Vol. 2: Draft Environmental and Social Impact Assessment of Reliance Meghnaghat 750 Combined Cycle Power Plant

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BAN: Reliance Bangladesh LNG and Power Limited

Prepared by Adroit Environment Consultants



Environmental & Social Impact Assessment (ESIA)

OF

Reliance Meghnaghat 750 Combined Cycle Power Plant

A Project by

Reliance Bangladesh LNG & Power Ltd.


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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Annexures

Annexure-21 Project Schedule (Phase I)

ABBREVIATION

ADB	Asian Development Bank
AECL	Adroit Environment Consultants Limited
ACW	Auxiliary Cooling Water
AVT	All-Volatile Treatment
AER	Agro-Ecological Region
AQM	Air Quality Management
BB	Bangladesh Bank
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BDT	Bangladesh Taka
BMD	Bangladesh Meteorological Department
BPDB	Bangladesh Power Development Board
BERC	Bangladesh Energy Regulatory Commission
BIWTA	Bangladesh Inland Transport Authority
BWDB	Bangladesh Water Development Board
CCPP	Combined Cycle Power Plant
CSMC	Construction Supervision and Monitoring Consultants
CAAB	Civil Aviation Authority of Bangladesh
CCCW	Closed Cycle Cooling Water
CCIE	Chief Controller of Import and Export
CCR	Central Control Room
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DOE	Department of Environment
ECR	Environment Conservation Rules 1997
ESIA	Environmental & Social Impact Assessment
EMP	Environmental Management Plan
EPZ	Export Processing Zone

FSRU	Floating Storage Regasification Unit
GIS	Geographic Information System/ Gas Insulated Switchyard
GOB	Government of Bangladesh
GPS	Global Positioning System
GSTP	Gas Sector Development Program
GTCL	Gas Transmission Company Limited
IEC	Important Environmental Component
IEE	Initial Environmental Examination
LGED	Local Government Engineering Department
LNG	Liquefied Natural Gas
MoEF	Ministry of Environment and Forests
MMSCFD	Million Metric Standard Cubic Feet per Day
MSL	Mean Sea Level
MT	Metric Ton
NEMAP	National Environment Management Action Plan
NGO	Non-Government Organization
NWMP	National Water Management Plan
PAP	Project Affected Person
PCP	Project Concept Paper
PGCB	Power Grid Company of Bangladesh
RBLPL	Reliance Bangladesh LNG & Power Limited
REB	Rural electrification Board
SPM	Suspended Particulate Matter
STG	Steam Turbine Generator
SWAS	Steam Water Analyzing System
SRDI	Soil Resource Development Institute
TBS	Town Border Station
TOR	Terms of Reference
UNDP	United Nations Development Program

GLOSSARY

Adverse impact: An impact that is considered undesirable.

Ambient air: Surrounding air.

Aquatic: Growing or living in or near water.

Bangla: Bengali language.

Baseline (or existing) conditions: The 'baseline' essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e. the 'No-development Option'.

Bazar: Market.

Beel: A 'back swamp' or depression can be either perennial or seasonal.

Beneficial impacts: Impacts, which are considered to be desirable and useful.

Biological diversity: The variety of life forms, the different plants, animals and microorganisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity.

Char: Newly accreted land: Land, sometimes islands, within main river channels and nearby mainland or in the estuary, subject to erosion and accretion.

Ecosystem: A dynamic complex of plant, animal, fungal and microorganism communities and associated non-living environment interacting as an ecological unit.

Emission: The total amount of solid, liquid or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source.

Endangered species: Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction.

Environmental effects: The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity.

Environmental Impact: An estimate or judgment of the significance and value of environmental effects for natural, socio-economic and human receptors.

Environment Management Plan (EMP): A Plan to undertake an array of follow-up activities which provide for the sound environmental management of a project/

intervention so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized; and sustainable development is ensured.

Environmental Management: Managing the productive use of natural resources without reducing their productivity and quality.

Erosion: Process in which wind and water removes materials from their original place; for instance, soil washed away from an agricultural field.

Evaluation: The process of looking back at what has been really done or accomplished.

Fauna: A collective term denoting the animals occurring in a particular region or period.

Field Reconnaissance: A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal.

Flora: All of the plants found in a given area.

FSRU: A Floating Storage Regasification Unit (FSRU) is the vital component required while transiting and transferring Liquefied Natural Gas (LNG) through the oceanic channels. Thus, FSRU can be termed as a special type of ship which is used for LNG transfer.

Habitat: The natural home or environment for a plant or animal.

Household: A household is identified as a dwelling unit where one or more persons live and eat together with common cooking arrangement. Persons living in the same dwelling unit having separate cooking arrangements constitute separate household.

Important Environmental Component (IEC): These are environmental components of biophysical or socio-economic importance to one or more interested parties. The use of important environmental components helps to focus the environmental assessment.

Khal: Small Channel, canal.

Land use: Types include agriculture, horticulture, settlement, pisciculture and industries.

Mauza: A Bangla word for the smallest government administrative area corresponding to village revenue unit.

Mitigation: An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.

Negative Impact: Negative change from the existing situation due to the project.

Public involvement / Public consultation: A range of techniques that can be used to inform, consult or interact with stakeholders' affected / to be affected by a proposal.

Reversible impact: An environmental impact that recovers either through natural process or with human assistance (e.g. cutting off fish migration by an embankment might be reversible at a later stage if a proper regulator is built).

Stakeholders: Those who may be potentially affected by a proposal, e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or to take an interest in it.

Taka: Unit of Bangladeshi currency.

Terrestrial: Living on land.

Thana: Sub-district level of government administration, comprising several unions under district.

Union: Smallest unit of local self-government comprising several villages.

Upazila: Sub-district name. Upazila introduced in 1982.

Zila: Bengali word for district.

EXECUTIVE SUMMARY

1. Introduction

This report represents the results of Environmental & Social Impact Assessment (ESIA) of **Reliance Meghnaghat 750 MW Combined Cycle Power Plant** at Sonargaon, Narayanganj. To provide access to affordable and reliable electricity to all by 2021 as well as to comply with the policy of Government of Bangladesh (GOB) and to increase the efficiency on natural gas based power plants, RPL intends to construct a new 750 MW Combined Cycle Power Plant in the Government allotted land for BPDB.

Reliance Meghnaghat 750 MW Combined Cycle Power Plant project is a natural gas fired power generation plant with rated capacity of 750 MW. The proposed area of the plant is located at Meghnaghat inside the vicinity of BPDB's allocated 100 acre government land where three other power plant exist viz. Meghnaghat Power Limited, with capacity of 450 MW CCPP, Summit Meghnaghat Power Company Limited (SMPCL) with capacity of 350 MW and Orion Power Meghnaghat Power Plant (OPML) with capacity of 100 MW. The project company has applied for the Environmental Site Clearance Certificate from Department of Environment (DoE) by submitting the IEE and other documents.

The **Reliance Meghnaghat 750 MW Combined Cycle Power Plant** project will be implemented by ADB & IDB Co-financing. The objective of this study is to provide an examination and assessment of the major environmental & social impacts to be created due to the project activity during its construction and operation phase. The study will also focus on suggesting the possible mitigation measures for any adverse impacts and a management & monitoring plan to evaluate the effectiveness of the mitigation measures.

This ESIA report comprises of 12 sections and the contents of these sections are summarized below.

2. The Project

Electricity generated in the power plant will be supplied to the 400 KV National Grid of PGCB (Power Grid Company of Bangladesh). Fuel for the project shall be supplied through a proposed 24 inch Gas Pipeline from Kutumbpur to Meghnaghat being set up by GTCL (Gas Transportation Company Limited).The basic information of the project is given below:

1. Name of the Project	Reliance Meghnaghat 750 MW Combined Cycle Power Plant
2. Sponsoring Ministry/ Division	Ministry of Power, Energy and Mineral Resources (Power Division)
3. Executing Agency	Reliance Bangladesh LNG & Power Ltd.

4. Project Location	Meghnaghat, Sonargaon, Narayanganj, Bangladesh.
5. Location of the Proposed Plant	23°36'25.56"N, 90°35'32.16"E
6. Type of Project	Combined Cycle power plant
7. Raw Materials	The main raw material of the project is natural gas.
8. By-product, if any	None
9. Net Plant Capacity	750 MWh of Electric Power
10. Project Cost	Yet to be estimated
13. Total Area of Land	35 acres
14. Fuel Requirement	RLNG/Natural Gas: 130mmscfd @ 100% load
15. Water Requirement & Source of Water	1100 m^3/h; Source: Meghna River
16. Quantity of Discharge Water	196 m^3/hr

The proposed power plant will be located on Meghnaghat, Sonargaon in the district of Narayanganj, Bangladesh. This land will be sufficient for the proposed 750 MW combined cycle power plant. The power plant of 750 MW shall consist of multi shaft configuration with two numbers of advanced classes GE Frame 9FA Gas Turbines, two numbers of HRSGs & one number of Steam Turbine Generator. The project will comprise of "Closed Loop Cooling" system for steam condensation which will decrease the amount of water discharge significantly.

3. Policy and Legal Considerations

Environment

This ESIA report has been prepared by following the methodology prescribed in the EIA guidelines for industries of DOE, ECA95 and ECR97, that are the main legislative documents relating to environment protection in Bangladesh.

The environmental classifications for industrial projects in Bangladesh are based on "inclusion lists" given in the ECR97 with "RED" being the highest category. Power Plant is listed in the "Red Category" in ECR97 (i.e., serial no.6 in the ECR97 Red list in Schedule-1.).

International Safeguard Requirements

The report is also compliant with ADB‘s Environmental Safeguard Framework. Steps to consult potentially affected people by the project and to disclose the ESIA report to the public have been taken for compliance with the Bank‘s policies of the ESIA preparation, although these are non-mandatory as per national legislations.

The Safeguard Policy Statement (SPS), 2009 governs the environmental and social safeguards of ADB's operations. It applies to all ADB-financed and/or ADB-administered projects and their components, regardless of the source of financing, including investment projects funded by a loan; and/or a grant; and/or other means, such as equity and/or guarantees.

According to ADB environmental classification, the project falls under Category **A** from environmental aspect, Category **C** from the aspect of "Involuntary Resettlement" (as there is no land acquisition needed) and Category **C** from the aspect of "Indigenous People" (no indigenous community lives nearby)under SPS, 2009.

4. Baseline Environment

Baseline environment is concerned with existing physical, chemical and biological conditions of the area where the plant is going to be set up. The surface water, ground water, ambient air quality and noise level have been analyzed to evaluate the primary baseline of the area. The data from the monthly monitoring data of proposed Reliance Meghnaghat 750 MW CCPP have also been used to evaluate the monthly concentrations of $PM_{2.5}$ and PM_{10} in the project area.

Water Environment: In the vicinity of the plant, the main surface water body is the River Meghna which is adjacent to the site. The quality of the river water at three locations around the project have been analyzed and found satisfactory. Ground water level exists at a moderate (Generally below 8.0 m) depth in the area. Water from underground source is assumed to be available as because most of the period of the year the area remains under water. That means the recharge capacity of the ground water level seems to be adequate. The ground water from the three locations around the site has been analyzed and no parameter was found to be above the national and international safe limit.

