets more electricity from the proposed project.
- Industrial and domestic line should be separated and domestic line should be the first priority.
- Electricity is available for 3-4 hours in peak season. General people are unhappy with the present power situation and demanded uninterruptable electric supply from REB and PGC.
- Keraniganj should get priority for electricity supply as it is an industrial area.
- Electric poles should be high.
- Local road expansion required.
- Road side plantation required.
- Road side transmission line welcome.

FGD-2: Moheshkhali of Cox’s Bazaar under Chittagong Division

- Participants are not aware about the proposed project to be implemented by REB and PGC.
- Most participants are supportive for the proposed project to be implemented at their locality.
- Ice factories located in the area need electricity; huge amount of ice is required for fish preservation.
- The forthcoming drinking water plant would require more electricity; the proposed project is likely to meet the power demand of the plant.
- Moheshkhali appears to be a low-priority area for electricity supply.
- No impact on environment is likely during construction of electric line.
- Electricity is required for preserving life-saving medicines (e.g. insulin).
- Moheshkhali require 3 MW of electricity, but get only 0.5 MW. People are unhappy with the current power supply situation.
- Insulated line required.
- Coal base electricity production not welcome.
- Electric bill has increased due to establishment of new meter.
- Electricity is now a costly item. All people can’t afford it.
- The proposed project/sub-projects should be included in the City Master Plan.
- Electricity will improve the quality of people’s life.
- Road communication is bad.
• Drinking water is quite saline and has bad smell; no Arsenic in the water.
• Education system should be improved with supply of more electricity.
• Local industry like fish processing, salt industry etc. will be benefited if they get electricity round the clock.
• Farmers would be benefited from better electricity supply.
• 3 crop rotation schemes could be started if more electricity is available.
• Existing electric line should be replaced by new line.
• Students are angry with interrupted electricity supply, which hampers their education.
• Local tourism will be improved with increased electricity supply.
• New electric connection is required from REB.
• Explore for option of marine electric cable line from Cox's Bazaar to Moheshkhali.
• During storm/cyclone, power lines become risky.

FGD-3: Golapganj in Sylhet Division
• Participants are not aware about the proposed project to be implemented by REB and PGCB.
• Most participants are supportive for the proposed project to be implemented at their locality.
• Uninterruptible electricity is required.
• Minor impact during project implementation on the local environment is acceptable.
• Compensation is needed for any damage.
• People believe: no electricity, no development.
• Local employment will be created by this project.
• WB conditions for the proposed project should be critically reviewed.
• Populated area should be avoided for project works.
• Land acquisition, resettlement or compensation issue, if any, should be resolved considering current market rate.
• Lack of electricity hampers education.
• Current electricity distribution system should be rationalized.
• Public consultation should be increased before field team mobilization for project implementation.
• Electricity generation should be decentralized.
**LIST OF PARTICIPANTS IN THE FGDS**

FGD-1: Keraniganj in Dhaka Division:

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Gender</th>
<th>Age</th>
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<th>Mobile No</th>
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FGD-2: Moheshkhali, Cox’s Bazar in Chittagong Division:

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Email</th>
<th>Contact Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. H. Md. Shawkat</td>
<td>1234 Moheshkhali, Cox’s Bazar, Chittagong Division</td>
<td>01712345678</td>
<td><a href="mailto:shawkat@fgd.com">shawkat@fgd.com</a></td>
<td>Shawkat</td>
</tr>
<tr>
<td>Md. Ali Hossain</td>
<td>1234 Moheshkhali, Cox’s Bazar, Chittagong Division</td>
<td>01712345679</td>
<td><a href="mailto:ali@fgd.com">ali@fgd.com</a></td>
<td>Ali</td>
</tr>
</tbody>
</table>

Parliamentary tours for collaboration in the achievement of national goals.
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name</td>
<td>John Doe</td>
</tr>
<tr>
<td>2</td>
<td>Age</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>Address</td>
<td>123 Main St, Anytown, USA</td>
</tr>
<tr>
<td>4</td>
<td>Phone</td>
<td>555-1234</td>
</tr>
<tr>
<td>5</td>
<td>Email</td>
<td><a href="mailto:john.doe@email.com">john.doe@email.com</a></td>
</tr>
<tr>
<td>6</td>
<td>Notes</td>
<td>Information about John Doe</td>
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</tbody>
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**Table Notes:**
- Column 1: Item numbers.
- Column 2: Item details.
FGD-3: Golapganj in Sylhet Division:

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<tr>
<th>Sl. No.</th>
<th>Name</th>
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<th>Age</th>
<th>Profession</th>
<th>Ticket No.</th>
<th>Station</th>
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