

ENVIRONMENTAL IMPACT ASSESSMENT REPORTS ON RUPSHA 800MW COMBINED CYCLE POWER PLANT PROJECT



Volume-I: Component 1 – EIA of Rupsha 800 MW Gas-fired Combined Cycle Power Plant

Volume- II: Component 2 – EIA of Gas Supply to the Power Plant

Volume- III: Component 3 – EIA of Power Transmission Interconnection

Environmental Impact Assessment

Document stage: Revised
Project Number: 50161-003
October, 2019

Bangladesh: Rupsha 800-Megawatt Combined Cycle Power Plant Project

Volume 3

(Component 3–EIA of Power Transmission Interconnection)

CURRENCY EQUIVALENTS

(as of 14 February 2018)

Currency unit	–	taka (Tk)
Tk1.00	=	\$0.0120548
\$1.00	=	Tk82.96

ABBREVIATIONS

ADB	–	Asian Development Bank
CCPP	–	combined cycle power plant
COD	–	chemical oxygen demand
CITES	–	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DPHE	–	Department of Public Health Engineering
DO	–	dissolved oxygen
DoE	–	Department of Environment
EA	–	executing agency
EC	–	electrical conductivity
ECA	–	Environment Conservation Act
ECC	–	Environmental Clearance Certificate
ECR	–	Environment Conservation Rules
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EMoP	–	Environmental Monitoring Plan
IEE	–	Initial Environmental Examination
MoEF	–	Ministry of Environment and Forests
PMU	–	project management unit
RoW	–	right-of-way
SPS	–	Safeguard Policy Statement

WEIGHTS AND MEASURES

°C	–	degree Celsius
dB(A)	–	A-weighted decibel
decimal	–	unit of area approx. equal to 1/100 acre (40.46 m ²)
ha	–	hectare
JTU	–	Jackson Turbidity Unit
lac	–	100,000
mg/L	–	milligram per liter
ppm	–	parts per million
µg/Nm ³	–	microgram per normal cubic meter
m ²	–	square meter

GLOSSARY

Bangla	– official language of Bangladesh
<i>gher</i>	– farming where a pond is dug into a rice field to use for fish farming and with the dugout soil used to create dykes around the pond for growing vegetables (traditional agriculture system in Bangladesh)
hydrostatic testing	– process of filling a pipeline with water, or a mixture of water and ethylene glycol or methanol to test the structural integrity of the pipeline under pressure
<i>khal</i>	– Bangla word for a small channel or canal
<i>thana</i>	– sub-district level of government administration, comprising several unions under the district
union	– smallest unit of local self-government comprising several villages
<i>upazila</i>	– Bengali for subdistrict (formerly called <i>thana</i>)

NOTE

In this report, "\$" refers to United States dollars.

This environmental impact assessment is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "terms of use" section of this website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

CONTENTS

	Page
EXECUTIVE SUMMARY	i
1.0 INTRODUCTION	1
2.0 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK	7
3.0 DESCRIPTION OF THE PROJECT	17
4.0 DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)	23
5.0 ANTICIPATED IMPACTS AND MITIGATION MEASURES	54
6.0 ANALYSIS OF ALTERNATIVES	86
7.0 INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION	89
8.0 GRIEVANCE REDRESS MECHANISM	92
9.0 ENVIRONMENTAL MANAGEMENT PLAN	94
10.0 CONCLUSION AND RECOMMENDATION	107

List of Tables

Table 2.1	Relevant national environmental regulations
Table 2.2	Relevant international environmental agreements
Table 2.3	SPS 2009 environmental categorization
Table 2.4	Comparison of environmental safeguard principles
Table 3.1	Physical Features of 230 kV transmission line
Table 4.1	Ambient air quality results at Khulna CAMS Station
Table 4.2	Comparison of ambient air quality standards
Table 4.3	Results of ambient noise level measurements
Table 4.4	In-situ surface water quality measurements (post-monsoon)
Table 4.5	Results of surface water quality analyses
Table 4.6	In- situ groundwater quality measurements
Table 4.7	Results of groundwater quality analyses
Table 4.8	Summary of erosion accretion in the study area
Table 4.9	Soil salinity in the study area
Table 4.10	Land use in the study area
Table 4.11	Status of fish habitat in the study area
Table 4.12	Fish habitat and production in the study area
Table 4.13	Capture fish species in the study area
Table 4.14	Culture fish species in the study area
Table 4.15	Common plant species along the transmission line route
Table 4.16	List of common aquatic plant species in the study area
Table 4.17	List of faunal species in the study area
Table 4.18	Labor availability and wage rate in the study area
Table 4.19	Migration status in the study area

Table 5.1	IECs on physical-chemical environment
Table 5.2	IECs on water resources
Table 5.3	IECs on land and agriculture resources
Table 5.4	IECs on fisheries resources
Table 5.5	IECs on ecological resources
Table 5.6	ISCs on socio-economic aspects
Table 5.7	Parameters for determining magnitude
Table 5.8	Criteria for determining sensitivity
Table 5.9	Significance of impact criteria
Table 5.10	Impact matrix of Component 3
Table 5.11	Potential hazard identification for Component 3
Table 5.12	Hazard Consequence Scale
Table 5.13	Criteria for Determining Frequency of the Potential Hazard
Table 5.14	Risk Matrix of Potential Hazards/Impacts
Table 5.15	Risk evaluation for Component 3
Table 6.1	Comparison of “with project” and “no project” options
Table 6.2	Route options for Component 3
Table 7.1	Location of consultations
Table 7.2	Summary of consultations
Table 9.1	Environmental Management Plan
Table 9.2	EMoP for river bank and flooding
Table 9.3	Environmental Parameter for EMoP
Table 9.4	EMoP for agricultural resources
Table 9.5	EMoP for fisheries resources
Table 9.6	EMoP for ecological resources
Table 9.7	EMoP for socioeconomic resources
Table 9.8	EMP Budget Estimates
Table A1	Invitation list of Consultation meeting
Table A2	List of Participants in Public Consultation Meeting

List of Figures

Figure 1.1	Location Map
Figure 1.2	Project Implementation Arrangements
Figure 2.1	Process of obtaining ECC
Figure 3.1	Location map of Component 3
Figure 3.2	Type of transmission tower
Figure 3.3	Disc insulators for transmission line
Figure 3.4	Associated civil works in transmission line
Figure 3.5	Associated electrical works
Figure 4.1	Physiographic map of Bangladesh
Figure 4.2	Seismic map of Bangladesh
Figure 4.3	Climatic subregions of Bangladesh
Figure 4.4	Monthly temperature variation at Khulna Station
Figure 4.5	Seasonal Change of Relative Humidity at Khulna Station (1985-2015)
Figure 4.6	Change in Rainfall at Khulna station (1985-2015)
Figure 4.7	Wind rose diagram
Figure 4.8	Location of water and noise sampling stations
Figure 4.9	Noise Level Measuring Location (In front of Putimari Bazaar, Lobonchora)
Figure 4.10	Noise Level Measuring Location (Sholpur Zugihati Govt. Primary School)
Figure 4.11	Sample test and collection from the Bhairab and Rupsha River

- Figure 4.12 Average monthly groundwater depth (1978 – 2013)
- Figure 4.13 Rate of Erosion and Accretion in the Study Area
- Figure 4.14 Soil salinity in the study area
- Figure 4.15 Land use in the study area
- Figure 4.16 Different fish habitats in the study area
- Figure 4.17 Available fish species in the study area
- Figure 4.18 Bio-ecological zone within the study area
- Figure 4.19 Types of vegetation within the study area
- Figure 6.1 Location of Component 3

List of Annexes

- Annex 1 ToR of EIA for Component 3 Approved by DoE
- Annex 2 Public Disclosure Meeting
- Annex 3 List of Participants during Focus Group Discussions and Public Consultation Meeting
- Annex 4 Photographs of Public Consultation Meetings
- Annex 5 “Chance Find” Procedures for Physical Cultural Resources – Component 3
- Annex 6 Format of Environmental Monitoring Report

EXECUTIVE SUMMARY

Introduction

1. North-West Power Generation Company Limited (NWPGL), an enterprise of the Bangladesh Power Development Board (BPDB) has taken the initiative to enhance the power generation capacity of Bangladesh to address the growing demand for electricity. This initiative will involve the construction of a new Rupsha 800 MW Combined Cycle Power Plant (CCPP) in Khalishpur Upazila, Khulna District in the administrative division of South-Western Bangladesh. The Rupsha 800 MW CCPP will be designed to use natural gas as the main fuel and high speed diesel (HSD) as back-up fuel (about 500 hours maximum annually). The Government of Bangladesh (GoB) has applied for financing of this new power plant from the Asian Development Bank (ADB). The Islamic Development Bank (IsDB) is expected to co-finance about 20% of the total project cost.

Project Description

2. Key interrelated project components include: (i) the development and operation of the Rupsha 800 MW gas-fired CCPP (Component 1); (ii) the construction of a gas distribution pipeline and related network infrastructure ensuring reliable supply of fuel to the CCPP (Component 2); (iii) the construction of a power transmission interconnection facility to transfer the generated power to the national grid at the existing substation in Khulna (Component 3); and (iv) capacity strengthening of NWPGL (Component 4).

3. Component 3 will consist of the power transmission interconnection from the new substation within the Rupsha 800 MW CCPP complex in Khalishpur to the existing 230/132 kV Khulna South substation (SS) located in the outskirts of Khulna City. The power transmission interconnection will involve construction of about 29.3 km, 230 kV double circuit overhead transmission line (24.561 km new transmission line and 4.7 km stringing of an existing single line from Khulna South SS to Mongla transmission line) from the new switchyard at Rupsha 800 MW CCPP to the existing Khulna SS. A total of about 75 transmission towers will be installed consisting of 25 angle towers, 48 suspension towers, and 2 terminal towers. The base of a transmission tower will require about 400 m² (20 m x 20 m). The alignment of Component 3 will not traverse areas that are protected by the GoB but will cross three major rivers: Bhairab River (once), Rupsha River (twice), and Atai River (thrice).

4. Occupying an area of 12.96 acres, the Khulna South SS is part of the West Zone Power System Development Project funded by ADB and the Nordic Development Fund, and was commissioned on 29 January 2007. The 4.7 km stringing is part of the 24-km four circuit 230 kV Mongla to Khulna South SS transmission line project of the Power Grid Company of Bangladesh (PGCB) funded by GoB. The 230 kV transmission line from Mongla to Khulna South SS has completed the requirements of the Environmental Conservation Rules (ECR) 1997 of the Department of Environment (DoE) for red category project. Together, these transmission lines form part of the power evacuation interconnection facilities in southwestern Bangladesh.

4. NWPGL will be the executing agency of the entire project. On 17 October 2015, NWPGL approved its Environmental, Health & Safety and Social Policy. NWPGL is also certified in ISO 9001, ISO 14001, BS OSHAS 18001 valid until October 2019.

5. To manage the day-to-day implementation of the project, NWPGL will create a Project Management Unit (PMU) that will have about 80 staff. NWPGL will get the necessary technical support from the Sundarban Gas Company Limited (SGCL) for Component 2 and the Power Grid Corporation of Bangladesh (PGCB) for Component 3. The project will have a high-level Project Steering Committee (PSC) consisting of members from various government departments, NWPGL, PGCB and SGCL will act as overseer of the project. The steering committee will meet every quarter to monitor progress and will report to the GoB.

Environmental Requirements

6. **National requirements.** The main environmental regulations in Bangladesh are the Environment Conservation Act (ECA) 1995 and the ECR 1997. Under these regulations, except for Component 4, all the three components of the Project are “Red” category requiring an environmental clearance certificate (ECC). Securing the ECC involves two steps: (i) issuance of locational (or site) clearance certificate (SCC), and then (ii) the ECC. An initial environmental examination (IEE) is required for the SCC and an environmental impact assessment (EIA) is required for the ECC. The terms of reference (ToR) of the EIA for Component 3 was approved by the DoE on 3 November 2016 (see **Annex 1**). NWPGL has obtained exemptions for submitting an IEE in obtaining the SCC for all the project components as follows:

- (1) Component 1 – 5 November 2017; DoE/Clearance/5584/2016/564
- (2) Component 2 – 5 November 2017; DoE/Clearance/5668/2016/563
- (3) Component 3 – 5 November 2017; DoE/Clearance/5669/2016/549

7. In August 2016, NWPGL contracted the Center for Environmental and Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources, to prepare the EIAs for the three components.

8. **ADB and IsDB requirements.** The project is subject to the environmental requirements of both ADB and IsDB since NWPGL is seeking their financial support. The Safeguard Policy Statement (SPS) 2009 of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects. IsDB is still in the process of preparing its Statement on Environmental and Social Safeguards Principles, and Commitments to Environmental and Social Responsibility. Given this, ADB and IsDB agreed to adopt SPS 2009 as the unified approach to documentation, consultation, and disclosure requirements to be complied by NWPGL for this project.

9. Under SPS 2009, projects are screened and categorized based on their potential environmental impacts. Following this screening procedure, the project is category A on environment which requires the preparation of an environmental impact assessment (EIA).¹ This EIA (Volume 3) covers the Component 3 of the project.

Description of the Existing Environment

10. The description of the existing environment for Component 3 was based on the areas that will be traversed by the overhead transmission line, the right-of-way (RoW) of 20 m, and

¹ Asian Development Bank Safeguard Policy Statement (SPS 2009), <https://www.adb.org/documents/safeguard-policy-statement>. (Accessed 23 November 2017)

another 40 m on each side of the RoW. This is referred to as the study area of about 292.61 hectares (ha).

11. Based on the Earthquake Zoning of Bangladesh, Component 3 lies within Zone III (Low Risk) which is the least vulnerable in terms of seismicity compared to the other parts of Bangladesh like Sylhet (Zone 1, high risk). Based on the 30-year meteorological record (1985-2015) from the Bangladesh Meteorological Department, the monthly variation of maximum temperature in Khulna is 30.7°C to 40.7°C, while the monthly minimum temperature varies between 6.4°C to 22.2°C. The maximum temperature recorded was 40.7°C in 2014 while a minimum temperature of 6.4°C was recorded in 2003.

12. According to Köppen climate classification, Khulna division falls under Aw category which is characterized by tropical wet and dry climate. The average annual rainfall is recorded at 1,808 mm/year while the monthly average maximum rainfall occurred in July (928 mm/month). The highest yearly rainfall was recorded in 2002 at 2,594 mm/year.

13. Ambient air quality was based on the continuous monitoring through the World Bank-funded Clean Air and Sustainable Environment (CASE) Project of the DoE which started monitoring in November 2011. CASE project monitors the criteria pollutants such as CO, NO₂, O₃, SO₂, PM₁₀ and PM_{2.5}. Results show that the criteria pollutants of concern in Khulna are PM₁₀ and PM_{2.5}. Existing sources of air pollution are vehicular emissions, brickfields, power generation, and industries.

14. There are three major rivers within the study area: Bhairab River, Atai River, and Rupsha River which are influenced by the tidal action of the Bay of Bengal. Existing sources of water pollution are navigation, river bank erosion, industries, and domestic wastes. Bhairab River receives most of the wastewater discharges from Khulna City. Existing beneficial uses of these rivers are navigation, subsistence fishing, swimming, industrial purposes, general purpose washing, and agriculture. Culture fisheries occupy about 17.4 ha while capture fisheries covers 17.81 ha. The estimated fish production is about 18 metric tons.

15. According to Bangladesh Bureau of Statistics (BBS) 2012, the total population is 278,187 with a household size of 4. Literacy rate is 60% while employment rate is 41%. About 43% of the population belongs to the age group of 25-59 years old. Main source of drinking water is tube well (97.31%).

Anticipated Impacts and Mitigation Measures

16. Considering the base of a transmission tower as 20 m x 20 m, the area affected and permanently lost due to 75 tower bases will be about 3 ha. With a right-of-way (RoW) of 10 m on each side of the transmission line, the area that will be affected is 49.122 ha. Thus, the total land within the direct impact area will be 52.122 ha. With a buffer of 40 m on each side of the RoW, the total land area that may be indirectly affected will be about 196.488 ha. The alignment of Component 3 will not traverse areas that are protected by the GoB but will cross three major rivers: Bhairab River (once), Rupsha River (twice), and Atai River (thrice).

17. Implementation of Component 3 will involve the following activities: route survey, establishment of construction camps for workers, site preparation and vegetation clearing, erection of towers, stringing of conductors, clearing of RoW, and operation and maintenance of the transmission line.

18. Environmental impacts associated with construction phase are increased dust and noise levels, potential traffic congestion, generation of wastes, impairment of surface water quality in Bhairab River, Atai River, and Rupsha River, loss of about 11.44 tons high yield variety (HYV)crops, clearing of vegetation within 52.122 ha to accommodate the 75 tower bases and RoW, and occupational and safety risks. Construction works may temporarily damage the *ghers* area near the bank of Rupsha River at Tentultola village resulting to a loss of about 81 m².

19. Before construction works start, PMU, NWPGL will conduct orientation to the Engineering, Procurement, and Construction (EPC) Contractor and workers on their roles and responsibilities in complying with the requirements of DoE and ADB, emergency preparedness including awareness on HIV/AIDS to prevent potential incidence in the workplace. A Construction Management Plan (CMP) outlining actions and measures to manage potential environmental impacts during construction phase will be required from the EPC Contractor. The environmental management plan (EMP) will be referred to in the CMP which will be reviewed and approved by PMU, NWPGL.

20. Erection of about 75 transmission towers will involve considerable excavation works, a “chance find” procedures will guide workers in the event a physical cultural resource may be discovered or affected.

21. EPC Contractor will provide workers with personal protective equipment (PPE) for mandatory use if needed, sanitary facilities, wash areas, safe drinking water, and adequate water supply for general washing purposes. No field camps will be located close to Bhairab River, Rupsha River, Atai River and other water bodies. Construction sites will be provided with first aid kit, garbage bins, fire-fighting equipment, and good housekeeping will be enforced at all times. Clear and visible safety and danger signs will be posted by the EPC Contractor at and around the field camps that may be enclosed to contain dust and reduce ambient noise. Oil-water separator will be used to deal with oily wastes generated. Compliance of EPC Contractor to relevant provisions in ECR 1997 on discharge of wastewater including waste management at the construction sites will be monitored by PMU, NWPGL.

22. During operation, improper disposal of used mineral oil as insulating medium to electrical equipment in the new substation at Rupsha 800 MW CCPP may affect water quality of Bhairab River and may also cause land contamination.

23. No polychlorinated biphenyls (PCB) or PCB-containing material will be used in Component 3. Excess chemicals that may be needed for construction and operation will be labelled properly and disposed of following its material safety data sheet. EPC Contractor will be encouraged to use non-toxic and biodegradable chemicals on-site.

24. Overhead transmission lines have always been associated with concerns on potential risks of cancer from exposure to electromagnetic field (EMF) from overhead transmission lines and substations. However, in spite of all the studies that have been carried out over the past 30 years, there is still no persuasive evidence that the fields pose any health risks. The World Health Organization (June 2007) recommends using exposure guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP has set the limit of exposure for the general public as: (1) electric field (kV per meter) is 4.17 and (2) magnetic field is 833 milliGauss (mG).

25. The British Columbia Hydro measured the magnetic field levels near their transmission and distribution lines. For 230 kV, the magnetic field level at 0 m from the line is 38 mG, 28 mG

at 10 m, 15 mG at 20 m, 8 mG at 30 m and 5 mG at 40 m.² These levels are much lower than the magnetic fields in the house: (1) hairdryer (300 mG), (2) dishwasher (20 mG), and (3) washing machine (20 mG) taken 6 inches from the source.³

26. To avoid the impacts of EMF, houses will not be allowed within the RoW of the project. During the design, the transmission line and substation equipment will be rated to ensure EMF is within the permissible limits specified in the EHS guidelines.

Analysis of Alternatives

27. A “no project” option means that the area along the proposed alignment of Component 3 will remain the same as the current condition. However, the power to be generated by the Rupsha 800 MW CCPP will not be evacuated to the national grid. The “with project” option evaluated three routes and the selected alignment will not pass through protected areas, any bird habitats, and dense settlements.

Information Disclosure, Consultation and Participation

28. A total of four consultation events were conducted on 11 November 2016 and on 21 December 2016 by the CEGIS, consultant of NWPGL for Component 3. Participated by 54 persons, these consultation events were done through key informant interviews, focus group discussions, and public meetings. Consultations were conducted in Dighalia, Batiaghata, and Malapara. Among the concerns raised during the consultations are compensation not only for the crops that may be damaged but also the land that is permanently lost due to tower footings. Overall, the local people within the project area are supportive of Component 3. Consultations will continue and a program for consultation will be finalized by NWPGL with support from communications expert to ensure that stakeholders are consulted, as and when needed.

29. A project summary with details on grievance redress mechanism (GRM), and contact person in case of complaints will be prepared in Bangla (and English) and will be made available at the field office of PMU in Khaliapur, Khulna and at the NWPGL office in Dhaka. More details on Component 3 will also be available from the EIA posted in the website of ADB.

Grievance Redress Mechanism

30. NWPGL currently manages grievance and/or complaints through the Grievance Redress System (GRS) which is required by the GoB and part of the mandatory Annual Performance Agreement (APA). This agreement will be signed and renewed annually between NWPGL and GoB.

31. To meet the requirements of SPS 2009, a grievance redress mechanism (GRM) will be set up once ADB funding for Component 3 becomes effective. The GRM will provide three-tier entry points in grievance redress. Two grievance redress committees (GRCs) will be formed: (i) local grievance redress committee (LGRC); and (ii) project grievance redress committee (PGRC). Grievances considered minor can be resolved onsite at the LGRC level within 7 days from receipt of complaint. Other complaints not resolved at the LGRC level will be forwarded to PGRC which will take two weeks (or 14 days) to resolve. Meetings of the LGRC will be held

² BC Hydro Power Smart. Understanding Electric and Magnetic Fields. <https://www.bchydro.com/.../BCHydro/.../understanding-emf-booklet-jan2017.pdf>

³ US EPA. EMF in Your Environment. December 1992. <https://nepis.epa.gov/>.

onsite (PMU office) and members may do site visits to check or verify the issue. Complainants will be informed of the status of resolution. The third tier entry point for grievance redress will be the appropriate rule of court. NWPGL will ensure the representation of women in the members of the GRCs.

(a) LGRC – members will include (i) Deputy Manager/Executive Engineer (Environment) of PMU, (ii) Ward member, (iii) community representative, (iv) representative of women affected persons, and (v) EPC Contractor representative

(b) PGRC – members will include (i) Project Director(PD), NWPGL as the Chairperson, (ii) Environment staff of Project Management and Construction (PMC) consultant, and (iii) representative of civil society nominated by PD with the help of PMC.

Environmental Management Plan

32. The Corporate environmental staff of NWPGL and the PMU will monitor the EPC Contractor on its compliance to the EMP. Environmental monitoring plans (EMoPs) have been prepared. A total of BDT 76Lakh has been budgeted for the 3-year implementation of EMP. Environmental monitoring reports will be submitted by PMU to ADB semi-annually during construction phase and annually during operation. The environmental monitoring reports will be posted in the ADB website as required by SPS 2009 and PCP 2011.

Conclusion and Recommendation

33. The EIA for Component 3 was prepared following the requirements of the DoE and ADB. An EMP and EMoP were included in the EIA with cost estimates.

34. The transmission line route was selected considering potential environmental impacts and avoiding areas protected by GoB such as national park, wetlands of wildlife sanctuary. Environmental impacts due to the implementation of Component 3 can be easily mitigated by proper planning, best practices in construction engineering, and compliance to the EMP and environmental requirements of DoE and ADB.

35. Stakeholders have been identified and consulted during the preparation of the EIA and will continue throughout the project cycle. The GRM has been identified and will be set up as soon as the funding of the project becomes effective.

36. This draft EIA will be disclosed at the ADB website as required by SPS 2009 and PCP 2011. Prior to construction works, all the relevant permits required for Component 3 will be obtained by NWPGL.

1.0 INTRODUCTION

1. The Power System Master Plan 2016 recommends for diversification in the use of fuel for power generation such as domestic and imported coal and natural gas, oil, nuclear power, and renewable energy.⁴ Consistent with this, the North-West Power Generation Company Limited (NWPGL), an enterprise of the Bangladesh Power Development Board (BPDB) has taken the initiative to enhance the power generation capacity of Bangladesh to address the growing demand for electricity. This initiative will involve the construction of a new Rupsha 800 MW Combined Cycle Power Plant (CCPP) in Khalishpur Upazila, Khulna District in the administrative division of South-Western Bangladesh. The Rupsha 800 MW CCPP will be designed to use natural gas as the main fuel and high speed diesel (HSD) as the back-up fuel (about 500 hours maximum annually). The Government of Bangladesh (GoB) has applied for financing of this new power plant from the Asian Development Bank (ADB). The Islamic Development Bank (IsDB) is expected to co-finance about 20% of the total project cost.

2. The objectives of this initiative include the following:

- To contribute in meeting the demand for electricity and to increase reliability of supply by minimizing load-shedding;
- To support in achieving the vision of GoB, “Power to All by 2021;”
- To reduce the increasing gap between demand and supply of electricity throughout the country;
- To accelerate economic development by providing adequate and reliable power generation;
- To enhance the stability and reliability of the national grid system, and to reduce the systems loss by local generation; and
- To develop human resource through technology transfer.

3. Overall, the goal is to improve the economic growth of Bangladesh by providing a reliable and stable power supply with this initiative.

1.1 Overview of the Project

4. The project targets strengthening energy security in Bangladesh. The country faces serious electricity shortages in the short- to medium-term and needs to secure cost-effective, new and diversified energy sources. Key interrelated project components include: (i) the development and operation of the Rupsha 800 MW gas-fired CCPP; (ii) the construction of a gas distribution pipeline and related network infrastructure ensuring reliable supply of fuel to the CCPP; (iii) the construction of a power transmission interconnection facility to transfer the generated power to the national grid at the existing substation in Khulna; and (iv) capacity strengthening of NWPGL. The project will establish the first ever power plant to use gas from the Bangladesh gas transmission network, where its gas supply would be attributed to LNG imported into Bangladesh. **Figure 1.1** shows the project.

⁴ Ministry of Power, Energy and Mineral Resources, and Bangladesh Power Development Board. People’s Republic of Bangladesh Power & Energy Sector Master Plan. [http://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/\(E\)_FR_PSMP2016_Summary_revised.pdf](http://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/(E)_FR_PSMP2016_Summary_revised.pdf). (Accessed 18 August 2017)

Component 1: Rupsha 800 MW CCGP

5. Rupsha 800 MW CCGP will be built in the (now abandoned) Khulna newsprint factory premises. The power plant will use combined cycle gas turbine technology, comprising two identical generating units, each nominally rated at 400 MW. Each combined cycle unit will consist of one gas turbine and one heat recovery steam generator (HRSG), forming a one-on-one configuration. At full capacity of 800 MW, the Rupsha power plant is capable of meeting 5% of the forecast peak demand of Bangladesh in year 2022. The cooling system will be closed-loop forced-draught cooling tower system that will require 2,010 m³/hour of water to be taken from the Bhairab River.

Component 2: Gas Supply to the Power Plant

6. Petrobangla, the national gas utility and the single-buyer for the gas industry, will procure liquefied natural gas (LNG) from international sources and deliver regasified LNG to Khulna city gas station (CGS). The regional gas distribution company, Sundarban Gas Company Limited (SGCL) will deliver gas from the existing Khulna CGS in Arongghata to the Rupsha power plant in Khalishpur. A new 24-inch (0.6 m) underground gas pipeline about 10 km long will be installed from Khulna CGS to the Rupsha 800 MW power plant. The gas receiving and metering station (RMS) will be located at the Rupsha power plant. In addition, a new 20-inch (0.5 m) underground gas pipeline 2 km long will be branched off from the line from Khulna CGS to Rupsha power plant, to serve NWPGL's existing Khulna 225 MW power plant. Owing to non-availability of gas, this 225 MW power plant is presently operating on diesel.

Component 3: Power Transmission Interconnection

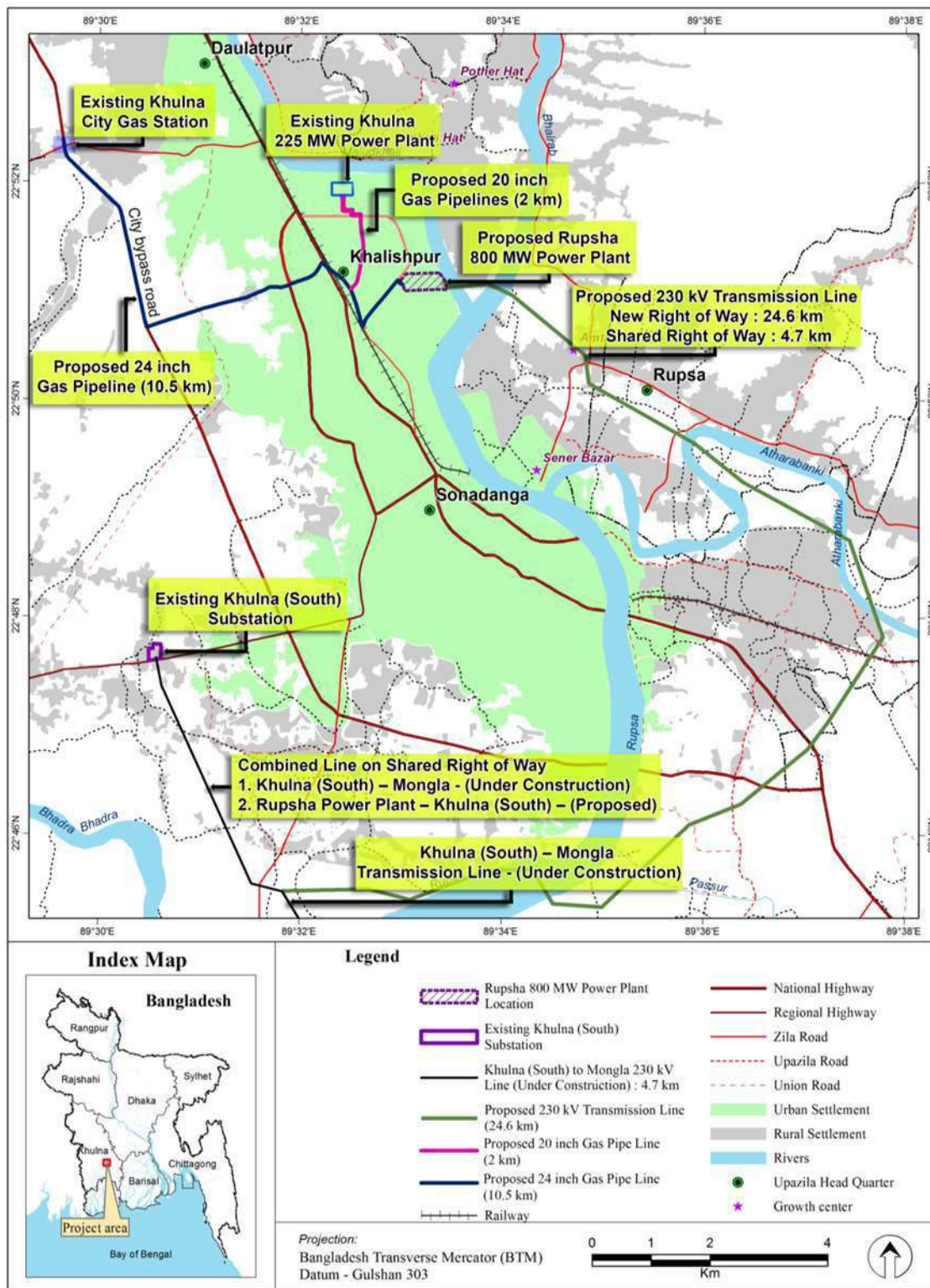
7. Electricity generated in the Rupsha power plant will be stepped-up to the transmission voltage of 230 kilovolt (kV). A new 29.3 km transmission line will be built from Rupsha 800 MW CCGP to the existing Khulna SS. The conductor to be used is twin-ACCC Hamburg⁵, and the line will have two circuits, each capable of transferring 1400 MW. The new transmission line will require three main river crossings and three minor river crossings, and would traverse for 29.3 km, mostly through rice fields. Upon reaching the existing Khulna SS, the line will be terminated at two new line bays and termination equipment to be installed under the project. Thereafter, electricity produced at Rupsha power plant will flow into the 230 kV transmission network to serve the electricity demand in Khulna and elsewhere in the country.

Component 4: Capacity Strengthening of NWPGL

8. Strengthening institutional capacity has the following three major subcomponents: (i) improving project implementation, management, and construction supervision capabilities; (ii) establishing enterprise resource planning (ERP) system in NWPGL; and (iii) enhancing operation and maintenance practices through procurement and installation of modern and high technology universal power plant operations training simulator. Project management and construction supervision support will be provided for the development of Rupsha power plant. ERP system support includes both hardware and software for introducing computerized management system for NWPGL. The ERP system will substantially improve business process and NWPGL's efficiency and transparency by computerizing the Financial Accounting, Budgeting & Costing, Human Resource Management, Procurement Inventory, Planning and Monitoring, Operations & Maintenance and Project Management and Accounting.

⁵ Aluminium Conductor Composite Core (ACCC) Hamburg has a current carrying capability of 1440 ampere at 120°C.

Figure 1.1: Location Map

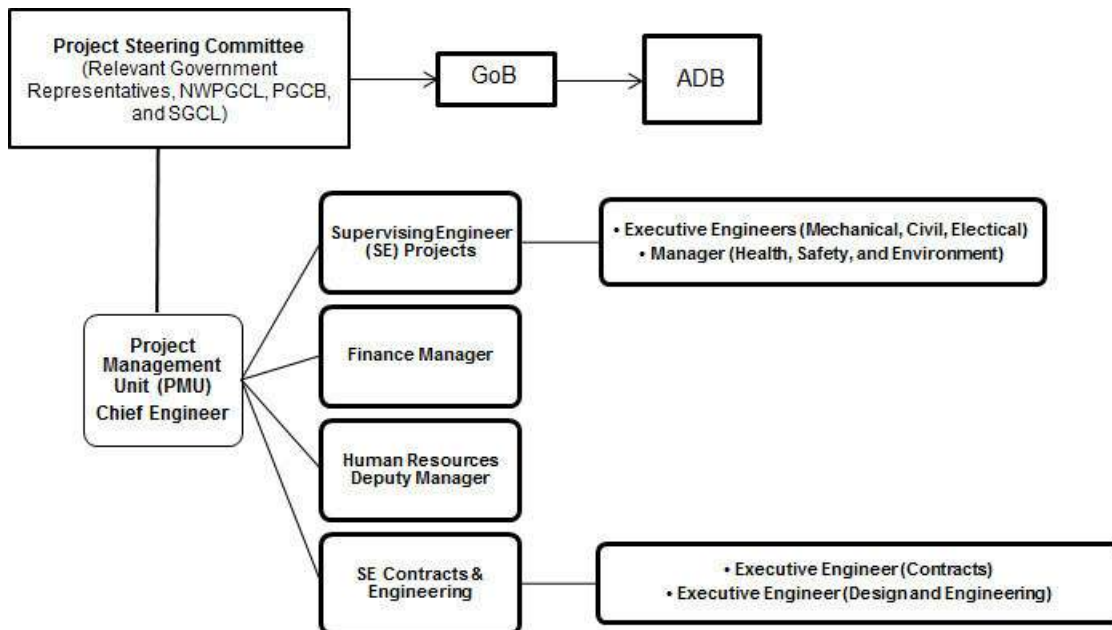


1.2 Project Implementation Arrangements

9. Implementation supervision for the Rupsha 800 MW CCPP, power transmission, and gas distribution facilities will be carried out by the NWPGL with assistance from a team of international and national implementation consultants. From time to time, assistance will be provided by the Power Grid Company of Bangladesh (PGCB) for Component 3, and the SGCL for Component 2 to ensure that coordination is achieved and implementation progresses smoothly. During construction, further assistance will be provided by SGCL and PGCB for approval of detailed design and drawings submitted by the contractors of Component 2 and Component 3, respectively. This arrangement has worked well for the Bheramara 360 MW CCPP project financed by the Japan International Cooperation Agency (JICA), which is very similar to the Rupsha 800 MW CCPP.

10. NWPGL is currently setting up the PMU and so far, has assigned limited staff to it. The organogram (see **Figure 1.2**) prepared for the PMU shows the unit will have a complement of 80 staff. It will be headed by a Chief Engineer, and will have 4 divisions, headed by: (i) Supervising Engineer (SE) Projects; (ii) Manager Finance; (iii) Deputy Manager Human Resources and (iv) SE Contracts & Engineering. SE Projects will have reporting to him, three Executive Engineers, (Mechanical, Civil, and Electrical) and Manager Health, Safety and Environment (HSE) while the SE Contracts & Engineering will have reporting to him Executive Engineer Contracts and Executive Engineer Design and Engineering. In addition, the project will have a high-level Project Steering Committee (PSC) consisting of members from various government departments, NWPGL, PGCB and SGCL and act as overseer of the project. The steering committee will meet every quarter to monitor progress and will report to the GoB.

Figure 1.2: Project Implementation Arrangements



1.3 The Need for Environmental Assessment

11. The project is subject to the environmental requirements of GoB, ADB, and IsDB since NWPGL is seeking the financial support of ADB and IsDB.

1.3.1 National Requirements

12. The main environmental regulations in Bangladesh are the Environment Conservation Act (ECA) 1995 and the Environment Conservation Rules (ECR) 1997. Under these regulations, all the three components of the Project are “Red” category requiring an environmental clearance certificate (ECC). Securing the ECC involves two steps: (i) issuance of locational (or site) clearance certificate (SCC), and then (ii) the ECC. An initial environmental examination (IEE) is required for the SCC and an environmental impact assessment (EIA) is required for the ECC. The terms of reference (TOR) of the EIA needs the approval of the Department of Environment (DoE). The DoE is the authority that regulates and enforces environmental management regulations to ensure that development projects are implemented sustainably, and to conserve and manage the environment in Bangladesh.