Ecological Baseline: In common with other peri-urban or rural areas; birds like Crow, Salik, Chorui, doel, ghughu, Kokil, etc are seen at times at the project site. There are no wildlife, natural forest and vegetation, endangered species of present in and around the plant site. Although the plant site is mostly barren, there are a number of different types of trees like jack fruit, mehogoni, krisnochura etc. along with few other shrubs around the plant site.

Climate: The climate of the region is of tropical monsoon type. According to Bangladesh Meteorological Department, the maximum temperature of 2013 at project site is 37.0° C in June & July and minimum temperature is 5.3 °C in January. Mean relative humidity for an average year (2013) is recorded as 73% and on a monthly basis; it ranges from 54% in March to 81% in August. At normal times, the maximum and minimum wind speeds at Dhaka (no meteorological station in Narayanganj) are 3.2 Knots/hr and 2.1 Knots/hr respectively in 2013. The rainfall is mostly confined in the

monsoon season i.e., between May to October. Maximum and minimum rainfall in May 2015 is 623 mm and 0 mm in Nov respectively.

Ambient Air Quality: The data from the DOE CAMS (continuous air quality monitoring stations) is not available near the project area. So, to establish a realistic baseline air quality, AECL has conducted 24 hours air sampling at 6 locations twice a week at each location12 weeks. The baseline levels for criteria pollutants i.e., $PM_{2.5}$, PM_{10},CO, NO_2 and SO_2 are compliant with DoE and World bank/IFC standard.

Noise: Baseline noise levels measured near the plant site were rarely found to be above 70dBA except for few cases and the maximum value is 74.8 dBA, at 4 PM and 79.5 dBA at 6 PM in Mograpara. Since there is no homestead within the 2 km radius of the proposed project, so, the noise emission from the project or anywhere nearby would not create any harm to the neighboring community.

5. Potential Impacts of the Proposed Project

The purpose of impact evaluation is to assign relative significance to the predicted impacts associated with the project, and thus determine the order in which impacts are to be avoided or mitigated. It should be noted that impact evaluation are somewhat subjective as the impacts can't always be quantified before the event.

The following are the main objectives of impact evaluation: (i) Distinguish between impacts that are of most concern (need to be avoided/ mitigated) and those that are considered to be less important; (ii) Organize measures of significance in a way that allows a comparison of alternative project proposals; and (iii) Facilitate the communication of results to the concerned public and to decision makers.

Key elements for assessing impact significance are: (i) Scientific and professional judgment; (ii) Disturbance/disruption of valued ecological systems; (iii) Degree of negative impact on social values and quality of life; and (iv) Public perception versus the scientific/professional opinion of the risks/benefits involved.

Identification of potential impacts due to the plant location, construction and operation of the plant has been done using a checklist. The checklist contains the environmental effects and impacts designated to stimulate the analysis and to consider broadly the possible consequence of contemplated actions.

The significant impacts in different phases i.e., (i) due project location and design, (ii) construction phase and (ii) operation phase have been identified using the process. There are some impacts during construction of the power plant are air quality, surface water quality and drainage pattern are concern. The impacts due to operation are most important, which are: (i) Air Emissions especially NO_2 (ii) Noise, (iii) Water pollution, and (iv) Occupational health

6. Prediction and Evaluation of Impacts

Preconstruction Stage: The power project would have minor impacts due to the location of the project such as Impact on land use pattern in terms of Loss of Homestead land, historical and Aesthetic Loss, Loss of sensible places, change in landscape, disruption of earth surface, etc. All the impacts have been discussed and mitigation measures have been recommended in the ESIA report.

During construction period: The power project would have significant environmental impacts during the construction period. The potential impact would be divided into two parts as 1) Impact due to construction associated facilities and 2) Impact during project construction.

1. **Impact due to construction of associated facilities:** These include the following:

- Construction of Jetty
- Construction of Labour Shed and Site Office
- Construction of Access Road
- Construction of Transmission Line

2. Impact during project construction: These include the following:

- Impact on air quality
- Impact on surface and ground water quality
- Impact on noise quality
- Impact on solid waste management
- Impact due to sanitation and drinking water hazard
- Social acceptability of migratory and foreign workers at site
- Workers accident and Occupational safety
- Traffic congestion
- Hazardous waste management at site

Since the project would be implemented on the preoccupied and developed land of BPDB for the power project and situated at the designated power village of BPDB, resettlement will not be an issue in this case. Detailed environmental impacts and its mitigation measured have been discussed in the ESIA report and proper management & monitoring plan have been suggested to control the above impacts. The EPC contractor and the project company – RBLPL will ensure the necessary implementation and monitoring of EMP to comply the national and IFC/WB guideline during the construction period.

During Operation period: As explained, the main potential environmental impacts, which may arise as a result of operation of the project have been summarized below.

Atmospheric Emission and Air Quality: As the proposed power plant will utilize Natural gas as fuel, the pollutants of potential concern will only be the Oxides of Nitrogen (NO_x) during the operation period of the project. The Heat recovery Steam Generation (HRSG) system which produces steam by using the waste heat from the Gas turbine will reduce the exhaust heat temperature to 365^0C. The ground concentration of NO_x emission has been determined by emission dispersion modeling (USEPA approved AERMOD 9.2.0 model). The air quality modeling has been done for individual emission from this particular power project as well as the cumulative emission from the all power projects in the area.

Bangladesh National Ambient air quality standard NOx level set for annual average. As the primary data is not available throughout the year to measure at an annual basis, Continuous Air Monitoring Station (CAMS) secondary data available from Narayanganj CAMS station (Article 4.6) of DOE was used for analysis. The Narayanganj CAMS station (23.63N and 90.51E) is around 10 km away from the project site and the concentration of Narayanganj is much higher than the project area considering the volume of industrial activity and emission level. Even considering the highest concentration of NOx at Narayanganj CAMS, still the aggregated NOx concentration (35.77 µg/m^3 and 36.47 µg/m^3) is within the limit of IFC/WB and Bangladesh standard. But the maximum & minimum 24hr NOx concentration has been found in our baseline study at Vatibalaki as 11.9 µg/m^3 on Nov and 5.1 µg/m^3 on October respectively.

Comparison Ambient air quality guideline for NOx (individual stack emission)

Pollutants	Average Period	Ambient concentration	Concentration From RPLBL	Total	Standard in µg/m^3		
					BNAAQS***	WHO/IFC 2007*	US EPA
NO_x	1 hr	-	10	-		200**	188
	Annual	35.67****	0.10	35.77	100	40**	100

Comparison Ambient air quality guideline for NO_2 (cumulative stack emission)

Pollutants	Average period	Ambient concentration	Concentration From RPLBL	Total	Standard in µg/m^3		
					BNAAQS***	WHO/IFC 2007*	US EPA
NO_2	1 hr		30			200**	188
	Annual	35.67****	0.80	36.47	100	40**	100

* IFC Environmental Health & Safety Guidelines 2007

** Ambient air quality standard for small combustion facility using gas fuel and spark engine

***Bangladesh National Ambient Air Quality Standard

****Maximum Annual average of NO_x as per Narayanganj CAMS

Noise: The gas turbine and the steam turbine will have internal noise level of around 85dBA which will be minimized by sophisticated acoustic power house building design so as to minimize the noise up to standard. The heat recovery steam generator stack

will emit a noise level of 85dBA after providing the silencer. To reduce the effect, the most effective and technologically advanced Critical Type Silencer will be used in the stack.

In particular, significant noisy components such as the gas turbine sets are enclosed in buildings acoustically designed, providing Styrofoam filler of 50 mm width in between 300 mm thick brick walls around the power house building. Moreover, thick doors are provided and holes which may create sound pollution are sealed with sound proof materials. Vibration pad will also be used at the bed of all power generation units to prevent the vibration. The stack noise emission dispersion has been predicted by means of noise impact modeling. It is observed from the noise emission modeling that the max noise level within the 50m radius is 32.16dBA.

The resultant noise calculation with the ambient noise level shows that the noise level after 300m from the power plant will not affect the ambient noise level of the area, so, there would not create any noise problem due to the power plant to the nearest settlement.

Liquid Discharge: The estimated water consumption is 1096 m^3/hr and discharge will be 196 m^3/hr in the proposed Reliance Meghnaghat 750 MW CCPP project. The low amount of water discharge is due to the use of "Closed Circuit Cooling System". Owing to the low amount of discharge and use of closed circuit cooling, rise in river temperature will have no impact on river water temperature considering the amount of discharge from the other power plants near the project premise.

The domestic liquid wastes would be disposed through a septic tank system. It has been planned that the surface drainage network would be connected with an interceptor prior to discharge to surface drainage system. All other surface water coming from cooling tower blow down, DM plant rejects and service water will be taken to wastewater treatment plant prior to discharge to natural water. The capacity of the WWTP is 20 cu.m/ hour and detail of the WWTP has been given in the EISA report.

The other potential impact during the project operation will be as following:

- Solid and municipal Waste
- Lubricating oil
- Hazardous waste management
    - E waste
    - Battery waste
- Occupational Health & safety
- Ecological Impact
    - Flora & Fauna
    - Fishery
    - Forest

  - Wild life
  - Agriculture
  - Hydrology
  - Archaeological & cultural resources
- Socioeconomic Impact
- Impact on climate change
- beneficial impact

Detail of the above impacts and the mitigation measures have been discussed in the ESIA report and proper management & monitoring plan have been suggested to control the above impacts.

7. Environmental Management Plan (EMP)

In the context of a project, Environmental Management Plan (EMP) is concerned with the implementation of the measures necessary to minimize and offset the adverse impacts and to enhance beneficial impacts. Unless the mitigation and benefit enhancement measures are identified in ESIA and fully implemented, the prime function of the ESIA cannot be achieved.

The objectives of EMP for the present project are: (i) Identification of Monitoring requirements and Monitoring indicators; (ii) Mitigation measures to reduce or eliminate negative impacts; and (iii) Enhancement measures to maximize positive impacts. Environmental management plan has to be considered as part of the plant's overall management and it would be part of the plant operational manual.

Management in Construction Stage

General construction management and control over conducting technological process during construction works will be assigned to the contractor and RBLPL project management. The contractor, in turn, concludes contracts with subcontract organizations performing works at the construction site. The RBLPL authority bears responsibility under Project Implementation unit (PMU) for selection and assessment of subcontract organizations. Control functions over contract organizations activity in the field of labor safety, industrial safety and preservation of the environment are also assigned to the Consortium.

Management in Operation Phase

RBLPL Management will be responsible to operate the power project under Operation & Maintenance unit (O&M) during the operation phase and will be responsible to maintain the environmental and social standards for the project.

Mitigation Enhancement Measures

For effective and environment friendly operation of a project, a set for guiding tools and suggestions are necessary which need to be followed at various stages of plant installation, operation and maintenance. This plan generally has various components of management depending on the type of project or plant activity and types of discharge and their pollution potential. This Environmental and Social Management Plan (ESMP) once prepared forms the basis of environmental management actions from the part of the project authority may need modification or up-gradation because of changes in the plant operation or accurate pollution load/environmental problems detected afterwards.

Monitoring Plans

Monitoring of the performance of a plant is very important and sometimes vital. Industrial units in Bangladesh generally do not monitor the environmental parameters related to plant operation, thereby neglecting the environment. For surveillance of the environmental performance of an industry, and monitoring of the quality of the local environment, environment in the work-zone and the general impact zone have to be performed on a regular basis.

A management set up has to be created for the environmental monitoring program which can ensure compliance with national environmental standards. To this end a committee (Environmental Management and Safety Committee) will be created with plant manager as head and with 2-4 other members. The committee must meet at least once in a quarter and discuss about the environmental status of the plant. The main emission from the plants (i.e., air emissions, noise and any other) are to be analyzed as per monitoring plan. The “the quarterly and annual environmental monitoring reports will be submitted to DOE, ADB and will also be placed on the company website for public scrutiny.

Monitoring in Construction Phase

The environmental monitoring program should be carried out as an integral part of the planning and execution of the construction phase. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. There are two types of monitoring during construction, 1) Visual Monitoring and 2) Analytical Monitoring. The following are the visual monitoring, its parameters and monitoring frequency for the RBLPL750 MW CCPP:

Visual Monitoring and Observation during Construction Phase:

Issue	Key aspects	Monitoring Frequency	Responsibility
Traffic volume	Incoming & outgoing traffic, traffic movement records	Monthly	EPC Contractor/ Consultant
Site Security	Proper fencing, isolation of site from	,,	,,

	general access, marked passage for workers and visitors		
Personal Protective Equipment	Ensure every single person involved in the construction activity wear proper PPE	,,	,,
Incident record & reporting	Documented record of all incident, accident, near misses etc. and its remedial process.	,,	,,
Solid waste	Quantity of solid waste, segregation and disposal process	,,	,,
Oily waste generation & disposal system	Quantity of oily waste, storage and disposal process	,,	,,
Worker's health	Monitoring process of worker's health	,,	,,
Complain from neighbours	Any significant complain from neighbours and it's remedial procedure	,,	,,
Safety orientation & training of workers	Frequency of training & orientation of workers for safety	,,	,,
Sanitation & drinking water facility to workers	Availability of safe drinking water and sanitation to the workers	,,	,,
Site Drainage	Maintaining proper drainage	,,	,,

Analytical monitoring and observation during Construction Phase:

Issue	Parameters	Monitoring Frequency	Responsibility
Ambient air Quality	PM_{10} and $PM_{2.5}$	Monthly	EPC Contractor/ Consultant
River water	Water temp., DO, BOD_5, COD, Oil and Grease and heavy metals (Cr, Cd, Pb)	Monthly	,,
Groundwater	Groundwater level, p^H, TDS, Ammonia, Nitrate, Phosphate, As, Fe, Mn and Coliforms	Once in 6 months	,,
Soil quality	Cr, Cd, Pb and Oil and Grease	Once in 12 months	,,
Noise level	Noise at different locations	Monthly	,,
Drinking water	p^H, Ammonia, Nitrate, Phosphate, As, Fe, Mn and Coliforms	Monthly	,,

Monitoring in Operation Phase

Most of the environmental parameters will experience beneficial effects during the operation phase of the power plant project. The following are the monitoring

parameters and monitoring frequency for the RBLPL 750 MW CCPP east during operation:

Issue	**Parameters**	**Monitoring Frequency**
Stack emissions	NOx, and temperature	Continuous
Ambient air quality	CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2	Quarterly at four locations, seasonal or half yearly monitoring at other sensitive receptors
River water	Water temperature and DO, PH, COD. BOD, TOC, DO, TSS, oil & grease etc.	Monthly
Effluent quality	pH, DO, Sulphate, TSS, TDS, BOD, COD, Total N, Total P	Monthly
Groundwater	pH, Colour, Turbidity, TDS, Ammonia, Nitrate, Phosphate, As, Fe , Mn and Coliforms; Groundwater level	Once in 6 months
Noise level	Noise at different locations	Once in 3 months
Fisheries, Plankton, Zooplankton, Vegetation etc.	Number and Condition	Once in 6 months
Occupational health and safety	Health status and safety	Once in 3 months

The cost of the Environmental Management Plan (EMP) is divided into several parts to reflect the different phases of the project and the requirements of each phase. The cost of EMP must include the costs of the capacity building, public consultation and the quality control requirements for a period of 5 years of operation. An allocation will be made for EMP every year in budget estimated for the project.

8. Emergency Response and Occupational Health & Safety

Under the supervision of the 'Environment Management and Safety Committee', all plant personnel will have responsibilities assigned to them during emergency. The documented responsibility will be included in a program manual which can constitute a part of the plants operation manual. Compliance with the responsibilities should be monitored and if these are not carried out for any reason, corrective measures should be taken.

The plant management will prepare an occupational health safety policy manual which should be updated from time to time. The policy should be signed and dated by the Chief Safety Officer who may be the Plant Manager. The policy should be discussed with all the plant personnel. The Chief Safety Officer should periodically review the

policy and re-issue the policy.

9. Analysis of Alternatives

The 'No Build' alternative in the present case would mean continued power deficiency, and in the face of increasing demand for industrial and economic growth leading to worsening of poverty situation. So, the 'No build' alternative is unacceptable, and the potential socio-economic benefits of implementation of such a project far outweigh the adverse impacts, all of which can be controlled and minimized to an acceptable level.

After understanding the resource limitation of Bangladesh, it is evident that the best possible technology for power generation is combined cycle technology. So, no other power generation technology is recommended.

After the analysis of air quality modeling, it is evident that the air quality of the project site is satisfactory and the air quality parameters are all within limit. Better air environment is not easily found in an industrial area like Narayanganj district.

As the project site is far from locality and in a power hub, the power plant will not affect the nearby people. Also, the power plant technology will not contribute to the NO_x content of the existing air and very little CO_2 will be contributed overall.

The power plant will use the first ever closed loop cooling system in Bangladesh and will have zero thermal discharge in the River Meghna. That leads to the conclusion that the selection of site is well calculated and no water related issue will arise in the distant future due to the construction and operation of the Reliance Meghnaghat 750 MW CCPP.

The proposed power plant site is an empty government acquired land and no further land acquisition was required. The land is now used as temporary grazing ground for local cows as there is no boundary around the land. The cows will graze in the remaining land that will be left after the construction of power plant. As there is no relocation needed, no alternative is required for the proposed project site.

The project site is Bangladesh Power Development board's property which will be leased to Reliance Bangladesh LNG & Power Limited, which was vacant and therefore no resettlement issues are involved. After analysis of various possible alternatives, this ESIA finds the plant's environmental impacts at the selected site are acceptable if the management procedures delineated are properly implemented. Therefore, the site has been considered suitable for the plant.

10. Stakeholder Consultation and disclosure

Stakeholder consultations are very important and sensitive issues for setting up a new industry in any area of Bangladesh. The process was initiated with an open objective to

ensure people's participation right from the planning stage of the project. Furthermore, this was aimed at improving the study taking into account opinions from the people of the impacted area. Meetings with stakeholders consisted of community consultation meetings, focus group discussions, and in-depth interviews with men and limited focus-group discussions with women.

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and 'local knowledge' can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation.

In the series of informal profess of consultation various stakeholders have been consulted e.g. local communities, men, women and local elders, local government representatives, NGOs, local fishermen and their family, local cow owners etc. The most important consultation was the consultation of local fishermen and cow owners.

Consultation of local fishermen

The village, Char Balaki, has roughly 200 families living there nearly for many years. Most of the households depend on the fishing for their livelihood. On the aspect of livelihood currently their greatest needs are lack of safe landing station for travelers, commodities and goods, no proper communication means to reach from mainland to the char, lack of variety of fish nets, seasonal variation of number of fishes found.

Fishermen in the village do fishing within 5-6 kilometres around the char including 40-50 meters from the outfall. Some fishermen do fishing in other areas sometimes. Each fishermen consisting of two members can catch 5-10 kg fish per day in rainy season and 1.5 - 2 kg per day in winter season. Per kg of fish is sold ranging from BDT 500 to BDT 700.

The participants including men and women were noticed from the local people about installation of Reliance Meghnaghat 750 MW CCPP and they do not find any negative impact on their livelihood/ fishing. Instead they welcome the power generation activities for the betterment of the country but they regret being deprived of electricity till days. In the past, they didn't find the activities of the power plants detrimental to the fishing activity.

Consultation of Cow Owners

There are no formal cattle farms near the project area but some people living near the project area used to graze some of their domestic cows on the project land since the land is unprotected and has no fencing. The number of cows is merely 25-30 and there are plenty of green fields in the vicinity of the project area where they could find

alternative grass land for the grazing of their cows. They are aware of the project and they informed that they will drive their cows elsewhere once the proposed land is occupied.

The stakeholders' consultation process will be continued in the operation phase of the plant as well, so that issues of public concern can be addressed.

According to the cow owners, the Project site is not the only place they use for grazing their cows. They graze their cows wherever they can manage an empty piece of land covered with grass. The project will not occupy the entire land; therefore the remaining land can be used as a grazing ground.

The ESIA report will be uploaded in the Company's website and a copy of ESIA is kept at the plant for public review. The executive summary will be translated into Bangla and will also be made available to the public.

11. Grievance Redress Mechanism

The Project Management has established a procedure to answer to project-related queries and address complaints and grievances about any irregularities in application of the guidelines adopted for assessment and mitigation of environmental safeguards impacts. The complaints related to plant operation that may create inconveniences to agency/ individual should be addressed based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly without resorting to expensive, time-consuming legal actions.

To ensure impartiality and transparency, hearings on complaints will remain open to the public. The GRC will record the details of the complaints and the reasons that led to acceptance or rejection of the particular cases. The GRC will keep records of all resolved and unresolved complaints and grievances and make them available for review as and when asked for by appropriate authority, WB and any organizations known to be working with urban development issues. However, it should be noted that the GRC process will not pre-empt and aggrieved person's right to seek redress in the courts of law.

12. Conclusion and Recommendations

The present ESIA report finds that though there are certain environmental impacts associated with the industrial unit under consideration, these are manageable.

The project is indispensable in view of the current energy shortage scenario in Bangladesh. The impact on the social environment is positive given the employment and business opportunities created for local residents from the project. The project will help in the industrialization, accelerating socioeconomic growth, and improving quality of life. One of the most critical issues for the project is safety. This has been

adequately addressed through compliance with national building code (BNBC) in the construction to ensure safety during natural disasters like earthquake and cyclone.

The project has been designed to comply with the country's environmental laws and regulations, especially on air emissions, ambient air quality, waste water effluent, and noise. The project management has taken steps to ensure that the plant meets the DOE/World Bank/ADB's environmental standards. Given the management measures and monitoring commitments by the RPL for the project, environmental impact of the project will be manageable.

No development can be expected without any adverse impact on the environment. The beneficial impacts on the nation as well as human beings would only be meaningful and sustainable development would only be possible if adverse impacts are minimized through strict maintenance and control measures as mentioned for this project. All this would need vigilant care and cost money, and the project authority should take these into consideration. However, the following are the recommendations should be followed by the RBLPL during the construction and operation of the project:

Follow the EMP: The Environmental monitoring Plan should be followed properly and review of the EMP should be done as per plan.

Continuation of the baseline air monitoring study: Since the baseline air monitoring study has been conducted from Sep-December, a follow up baseline air quality monitoring should be conducted at July-Aug and Jan-Feb so that the proper monsoon and dry season data would be reflected.

Continuation of the Stakeholder Consultation: To evaluate the true consequences of the project, the Stakeholder consultations should be continued during the Construction and operation of the project in a regular interval.

Post Environmental Impact Assessment: A post EIA should be conducted after the implementation of the project to compare the ESIA mitigation measure that suggested are logical and working properly.