13. NWPGL has obtained exemptions for submitting an IEE and approval of the TOR of the EIA in obtaining the SCC for all the project components as follows:

- (1) Component 1 – 5 November 2017; DoE/Clearance/5584/2016/564
- (2) Component 2 – 5 November 2017; DoE/Clearance/5668/2016/563
- (3) Component 3 – 5 November 2017; DoE/Clearance/5669/2016/549

14. The ToR of the EIA for Component 3 was approved by the DoE on 3 November 2016 (see **Annex 1**). Without the EIA approved by DoE, NWPGL cannot open line of credit in favor of importable machineries and cannot start any physical activities for the project. In 2016, NWPGL has engaged the Center for Environmental and Geographic Information Services (CEGIS) to prepare the EIAs of all the project components required by the DoE.

1.3.2 Environmental requirements of ADB and IsDB

15. Safeguard Policy Statement (SPS) 2009 of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects. The IsDB is still in the process of preparing its Statement on Environmental and Social Safeguards Principles, and Commitments to Environmental and Social Responsibility.⁶ Given this, ADB and IsDB agreed to adopt SPS 2009 as the unified approach to documentation, consultation, and disclosure requirements to be complied by NWPGL for this project.

16. Under SPS 2009, projects that require funding from ADB will be subject to screening and categorization based on their potential environmental impacts. The project has four components: (i) Component 1 – Rupsha 800 MW CCPP, Component 2 – Gas Supply to the Power Plant, Component 3 – Power Transmission Interconnection, and Component 4 – Capacity Strengthening of NWPGL. Component 4 is not expected to have adverse

⁶ IsDB.Statement by Dr. Ahmad Mohamed Ali, President, IDB. United Nation’s Conference on Sustainable Development (Rio +20), 20-22 June 2012.
http://www.isdb.org/irj/go/km/docs/documents/IDBDevelopments/Internet/English/IDB/CM/About%20IDB/President%20IDB%20Group/PS_UN_ConferenceSustainableDevelopment_20June2012.pdf. (Accessed 6 December 2017)

environmental impacts. The project is category A on environment according to ADB's SPS 2009 which requires the preparation of an EIA.⁷

17. The EIA required by ADB was based on the findings of CEGIS and additional research for available secondary data to meet SPS 2009. Aside from the EIA, NWPGL will provide ADB a copy of the ECC issued by the DoE for all the project components.

1.4 Structure of the Report

18. Following the requirements of SPS 2009, the environmental assessment for the project is presented as follows:

- 1) Volume 1 – EIA of Component 1;
- 2) Volume 2 – EIA of Component 2; and
- 3) Volume 3 – EIA of Component 3.

19. The EIAs of all the project components are based generally on the EIA format given in Annex to Appendix 1 of SPS 2009, pp41-43. This EIA covers Component 3 – Power Transmission Interconnection.

⁷Asian Development Bank Safeguard Policy Statement (SPS 2009), <https://www.adb.org/documents/safeguard-policy-statement>.

2.0 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

2.1 National environmental agency

20. The Ministry of Environment and Forests (MoEF) is the agency responsible for planning, promoting, coordinating and overseeing the implementation of programs and plans regarding environment and forestry. The MoEF deals with all national environmental matters and is responsible for the prevention and control of pollution, forestation and regeneration of degraded areas and protection of the environment, and in the framework of legislations. MoEF also undertakes surveys, impact assessment, pollution control, research, and collection and dissemination of environmental information, as well as environmental awareness among all sectors in Bangladesh.

21. Under the MoEF is the Department of Environment (DoE), which performs regulatory functions. DoE was created in 1989 as the primary government agency responsible for enforcing environmental management regulations to ensure sustainable development and to conserve and manage the environment. The DoE ensures the consistent application of environmental rules and regulations, and provides guidance, training and promotional campaign on improving environmental awareness.

2.2 National environmental regulations

22. The main environmental regulations in Bangladesh are the Environment Conservation Act (ECA) 1995 (amended 2000, 2002, 2007 and 2010) and Environment Conservation Rules (ECR) 1997. ECA 1995 provides the requirements on environmental protection, improvement of environmental standards, and control and abatement of environmental pollution. Through the ECA 1995, the DoE is mandated to undertake any activity needed to conserve and enhance the quality of environment and to control, prevent and mitigate pollution.

23. ECR 1997 provides for the declaration of ecologically-critical areas, categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects. Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc.; (ii) the requirement for and procedures to obtain environmental clearance, and (iii) the requirement for the IEE and the EIA based on categories of industrial and other development interventions. ECA 1995 and ECR 1997 outline the regulatory mechanism to protect the environment in Bangladesh. Aside from ECA 1995 and ECR 1997, **Table 2.1** presents a summary of relevant environmental regulations.

Table 2.1: Relevant national environmental regulations

Regulation	Brief Description	Remarks
Environment Court Act 2000 (amended in 2002 and 2010)	This Act is under the Judiciary and MoEF to ensure the resolution of disputes on environmental and social damages resulting from any development activities. This Act also allows for the completion of environment-related legal proceedings effectively.	NWPGCL will ensure that all potential environmental complaints will be dealt with effectively at the project level through the PMU. SPS 2009 requires setting up of a grievance redress mechanism for projects known to cause potential environmental impacts.
Bangladesh Water	Makes provisions for integrated	Component 3 will cross three major

Regulation	Brief Description	Remarks
Act 2013	development, management, abstraction, distribution, use, protection and conservation of water resources	rivers: Bhairab River, Atai River, and Rupsha River and NWPGL will ensure compliance of this Act.
Vehicle Act 1927, the Motor Vehicles Ordinance 1983	These are under the Bangladesh Road Transport Authority (BRTA) which regulates vehicular emissions and noise including road safety.	This regulation will be complied with by vehicles that may be used during construction and operation of Component 3.
Factories Act 1965 and Bangladesh Labour 2006, Bangladesh Labor Act 2013	Regulations that aim to protect the interests and rights of the workers and to ensure their safety.	Workers recruited under Component 3 will be provided with PPE (if needed) and will comply with these regulations. No worker under 18 years old will be recruited.
The Forest Act 1927 (amended in 1982 and 1989)	This Act under the MoEF aims to protect the forest resources.	Component 3 will not traverse protected forest area or other forest type.
Telegraph Act 1885	Under the Ministry of Posts and Telecommunications, this provides power to the Telegraph Authority to alter position of gas or water pipes or drain (Sect. 14, a and b).	The route for Component 3 was selected considering this Act.
Electricity Act 1910	Relates to the supply and use of electrical energy, allows any person to secure a license to supply energy and to put down or place electrical supply lines for the transmission of energy. Sect 19(1) of the Act provides that the licensee, in the exercise of any of the powers conferred by or under this Act, will cause as little damage, detriment and inconvenience as may be, and will make full compensation for any damage, detriment or inconvenience caused by the licensee or by any one employed by the licensee.	Component 3 referred to the applicable provisions in this Act.
The Antiquities Act 1968 (amended 1976)	Regulation on the preservation and protection of antiquities.	NWPGCL will have a "chance find" procedures (see Annex 5).
Natural Water Bodies Protection Act 2000	According to this Act, the character of water bodies i.e. rivers, canals, tanks, or floodplains identified as water bodies in the master plans or in the master plans formulated under the laws establishing the municipalities in division and district towns shall not be changed without approval of concerned ministry. This Act is under the Rajdhani Unnayan Kartipakkha/Town Development Authority/Municipalities.	Any part of Component 3 that will cross rivers, ponds, canals, and drainage channels will refer to this Act and will secure the required approval and clearances.
Wildlife (Protection and Safety) Act 2012	Provides for the conservation and safety of biodiversity, forest and wildlife of the country by repealing the existing law relating to conservation and management of wildlife of Bangladesh. Under this Act, hunting, trapping, killing of wildlife are strictly prohibited.	Component 3 will not affect areas of habitats known to host wildlife. Route is along urban areas.
Noise Pollution	Provides guidelines on receptor areas:	Associated noise-generating

Regulation	Brief Description	Remarks
Control Rules 2000 (amended 2006)	silent, residential, mixed, commercial or industrial, and sets the limits to noise levels based on receptor areas. Defines daytime hours as 6AM to 9PM and nighttime from 9PM to 6AM.	activities of Component 3 will comply with the limits.
National River Protection Act 2013	Creation of National River Protection Commission to manage and control water and environmental pollution, etc., and ensure socio-economic development of a multi-use and rational use of natural resources.	Component 3 will ensure compliance to relevant provisions of this Act
The Protection and Conservation of Fish Act 1950 (amended 1973, 1982, 1995, 2002)	Provides for the requirements for the protection and conservation of fish. This Act defines fish as “all cartilaginous, bony fishes, prawn, shrimp, amphibians, tortoise, turtles, crustacean animals, molluscs, echinoderms and frogs at all stages in their life history.”	Component 3 will cross Bhairab River, Rupsha River, and Atai River and will ensure that no protected fish species under this Act will be destroyed or affected. Any potential impact will be mitigated.

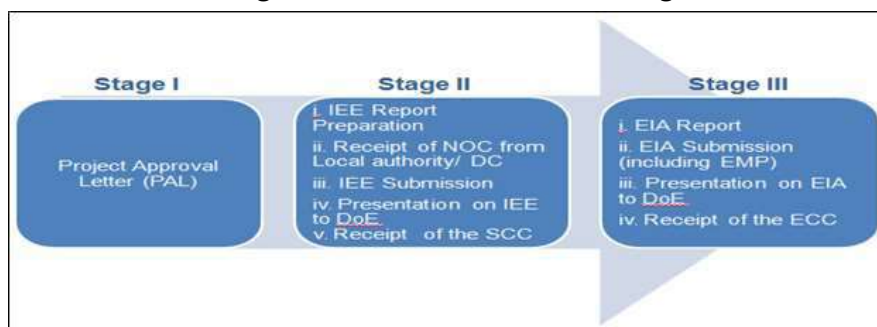
Source: ADB Consultant, November 2017

2.3 Overview of the environmental approval process

24. Section 12 of ECA 1995 provides that no industrial unit or project can be established or undertaken without securing an environmental clearance certificate (ECC) from the DoE. Following the requirements of ECR 1997, the DOE has classified various development interventions according to the potential adverse environmental impacts for the purpose of issuing the ECC. This classification includes: (i) green, (ii) orange-A, (iii) orange-B, and (iv) red. Green category refers to industries or projects considered to be relatively pollution-free, thus, no environmental study will be required while the Red category refers to industries/projects which may cause significant adverse environmental impacts and therefore, require an EIA.

25. For projects and industrial units classified as Orange-A, Orange-B, and Red (those that may have potential adverse environmental impacts), securing the ECC involves two steps: (i) issuance of site clearance certificate (SCC), and then (ii) the ECC.

26. SCC will be issued by the DoE upon approval of the IEE, receipt of the No Objection Certificate (NOC), which a “proof of authorization” to initiate a project, and the ToR of the EIA while the ECC will be issued upon the approval of the EIA. The project proponent cannot open line of credit in favor of importable machineries and cannot start any physical activities for the project without the EIA approved by the DoE. **Figure 2.1** shows the process of obtaining the ECC for Red category project.

Figure 2.1: Process of obtaining ECC

2.3.1 National environmental requirements for Component 3

27. According to ECR 1997, Component 3 is Red category requiring an SCC and an ECC. The NOC from the local government, Aviation Authority, and the Department of Forest have been obtained. On 5 November 2017, NWPGL has obtained for Component 3 the exemption from the DoE for submitting an IEE and approval of the ToR of the EIA (DoE/Clearance/5669/2016/549).

2.4 Relevant International Environmental Agreements

28. **Table 2.2** lists the applicable international environmental agreements where Bangladesh is a signatory which can provide guidance during the implementation of Component 3.

Table 2.2: Relevant international environmental agreements

International Environmental Agreement	Description	Date Ratified	Date Entered into Force	Comments
Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris 1972)	Defines and provides for the conservation of world's heritage by listing the natural and cultural sites whose value should be preserved.	3 November 1983	23 November 1972	Component 3 will have "chance find" procedures
Convention on Biological Diversity (1992)	A framework for biodiversity and requires signatories to develop national strategies (National Biodiversity Strategy and Action Plan) for the conservation and sustainable use of biological diversity.	3 May 1994	29 December 1993	Any replacement of cleared vegetation resulting from Component 3 will be consistent with the objectives and priorities of the current Action Plan.
Convention on International Trade in Endangered	Addresses the exploitation patterns and overharvesting	20 November 1981	1 July 1975	Component 3 will ensure that it will not cause any harvesting

International Environmental Agreement	Description	Date Ratified	Date Entered into Force	Comments
Species of Wild Fauna and Flora (Washington 1973) – also known as CITES	that threaten species of flora and fauna. Under this Convention, the governments agree to restrict or regulate trade in species that are threatened by unsustainable patterns and to protect certain endangered species from overexploitation by means of a system of import/export permits.			and exploitation of wild flora and fauna during implementation.
Vienna Convention for the Protection of the Ozone Layer	A framework for efforts to protect the globe's ozone layer by means of systematic observations, research and information exchange on the effects of human activities on the ozone layer and to adopt legislative or administrative measures against activities likely to have adverse effects on the ozone layer.	2 August 1990	22 March 1985	Component 3 will not use chemicals that can affect the ozone layer like methyl chloroform, a solvent generally used for industrial processes.
Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer)	Designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.	2 August 1990	1 January 1989	Component 3 will not use chemicals that can cause harm to the ozone layer.
Kyoto Protocol (1997)	Commits its Parties to set internationally-binding emission reduction targets. This agreement is linked to the United Nations Framework	22 October 2001	16 February 2005	Component 3 will ensure zero or minimal fugitive natural gas emissions.

International Environmental Agreement	Description	Date Ratified	Date Entered into Force	Comments
	Convention on Climate Change (UNFCCC).			
UNFCCC (1992)	Aims to achieve stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level low enough to prevent dangerous anthropogenic interference with the climate system.	15 April 1994	21 March 1994	Component 3 will ensure any operation related to its implementation will comply with this agreement.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)	Aims to reduce the amount of waste produced by signatories and regulate the international traffic in hazardous wastes.	1 April 1993	5 May 1992	Component 3 will ensure that disposal of chemicals used (if and when needed) will follow the instructions in the material data safety sheet.

Source: ADB Consultant, November 2017

2.5 Environmental requirements of ADB and IsDB

29. SPS 2009 of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects. The IsDB is still in the process of preparing its Statement on Environmental and Social Safeguards Principles, and Commitments to Environmental and Social Responsibility.⁸ Given this, ADB and IsDB agreed to adopt SPS 2009 as the unified approach to documentation, consultation, and disclosure requirements to be complied by NWPGL for this project.

2.5.1 ADB

30. SPS 2009 consists of three key safeguard areas, (i) environment, (ii) involuntary resettlement, and (iii) indigenous peoples; aims to avoid adverse project impacts to both the environment and the affected people; minimize, mitigate and/or compensate for adverse project impacts; and help Borrowers to strengthen their safeguard systems and to develop their capacity in managing the environmental and social risks.

31. During the project identification stage, ADB uses a categorization system to indicate the significance of potential environmental impacts and is determined by the category of its most environmentally-sensitive component, including direct, indirect, cumulative, and induced impacts

⁸ IDB. Statement by Dr. Ahmad Mohamed Ali, President, IDB. United Nations Conference on Sustainable Development (Rio +20), 20-22 June 2012.

http://www.isdb.org/irj/go/km/docs/documents/IDBDevelopments/Internet/English/IDB/CM/About%20IDB/President%20IDB%20Group/PS_UN_ConferenceSustainableDevelopment_20June2012.pdf. (Accessed 6 December 2017)

within the project's area of influence. The project categorization system and the assessment required is described in **Table 2.3**.

Table 2.3: SPS 2009 environmental categorization

Category	Definition	Assessment Requirement
A	Likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works.	Environmental impact assessment (EIA)
B	Likely to have adverse environmental impacts that are less adverse than those of Category A. Impacts are site-specific, few if any of them irreversible, and in most cases mitigation measures can be designed more readily than Category A.	Initial Environmental Examination (IEE)
C	Likely to have minimal or no adverse environmental impacts.	No environmental assessment is required but the environmental implications of the project will be reviewed.
FI	Project involves investment of ADB funds to or through a financial intermediary (FI).	FIs will be required to establish an environmental and social management commensurate with the nature and risks of the FI's likely future portfolio to be maintained as part of the FI's overall management system.

Source: ADB. Safeguard Policy Statement 2009, p. 19. <http://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf>.

2.5.1.1 Environmental requirements of ADB for Component 3

32. Based on SPS 2009, Component 3 is category A given that it is an auxiliary part of the Rupsha 800 MW CAPP. The EIA of Component 3 is referred to in the overall project environmental assessment as Volume 3. This draft EIA was based on the findings of CEGIS and additional research for available secondary data to meet SPS 2009. Aside from this draft EIA, the NWPGL will provide ADB with a copy of the ECC issued by the DoE for Component 3.

2.5.1.2 Disclosure requirements

33. Aside from SPS 2009, the Public Communications Policy (PCP) 2011 provides for the requirements of disclosure for project information of projects and grants funded by ADB. Consistent with SPS 2009, PCP 2011 requires the disclosure of documents submitted by the borrower and/or client:

- (i) a draft EIA report for category A project, at least 120 days before Board consideration;
- (ii) a draft EARF, where applicable, before appraisal;⁹
- (iii) the final EIA or IEE, upon receipt by ADB;

⁹ If no further mission for appraisal is required, the document will be posted before the management review meeting or the first staff review meeting for sovereign projects, or before the final investment committee meeting for non-sovereign projects, as applicable (ADB procedures).

- (iv) a new or updated EIA or IEE, and a corrective action plan, if any, prepared during project implementation, upon receipt by ADB; and,
- (v) the environmental monitoring reports, upon receipt by ADB.

34. To meet the disclosure requirements of ADB, the EIA of Component 3 will be disclosed to ADB website at least 120 days prior to Board consideration of the project by ADB Management.

2.5.2 IsDB

35. On 8 December 1974, the IsDB was created as an international financial institution in accordance with the Articles of Agreement signed and ratified by all member countries done in the City of Jeddah, Kingdom of Saudi Arabia.¹⁰ Consisting of 57 member countries in Africa, Asia, Europe, and Latin America, IsDB aims to foster the economic development and social progress in its member countries, and Muslim communities in non-member countries. Among others, IsDB is already a key player in the clean energy sector, with investments of around \$ 1 billion between 2010 and 2012.¹¹ Since inception, IsDB has funded about \$2.75 billion in renewable energy projects and has allocated 6% of its operation to climate change mitigating projects.¹²

36. During the projects' appraisal/negotiations stage in the IsDB's project cycle, activities cover the review and assessment of the following major aspects of a project: technical, institutional, economic, financial, social, and environmental impact.

37. IsDB is ADB's third-largest multilateral partner for project cofinancing since December 2015 and has signed a framework cofinancing agreement in September 2008 and was extended until 2017.¹³

2.6 Comparison of environmental safeguard principles between ADB and Bangladesh

38. **Table 2.4** presents a summary comparing the environmental safeguard principles of ADB and the Government of Bangladesh (GoB).

Table 2.4: Comparison of environmental safeguard principles

SPS 2009			GoB	Gaps (if any)
No.	Principles	Delivery Process		
1	Use of screening process to determine the appropriate environmental assessment	Uses sector-specific rapid environmental assessment checklist for screening and assigns categories based on potential impacts: <ul style="list-style-type: none"> • A - EIA required (irreversible, diverse or unprecedented 	ECA 1995 and ECR 1997 set screening criteria to classify industries/projects based on potential environmental impacts as follows: Green (pollution-free), Orange-A, Orange-B and Red (cause	No major gaps

¹⁰ Islamic Development Bank, About IsDB.

<http://www.isdb.org/irj/portal/anonymous?NavigationTarget=navurl://24de0d5f10da906da85e96ac356b7af0>

¹¹ UN Environment. UNEP and Islamic Development Bank Sign Agreement on Environmental Conservation. 20 January 2016. <http://web.unep.org/newscentre/unep-and-islamic-development-bank-sign-agreement-environmental-conservation>. (Accessed 6 December 2017)

¹² IsDB. What do Islamic Bank Care About the Environment: Role of Islamic Development Bank in Financing Sustainable Development. 6 March 2017.

¹³ Asian Development Bank-Islamic Development Bank Partnership and Cofinancing Guide. 2016

SPS 2009			GoB	Gaps (if any)
No.	Principles	Delivery Process		
		adverse environmental impacts) <ul style="list-style-type: none"> • B - IEE required • C - no environmental assessment required but a review of environmental implications • FI - ESMS required 	significant environmental impacts). The screening criteria is based on project or industry type and do not consider the scale and location. The category determines the level of environmental assessment.	
2	Conduct an environmental assessment	<ul style="list-style-type: none"> • EIA and IEE - Identify potential impacts on physical, biological, physical cultural resources, and socioeconomic aspects in the context of project's area of influence (i.e., primary project site and facilities, and associated facilities) • ESMS for FIs 	<ul style="list-style-type: none"> • Industry/project category • Green- no environmental assessment required • Orange A - no IEE or EIA required but must provide process flow, lay-out showing effluent treatment plant, etc. • Orange B - IEE required • Red - both IEE and EIA are required 	No major gaps
3	Examine alternatives	<ul style="list-style-type: none"> • Analyze alternatives to the project's location, design, and technology • Document rationale for selecting the particular project location, design, and technology • Consider "no project" alternative 	<ul style="list-style-type: none"> • Regulations (i.e., ECA 1995 and ECR 1997) do not require specifically the identification and analysis of alternatives 	Not required by law but the ToR for EIA to be approved by the DoE now includes a discussion on analysis of alternatives.
4	Prepare an environmental management plan (EMP)	<ul style="list-style-type: none"> • EMP to include monitoring, budget and implementation arrangements 	<ul style="list-style-type: none"> • EMP and procedures for monitoring included in the IEE and EIA (i.e., Orange-A, Orange-B, and Red category projects) 	No major gaps
5	Carry out meaningful consultation	<ul style="list-style-type: none"> • Starts early and continues during implementation • Undertaken in an atmosphere free of intimidation • Gender inclusive and responsive • Tailored to the needs of vulnerable groups • Allows for the incorporation of all relevant views of stakeholders • Establish a grievance redress mechanism 	<ul style="list-style-type: none"> • Public consultation and participation are not mandatory based on ECA 1995 and ECR 1997 • Grievance redress mechanism is not mentioned in ECA 1995 and ECR 1997 • EIA format required by DoE includes stakeholders' consultation 	Approval of the ToR of EIA by DoE now includes consultation with stakeholders.
6	Timely disclosure of draft environmental assessment (including the EMP)	<ul style="list-style-type: none"> • Draft EIA report posted on ADB website at least 120 days prior to Board consideration • Draft EA/EARF prior to appraisal • Final or updated EIA/IEE upon receipt • Environmental monitoring 	<ul style="list-style-type: none"> • No requirement for public disclosure of environmental reports but DoE posts the Minutes of the Meeting on the application for environmental clearance certificate to its website, http://www.doe- 	Still no requirement for public disclosure of environmental assessment

SPS 2009			GoB	Gaps (if any)
No.	Principles	Delivery Process		
		report submitted by borrowers upon receipt	bd.org/minutes.php	
7	Implement EMP and monitor effectiveness	<ul style="list-style-type: none"> • Prepare monitoring reports on the progress of EMP • Retain qualified and experienced external experts or NGOs to verify monitoring information for Category A projects • Prepare and implement corrective action plan if non-compliance is identified • Requires submission of quarterly, semi-annual, and annual reports to ADB for review 	<ul style="list-style-type: none"> • ECC is subject to annual renewal based on compliance of the conditions set by DoE 	No major gaps
8	Avoid areas of critical habitats (use of precautionary approach to the use, development and management of renewable natural resources)	Provides guidance on critical habitats	<ul style="list-style-type: none"> • ECA 1995 and ECR 1997 identifies ecologically-critical areas and the rules to protect them 	No major gaps
9	Use pollution prevention and control technologies and practices consistent with international good practices	<ul style="list-style-type: none"> • Refers to World Bank's Environmental Health and Safety (EHS) General Guidelines 2007 (or any update) • If national regulations differ, more stringent will be followed • If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification 	<ul style="list-style-type: none"> • Effluent standards, ambient and emission standards included in ECA 1995 and ECR 1997 • Ambient noise levels included in Noise Pollution Control Rules 2006 	No major gaps
10	Provide workers with safe and healthy working conditions	<ul style="list-style-type: none"> • Refers to WB EHS General Guidelines 2007 (or any update) 	<ul style="list-style-type: none"> • Occupational health and safety standards included in the Factories Act 1965, the Bangladesh Labour Law 2006, and the Bangladesh Labor Act 2013. 	No major gaps
11	Conserve physical cultural resources (PCR) and avoid destroying or damaging them	<ul style="list-style-type: none"> • Use of field-based surveys and experts in the assessment • Consult affected communities on PCR findings • Use chance find procedures for guidance 	<ul style="list-style-type: none"> • Preservation and protection of cultural resources are within the Antiquities Act 1968. 	No major gaps

Source: ADB Environmental Consultant, November 2017

3.0 DESCRIPTION OF THE PROJECT

3.1 Background

39. Component 3 will consist of the power transmission interconnection from the new substation within the Rupsha 800 MW CCPP complex in Khalishpur to the existing Khulna South Substation (SS) located in the outskirts of Khulna City. Power Grid Company of Bangladesh (PGCB) will provide the technical support to NWPGL for Component 3.

3. Occupying an area of 12.96 acres, the Khulna South SS is part of the West Zone Power System Development Project funded by ADB and the Nordic Development Fund and was commissioned on 29 January 2007. The 4.7 km stringing is part of the 24-km four circuit 230 kV Mongla to Khulna South SS transmission line project of PGCB which was funded by GoB. The 230 kV transmission line from Mongla to Khulna South SS has completed the requirements of ECR 1997 by the DoE for red category project. Together, these transmission lines form part of the power evacuation interconnection facilities in southwestern Bangladesh.

40. Electricity generated in the Rupsha 800 MW CCPP will be stepped-up to the transmission voltage of 230 kilovolt (kV). A new transmission line of about 29.3 km will be built from Rupsha 800 MW CCPP to the existing Khulna SS. The conductor to be used is twin-ACCC Hamburg¹⁴, and the line will have two circuits, each capable of transferring 1,400 MW. The new transmission line will require three main river crossings and three minor river crossings and will traverse mostly through rice fields. Upon reaching the existing Khulna SS, the line will be terminated at two new line bays and termination equipment to be installed under the project. Thereafter, electricity produced at Rupsha 800 MW CCPP will flow into the 230 kV transmission network to serve the electricity demand in Khulna and elsewhere in the country. **Figure 3.1** presents the location of Component 3.

Figure 3.1: Location map of Component 3



¹⁴ Aluminium Conductor Composite Core (ACCC) Hamburg has a current carrying capability of 1440 ampere at 120°C.

3.2 Features of Component 3

41. Component 3 will involve the construction of about 29.3 km, 230 kV double circuit overhead transmission line (24.561 km new transmission line and 4.7 km stringing) from the new switchyard of Rupsha 800 MW CCPP to the existing Khulna SS.

42. A total of 75 transmission towers will be installed consisting of 25 angle towers, 48 suspension towers, and 2 terminal towers. The base of a transmission tower will require about 400 m² (20 m x 20 m). The 4.7 km transmission line will involve stringing to make it double circuit from Khulna SS to Mongla transmission line.

3.2.1 Physical Features of the transmission line

43. Physical features of the 230 kV overhead transmission line (OHTL) is given in Table 3.1. OHTL will be double circuit and conductor materials will be made of aluminum alloy. Transmission towers to support the OHTL will be made of steel and of two types: (i) tension, and (ii) suspension. Tension towers will be installed in angles and suspension towers (see Figure 3.2) will be installed along the line as load bearing support. Disc type insulator will be used in the poles to bear the wire (Figure 3.3).

Table 3.1: Physical Features of 230 kV transmission line

Physical Features	Attribute
Voltage Rating	230 kV
Type of Transmission Line (T/L)	Double circuit
Width of T/L Right of Way (RoW)	100 meters (40 m left + 20m DIA + 40 m right)
Type of Line Support	Steel 230 kV lattice Towers
Conductor Material	ACSR Mallard
Line Insulator	Disc type, Porcelain
Type of Connection	230 kV substation from the Rupsha 800 MW CCPP in Khalispur (Khulna) to the existing 230/132 kV Khulna South (Khulna)

Source: PGCB, 2016

Figure 3.2: Type of transmission tower



Figure 3.3: Disc insulators for transmission line



3.3 Project Activities

44. The construction activities associated with Component 3 will include the installation of transmission towers and stringing of conductors along the 24.561 km, 230 kV transmission line, stringing of 4.7 km, 230 kV transmission line, and construction of a new 230 kV substation within the Rupsha 800 MW CCPP in Khaliaspur, Khulna. Some activities include the following:

3.3.1 Construction phase

3.3.1.1 Civil works

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

46. *Excavation.* After completion of piling work, the top soil of the piles will be excavated up to a specified depth using excavators.

47. *Pile cap casting.* At the finishing of excavation, top and bottom reinforcements will be placed the concreting of pile cap will be performed. The pile cap transfers load to the subsoil through the piles.

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

49. **Figure 3.4** shows the associated civil works.

Figure 3.4: Associated civil works in transmission line



placing of steel ring bunds



tower piling works



pile cap reinforcement



Casting CC into tower foundation



Placing tower on its foundation



Tower erection work

3.3.1.2 Electrical works

50. Installation of equipment will include circuit breakers, transformers, lightning arresters, panel boards, batteries and battery charger insulators, current transformer, potential transformers, etc. Figure 3.5 shows some associated electrical works.

51. After completion of the building, all equipment will be installed at the substation as per design specification and standard. For Component 3, substation materials may be procured from foreign countries. Local materials like bricks, sand, cement, rods, etc. will be used for the installation works.

52. Transformers are heavy equipment and its transportation may require grading of river embankment along Bhairab River, Atai River and Rupsha River, and skidding through open field. Compensation to damages will be provided to the land owners.

Erection of Tower. The towers will be constructed to take the load of the tower, conductors, accessories as well as wind load and earthquake load. The towers in paddy fields will have proper clearance to maintain sag (lowest point on line). At homesteads, if any, the sag will be above the canopy.

Drawing of OHTL. The transmission line will be drawn keeping suitable clearance at all locations. The lowest sag point will be considered in drawing stringing.

53. **Testing and commissioning of equipment.** Once all the equipment have been installed, they will be tested according to specifications and standards of GoB and international industry requirements. After successful completion of these tests, the OHTL and substation will be commissioned.

Figure 3.5: Associated electrical works



Welding of reinforcement



Tower erection works



Conductor stringing

3.3.2 Operation phase

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

55. Except for vegetation management on the RoW, OHTL requires very little intervention during normal operation. The RoW allows for safety margin between the OHTL and the surrounding structures and vegetation. The RoW also provides a space for ground inspections and repairs, if needed. Other activities during operation phase are training and preparedness during emergency and disaster by NWPGCL staff who will be involved in the O&M of Component 3 including the orientation to emergency restoration system (ERS). ERS will be used for early restoration in the event of natural disasters or other emergencies.

4.0 DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

4.1 Project's Area of Influence – Component 3

56. The area will cover the new substation from the Rupsha 800 MW CCPP, the 230 kV transmission line route and right-of-way (RoW) until the end of connection to Khulna SS of PGCB. This area is where the potential impacts of Component 3 may be expected. A 20 m RoW from the transmission line (i.e., 10 m each side from the alignment) has been defined as the direct impact area (DIA) and a 40m buffer along both sides (i.e., 40 m+40m = 80m) of the power transmission line has been considered as the general impact area (GIA). Thus, a total of 100 m RoW was considered in describing the existing environment.

57. Component 3 will be about 29.3 km (24.561 km new construction and 4.7 km stringing), 230 kV overhead double circuit transmission line (OHTL) from the switch yard of Rupsha 800 MW CCPP in Khalishpur to the existing Khulna SS.

4.2 Physical environment

58. The description of the physical environment was based on secondary data available from sources such as Bangladesh Geological Society (BGS), National Water Resources Database (NWRD), nearest station of Bangladesh Meteorological Department (BMD) located in Khulna, etc.

4.2.1 Physiography

59. Component 3 falls under two physiographic units. The northern part of the OHTL is aligned NNW to SSE and this part falls under the High Ganges River Floodplain physiographic unit while the southern part is aligned NNE to SSW within mostly under the Ganges Tidal Flood Plain physiographic unit and partly under High Ganges River Floodplain of Bangladesh. Generally, the Ganges River sediments are rich in easily weatherable minerals. Soil patterns of the Ganges Tidal Flood Plain are simpler than they are in river floodplains. The ground elevation of the area compared to mean sea level is very low, about two and half meters (2.5 m). The physiographic map of the project area is shown in **Figure 4.1**.

4.2.2 Seismicity

60. BGS has published an Earthquake Zoning Map of Bangladesh based on seismic intensity. They have divided the country into three zones depending on the seismic intensity as Zone I (High Risk), Zone II (Moderate Risk) and Zone III (Low Risk). **Figure 4.2** shows the seismic map of Bangladesh.

61. Component 3 lies within Zone III (Low Risk). The project area is the least vulnerable in terms of seismicity compared to the other parts of Bangladesh like Sylhet (Zone 1). While situated in the least vulnerable area on seismicity, Component 3 will be designed following the Bangladesh Building Code 2006 (or latest approved code). Historical record of major earthquakes from 1997 to 2016 originating in Bangladesh shows a magnitude in the Richter scale ranging from 4.2 to 5.6 and for the last 450 years, a maximum of about 8.8 in Chittagong-Arakan.

Figure 4.1: Physiographic map of Bangladesh

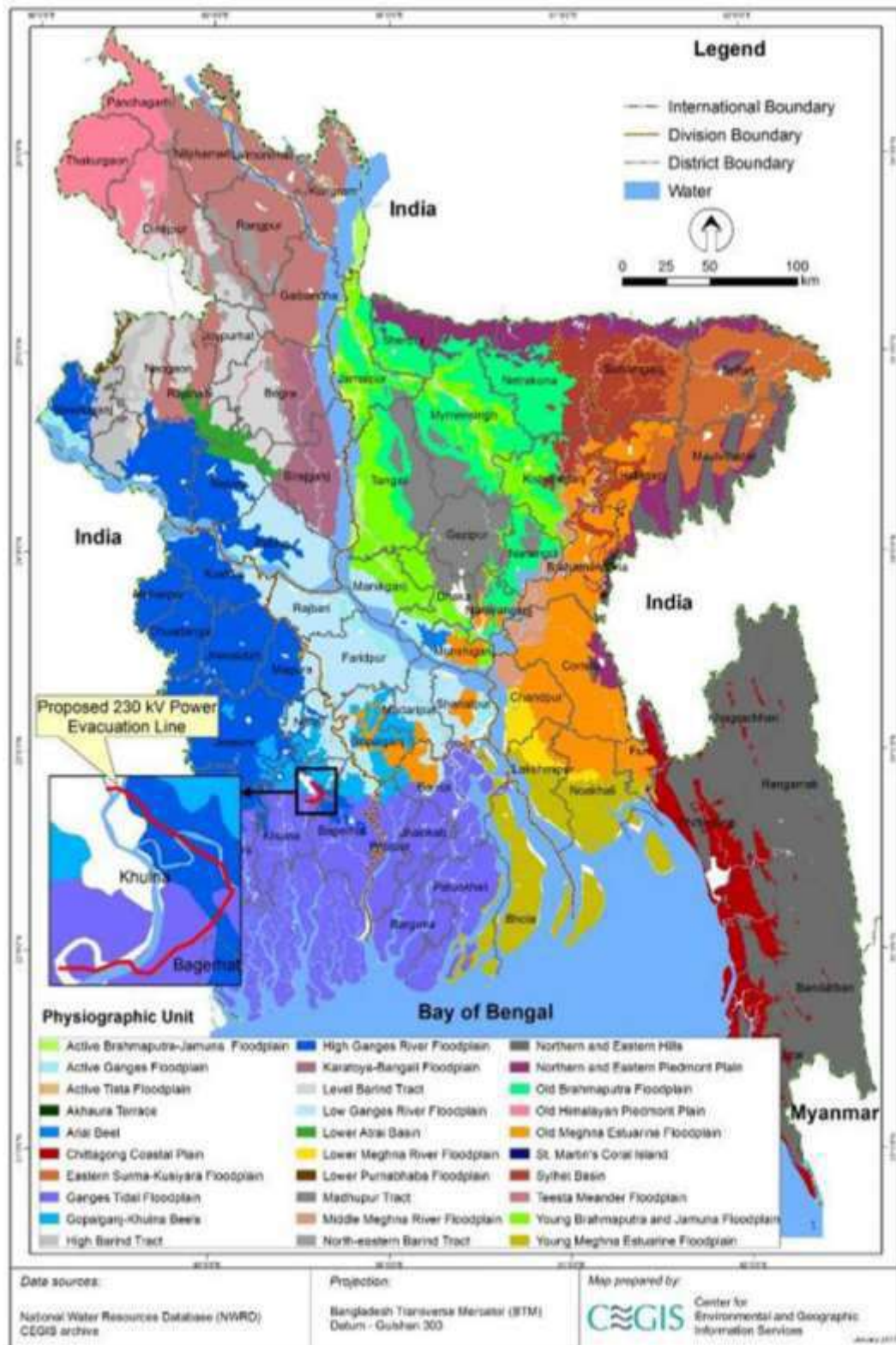


Figure 4.2: Seismic map of Bangladesh



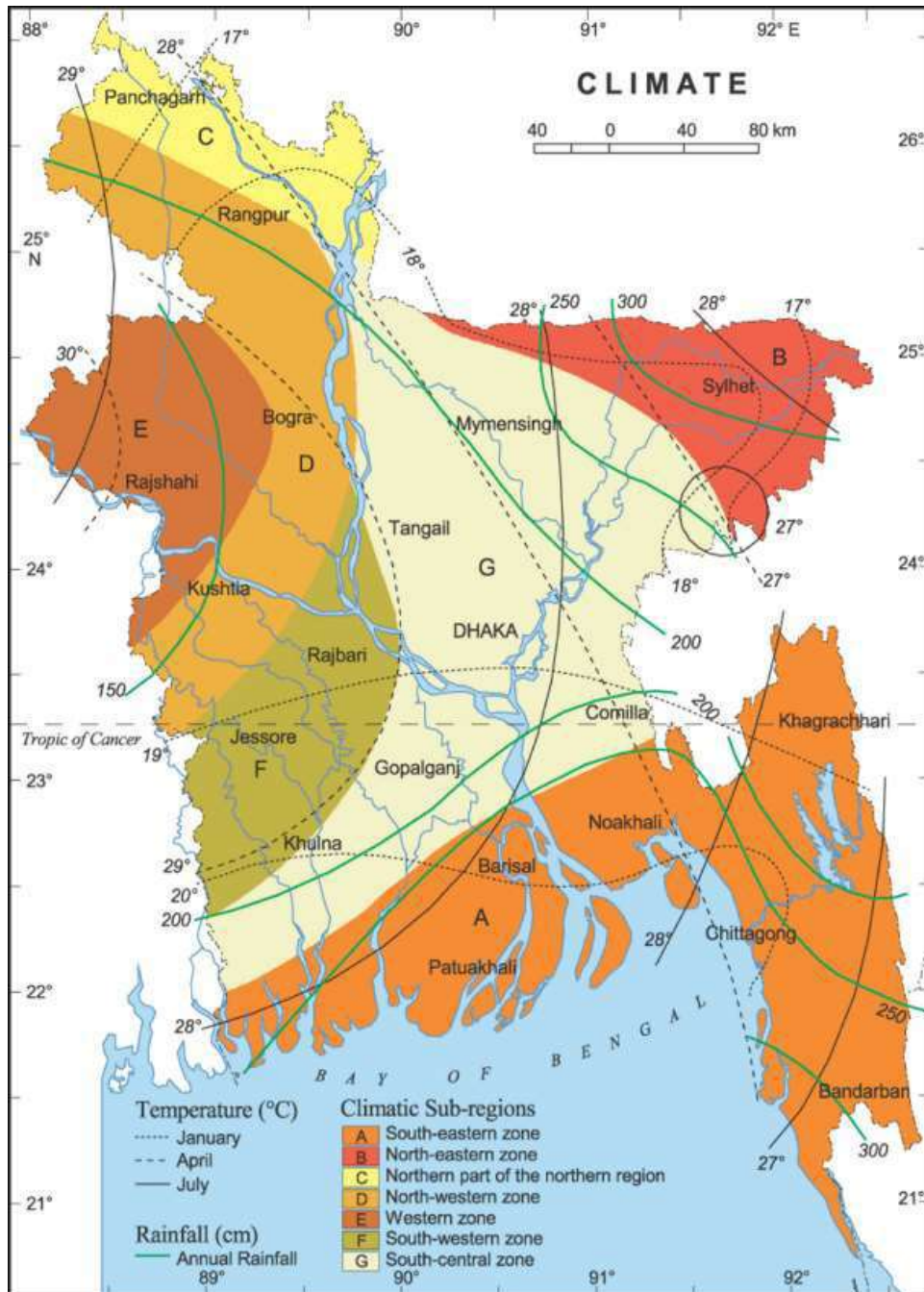
4.2.3 Climate

62. According to Köppen climate classification, Khulna division falls under Aw category which is characterized by tropical wet and dry climate.¹⁵ Khulna experiences hot and humid summer and dry winter. According to these climatic characteristics, Bangladesh is divided into seven different climatic sub-regions. Under these climatic sub-regions, Component 3 fall under category “G”, which is the south-central climatic sub-region of the country (Figure 4.3). In general, this zone receives abundant rainfall. This is a transitory zone between the South-

¹⁵ <https://en.climate-data.org/region/2263/>

eastern, North-western and South-western zones and most of the severe hail storms, nor'westers and tornadoes have been recorded in category G area.