Given the proponent's commitments, actions undertaken for further measures to be adopted in due course of time as required, the **Reliance Meghnaghat 750 MW Combined Cycle Power Plant** project is going to be a nationally important and environmentally sustainable industrial venture.

CHAPTER ONE: INTRODUCTION

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

Electricity, the most usable form of energy, is one of the most important issues for the economic development of a country. Electricity is a vital ingredient to upgrade the socio-economic condition and to alleviate poverty. The supply of electricity has a great impact on the national economy. Proper and enough reliable electricity supply have a great positive impact on the country's GDP. Therefore, use of electrical energy is increasing day by day with rise of GDP growth. Human civilization has tremendously been advanced by the versatile uses of electricity and demand for electricity is integrated with all aspects of development.

Bangladesh is still at a very low level of Electrification. The government of Bangladesh has declared its vision 2021 to provide electricity for all. Power Sector Master Plan 2010 (PSMP-2010) has been undertaken to accommodate the govt.'s vision 2021.According to the study the total demand would reach 34,000 MW assuming a 7% GDP growth over the time period while according to plan, the generation capacity would be about 40,000 MW. The aggregated investments for the development of the generation, transmission and related facilities are found to be at BDT 4.8 trillion (US$ 69.5 billion). The annual average of the investment amounts to BDT 241 billion (US$ 3.5 billion).

According to Bangladesh Power Development Board (BPDB) presently the installed generation capacity as on March 2017 in the power sector is 13,179 MW. The per capita electricity consumption in Bangladesh remains one of the lowest in the Asian region, At present, only about 68% of the total population (including renewable energy) has access to electricity and per capita generation is 348 kWH, which is very low compared to other developing countries. To alleviate poverty in the face of resource limitations and high population density, Bangladesh requires an economic growth rate of more than 7% p. a. In order to achieve this growth rate, electricity growth needs to be achieved by 10%.So, the generation of electricity should be increased for the following years to fulfill the upcoming increasing demands. Now the biggest challenge for Bangladesh's economic growth is to ensure uninterrupted electricity supply to reduce the demand- supply gap for the growing industrial, agricultural and household needs.

Because of the critical nature, the Government of Bangladesh has given highest priority to the power sector to enhance the generation capacity. BPDB has come up with a comprehensive plan to meet the surging demand in power. Accordingly, the government plans to eliminate the demand supply gap and achieve the ultimate goal of providing "electricity to all" by 2021 by having generation capacity of 20,000 MW.

To ensure overall and balanced development of the sector government has devised immediate, short term, medium term and long term generation plans. The plans have been developed based on a techno-economic analysis and least cost options.

However, the timely implementation of above plans is a concern as there are issues with regards to availability of finance, competency of project sponsors and inherent bureaucracies and other bottlenecks in the system. Further, the demand estimates for power may also be understated to some extent. Strategies have been made to meet the investment requirement by involving private sector with Government through Public Private Partnership (PPP) initiatives. A successful IPP model has been designed with a lot of comforts and protection to investors.

Responding to the need of the country, now the **Reliance Bangladesh LNG & Power Limited (the Company),** part of the Reliance Group and one of the India's largest private power generation company, has proposed to set up gas based combined cycle power plant project named **Reliance Meghnaghat 750 MW CCPP** at Meghnaghat, Sonargaon, Narayanganj. Due to the scarcity of the natural gas resources in Bangladesh, Reliance Power Limited has aimed to establish FSRU in Bangladesh for this power project so that to give a proper solution by not enforcing the present gas scarcity.

1.2 POWER GENERATION PLAN OF THE GOVERNMENT

In spite of financial constraints and gas supply shortages, the government designed a strategy to overcome the crisis and at the same time meet the ever increasing demand for power. It launched immediate, short, medium and long term programs to increase power supply through introduction of fuel mix (gas, coal, liquid fuel, nuclear energy and renewable), demand side management, energy efficiency and conservation. After assessing the latest demand, the government has revised its targets for increasing power generation. The year-wise details of the additional power generation programs, both in public and private, are listed below:

Table 1.1 Plants Commissioned During 2012- 2016 in MW

YEAR	2012	2013	2014	2015	2016	TOTAL
Public	632	1467	1600	1410	750	5919
Private	1354	1872	1637	772	1600	7235
Total	1986	3339	3297	2182	2350	13154

(Source: Bangladesh Power Development Board)

Natural gas is the major source of fuel used for power generation (62.73%) with furnace oil being the next (21.25%). Although coal is available in Bangladesh, due to the huge cost of extraction and processing, use of coal in power generation has not yet been more widespread (Table 1.2).

Table 1.2 Power Generation Units (Fuel Type Wise)

Installed Capacity of BPDB Power Plants as on March 2017			
Fuel Type	**Capacity (Unit)**		**Total (%)**
Coal	250	MW	1.9 %
Gas	8,267	MW	62.73 %
HFO	2,800	MW	21.25 %
HSD	1,032	MW	7.83 %
Hydro	230	MW	1.75 %
Imported	600	MW	4.55 %
Total	13,179	MW	100 %

Derated Capacity of BPDB Power Plants as on March 2017			
Fuel Type	**Capacity(Unit)**		**Total (%)**
Coal	200	MW	1.59 %
Gas	7,844	MW	62.36 %
HFO	2,743	MW	21.81 %
HSD	961	MW	7.64 %
Hydro	230	MW	1.83 %
Imported	600	MW	4.77 %
Total	12,578	MW	100 %

(Source: BPDB, March 2017)

Bangladesh is facing a major electrical power shortage for the last one decade. The shortfall aggravated during recent years and the scenario in the power sector has become a cause for great concern. The unbalanced supply-demand situation in this sector will significantly hamper the development in all sectors of life including those in agricultural, industrial, commercial and domestic sectors.

There is no alternative than to add more power generating units to the existing power system of Bangladesh within the shortest possible time frame. The urgency is not only because of the ever-increasing demand for electricity but also due to the fact that many our existing power generating units are nearing the end of their life cycle. The proposed 750 MW combined cycle power plant at Meghnaghat, Narayanganjwould certainly help improving power demand situation to a considerable extent.

1.3 Natural Gas reserve and Necessity of LNG import in Bangladesh

Bangladesh is the seventh-largest producer of natural gas in Asia. Gas supplies meet 56% of domestic energy demand. As of 2015, the natural gas reserves of Bangladesh are 14.16 trillion cubic feet. The country has an average daily natural gas production of around 2,700 million cubic feet. According to Table-1.2 around 62.73% power generation in Bangladesh is based on natural gas.

The demand for natural gas has been increasing day by day for its diversified use. On the contrary the existing reserve is depleting. As a consequence, we are being experiencing severe gas crisis especially to ensure gas supply to the power plants. However, to alleviate gas reserve constraint government and private sector stakeholders are exploring the import of LNG as well as natural gas through pipeline from the neighboring countries.

Present government has accorded high priority to meet the increasing gas demand of the country and to ensure uninterrupted gas supply to the national grid by importing LNG and injecting it to the national gas grid pipeline. Government is also considering import of gas either through pipeline from neighboring countries.

1.4 FSRU by Reliance Power Limited

Indications that indigenous gas resources are falling below sustainable economic operational levels and eventually may run out in the short- to medium-term have resulted in the need for supplementary feedstock in form of importing liquefied natural gas (LNG).Keeping this is view; Reliance Power plans to establish a Liquefied Natural Gas (LNG) storage and re-gasification facility/Terminal of up to 5 MMTPA capacities. The Terminal may be a Land based LNG terminal or a Floating storage & Regasification Unit (FSRU) in the range of 6 MMTPA (million tons per annum) with a storage capacity of 266,000 m^3 located offshore of Kutubdia island in Chittagong region of Bangladesh. Subsea and overland pipelines would transport the gas from FSRU to the nearest gas grid pipeline.

1.5 OBJECTIVES OF ESIA STUDY

This report presents the finding of an Environmental & Social Impact Assessment (ESIA) of the project proposed by**Reliance Bangladesh LNG & Power Ltd.,** a 750 MW gas based CCPP**.**The proposed plant is located at Meghnaghat, Sonargaon, Narayanganj. The objective of the study is to provide an examination and assessment of the principal environmental impacts of the proposed plant. The outline of an environmental management plan also suggested with an indication of the extent of work to be done to keep the development and environment compatible. In this context, it should be noted that the term “environment” and its derivatives have been used in a wide sense, which covers not only physical and chemical aspect, but also the human dimension. The specific objectives of this ESIA are to:

- Present a brief discussion on the ESIA process and its role in the planning and implementation of development projects;

- Present a general description of the project and the process;
- Present a description of the pre-project environment;
- Delineate the significant environmental issues found and believed to be involved;
- Identify the environmental impacts of the project and quantify them to the extent possible;
- Suggest the plan for management of the environment, during the implementation and operation of the plant.

1.6 STUDY METHODOLOGY

Based on the above Scope of Work, the following steps were followed during the ESIA process:

- Undertaking a field survey towards collection of primary Baseline Social and Environmental information and data pertaining to the project area;
- Collection of Secondary data;
- Understanding the technical aspects of the proposed power plants
- Conducting modeling exercise to analyze environmental impact;
- Undertaking identification of potential environmental impacts (along with residual impacts and cumulative impacts, if any) and evaluation of socio-economic consequences of such impacts.

Identification of impacts was done using Checklists method. All the relevant social and environmental risks and potential impacts have been taken due care of as part of the assessment in compliance of the Performance Standards set by the Asian Development Bank (ADB) following the guidelines set forth by DOE.

1.7 THE ESIA TEAM

Adroit Environment Consultants Ltd. (AECL) has prepared this report under the guidance and supervision of Dr. Nasir Uddin Khan. The total team composition and their expertise have been given in the table below:

Professional	Name	Expected Expertise
ESIA& Emission Modeling Expert	Dr. Nasir Uddin Khan	Highly experienced on conducting ESIA of various nature in home and abroad. Have vast experience on identifying different environmental impacts and suggesting mitigation measures for any project. Experienced on emission and noise modeling of various projects. Experienced on

		Project stakeholder engagement - Public consultation and Disclosure Plans.
Legal, Policy, Health & Safety Professional	Md. Zahedur Rahman	Highly experienced in identifying different environmental impacts and suggesting mitigation measures.
Power Plant Engineer	Md. Abdul Matin	Understanding the power plant configurations for environmental issues.
Socio-economist	Md. HumayunKabir	Experienced on Social baseline studies, community needs assessment, Social and Community Health Impact Studies/Assessments etc.
Ecological Survey Specialist	Dr. Abdur Jabber	Experienced in aquatic flora and fauna analysis for different power projects
Project Liaison Officer	MdHasanul Islam	Experienced on conducting ESIA of various nature. Involved in baseline environmental study, identifying different environmental impacts, suggesting mitigation measures and environmental management plan for any project.
Field Investigator/ co-coordinator	Nuvia Noorain Rashid	Make Liaison with all field staff and Consultants; allocate staff & resources to different places when necessary. Background of organizing site visits, surveys, liaison with community, public and govt. organizations, etc.
	Md. Hadiuzzaman	Make Liaison with all field staff and Consultants; allocate staff & resources to different places when necessary. Background of organizing site visits, surveys, liaison with community, public and govt. organizations, etc.
	Syed Hosnee Jahab	Base line data collection, sample collection from site, sample preservation and laboratory analysis.
	Md. MuradHossain	Base line data collection, secondary data collection, sample collection and site survey
	NigarShultana	Base line data collection, sample collection from site, sample preservation and laboratory analysis.