Figure 4.3: Climatic sub-regions of Bangladesh



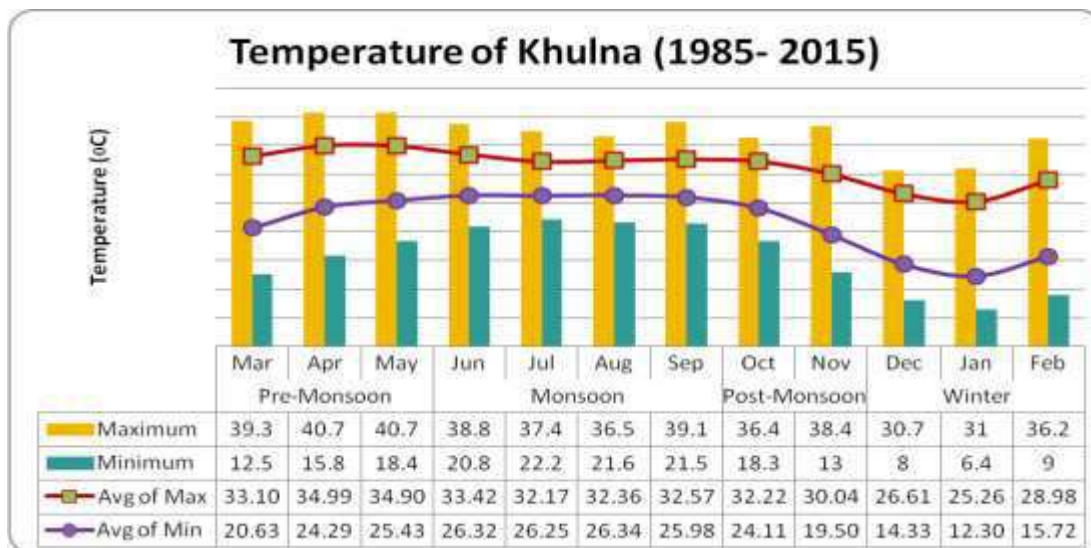
Source: ASB, 2006

Temperature

63. Based on the 30-year historical record from the BMD Khulna station (1985-2015) on temperature, monthly variation of maximum temperature is 30.7°C to 40.7°C, while the monthly

minimum temperature varies between 6.4°C to 22.2°C. The maximum temperature in Khulna station was 40.7°C recorded in 2014 while a minimum temperature of 6.4°C was recorded in 2003.

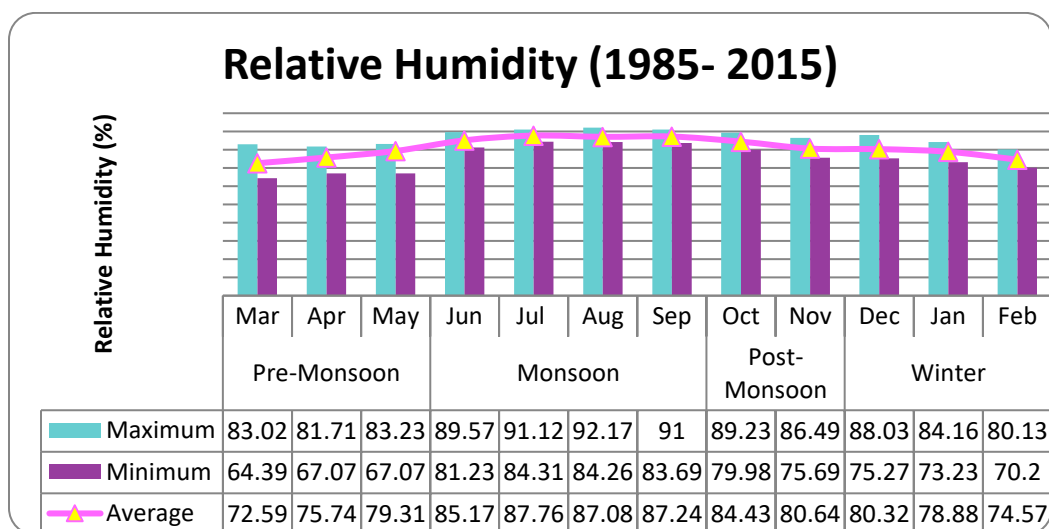
Figure 4.4: Monthly temperature variation at Khulna Station



Humidity

64. Humidity is directly related with temperature fluctuation of a region. The average humidity recorded at the Khulna station remains highest from June to October while the monthly variation of the average relative humidity is 87.76% to 72.59%. Monsoon (June to September) is the most humid months, whereas from winter season to pre-monsoon, i.e., December to May, the weather remains relatively dry. **Figure 4.5** shows the average humidity within the last 30 years.

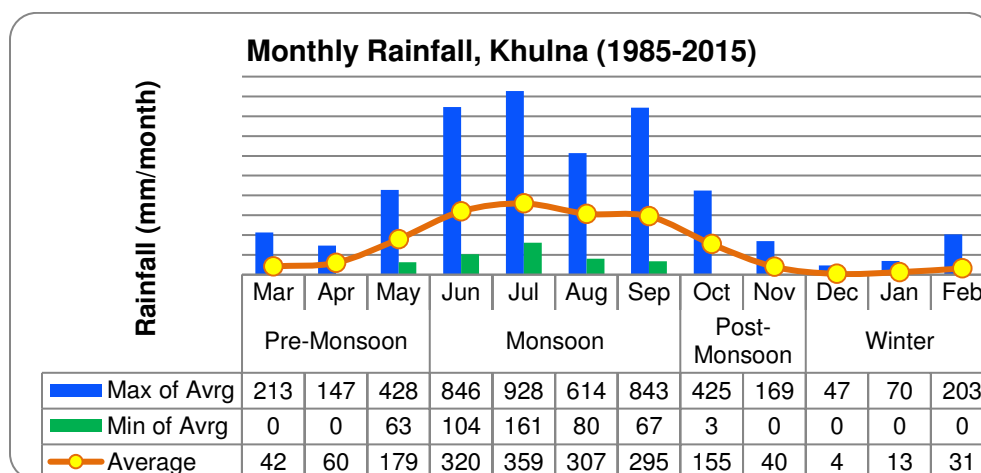
Figure 4.5: Seasonal Change of Relative Humidity at Khulna Station (1985-2015)



Rainfall

65. The average annual rainfall is recorded at 1,808 mm/yr. Monthly average maximum rainfall occurred in July (928 mm/month) and monthly average minimum rainfall recorded during winter season (see **Figure 4.6**). This suggests that the rainy season is very prominent in this region. The average monthly rainfall during monsoon in Khulna is 320 mm. Records show that the maximum rainfall during the monsoon season (June-September) ranges from 614mm/month to 928 mm/month while the minimum rainfall during the monsoon ranges from 67mm/month to 161mm/month. Winter from December to February is the driest season and the average winter rainfall is 16.14mm/month. The highest yearly rainfall was recorded in 2002 at 2,594 mm/year.

Figure 4.6: Change in Rainfall at Khulna station (1985-2015)



Windspeed and direction

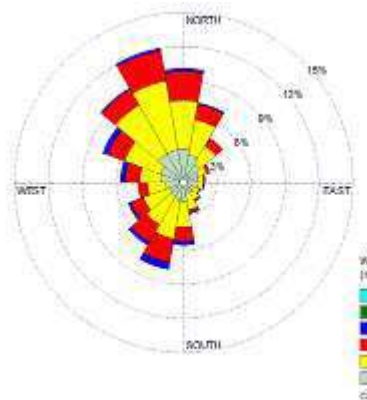
66. The maximum yearly windspeed recorded in Khulna station is 120.38 km/hr during 1997 and 2007.

67. The direction of wind varies depending on the seasons. The whole year has been categorized into four clusters of months and these are: Cluster 1: January-March, Cluster 2: April-June, Cluster 3: July to September, and Cluster 4: October to December. Wind speed data and direction have been obtained from the analysis of upper atmospheric data collected for last three years from Lakes Environmental, Canada.

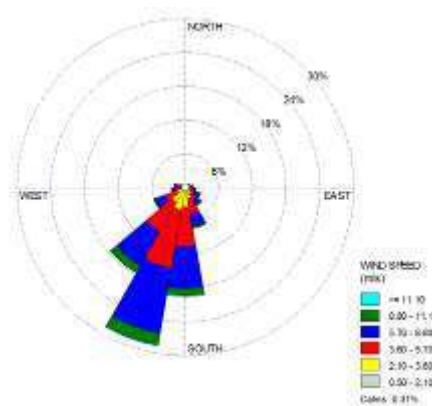
68. During Cluster 1 and Cluster 4 (a & b of **Figure 4.7**), wind direction is predominantly from north and northwest to southeast direction, and for Cluster 2 and Cluster 3 (c & d of **Figure 4.7**), it is predominantly from south and southwest to north and northeast. The annual wind rose diagrams of 8 and 36 directions (e & f of **Figure 4.7**) show the wind direction predominantly towards the northeast.

69. In Cluster 1, calm wind prevails for 1.52% of total period, similarly it is 0.31% for Cluster 2, 0.72% for Cluster 3, and 3.17% for Cluster 4. Calm wind prevails for 1.33% for annual 8-direction and 1.77% for annual 36-direction wind rose diagrams, respectively

Figure 4.7: Wind rose diagram



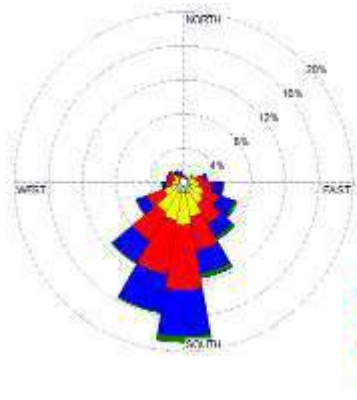
a)



(b)

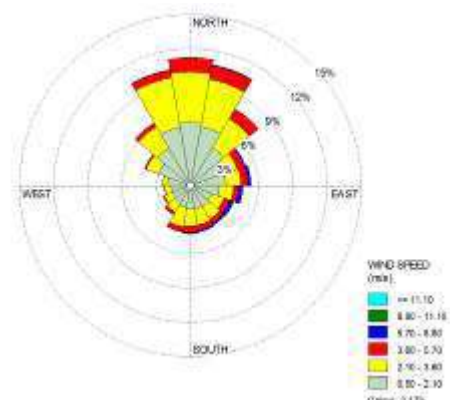
Cluster 1: Wind rose diagram for Jan-Mar

Cluster 2: Wind rose diagram for Apr-Jun



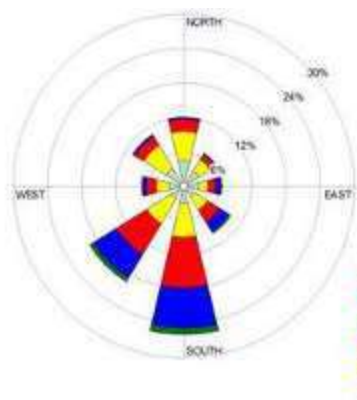
(c)

Cluster 3: Wind rose diagram for Jul-Sep



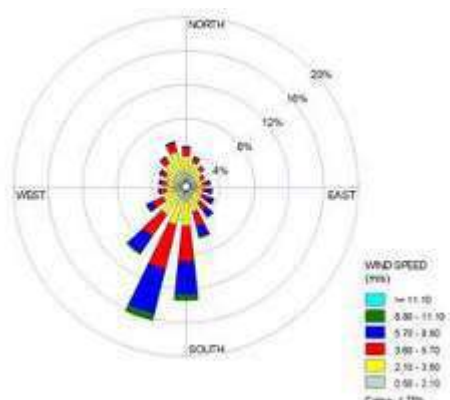
(d)

Cluster 4: Wind rose diagram for Oct-Dec



(e)

Annual wind rose diagram (8 directions)



(f)

Annual wind rose (36 directions)

4.2.3 Ambient air quality and noise

Ambient air quality

70. Ambient air quality is characterized by the presence of criteria pollutants. Major criteria pollutants are particulate matter (PM₁₀ and PM_{2.5}), NO₂, CO, SO₂ and ozone (O₃). The DoE has set the national ambient air quality standards for these pollutants in ECR, 2005. These standards aim to protect against adverse human health impacts.

71. Air pollution due to enhanced anthropogenic activities has become an important environmental concern in Bangladesh urban areas in view of its adverse health effects. In this connection, the criteria pollutants of eight major cities in Bangladesh are continuously monitored since November 2011 through the Clean Air and Sustainable Environment (CASE) Project of the DoE funded by the World Bank.¹⁶

72. Khulna is the third largest city in Bangladesh which has been remarked as industrial city. The population of the city, under the jurisdiction of the Metropolitan Area is 1,435,422 living in an area of about 59.6 km². It is one of the important industrial and commercial areas of the country. Mongla, the second seaport of Bangladesh situated on its outskirts, about 40 km south from Khulna City.

73. Khulna is located in south-western part of Bangladesh and on the banks of the Rupsha River and Bhairab River. Considering the importance of Khulna City, one continuous air monitoring stations (CAMS-9)¹⁷ has been established to monitor the criteria pollutants under the CASE Project. It is located in the Department of Social Forestry Office Campus at Baira, which is around 2.5 km from the Rupsha 800 MW CCPP. Ambient air quality data from CAMS-9 is used to describe the existing environment within the project area.

74. CASE project monitors the criteria pollutants such as CO, NO₂, O₃, SO₂, PM₁₀ and PM_{2.5}. Monitoring is performed to demonstrate attainment or non-attainment of national ambient air quality standards to assess the trends of air pollution levels. Results of ambient air quality monitored by CAMS-9 in 2013, 2014 and 2015 are given in **Table 4.1** while a comparison of ambient air quality standards is given in **Table 4.2**. Based on these results, the criteria pollutants of concern are PM₁₀ and PM_{2.5}.

Table 4.1: Ambient air quality results at Khulna CAMS Station

Criteria Pollutants	Standard Concentration (ECR 2005)		2013	2014	2015
	Period	µg /m ³	µg /m ³	µg /m ³	µg /m ³
Carbon Monoxide (CO)	8 Hr	10,000µg /m ³	1,790	1,020	550
	1 Hr	40,000 µg/m ³	1,590	860	460
Sulphur Dioxide (SO ₂)	24 Hr	365µg/m ³	16.7	12.1	31.4

¹⁶ Ministry of Environment and Forests, Clean Air and Sustainable Environment, http://case.doe.gov.bd/index.php?option=com_content&view=article&id=29&Itemid=7.

¹⁷ Located at latitude 22.83 N and longitude 89.53 E

Nitrogen Dioxide (NO ₂)	24 Hr	-	27.07	DNA	122.76
Particulate Matter (PM ₁₀)	24 Hr	150 µg/m ³	132	219	93.5
Particulate Matter (PM _{2.5})	24 Hr	65 µg/m ³	76.0	102	83.6

Table 4.2: Comparison of ambient air quality standards

Pollutant	Averaging Period	Bangladesh Standards ^a	WHO ^b Guideline Values (µg/m ³)	US EPA Standards (µg/m ³) ^d
CO	8-hour	10,000 µg/m ³ (9 ppm)	10,000 ^c	10,000
	1-hour	40,000 µg/m ³ (35 ppm)	30,000 ^c	40,000
Pb	Annual	0.5 µg/m ³	0.5	-
NO _x	Annual	100 µg/m ³ (0.053 ppm)	-	-
TSP	8-hour	200 µg/m ³	-	-
PM ₁₀	Annual	50 µg/m ³	20	revoked
	24-hour	150 µg/m ³	50	150
PM _{2.5}	Annual	15 µg/m ³	10	15
	24-hour	65 µg/m ³	25	35
O ₃	1-hour	235 µg/m ³ (0.12 ppm)	-	235
	8-hour	157 µg/m ³ (0.08 ppm)	100	157
SO ₂	Annual	80 µg/m ³ (0.03 ppm)	-	78
	24-hour	365 µg/m ³ (0.14 ppm)	20	365

CO = carbon monoxide; NO_x = nitrogen oxide; O₃ = ozone; Pb = lead; PM₁₀ = particulate matter with a diameter of not more than 10 microns; PM_{2.5} = particulate matter with a diameter of not more than 2.5 microns; SO₂ = sulfur dioxide; S.R.O. = US EPA = United States Environmental Protection Agency; TSP = total suspended particulates; WHO = World Health Organization; µg/m³ = micrograms per cubic meter; ppm = parts per million; - = no value. Sources: ^aS.R.O. No: 220-Law,2005; ^bWHO, 2005; ^cWHO, 2000; and ^dUS EPA, 2006.

Ambient noise level

75. Noise is generated in this area due to the movement of vehicles and vessels like bus, micro, auto, van, motorbike, trawler, engine boat, launch and other local machines which ply all day long. Noise Pollution Control Rules 2006 has specified noise level limits based on location sensitivity. Based on these rules, the area is considered as commercial area. Results of ambient noise level measurements indicate that daytime noise limits are met (**Table 4.3**). **Figure 4.8** shows the noise sampling stations.

Table 4.3: Results of ambient noise level measurements

21-23 December 2016

Sample ID	Location	GPS Coordinates	Day Time Monitoring Result	ECR, 2006 (Day)
			Leq (dBA)	Leq (dBA)
NL01	Sholpur Fisheries Community	N 22° 51' 6.9" E 89° 33' 31.5"	58.8	70
NL02	Sholpur Zugihati Govt. Primary School	N 22° 50' 28.5" E 89° 33' 35.7"	58.1	70
NL03	Abdoli turning point of Shener Bazaar and Easybike Stand	N 22° 50' 21.1" E 89° 34' 45.8"	76.1	100
NL04	Bottola Turning Point	N 22° 49' 25.8" E 89° 35' 28.9"	67.9	85
NL05	Fakirhat – Khulna Bypass Highway Road	N 22° 47' 40.9" E 89° 37' 31.6"	68.8	85

NL06	Mongla-Khulna Highway Road	N 22° 46' 51.4" E 89° 36' 56.3"	73.4	85
NL07	Jebusa village Road	N 22° 46' 15.9" E 89° 36' 7.5"	69.3	85
NL08	Putimari Bazaar, Lobonchora.	N 22° 45' 42.1" E 89° 33' 43.4"	60.2	85

Source: Field visit, CEGIS, December 21-23, 2016

Figure 4.8: Location of water and noise sampling stations

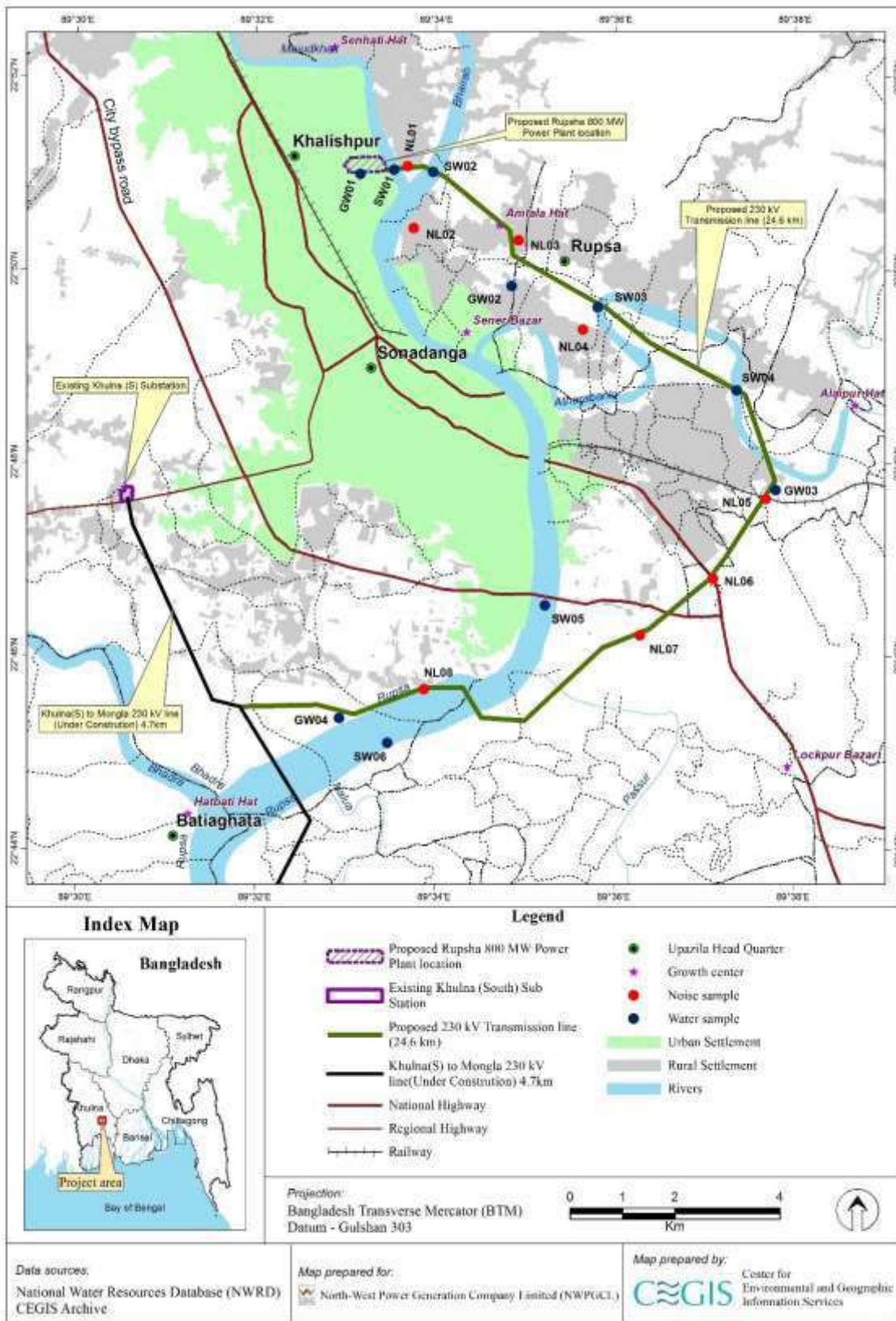


Figure 4.9: Noise Level Measuring Location

Figure 4.10; Noise Level Measuring Location

(In front of Putimari Bazaar, Lobonchora)



(Sholpur Zugihati Govt. Primary School)



4.3 Water Resources

4.3.1 Surface Water

76. Component 3 will cross three major rivers: Bhairab, Atai and Rupsha which are tidal in nature and the width of these rivers are 270m, 320m and 500m, respectively. The route along the stretch of the Bhairab River will be located downstream on the left river bank. There are no khals or channels along the right bank of the Bhairab River. The Bhairab River receives most of the wastewater discharges in Khulna City.

Surface Water Quality

77. Water quality test has been performed in and around the project area for both surface and ground water during pre-monsoon and monsoon period. In Situ tests for seven parameters of six surface water samples have been conducted following standard practice during field visit on 21 December 2016. The measured values of pH, DO, EC, TDS and Salinity are presented in **Table 4.4** (locations in **Figure 4.8**).

Table 4.4: In-situ surface water quality measurements (post-monsoon)

Sampling Station	Coordinates	pH	DO ppm	BOD ₅ at 20°C	TDS ppm	EC	Salinity (ppt)	Temperature (°C)
SW01	22°51'4.77"N 89°33'22.41"E	8.38	7.8	0.7	100	210	0	36
SW02	22°51'3.42"N 89°33'48.46"E	8.47	6.89	0.89	117	245	0	32
SW03	22°49'39.59"N 89°35'38.73"E	8.38	5.9	0.7	110	230	0	30
SW04	22°48'48.25"N 89°37'11.76"E	8.45	6.2	0.55	165	320	0	33
SW05	22°46'34.53"N 89°35'4.00"E	8.25	6.92	1.02	185	355	0	30
SW06	22°45'8.69"N 89°33'18.88"E	8.1	6.48	2.28	130	290	0	34
ECR 1997, Schedule 3 (assumed that river water usable for fisheries)		6.5-8.5	5 or higher	6 or less				20-30

Source: CEGIS study team, 21-23 December 2016.

78. The central laboratory of the Department of Public Health Engineering (DPHE) tested and analyzed the 18 parameters of surface water quality (**Table 4.5**). ECR 1997 does not include surface water quality standards.

Table 4.5: Results of surface water quality analyses

No.	Water Quality Parameters	Unit	SW 01	SW02	SW 03	SW04	SW05	SW06	Analysis Method	LOQ
01	Alkalinity	mg/L	120	123	125	103	153	125	Titrimetic	-
02	Arsenic	mg/L	0.002	0.002	0.002	0.002	0.002	0.002	AAS	0.001
03	Calcium	mg/L	18.68	16.77	15	15.5	16.6	13.6	AAS	0.17
04	COD	mg/L	40	48	20	20	16	32	CRM	-
05	Chloride	mg/L	18	16	20	17	18	16	Titrimetic	-
06	Silica	μS/cm	15.5	42.9	34	50	45	37	Multimeter	-
07	Hardness	mg/L	143	185	173	143	158	145	Titrimetic	-
08	Iron	mg/L	2.38	2.32	2.45	3.06	2.85	3.21	AAS	0.05
09	Lead	mg/L	0.008	0.007	0.004	0.003	0.005	0.004	AAS	0.001
10	Magnesium	mg/L	3.5	38	3.6	3.3	3.2	3.4	AAS	0.05
11	Nitrogen	mg/L	3.1	3.8	1.2	0.7	1.3	0.8	UVS	0.10
12	Phosphate	mg/L	1.56	2.02	1.30	2.51	1.24	1.33	UVS	0.98
13	Potassium	mg/L	2.0	3.0	3.0	2.0	2	2	AAS	-
14	Sodium	mg/L	21	19	18	19	20	16	AAS	0.34
15	Sulphate	mg/L	2	1	1.0	1	2	4	UVS	1.0
16	TSS	mg/L	6	6	7	6	6	7	Multimeter	-
17	Turbidity	NTU	66	60	65	69	67	59	Turbidity meter	-
18	Oil and Grease	mg/L	<5.0	<5.0		<5.0			APHA 5220.B	10

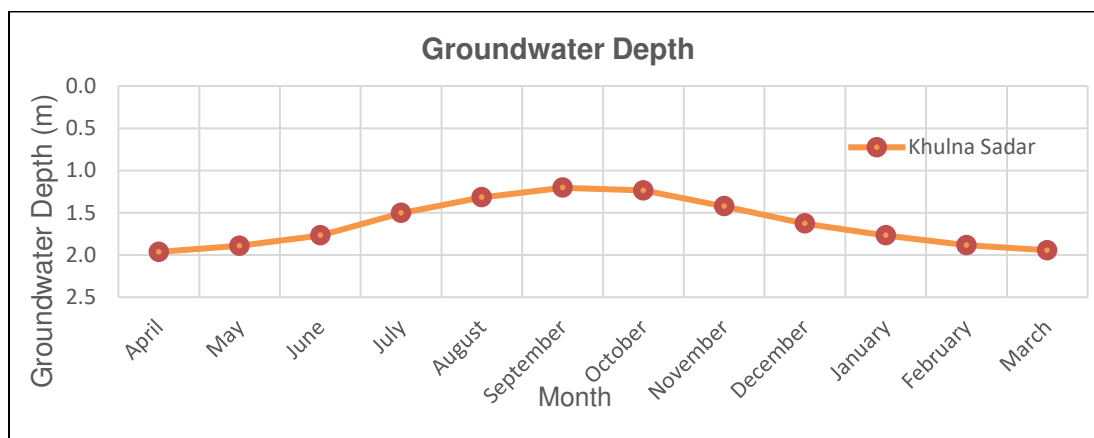
AAS = atomic absorption spectrophotometer; CRM = closed reflex methods; LOQ = limit of quantification; NM = not measured; UVS = UV-visible spectrophotometer.

Figure 4.11: Sample test and collection from the Bhairab and Rupsha River



Groundwater

79. Groundwater level data has been collected from Khulna Sadar observation well to find the status of groundwater availability in the study area. **Figure 4.12** shows monthly variation of ground water depth from 1978 to 2013. According to the figure, groundwater level in study area usually starts to deplete at later stages of pre-monsoon (end of April) and continues up to the middle of October. Thereafter, at the beginning of post-monsoon the aquifer recharge begins.

Figure 4.12: Average monthly groundwater depth (1978 – 2013)

Source: BWDB

Groundwater quality

80. The quality of groundwater has been tested in and around the project area. Four samples of ground water were collected on 21 December 2016 during field visit. Results of analyses are given in **Table 4.6** (sampling stations shown in **Figure 4.8**).

Table 4.6: In- situ groundwater quality measurements

Sampling Location	Coordinates	pH	DO ppm	BOD ₅ at 20°C	EC (mS/cm)	TDS ppm	Salinity (ppt)	Temp. (°C)	Time
GW01	Deep tube well of 250 ft depth 22°51'2.07"N 89°32'59.85"E	7.45	1.7	0.5	1530	760	2	28	11:20am
GW02	Deep tube well of 600 ft depth 22°49'52.75"N 89°34'41.14"E	7.9	5.99	0.64	1820	910	3	26	10:15am
GW03	Deep tube well of 400 ft depth 22°47'46.47"N 89°37'38.14"E	4.51	2.5	0.2	1260	630	2	27	16:45pm
GW04	Deep tube well of 500 ft depth 22°45'24.07"N 89°32'46.70"E	7.75	4.8	0.5	1570	780	2	26	12:30pm
ECR 1997 (Schedule 3) (drinking water standards)		6.5-8.5	6	0.2	-	1,000	0	20-30	-

Source: CEGIS field study, December 21-23, 2016.

81. Ten water quality parameters were analyzed and tested by the central laboratory of the DPHE. The results are given in **Table 4.7** (sampling locations shown in **Figure 4.8**).

Table 4.7: Results of groundwater quality analyses

No.	Water Quality Parameters	Unit	GW01	GW02	GW03	GW04	LOQ	ECR 1997 (mg/L) (drinking water standards)	WHO Guidelines (mg/L)
01	Arsenic	mg/L	0.002	0.001	0.001	0.001	0.001	0.05	0.01
02	Calcium	mg/L	29.6	34.7	49.3	48.3	0.17	75	-
03	COD	mg/L	4	4	4	4	-	4	-
04	Chloride	mg/L	332	461	210	348	-	150-600	-
05	Silica	mg/L	31	33	33	42	-	-	-
06	Hardness	mg/L	353	315	350	405	0.05	200-500 (as CaCO ₃)	-
07	Iron	mg/L	3.03	5.37	4.38	6.52	0.001	0.3-1.0	-
08	Lead	mg/L	0.015	0.015	0.013	0.002	0.10	0.05	0.01
09	Nitrogen	mg/L	0.87	1.2	1.6	1.1	-	1.0	-
10	Phosphate	mg/L	0.16	0.37	1	0.50	0.98	6.0	-
11	Sulphate	mg/L	5	5	3	2	1.0	400	-

Source: DPHE, December 2016.

4.3.2 Water resources issues and functions

Water Use

82. Water is used for domestic, agriculture, fisheries and other commercial purposes. The water of Bhairab River is used for fisheries, shrimp farming and agricultural purposes. The consumption of water mainly takes place at the left bank of Bhairab River. Local people opined that they prefer Shallow Tube Wells (STWs) for drinking (where the layer of Deep Tube Wells (DTWs) aquifer becomes contaminated) water source to meet up their daily requirements. For other domestic uses, STWs and surface water sources are also used. Overall, water availability in the study area is not a major concern as local people expressed that they have sufficient surface and groundwater sources to meet up their daily need for drinking and domestic purposes.

Flooding

83. Flooding is common every year in the study area like other areas in Bangladesh. The main causes of flooding are heavy rainfall, tidal water intrusion and storm surge. During monsoon season, extreme flooding submerges some areas by about 1.0 feet – 2.5 feet and extends for about 7-30 days.

Salinity

84. Saline intrusion from tidal action is another issue in the study area. In-situ measurement shows that salinity of groundwater ranges from 2 ppt to 3 ppt within the study area. According to local people, salinity becomes an issue during the months of July to October.

Riverbank erosion

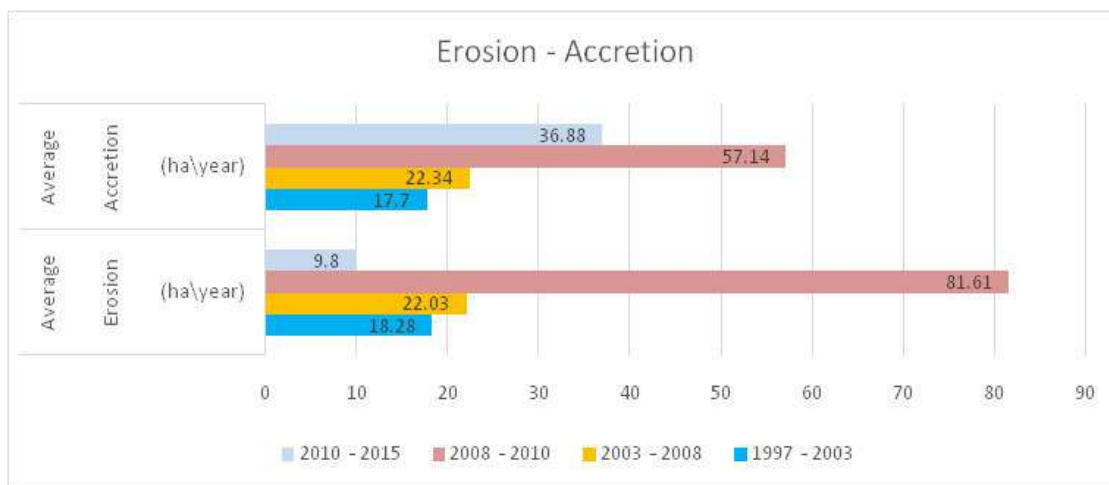
85. The Bhairab, Atai and Rupsha River have tremendous pattern and attitude of shifting every year. The detail of shifting is listed below in **Table 4.8** and **Figure 4.13**. During 1997-2003, there were much erosion than accretion in those rivers within the study area, but after constructing sheet piles and riverbank protection works at several segments of Bhairab and Rupsha River, the erosion becomes negligible. The erosion – accretion analysis has been performed by CEGIS using four satellite images of 1997, 2003, 2008, 2010 and 2015. GIS and remote sensing tools and technologies have been used for this assignment. Bank lines of those five years have been delineated following the CEGIS defined methodologies.

Table 4.8: Summary of erosion accretion in the study area

Duration	Total Erosion in the study area (ha)	Average Erosion (ha/year)	Total Accretion in the study area (ha)	Average Accretion (ha/year)
1997 - 2003	109.65	18.28	106.18	17.70
2003 - 2008	101.19	22.03	111.67	22.34
2008 - 2010	163.21	81.61	114.28	57.14
2010 - 2015	48.94	9.8	184.40	36.88

Source: CEGIS analysis result January,2017

Figure 4.13: Rate of Erosion and Accretion in the Study Area



Source: CEGIS analysis result January 2017.

Navigation

86. Bhairab River and Rupsha River are major navigation routes crossing the project area. According to the BIWTA categorization, these rivers are categorized as class II and class I navigation route, respectively. This route is extensively used for the transportation of goods and people. Local people use small boats and trawlers for local transportation of goods and other vessels like ships, barges, cargo for transportation across the country through these rivers. It is estimated that about 45km navigation route exists within the study area.

4.4 Land Resources

4.4.1 Soil Characteristics

87. According to Water Resources Planning Organization (WARPO), five land types classes: F0, F1, F2, F3 and F4 have been classified in terms of depth of flooding on agriculture land. Land type data source is SOLARIS-SRDI, 2006 and our field observation in December 2016. The project area is within the High Land (F0) (8%), Medium High Land (F1) (70%), Medium Low Land (F2) (13%), and Low Land (F3) (9%).

88. The drainage characteristics have been divided into six classes from the agriculture point of view, e.g. Excessively Drained, Well Drained, Moderately Well Drained, Imperfectly Drained, Poorly Drained and Very Poorly Drained (SRDI; 1988). In the study area three types of drainage characteristics were identified: Imperfectly Drained (26%), Poorly Drained (52%) and Very Poorly Drained (22%).

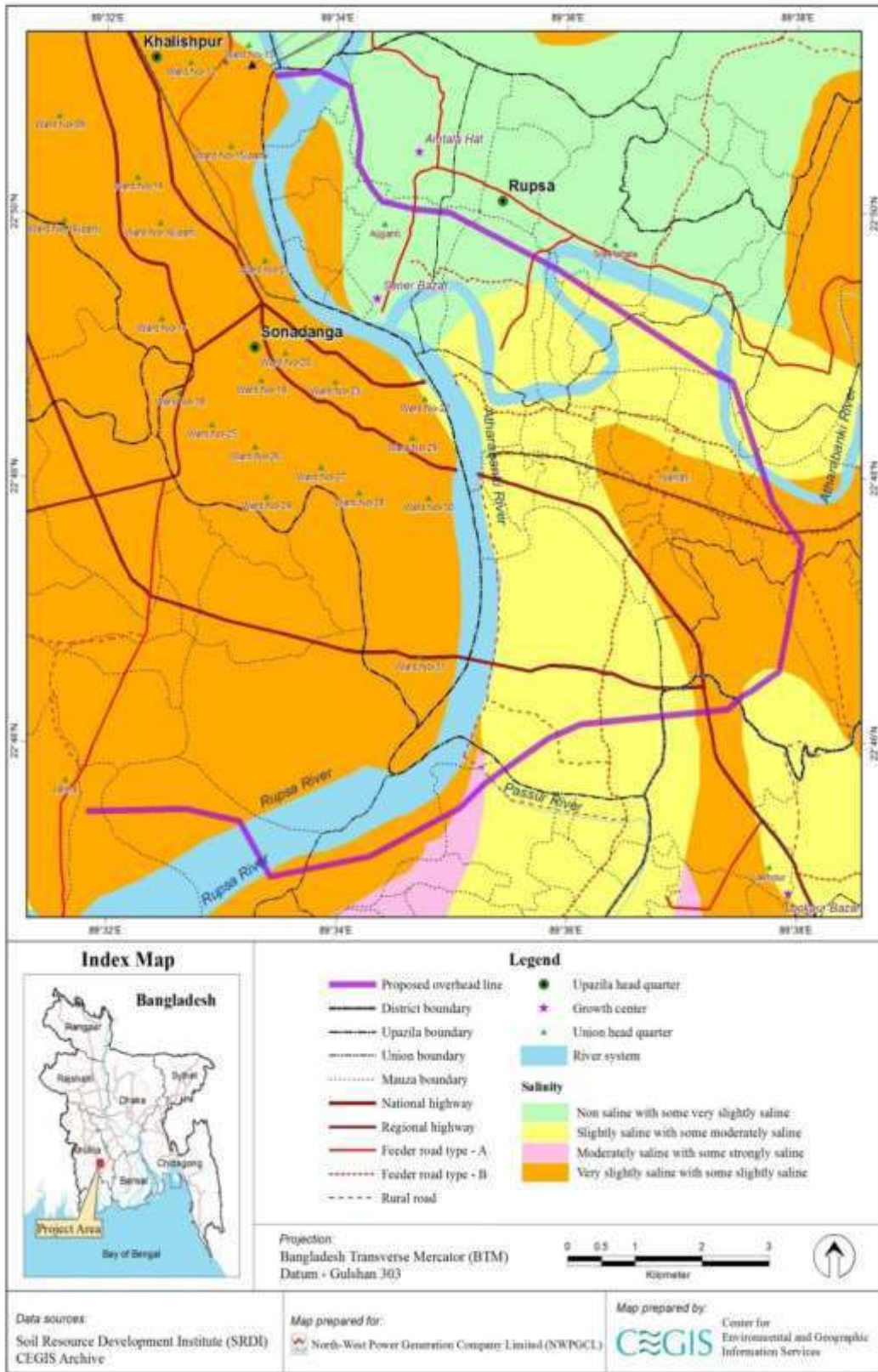
89. CEGIS estimation from SOLARIS-SRDI (2006) data showed that soil salinity of the study area (including project area) increased gradually over the year. Local farmers reported that soil and water salinity gradually increased with the dry season from January and reached maximum level in March to April then subsequently decreased due to the onset of monsoon rainfall. Detailed soil salinity of the study area is presented in **Table 4.9** and **Figure 4.14**.

Table 4.9: Soil salinity in the study area

No	Soil Salinity Characteristics	Soil salinity class	Study Area	
			Area (Acre)	% of Net Cultivable Area (NCA)
1	Non-saline with some very slightly saline (S1)	2.0-4.0	14	2
2	Very slightly saline with some slightly saline (S2)	4.1 - 8.0	145	24
3	Slightly saline with some moderately saline (S3)	8.1 - 12.0	203	33
4	Moderately saline with some strongly saline (S4)	12.1 - 16.0	247	41
Total			609	100

Source: SRDI; 2006

Figure 4.14: Soil salinity in the study area



4.4.2 Land Use

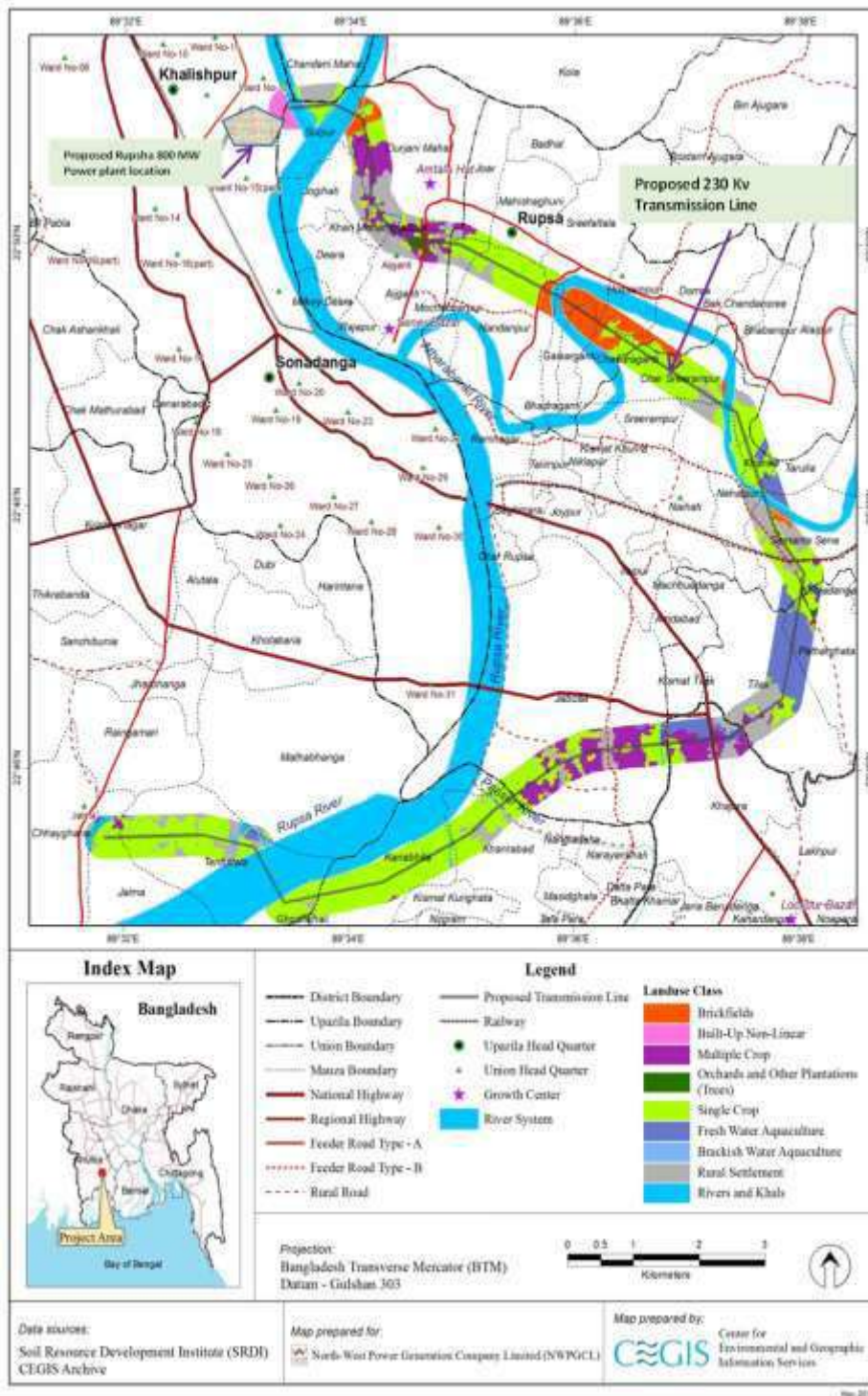
90. The study area for Component 3 is about 609 acres, of which 427 acres (70%) is net cultivable area (NCA). The remaining 30% is covered by brackish water aquaculture, brickfields, built-up non-linear, fresh water aquaculture, orchards and other plantations (trees), rivers and khals, and rural settlements, respectively. Details of land use/land cover of the study area are presented in **Table 4.10** and **Figure 4.15**.

Table 4.10: Land use in the study area

Land use	Area (Acre)	% of Total area
Brackish Water Aquaculture	3	0.5
Brickfields	32	5.3
Built-Up Non-Linear	2	0.3
Fresh Water Aquaculture	40	6.6
Multiple Crop	82	14
Orchards and Other Plantations (Trees)	4	0.7
Rivers and Khals	44	6.6
Rural Settlement	57	9.4
Single Crop	345	56.6
Total	609	100

Source: NWRD and rapid eye image analysis and field visit in December 2016.

Figure 4.15: Land use in the study area



4.4.3 Fisheries Resources

Fish habitats

91. Fish habitats of the study area are classified into two broad categories: capture fisheries and culture fisheries. The capture fisheries comprise mainly of river and khal, whereas culture fisheries are represented by brackish water aquaculture (*Bagda Gher*) and fresh water aquaculture (*Galdagher*).

92. Major rivers: Bhairab River, Atai River, and Rupsha Rivers are tidal in nature. These rivers function as fish habitat for major carp, cat fish, bagda, galda and other inland fresh water fishes. A number of khals maintain connectivity with these rivers. Most of the connecting khals are seasonal which functions only during the wet season. Water availability in these khals vary from mid-May to mid-October. Different types of fish habitat in the study area are shown in **Figure 4.16**.

Figure 4.16: Different fish habitats in the study area



Reach of the Bhairab River over which transmission line crosses



Shrimp farm (Bagda gher) over which transmission line crosses



Reach of the Rupsa River over which transmission line crosses

Fish habitat assessment

93. Based on land use data, culture fisheries (Bagda and Galdagher) occupy 43 acres and capture fisheries (river and khal) occupy 44 acres. Fish habitat status of the study area is shown in **Table 4.11**.

Table 4.11: Status of fish habitat in the study area

Sl.	Fisheries Category	Habitat Types	Area (acre)
1	Capture Fisheries	River and khal	44
Sub-total			44
2	Culture Fisheries	Brackish water aquaculture (Bagdagher)	3
3		Fresh water aquaculture (Galdagher)	40
4			
Sub-total			43
Grand Total			87

Source: CEGIS estimation based on GIS imagery, December 2016.

Fish production assessment

94. The estimated total fish production in the study area is about 18 metric tons (MT). Out of this estimate, about 3 MT comes from capture fisheries and about 15 MT comes from culture fisheries (Table 4.12).

Table 4.12: Fish habitat and production in the study area

Sl. No	Categories	Type of Habitat	Production (MT)
1	Capture Fisheries	River and khal	3
1.	Culture Fisheries	Brackish water aquaculture (Bagdagher) and cultured fish	1
2.		Fresh water aquaculture (Galdagher) and cultured fish	14
Sub total			15
Grand total			18

Source: CEGIS Estimation based FRSS, 2015 and Field Observation December 2016.

Fish biodiversity

95. Figure 4.17 shows the fish species found in the study area while Table 4.13 and Table 4.14 give the list of fish species and their conservation status.

Figure 4.17: Available fish species in the study area



Assemblage of Tengra (*Mystustengara*)



Assemblage of Shing (*Heteropneustes fossilis*)

Table 4.13: Capture fish species in the study area

Sl.	Scientific Name	Local Name	IUCN Conservation Status (Bangladesh)	IUCN Conservation Status (Global)
1	<i>Leander styliferus</i>	Icha	NL	NL
2	<i>Macrobrachium spp.</i>	Golda	NL	NL
3	<i>Penaeus monodon</i>	Bagda	NL	NL
4	<i>Penaeus indicus</i>	Chaka chingri	NL	NL
5	<i>Metapenaeus sensis</i>	Harinachingri	NL	NL
6	<i>Labeorohita</i>	Rui	LC	LC
7	<i>Catla catla</i>	Catla	LC	NE
8	<i>Cirrhinus cirrhosus</i>	Mrigel	NT	VU
9	<i>Labeobata</i>	Bata	LC	LC
10	<i>Puntius ticto</i>	Tit punti	LC	LC
11	<i>Glossogobius giuris</i>	Bele	LC	LC
12	<i>Mystus tengara</i>	Tengra	LC	LC
13	<i>Channa punctatus</i>	Taki	LC	LC
14	<i>Channa striatus</i>	Shol	LC	LC
15	<i>Mastacembelus armatus</i>	Baim	EN	LC
16	<i>Heteropneustes fossilis</i>	Shing	LC	LC
17	<i>Colisa fasciata</i>	Khalisa	LC	LC
18	<i>Lepidocephalus guntea</i>	Gutum	LC	LC
19	<i>Anabas testudineus</i>	Koi	LC	DD

DD = data deficient; LC = least concern; NE = not evaluated; NL = not listed, VU = vulnerable; NT = near threatened.
Source: Red list of IUCN Bangladesh, 2016.

Table 4.14: Culture fish species in the study area

Sl.	Scientific Name	Local Name	IUCN (Bangladesh)	IUCN (Global)
1	<i>Labeorohita</i>	Rui	LC	LC
2	<i>Penaeus monodon</i>	Bagdachingri	NL	NL
3	<i>Catla catla</i>	Catla	LC	NE
4	<i>Cirrhinus cirrhosus</i>	Mrigel	NT	VU
5	<i>Hypophthalmichthys molitrix</i>	Silver carp	Exotic	
6	<i>Ctenopharyngodon idella</i>	Grass carp	Exotic	
7	<i>Cyprinus carpio</i>	Mirror carp	Exotic	
8	<i>Oreochromis mossambicus</i>	Tilapia	Exotic	

NT = near threatened; LC = least concern; NL = not listed; NE = not evaluated; VU = vulnerable.
Source: Red list of IUCN Bangladesh, 2016.

4.5 Biological environment

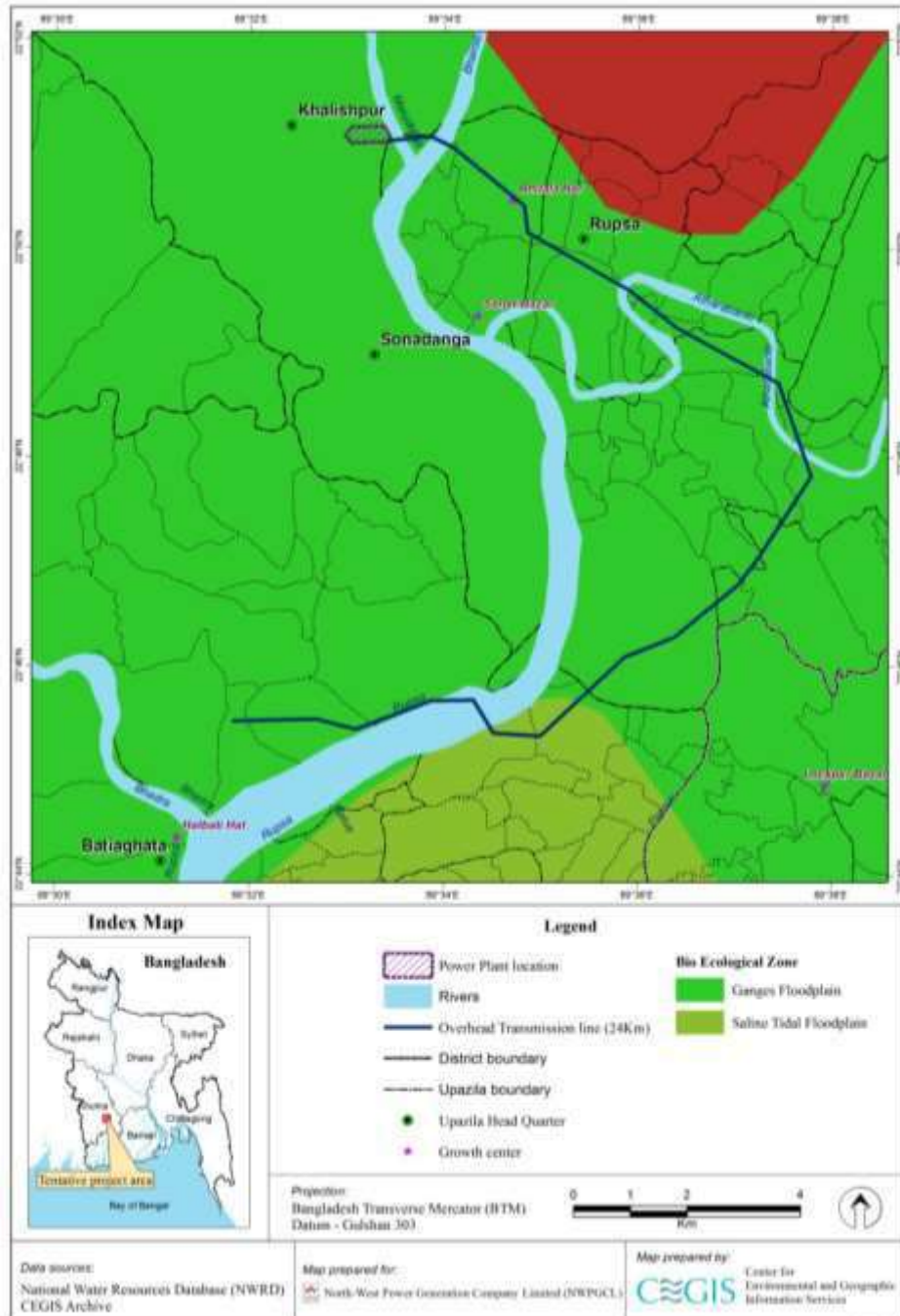
96. Major types of ecosystem are: i) homestead vegetation, ii) crop field vegetation, iii) roadside vegetation, and iv) riparian vegetation. Study area is mainly crop field vegetation.

4.5.1 Bio-ecological zones

97. The International Union for Conservation of Nature (IUCN) has divided Bangladesh into 25 bio-ecological zones (Nishat et al. 2002) within the context of physiographic units and biological diversity. Each of the bio-ecological zone represents the overall ecological situation of an area in the country. The study area is within two different bio-ecological zones: Ganges

floodplain, and Saline tidal floodplain (**Figure 4.18**). The bio-ecological zones consist of Ganges Floodplain, 29.5 acres (8.7%) and Saline tidal floodplain, 308.88 acres (91.3%).

Figure 4.18: Bio-ecological zone within the study area



4.5.3 Floral diversity in the study area

98. The types of vegetation within the study area are shown in **Figure 4.19**. Homestead vegetation is characterized by fruit-bearing trees, timber trees, and vegetable (**Figure 4.19**). The common cultivated plants are Betel nut palm (*Areca catechu*), coconut (*Cocos nucifera*), Indian Lilac (*Azadirachta indica*), West Indian mahogany (*Swietenia macrophylla*), Jackfruit (*Artocarpus heterophyllus*), etc. Homestead vegetation provides good shelter and habitat for local animals like birds, reptiles and amphibians. **Table 4.15** presents the plant species commonly found along the transmission line route.

Figure 4.19: Types of vegetation within the study area



Homestead vegetation



Roadside vegetation



Crop field vegetation



River side vegetation

Table 4.15: Common plant species along the transmission line route

Sl.	Local Name	Scientific Name	IUCN Conservation Status (Global)	IUCN Conservation Status (Bangladesh)
1	Amra	<i>Spondias dulcis</i>	Not Assessed	Not Assessed
2	Bara Mahogonii	<i>Swietenia macrophylla</i>	Vulnerable (A cultivated species in Bangladesh and not listed as Vulnerable)	
3	Jum	<i>Syzygium cumini</i>	Not Assessed	
4	Jamrul	<i>Syzygium samarangense</i>	Not Assessed	
5	Tentul	<i>Tamarindus indica</i>	Not Assessed	
6	Sagun	<i>Tectona grandis</i>	Not Assessed	
7	Arjun	<i>Terminalia arjuna</i>	Not Assessed	
8	Bohara	<i>Terminalia bellirica</i>	Not Assessed	
9	Khatbadam	<i>Terminalia cattapa</i>	Not Assessed	
10	Baroi	<i>Ziziphus mauritiana</i>	Not Assessed	
11	Royel Plam	<i>Roystonea regia</i>	Not Assessed	
12	Raindee Kory	<i>Samanea saman</i>	Not Assessed	
13	Aum	<i>Mangifera indica</i>	Data Deficient	
14	Safoda	<i>Manilkara zapota</i>	Not Assessed	
15	Karnaga	<i>Millettia pinnata</i>	Not Assessed	
16	Sajna	<i>Moringa oleifera</i>	Not Assessed	
17	Kala	<i>Musa sapientum</i>	Not Assessed	
18	Kadam	<i>Neolamarckia cadamba</i>	Not Assessed	
19	Jalpai	<i>Olea europaea</i>	Not Assessed	
20	Khegur	<i>Phoenix sylvestris</i>	Not Assessed	
21	Khatgolap	<i>Plumeria rubra</i>	Not Assessed	
22	Debdaru	<i>Polyalthia longifolia</i>	Not Assessed	
23	Peara	<i>Psidium guajava</i>	Not Assessed	
24	Ulatkambol	<i>Abroma augusta</i>	Not Assessed	
25	Akashia	<i>Acacia auriculiformis</i>	Not Assessed	
26	Bel	<i>Aegle marmelos</i>	Not Assessed	
27	Karoi	<i>Albizia lebbek</i>	Not Assessed	
28	Chatim	<i>Alstonia scholaris</i>	Not Assessed	
29	Ata	<i>Annona reticulata</i>	Not Assessed	
30	Supari	<i>Areca catechu</i>	Not Assessed	
31	Khanthal	<i>Artocarpus heterophyllus</i>	Not Assessed	
32	Dewa	<i>Artocarpus lakoocha</i>	Not Assessed	
33	Kamranga	<i>Averrhoa carambola</i>	Not Assessed	
34	Neem	<i>Azadirachta indica</i>	Not Assessed	
35	Shimul	<i>Bombax ceiba</i>	Not Assessed	
36	Tal	<i>Borassus flabellifer</i>	Not Assessed	
37	Papya	<i>Carica papaya</i>	Not Assessed	
38	Batabilebu	<i>Citrus grandis</i>	Not Assessed	
39	Narikel	<i>Cocos nucifera</i>	Not Assessed	
40	Sisso	<i>Dalbergia sissoo</i>	Not Assessed	
41	Krishnochura	<i>Delonix regia</i>	Least Concern	
42	Chalta	<i>Dillenia indica</i>	Not Assessed	
43	Bilati Gab	<i>Diospyros blancoi</i>	Not Assessed	
44	Eucalyptus	<i>Eucalyptus sp</i>	Not Assessed	
45	Bot	<i>Ficus benghalensis</i>	Not Assessed	
46	Gamari	<i>Gmelina arborea</i>	Not Assessed	

Sl.	Local Name	Scientific Name	IUCN Conservation Status (Global)	IUCN Conservation Status (Bangladesh)
47	Jarul	<i>Lagerstroemia speciosa</i>	Not Assessed	
48	Ipil	<i>Leucaena leucocephala</i>	Not Assessed	
49	Lichu	<i>Litchi chinensis</i>	Not Assessed	

99. Component 3 will also traverse agricultural land. The crop field vegetation consists of highland and medium highland. This area is mostly utilized for rice monoculture as well as different types of economic crops. Aside from economic crops being cultivated, there are varieties of weeds in the area: Bermuda grass (*Cynodon dactylon*), Spider wort (*Commelina bengalensis*), Peruvian primrose (*Ludwigia peruviana*), Busket grass (*Oplisma burmaniai*), Mutha grass (*Cyperus rotandus*), Dollar weed (*Hydrocotyle* spp.), Carpet grass (*Axonopus compressus*), Indian heliotrope (*Heliotropium indicum*), spiny pigweed (*Amaranthus spinosus*), and Croton (*Croton bonplandianum*) were observed. Other vegetation commonly observed in freshwater ditches includes: water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*), floating fern (*Salvinia natans*), common duckweed (*Lemna perpusilla*), and water velvet (*Azolla pinnata*).

100. Component 3 will also cross roads and rivers. Road side vegetation includes Indian Gum Arabic Tree (*Acacia nilotica*), Broad leafed Mahogany (*Swietenia macrophylla*), Silk tree (*Albizia richardiana*), and lebbek tree (*Albizia lebeck*), which are very common.

101. Different types of aquatic flora within the study area are listed in Table 4.16.

Table 4.16: List of common aquatic plant species in the study area

Sl.	Category	Local Name	Scientific Name
1	Submerged	Jhangi	<i>Hydrilla verticillata</i>
2		Bicha	<i>Vallisneria spiralis</i>
3		Ghechu	<i>Aponogeton natans</i>
4	Free floating	Kachuripana	<i>Eichhornia crassipes</i>
5		Topapana	<i>Pistia stratiotes</i>
6		Tetulpana	<i>Salvinia natans</i>
7		Khudipana	<i>Lemna perpusilla</i>
8		Azola	<i>Azolla pinnata</i>
9	Rooted floating	Sada sapla	<i>Nymphae nouchali</i>
10	Sedges and Meadows	Kolmi	<i>Ipomoea aquatica</i>
11		Dhol kolmi	<i>Ipomoea fistulosa</i>
12		Keshordam	<i>Ludwigia adscendense</i>
13		Helencha	<i>Alternanthera philoxiroides</i>

Source: Field survey and local people interview; June 2017.

4.5.4 Faunal diversity in the study area

Amphibians

102. The skipper frog (*Euphlyctis cyanophlyctis*) is commonly found all year round. There is an abundance of bullfrogs (*Hoplobatrachus tigerinus*) during the monsoon season and they are found in ditches and other marshy places. Common toad (*Duttaphrynus melanostictus*) and cricket frog (*Fejervarya limnocharis*) are also found in the study area.

Birds

103. Terrestrial bird species include: Black Drongo, Brown Shrike, Jungle Myna, Rock pigeon, House crow, House Sparrow, Common Myna, Large-billed crow, Spotted Dove, Little Cormorant, Long tailed Shrike, Pied Myna, and Black Crowned Nigh Heron.

Reptiles

104. The species include: Common skunk (*Mabuya carinata*), garden lizard (*Calotes versicolor*), Bengal Monitor (*Varanus bengalensis*), Water Monitor (*Varanus salvator*), Common vine Snake, Painted Bronzeback tree snake, Common Bronzeback, Tree Snake Common Wolfe Snake, Indo Chinese rat Snake, and Checkered Keel back.

Mammals

105. Common species are House Mouse (*Mus musculus*), Asian House Shrew (*Suncus murinus*), Common Mongoose (*Herpestes edwardsii*), Jungle Cat (*Felis chaus*), Small Indian Civet (*Viverricula indica*), Indian Palm Civet (*Paradoxurus hermaphroditus*), Asiatic Jackal (*Canis aureus*), short-nosed bat (*Cynopterus sphinx*), and Indian Flying Fox (*Pteropus giganteus*). Gangetic River Dolphins (*Platanista gangetica gangetica*) were seen during survey. Table 4.17 gives the list of faunal species.

Table 4.17: List of faunal species in the study area

English Name	Scientific Name	IUCN Bangladesh (2015)	IUCN Global Status	CITES Appendices
Mammals				
Common House Rat	<i>Rattus</i>	Least Concern	Least Concern	Not Listed
House mouse	<i>Mus musculus</i>	Least Concern	Least Concern	Not Listed
Field Mouse	<i>Mus booduga</i>	Least Concern	Least Concern	Not Listed
Grey Musk Shrew	<i>Suncus murinus</i>	Least Concern	Least Concern	Not Listed
Common mongoose	<i>Herpestes edwardsii</i>	Least Concern	Least Concern	III
Jungle Cat	<i>Felis chaus</i>	Near Threatened	Least Concern	Not Listed
Greater Short nosed Fruit Bat	<i>Cynopterus sphinx</i>	Least Concern	Least Concern	Not Listed
Small Indian Civet	<i>Viverricula indica</i>	Near Threatened	Least Concern	Not Listed
Indian Palm Civet	<i>Paradoxurus hermaphroditus</i>	Least Concern	Least Concern	III
Asiatic Jackal	<i>Canis aureus</i>	Least Concern	Least Concern	III
Indian Flying Fox	<i>Pteropus giganteus</i>	Least Concern	Least Concern	Not Listed
Gangetic River Dolphin	<i>Platanista gangetica</i>	Vulnerable	Endangered	I
Birds				
Magpie Robin	<i>Copsychus saularis</i>	Least Concern	Least Concern	Not Listed
Barn Owl	<i>Tyto alba</i>	Least Concern	Least Concern	Not Listed
Black-hooded Oriole	<i>Oriolus xanthornus</i>	Least Concern	Least Concern	Not Listed
Rock Dove	<i>Columba livia</i>	Least Concern	Least Concern	Not Listed
Spotted Dove	<i>Streptopelia chinensis</i>	Least Concern	Least Concern	Not Listed
Common Kingfisher	<i>Alcedo atthis</i>	Least Concern	Least Concern	Not Listed
Bronzed Drongo	<i>Dicrurus aeneus</i>	Least Concern	Least Concern	Not Listed
House Crow	<i>Corvus splendens</i>	Least Concern	Least Concern	Not Listed

English Name	Scientific Name	IUCN Bangladesh (2015)	IUCN Global Status	CITES Appendices
Common Mynah	<i>Acridotheres tristis</i>	Least Concern	Least Concern	Not Listed
Red-vented Bulbul	<i>Pycnonotus cafer</i>	Least Concern	Least Concern	Not Listed
Brahminy Kite	<i>Haliastur indus</i>	Least Concern	Least Concern	Not Listed
Black Kite	<i>Milvus migrans</i>	Least Concern	Least Concern	Not Listed
Amphibians				
Bull Frog	<i>Hoplobatrachus tigerinus</i>	Least Concern	Least Concern	II
Tree Frog	<i>Rana temporalis</i>	Least Concern	Least Concern	Not Listed
Cricket Frog	<i>Rana limnocharis</i>	Least Concern	Least Concern	Not Listed
Common Toad	<i>Bufo melanostictus</i>	Least Concern	Least Concern	Not Listed
Green Frog	<i>Euphlyctis hexadactylus</i>	Least Concern	Least Concern	II
Reptiles				
House Lizard	<i>Hemidactylus brooki</i>	Least Concern	Least Concern	Not Listed
House Lizard	<i>Hemidactylus frenatus</i>	Least Concern	Least Concern	Not Listed
Common Garden Lizard	<i>Calotes versicolor</i>	Least Concern	Least Concern	Not Listed
Water Monitor	<i>Varanus salvator</i>	Vulnerable	Least Concern	
Bengal Monitor	<i>Varanus bengalensis</i>	Near Threatened	Least Concern	I
Stripes Keelback	<i>Amphiesma stolata</i>	Least Concern	Least Concern	Not Listed
Olive Keelback	<i>Atrietium schistosum</i>	Least Concern	Least Concern	III
Rat Snake	<i>Ptyas mucosus</i>	Least Concern	Least Concern	II

Source: CEGIS Field visit, literature review, and interview of local people, June 2017.

4.6 Socio-economic conditions

106. Primary data were collected using tools and techniques such as Rapid Rural Appraisal, Key Informant Interview (KII), observations and informal consultations. Secondary data were collected from Bangladesh Bureau of Statistics (BBS) 2012 and other available government publications.

4.6.1 Demographic Profile

107. **Location.** According to Spatial GIS Analysis (CEGIS 2016), the study area consists of seven (7) unions and one (1) ward (ward no. 13) under Khalishpurthana in Khulna City. The upazilas are: Batiaghata, Dighalia and Rupsha under Khulna district and one under Fakirhatupazila of Bagerhat district.

108. **Population.** There are 66,109 households in the study area and has a total population of 278,187. The population consists of 142,001 males (51%) and 136,186 females (49%). The male-female ratio is 105 which is higher than the national figure of 100.3 (BBS, 2012).

109. **Household size.** The average household size is 4.2 compared to the national average of 4.4 (BBS, 2012).

110. **Age structure.** Prime working age group (25-59 years old) dominates the population (43%) followed by children, 30% (with age group 0-14 years old). About 26% of the population belongs to the age group 30-49 years old and the lowest, about 3% belongs to the age group of 60-64 years old. This classification is important as the size of young population (under age 15)

would need more investment in education and health while size of older populations (ages 65 and over) would need more investments in the health sector.

111. **Housing condition.** On average, 14.1% of the households are in pucca, 51.2% are kutcha, 30.6% are in semi pucca while the rest of the households are in Jhupri house (4.1%).

112. **Literacy rate.** Literacy rate is 60% compared to the national rate of 52%. Male population accounts for 62% and female accounts for 57%.

113. **Employment.** About 41% is employed in different sectors of which 34% are male and 7% are female. About 34.4% of people are engaged in household work while 24.2% are not working.

114. **Occupational pattern.** Main occupation is service (47.8%) in which 38.2% is male and 9.6% is female. This is followed by people engaged in agriculture (27.1%) and about 25.1% are engaged in industrial work.

115. **Labor availability and wage rate.** Daily wage rate varies between 400Tk to 500Tk (**Table 4.18**). A few migrant laborers stay in the study area all year round and return to their homes at the end of the year with all their income. Women's participation in the agricultural sector is negligible.

Table 4.18: Labor availability and wage rate in the study area

Type		Male			Female		
		Labor Availability	Average Wage Tk/day		Labor Availability	Average Wage Tk/day	
			Max.	Min.		Max.	Min.
Farming	Skilled	High	400	300	Nil	-	-
	Non-Skilled	High	350	300	Low	300	250
Non-Farming	Skilled	Medium	500	400	Low	400	300
	Non-Skilled	High	350	300	Medium	250	200

Source: CEGIS fieldwork, 2016.

116. **Population migration.** Seasonal labor migration is such that during the rainy season, they remain out of work and thus, migrate temporarily to other districts for livelihood. They migrate to Dhaka, Sylhet and Mymensingh where they work as laborer, rickshaw puller, small scale businessman, etc. (**Table 4.19**).

Table 4.19: Migration status in the study area

Type of Migration	Labor Migration-Out		Labor Migration-In	
	Place of destination	% of total population	Place of origin	% of total population
Seasonal labour migration	Dhaka, Chittagong	8%	Bagerhat, Gopalganj, Pirojpur, Barisal, Jhalokathi, Satkhira	15%
Permanent household migration	Dhaka, Chittagong	2%	Bagerhat, Gopalganj, Pirojpur, Barisal, Jhalokathi, Satkhira	1%

Source: CEGIS fieldwork, 2016.

117. **Drinking water.** About 97.3% of the population gets drinking water from tube wells, 1.4% is dependent on tap water, and 1.3% depends on other sources such as pond, river and canal.

118. **Sanitation.** About 17.6% of the population still has no sanitary toilet. More than half of the population (81.2%) has sanitary toilet facilities of which 34.8% are water-sealed and 46.4% are non-water-sealed. Still about 1.1% of the population does not have sanitary facilities.

119. **Electricity.** BBS (2012) data shows that about 71.9% of the households are consuming grid electricity to meet their daily demand, the rest on solar energy.

120. **Transportation.** Modes of transport available are roadway, railway and waterway. The main roadway is Jessore-Khulna highway road, Khulna-Bagerhat–Pirojpur road which is connected to the southern part of Bangladesh. One of the major roads is Khulna to Dhaka via Gopalganj and Mawaghat. There is railway connection in Khulna and an airport in Jessore district. Water transport is mainly through Bhairab River, Rupsha River and Passur River.