Services performed by the consultant are conducted in a manner consistent with that level of care and skill generally exercised by members of the engineering and consulting profession. The report may not exhaustively cover an investigation of all possible circumstances that may exist. However, an effort is made to discover all meaningful areas under the stipulated time available. In evaluating subject site, consultant relies in good faith on information provided by client's management or employees. The Consultant assume that the information provided is factual, accurate and accepts no responsibility for any deficiency, misstatement or inaccuracies contained in this report as a result of omission or misrepresentation of any person interviewed or contacted. However, the consultant notifies the contradictions and errors in the data, where it seems appropriate.

It should be recognized that the information given in the report is time specific and with the passage of time the relevancy of data and analysis may suffer. Specific circumstances and condition of site can change due to which conclusion and opinions may also change.

1.8 ACKNOWLEDGEMENT

The ESIA Report has been prepared basically with the support from **Reliance Bangladesh LNG & Power Limited** and also from various government agencies and NGOs including Bangladesh Power Development Board (BPDB), Bangladesh Meteorological Department (BMD), Soil Resource Development Institute (SRDI), Bangladesh Bureau of Statistics (BBS), Bangladesh Water Development Board (BWDB), Department of Environment (DOE) and Department of Agriculture Extension (DAE), etc. We would like to say thanks to each organization and its employees for their contribution in conducting the study.

1.9 REPORT STRUCTURE

The ESIA report has been structured to provide primarily the information content of ADB guideline and review requirement of TOR in a logical sequence. The issue and the Corresponding section of the report where it has been addressed is summarized in the following table (**Table 1.3**)

Table - 1.3 Issues and corresponding section of the report where these are addressed

Sl. No	ESIA Review Issues	Sections where addressed
1	Introduction	Chapter-1
2	The Project	Chapter-2
3	Policy and Legal Consideration	Chapter-3

Sl. No	ESIA Review Issues	Sections where addressed
4	Baseline Existing Environment	Chapter-4
5	Identification of Project Impact	Chapter-5
6	Evaluation of Project Impacts and Mitigation Measures	Chapter-6
7	Environmental Management Plan (EMP)	Chapter-7
8	Disaster Management Plan	Chapter-8
9	Alternative Site	Chapter-9
10	Stakeholder Consultation	Chapter-10
11	Grievance Redress Mechanism	Chapter-11
12	Conclusion	Chapter-12

CHAPTER TWO: DESCRIPTION OF THE PROJECT

2.0 DESCRIPTION OF THE PROJECT

2.1 PROJECT DESCRIPTION

Reliance Meghnaghat 750 MW Combined Cycle Power Plant project is a natural gas fired power generation plant with rated capacity of 750 MW combined cycle power plant with the highest efficient technology will be selected. It is an optimized system of high technology power generating equipment, software, and services that are integrated into the utilities ancillary equipment to create an economical and stable power generating facility.

Reliance Power Limited, a sister concern of the Reliance Group, is India's largest private sector power generation company. Reliance Power has been established to develop, construct and operate power projects both in India as well as internationally. To enhance cooperation between India and Bangladesh in the field of power, Reliance Power agreed to invest in Bangladesh in the name of **Reliance Bangladesh LNG & Power Limited** to build an integrated facility that consists of 3,000 MW LNG-based combined cycle power plants at various locations in Bangladesh in phases and a LNG terminal with a Floating Storage Re-gasification Unit (FSRU). Reliance Bangladesh LNG and Power has earlier submitted a detailed techno-commercial proposal (in Oct-2014) with the pre-feasibility report, followed by a tariff proposal (in Feb-2015) to the Power Division, Ministry of Power, Energy and Mineral Resources, Bangladesh. After detailed discussions and valuable comments from Bangladesh Power Development Board (BPDB), Power Grid Company of Bangladesh (PGCB) and officials from the Power Division, it was proposed to split the projects into three locations as follows – Phase I of 750 MW at Meghnaghat, Phase II of 1,500 MW in two sub phases at Chittagong and Phase III of 750 MW at Maheshkhali. Reliance Bangladesh LNG and Power will now set up a 750 MW gas-fired power plant at Meghnaghat near Dhaka as a start-up towards implementing the agreement to set up 3,000 MW power plants.

Reliance Bangladesh LNG and Power shall procure equipment of Gas turbines, Heat recovery steam generator, Steam turbine etc. from renowned venders.

2.2 PROJECT CATEGORY

Under the criteria of DoE as per The Environment Conservation Rules, 1997, the power generation process plant operation fall under Red Category that requires Environmental & Social Impact Assessment (ESIA). As per the ESIA Guidelines of DoE, it is mandatory to carry out Initial Environmental Examination (IEE) for Red

Category projects prior to conducting ESIA. The IEE report should be submitted to get environmental site clearance. As per **ADB classification**, the project falls under:

- Category **A** from environmental aspect,
- Category **C** from the aspect of "Involuntary Resettlement" (as there is no land acquisition needed) and
- Category **C** from the aspect of "Indigenous People" (no indigenous community lives nearby).

The basic data of the project are furnished in **Table-2.1**.

Table-2.1: Basic data on Reliance Meghnaghat 750 MW Combined Cycle Power Plant

1. Name of the Project	Reliance Meghnaghat 750 MW Combined Cycle Power Plant	
2. Executing Agency	Reliance Bangladesh LNG & Power Ltd.	
3. Project Location	Meghnaghat, Sonargaon, Narayanganj, Bangladesh.	
4. Location of the Proposed Plant	23°36'25.56"N, 90°35'32.16"E	
5. Type of Project	Combined Cycle power plant	
6. Raw Materials	The main raw material of the project is natural gas.	
7. By-product, if any	None	
8. Net Plant Capacity	750 MW of Electric Power	
9. Project Cost	US$ 833 Million	
10. Total Area of Land	35 Acres	
11. Employment	During Construction	During Operation
	1,800	160
12. Fuel Requirement	RLNG/Natural Gas: 130mmscfd @ 100% load	
13. Water Requirement & Source of Water	1096 m^3/hr, Source: Meghna River.	
14. Quantity of Discharge Water	206 m^3/hr	

2.3 SITE DESCRIPTION

2.3.1 Location

The proposed power plant will be set up at Meghnaghat, Sonargaon, Narayanganj, Bangladesh. It is situated approximately 36 kilometers southeast of Dhaka, near the Meghna Road Bridge on the Dhaka-Chittagong Highway and is at around 2 km west from Dhaka-Chittagong highway, at the bank of the river Meghna. The environmental setting of the site is given in **Table: 2.2**.

Table 2.2: Environmental Setting of the site

Sr. No.	Particulars	Details	
1	Plant Location	Pirojpur Union, Meghnaghat, Sonargaon, Narayanganj.	
2	Plant Site Coordinates	Latitude	Longitude
		23°36'25.56"N	90°35'32.16"E
3	General Elevation	3 m above MSL	
4	Plant Site Topography	Generally plain	
5	Present land use at the site	Empty BPDB land allotted for power plant	
6	Nearest Highway	Dhaka-Chittagong Highway- 2km E	
7	Nearest Railway Station	Narayanganj Railway Junction (8.94-km W)	
8	Nearest Airport	Hazrat Shahjalal International Airport- 45 km N	
9	Nearest Seaport	Chittagong Port- 190 km S	
10	Nearest Major Water Bodies	The River Meghna- Adjacent to project site	
11	Nearest Town/City	Narayanganj- 9 km West [Population as per 2011 Census: 1,323,600]	
12	Nearest Village	Char Balaki (1-km, W)	
13	Hills/Valleys	No hills and valleys within 5 km radius	
14	Archaeologically important places	No important site within 5 km Radius	
15	Protected areas as per Wildlife Protection Act,1972	None within 10-km radius	
16	Reserved/ Protected Forests	None within 10-km radius	
17	Seismicity	Seismic Zone-II as per Geological Survey of Bangladesh (GSB)	
18	Defence Installations	None within 10-km radius area	

The site is situated to the west of a box- shaped island formed due to meandering of River Meghna from its main course. The site is surrounded by Meghna River in the north, west and south direction. There are three major power plants situated in the east of the project site. Meghnaghat Power Limited, with capacity of 450 MW CCPP, Summit Meghnaghat Power Company Limited (SMPCL) with capacity of 350 MW and Orion Power Meghnaghat Power Plant (OPML) with capacity of 100 MW are

situated at the eastern part of the project site. Char Balaki village is in the south-west direction and Hossaindi Union of Gazaria Upazila is in the south of the project.

The nearest airport is Dhaka airport at a distance of 45 km north and the nearest port is Chittagong port at a distance of 190 km south from the project site.

This power plant project altogether covers total land of 35 acres. This land will be sufficient for the proposed 750 MW combined cycle power plant. With geospatial reference, the project site lies in 23°36'25.56"N & 90°35'32.16"E. The Narayanganj district map, Sonargaon upazila map, 1 km radius satellite map of the project and the location map are presented in the following figures.

2.3.2 Land Use

The existing land that will be used for the proposed power plant project is a government Khas Land. The land is currently empty and has been leased out by the BPDB. Although, it's not been authorized for any use, the existing land is used as a temporary grazing ground for the local cows. There is no locality within the two kilometers radius of this project site. This part of Meghnaghat is mainly used for industrial land use. There is numerous industries in this area including 3 other power plants adjacent to the proposed Reliance Meghnaghat 750 MW CCPP.

Figure: 2.1 (a) Narayanganj District Map

Figure 2.1(b): Sonargaon Upazila Map

Figure 2.1 (c): Location of the Proposed Site

Figure 2.1 (d):1 km radius satellite map of the Proposed Project

Location Map of Reliance Meghnaghat 750 MW CCPP

Map: Nearest Receptors near Reliance Meghnaghat 750 MW CCPP

Figure 2.1 (i): Nearest receptors around Reliance Meghnaghat 750 MW CCPP

2.3.3 Existing Industries at Meghnaghat

Existing Power Plants

Meghnaghat is an area consisting of several power plants situated in the Sonargaon Upazila of the District of Narayanganj. Meghnaghat Power Limited, with capacity of 450 MW CCPP, Summit Meghnaghat Power Company Limited (SMPCL), a dual fuel (Natural Gas/ liquid Fuel Oil) fired combined cycle power plant with capacity of 350 MW and Orion Power Meghnaghat Power Plant (OPML), a 100 MW HFO fired power project under the government policy QRPP are situated at Power village, Meghnaghat, Sonargaon, Narayanganj, near the bank of the Meghna River which is adjacent to the proposed project. Around 65 acres of fallow land is still available in that area under the supervision of Bangladesh Power Development Board (BPDB).