121. **Community health** Local people in the study area reported that the most prevalent diseases in the study area are diarrhea, typhoid, pneumonia, jaundice, skin diseases, etc. Children are mostly affected by water-borne diseases. Instant health facility is inadequate in nearby areas except the city corporation area. Hyper tension/high blood pressure is also increasing among the people. Disability is also found in the study area. Total disability is about 1.5%.

122. **Health services.** There is a 250-bed capacity health complex at Boyra. Patients from different districts go to Boyra for better medical treatment. There are a number of private clinics in Khulna city where people can get better medical treatment.

123. **Availability of health services and facilities.** About 48% of patients go to trained physician as people have easy access to the trained physician in Khulna city. About 25% people in the study area go to paramedic doctor and about 22% patients go to quack doctors. Local people are nowadays much more aware about their health. They have eagerness to receive health treatment from trained physicians but all of them are not able to do that due to inadequate financial capability and availability of health facility.

124. **Literacy rate.** Literacy rate in the area is 71% where male accounts for 74% and female 68%

125. **Vulnerability to natural disaster.** Khulna is situated in the natural disaster prone area. Local people opined that waterlogging, salinity intrusion, cyclone, surge, river erosion are the main natural disasters in the study area. These occur almost every year in this area.

126. **Safety nets.** Major social safety nets and poverty reduction programs in the area include the Vulnerable Group Development (VGD), Food/Taka for Work (F/TFW), Food for Education/Cash for Education, Rural Maintenance Program (RMP), Old Age Allowance, Freedom Fighter Allowance and Integrated Poverty Reduction Program. According to local people, these programs have created food security as well as social security among the targeted poor households and vulnerable communities. A number of local, national and international NGOs are working in the study area. The main activities of these NGOs are operating microcredit programs among the rural poor and landless women/men.

5.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Introduction

127. Considering the base of a transmission tower as 20mx20m, the area affected due to 75 tower bases will be about 3 hectares (ha). With the RoW of 10 m on each side of the transmission line, the area that will be affected is 49.122 ha. Thus, the total land within the direct impact area will be 52.122 ha. With a buffer of 40 m on each side of the RoW, the total land area that may be indirectly affected will be 196.488 ha.

128. Environmental components likely to be impacted by Component 3 are referred to as important environmental components (IECs) and important social components (ISCs). For Component 3, the IECs and ISCs likely to be impacted by the pre-construction, construction, operation and decommissioning are selected as follows:

5.1.1 Selection of IECs and their Rationale

Table 5.1: IECs on physical-chemical environment

IECs	Rationale for selection
Ambient air quality	Construction and operation of OHTL will generate minimal amount of air pollutants such as particulate matter (PM), hydrocarbons, nitrogen oxides (NO _x), carbon monoxide (CO), sulfur dioxide (SO ₂), heavy metals from the operation of trucks, heavy equipment and from activities such as excavation of foundation for the bases of the transmission line towers. These may impact air ambient quality.
Ambient noise quality	Noise pollution during construction phase may come from the operation of construction equipment, vehicular movements, construction works and other noise-generating activities of settlements. Elevated noise level may cause inconvenience and annoyance of the settlements within the study area.

Table 5.2: IECs on water resources

IECs	Rationale for selection
Surface and Groundwater Quality	Construction of OHTL may affect nearby surface water quality due to the excavation of the foundation for the bases of the transmission line. This may potentially cause siltation. During operation, groundwater may be a source of domestic water supply which may be contaminated with hazardous wastes coming from the drainage of the electrical substation. The hazardous wastes may be used mineral oil disposed from the electrical equipment such as transformers.
River bank erosion	Protection measures against erosion and construction of adequate anchorage against flotation, collapse or lateral movement shall be followed according to the design for both river banks where the OHTL will cross.
Flooding	Design and management of towers will include flooding elevation in Bhairab River, Atai River, and Rupsha River.

Table 5.3: IECs on land and agriculture resources

IECs	Rational for selection
Soil quality for agricultural purposes	There will be permanent land loss if agricultural land would be converted to non-agricultural land to accommodate the base of the transmission towers. Installation of towers will involve excavation of soil which may affect soil quality.
Soil/Land contamination	During operation of the electrical substations, used insulating mineral oil from electrical equipment such as transformer, if not disposed off properly, may cause land contamination. The mineral oil to be used should be free from PCB.

IECs	Rational for selection
	There can be also soil/land contamination due to improper solid wastes disposal from the construction and operation phases of the transmission line component of the project.
Change of land use	Land use may be changed with the presence of transmission towers. Agricultural land may be permanently lost due to tower footings. As a result, present crop land might be changed into non-crop land.
Change in surface topography or terrain	During construction and operation, there may be continuous soil erosion in unavoidable steep location of transmission towers that may cause permanent changes in landform, topography and slope.
Loss of crop production	During construction, standing crops in the area might be affected with a possibility of change in crop production. Use of heavy equipment and movement of vehicles may cause loss of crops.
Intercropping	Intercropping may be affected due to the installation of towers.
Impairment of visual aesthetics	Aesthetics and urban landscape may be affected by the presence of transmission towers.

Table 5.4: IECs on fisheries resources

IECs	Rationale for selection
Fish habitat	About 75 towers will be erected along the OHTL route. Installation of these towers may cause temporary damage to fish habitat or new fish habitat may be created at the center of the tower footings.
Fish disease and mortality	Use of chemicals and mineral oil from substation in Rupsha 800 MW CCPP may affect the culture fish species, particularly Bagda and Galda.
Fish production	Inundation of the tower base exposing soil with poor nutrient content in selected area may affect fish production

Table 5.5: IECs on ecological resources

IECs	Rationale for selection
Terrestrial vegetation	Terrestrial vegetation provides food and shelter to local birds and various animals. Construction activities may require clearing of terrestrial vegetation and operation phase requires vegetation management along the RoW and restriction of vegetation height below the transmission line.
Wildlife habitat and their disturbance	Movement of local wildlife may be disturbed due to construction activities and vegetation management along the RoW during the operation phase.

Table 5.6: ISCs on socio-economic aspects

ISCs	Rationale for selection
Land price	Land affected by the tower footings may be devalued. Land development between transmission towers and below the transmission line will be restricted affecting land value.
Employment opportunities	Employment opportunities will be created during the construction and operation phase.
Human health and safety	Working on heights and other construction activities may pose occupational and safety risks. Exposure of workers maintaining the OHTL may also pose health risks.
Regional and national development	Economic development largely depends on the availability of a reliable power supply. Uninterrupted power supply is expected to improve productivity and development.

5.2 Analysis of potential impacts

Impact assessment methodology

129. Potential environmental and social impacts were identified based on-site visits, interviews with affected persons, stakeholder engagement, environmental sampling, collection of relevant and available secondary data, review of relevant project documents such as Feasibility Study, survey reports, etc. Significance of potential impacts was assessed using the criteria and methodology given below.

Impact magnitude

130. The potential impacts have been categorized as major, moderate, minor or nominal based on consideration of the parameters such as: i) duration of the impact; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria. The magnitude of potential impacts has been identified according to the categories outlined below.

Table 5.7: Parameters for determining magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration	Long-term (more than 15 years)	Medium-term Lifespan of the project (5 to 15 years)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Potential impact requires a year or so for recovering with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains almost constant
Legal standards and established professional criteria	Breaches national standards and/or international guidelines/ obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of occurrence	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (Occasional)	Unlikely to occur

Sensitivity of Receptor

131. The sensitivity of receptor has been determined based on review of the population (including proximity/numbers/vulnerability) and presence of features on the site or the surrounding area. Criteria for determining receptor sensitivity are given in **Table 5.8**.

Table 5.8: Criteria for determining sensitivity

Sensitivity Determination	Definition
Very High	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Medium	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good capacity to absorb proposed changes and/or good opportunities for mitigation

Assigning significance

132. Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance matrix shown in **Table 5.9**.

Table 5.9: Significance of impact criteria

Magnitude of Impact	Sensitivity of Receptors			
	Very High	High	Medium	Low
Major	Critical	Major	Moderate	Minimal
Moderate	Major	Major	Moderate	Minimal
Minor	Moderate	Moderate	Minor	Minimal
Minimal	Minimal	Minimal	Minimal	Minimal

Impact matrix

133. Potential environmental impacts on the IECs during pre-construction, construction, and operation phases of Component 3 are presented in a matrix form in **Table 5.10**.

Table 5.10: Impact matrix of Component 3

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation
Pre-construction Stage				
Physical-Chemical Environment and Water Resources				
Ambient air quality	Vehicular emissions; dust from excavation works, land clearing, and material stockyards may affect ambient air quality	Medium	Minor	Minor Adverse

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation
Ambient noise	Noise level may increase due to mobilization of vehicles and unloading of materials.	Medium	Minor	Minor Adverse
Quality of surface and groundwater	N/A	N/A	N/A	N/A
Riverbank erosion	Regular erosion of river bank	High	Moderate	Major Adverse
Flooding	Minor impact	Low	Minor	Minimal Adverse
Land and Agricultural Resources				
Soil quality for agricultural purposes	N/A	N/A	N/A	N/A
Soil/Land contamination	N/A	N/A	N/A	N/A
Land use	Would be partially impacted	Low	Minor	Minimal Adverse
Crop production	Would be highly impacted	Medium	Moderate	Moderate Adverse
Change in topography/ terrain	N/A	N/A	N/A	N/A
Impairment of visual aesthetics	N/A	N/A	N/A	N/A
Fisheries Resources				
Fish habitat	Fish habitat quantity and quality will be the same	Low	Minor	Minimal Adverse
Fish disease and mortality	There will be no change	Low	Minor	Minimal Adverse
Fish production	There will be no effect	Low	Minor	Minimal Adverse
Socioeconomic Resources				
Land price	No minimal impact	Low	Minor	Minimal Adverse
Employment opportunities	Temporary or minimal opportunities at this stage	Medium	Moderate	Moderate Beneficial
Human health and safety	No impact	Low	Minor	Minimal Adverse
Regional and national development	No impact	Medium	Moderate	Moderate Beneficial
Construction Stage				
Physical-Chemical Environment and Water Resources				
Ambient air quality	Suspended particulate matter from excavation works and land clearing including vehicular emissions may affect workers and community	Medium	Moderate	Moderate Adverse
Ambient noise	Mobilization of heavy equipment and machineries, use of construction vehicles, transport of materials, and construction activities may increase ambient noise level. Exposure to high level ambient noise may cause anxiety and disturbance to workers and community.	Medium	Moderate	Moderate Adverse

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation
Quality of surface and groundwater	Potential for siltation at Bhairab River, Atai River and Rupsha River due to construction works at river crossings.	Medium	Moderate	Moderate Adverse
Riverbank erosion	Potential erosion due to ground movements along the river crossings at Bhairab River, Atai River, and Rupsha River. A total of 6 river crossings will result from Component 3.	High	Major	Moderate
Flooding	Potential flooding during monsoon season along the crossings at Bhairab River, Atai River, and Rupsha River.	Medium	Moderate	Moderate Adverse
Land and Agricultural Resources				
Soil quality for agricultural purposes	During construction, top soil at the tower footings may be eroded during excavation.	High	Major	Moderate
Soil/Land contamination	N/A	N/A	N/A	N/A
Land use	Would be partially impacted as agricultural land may be permanently lost due to the tower footings	Medium	Moderate	Moderate Adverse
Crop production	May be moderately affected due to crop loss at the tower footings and in the clearing for RoW	Medium	Moderate	Moderate Adverse
Change in topography/terrain	Excavation works for the transmission towers may affect topography	Low	Minor	Minimal Adverse
Impairment of visual aesthetics	N/A	N/A	N/A	N/A
Fisheries Resources				
Fish habitat	Construction activities may temporarily affect fish habitat	Medium	Minor	Minor Adverse
Fish disease and mortality	There will be no change	Low	Minor	Minimal Adverse
Fish production	Fish production will have same as base condition	Low	Minor	Minimal Adverse
Terrestrial Resources (Flora and Fauna)				
Terrestrial vegetation	Vegetation clearing may be required at the tower footings and RoW	Medium	Moderate	Medium
Wildlife habitat and their disturbance	Route will be mainly in urban areas. Habitat in the areas affected may not host wildlife	Medium	Moderate	Medium
Socioeconomic Resources				
Compensation for crop damage	Standing crops at the tower footings and RoW may be damaged	Medium	Moderate	Moderate Adverse
Land price	Value of land may be temporarily	Medium	Moderate	Moderate Adverse

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation
	affected			
Temporary employment opportunity	Both technical and non-technical laborers will be required	Medium	Moderate	Moderate Beneficial
Human health and safety	Workers may be exposed to occupational health risks and safety hazards	Medium	Minor	Minor Adverse
Regional and national development	May create development opportunities in anticipation of stable power supply	Medium	Moderate	Moderate Beneficial
Operation Stage				
Physical-Chemical Environment and Water Resources				
Ambient air quality	No or minimal impact	Low	Minor	Minimal Adverse
Ambient noise	No or minimal impact	Low	Minor	Minimal Adverse
Quality of surface and groundwater	No or minimal impact	Low	Minor	Minimal Adverse
Riverbank erosion	No or minimal impact	Low	Minor	Minimal Adverse
Flooding	No or minimal impact	Low	Minor	Minimal Adverse
Land and Agricultural Resources				
Soil quality for agricultural purposes	May result to permanent loss of agricultural land due to tower footings	Low	Minor	Minimal Adverse
Soil/Land contamination	Potential for spill or improper disposal of mineral oil used as insulating oil in transformers. No use of PCB or PCB-containing material will be allowed.	Low	Minor	Minimal Adverse
Land use	No impact	Low	Minor	Minimal Adverse
Crop production	Tower footings may have minimal impact on crop production due to permanent loss of agricultural land.	Medium	Minor	Minor Adverse
Change in surface topography/ terrain	Transmission towers may have minimal impact on topography	Low	Minor	Minimal Adverse
Impairment of visual aesthetics	N/A	N/A	N/A	N/A
Fisheries Resources				
Fish habitat	No change expected	Low	Minor	Minimal Adverse
Fish disease and mortality	Potential for higher mortality rate after the first year of tower installation	Medium	Moderate	Moderate Adverse
Fish production	May improve after completion of construction works	Medium	Minor	Minor beneficial
Terrestrial Resources (Flora and Fauna)				
Terrestrial vegetation	Restriction of vegetation height below the transmission line	Low	Minimal	Low
Wildlife habitat and their disturbance	Flyway paths of bats may be affected by the transmission towers (e.g. Greater shortnosed fruit bat (<i>Cynopterus sphinx</i>), Indian Flying Fox (<i>Pteropus giganteus</i>))	Low	Minimal	Low

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation
Socioeconomic Resources				
Compensation	Permanent loss of land at the tower footings	Medium	Moderate	Moderate Adverse
Land price	No land value at the tower footings; development restrictions below the transmission line and between towers may affect land value	Medium	Moderate	Moderate Adverse
Employment opportunity	Jobs will be created directly due to Component 3 and indirectly through businesses and development resulting from the availability of power supply	Medium	Minor	Minor beneficial
Human health and safety	Occupational and community safety risks	Low	Moderate	Minimal Adverse
Regional and national development	Availability of a stable and reliable power supply may improve productivity and national development.	Medium	Moderate	Moderate Beneficial

5.3 Impact Assessment

5.3.1 Pre-construction stage

Ambient air quality

134. Exhaust from vehicles usually operating within the area may contribute to impairment of ambient air quality. Fugitive dust emissions from the material stockyards may also affect ambient air quality. Impacts to ambient air quality will be temporary at this stage and maybe characterized as minimal adverse.

Mitigation measures

135. Regular maintenance of vehicles may improve combustion efficiency of engines. Water can be sprayed to unpaved roads and stockyards can be covered to contain dust or generation of suspended particulates. Area allocated as stockyard for construction materials will be enclosed to minimize dispersion of dusts.

Ambient noise

136. At this stage, there are no activities that generate noise associated with Component 3. Sources of noise are from activities of settlements living close to the transmission line route.

Surface and groundwater quality

137. During pre-construction stage, there will be no impacts on the surface and groundwater quality resulting from Component 3.

Potential riverbank erosion

138. Without considering the potential for riverbank erosion along the Bhirab River, Atai River, and Rupsha River, the significance of this impact will be major. The selected alignment will cause a total of six crossings on these rivers.

Mitigation measures

139. An expert will review the structural design, specifications and plans for construction of the transmission towers that will be erected close to the banks of these rivers as well as the activities to be done at the six river crossings to ensure that Component 3 will not cause undue riverbank erosion on these rivers.

Residual impact

140. With mitigation, the residual impact will be moderate.

Intercropping

141. Intercropping and related activities may be potentially affected due to detailed ground survey activities along the transmission line route.

Mitigation measure

142. Consultations between the surveyors and the appropriate community representative will be undertaken. Affected area will be informed of the survey schedule.

5.3.2 Construction Stage

Impairment of visual aesthetics/Impact on urban landscape

143. Site preparations and land clearing may temporarily affect aesthetics and urban landscape. This impact is considered minimal adverse.

Mitigation measures

144. Good housekeeping at the construction site will be enforced at all times. Garbage bins will be provided by the EPC Contractor for proper disposal of solid wastes generated.

Residual impact

145. With mitigation, the significance of the impact will be low.

Ambient air quality

146. Site preparation along the transmission line route, land clearing and excavation works, use of construction vehicles, mobilization of heavy equipment and machineries, use of diesel generators as back-up power supply, and transport of construction materials may generate dusts and emissions affecting ambient air quality. Vehicular emissions will contribute to GHG emissions. This impact is characterized as **minimal adverse**.

Mitigation measures

147. The following measures will be implemented: (i) require EPC Contractor to monitor the maintenance of construction vehicles, (ii) water will be sprayed to unpaved roads and opened land areas, as and when necessary, to minimize dust dispersion, (iii) vehicles transporting construction materials generating dusts will be covered with tarpaulin, (iv) stockyards of construction materials will be covered including opened areas during off-work, and (v) construction area with excavation works and opened land areas will be temporarily enclosed to contain dust generated.

Residual impact

148. With mitigation, significance of this impact will be low.

Ambient noise

149. Construction activities such as civil works, use of heavy equipment and machineries, welding and electrical works may increase the ambient noise level at the construction site. Prolonged exposure to elevated noise level may cause hearing impairment to workers and annoyance to local people. This impact is characterized as minimal adverse.

Mitigation measures

150. Workers assigned to noise-generating activities will be provided with ear muffs and will be rotated every 4 hours to minimize exposure. Construction activities that generate noise will be undertaken only during daytime. Machines and vehicle engines not in use will be turned off. Drivers of vehicles used in construction will be instructed not to use horns or sirens unnecessarily. Noise-generating activities will be enclosed to minimize the noise level.

Residual impact

151. With mitigation, the level of significance of this impact will be low.

Generation of wastes at construction site and field camps

152. Workers and construction activities will generate wastes. Improper collection and disposal of solid waste generated may pose safety and health risks both to workers and the community. Aside from this, mismanaged solid waste will be unsightly and unhygienic. Oily wastes from machine workshops and vehicle maintenance may cause land contamination. This impact is considered moderate adverse.

Mitigation measures

153. The EPC Contractor will be required to have a Waste Management Plan approved by PMU, NWPGL. Garbage bins will be provided at the construction sites and EPC Contractor will make arrangement with the local government institution managing solid wastes for collection and proper disposal to designated sites. Good housekeeping will be enforced at all times that workers found not in compliance will be dealt with accordingly. Practice of reuse, reduce and recycle will be adopted to decrease the volume of generated waste from construction activities and to maximise the resource recovery of materials. Workers will be encouraged to sort the solid wastes at source prior to disposal. Oily wastes will be passed through an oil-water separator before discharge.

154. EPC Contractor will provide workers with sanitary facilities, wash areas, safe drinking water, and adequate water supply for general washing purposes. Compliance of EPC Contractor to relevant provisions in ECR 1997 on discharge of wastewater including waste management at the construction sites will be monitored by PMU, NWPGL.

Residual impact

155. With mitigation, the significance of this impact will be low.

Flooding

156. Bhairab River, Atai River, and Rupsha River are influenced by tidal action from the Bay of Bengal. Construction works at the six river crossings may potentially cause flooding during high tide. This impact may be considered moderate.

Mitigation measures

157. Construction work schedule at the river crossings will consider tidal influence to avoid potential flooding. Highest flood level at the river crossings will be incorporated in the design and construction of the transmission towers.

Residual impact

158. With mitigation, the significance level of this impact will be low.

Impact on surface and groundwater quality

159. Construction works at the river crossings in Bhairab River, Atai River and Rupsha River may affect surface water quality. Excavated soil and opened land areas near the river banks including spoils disposal may cause erosion.

160. Oily wastes and accidental spill of liquid fuel may find its way to the rivers and ground water. Improper collection and disposal of solid wastes generated by workers may also find its way to the rivers. Field camps close to the rivers may cause degradation of surface water quality from wastes generated by workers.

Mitigation measures

161. No field camps will be located close to Bhairab River, Rupsha River, Atai River and other water bodies. The EPC Contractor will be required to prepare CMP that will address, among others, field camps, provision to workers of sanitary facilities, safe drinking water, wash areas away from water bodies, and adequate water supply for general purpose washing. EPC Contractor and its workers will be required to observe proper waste disposal and proper sanitation.

162. All construction vehicles and equipment will be maintained in proper conditions. EPC Contractor will use silt traps and erosion control measures where the construction is carried out in close proximity to the drains and water bodies to avoid entering of cement particles, rock, rubbles and waste water to the surrounding water bodies.

Impact on soil quality

163. During site preparation, vegetation clearing will be required and will involve excavation works for the foundation of the transmission towers. Improper handling of excavated soil, spoils disposal, and generation of wastes at the construction site may affect soil quality of adjacent land.

Mitigation measures

164. Construction activities will be limited to designated areas. Proper storage of chemicals such as lubricants will be implemented. Areas for machine repair and other mechanical work that may require mineral oil or lubricants will be lined with impermeable material to prevent land contamination. Excess chemicals that may be needed for construction will be disposed of following its material safety data sheet (MSDS). EPC Contractor will be encouraged to use non-toxic and biodegradable chemicals on-site. Solid waste generated on-site will be collected and disposed of properly.

Impact on terrain and topography

165. During construction, erosion might occur in the location of towers in steep terrain.

Mitigation measures

166. Construction works will be scheduled, to the extent possible, during the dry season. Where required, erosion control and slope protection measures will be provided. Stabilization of embankment with grasses or other soil cover will be conducted as soon as necessary.

Change in land use

167. Mobilization of construction equipment, machineries, and vehicles, and transport of construction materials will require space for storage and parking. Areas for field camps will also require space. A total of about 3 ha will be lost permanently to tower footings and about 49.122 ha will be RoW. These interventions may affect the existing land use.

Mitigation measures

168. Use of space for stockyard and parking will secure permits and approval from respective local government institutions. EPC Contractor will be required to use only the designated areas indicated in the permits. Compliance will be monitored by PMU, NWPGCL. Except for the towers, space to be used during construction for storage and parking will be rehabilitated to a condition similar to before construction.

Loss of crop production

169. Vegetation and standing crops along the RoW will be cleared and stringing of conductors may also affect standing crops. It is estimated that about 11.44 tons of crops (HYV Aman: 3.42 tons, HYV Boro: 6.0 tons, Kheshari: 0.9 tons and Sesame: 1.12 tons) may be affected by these activities.

Mitigation measures

170. Construction work schedule will consider harvest time of farmers that may be affected to minimize crop damage. Any crop damage that may be incurred due to Component 3 will be properly compensated.

171. Farmers will be informed way ahead (before start of cropping season) about the construction activities and schedule, so they would not take any initiative for crop cultivation in the affected areas. Farmers will be given the chance to harvest their crops before the EPC Contractor will start construction works.

Fish habitat loss

172. Construction works may temporarily damage the *ghers* area especially the *gher* near the bank of Rupsha River at Tentultola village. Temporary loss of gher area is about 0.02 acre (2 decimal). During tower installation, the nutrient-rich soil will be excavated which may affect the habitat quality of the gher.

Mitigation measures

173. Construction of temporary bund around the base of the tower will be undertaken to protect the other part of the gher. Top soil removed for the base of the towers will be set aside and returned to the adjacent area after construction.

Impact on fish production

174. Loss of fish production is about 10 kg due to construction of tower in the gher which is insignificant. However, habitat quality due to exposure of nutrient deficient subsoil may affect fish production.

Mitigation measures

175. Construction of temporary bund around the base of the tower will be undertaken to avoid disturbance of fish culture within the gher. Consideration of work schedule for erection of towers will be taken to avoid the period January to August. Any damage to gher production will be properly and timely compensated.

Impact on terrestrial vegetation

176. Vegetation along the RoW will be cleared during construction. No plant species of conservation status along the RoW.

Mitigation measures

177. Construction works will not be scheduled during harvest time to minimize damage to cash crops. If work schedule cannot be adjusted, land owners will be properly compensated for any crop damage along the RoW. EPC Contractor will be required to clear vegetation only in designated areas. Agricultural activities within the RoW will be allowed after construction but with restrictions to height of vegetation. Only plants such as sugarcane, corn, rice, etc. that are less than 3 m tall will be allowed for cultivation.

Effect on local workforce

178. During construction, there will be employment opportunities as well as opportunities for local people to engage in small-scale and temporary business opportunities of selling food, temporary accommodation, etc. due to the presence of workers.

Mitigation measures

179. EPC Contractor will be required to give priority to local hiring especially to non-skilled workers. This will be monitored by PMU, NWPGL. For recruitment of skilled workers, local labour will be given preference.

Impacts to health and safety

180. Construction works along the transmission line route, which is located mostly in urban areas with river crossings, may pose safety risks to workers and the community. Exposure to sources of increased dust and noise levels may also pose health risks to workers and the community.

Mitigation measures

181. EPC Contractor will require workers to wear safety gears (helmets, safety belts, masks, gloves and boots) provided to them to minimize safety and accident risks. Toolbox meetings will be held before workers go to the work assigned to them. First aid kits and fire-fighting units will be made available at the construction sites. Before start of construction works, the EPC Contractor and PMU, NWPGL will provide orientation and brief training to workers on emergency preparedness, and create awareness on the potential for sexually-transmitted disease in the workplace. The EPC Contractor will be required to provide affordable group medical and accident insurance to their workers or arrange with the local health facilities to provide assistance in the event of emergency. Recruitment of workers below 18 years old will be strictly prohibited. EPC Contractor (and subcontractors) will be required to comply with all relevant regulations on labour, occupational health and safety. PMU, NWPGL will monitor compliance.

5.3.3 Operation stage

Presence of transmission towers may affect aesthetics and urban landscape

182. OHTL generally follows the easement of existing urban roads and may just blend with the urban landscape. There is no known building structure of conservation status along the transmission line route.

Impact on riverbank erosion

183. The level of significance of this impact is considered as low. Design of transmission towers crossing the rivers will incorporate the potential for riverbank erosion.

Mitigation measure

184. Planting/revegetation along the river bank side affected by Component 3 will be undertaken to minimize potential erosion.

Residual impact

185. With mitigation, significance of the impact will be low.

Impact on water quality and potential land contamination

186. Improper disposal of used mineral oil as insulating medium to electrical equipment in the substation may affect water quality and cause land contamination. Use of PCB in Bangladesh has been stopped in the 1980s. However, some equipment imported in 2000 was found to be labelled as with PCB-content. On 15 March 2005, DoE issued a letter to BPDB and other relevant organizations requesting that they buy PCB-free transformers, transformer oil, and capacitors, store all unserviceable oil in safe and secure locations, and ensure that out-of-service equipment and oils are not sold in the market for other uses.¹⁸

Mitigation measures

187. No PCB or PCB-containing material will be used in Component 3. Used mineral oil (replacement of PCB) as transformer oil is considered hazardous wastes and will be handled properly based on relevant regulations and international environmental agreements such as Stockholm Convention and the Basel Convention. Used mineral oil will be stored in plastic drums with proper labeling. Disposal of excess and used mineral oil will follow the accompanying material safety data sheet (MSDS).

Loss of crop production

188. About 3 ha of land will be permanently lost due to the tower footings and cultivation of some plants/crops will be restricted along the RoW.

Enhancement measure

189. Agricultural activities within the RoW will be allowed after construction but with restrictions to height of vegetation. Only plants such as sugarcane, corn, rice, etc. that are less than 3 m tall will be allowed for cultivation. Given the ground clearance at the base of the towers, farmers can still opt to use the land below the towers for cultivation of low growth crops.

Impact on terrestrial vegetation

190. Planting trees and cultivation of crops higher than 3 m along the RoW will be restricted. Vegetation that grew after construction phase will be trimmed regularly to maintain the height restrictions for safety reasons.

Mitigation measures

191. Restriction in vegetation height is to ensure that the required vertical spacing between the conductors and the vegetation is maintained for safety reasons. NWPGL will continue dialogue with farmers (as needed) to remind them of the height restrictions on vegetation along the RoW. Any crop that may be damaged due to maintenance of the OHTL will be properly compensated.

¹⁸ Department of Environment, Ministry of Environment and Forests, Bangladesh National Implementation Plan (NIP) For Management of Persistent Organic Pollutants (POPs), January 2007.

Impact on wildlife habitat and their disturbance

192. Component 3 is not close to protected areas or national parks. However, birds may be attracted to the presence of transmission towers. The risk of bird electrocution due to the presence of transmission towers may be likely and may affect bat species such as Indian flying fox (*Pteropus giganteus*).

Mitigation measures

193. Transmission lines are designed to have ground wire spacing and lightning arresters as safety features to generally protect the public (and birds). Spot checks/ocular inspection of wildlife crossing and bird electrocution (if any) will be included as part of maintenance work along the transmission line. NWPGCL staff assigned to maintenance works will be trained to create awareness.

Exposure of community to OHTL

194. Presence of transmission line may pose potential hazards such as electrocution, lightning strike, etc., due to accidental failure of power transmission. Maintenance of RoW may disturb communities living close to the RoW. Overhead transmission lines have always been associated with concerns on potential risks of cancer from exposure to electromagnetic field (EMF) from overhead transmission lines and substations. However, in spite of all the studies that have been carried out over the past 30 years, there is still no persuasive evidence that the fields pose any health risks. The World Health Organization (June 2007) recommends using exposure guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP has set the limit of exposure for the general public as: (1) electric field (kV per meter) is 4.17 and (2) magnetic field is 833 milliGauss (mG). The British Columbia Hydro measured the magnetic field levels near their transmission and distribution lines.¹⁹ For 230 kV, the magnetic field level at 0 m from the line is 38 mG, 28 mG at 10 m, 15 mG at 20 m, 8 mG at 30 m and 5 mG at 40 m. These levels are much lower than the magnetic fields in the house: (1) hairdryer (300 mG), (2) dishwasher (20 mG), and (3) washing machine (20 mG) taken 6 inches from the source.²⁰ To avoid the impacts of EMF, houses will not be allowed within the RoW of the project. During the design, the transmission line and substation equipment will be rated to ensure EMF is within the permissible limits specified in the EHS guidelines.

Mitigation measures

195. Clear and visible danger and warning signs will be posted at designated areas to alert the community of the safety risks. In addition, transmission towers are equipped with danger boards, barbed wire, and galvanized ground wire for earthing purposes. NWPGCL staff assigned to maintenance works, inspection and security personnel will conduct ocular inspection regularly to prevent vandalism and pilferage of cables that may cause accidents or electrocution.

196. Power transmission systems like Component 3 are designed with protection system that shuts off during power overload or similar emergencies. As well, an emergency preparedness

¹⁹ BC Hydro Power Smart. Understanding Electric and Magnetic Fields. <https://www.bchydro.com/.../BCHydro/.../understanding-emf-booklet-jan2017.pdf>.

²⁰ US EPA. EMF in Your Environment. December 1992. <https://nepis.epa.gov/>

and response mechanism will be employed by the NWPGL. As part of consultations, NWPGL will conduct information campaign to local people to enhance awareness on living safely near the power transmission systems.

5.4 Hazard and risk assessment

5.4.1 Hazard assessment process

197. The steps followed in this preliminary hazard and risk assessment are as follows:

- Identification of Hazards
- Analysis of Causes
- Assessment of Likelihood
- Identification of Existing Safeguards
- Risk Ranking for Prioritization of Corrective Actions
- Recommended Actions and Safety Measures

5.4.2 Hazard identification, classification and potential hazard points

Construction and operation

198. Potential hazard points based on hazard classification and the type of hazard occurrences from the hazard points are listed in **Table 5.11**.

5.4.3 Hazard Consequence & Frequency Scales

199. Potential impacts from Component 3 have been scaled and prioritized based on the magnitude of those potential impacts (consequence) and the likelihood of them occurring (frequency). The consequence of the impacts is classified and illustrated in **Table 5.12**.

Table 5.11: Potential hazard identification for Component 3

Location of hazard	Project Activities	Potential hazard	Root/main Causes	Possible consequences
Construction stage				
Construction site	Mobilizing machines, equipment and vehicles for site clearance activities	<ul style="list-style-type: none"> • Trips and falls • Cuts and bruises 	<ul style="list-style-type: none"> • Fatigue or prior illness/sickness • Mechanical failure • Lack of safety training • Not abiding to general health and safety and traffic rules 	<ul style="list-style-type: none"> • Health injury • Disability • Life loss
	Construction of structures and its foundation, cutting, welding, painting works, drilling work, etc.	<ul style="list-style-type: none"> • Accidents (burns, electric shocks etc.) • Injuries from falls and slips • Inhalation of dust • Cuts and bruises 	<ul style="list-style-type: none"> • Fatigue or prior illness/sickness • Electric failure • Mechanical failure • Unrated or faulty cables • Equipment failure • Lack of safety protocols (e.g. not putting up warning signs or enclosing the area to prevent entry of outside people) • Not maintaining a designated place for backfilling storage • Not maintaining enough lighting during the night (for those working overtime) • Not properly checking for faults in machineries • Not using appropriate PPE during work 	<ul style="list-style-type: none"> • Physical injury • Disability • Life loss
	Erection of heavy structures	<ul style="list-style-type: none"> • Falling of heavy objects/debris from height • Tipping off heavy solid objects during erection. • Mechanical failure of lorries/cranes may lead to accidents 	<ul style="list-style-type: none"> • Mechanical failure • Faulty equipment, steel wires, ropes and machineries • Lack of proper maintenance • Negligence of crane operators and constructions workers 	<ul style="list-style-type: none"> • Environmental damage • Blockage of access roads • Severe injuries/ disabilities • Fatality
	Work at heights	<ul style="list-style-type: none"> • Accidents • Injuries from falls and slips (e.g. broken bones, 	<ul style="list-style-type: none"> • Fatigue or prior sickness • Lack of safety protocols (e.g. not wearing safety harness and other protective gears) • Not maintaining a designated place for 	<ul style="list-style-type: none"> • Physical injury • Disability • Fractures

Location of hazard	Project Activities	Potential hazard	Root/main Causes	Possible consequences
		fractures, traumas, etc.) • Fatalities	backfilling storage • Not maintaining enough lighting during the night	
	Vehicle movement	• Noise generation • Accident • Emission from vehicles • Spread of dust and minute particles due to vehicle movement.	• Running engine, hydraulic horns, etc. • Mechanical failure • Old engine or engine parts/lack of maintenance	• Injuries • Health problems (e.g. respiratory, hearing and/or cardiac, asthma problems) • Fatalities • Disabilities
	Occupational Hazard	• Cuts, bruises and burns • Falls, slips and trips • Health injuries • Sickness and illness	• Lack of safety awareness • Carelessness in maintaining safety protocols • Use of faulty machineries and equipment • Improper hygiene • Prior sickness or illness • Heavy workload	• Health injuries (burns, anxiety, depression, etc.) • Disabilities • Fatalities
Operation stage				
<ul style="list-style-type: none"> • Cable Gallery • Switchyards • Transformer area • Transmission line area 	<ul style="list-style-type: none"> • Stepping up voltage via transformer • Switchyard to transmit electricity to national grid 	<ul style="list-style-type: none"> • Fire due to resulting arc flash/arc blast • Other electric hazard due to unprotected cables • Slips and trips from unorganized/lose cables lying in the floor 	<ul style="list-style-type: none"> • Short circuit in control room and switch gears • Faulty cables and wires • No safe connection to earth • Not maintaining risk evaluation form before starting work • Negligence of maintenance workers • Bringing in conductive materials during maintenance work • Not disconnecting electricity supply from live connections before maintenance work • Not wearing appropriate PPEs during maintenance work • Not de-energizing machines or equipment before maintenance work • Using cables with different voltage and current ratings • Unorganized cable 	<ul style="list-style-type: none"> • Health injury from electric shock, fires, etc. • Fatality from electric shock, fires and so forth. • Electric burns

Location of hazard	Project Activities	Potential hazard	Root/main Causes	Possible consequences
	Sabotage of equipment	<ul style="list-style-type: none"> • Loss of power/electricity • Possible physical harm 	<ul style="list-style-type: none"> • Lack of on-site security measures • Unrest amongst workers 	<ul style="list-style-type: none"> • Indefinite power outage • Loss in economy • May affect any further industrial development • Possible injuries/hospitalizations

Table 5.12: Hazard Consequence Scale

Parameter	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Catastrophic)
Duration of potential impact	Temporary with no detectable potential impact	Limited to construction period	Medium Term (1 to 2 years)	Long term (more than 2 years)	Permanent Damage
Spatial extent of the potential impact	Specific location within project component or site boundaries with no detectable potential impact	Within project boundary	Beyond immediate project components, site boundaries or local area	Widespread far beyond project boundaries with some community and wildlife habitat coverage	Beyond project boundaries extending to widespread communities and wildlife habitat
Reversibility of potential impacts	Baseline remains almost constant	Baseline returns naturally or with limited intervention and within a few months	Potential impact requires a year or so for recovering with some interventions to return to baseline	Potential impact is long-term, requiring considerable intervention to return to baseline	Potential impact is effectively permanent, with little to no chance of returning to baseline
Compliance to Legal Standards before Mitigation Measures	Complies with all minimum requirements only some improvement opportunities to strengthen good practices	Meets minimum national standard limits or international guidelines	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Complies partially with limits given in national standards but breaches international lender guidelines	Completely breaches national standards and or international guidelines/ obligations
Extent of health injuries	Minor pain, scratch, discomfort requiring no medical attention	Health injuries can be cured with first aid and/or some medical attention	Health injury requires hospitalization; may require long term recuperation; may lead to long term absence from work	Health injury may lead to permanent disability; few fatalities of workers and or community people	Fatalities of workers more than five (5) and or community people more than two (2)
Impact on wildlife	Minimal disturbance within compliance	Disturbing habitat of wildlife causing discomfort	Disturbing habitat of wildlife causing decrease of prey and forcing them to relocate	Impact leading to deaths of any endangered species and decrease of their food source	Impact may lead to deaths of two or more endangered marine mammals and/or five of other endangered species

Criteria for determining the frequency of the potential hazard being occurred are outlined in Table 5.13.