Existing Industries

Apart from power plants, being in an industrial zone, there are numerous numbers of factories near and across the project site. In the inventory of the industries, there includes ship yards, cement plants, packaging industries, chemical industries and so many more. An inventory of the surrounding industries has been described in **Table 2.3** and the locations have been shown in **Figure 2.2 (a) & 2.2 (b).**

Table 2.3: Existing Industries near the Project Site

Name of the Existing Industry	Distance from the Project Site (km)
Orion Power Meghnaghat Limited	0.4
Summit Meghnaghat Power Company Limited	0.75
Meghnaghat Power Company Limited	0.95
Anandya Shipyard Limited	1.3
MTC Tiger Cement Plant	1.46
United Cement Plant	1.54
Unique Power Plant	1.81
Fresh Cement Factory	1.97
Holcim Cement Factory	2.15
Magura Paper Mills Ltd.	2.25
Bashundhara Paper Mills Ltd.	2.6
KSB Engineering Dockyard	3.1
Tasnim Chemical Complex	3.4
Khan Brothers Ship Building Limited	1.76
Bengal Shipyard Limied	1.6
Super Board Mills Limited	1.9
Rupsha Tank Terminals and Refinary Limited	2.05
Samuda Chemical Complex Limited	2.02
S.Co. Steel Limited	2.35

Map: Industries near Reliance Meghnaghat 750 MW CCPP

Figure 2.2 (a): Existing Industries near the Project Site

Figure 2.2(b): Existing Power plant beside the Proposed Project

2.3.4 Access to Site

The project site is easily accessible from Dhaka through Dhaka-Chittagong highway. Construction of a 1km access road between the Dhaka-Chittagong Highway and the project site was completed by the BPDB in August 1999 in accordance with GOB and DOE requirements. The roadway has been raised to the same elevation as the MPSA using fill from the Meghna River. The inland waterway accessibility via Meghna River is also considered to be feasible for the project site & logistics. The proposed project will use the existing access road and no new access road will be constructed. The location map of the proposed project is shown in **Fig 2.3**.

Figure 2.3: Location of the Proposed Project

Figure 2.4: Surrounding picture of the Proposed Project.

2.3.5 Gas Interconnections

The total gas requirement for the project is about 130 mmscfd @ 100% load. The proposed power plant will be run by natural gas which will be supplied by a GTCL national gas pipeline coming from Kutumbpur, Comilla. On the other hand Reliance Power is working to set up a LNG terminal where they will supply gas to national grid through 36 inch Gas Pipeline from Kutubdia to Pekua. After the gas is commingled with the national grid, a new pipeline will be built by GTCL which will deliver gas from Kutumbpur, Comilla to the site. This pipeline is a project of GTCL and it is considered as an associated facility of the project. The diagram of fuel gas system is attached in **Annexure 4**.

2.3.6 Details of Gas Turbine Exhaust Gas Composition

The detail of the Gas Turbine Exhaust Gas Composition is given in **Table 2.4:**

Table 2.4: Gas Turbine Exhaust Gas Composition

Gas Turbine Exhaust Gas Composition (% Molar)	
Nitrogen	66-78
Oxygen	10-18
Water Vapor	3-12
Carbon Dioxide	2-5
Argon	0.7-0.9
Pollutants	**PPMV**
NOx	**25 (DRY @15% O2)**

2.3.7 Evacuation of Power from the Proposed Reliance Meghnaghat 750 MW CCPP

At present the spread of 400 kV transmission lines in Bangladesh is limited to only Dhaka region. Part of Dhaka ring is at 400 kV and another 400 kV two double circuit line connects Indian grid substation of Baharampur to Bheramara grid substation of Western Bangladesh which is used for power import from India. The other 400 kV

network extends from Meghnaghat – Aminbazar to evacuate power from existing Meghnaghat Power station & reliable power to western part of the Dhaka.

Govt. of Bangladesh shall facilitate firm power evacuation for the Project. For the plant capacity of 750 MW, 400 kV two double circuit lines will be used for the evacuation of power. It is proposed to connect plant substation to the 400 kV lines connecting Aminbazar using a LILO as a temporary measure. Further, it will be connected to PGCB 400 kV AIS at Meghnaghat in future once it is ready. The temporary facility for power evacuation will again be built in the existing land of the BPDB where absolutely no land acquisition is needed and therefore, no resettlement is necessary.

The power evacuation plan has been shown in **Annexure 3**.

Figure 2.5 - Grid Transmission network of Bangladesh

Land for the LILO Facility

National Survey Organization has conducted survey on the location for suitable LILO attachment facility and proposed Three Transmission Towers. The temporary facility for LILO attachment will be built in the existing Govt. land where absolutely no land acquisition is needed and therefore, no resettlement is necessary. But local people use the land for one crop cultivation. If those lands are used, they need to be paid for the crop 2-3 times from market price.

The coordinate of the proposed towers and their distances from the transmission gantry is given below:

Tower Name & Location	Co-ordinate	Distance from Transmission Gantry
Tower I	X= 254173.03 Y= 2613146.07	203 m
Tower II	X= 253658.45 Y= 2613275.80	733 m
Tower III	X= 253353.46 Y= 2613161.05	1058 m

The alignment and details of the tower has been given in **Fig 2.6**.

Figure 2.6: Transmission Tower Facility

2.3.8 Land Acquisition

BPDB has allocated the land on priority & accorded clearance for development of 750 MW CCPP at Meghnaghat power site for this power project. The draft land lease agreement has agreed between Reliance Bangladesh LNG and Power Limited and BPDB and final agreement shall be signed shortly. It is a vacant land of BPDB which is used as a power generation hub. The project company has no issue of land acquisition as they are getting the land from BPDB.

The land was initially acquired by government of Bangladesh for BPDB in 1995 (Source: BPDB) with a vision of building a power hub to deal with the increasing demand of electricity. At that time, the land was newly formed low lying char type land which was owned by the government (Khas land) and allotted for BPDB. Later BPDB has developed the land and allocated as power generation hub.

Although, no acquisition is needed for the project, the land is used as a grazing ground for the local cow owners even though it's not permitted. The number of cows grazing in this land is merely 25-30. Therefore, the grazing ground can be relocated at a different place according to the owners.

2.4 PROJECT OBJECTIVES

In Bangladesh, there is acute shortage of electricity generation capacity. Addition of generation capacity is urgently required to fulfill the demand and to provide reliable and quality power supply in Bangladesh. Hence, to supply clean, green and sustainable power in Bangladesh, Reliance Bangladesh LNG and Power Limited has planned to establish the LNG based power plant at Meghnaghat. The main objectives to undertake this project are to:

- Meet the growing electricity demand of the country and to increase the stability and reliability of the power system.
- Reduce the ever increasing gap between demand and supply of electricity of the country.
- Increase the power generation through maximum utilization of country's natural gas resources available.
- Using clean and environment friendly re-gasified LNG due to the scarcity of the natural gas in Bangladesh (or even run the power plant on natural gas as and when the domestic gas situation improves in the country).
- Accelerate the economic development of the country by adequate and reliable power generation.
- Support the planned target of power generation in the country for meeting long term power development plans.

2.5 PROJECT COMPONENT DURING CONSTRUCTION

2.5.1 JETTY

A temporary jetty will be constructed during the construction phase of the project to ensure convenient and efficient transportation of the construction material and the component of the actual power plan. The proposed jetty will be constructed on the western bank of the River Meghna or on the southeast corner of the project site and it'll be demolished after the completion of the project.

The location of the RO-RO jetty is on the western boundary as per BPDB recommendation. Total land requirement is ~1.5 acres. This is a temporary jetty required only for the purpose of transportation during the construction period. The dredged depth of 3 to 4 m is required. The Jetty has been shown in the layout of the project in **Annexure-2.**

2.6 PROJECT COMPONENT DURING OPERATION

2.6.1 THE POWER PLANT DETAIL

2.6.1.1 Description of the Technology

The proposed configuration of 750 MW Power block shall consist of Two (2) gas turbine generators, two (2) heat recovery steam generators and One (1) steam turbine generator with “Multishaft” arrangement .The proposed combined cycle plant shall be based on latest state-of-the art heavy duty industrial type gas turbines suitable for base load and cyclic load operation in both simple (open) cycle and combined cycle mode.

The main advantages of the above selected configuration include:

- Has higher part load efficiency.
- Higher reliability.
- More operational flexibility.
- Lesser time for installation.
- Can be used for peaking Duty.
- It is proven equipment globally with reference conditions.
- Spares are easily available as few machines of 9FA class are running in India and Bangladesh.

A combined-cycle facility consists of four main components: control, auxiliary components, gas turbine, and generator. A gas turbine could function in simple cycle, in combined cycle or in both cycles. In simple cycle, high-temperature exhaust gases are released directly into the atmosphere through bypass stack of 44 mtr height, while in combined cycle exhaust gases enter the recovery boiler for

production of steam. The steam then enters the steam turbine for production of electric energy. Combined steam-gas cycle has some advantages:

(i) Energy generation is clean—i.e. it's the most acceptable technology from an ecological standpoint.

(ii) High efficiency factor, more than 50%.

(iii) Minimal land requirement.

(iv) Minimal water requirements.

(v) Fast operations: The station starts and shuts down quickly, so it is possible to operate the facility both for base and peak load.

The Gas Turbine proposed for the Plant is the General Electric (GE) PG 9351(FA) (9FA), equipped with a hydrogen/air cooled generator. The 9FA is derived from the GE 9F CTG of 50 Hz, heavy-duty type GTs. The proven model is an integrated system solution that delivers improved reliability, higher efficiency, increased power output, and extended maintenance intervals, while maintaining current best-in-class NOx and CO emission levels. Only natural gas fuel firing is conceived for the proposed project.

The 9FA gas turbine is configured with the robust Dry Low NOx (DLN) 2.0+ combustor, which is ideally suited for 50 Hz power generation market. The DLN 2.0+ combustor is the industry leader in pollution prevention for 50 Hz combined cycle applications with greater than 56% efficiency achieving less than 25 ppm NOx. On gas, the combustor operates in a diffusion mode at low loads (< 50% load), and a pre-mixed mode at high loads (> 50% load). While the combustor can operate in the diffusion mode across the load range, diluents injection would be required for NOx abatement. All F class gas turbines include 15 to 18 stage axial compressor and a three-stage turbine, and they feature a cold-end drive and axial exhaust, which is beneficial for combined cycle arrangements where net efficiencies over 56-58% can be achieved.

The HRSGs, which have been contemplated for the proposed project, are fabricated, horizontal, triple pressure, reheat, natural circulation type, unfired, outdoor type metal duct that connects to the combustion turbine exhaust and directs the exhaust hot gas from Gas Turbines that will pass through a series of metal tubes to the exhaust stack to produce steam for the condensing type Steam Turbine Units (Two HRSGs to Feed one Steam Turbine). HRSGs consist of a casing that houses super heaters (HP, IP and LP), evaporators (HP, IP and LP), economizers (HP, IP and LP), reheater sections, mounted steam drums (HP, IP and LP) and internal insulation and lagging. No supplementary firing in the HRSG is envisaged for the project.

Gas flow leaving the gas turbine passes through diffuser and transition duct to the HRSG where the available energy converts water to superheated steam. The relatively cool gases leaving the HRSG pass through the outlet duct, stack breeching

and exhaust stack of 50 mtr heights to the atmosphere. The height of the HRSG flue gas stack will be sufficient to meet all applicable environmental regulations.

The steam turbine shall be high performance tandem compound reheat design with condensing type. The steam turbine shall be two casing design with a single shell, opposed flow combined high (HP) and intermediate pressure (IP) section and a two-flow low pressure (LP) section. The HP and IP sections are on one rotor, supported by two journal bearings, and utilizes impulse staging. The Generator is on the LP end of the turbine. The steam turbine has a down flow exhaust.

A generic process flow diagram of the proposed project with the above configuration is shown as below in **Figure 2.7**.