Table 5.13: Criteria for Determining Frequency of the Potential Hazard

Frequency Scale Determination	Definition
1 (Rare)	Rare chance of occurrence, if not at all
2 (Low)	Very minimal chance of occurring
3 (Medium)	May occur considering if the conditions are abnormal or exceptional
4 (High)	Occurs more frequently without prior warnings
5 (Almost Certain)	Occurs under typical conditions

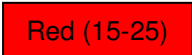

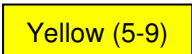
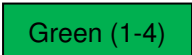
5.4.4 Developing Risk Matrix

200. Following the consequence and frequency scales, a risk matrix was developed after analyzing the potential hazards of Component 3. **Table 5.13** shows the risk matrix for the potential hazards and how frequently they may occur. In **Table 5.14**, the risk evaluation based on the type of activities and potential hazards are shown.

Table 5.14: Risk Matrix of Potential Hazards/Impacts

Frequency (F) of Hazards ↓	Hazard Consequence (C) →				
	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Severe)
1 (Rare)	1	2	3	4	5
2 (Low)	2	4	6	8	10
3 (Medium)	3	6	9	12	15
4 (High)	4	8	12	16	20
5 (Almost Certain)	5	10	15	20	25

Color Legend:

	≡ Top Priority	: Action with follow-up Verification & Validation by Authority needed before allowing work
	≡ High Priority	: Action needed under follow-up Supervision before allowing work
	≡ Medium Priority	: Need maintaining with routine monitoring & reporting
	≡ Low Priority	: Only for awareness; no Intervention Action needed to start work

201. The risk for the potential hazard/impact is evaluated based on the combination of the hazard consequence and their frequency (NHS, 2008). In order to calculate the potential risk, the frequency of impact is multiplied with consequences. E.g. Level 1 of frequency of a hazard (Rare) is multiplied with Level 1 of hazard consequence (insignificant) to give a total score of 1 (1X1=1) and so on. In that regards, a score between 1 to 4 is considered low priority; a score between 5 to 9 is considered medium priority and; a score between 10 to 14 is considered high priority and; a score between 15 to 25 is considered top priority.

5.4.5 Risk Estimation, Evaluation and Management Plan

202. Based on the hazard consequence and frequency scales, potential risk of a particular hazard/impact is estimated and given a score. The score is given in terms of the presence

and absence of safeguards. The final evaluation of the potential risks is determined based on combined score of hazard consequence and its frequency. **Table 5.15** shows the risk evaluation (risk ranking) of project activities and its subsequent hazards (both before and after implementing safety measures).

Table 5.15: Risk evaluation for Component 3

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
Construction Stage										
• Construction site	Mobilizing machines, equipment and vehicles for site clearance activities	<ul style="list-style-type: none"> • Trips and falls • Cuts and bruises 	<ul style="list-style-type: none"> • Fatigue or prior illness/sickness • Mechanical failure • Lack of safety training • Not abiding to general health and safety and traffic rules 	3	3	9	<ul style="list-style-type: none"> • Arranging toolbox meeting before going out for work • Cable/wire needs to be check regularly • Regular inspection and maintenance of equipment • A thorough lorry driver selection process via interviews, checking whether they have the proper licenses and from past experiences • Training of traffic rules and regulation, including maintaining vehicle speed limit for different categories of road after the selection process is complete • Limiting movement of vehicles after sunset and before sunrise • Regular health and safety training to all construction workers and lorry drivers, including the proper use of PPEs. 	2	2	4
	Construction of structures and its foundation, cutting, welding,	<ul style="list-style-type: none"> • Accidents (burns, electric shocks etc.) • Injuries 	<ul style="list-style-type: none"> • Fatigue or prior illness/sickness • Electric failure • Mechanical failure 	3	2	6	<ul style="list-style-type: none"> • Arranging toolbox meeting before going out for work (during each construction activities.). Provide each worker with a safety checklist and safety permit (based on their work) before starting work. 	2	2	4

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
	painting works, drilling work, etc.	<p>from falls and slips</p> <ul style="list-style-type: none"> • Inhalation of dust ▪ Cuts and bruises 	<ul style="list-style-type: none"> • Unrated or faulty cables • Equipment failure • Lack of safety protocols (e.g. not putting up warning signs or enclosing the area to prevent entry of outside people) • Not maintaining a designated place for backfilling storage • Not maintaining enough lighting during the night (for those working overtime) • Not properly checking for faults in machineries • Not using appropriate PPE during work 				<ul style="list-style-type: none"> • Regular inspection and maintenance of equipment, machineries and especially, safety harness. • Maintain a registry for any faulty equipment found; inform site contractors and they should replace those immediately. • No work should be done until the faulty machineries are replaced and tested. • Regular health and safety training and firefighting drills to all construction workers, including the proper use of PPEs during work. • Enclosing the area with yellow barricade tape and restricting outside access to local people during the whole construction process. • Spraying water on dust to minimize its spread via wind; put stockpile at a designated place and cover them with GI sheet; put up GI sheet fencing around the construction site. • Equipment, machineries and electric wires should be checked for current and voltage ratings. When using an extension cable, its wire rating should match with the 			

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
							<p>equipment wire rating.</p> <ul style="list-style-type: none"> Recording of any unusual activities and issuance of fines or suspensions if any rules are broken Work load should be managed effectively. Workers working every 2 hours should be given a mandatory 30 minutes break as stipulated in chapter 9 of Bangladesh Labour Rules, 2015²¹. Maintenance of an accident registry book 			
	Erection of heavy structures	<ul style="list-style-type: none"> Falling of heavy objects or debris from height Tipping off heavy solid objects during erection. Mechanical failure of lorries/ cranes 	<ul style="list-style-type: none"> Mechanical failure Faulty equipment, steel wires, ropes and machineries Lack of proper maintenance Negligence of crane operators and constructions workers 	3	3	9	<ul style="list-style-type: none"> Regular inspection and maintenance of equipment, machineries, vehicles and especially, safety straps of pulleys. Maintain safe vehicle speed limit at the construction site. Proper traffic guidelines and regulations as per The Motor Vehicle Rules, 1984, should be ensured. Maintain a registry for any faulty equipment found; inform site contractors and have them replace those immediately. No work should be done until the faulty machineries are replaced and tested. Regular health and safety training and fire 	2	2	4

²¹ Bangladesh Labour Rules (2015). *Ministry of Labour and Employment*. Retrieved from http://www.dpp.gov.bd/upload_file/gazettes/14079_83432.pdf.

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
		may lead to accidents					<p>fighting drills to all construction workers, including the proper use of PPEs during work.</p> <ul style="list-style-type: none"> Recording of any unusual activities and issuance of fines or suspensions if any rules are broken. Work load should be managed effectively. Workers working every 2 hours should be given a mandatory 30 minutes break as stipulated in chapter 9 of Bangladesh Labour Rules, 2015²². Maintenance of an accident registry book. Monthly health check-up of workers for any sickness or illness. Provide treatment/consultation accordingly. In serious cases of injuries or sickness, an ambulance should be on standby for transporting them to nearby hospital. 			
	Working at heights or elevation	<ul style="list-style-type: none"> Accidents Injuries from falls and slips (e.g. broken 	<ul style="list-style-type: none"> Fatigue or prior sickness Lack of safety protocols (e.g. not wearing safety harness 	3	3	9	<ul style="list-style-type: none"> Regular inspection and maintenance of equipment, safety harness and machineries. Maintain a registry for any faulty equipment/safety harness found; inform site contractors and have them replace 	2	2	4

²² Bangladesh Labour Rules (2015). *Ministry of Labour and Employment*. Retrieved from http://www.dpp.gov.bd/upload_file/gazettes/14079_83432.pdf.

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
		bones, fractures, traumas, etc.) • Fatalities	and other protective gears) • Not maintaining a designated place for backfilling storage • Not maintaining enough lighting during the night				those immediately. • No work should be done until the faulty machineries/safety harness are replaced and tested. • Regular health and safety to all construction workers working at height, including the proper use of PPEs/safety harness during work. • Recording of any unusual activities and issuance of fines or suspensions if any rules are broken. • Maintenance of an accident registry book. • Monthly health check-up of workers for any sickness or illness. Provide treatment/consultation accordingly. In serious cases of injuries or sickness, an ambulance should be on standby for transporting them to nearby hospital.			
	Vehicle movement	• Noise generation • Accident • Emission from vehicles • Spread of dust and	• Running engine, hydraulic horns, etc. • Mechanical failure • Old engine or engine parts/lack of maintenance	3	3	9	• Regular inspection and maintenance of equipment, machineries and vehicles. • Maintain safe vehicle speed limit at the construction site. Proper traffic guidelines and regulations as per The Motor Vehicle Rules, 1984, should be ensured. • Noise emission should be controlled as per ECR, 2006 guidelines	2	2	4

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
		minute particles due to vehicle movement.					<ul style="list-style-type: none"> Regular spraying of water (at least twice a day) at earthen road networks should be done at the construction site. 			
Operation Phase										
<ul style="list-style-type: none"> Cable Gallery Switchyards Transformer area Transmission line area 	<ul style="list-style-type: none"> Stepping up voltage via transformer Switchyard to transmit electricity to national grid 	<ul style="list-style-type: none"> Fire due to resulting arc flash/arc blast Other electric hazard due to unprotected cables Slips and trips from unorganized/lose cables lying in the 	<ul style="list-style-type: none"> Short circuit in control room and switch gears Faulty cables and wires No safe connection to earth Not maintaining risk evaluation before starting work Negligence of maintenance workers Bringing in conductive 	4	4	16	<ul style="list-style-type: none"> Installation and monitoring of fire defense and fighting systems. Checking the insulation of the wire, along with the wire's voltage and electric ratings. Change wires if ratings do not match with the power supply or if the insulation is damaged Proper earthlings should be made to avoid electric shocks. Open wires should be passed through a plastic pipe to avoid exposing them with outside contact. Switch off power before doing any electrical work. Inform supervisor and respected officers before starting any electrical work (Lockout/Tag Out)²³. Inform them again after the electrical 	2	2	4

²³ Canadian Centre for Occupational Health and Safety (2013). OSH Answers Fact Sheets – *Lockout/Tag out*. Retrieved from <https://www.ccohs.ca/oshanswers/hsprograms/lockout.html>

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
		floor	<p>materials during maintenance work</p> <ul style="list-style-type: none"> • Not disconnecting electricity supply from live connections before maintenance work • Not wearing appropriate PPEs during maintenance work • Not de-energizing machines or equipment before maintenance work • Using cables with different voltage and current ratings 				<p>works are done.</p> <ul style="list-style-type: none"> • De-energizing of equipment, machineries and transformers before doing maintenance work. • Maintenance workers should regularly maintain a risk evaluation form, starting which equipment is being maintained/repared, their voltage and current capacity and the appropriate PPE for the job. • The risk evaluation form should be assessed and cleared by the supervisor before starting any maintenance work. • All power transformers and transmission should be fitted with lightning arrester to protect from lightning strikes. • Switchyards should be fitted with circuit breaker in case of short circuit or during an unusual surge of electrical current. • When working with exposed live wire/machines, the maintenance worker should maintain distance of 6 meters from the live exposed part²⁴. 			

²⁴ Parmar, J (2012). Electrical Engineer Portal. *Electrical Safety Standards for LV/MV/HV (Part-2)*. Retrieved from <http://electrical-engineering-portal.com/electrical-safety-standards-for-lvmvhv-part-2#16>

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
			<ul style="list-style-type: none"> • Unorganized cable 				<ul style="list-style-type: none"> • Maintenance worker must avoid bringing any conductive material whilst any maintenance works. Any conductive materials, such as metal key-chains, coins, watches etc. should be removed. • Maintain a safe distance from the rights-of-way (RoW). Don't raise any construction under the RoW. • Any cranes or vehicles passing through a high voltage overhead transmission line should have a minimum 1 meter distance from the overhead transmission line. • Place "electrical hazard" or "high voltage" signs on all switchboards and power transformers. • Restrict access to power transmission area, switchyards and control area to power plant officials and maintenance workers only. • Raising awareness on occupational hazards. Arrange monthly health and safety training, electrical safety training and fire fighting drills to all officers and plant workers, including the proper use of PPEs during work • Monthly health check-up of officers and 			

Hazard points	Project Activities	Potential hazard	Root causes	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
							workers for any sickness or illness. Provide treatment/consultation accordingly. In serious cases of injuries or sickness, an ambulance should be on standby for transporting them to nearby hospital <ul style="list-style-type: none"> Maintain safety precaution measure in case of an accident such as, maintaining first aid, on-site medical center, doctors, nurses, ambulance services etc. 			
	<ul style="list-style-type: none"> Sabotage of equipment 	<ul style="list-style-type: none"> Loss of power/electricity Fire hazard Possible physical harm 	<ul style="list-style-type: none"> Lack of on-site security measures Unrest amongst workers 	4	2	8	<ul style="list-style-type: none"> Increased on-site security measures Maintaining entry-exit registry of workers and/or visitors Elect a representative amongst the worker groups who will discuss and advocate their grievances and problems to the plant authorities. 	2	2	4

6.0 ANALYSIS OF ALTERNATIVES

203. Aside from the economic, financial, safety and engineering factors, the potential environmental and social impacts have been carefully considered in selecting the best route for the overhead transmission line. Both the “no project” and “with project” options have been studied.

6.1 “No project” option

204. The “no project” option means that the area along the proposed alignment will remain the same as the current condition. However, the power to be generated by the Rupsha 800 MW CCPP will not be evacuated to the national grid. A “no project” option will entail that the proposed and planned economic development and business opportunities within southwestern Bangladesh may not altogether happen due to lack of reliable power, and thus, will be an opportunity cost for GoB. **Table 6.1** presents a comparison of “with project” and “no project” options.

Table 6.1: Comparison of “with project” and “no project” options

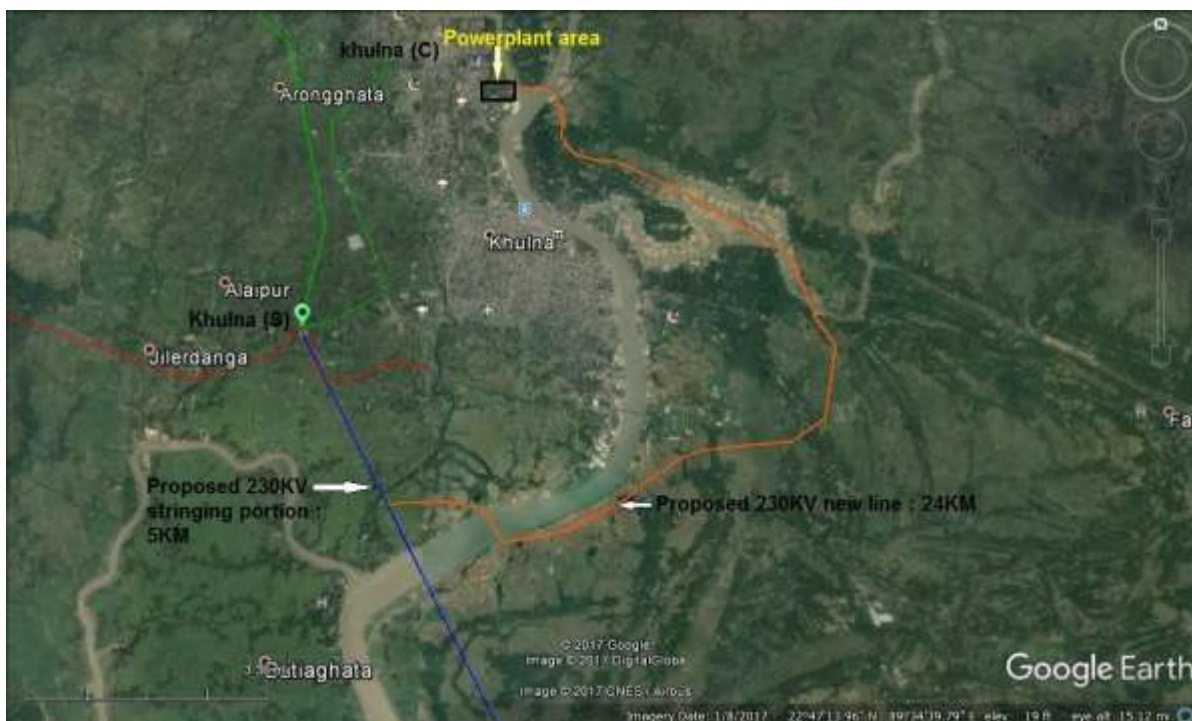
Description	“With Project” Option	“No Project” Option
Power transmission interconnection from the Rupsha 800 MW CCPP to the national grid	Provides a stable and reliable power with Component 3	No additional power generation capacity
Economic development	More opportunities for southwestern part of Bangladesh as a result of a stable and reliable power supply	<ul style="list-style-type: none"> • Minimal, if any, due to lack of reliable power supply • Development plan may be restricted by the availability of power supply
Potential impacts to ecologically-sensitive areas	Route selected does not pass through protected areas or national parks. Potential impacts due to the implementation of Component 3 can be readily mitigated by compliance to relevant regulations, EMP, and industry safety design standards and specifications, etc.	None
Potential impacts to terrestrial flora and fauna	RoW along the transmission line route will not pass through protected areas	None
Fugitive GHG emissions	Will use air insulated switchgear for the 230 kV substation in Rupsha 800 MW CCPP. No GHG expected GHG emissions.	No GHG contribution
Disruption to local residents along the transmission line route	Potential disruption to daily activities will be minimal (i.e., temporary and short duration during construction/installation). Any disruption can be managed by consultation, implementation of environmental management plan (EMP), proper construction planning and scheduling of activities.	None
Employment	Creation of job opportunities with the	None

Description	“With Project” Option	“No Project” Option
	implementation of Component 3.	

6.2 “With project” options considered for Component 3

205. Three options were considered in selecting the transmission line route from the 230 kV substation in Rupsha 800 MW CCPP to the existing Khulna SS (see Figure 6.1).

Figure 6.1: Location of Component 3



206. The following criteria were considered during the route selection:

- Existence of open agricultural land;
- Distance from connecting road should not to be more than 1 km;
- Avoid: settlements and urban areas (as much as possible), river crossings, and water bodies.

207. Aside from these criteria, the Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution of the World Bank Group was also referred to.²⁵

Table 6.2: Route options for Component 3

Description	Option 1	Option 2 (Final)	Option 3
Route length, km	23.2	24.561	10.9
Presence of urban area	No	No	Yes
Density of settlements	Medium	Low	High

²⁵ International Finance Corporation, Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines. (Accessed 16 November 2017)

Description	Option 1	Option 2 (Final)	Option 3
Existing power transmission line	N/A	1	1
Presence of existing important infrastructure	Medium	Low	High
Number of river crossing	4	6	N/A
Cost effectiveness	Medium (OHT)	Low (OHT)	High (underground T/L)
Presence of reserved forest	No	No	No
Any ecologically critical area (ECA)	No	No	No
Any bird habitat and declared Important Bird Area (IBA)	No	No	No

208. From the options considered, Option 2 appears to be the most suitable route for further evaluation.

7.0 INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

7.1 Introduction

209. Consultations for Component 3 were conducted as part of the requirements of the DoE and ADB's SPS 2009. The main objective is to involve stakeholders throughout the project implementation and to know their concerns and perceptions about the project. Specific objectives of consultations include the following:

- a) To ensure peoples' participation in the proposed project;
- b) To inform key stakeholders about the project, its environmental implications within the project area, potential environmental impacts and mitigation measures, project benefits, and about the "cut-off date" for persons directly affected by the project;
- c) To determine the perceptions of the people about the project and share experiences of the participants on similar projects;
- d) To understand and create awareness of problems in the project area;
- e) To discuss and propose possible solutions to the problems identified;
- f) To describe the mechanism for handling potential grievance related to the project; and,
- g) To inform stakeholders on access to information about the project.

7.2 Approach and Methodology

210. Stakeholders were classified into primary and secondary stakeholders. These stakeholders are characterized as the following:

- a) Primary stakeholders

211. These are persons who will be along the RoW of the pipeline route that may be directly affected during construction and operation phase. Primary stakeholders of Component 3 may include teachers, students, and different local occupational groups.

- b) Secondary stakeholders

212. These are persons or organizations that will not be directly affected but may have interests that can contribute to the projector may affect decision-making in some areas. Secondary stakeholders may include relevant government agencies like local government institutions, PGCB, Road Development Authority, DoE, community-based organizations, NGOs, and other interested individuals or groups.

213. Checklists were used to guide the consultations to ensure that the discussions are focused and relevant. A summary includes information about the project, proposed implementation schedule, and potential project impacts. Views and concerns of the participants were recorded and their questions were properly responded to by NWPGL and their consultants.

7.3 Consultations during the preparation of the EIA

214. A total of five consultation events were conducted on 11 November, 2016, 21 December 2016 and 21 October 2017 by the CEGIS. These consultations were workshop, key informant

interviews (KII), Focus Group Discussion (FGD) and Informal Interviews done in Khulna (IEB conference hall), Dighalia, Batiaghata, and Malapara. the list of participants and photos of consultations (12/11/2016 and 21/12/2016) are given in **Annex 3** and **Annex 4**. In addition, the details of the Public Consultation held on 21st October 2017 are attached in **Annex 2**.

Table 7.1: Location of consultations

Division	District	Upazila	Meeting type	Meeting Place	Date
Khulna	Khulna	Dighalia	FGD and KII	Chandoni Mahal village	21/12/2016
		Batiaghata	Group Discussion and KII	Tetultola village	21/12/2016
		Batiaghata	Group Discussion and KII	Puthimari village	21/12/2016
		Malapara	FGD	Malapara	12/11/2016
Khulna	Khulna	13 no. ward, Khulna City Corporation	Workshop	IEB conference room, Khalishpur	21/10/2017

7.4 People's perceptions of the Project

215. At the outset of the interviews and discussions, an overview of Component 3 including the ongoing activities of NWPGL and PGCB, and the EIA process was shared with the participants. Key environmental and socio-economic aspects listed below were discussed:

- Land price of different places
- Perceptions to the existing Electricity Act
- Compensation method and policy
- Positioning of the angle points
- Price of crop, trees, and different structures
- Cropping pattern and intensity
- Occupation and employment (unemployment/availability of labor, etc.)
- Social Safety & Security (availability of law enforcement agencies, social unrest issues, etc.)
- Quality of life (poor housing and sanitation facilities, drinking water, fuel and fodder, etc.)
- Condition of infrastructure throughout the RoW

216. CEGIS, the environmental and social consultants of NWPGL, discussed with the participants the different physical interventions involved in the implementation of Component 3 and the potential environmental impacts. The participants are not aware of Component 3 but showed positive attitude towards its implementation. However, they identified some problems and suggested measures (see **Table 7.2**). They urged NWPGL to mitigate/address the issues they raised.

Table 7.2: Summary of consultations

Issues Raised	Suggested Measures
<ul style="list-style-type: none"> • Compensation for standing crops only is not sufficient as the land below the base of transmission tower will be permanently unusable 	<ul style="list-style-type: none"> • Compensation process in the existing Electricity Act should be revised • Construction activities will be done after crop harvesting time initiate

Issues Raised	Suggested Measures
<ul style="list-style-type: none"> • After installation of tower the land will lose its selling value • Restrictions on development in land areas between two towers will be permanent loss to land owners • Complex compensation process • Damage to standing crops due to construction activities • Noise from land development, mobilization of equipment for stockpiling materials and construction activities may damage listening ability; and may deteriorate mental and physical condition of the people residing adjacent to the project site 	<ul style="list-style-type: none"> • Just compensation to land owners not only for standing crops but also for the permanent loss of land below the transmission towers, restrictions to development in their own land due to the presence of transmission towers • Crop compensation should be given to affected land owners within a shortest possible time • Value of damages for crops and land price should consider not only government rate but also justified by the market price • Consider provision of livelihood trainings so that affected people can engage in different occupation • There should be an option for local people to be engaged in the construction activities to create employment opportunity • During recruitment, local people would be considered as the first priority • A meeting should be arranged to identify suitable hours for transport of construction material to minimize the risks of accidents • Construction activities that generate elevated noise level should not be done during night time • A neutral monitoring agency should be engaged for monitoring the construction and post construction activities of the project

217. Consultations with stakeholders will continue during the implementation of Component 3, power transmission interconnection. A communications strategy plan will be prepared by PMU, NWPGCL with technical support from a Consultant. This will ensure that stakeholders are engaged, as and when needed.

218. A project summary will be posted in the website of NWPGCL. In addition, a one-page flyer on project brief including details on grievance redress mechanism, and contact person in case of complaints and/or concerns will be prepared in Bangla and will be made available at the field office of PMU in Khaliapur, Khulna and at the NWPGCL office in Dhaka. More details on Component 3 will also be available from the EIA posted in the website of ADB.

8.0 GRIEVANCE REDRESS MECHANISM

8.1 Current system at NWPGL

219. NWPGL manages grievance and/or complaints through the Grievance Redress System (GRS) which is required by the GoB and part of the mandatory Annual Performance Agreement (APA). This agreement will be signed and renewed annually between NWPGL and GoB.

220. GRS requires the NWPGL to designate a staff as Focal Point whose name and contact details are disclosed at the website of NWPGL. Compliance to the GRS is a Performance Indicator in the APA. NWPGL has designated its Focal Point as required by GRS and the details disclosed in its website.

221. The GRS consists of specified roles, rules, and procedures for resolving complaints, grievances, disputes, or conflicts systematically. The objective is to provide an effective and objective way of lodging and resolving complaints on public service delivery.

8.2 Grievance system required by SPS 2009

222. A grievance redress mechanism (GRM) will be set up once ADB funding for Component 3 becomes effective. Similar to GRS, the GRM aims to provide stakeholders with a clear and simple way of filing a complaint on the environmental performance of Component 2. According to SPS 2009, the GRM will address complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to the affected persons at no costs and without retribution. Given these requirements, handling of potential complaints/grievance on the implementation of Component 3 will be as follows:

223. **Information disclosure.** NWPGL will post signboards at the construction sites on the grievance mechanism including the details of the contact person who will take grievance. Details of the grievance mechanism together with the project brief will be posted in the website of NWPGL.

224. **Procedure.** The GRM will provide three-tier entry points in grievance redress. Two grievance redress committees (GRCs) will be formed: (i) local grievance redress committee (LGRC); and (ii) project grievance redress committee (PGRC). Grievances considered minor such as increased dust level at the construction site and immediate vicinity can be resolved onsite at the LGRC level within 7 days from receipt of complaint. Other complaints not resolved at the LGRC level will be forwarded to PGRC which will take two weeks (or 14 days) to resolve. Meetings of the LGRC will be held onsite (PMU office) and members may do site visits to check or verify the issue. Complainant will be informed of the status of resolution.

225. **Composition.** NWPGL will ensure the representation of women in the members of the GRCs.

- (a) **LGRC** – members will include (i) Deputy Manager/Executive Engineer (Environment) of PMU, (ii) Ward member, (iii) community representative, (iv) representative of women affected persons, and (v) EPC Contractor representative

- (b) **PGRC** – members will include (i) Project Director(PD), NWPGL as the Chairperson, (ii) Environment staff of Project Management and Construction (PMC) consultant, and (iii) representative of civil society nominated by PD with the help of PMC.

226. **Responsibilities.** GRCs will be expected to: (i) resolve grievances filed in writing or by phone to any member of the PMU, (ii) convene at least once a month to review grievances lodged (if any), (iii) record the grievances and resolve the issues within 15 days or a maximum of 30 days from the date the grievance was filed, and (iv) report to the complainant(s) the status of grievance resolution and the decisions made.

9.0 ENVIRONMENTAL MANAGEMENT PLAN

227. The environmental management plan (EMP) covers measures that will be conducted in every phase of implementing Component 3 to ensure that adverse impacts are minimized and positive impacts enhanced. Aside from the mitigation measures, the EMP also includes the required monitoring and implementation arrangements with cost estimates.

9.1 Implementation Arrangements

228. NWPGL has a total of six staff on environmental, chemical and safety managing the environment, health, and safety (EHS) concerns related to their operations. According to the Annual Report 2015-2016 of NWPGL, additional eight staff will be recruited to enhance the technical capacity on EHS.

229. For the Rupsha 800 MW CCPP, NWPGL will set up a PMU who will be responsible for project management and safeguards compliance monitoring of the EPC contractor during the construction stage. Component 3 will be managed and supervised also by the PMU. NWPGL will require the EPC Contractor to recruit an environmental staff (or a Consultant) who will be primarily responsible for ensuring that the EMP is properly implemented during construction. This requirement for the EPC Contractor will be included in the Bid documents. The Environmental staff (or consultant) of the EPC Contractor will coordinate and liaise with the PMU (NWPGL) on compliance to ADB requirements, relevant government agencies and local authorities on clearances (as needed), and will prepare the environment section of the Project's Quarterly Progress Report (QPR) submitted by the EPC Contractor to the PMU. The environment section in the Project's QPR will be summarized by the PMU Environmental staff and submitted to ADB during construction phase as semi-annual environmental monitoring reports (see **Annex 6** for the format of environmental monitoring report). The semi-annual environmental monitoring reports are posted to ADB's website as required by SPS 2009 and PCP 2011. NWPGL will submit the environmental monitoring reports starting from the date the loan become effective.

230. Should there be any change in the OHTL route, this EIA will be revised and/or updated and submitted to ADB prior to any construction works. The PMU Environmental staff together with NWPGL Environmental staff will revise or update the EIA and submit to ADB for review. The revised and/or updated EIA of Component 3 will be re-posted to the ADB website to comply with the disclosure requirements of SPS 2009 and PCP 2011.

231. Before the start of any construction work, the PMU will inform the EPC Contractor on their responsibility to comply with the EMP and the requirements of DoE and ADB. The specific responsibilities of the EPC Contractor on the implementation and compliance to the EMP, environmental monitoring, and submission of environmental compliance status during the construction phase will be monitored by the PMU and the NWPGL Corporate Environment staff (or Consultant).

232. During the operation phase, PMU will assign a staff (or Consultant) who will be responsible to handle the associated environmental issues and compliance to DoE and ADB's environmental requirements. Submission of environmental monitoring reports by NWPGL to ADB during the operation phase will be annually. These environmental monitoring reports will be reviewed by ADB and will post them into their website as required by SPS 2009 and PCP 2011.

233. In case of non-compliance to any environmental covenant in the loan agreements, NWPGL will prepare a corrective action plan (CAP) describing the process and the time-bound actions that will be undertaken to ensure compliance. The CAP will be submitted to ADB for review and disclosure to ADB's website.

9.2 Mitigation and enhancement plan

234. **Table 9.1** presents the environmental management plan for various resources that may be affected by the implementation of Component 3.

Table 9.1: Environmental Management Plan

Impact	Mitigation/Compensation	Enhancement	Contingency Plan	EMP cost (BDT)	Responsible Unit	Supervision
Physical-Chemical Environment and Water Resources						
Pre-construction phase						
Potential for riverbank erosion along the Bhirab River, Atai River, and Rupsha River	An expert will review the structural design, specifications and plans for construction of the transmission towers that will be erected close to the banks of these rivers as well as the activities to be done at the six river crossings	-	-	Included in the project cost	NWPGCL Contractor	NWPGCL
Construction phase						
Impairment of ambient air quality	<ul style="list-style-type: none"> • Regular spraying of water to dust-generating areas • Covering excavated soil/dump during off-work with tarpaulin • Provide temporary enclosure of dust-generating construction area/activities • Trucks transporting construction materials that generate dust will be covered • Implement traffic management to minimize vehicular emissions 	-	-	1.5	EPC Contractor	PMU, NWPGCL
Potential increase in ambient noise level	<ul style="list-style-type: none"> • Ambient noise level monitoring will be done • Provide temporary enclosure of noise-generating activities and equipment • Construction works will be limited to daytime only • Drivers will be instructed to avoid unnecessary use of horn 	-	-	0.5	EPC Contractor	PMU, NWPGCL
Degradation of water quality in Bhairab River, Atai River, and Rupsha River due to construction works at the river crossings	<ul style="list-style-type: none"> • No field camps will be located adjacent to these rivers • Good housekeeping will be enforced at all times. Bins will be provided on-site for proper collection of wastes • Oil-water separator will be used to handle oily waste • EPC Contractor will be required to prepare Waste Management Plan • Observation of proper solid waste disposal and proper sanitation 	-	-	1.5	EPC Contractor	PMU, NWPGCL

Impact	Mitigation/Compensation	Enhancement	Contingency Plan	EMP cost (BDT)	Responsible Unit	Supervision
	Workshop for vehicle, equipment and machineries repair will be lined with impermeable material to prevent land contamination and potential river pollution of greasy material/residue					
Operation phase						
Improper disposal of used mineral oil from the new substation in Rupsha 800 MW CCPP may affect water quality of Bhairab River, groundwater, and may cause land contamination.	<ul style="list-style-type: none"> No PCB or PCB-containing material will be used in Component 3 Used mineral oil (replacement of PCB) as transformer oil is considered hazardous wastes and will be handled properly based on relevant regulations and international environmental agreements such as Stockholm Convention and the Basel Convention. Used mineral oil will be stored in plastic drums with proper labeling. Disposal of excess and used mineral oil will follow the accompanying material safety data sheet (MSDS) 	-	-	1.5	PMU, NWPGCL	NWPGCL (Corporate Unit)
Land and agriculture resources						
Pre-construction phase						
Loss of crop production during the survey	<ul style="list-style-type: none"> Compensation will be provided for any damage incurred during the survey Inform farmers of the survey schedule to minimize disturbance 	-	-	Included in the project cost	EPC Contractor	PMU, NWPGCL
Construction phase						
Vegetation and standing crops along the RoW will be cleared and stringing of conductors may also affect standing crops. About 11.44 tons of crops may be affected by these activities.	<ul style="list-style-type: none"> Construction work schedule will consider harvest time of farmers that may be affected to minimize crop damage Crop damage that may be incurred due to Component 3 will be properly compensated Farmers will be informed way ahead on the construction activities and schedule Farmers will be given the chance to harvest their crops before construction works. 	-	-	N/A	EPC Contractor	PMU, NWPGCL
Soil quality may be affected due to wastes generation, soil erosion, and surface	<ul style="list-style-type: none"> Construction activities will be limited to designated areas Proper storage of chemicals onsite 	-	-	NA	EPC Contractor	NWPGCL

Impact	Mitigation/Compensation	Enhancement	Contingency Plan	EMP cost (BDT)	Responsible Unit	Supervision
runoff	<ul style="list-style-type: none"> Excess chemicals will be disposed of following its MSDS EPC Contractor will be encouraged to use non-toxic and biodegradable chemicals on-site Solid waste generated on-site will be collected and disposed of properly The installation of natural or synthetic liners beneath chemical storage tanks. Minimization of on-site water and chemical usage (oil, lubricants and fuel) Limiting the exposure of the soil to accidental releases of pollutants 					
Operation phase						
Soil quality may be affected due to maintenance of OHTL	Fuel and lubricants will be stored in drums or tanks and will be placed on an impermeable surface	-	-	Included in the O&M cost	PMU, NWPGCL	NWPGCL (Corporate Unit)
Loss of crop production About 3 ha of land will be permanently lost due to the tower footings and cultivation of some plants/crops will be restricted along the RoW.	<ul style="list-style-type: none"> Agricultural activities within the RoW will be allowed after construction but with restrictions to height of vegetation Only plants such as sugarcane, corn, rice, etc. that are less than 3 m tall will be allowed for cultivation Given the ground clearance at the base of the towers, farmers can still opt to use the land below the towers for cultivation of low growth crops 	Conduct orientation to farmers if they opt to cultivate area below the tower footings	-	3.0	PMU, NWPGCL	NWPGCL (Corporate Unit)
Fisheries Resources						
Construction phase						
Bagda and Galdagher will be temporarily damaged due to installation of tower in Tentultola village.	<ul style="list-style-type: none"> Construction of temporary bund around the base of the tower to protect the other part of the gher Preserve top soil of the base of constructed tower and spread over same places after construction activities. 	-	-	-	EPC Contractor	PMU, NWPGCL
Temporary loss of fish production	<ul style="list-style-type: none"> Construction of temporary bund around the base of the tower to avoid disturbance of fish culture within the gher 	-	-	-	EPC Contractor	PMU, NWPGCL

Impact	Mitigation/Compensation	Enhancement	Contingency Plan	EMP cost (BDT)	Responsible Unit	Supervision
	<ul style="list-style-type: none"> Project work will avoid January to August to minimize loss of fish production If schedule cannot be adjusted, gher owners will be properly compensated 					
Ecological Resources						
Construction phase						
Vegetation along the RoW will be cleared during construction.	<ul style="list-style-type: none"> No plant species of conservation status along the RoW Construction works will not be scheduled during harvest time to minimize damage to cash crops If work schedule cannot be adjusted, land owners will be properly compensated for any crop damage along the RoW EPC Contractor will be required to clear vegetation only in designated areas Agricultural activities within the RoW will be allowed after construction but with restrictions to height of vegetation Only plants such as sugarcane, corn, rice, etc. that are less than 3 m tall will be allowed for cultivation 	-	-	Included in the project costs	EPC Contractor	PMU, NWPGL
Operation phase						
<ul style="list-style-type: none"> Planting trees and cultivation of crops higher than 3 m along the RoW will be restricted. Vegetation that grew after construction phase will be trimmed regularly to maintain the height restrictions for safety reasons. 	<ul style="list-style-type: none"> Restriction in vegetation height is to ensure that the required vertical spacing between the conductors and the vegetation is maintained for safety reasons NWPGL will continue dialogue with farmers (as needed) to remind them of the height restrictions on vegetation along the RoW Any crop that may be damaged due to maintenance of the OHTL will be properly compensated 	-	-	6.00	PMU, NWPGL	NWPGL (Corporate Unit)
<ul style="list-style-type: none"> Component 3 is not close to protected areas or national parks birds may be attracted to 	<ul style="list-style-type: none"> Transmission lines are designed to have ground wire spacing and lightning arresters as safety features to generally protect the public (and birds) 	-	-	1.00	PMU, NWPGL	NWPGL (Corporate Unit)

Impact	Mitigation/Compensation	Enhancement	Contingency Plan	EMP cost (BDT)	Responsible Unit	Supervision
<p>the presence of transmission towers.</p> <ul style="list-style-type: none"> The risk of bird electrocution due to the presence of transmission towers may be likely and may affect bird species such as Indian flying fox (<i>Pteropus giganteus</i>). 	<ul style="list-style-type: none"> Spot checks/ocular inspection of wildlife crossing and bird electrocution (if any) will be included as part of maintenance work along the transmission line NWPGCL staff assigned to maintenance works will be trained to create awareness 					
Socioeconomic condition						
Construction phase						
<ul style="list-style-type: none"> There will be employment opportunities There will be opportunities for local people to engage in small-scale and temporary business opportunities of selling food, temporary accommodation, etc. due to the presence of workers. 	<ul style="list-style-type: none"> EPC Contractor will be required to give priority to local hiring especially to non-skilled workers This will be monitored by PMU, NWPGCL. For recruitment of skilled workers, local labour will be given preference 	-	Provision of contingency budget in case of accidents	5.00	LGI and EPC contractor	PMU, NWPGCL
<ul style="list-style-type: none"> Construction works along the transmission line route, which is located mostly in urban areas with river crossings, may pose safety risks to workers and the community. Exposure to sources of increased dust and noise levels may also pose health risks to workers and the community 	<ul style="list-style-type: none"> EPC Contractor will require workers to wear safety gears (helmets, safety belts, masks, gloves and boots) provided to them to minimize safety and accident risks Toolbox meetings will be held before workers go to the work assigned to them First aid kits and fire-fighting units will be made available at the construction sites Before start of construction works, the EPC Contractor and PMU, NWPGCL will provide orientation and brief training to workers on emergency preparedness, and create awareness on the potential for sexually-transmitted disease in the workplace The EPC Contractor will be required to provide affordable group medical and accident insurance to their workers or arrange with the local health facilities to 	-	Special or contingency fund will be allocated to cover accident costs	6.00	Project authority and EPC contractor	PMU, NWPGCL

Impact	Mitigation/Compensation	Enhancement	Contingency Plan	EMP cost (BDT)	Responsible Unit	Supervision
	provide assistance in the event of emergency <ul style="list-style-type: none"> • Recruitment of workers below 18 years old will be strictly prohibited • EPC Contractor (and subcontractors) will be required to comply with all relevant regulations on labour, occupational health and safety. PMU, NWP GCL will monitor compliance • Worker colonies will comply with good housekeeping • Noise barrier will be installed in areas and equipment with high level noise • EPC Contractor will provide workers with sanitary facilities, safe drinking water, wash area, adequate water for washing purposes, fire-fighting unit, etc. • A registered doctor or health professional will be detailed at the field office or onsite 					
Operation phase						
Employment opportunity	Skilled jobs may be required during O&M	-	N/A	-	PMU, NWP GCL	NWP GCL (Corporate Unit)
<ul style="list-style-type: none"> • Presence of transmission line may pose potential hazards such as electrocution, lightning strike, etc., due to accidental failure of power transmission. • Maintenance of RoW may disturb communities living close to the RoW. 	<ul style="list-style-type: none"> • Clear and visible danger and warning signs will be posted at designated areas to alert the community of the safety risks • Transmission towers are equipped with danger boards, barbed wire, and galvanized ground wire for earthing purposes • NWP GCL staff assigned to maintenance works, inspection and security personnel will conduct ocular inspection regularly to prevent vandalism and pilferage of cables that may cause accidents or electrocution. • Power transmission systems like Component 3 are designed with protection system that shuts off during power overload or similar emergencies. • An emergency preparedness and response mechanism will be employed by the NWP GCL 	-	N/A	4.00	PMU, NWP GCL	NWP GCL (Corporate Unit)

Impact	Mitigation/Compensation	Enhancement	Contingency Plan	EMP cost (BDT)	Responsible Unit	Supervision
	<ul style="list-style-type: none">NWPGCL will conduct information campaign to local people to enhance awareness on living safely near the power transmission systems					

9.3 Environmental Monitoring Plan (EMoP)

235. The following tables present the different monitoring plans that will be implemented during construction and operation phase. Results from the implementation of these plans will be included in the environmental monitoring reports to be submitted to ADB. Implementation of Component 3 will be carried out under the overall supervision of the Project Director, NWPGL.