Figure 2.7: Generic process flow diagram of the proposed project

2.6.1.2 Power Plant Configuration

The proposed configuration of 750 MW Power block shall consist of Two (2) gas turbine generators, two (2) heat recovery steam generators and One (1) steam turbine generator with "Multishaft" arrangement . So, the configuration would be of 2+2+1. The proposed combined cycle plant shall be based on latest state-of-the art heavy duty industrial type gas turbines suitable for base load and cyclic load operation in both simple (open) cycle and combined cycle mode.

The main advantages of the above selected configuration include:

- More suitable for phase wise implementation.
- Has higher part load efficiency.
- Higher reliability.
- More operational flexibility.
- Lesser time for installation.
- Can be used for peaking Duty.
- It is proven equipment globally with reference conditions.
- Spares are easily available as few machines of 9FA class are running in India.

2.6.1.3 Type of Gas Turbine

The GT used for the performance runs is the General Electric (GE) PG 9351(FA) (9FA), equipped with a hydrogen cooled generator. The 9FA is derived from the GE 9F CTG of 50Hz, heavy-duty type GTs.

The following assumptions, guidelines, and criteria govern the selection process.

- ✓ 2x1 General Electric PG 9351(FA) combined cycle operating on natural gas.

- ✓ New and clean equipment operating at ISO conditions; 15°C, 60% relative
- ✓ Humidity, mean sea level.
- ✓ Operating on natural gas with a dry low nitrogen oxides combustion system.
- ✓ The design characteristics of the Natural gas are given in table.
- ✓ The gas line pressure is approximately 35-40 bar
- ✓ The cooling water temperature is provisional at 15°C.

2.6.1.4 Type of Boiler

Considering ease of operation and maintenance, ease of handling during transportation, ease of erection and simplicity of construction, a vertical module forced circulation triple pressure reheat type heat-recovery boiler with water tube construction without supplementary firing is considered for this project.

2.6.1.5 Heat Recovery Steam Generator

The HRSGs, which have been contemplated for the proposed project, are fabricated, horizontal, triple pressure, reheat, natural circulation type, unfired, outdoor type metal duct that connects to the combustion turbine exhaust and directs the exhaust hot gas from Gas Turbines that will pass through a series of metal tubes to the exhaust stack to produce steam for the condensing type Steam Turbine Units (Two HRSGs to Feed one Steam Turbine).

HRSGs consist of a casing that houses super heaters (HP, IP and LP), evaporators (HP, IP and LP), economizers (HP, IP and LP), reheater sections, mounted steam drums (HP, IP and LP) and internal insulation and lagging.

Gas flow leaving the gas turbine passes through diffuser and transition duct to the HRSG where the available energy converts water to superheated steam. The relatively cool gases leaving the HRSG pass through the outlet duct, stack breeching and exhaust stack to the atmosphere.

i) Maximum pressure & temperature- 122 bar and 567 ºC

ii) Steam output: 542 TPH

iii) Exhaust gas temperature: 613 ºC

iv) Estimate of boiler evaporation: 1.5%

2.6.1.6 Steam Turbine

The steam turbine shall be high performance tandem compound reheat design with condensing type. The steam turbine shall be two casing design with a single shell, opposed flow combined high (HP) and intermediate pressure (IP) section and a two-flow low pressure (LP) section. The HP and IP sections are on one rotor, supported by two journal bearings. The Generator is on the LP end of the turbine. The steam turbine has a down flow exhaust.

1 Make : GE

2	Model	:	D11
3	Type	:	TC-Down flow
4	Rated Load	:	266520
5	Rated Speed	:	3000 rpm

Steam Parameters

a	HP steam pressure admission	:	119.83 bar
b	HP steam temperature admission	:	565.6 °C
c	HP steam flow admission	:	541.77 t/hr
d	IP steam pressure admission	:	25.242 bar
e	IP steam temperature admission	:	565.6 °C
f	IP steam flow admission	:	613.69 t/hr
g	LP admission pressure	:	4.6912 bar
h	LP admission temperature	:	318.8 °C
i	LP admission flow	:	706.85 t/hr
j	Exhaust pressure	:	0.092354 bar

2.6.1.7 Water treatment Plant

The requirement of raw water for 750 MW CCPP would be 1096 m^3/hr which will be pumped from the Meghna River to the plant. Hence raw water pump house/channel will be planned at off take point for the plant.

The scheme to be selected for water treatment depends upon the quality of raw water available, required quality of treated water and also economic considerations.

The Raw Water Treatment Plant needs to produce water of a quality that satisfies the requirements of suitable feed water to Secondary Treatment Systems. The required design quality of treated water from the Raw Water Treatment Plant is mentioned as below.

Iron	:	Less than 0.3 ppm.
Turbidity	:	Less than 10 NTU at rated capacity of Clariflocculator and less than 15 NTU at 20% overloading condition
Organic matter	:	Less than 0.05 ppm

There are several treatment options in the plant to treat the raw water as per the requirement and consumption. The water first passes through clarification plant in

which solid particles will be separated by coagulation and clarification. The proposed treatment plant envisages the aeration of raw water & for removal of organic matter, chlorination of raw water is envisaged. Clarification by Klari-tubesettler type Clarifier is established technique for removal of suspended solids from raw water and the same is envisaged in Raw Water Treatment Plant. To optimize the consumption of coagulant and to increase the efficiency of TSS removal, suitable provision for addition of coagulant aid shall also be provided in the Raw Water Treatment Plant. Around 921 cu.m/hour water will flow to close loop condensate cooling system as make up water.

Around 198 m^3/hour water will be carried to DM plant to receive polish water to feed those to different precision cooling system in generator and NOx injection.

Effluent Treatment Plant: All liquid effluents emerging out of the power plant from different sections shall be collected in an effluent treatment plant and treated (as required) to meet the stipulations of Pollution Control Board. The capacity of the ETP would be around 20 m^3/hour.

The treated effluents shall also meet quality requirements mentioned in Ministry of Environment and Forests Gazette Notifications.

Design Raw water Analysis

Sl No	Parameters	Unit	Values
1	Aluminium (Al)	Ppm	0.27
2	Biochemical Oxygen Demand (BOD)	Ppm	5
3	Chemical Oxygen Demand (COD)	Ppm	16
4	Chloride (Cl)	Ppm	12
5	Color	Hazen	3.3
6	Fluoride	Ppm	<MDL
7	Manganese (Mn)	Ppm	0.06
8	Nitrogen (Nitrate)	Ppm	5
9	Nitrogen (Nitrite)	Ppm	<MDL
10	pH	Ppm	7.8
11	Phosphate	Ppm	0.37
12	Potassium (K)	Ppm	5
13	Sodium (Na)	Ppm	20
14	Sulphate	Ppm	2
15	Total Suspended Solid (TSS)	Ppm	8
16	Turbidity	NTU	25*
17	Ammonia	Ppm	0.6
18	Total Organic Carbon (TOC)	Ppm	3.2
19	M – Alkalinity	Ppm	35
20	P – Alkalinity	Ppm	0
21	Ca - Hardness (as $CaCO_3$)	Ppm	20
22	Mg - Hardness (as $CaCO_3$)	Ppm	15
23	Iron (Fe)	Ppm	0.6
24	Ferrous Iron (Fe^{2+})	Ppm	0.01
27	Free Chlorine (Cl_2)	Ppm	0.03

28	Silica (SiO_2), reactive	Ppm	11
29	Silica (SiO_2), colloidal	Ppm	3.5
Note	* Pretreatment plant shall be designed considering 500 NTU as inlet raw water turbidity		

Note * Pre-treatment plant shall be designed considering 500 NTU as inlet raw water turbidity

2.6.1.8 Cooling Water System Detail

Heat rejection for a combined cycle in this project is accomplished by circulating cooling water through the condenser. The circulating cooling water system envisaged for the plant is re-circulating type system with cooling towers. For the re-circulating type CW system, the clarified water will be pumped by CW Makeup pumps to the cold water channel. Water from cold water channel will enter the CW pump house through bar screens/trash racks at low velocity to filter out debris. Stop log Gates will be provided after the screens to facilitate the maintenance. For carrying circulating water from CW pump house to TG area and from TG area to cooling tower, steel lined concrete duct would be provided. For interconnecting CW duct with CW pump, condenser and cooling towers, steel pipes shall be used. Induced Draft Cooling Tower for the module is envisaged. Cooling tower shall be with FRP Frame, PVC tower fill, fill supports, air inlet louvers, drift eliminators etc.

2.6.1.9 Water Requirement

It was calculated that about 1096 cubic meters of fresh water per hour flow is required as the makeup water for the close circuit cooling system and other uses. As the location of the plant is at the bank of the river Meghna, so, to fulfil the requirement of the cooling water a new pump station could be constructed at bank of the Meghna River. As closed loop cooling system with cooling towers will be adopted in this project, major portion of the water will be recirculate for further use. About 206 cum/hour of water is expected to discharged from the plant to the river after treatment. The detailed water balance diagram is attached in **Annexure 10**.

Figure 2.8: Water Balance Diagram

2.6.1.10 Effluent Treatment Plant (ETP)

All the waste water generated at the various sources will be collected at one point, as far as practicable and technically viable, before treatment and then treated to meet the statutory requirements. Treated effluents are equalized in Guard pond before reuse and recycling within the plant. Excess treated and equalized effluent will be disposed off through plant's effluent outfall. This discharge will thus meet the permissible standards

Treated Effluent quality shall be as per the following:

pH : 6.0 – 9.0

Suspended solids : 100 mg/l

Oil and grease : 10 mg/

The Effluent Treatment Plant conceived will handle effluent from the following facilities-

- Neutralized waste from DM plant
- Cooling tower blow down
- Boiler blow down
- Waste water from the plant wash

Neutralized waste from DM Plant, Cooling tower blow down and Boiler blow down do not need any treatment except only dilution and retention of effluent in CMB is envisaged before discharging outside the plant boundary

For waste water from the plant wash, Treatment plant is envisaged with suitable capacity before discharging through CMB. The capacity envisaged is 20 cum/hr. The following treatment will be done in the ETP:

- Collection tank
- Coagulation & Flocculation
- Solid separation by clarifier
- clean water to CMB
- Sludge thickening
- Sludge dewatering by centrifuge

Sludge generated from Pre Treatment plant shall be treated suitably and solid waste generated shall be disposed outside plant.

The layout plan of the ETP is attached in **Annexure 12.**

2.7 Project Schedule

Pre Construction Period

The pre construction period started with the principle approval from the GOB on March 27, 2016. The pre construction period will be completed with the completion of site clearance which will indicate the end of all bureaucratic procedure.

Construction Period

The construction period will start in 5th of June, 2017. The mechanical erection is expected to be started on 5th March, 2018. The construction period is expected to be finished by 3rd June, 2019.

Operation Period

The operation period is expected to start after the erection of the plant has been completed and the test generation has been observed to be fully functional.

The detail of the project schedule has been provided in **Annexure 21**.

CHAPTER THREE: POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

3.0 POLICY AND LEGAL CONSIDERATION

3.1 BACKGROUND

The emerging environmental scenario calls for attention on conservation and judicious use of natural resources. There is a need to integrate the environmental consequences of the development activities and for planning suitable measures in order to ensure sustainable development. The environmental considerations in any developmental process have become necessary for achieving sustainable development. To achieve such goals the basic principles to be adopted are:

- To enhance the quality of environment in and around the project area by adopting proper measures for conservation of natural resources;
- Prevention of adverse environmental and social impact to the maximum possible extent;
- To mitigate the possible adverse environmental and socio-economic impact on the project-affected areas.