Table 9.2: EMoP for river bank and flooding

Project phase	Parameter/ Indicator	Locations	Method of Measurement	Frequency	Monitoring Agency
Construction Phase	River bank and flooding	At every bank side tower location	Direct observation	Daily	EPC Contractor (with their Experts as required)
Operation Phase	River Bank and flooding	At every bank side tower location	Direct observation	Yearly at the end of monsoon	Project Director, NWPGL

Table 9.3: Environmental Parameter for EMoP

Issues of monitoring	Parameters	Measurement unit
Water Pollution	Turbidity	JTU
	DO	mg/l
	pH	-
	BOD ₅	mg/l
	COD	mg/l
	Arsenic	mg/l
	Iron	mg/l
	Coliform (fecal)	N/100ml
	Manganese	mg/l
Air Pollution	SPM (PM ₁₀ or PM _{2.5})	µg/Nm ³
	Carbon Monoxide	µg/Nm ³
	SO ₂	µg/Nm ³
	NO ₂	µg/Nm ³
Noise Pollution	Ambient noise level	dB(A)

Table 9.4: EMoP for agricultural resources

Project stage	Parameters/ Indicators	Locations	Method of Measurement	Frequency	Monitoring Agency
Construction phase	Crop compensation for the affected land owners/ share croppers	<ul style="list-style-type: none"> Substation in Rupsha 800 MW CCPP 230 kV transmission line route 	Ocular inspection, FGD with affected persons, transect survey.	Twice or once a month	EPC Contractor (with their Experts as required)
Post-Construction phase	Land recovery after wastes removal by contractor.	<ul style="list-style-type: none"> Substation in Rupsha 800 MW CCPP Every tower sites, stringing of conductors (new power lines). 	Ocular inspection/spot check	Once a month	PMU, NWPGL

Table 9.5: EMoP for fisheries resources

Project stage	Parameter/ Indicator	Locations	Method of measurement	Frequency	Monitoring agency
Construction phase	Soil Management	Ghers	Physical Observation	Two times (dry and wet season) during construction	PMU, NWP GCL with help of DoF

Table 9.6: EMoP for ecological resources

Project stage	Parameter/ Indicator	Location	Method of measurement	Frequency	Monitoring agency
Construction phase	Terrestrial vegetation	Proposed transmission lines and tower sites	Direct observation	Twice a year	EPC Contractor (with their Expert as required)
	Wildlife habitat and their disturbance	Under transmission lines and tower sites	Transect Survey	Twice a year	EPC Contractor (with their Expert as required)
Operation phase	Terrestrial vegetation	Under transmission lines and tower sites	Direct observation	Quarterly	Project Director, NWP GCL
	Wildlife habitat	Under transmission lines and tower sites	Direct observation	Half-yearly	Project Director, NWP GCL

Table 9.7: EMoP for socio-economic resources

Parameter/Indicator	Locations	Method of measurement	Frequency	Monitoring agency
Pre-construction Phase				
Perception of affected land owners	At the tower point location	Inspection and consultation with the land owners	Weekly	EPC Contractor
Availability of safe drinking water, sanitary facilities	Project area	Inspection and interview of workers and project personnel	Quarterly	EPC Contractor
Implementation of general guidelines on worker's health and safety	As specified in the general guidelines	Inspection and interview of workers and project personnel followed by a checklist	Quarterly	EPC Contractor
Emergency Preparedness	Project site	Visual Inspection and Record Checking	Yearly	PMU, NWP GCL
Construction Phase				
<ul style="list-style-type: none"> • Drinking water and sanitation • General condition of workplace 	Construction sites	Interview, ocular inspection	Weekly	EPC Contractor
Restoration of Work Sites	All Work Sites	Visual Inspection	After completion of all works	EPC Contractor
Safety of workers monitoring and reporting accidents	At work sites	Visual inspection of usage of PPE, Safety Sign, Safety Documentation, safety training, etc.	Daily	EPC Contractor
Emergency Response Facilities	At project sites	Inspection of Emergency Preparedness and Response mechanism and facilities	Monthly	EPC Contractor

Parameter/Indicator	Locations	Method of measurement	Frequency	Monitoring agency
Grievance Redress Mechanism	At project site, field office	Inspection of the complaint register	Monthly	EPC Contractor
Operation Phase				
Grievance Mechanism	At project site	Inspection of the complaint register/grievance form and interviewing local people	Six-monthly	NWPGCL
Emergency Response Plan	Project site	Inspection of Emergency Preparedness and Response mechanism	Quarterly	NWPGCL
Health and Safety Preparedness	Project site	Inspection of training list, safety meetings records, means of awareness growing	Quarterly	NWPGCL
Community Relation	Nearby Community	Inspection of community relation maintaining procedures, relation building activities, FGD with community	Quarterly	NWPGCL

9.4 EMP Budget

236. For implementing the EMP, Table-9.1 indicated around BDT 30 lakh. in addition, two more items such as training (lump sum BDT 5 lakh) and occupational Health and safety (lump sum BDT 8 lakh) altogether BDT 43 lakh will be required. Therefore, EMP BDT 43 lakh and EMoP BDT 33 lakh total (BDT 43 + 33) = BDT 76 lakh as shown in Table 9.8 below will be required. The budget estimates cover a three-year EMP implementation.

Table 9.8: EMP Budget Estimates

Item	Quantity	Rate/Ref.	Total Taka (lakh)
Implementation of EMP	-	Table 9.1	30
Training of professionals and workers about accidental cases and safety measures	-	Lump sum	5
Occupational Health, Safety and security	-	Lump sum	8
Sub total			43
Monitoring Plan	From revenue budget		
Consultant (for environmental and social monitoring)	3 years	Lump sum	20
Transport (for monitoring team)	3 years	Lump sum	2
Reporting and others (Yearly DoE renewal cost)		Lump sum	2
Vegetation trimming and plantation	3 years	Lump sum	6
Wildlife occurrence (including Bat, Birds)	3 years	Lump sum	3
Sub Total			33
Total Cost			76

10.0 CONCLUSION AND RECOMMENDATION

237. Component 3 is an important part of the Rupsha 800 MW CCPP that will provide the necessary infrastructure to enhance the power generation capacity of Bangladesh in addressing the increasing demand for electricity. The transmission line route was selected after careful consideration of several factors including environmental and social aspects. As a result, no areas protected by GoB such as national park or sanctuary will be traversed by the transmission line route. However, three major rivers in Khulna will be crossed over: Bhairab River (once), Rupsha River (twice), and Atai River (thrice).

238. Component 3 consists of a new substation in Rupsha 800 MW CCPP and about 29.3 km, 230 kV overhead transmission line terminating in the existing Khulna SS. This draft EIA for Component 3 was prepared based on the requirements of the DoE and ADB.

239. Affected persons along the transmission line route were consulted including other secondary stakeholders. During the preparation of this EIA, five consultations were completed in November 2016, December 2016 and October 2017. Stakeholder consultations will continue until the operation phase. The GRM will be set up to deal with potential complaints on Component 3. NWPGL will create a PMU to handle the daily management of implementing Component 3.

240. Identified environmental impacts such as increased level of noise and dusts, generation of waste from construction works, clearing of vegetation, disruption to navigation, and potential water pollution in the three major rivers due to Component 3 can be easily mitigated by compliance to EMP, requirements of DoE and ADB, effective project planning, and best practice construction engineering. A budget estimate of BDT 76 lakh is allocated for the EMP (including EMoP).

241. Access to information by interested individuals will be through a project summary at the NWPGL website, one-page flyer on project info which includes details on grievance redress mechanism and contact person. Additional information will be through this draft EIA which will be posted in ADB website as required by PCP 2011 and SPS 2009.

Annex 1
TOR of EIA for Component 3 Approved by DoE

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, E-16 Agargaon
Sher-e-Bangla Nagar, Dhaka-1207
www.doe.gov.bd

Memo No: DoE/Clearance/5669/2016/ 476

Date: 03/11/2016

Subject: Exemption from Initial Environmental Examination (IEE) and Approval of Terms of Reference (TOR) for Environmental Impact Assessment (EIA) in favour of Construction of Power Evacuation Line under Proposed Khulna LNG Based 800 MW Combined Cycle Power Plant Project at Khulna.

Ref: Your Application dated 10/10/2016.

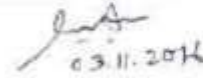
With reference to your letter dated 10/10/2016 for the subject mentioned above, the Department of Environment hereby gives exemption from IEE and approval of TOR for Environmental Impact Assessment (EIA) Study in favor of Construction of Power Evacuation Line under Proposed Khulna LNG Based 800 MW Combined Cycle Power Plant Project at Khulna subject to fulfilling the following terms and conditions:

1. The project authority shall submit a comprehensive Environmental Impact Assessment (EIA) study considering the overall activity of the said project in accordance with the TOR and time schedule submitted to the Department of Environment (DOE) and additional suggestions provided herein.
- ii. The project authority shall prepared individual EIA report for Each Component and the EIA reports should be prepared in accordance with following indicative outlines:
 1. Executive summary.
 2. Introduction: (Background, brief description, scope of study, methodology, limitation, EIA team, references).
 3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared).
 - 4a. Project activities:
 - A list of the main project activities to be undertaken during site clearing, construction as well as operation
 - Project Plan, Design, Standard, Specification, Quantification, etc.
 - 4b. Project schedule: The phase and timing for development of the Project.
 - 4c. Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.
 - 4d. Map and survey information
Location map, Cadastral map showing land plots (project and adjacent area), Topographical map, Geological map showing geological units, fault zone, and other natural features.
 5. Baseline Environmental Condition should include, inter alia, following: (Identification and Quantification of Physical Situation that has been proposed to be changed)



- Physical Environment : Geology, Topology, Geomorphology, Land-use, Soils, Meteorology, and Hydrology
 - Biological Environment : Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora and Fauna
 - Environment Quality : Air, Water, Noise, Vibration, Soil and Sediment Quality
 - Relate baseline in both Quantitative and Qualitative term with the anticipated outcomes, achievement of goals, objectives and changes due to project interventions
6. Socio-economic environment should include, inter alia, following:
- Population: Demographic profile and ethnic composition
 - Settlement and housing
 - Traffic and transport
 - Public utilities: water supply, sanitation and solid waste
 - Economy and employment: employment structure and cultural issues in employment
 - Agriculture: activities, communities, commercial important, resources, commercial factors.
7. Identification, Prediction and Evaluation of Potential Impacts (identification, prediction and assessment of positive and negative impacts likely to result from the proposed project).
- In identification and analysis of potential impacts'-the 'Analysis' part shall include the analysis of relevant spatial and non-spatial data. The outcome of the analysis shall be presented with the scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man made or natural, wildlife, socio-economic aspect shall be incorporated in detail.
- Appropriate models shall be used for prediction of potential impacts of the project on surface water and ambient air quality using updated data. Model prediction shall be compared with national water and air quality standards and specific sensitivity data of the organisms known to be present in the project area (likely impacted area) for impact assessment.
8. Management Plan/Procedures:
- For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not mitigable, will be identified as residual impacts. Both technical and financial plans shall be incorporated for proposed mitigation measures.
- An outline of the Environmental Management Plan shall be developed for the project.
- In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).
9. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)
- Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)
10. Risk assessment, risk management, system of valuation of environmental and properties damage, damage compensation issues shall be addressed
11. Conclusion and Recommendations
1. Without approval of EIA report by the Department of Environment, the project authority shall not be able to open L/C in favor of importable machineries.

- II. Without obtaining Environmental Clearance, the project authority shall not be able to start the physical activity of the project,
- III. The project authority shall submit the EIA report along with the filled-in application for Environmental Clearance in prescribed form, the feasibility study report, the applicable Environmental Clearance fee in a treasury chalan, the applicable VAT on clearance fee in a separate treasury chalan, the No Objection Certificate (NOC) from local authority, NOC from Forest Department (if it is required in case of cutting any forested plant, private or public), NOC from concerned authority for cutting/razing/dressing of hill or hilly land (if it is required) and NOC from other relevant agencies for operational activity etc. to the Khulna Divisional Office of DOE in Khulna with a copy to the Head Office of DOE in Dhaka.



(Syed Nazmul Ahsan)
Director (Environment Clearance, c.c)
Phone # 02-8181673

Project Director

Proposed Khulna LNG Based 800 MW
Combined Cycle Power Plant Construction Project
North-West Power Generation Company Ltd.
Bidyut Bhaban (Level-14)
1, Abdul Gani Road, Dhaka-1000.

Copy Forwarded to :

- 1) Private Secretary to the Hon'ble Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
- 2) Director, Department of Environment, Khulna Divisional Office, Khulna.
- 3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Annex 2

Public Disclosure Meeting

Introduction

The Center for Environmental and Geographic Information Services (CEGIS) organized a public disclosure meeting on behalf of Northwest Power Generation Company Ltd. (NWPGL), for exposure of the proposed “Rupsha 800MW combined cycle power plant Project” at the conference room of Khulna Engineers Institute at Khalishpur, Khulna on October 21, 2017.

Objectives

The overall objective of the consultation was to explore the peoples’ perception and attitudes towards the proposed project and to provide information regarding the findings of EIA study. The specific objectives were to:

- Aware the local people about the proposed project
- Sharing the information to the participants about EIA and RP findings
- Explore the problems of the study area;
- Share experiences of the participants over the years;
- Unveil the potential negative or positive impacts of the proposed project;
- Outline potential mitigation measures for negative impacts and enhancement measures for the positive impacts.
- Ensure the peoples’ participation in the proposed project;

Approaches of the Public Disclosure Meeting

The main purpose of the PDM was to disclose the findings of EIA and RP study to the key stakeholders and take suggestions/opinions from them. To serve that purpose it was mandatory to gather key stakeholders at a certain venue.

Identification of Stakeholders

Stakeholders included all those who would affect and/or would be affected by policies, decisions or actions within a particular system. Stakeholders included groups of people, organizations, institutions and sometimes-even individuals. Stakeholders can be divided into primary and secondary stakeholder categories.

Primary Stakeholders

Primary stakeholders are people who would be directly benefited or impacted by a certain project intervention. In case of the proposed project, the primary stakeholders include the people whose land will be affected and who are living within the project area.

Secondary Stakeholders

This category of secondary stakeholders pertains to those who may not be directly impacted but have interest to contribute in the study, play a role in implementation at some stage, or decision making on project aspects. In this project, secondary stakeholders include PDB, Local

Government Institutions (LGIs), local public representatives, other relevant government agencies, academia, journalists, NGOs and general public at large.

Time, Date and Venue Selection

Venue, date and time of meeting was selected in consultation with the local administration, local government, local people, the project proponent and the consultant. The local people and local government selected an agreed venue e.g. Khulna Engineers Institute at Khalishpur, having easy accessibility and which is likely to be neutral. Date and time was also finalized in the similar way considering availability of the participants, ensuring the maximum participation and compliance with the other arrangement.

Enlisting and Invitation

A comprehensive list of potential stakeholders was prepared through the consultation. This list was intended to cover all sorts of interest groups, occupational groups, socially acceptable and knowledgeable peoples.

Table A1: Invitation list of Consultation meeting

SL.NO	Organization/Persons	No. of invitation
1.	Representative of Government Institutions (DC, DoE, Forest etc.)	21
2.	Representatives Khulna City Corporation	03
3.	Academia/School (Teacher, Managing committee and Students)	07
4.	Project proponent	05
5.	Representative of NGOs	02
6.	Representative of Journalists	03
7.	Representative of Fisherman community	05
8.	Representative of Affected parsons of Gas Transmission line	03
9.	Representative of Affected parsons of Overhead Transmission line	03
10.	Political leader	03
11.	Local elite persons	15
Total		70

To make the meeting successful and to ensure maximum participation, an advertisement was published in the local daily newspaper:



Consultation Instrument

Checklist: A comprehensive checklist and questionnaire covering all possible issues to be addressed was prepared through consultation with the multidisciplinary study team. This checklist was used in the meeting to unveil peoples' perception and opinion along with suggestions.

Attendance list: An inventory of the participants was maintained in attendance sheet containing contact number. Camera: For visualizing the participants, photographs were taken using camera. These photos are presented in this chapter. Photos of the meeting participants are presented at the end of this chapter.

Consultation Participants

The main participants of the consultation meetings included public representative of Government Institutions, Khulna City Corporation, Academia/School representative, Project proponent, NGOs, Journalists, Fisherman community, Affected persons of Gas Transmission line, Affected persons of Overhead Transmission line, Political leader Local elite persons, of the nearby "Rupsha 800MW combined cycle power plant Project" areas. A total of 64 participants attended these consultations in which 52 is male and rest of female.

The stakeholders have right to know about the activities, pattern and impacts of the project. In doing so, a brief description on project was distributed to each participant:

নর্থওয়েস্ট পাওয়ার জেনারেশন কোম্পানী কর্তৃক অত্র এলাকায় গৃহীত খুলনা ৮০০ মেগাওয়াট গ্যাস ও তেল ভিত্তিক কন্সট্রাক্ট সাইকেল বিদ্যুৎ কেন্দ্র এবং সংশ্লিষ্ট উপাদান সমূহের তথ্য, খুলনা

✓ সভার মূল উদ্দেশ্য

- আজকের সভার মূল উদ্দেশ্য হচ্ছে প্রস্তাবিত ২ x ৮০০ (৮০০) মেগাওয়াট গ্যাস ও তেল ভিত্তিক বিদ্যুৎ প্রকল্প ও অত্র প্রকল্প সংশ্লিষ্ট উপাদান সমূহ স্থাপিত হলে প্রকল্প সংশ্লিষ্ট এলাকায় কী ধরনের পরিবেশগত ও আর্থ-সামাজিক প্রভাব পড়তে পারে এ সম্বন্ধে এলাকার জনগোষ্ঠীর মতামত গ্রহণ করা।
- একই সাথে প্রকল্প নকশা ও নির্মাণ পর্যায়ে জনগণের প্রতিক্রিয়া নেওয়া যাতে প্রকল্প বাস্তবায়নে তাদের আকাঙ্ক্ষার প্রতিফলন ঘটে।

✓ প্রস্তাবিত প্রকল্প ও সংশ্লিষ্ট বিষয়াদি

▪ বাংলাদেশ সরকার ক্রমবর্ধমান বিদ্যুতের চাহিদা পূরণের লক্ষ্যে একটি মহাপরিকল্পনা, **Power System Master Plan** গণনন করে, যার মূল প্রতিপাদ্য বিষয় হচ্ছে:

- জ্বালানীর বহুমুখীকরণ যেমন: গ্যাস, এলএনজি, কয়লা, এইচএসডি, ফার্মেস অয়েল নব্যায়নযোগ্য জ্বালানী ইত্যাদি।
- জ্বালানীর উৎস সনাক্তকরণ ও এর সর্বোত্তম ব্যবহার নিশ্চিত করণ।
- জ্বালানী উৎসের ও সরবরাহের সুবিধাদির ভিত্তিতে বিদ্যুৎ প্রকল্প নির্মাণের স্থান নির্বাচন।
- বিদ্যুতের ক্রমবর্ধমান চাহিদার উপর ভিত্তি করে উৎপাদন ক্ষমতা বৃদ্ধি করা, যা জাতীয় বিদ্যুৎ গ্রীডের মাধ্যমে নিরবিচ্ছিন্নভাবে বিদ্যুৎ সরবরাহ করতে পারবে।

▪ রূপকল্প-২০২১ অনুযায়ী 'পাওয়ার সিস্টেম মাস্টার প্লান, '২০১০ ও ২০১৬' এর আলোকে দেশের সর্বস্তরে বিদ্যুৎ পৌঁছে দেয়ার লক্ষ্যে নর্থ-ওয়েস্ট পাওয়ার জেনারেশন কোম্পানী লি: (NWPGL) খুলনা জেলায় গ্যাস ও তেল ভিত্তিক বিদ্যুৎ প্রকল্প নির্মাণ করে ১০০০ মেগাওয়াটের অধিক বিদ্যুৎ উৎপাদনের লক্ষ্য নির্ধারণ করেছে।

✓ পরিবেশগত ও আর্থ-সামাজিক প্রভাব বিশ্লেষণ সংক্রান্ত তথ্য সংগ্রহ ও প্রয়োজনীয় পরীক্ষানিরীক্ষা

▪ **CEGIS** এই প্রকল্পটির পরিবেশগত ও আর্থ-সামাজিক প্রভাব বিশ্লেষণে দায়িত্বপ্রাপ্ত হয়ে বিভিন্ন পর্যায়ে এলাকার জনগণের সাথে এই বিষয়ে আলাপ আলোচনা করে পরিবেশ ও আর্থ-সামাজিক প্রকল্পটির বর্তমান অবস্থা বিশ্লেষণ করার চেষ্টা করেছে এবং পর্যবেক্ষণ করার জন্য সংশ্লিষ্ট অফিসগুলো থেকেও তথ্য সংগ্রহ করে, যেমন:

- কৃষি অফিস থেকে ফসল, ফসলী জমি ও সেচ সংক্রান্ত তথ্য।
- মৎস্য অফিস থেকে মাছ ও মাছের আধার সংক্রান্ত তথ্য।
- ইউনিয়ন পরিষদ থেকে সামাজিক ও অর্থনৈতিক বিষয়াদি সংক্রান্ত বিভিন্ন তথ্য।
- বিভিন্ন প্রকার শিল্প থেকে নির্গত দূষণ সম্পর্কিত তথ্য সংগ্রহ।

▪ প্রকল্প এলাকার বিভিন্ন বৈশিষ্ট্য সঠিকভাবে বিশ্লেষণ করার নিমিত্তে নিম্নলিখিত পরীক্ষা-নিরীক্ষা করা হয়:

- ভূ-তাত্ত্বিক জরিপ যার মাধ্যমে প্রকল্প এলাকার মাটি ও ভূ-গর্ভস্থ পানি সম্বন্ধে ধারণা পাওয়া।
- বন্যার পানির সর্বোচ্চ উচ্চতার বিষয়টি বিশ্লেষণ করে কতটুকু মাটি ভরাট করতে হবে তা জানা।
- পানির গুণাগুণ বোঝার জন্য ভূ-গর্ভস্থ ও ভূ-পরিষ্ক পানি পরীক্ষা-নিরীক্ষা করা হয়।
- বায়ুর দূষণ মাত্রা বোঝার জন্য বায়ু পরীক্ষা-নিরীক্ষা করা হয়।
- শব্দ দূষণ মাত্রা বোঝার জন্য শব্দ দূষণ যন্ত্র ব্যবহার করা এবং প্রাক্ট থেকে ৫০০ মি. চারপাশে শব্দ দূষণ পরিমাপক যন্ত্রের মাধ্যমে শব্দের তীব্রতা মাপা হয়।

▪ পরিবেশগত ও সামাজিক প্রভাব বিশ্লেষণের জন্য প্রাক্টকে কেন্দ্র করে চারপাশে ১০ কি.মি এলাকা পর্যবেক্ষণ করা হয়েছে

✓ পরিবেশগত ও আর্থসামাজিক প্রভাব বিশ্লেষণ - প্রকল্প বাস্তবায়ন পরবর্তী অবস্থা বিশ্লেষণ (পরিবেশগত প্রভাব বিশ্লেষণ)

■ ৮০০ মেগাওয়াট গ্যাস ও তেল ডিভিকবিদ্যুৎ প্রকল্প বাস্তবায়ন পরবর্তী পরিবেশগত প্রভাব বিশ্লেষণ

- বিভিন্ন সংবেদনশীল এলাকায় বায়ু দূষণের মাত্রা মাপা হয়েছে এবং বায়ু দূষণের ক্ষেত্রে কালক্রমে মডেলের মাধ্যমে CO₂, SO_x, NO_x বিশ্লেষণ করে দেখা গেছে উল্লিখিত দূষণের মাত্রা বাংলাদেশ ও আশেপাশে গ্রহণযোগ্য সীমার নীচে আছে।
- শব্দ দূষণের মাত্রা উল্লিখিত শব্দ দূষণ নিয়ন্ত্রণ বিধি-২০০৬ এর গ্রহণযোগ্য সীমার নীচে থাকবে।
- মেশিন চালুকালে ডু-কম্পনের মাত্রা সহনশীল পর্যায়ে থাকবে।
- প্রকল্প চালু করার সময় কুনিং টাওয়ার এর জন্য ভৈরব নদ থেকে একাধীন ৬০,০০০ ঘন মিটার পানি উত্তোলন করা হবে এবং পরবর্তীতে প্রকল্প চালু অবস্থায় ভৈরব নদ থেকে প্রতি ঘণ্টায় ২১০ ঘন মিটার পানি উত্তোলন করা হবে যা খুবই কম এবং চলমান নদী প্রবাহের মাত্র ০.১২%।
- ভূ-গর্ভস্থ পানিদূষণের মাত্রা বর্তমানে উল্লিখিত ইন্ডিয়া- ১৯৯৭ এর গ্রহণযোগ্য সীমার নীচে থাকবে।
- বিদ্যুৎ কেন্দ্র থেকে নির্গত সকল তরল পদার্থ পরিশোধিত করে গ্রহণযোগ্য সীমার মধ্যে রাখতে হবে নচেৎ পরিবেশ বিপন্ন হবে।
- কৃষিক্ষেত্রে পানির কোন সংকট হবে না এবং মাছ চাষের উপর কোন বিরূপ প্রভাব পড়বে না।
- ২১৫ টি গাছের উপর প্রভাব পড়বে যা আইউসিএন এর লাল তালিকা বহির্ভূত।

■ গ্যাস পাইপলাইন প্রকল্প বাস্তবায়ন পরবর্তী পরিবেশগত প্রভাব বিশ্লেষণ

- উল্লিখিত গ্যাস পাইপলাইন প্রকল্প বাস্তবায়নের ফলে বায়ু দূষণ, শব্দ দূষণ, বর্জ্য দূষণ, পানি দূষণ অথবা সংশ্লিষ্ট এলাকায় পানির কোন অভাব দেখা দেবে না। এছাড়া উক্ত প্রকল্পের কারণে কৃষি জমি ও মাছ চাষ প্রকল্পের কোন ক্ষতি হবে না। তবে ১০.৫০ কিমি পাইপলাইনের জন্য কিছু গাছের উপর প্রভাব পড়বে যা বাংলাদেশ সরকার উল্লিখিত সিডিউল বহির্ভূত। উপস্থাপিত, উক্ত প্রকল্পের কারণে কোন গ্রাণি বা সর্বতভাবে পরিবেশের উপর তাৎপর্যপূর্ণ কোন প্রভাব পড়বে না।

■ ওভারহেড ট্রান্সমিশন লাইন প্রকল্প বাস্তবায়ন পরবর্তী পরিবেশগত প্রভাব বিশ্লেষণ

- উল্লিখিত ওভারহেড ট্রান্সমিশন লাইন প্রকল্প বাস্তবায়নের ফলে বায়ু দূষণ, শব্দ দূষণ, বর্জ্য দূষণ, পানি দূষণ অথবা পানির কোন অভাব দেখা দেবে না। উক্ত ২৯ কিমি ২৩০ কেভি লাইন কোন গ্রাণি, কৃষি জমি এবং নদীসহ সার্বিকভাবে পরিবেশের উপর তাৎপর্যপূর্ণ কোন প্রভাব ফেলবে না।

✓ পরিবেশগত ও আর্থসামাজিক প্রভাব বিশ্লেষণ - প্রকল্প বাস্তবায়ন পরবর্তী অবস্থা বিশ্লেষণ (আর্থসামাজিক প্রভাব বিশ্লেষণ)

- গ্যাস ও তেল ডিভিক ৮০০ মেগাওয়াট ককইন্ড সাইকেল বিদ্যুৎ প্রকল্প স্থাপনের জন্য খুলনা সরকারি নিউজেনিট মিলের পরিত্যক্ত ৫০ একর জমি নেয়া হয়েছে। উক্ত এলাকায় পরিত্যক্ত মিলের ০৫টি পরিবার স্থানান্তরিত হওয়ার কারণে অর্থনৈতিকভাবে প্রভাবিত হবে। অত্র প্রস্তাবিত প্রকল্প এলাকায় কোন আদিবাসি ও বুকিপূর্ণ পরিবার নেই।
- অত্র প্রস্তাবিত ৮০০ মেগাওয়াট বিদ্যুৎ প্রকল্প এলাকায় বর্তমানে অবস্থিত ০১ টি বালক উচ্চ বিদ্যালয় ও ০১ টি বালিকা উচ্চ বিদ্যালয় স্থানান্তরিত করা হবে। ২১৫ টি গাছ ক্ষতিগ্রস্ত হবে।
- গ্যাস ট্রান্সমিশন লাইন (১০.৫০ কিমি) মূলত রাজস্ব সংলগ্ন সড়ক ও জনপথের জমির উপর স্থাপিত হবে। এ ক্ষেত্রে মুচি সহ মোট ২৪ টি ক্ষুদ্র ব্যবসায়িক নিকটবর্তী পরিত্যক্ত জায়গায় স্থানান্তরিত করা হবে এবং ৩২৬ টি গাছ ক্ষতিগ্রস্ত হবে। ২ কিমি পাইপ লাইনের ক্ষেত্রে রাজস্ব পাশের ০৯ টি ক্ষুদ্র দোকান ব্যবসায়ী নিকটবর্তী স্থানে স্থানান্তরিত হবে ও ৪০ টি গাছ ক্ষতিগ্রস্ত হবে। উপস্থাপিত কোন স্থাপনা ক্ষতিগ্রস্ত হবে না।
- ২৯ কিমি ওভারহেড ট্রান্সমিশন লাইন প্রকল্প কৃষি জমি, নদী এবং কিছু বাড়ী, সামাজিক প্রতিষ্ঠানের উপর নিয়ে যাবে তবে কোন প্রত্নতাত্ত্বিক এবং ঐতিহাসিক স্থাপনার উপর নিয়ে যাবে না। উল্লিখিত প্রকল্পের আওতায় টাওয়ার স্থাপনের ফলে ০৭ টি পরিবার স্থায়ীভাবে ক্ষতিগ্রস্ত হবে যার মধ্যে ০৫ টি পরিবারের বসতবাড়ীও ক্ষতিগ্রস্ত হবে এবং ক্ষতিগ্রস্তদের মধ্যে ০২ টি পরিবার বুকিপূর্ণ। এছাড়া উক্ত প্রকল্পের কারণে শস্য ও ০১ টি মাছের খের সাময়িকভাবে ক্ষতিগ্রস্ত হবে।



✓ পরিবেশগত প্রশমন ব্যবস্থা

■ বায়ু দূষণ মোকাবেলায় করণীয়:

- Advance Dry Low NOx Burner যা বায়ুর একরকম দূষণ (NOx)-কে নিয়ন্ত্রণ করবে।
- প্রাক্ট এলাকার চতুর্দিকে ও খোলা যায়গায় সবুজ বেটনী তৈরীর ব্যবস্থা রাখা হয়েছে যা বায়ু দূষণের প্রভাবকে নিয়ন্ত্রণ করবে।
- প্রধান ও বাইপাস চিমনির উচ্চতা যথাক্রমে ন্যূনতম ৬০ মি. ও ৫০ মি. হতে হবে যাতে প্রাক্ট নিয়ন্ত্রিত ধোঁয়া আকাশে মিলিয়ে যায় এবং পরিবেশের উপর ক্ষতিকর প্রভাব না ফেলে।

■ পানি দূষণ মোকাবেলায় করণীয় :

- কুলিং টাওয়ারের কারণে কোন প্রকার গরম পানি নদীতে পড়বে না।
- প্রাক্ট হতে নির্গত পানি যথাযথ পরীক্ষা-নিরীক্ষার পর পুনঃব্যবহার করা হবে; যা পরিবেশের উপর কোন ক্ষতিকর প্রভাব ফেলবে না।
- তেল ও গ্রীজ পানি থেকে আলাদা করণের জন্য সেডিমেন্টেশন যন্ত্রের ব্যবহারের ব্যবস্থা রাখা হয়েছে। আলাদাকৃত তেল এলাকার ভেতরের কাছে বিক্রি করা হবে।
- বিন্যূৎকেন্দ্রে থেকে নিঃসৃত তরল; আধুনিক বর্জ্য ব্যবস্থাপনার (ETP) মাধ্যমে পরিশ্রুত করা হবে। তলে নদীর মাছ ও পানির তেমন কোন ক্ষতি হবে না।
- প্রদূষিত বিন্যূৎকেন্দ্রে পর্যায়নিষ্কাশন ব্যবস্থাপনারও সুবিধা থাকবে।

■ পানি উত্তোলন সীমিতকরণ ব্যবস্থা:

- প্রকল্প চালু অবস্থায় ভৈরব নদ থেকে প্রতি ঘণ্টায় ২১০ ঘন মিটার পানি উত্তোলন করা হবে যা খুবই কম এবং চলমান নদী প্রবাহের মাত্র ০.১২%।
- উদ্ভোদ্য, সর্ভ অনুসারে প্রকল্প চালু রাখার জন্য কখনই ডু-গর্ভস্থ পানি উত্তোলন করা হবে না।
- উচ্চ বিন্যূৎ কেন্দ্রে বসবাসকৃত জনসাধারণের খাবার পানির জন্য খুলনা ওয়াসে কতক পাইপ লাইন দ্বারা সরবরাহকৃত পানি ব্যবহার করা হবে।

■ শব্দ দূষণ মোকাবেলায় করণীয়:

- আধুনিক প্রযুক্তি সঞ্চলিত মেশিনারী স্থাপন করা।
- ঘূর্ণন মেশিনারীর জন্য শব্দ দূষণ প্রতিরোধী ছত বা ঢাকনার ব্যবস্থা করা।
- প্রাক্ট এলাকার চতুর্দিকে ও খোলা যায়গায় সবুজ বেটনী তৈরীর ব্যবস্থা রাখা হয়েছে যা শব্দ দূষণের প্রভাবকে নিয়ন্ত্রণ করবে।
- শব্দ দূষণ কমানোর জন্য প্রয়োজ্য স্থানে স্তর ভিত্তিক দেশীয় জাতের গাছ লাগানো।
- ঘূর্ণন মেশিনারীর ভিতরে যারা কাজ করবে তাদেরকে অবশ্যই পিপিই (PPE) যেমন: ইয়ার প্লাগ, মাফলার ইত্যাদি পরতে হবে।
- ধোঁয়া বের হওয়ার পথে চিমনিতে সাইল্যান্সার লাগানো।
- শব্দ প্রশমনীয় দেয়াল নির্মাণ করা।

■ কম্পন মোকাবেলায় করণীয়:

- সীম (প্রতি ১/১০০০ ইঞ্চি) প্রযুক্তির ব্যবহার করা।

■ পরিবেশ ও জলাঙ্গ প্রাণি ব্যবস্থাপনায় করণীয়:

- প্রদূষিত ৮০০ মেগাওয়াট বিন্যূৎ কেন্দ্রে হতে নির্গত সকল তরল বর্জ্য ও পর্যায়নিষ্কাশন যথাক্রমে ইটিপি (ETP) ও এসটিপি (STP) এর মাধ্যমে পরিশোধিত করে যথোপযুক্ত বাংলাদেশ বিধি ও আইএফসি (IFC) গাইডলাইনের প্রণয়োগ্য সীমার মধ্যে রাখা হবে যাতে ডলফিন সহ পরিবেশ ও জীববৈচিত্র্য দূষণের প্রভাব মুক্ত থাকে।

- গ্যাস লাইন ও OHT line এর ক্ষেত্রে প্রকল্প এলাকার কর্মচারীদের বাসস্থানের পর্যবেক্ষণ পরিশোধনের মাধ্যমে বাংলাদেশ বিধির (ECR, 1997) গ্রহণযোগ্য সীমার মধ্যে রাখা হবে।
 - অত্র প্রকল্প চালু অবস্থায় EMP সংশ্লিষ্ট পর্যবেক্ষণ ব্যবস্থা নিয়মিত বলবৎ থাকবে এবং উক্ত পর্যবেক্ষণ এর আওতায় প্রকল্প এলাকার পরিবেশ ও জীববৈচিত্র (ডলফিন সহ) এর উপর নিরীক্ষা করা হবে এবং প্রয়োজনীয় প্রশমন পরিল্পনা অনুযায়ী ব্যবস্থা নেয়া হবে।
- ✓ **আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা**
- **৮০০ মেগাওয়াট বিদ্যুৎ প্রকল্প বাস্তবায়ন পরবর্তী আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা**
 - অত্র প্রকল্পটি বাস্তবায়নের জন্য উদ্ভিচিত খুলনা সরকারি নিউজপ্রিট মিলের পরিত্যক্ত ৫০ একর জমি সরকারি প্রথা অনুসারে নির্ধারিত মূল্য পরিশোধ সাপেক্ষে নর্থ ওয়েস্ট পাওয়ার জেনারেশন কোম্পানী লি: এর অনুকূলে বরাদ্দ দেয়া হয়েছে।
 - অত্র প্রস্তাবিত প্রকল্প এলাকার উদ্ভিচিত ০২ টি বিদ্যালয় (০১ টি বালক ও ০১ টি বালিকা) পরিত্যক্ত পেপার মিলের অবশিষ্ট (৩৭.৬০ একর) জমির উপর পুনর্নির্মিত হবে যা পাওয়ার গ্রাউন্ডের সীমানার বাইরে অবস্থিত। এবং উক্ত বিদ্যালয় দুটিতে উন্নতমানের পাকা ইমারতসহ প্রয়োজনীয় আধুনিক সুযোগ সুবিধা যথা: কম্পিউটার ল্যাব, বিজ্ঞানাগার, পাঠাগার, খেলার মাঠ, সুগেয় পানি, সৌচাগার, ইত্যাদির সুব্যবস্থা থাকবে।
 - উক্ত এলাকায় পরিত্যক্ত মিলের ০৫টি স্থানান্তরিত পরিবারকে নর্থ ওয়েস্ট পাওয়ার জেনারেশন কোম্পানী লি: কর্তৃক ক্ষতিপূরণ দেয়া হবে।
 - উক্ত প্রকল্প এলাকা সংলগ্ন মসজিদ ও কবরস্থানের সংস্কার করা হবে এবং প্রকল্পসহ সর্বসাধারণের ব্যবহারের জন্য ব্যবস্থা থাকবে।
 - **গ্যাস পাইপলাইন প্রকল্প বাস্তবায়ন পরবর্তী আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা**
 - গ্যাস ট্রান্সমিশন লাইন (১০.৫০ কিমি) মূলত সড়ক ও জনপথের জমির উপর অনুমতি সাপেক্ষে স্থাপিত হবে। উক্ত প্রকল্পে মুচি সহ মোট ২৪ টি ক্ষুদ্র ব্যবসায়িকে অর্থনৈতিক ক্ষতির জন্য ক্ষতিপূরণ প্রদান করা হবে। এছাড়া ৩২৬ টি গাছের ক্ষতিপূরণ প্রদান করা হবে। উপর্যুক্ত, ২ কিমি পাইপ লাইনের ক্ষেত্রে রাজার পাশের ০৯ টি ক্ষুদ্র দোকান ব্যবসায়ীকে অর্থনৈতিক ক্ষতিপূরণ ও ৪০ টি গাছের জন্য ক্ষতিপূরণ দেয়া হবে।
 - **ওভারহেড ট্রান্সমিশন লাইন প্রকল্প বাস্তবায়ন পরবর্তী আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা**
 - অত্র প্রকল্পের আওতায় টাওয়ার স্থাপনের ফলে ০৭ টি পরিবারকে ক্ষতিপূরণ দেয়া হবে যারা স্থায়ীভাবে ক্ষতিগ্রস্ত হবে এবং এদের মধ্যে ০২টি পরিবার কৃষিপূর্ণ। এছাড়া উক্ত প্রকল্পের কারণে শসা ও ০১ টি মাছের ঘেরের সাময়িকভাবে ক্ষতির ক্ষতিপূরণ দেয়া হবে।

সারসংক্ষেপ

- ❖ প্রকল্পের পরিবেশগত প্রভাব প্রশমনের সুপারিশসমূহ যথাযথভাবে বাস্তবায়ন করা।
- ❖ প্রকল্পের আর্থ-সামাজিকসুপারিশসমূহ, সরকারি ও উল্লেখযোগ্য উদাহরণ/অনুশীলন বাস্তবায়ন করা।
- ❖ যথাযথভাবে পরিবেশগত নিরীক্ষণ কার্যক্রম পরিচালনা করা এবং প্রয়োজনীয় পদক্ষেপ গ্রহণ করা।
- ❖ আর্থ-সামাজিক বিষয় সংক্রান্ত অভিযোগ ও অসন্তোষ শিপিবদ্ধ করা ও তা প্রশমনের ব্যবস্থা নেয়া।
- ❖ আমরা প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক বিষয়ের উপর আপনার সুচিন্তিত মতামত/মন্তব্য গ্রহণ করবো যা EIA প্রতিবেদনে শিপিবদ্ধ করা হবে।
- ❖ অত্র প্রকল্প চলাকালীন ইএমপি (EMP) সংশ্লিষ্ট বিষয়ের সার্বক্ষণিক পর্যবেক্ষণ ব্যবস্থা বলবৎ থাকবে এবং ডলফিন সহ পরিবেশ ও জীববৈচিত্রের জন্য প্রয়োজনীয় টেকসই রক্ষণাবেক্ষণ পরিকল্পনা করা হবে।

Findings from the Public Disclosure Meeting

The Chief Guest of the Public Disclosure Meeting was Muhammad Moniruzzaman Moni, Mayor khulna City Corporation. The program was presided over by S.M Kurshid Ahmed Tona counselor, 13 no. ward, Khulna City Corporation, Md. Mofazzol Hossain Sarkar, Chief Engineer, Goalpara Power Station, Md. Shahidul Morsalin Joarder, Chief Engineer, NWPGL. Different government officials, Ward Counselors from different unions, NGO representatives, Journalists, political leader, freedom fighter, UP members, farmers and fishermen from the study area were present in the meeting. Mr. Md. Sharif Hossain Sourav from CEGIS started the meeting with an introductory speech. Dr. Kazi Md Noor Newaz, Advisor and Team leader of the study team, CEGIS, made a power point presentation of the key report of the project. A brief description about the project was delivered by Mr. Hasmat Ali, Executive Engineer, NWPGL.

Following the presentation, all the participants took part in an open discussion. They made various types of comments after the presentation of Dr. Kazi Md Noor Newaz. Their comments are given below:

The people's opinions and queries shared in the open discussion are given below:

Issues raised by the participants	Feedback from the NWPGL and CEGIS
Modern technology should be adopted.	<p>Latest available technology will be adopted for the proposed power plant to reduce air emission, noise level and water extraction within appropriate GOB and IFC acceptable limit and some of the specific options are as follows:</p> <ul style="list-style-type: none"> - To control SO_x, NO_x, latest technology will be applied. - Noise and vibration level will be within acceptable limit of GOB and IFC guidelines as appropriate during project implementation period. - The height of the chimney will be 60 meter and bypass chimney will be 50 meter height - Closed cycle cooling tower which require minimum water - No extraction of ground water for plant operation - Water will be extracted from Bhairab River as a source of surface water. And only 0.12 % of the total discharge of the Bhairab river will be extracted per hour for operation of the proposed power plant. - ETP will be installed to treat and keep all discharges from the proposed power plant within acceptable limit of GOB and IFC as appropriate. - STP will be installed to treat and keep all sewage discharges within acceptable limit of GOB and IFC as appropriate. - Govt. policy and SPS (2009) will be applied during project implementation period as required.

Local experts like experienced university (Khulna University) teacher should be taken part of the power Plant intervention.	It is suggested that relevant teachers from Khulna University may discuss with local NWPGL relevant technical staff and share their opinions to include in the documents. If necessary, the Khulna University staff may also contact with CEGIS or get access in the document while it will be posted in the web site by ADB and Proponent.
All the mitigation measures must be materialized.	All the development work will be monitored from the construction phase.
The study may be carefully reviewed to focus for people and gain optimum target.	<ul style="list-style-type: none"> - Construction phase to power plant will be monitored step by step. - All the steps will be taken to obtain optimum goal.
Health safety and security should be established all around the project.	<ul style="list-style-type: none"> - All the safety measures will be ensured following GOB and ADB/IFC guidelines. The labours will be trained. - Awareness programme will be taken. - Fast aid box and trained Physician will be ensured. - Appropriate PPE for workers and staff
All machinery should be modernized	
The location of the schools (both Boys and Girls) shall be fixed as early as possible	<ul style="list-style-type: none"> - Currently schools (Boys and Girls) are risky for the students and needs to be shifted as early as possible. - The locations of both Schools shall be fixed based on considering environmental and social issues before submission of the final report to ADB and GOB. - Two modern multi-storeyed schools buildings will be established with modern school furniture. - Two school buses (a bus per school) and laboratory with modern instruments, furniture will be bought. - A solar panel will be installed to support during load- shedding of electricity if it occurs. - A play ground (bigger one than the existing one) facility for the students will be ensured. - The schools will be established completely before shifting. The school building construction will begin according to the newsprint authority and BCIC. - A clinic with ambulance service will be established - Ensuring safe drinking water, there will be a proper system of water purification. - ADB and NWPGL will implement it.
The mosque should be renovated and developed	The mosque will be modernized and reformed. Graveyard of martyrs will be well decorated with proper respect.
Fisher man livelihood will be at the risk and disrupted. They need to migrate for better livelihood	- We (NWPGL assigned CEGIS) have made a study in buffer zone considering 10 km and found no impact on river ecology.

	- No impact will be found on the Bhoirab and Atai River.
Rehabilitation programme should be introduced for the affected fisherman	Such type of programme will not be needed.
All the Newsprint mill security guard should be employed in the New Power plant	<ul style="list-style-type: none"> - Newsprint mill has another place, factory with machinery and administrative office. All the security guard will be employed by the Khulna newsprint mill authority in other place. - If we (NWPGCL) have the opportunities of employing the security guard, we would take necessary action regarding the point. - In regard to the permanent employment in power plant, Bangladesh service rule will be followed.
The environmental impact must be addressed with care to protect fish and biodiversity	IUCN-recommendations on biodiversity and related management will be followed for dolphin management and future monitoring activities as well. In this regard, we (NWPGCL) have to wait up to that level for future plan for Bio-diversity management.
Is there any experience of NWPGCL regarding this type of project in Bangladesh?	NWPGCL is an experienced and reputed company to the related field and related type of gas based power plant. It has already implemented some project like this. Even in Goalpara, they have a power plant (225 MW).
Technical issues are not clearly understood. Is there any video document of power plant having gas based technology? If yes, please show us.	There are video documentaries regarding the gas based power plant. But due to inaccessibility we cannot show the video filming. It can be watched from internet.
Is there any plan of government for providing electricity for all houses?	Government already has a vision to provide electricity to every home within 2021 (Vision 2021).

The people showed nothing negative towards the project but they urged to maintain all the environmental, social and safety issues during construction and production as well.

Concluding Remarks

The answers to all questions were given by the relevant project personnel following the open discussion session. Then Mr. Md. Shahidul Morsalin Joarder, Chief Engineer and Project Director NWPGCL expressed his opinion about the project. Then the president of this assembly Mr. S.M Khurshid Ahmed Tona counselor, 13 no. ward, Khulna City Corporation concluded the PDM by thanking all the participants.

Photographs of the PCM

Photograph-1:



Photograph-2:



Photograph-3:



Photograph-4:



Photograph-5:



Photograph-6:



Photograph-7:



Photograph-8:



Photograph-9:



Photograph-10:



Photograph-11:



Photograph-12:



List of participants of PCM conducted on 21st October 2017

খুলনা ৮০০ মেগাওয়াট কম্বাইন্ড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থান: সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইন্সটিটিউট, খালিশপুর, খুলনা।

তারিখ: ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়: সকাল ১১:০০

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
১.	শ্রীমান সানি	শ্রীমান, প্রকল্প সিনিয়র ইঞ্জিনিয়ার	udayan21@yahoo.com	শ্রীমান
২.	শ্রীমান সুনীল	কাজীপুর-২০ কোচিং ইঞ্জিনিয়ার	০১৭১১-৩০৯০২২	শ্রীমান
৩.	শ্রীমান মোহাম্মদ হোসেন	প্রকল্প পরিচালক সিইও	০১৭১১-৪২২ ৪৭০	শ্রীমান
৪.	শ্রীমান রফিক	প্রধান প্রকৌশলী ২৩পাওয়ে	০১৭১১-৬৩০০২১	শ্রীমান
৫.	শ্রীমান সুনীল	উপ-প্রকল্প পরিচালক প্রকল্প পরিচালক ২৩পাওয়ে	০১৭৩০-০৬৬৭৮৭	শ্রীমান
৬.	Shanitul Islam	Consultant/ADB	০১৭৪১৪০৭১৬	শ্রীমান
৭.	RUBY CORREA ARICO	ADB - ENVIRONMENT CONSULTANT	—	শ্রীমান
৮.	Shamouddin Ahmed	ADB - Consultant (Gas Sector Specialist)	shamof.kd@gmail.com	শ্রীমান
৯.	Mozmun Nahar	ADB BRM	nnahar@adb.org	শ্রীমান
১০.	শ্রীমান সুনীল	প্রকল্প পরিচালক উপ-প্রকল্প পরিচালক	০১৭১১-৩০৯০২২	শ্রীমান
১১.	শ্রীমান সুনীল	উপ-প্রকল্প পরিচালক	০১৩৩৩৪৭৪৭২	শ্রীমান
১২.	শ্রীমান সুনীল	উপ-প্রকল্প পরিচালক	০১৬৩৫-২৬০২৪	শ্রীমান
১৩.	Saleha Huseen	Saleha Huseen Co	—	শ্রীমান
১৪.	Aziz Yusupov	Energy Spec. ADB	ayusupov@adb.org	শ্রীমান
১৫.	Md. Shahidul Mordaki Joarder	প্রকল্প পরিচালক, প্রধান প্রকৌশলী	shahidul.mordaki@gmail.com ০১৭৩০০৬৬৭৮৫	শ্রীমান

খুলনা ৮০০ মেগাওয়াট কন্সট্রাকশন সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইন্সটিটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল ১১:০০

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
১৬.	Syed Imdad Hossain	Manager, GTCL Arongghata, KGI	Gossain.unimelb @gmail.com 01709639723	
১৭.	Engr. Nizam Uddin	Manager, SCL 01711045978	uddinengr@gmail.com	
১৮.	Abdullah-Al-Mamun	Asst. Teacher 01710027985	eva_mamun @yahoo.com	
১৯.		Aty Press	01718444611	
২০.	Mashuda Parveen	Manager (EHS) (In-charge) NWP&CL	Parveen@nwp&cl.org .bd 0177736469	 21.10.17
২১.	Mr. Jamal Uddin	AM (EHS) NWP&CL	Jamalev466@ gmail.com	 21.10.17.
২২.	MR. HASMAT ALI	GEN NWP&CL	hasmat@nwp&cl .org.bd	 21.10.17
২৩.	Ziaul Alam Khan	General Secre- tary AL-13		 20/10/17
২৪.	Mr. Zakir Hossain	13, No. Ward Office	01712179692	
২৫.		১৩ নং ওয়ার্ড অফিস	০১৭১২১৭৯৬৯২	
২৬.		১৩ নং ওয়ার্ড অফিস	০১৭৩৩৪৫৪৯২	
২৭.		১৩ নং ওয়ার্ড অফিস	০১৭১২১৭৯৬৯২	
২৮.	সো. কফিলুল ইসলাম	১৩ নং ওয়ার্ড	01616229992	
২৯.	আফিক আল রাজা	১৩ নং ওয়ার্ড	01919606047	
৩০.	তাপস ব্রহ্মচর্য	১৩ নং ওয়ার্ড ৬ নং ওয়ার্ড	01926231008	

খুলনা ৮০০ মেগাওয়াট কন্ডাইড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইপটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল ১১:০০

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
৩১.	মুহম্মদের দাস	চন্দ্রনীপঞ্জন, ৬ নং ওয়ার্ড		মুহম্মদের
৩২.	মিত্য দাস	চন্দ্রনীপঞ্জন, ৬ নং ওয়ার্ড		মিত্য
৩৩.	স্বাচীন বিক্রম	চন্দ্রনীপঞ্জন, ৬ নং ওয়ার্ড		স্বাচীন বিক্রম
৩৪.	স্বাচীন	২৬ ওয়ার্ড		স্বাচীন
৩৫.	শেঃ হিউ মুন্ডাজ	২০ নং জোয়ার্ড, চন্দ্রনীপঞ্জন		
৩৬.	শেঃ বেদ্যনাথ কান্ত	৩ নং ওয়ার্ড, চন্দ্রনীপঞ্জন		
৩৭.	শেঃ হিউ মুন্ডাজ	৩ নং ওয়ার্ড, চন্দ্রনীপঞ্জন		
৩৮.	শেঃ হিউ মুন্ডাজ	৩ নং ওয়ার্ড, চন্দ্রনীপঞ্জন		
৩৯.	শেঃ মুহম্মদের	কে.এন.এম ০১৭১১৭১০৭০৭		
৪০.	সাইনাম হাভেল	সাইনাম হাভেল কে.এন.এম ০১৭১১৭১০৭০৭	০১৭১৪৪১১০০৪	২১.১০.২০১৭
৪১.	অপর্ণা রায়	অফিসার ইনচার্জ কে.এন.এম ০১৭১১৭১০৭০৭	০১৭২৭৭০৬৪৪১	২১.১০.১৭
৪২.	মুক্তা	সি.এম.এম. মার্জিনাল কে.এন.এম ০১৭১১৭১০৭০৭	০১৭৪২৫৫০৩৫৩	Mukta
৪৩.	সোহিনুর	সি.এম.এম. মার্জিনাল কে.এন.এম ০১৭১১৭১০৭০৭	০১৭১৬৫৬১৭৫১	Sohinur
৪৪.	নুসরাত জাহান পুতুল	সি.এম.এম. মার্জিনাল কে.এন.এম ০১৭১১৭১০৭০৭	০১৭৭৪৭৪৭৩১২	Putul
৪৫.	নুপুর	সি.এম.এম. মার্জিনাল কে.এন.এম ০১৭১১৭১০৭০৭	০১৭৩৫২৭৬৪৬৬	NUPUR

খুলনা ৮০০ মেগাওয়াট কম্বাইন্ড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইন্সটিটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল ১১:০০

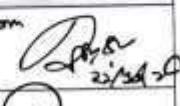
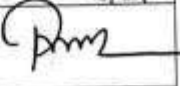
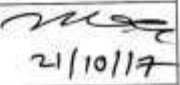

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
৪৬.	শ্রী: ব্রজেন চন্দ্র	কম্পিউটার	০১৭৩০-৪৪২২ ৪৯	
৪৭.	শ্রী: জে.এ.এ.	কম্পিউটার	০১৭৩৭৭৪৭৫৫	
৪৮.	শ্রী: মাসুদ	কম্পিউটার	০১৭১২-০৮৮৭৫	
৪৯.	শ্রী: মাসুদ (কম্পিউটার)	কম্পিউটার	০১৭১১৯৭৫৭ ১৬	
৫০.	কম্পিউটার প্রোগ্রামার	কম্পিউটার	০১৭২০০৩০৩৭৭	
৫১.	শ্রী: মাসুদ	কম্পিউটার	০১৭৫৪-৪৪৩৫০	
৫২.	শ্রী: মাসুদ	কম্পিউটার	০১৭১৬১৭০০ ৩৪	
৫৩.	ইমজিউর জে.এ.এ.	কম্পিউটার	০১৭৭৭৭৩৬৭৪	
৫৪.	শ্রী: মাসুদ	কম্পিউটার	০১৭৪৪১৫৭১০	
৫৫.	RUSHA KHAN	ADB-CAJUNAR	-	
৫৬.	Yoojung Jang	ADB-HQ	Yjang@adb.org	
৫৭.	ZHAOJING MU	ADB	zhaojingmu@adb.org	
৫৮.	SM Faruk Ahmad	BUSINESS	০১৭১৫০০১১০৬	
৫৯.	শ্রী: মাসুদ	কম্পিউটার	০১৭২৩৭০৭৬৭	
৬০.	শ্রী: মাসুদ	কম্পিউটার	০১৭১৬-১৫৭৬৩৩	

খুলনা ৮০০ মেগাওয়াট কয়লাইভ সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইন্সটিটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
৬১.	মুহাম্মদ আলী হোসেন	সম্মেলন সচিব টিই সিটিউট	mazizun@cegibd.com 01713865523	 21/10/17
৬২.	এনসি এদ্রুল ইসলাম	Electrical Engg CEGIS	01710-564066	
৬৩.	ড. জাহাঙ্গীর নেওয়াজ	Advisor, CEGIS	mamun@cegibd.com cegibd.com	 21/10/17
৬৪.	Md. Hasan	Asstt. IES KLN-	0155834831	 21/10/17
৬৫.				
৬৬.				
৬৭.				
৬৮.				
৬৯.				
৭০.				
৭১.				
৭২.				
৭৩.				
৭৪.				
৭৫.				

List of invited Government officials with their acknowledgement

খুলনা ৮০০ মেগাওয়াট কন্ট্রোল্ড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক
প্রভাব নিরূপণ বিষয়ক মতবিনিময় সভা মতবিনিময় সভার আপত্তন পত্রের প্রাপ্তি স্বীকার

ক্রমিক নং	নাম/পদবী	মোবাইল নং ও ইমেইল	
১.	মেয়র, খুলনা সিটি কর্পোরেশন, খুলনা		
২.	জেলা প্রশাসক, খুলনা।		
৩.	পুলিশ কমিশনার, ডিএমপি, খুলনা		
৪.	জেনারেল ম্যানেজার, সুন্দরবন গ্যাস কোম্পানি লিঃ, খুলনা		
৫.	ম্যানেজিং ডিরেক্টর, খুলনা ওয়াসাএবং চেয়ারম্যান, আইইবি, খুলনা		
৬.	ব্যবস্থাপনা পরিচালক, খুলনা নিউজপ্রিন্ট মিলস্ লিঃ খুলনা		
৭.	পরিচালক, পরিবেশ অধিদপ্তর, খুলনা		
৮.	প্রধান প্রকৌশলী, খুলনা বিদ্যুৎকেন্দ্র, বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড (বিপিডিবি), খুলনা		
৯.	প্লান্ট ম্যানেজার, খুলনা ২২৫ মেঃওঃ সিসিপিপি, এনডব্লিউপিজিসিএল, খুলনা		
১০.	এস এম খুরশিদ আহমেদ (টোনা) কাউন্সিলর, ওয়ার্ড-১০, খুলনা সিটি কর্পোরেশন, খুলনা		
১১.	মোঃ সাহিদুর রহমান কাউন্সিলর, ওয়ার্ড-০৮, খুলনা সিটি কর্পোরেশন, খুলনা		
১২.	সভাপতি, খুলনা প্রেসক্লাব, খুলনা		
১৩.	সম্পাদক, খুলনা প্রেসক্লাব, খুলনা		
১৪.	নির্বাহী প্রকৌশলী, বাংলাদেশ পানি উন্নয়ন বোর্ড, খুলনা		
১৫.	বন সংরক্ষক, খুলনা সার্কেল		

ক্রমিক নং	নাম/পদবী	মোবাইল নং ও ইমেইল	
১৬.	বিভাগীয় বন কর্মকর্তা, বনা প্রাণী ব্যবস্থাপনা ও প্রকৃতি সংরক্ষণ বিভাগ, খুলনা		
১৭.	জেলা মৎস্য কর্মকর্তা, খুলনা	০১৭১২০৬৬২১৬	
১৮.	উপ পরিচালক, বাংলাদেশ কৃষি সম্প্রসারণ অধিদফতর, খুলনা		
১৯.	নির্বাহী প্রকৌশলী, গনপূর্ত বিভাগ, -২ খুলনা	/	
২০.	নির্বাহী প্রকৌশলী, সড়ক ও জনপদ বিভাগ, খুলনা		✓
২১.	নির্বাহী প্রকৌশলী, বাংলাদেশ কৃষি উন্নয়ন কর্পোরেশন, খুলনা		✓
২২.	ভারপ্রাপ্ত কর্মকর্তা, খালিশপুর থানা, খুলনা		
২৩.	প্রধান শিক্ষক, খুলনা নিউজপ্রিন্ট মিলস্ স্কুল, খুলনা	০১১৮ ৮২২০০৮	
২৪.	ইমাম, খুলনা নিউজপ্রিন্ট মিলস্ মসজিদ, খুলনা		✓
২৫.	শ্রী: কামাল হোসেন	০১৭১১ ৩৩২৬৩৫	✓
২৬.	শ্রী: জেনারেল হোসেন	০১৭১২-৫১৫৭৫১	✓
২৭.	শ্রী: জেনারেল -	০১৭১২ ২৭১৬১২	
২৮.			
২৯.			
৩০.			
৩১.			

Annex 3: List of Participants during Focus Group Discussions and Public Consultation Meeting

List of Participants during Focus Group Discussion (Fisherfolks in Malapara)

FGD with Fishermen for 800 MW LNG Based Combined Cycle Power Plant Project at
Khalishpur, Khulna, Bangladesh

Attendance Sheet

Date: 12.11.2016

Venue: Malapara, Chandanail

SL No.	Name	Designation/Address	Mobile no./ e mail	Signature
01.	Atay Biswas	Malapara Chandanail	0171283980	Atay Biswas
02.	Dipak Biswas	"	01782086830	Dipak Biswas
03.	Suman Vekra	"	0176508887	Suman Vekra
04.	Condan Biswas	"	01729 327965	Condan Biswas
05.	Kishore Biswas	"	01756781702	Kishore Biswas
06.	Bikas Biswas	"	-	Bikas Biswas
07.	Condana Ray	"	01757 291173	Condana Ray
08.	Lilima Biswas	"	01703626645	Lilima Biswas
09.	Shakti Biswas	"	0176297876	Shakti Biswas
10.	Nomij Biswas	Harewife	0172687555	Nomij Biswas
11.	Sandj Sarkar	"	01768 509706	Sandj Sarkar
12.	Dambaba Biswas	"	0194810005	Dambaba Biswas
13.	Konika Biswas	"		Konika Biswas
14.	Quinn	"	01923906251	Quinn
15.	Jay	"	01766781702	Jay
16.	Kakoli Biswan	"	017283930	Kakoli Biswan
17.	Eti Rani	"	01931273238	Eti Rani

SL No.	Name	Designation/Address	Mobile no./ e mail	Signature
18	Anjona	Malopara, Chardoni Mahal	01770537454	ଅନଜନା
19	Mita	"	01949239056	ମିତା
20	Youna	"	01961152185	ସୁନା
21	Moyna	"	01914456249	ମୋୟନା
22	Biswajit	"	01982239056	ବିଷ୍ଣୁ
23	chandi	"	01768509106	ଚନ୍ଦୀ
24	Jayannath	"	01925074723	ଜୟନାଥ
25	Polek		01982704666	ପୋଲକ
26	Anup		01961152185	ଅନୁପ
27	Nikhil		01756607808	ନିଖିଲ
28	Biswa		01949239056	ବିଷ୍ଣୁ
29	Eti Biswas		01931273238	ଇତି ବିଷ୍ଣୁ
30	Kelpona		01757721865	କେଲପନା
31	Anoti		01766288698	ଅନୋତି
32	Robin Biswas		0	ରବିନ ବିଷ୍ଣୁ
33	Pappu		01995317251	ପାପୁ
34	Mithun		09211933920	ମିଥୁନ
35	Shanti		01961152185	ଶାନ୍ତି

Table A2: List of Participants in Public Consultation Meeting

No.	Name	Occupation	Address	Mobile Number
-----	------	------------	---------	---------------

No.	Name	Occupation	Address	Mobile Number
1	Motaleb Sarker	Farmer	Chandoni Mahal	01962693632
2	Arun	Fisherman	Chandoni Mahal	
3	Sk. Md. Ripon	Fisherman	Chandoni Mahal	01920175436
4	Sahabuddin	Fisherman	Chandoni Mahal	01743433354
5	Kanchan Bishwas	Fisherman	Chandoni Mahal	01914204284
6	Hassan	Fisherman	Chandoni Mahal	01980127323
7	Faizullah	Trader	Chandoni Mahal	01727381873
8	Makbul Hossain	Farmer	Tetultola, Batiaghata	
9	Modser Mallik	Farmer	Tetultola, Batiaghata	01941967416
10	Delower Hossain	SAAO	Tetultola, Batiaghata	01917953277
11	Abul Basher	Farmer	Tetultola, Batiaghata	
12	A Kader	Business	Tetultola, Batiaghata	01718445008
13	Moniruzaman	Fisherman	Tetultola, Batiaghata	01712963717
14	Bipul Biswas	Fisherman	Puthimari, Jalma	01951905570
15	Abdur Rahim	Trader	Puthimari, Jalma	01946433745
16	Ali Hossain	Fisherman	Puthimari, Jalma	01729952730
17	Shadhon Roy	Fisherman	Puthimari, Jalma	
18	Baburam Mollik	Trader	Puthimari, Jalma	
19	Alamin Kobiraz	Fisherman	Puthimari, Jalma	01960645838

Annex 4 Photographs of Public Consultation Meetings



Group discussion with the local people



Group discussion with the local people

Annex 5

“Chance Find” Procedures for Physical Cultural Resources

Component 3

1.0 Introduction

These procedures describe the measures to be undertaken if an accidental discovery or chance find, or an encounter with a physical cultural resource (PCR) occurred during the construction phase. The chance find procedures will be finalized as Physical Cultural Resources Plan (PCRP) by NWPGL and the EPC Contractor, in consultation with the Department of Archaeology (DoA) or the Ministry of Cultural Affairs to ensure compliance to The Antiquities Act 1968 (amended 1976), National Cultural Policy 2006, and applicable regulations. The PCRP will be included in the Construction Management Plan (CMP) that will be required from the EPC Contractor. The objectives of these procedures are to identify and promote the preservation, protection, and recording of any PCR that may be discovered or exposed during excavation other earthmoving works and ground alteration along the 29.3 km, 230 kV overhead transmission line(OHTL) from the new substation in Rupsha 800 MW CCPP to the existing Khulna South substation (SS). About 75 transmission towers will be erected along the OHTL.

2.0 Orientation and/or Briefing of Workers

The EPC Contractor, with technical support from the DOA or Ministry of Cultural Affairs and PMU, NWPGL will conduct an orientation or training for all workers, particularly those who will be involved in earth movements and excavation on how to recognize artifacts that they may potentially encounter or discover. The EPC Contractor will be responsible for creating awareness to construction personnel on the ADB requirements for any unanticipated impacts such as discovery of a physical cultural resource.

An archeological map of Bangladesh (if available) will be obtained from the DoA or other relevant sources to examine if there are potential "hot spots" within the project area. This map will be part of the references on-site to guide the construction supervision staff in determining the potential "hot spots."

3.0 Procedures

3.1 General

In case a PCR was encountered during excavation, construction activities including traffic within a 30.5 meter radius in the area will be stopped immediately by the EPC Contractor. The discovery will be reported by the site engineer or representative from the EPC Contractor to PMU, NWPGL environment staff (or Consultant). The site or area discovered will be marked or demarcated using a global positioning system (GPS) unit to determine the exact coordinates and photographs will be taken. The construction supervision staff of the EPC Contractor and PMU, NWPGL site engineer/staff will secure the site to prevent damage, loss or pilferage of removable objects. Site Engineer of PMU, NWPGL or designated staff will be responsible for coordinating with DoA.

If the encounter involves removable items, a security person will be posted until the representative of DoA or Ministry of Cultural Affairs arrives to assess and determine its value. The DoA staff will be responsible in determining the appropriate course of action. Further

excavation or earth moving works may be conducted at the distance and demarcation area recommended by the DoA staff.

If the chance find will have significant cultural value, this may entail consequent changes in the lay-out particularly if the discovery is considered or assessed as remains of cultural or archeological importance that is not removable.

EPC Contractor will not be entitled for compensation due to work stoppage as a result of the discovery and its associated subsequent actions.

3.2 Assessment and Recovery

Appropriate heavy equipment such as wheel loader will be made available to recover the excavated material from the excavation site to allow the geologist onsite or the DoA staff to inspect, recover or conduct sampling. A safe storage area will be provided to protect the discovered object. If the chance find is part of a large artifact, deposit or structure, the inspection or recording will include photography and video on an "as-is, where is" manner. The exact location will be recorded using a GPS unit.

3.3 Resumption of Work

The Contractor can continue with excavation and construction works within the affected area after the DoA staff has given clearance. All the discovered objects of value will be given to the Government.

4.0 Reporting

The EPC Contractor will prepare a "Chance Find" Report within a week showing the date and time of discovery, specific location, description of the PCR, and interim protection measures implemented. This Report will be submitted to PMU, NWPGCL who will provide it to the DoA or Ministry of Cultural Affairs. The chance find including measures on how it was dealt with will be included in the environmental monitoring report submitted to ADB.

Annex 6 Format of Environmental Monitoring Report

Environmental Monitoring Report

{Annual/Semestral} Report
{Month Year}

BAN: Rupsha 800 MW Combined Cycle Power Plant Project

Prepared by the North-West Power Generation Company Limited for the Asian Development
Bank

CURRENCY EQUIVALENTS

(as of {Day Month Year})

{The date of the currency equivalents must be within 2 months from the date on the cover.}

Currency unit	–	{currency name in lowercase (Symbol)}
{Symbol}1.00	=	#{ }
\$1.00	=	{Symbol_____}

ABBREVIATIONS

{AAA}	–	{spell out (capitalize only proper names)}
{BBB}	–	{spell out}
{CCC}	–	{spell out}

WEIGHTS AND MEASURES

{symbol 1 (full name 1)}	–	{Definition 1}
{symbol 2 (full name 2)}	–	{Definition 2}
{symbol 3 (full name 3)}	–	{Definition 3}

GLOSSARY

{Term 1}	–	{Definition 1}
{Term 2}	–	{Definition 2}
{Term 3}	–	{Definition 3}

NOTE

In this report, "\$" refers to US dollars.

This environmental monitoring report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

TABLE OF CONTENTS

Page

Executive Summary

- Brief status of environmental compliance during the coverage period

1.0 Introduction

- 1.1 Brief Project Description
- 1.2 Project Progress Status and Implementation Schedule

2.0 Compliance to National Regulations

- 2.1 Environmental Conservation Rules 1997

3.0 Compliance to Relevant Environmental Requirements from the ADB Loan Agreement

- 3.1 Schedule 5 (prepare a matrix to show how compliance was achieved)

4.0 Compliance to Environmental Management Plan

(Refer to the EMP of the Project)

5.0 Safeguards Monitoring Results and Unanticipated Impacts

(Refer to the Environmental Monitoring Plan and document any exceedence to environmental standards (if any), or any unanticipated impact not included in the EMP and any correction action/measures taken)

6.0 Implementation of Grievance Redress Mechanism and Complaints Received from Stakeholders

(Summary of any complaint/grievance and the status of action taken)

7.0 Conclusion and Recommendations