The proposed Project is covered under several environmental Policies & legislations pertained with GOB, ADB Safeguard Policy Statement (SPS) 2009. All of the policies or legislation aimed at the conservation and protection of the environment. The existing policies and legislation, which are relevant to the environment, are described in the following sections.

3.2 POLICIES

3.2.1 Industrial Policy 1991

The Industrial policy of 1991 contains the following clauses in respect of environmental protection

- To conserve ecological balance and prevent pollution during industrialization
- To take effective steps for pollution control and conservation of environment during industrialization

To ensure embodying of necessary pollution control and preventive measures by industrial investment project endangering environment.

3.2.2 National Environmental Policy 1992

Bangladesh National Environmental Policy (*GoB, 1992*) was approved in May 1992, and sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. Key elements of the policy are:

- Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment.
- Protection of the country against natural disasters.
- Identification the regulation of all types of activities which pollute and degrade the environment.
- Ensuring sustainable utilization of all natural resources.
- Active association with all environmentally-related international initiatives.

Environmental policy contains the following specific objectives with respect to the industrial sector:

- To adopt corrective measures in phases in industries that causes pollution.
- To conduct Environmental Impact Assessments for all new public & private industries.
- To ban the establishment of any industry that produces goods cause environmental pollution, closure of such existing industries in phases and discouragement of the use of such goods through the development and/or introduction of environmentally sound substitutes.
- To ensure sustainable use of raw materials in the industries to prevent their wastage.

3.2.3 National Conservation Strategy

National Conservation Strategy *(GoB/IUCN, 1992*) was drafted in late 1991 and submitted to the Government in early 1992. This was approved in principle; however the final approval of the document is yet to be made by the cabinet. It underwent a number of modifications over the last five years, and is waiting to be placed before the cabinet finally sometime in late September 1997. For sustainable development in industrial sector, the report offered various recommendations; some of those are as follows:

- Industries based on nonrenewable resources should be made to adopt technology which conserves raw materials, and existing industries should be given incentives to install technical fixes to reduce wastage rate.

- All industries, especially those based on imported raw materials, should be subjected to ESIA and adoption of pollution prevention/control technologies should be enforced.

- No hazardous or toxic materials/wastes should be imported for use as raw material.

- Import of appropriate and environmentally sound technology should be ensured.

- Complete dependence on imported technology & machinery for industrial development should gradually be reduced so that industrial development is sustainable with local skills and resources.

3.2.4 National Environmental Management Action Plan (NEMAP), 1995

National Environmental Management Action Plan, also referred to as NEMAP (GoB, 1995) is a wide-ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements during the period 1995 to 2005, and sets out the framework within which the recommendations of the National Conservation Strategy are to be implemented.

NEMAP has the broad objectives of:

- Identification of key environmental issues affecting Bangladesh;

- Identification of actions necessary to halt or reduce the rate of environmental degradation;

- Improvement of the natural and built environment;

- Conservation of habitats and biodiversity;

- Promotion of sustainable development;

- Improvement in the quality of life of the people.

One of the key elements of NEMAP is that sectoral environmental concerns are identified. In outline, the environmental issues of the industrial sector include the following:

- Pollution arising from various industrial processes and plants throughout the country causing varying degrees of degradation of the receiving environment (Air, Water, and Land).

- There is a general absence of pollution abatement in terms of waste minimization and treatment.

- Low level of environmental awareness amongst industrialists and entrepreneurs.

- Lack of technology, appropriate to efficient use of resources and waste minimization leading to unnecessary pollution loading in the environment.

- Economic constraints on pollution abatement and waste minimization such as the cost of new technology, the competitiveness of labor, and intensive production methods as compared to more modern methods.

- Concentration of industry and hence pollution in specific areas which exacerbate localized environmental degradation and exceed the carrying capacity of the receiving bodies.

- Unplanned industrial development has resulted in several industries located within or close to residential areas, which adversely affects human health and quality of human environment.

- Establishment of industries at the cost of good agricultural lands and in the residential areas.

- Lack of incentives to industrialists to incorporate emission/discharge treatment plant in their industries.

3.3 NATIONAL LEGISLATION

3.3.1 Environment Conservation Act 1995 (ECA 1995)

Formal concern at the national level, for the state of environment in Bangladesh can be traced back to at least Independence and passing of the Water Pollution Control Act in 1973. Under this a small unit was established in the Directorate of Public Health Engineering (DPHE) to monitor pollution of ground water and surface water.
In order to expand the scope of environmental management and to strengthen the powers for achieving it, the Government issued the Environmental Pollution Control Ordinance in 1977. The ordinance provided for the establishment of an Environmental Pollution Control Board, which was charged with formulating policies and proposing measures for their implementation. In 1982, the board was renamed as Department of Environmental Pollution Control (DEPC). Four divisional offices were established in Dhaka, Chittagong, Khulna and Bogra. A special presidential

order again renamed the DEPC to the Department of Environment (DOE) and placed under newly formed ministry of Environment and Forest (MoEF) in 1989.

The national environmental legislation known as **Environmental Conservation Act, 1995 (*ECA'95*)** is currently the main legislative document relating to environmental protection in Bangladesh, which repealed the earlier environment pollution control ordinance of 1997 and has been promulgated in 1995. The main objectives of ECA'95 are:

- Conservation and improvement of environment, and
- Control and mitigation of pollution of environment.

The main strategies of the act can be summarized as:

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

3.3.2 Environment Conservation Rules, 1997 (Subsequent Amendments in 2002 and 2003)

A set of the relevant rules to implement the ECA' 95 has been promulgated (August 1997). The rules mainly consist of:

- The national Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;

- Categorization of industries, development projects and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities.

- Procedure for obtaining environmental clearance;

- Requirement for undertaking IEE and ESIA as well as formulating EMP according to categories of industries/development projects/activities;

- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation.

Green: Industries/development projects/activities are considered relatively pollution-free and therefore, they do not require an environmental clearance certificate from the DOE and no environmental study.

Orange: Industries/development projects/activities fall into two categories. Orange "A" is less polluted and Orange "B" is moderately polluted required to submit general information, a process flow diagram and schematic diagrams of waste treatment facilities along with their application to DOE for obtaining environmental site clearance and environmental clearance.

Red: Industries/development projects/activities are those which may cause 'significant adverse' environmental impacts and are therefore required to submit an ESIA report. It should be noted that they might obtain an environmental site clearance on the basis of an IEE report, and subsequently submit an ESIA report for obtaining environmental clearance along with other necessary papers.

Environmental standards in operation in Bangladesh also Promulgated under the Environment Conservation Rules 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, vehicular emission etc.

The Bangladesh standards intend to impose restrictions on the volume and concentrations of wastewater/solid waste/gaseous emission etc. discharged into the environment. In addition a number of surrogate pollution parameters like Biochemical Oxygen Demand, or Chemical Oxygen Demand; Total Suspended Solids, etc. are specified in terms of concentration and/or total allowable quality discharged in case of waste water/solid waste. Additionally specific parameters depending on the manufacturing process are specified such as phenol, cyanide, copper, zinc, chromium etc. Air emission quality standards refer mostly to concentration of mass emission of various types of particulate, sulfur dioxide, and oxides of nitrogen and in some cases volatile organic compounds and other substances.

The Bangladesh standards in general are less stringent compared to the developed countries. This is in view to promote and encourage industrialization in the country. The Bangladesh standards are not for any specific period of time. There is no provision for partial compliance too.

The ambient standard of water quality, air quality and noise are presented in Table 3.1 to Table 3.5 in the following page. Standards refer to discharges to freshwater bodies with values in parentheses referring to direct discharges to agricultural land.

Table 3.1: Inland Surface Water Quality Standards for Waste from Industrial Units

Parameters	Unit	Inland Surface WaterQuality Standards
Temperature	Centigrade	40
Biological Oxygen Demand (BOD_5) at 20^0 C	mg/l	50
Chemical Oxygen Demand (COD)	mg/l	200
Dissolve Oxygen (DO)	mg/l	4.5-8
Total Dissolved Solids (TDS)	mg/l	2,100
p		6-9
Suspended Solid (SS)	mg/l	150
Nitrate	mg/l	10.0
Arsenic	mg/l	0.2
Lead	mg/l	0.1
Chloride	mg/l	600
Iron	mg/l	2
Manganese	mg/l	5
Copper	mg/l	0.5
Oil & Grease	mg/l	10

Source: ECR- Schedule 10

Table 3.2: Standards for Drinking Water

Parameters	Unit	DoE (Bangladesh) Standard for drinking water
pH		6.5-8.5
Hardness(as $CaCO_3$)	mg/L	200-500
Iron	mg/L	0.3-1.0
Chloride	mg/L	150-600

Parameters	Unit	DoE (Bangladesh) Standard for drinking water
Arsenic	mg/L	0.05
Residual chlorine	mg/L	0.2
Total Coliform	n/mL	0
Fecal Coliform	n/mL	0
Ammonia	mg/L	0.5
Nitrate	mg/L	10
Phosphate	mg/L	6

Source: ECR- Schedule 3

Table 3.3: Ambient Air Quality Standards

AIR POLLUTANT	STANDARDS	AVERAGE TIME
1	2	3
Carbon Monoxide (CO)	10 mg/m^3 (9 ppm) (Ka)	8-hour
	40 mg/m^3 (35 ppm) (Ka)	1-hour
Lead (Pb)	0.5 µg/m^3	Annual
Oxides of Nitrogen (NO_x)	100 µg/m^3 (0.053 ppm)	Annual
Suspended Particulate Matter (SPM)	200 µg/m^3	8-hour
PM_{10}	50 µg/m^3 (Kha)	Annual
	150 µg/m^3 (Ga)	24-hour
$PM_{2.5}$	15 µg/m^3	Annual
	65 µg/m^3	24-hour
Ozone (O_3)	235 µg/m^3 (0.12 ppm) (Gha)	1-hour
	157 µg/m^3 (0.08 ppm)	8-hour
Sulfur di Oxide (SO_2)	80 µg/m^3 (0.03 ppm)	Annual
	365 µg/m^3 (0.14 ppm) (Ka)	24-hour

Source: ECR- Schedule 2 (Amended in 2005)

Abbreviation: ppm: Parts Per Million
Notes:
(Ka) Not to be exceeded more than once per year
(Kha) Annual average value will be less than or equal to 50 microgram/cubic meter
(Ga) Average value of 24 hours will be less or equal to 150 microgram/cubic meter for one day each year.
(Gha) Maximum average value for every one hour each year will be equal or less than 0.12 ppm.

At national level, sensitive areas include national monuments, health resorts, hospitals, archaeological sites and educational establishments.

Table 3.4: Standards for Gaseous Emission from Industries

Parameters for power plant (<200 MW)	Standard present
Oxides of Nitrogen	40 ppm

Source: ECR- Schedule 11

Table 3.5: Ambient Noise Standards

Areas	Day Time dBa	Night Time dBa
Silence Zone: Zone A	50	40
Residential Area: Zone B	55	45
Mixed Activity Area: Zone C	60	50
Commercial Area: Zone D	70	60
Industrial Area	75	70

Source: ECR- Schedule 1 (Amendment in 2006)

The second column of limits values refer to day time (06.00 to 21:00) and the third column to night time (21.00 to 06.00). A silence zone is defined as an area within 100m, around hospitals or educational institutions.

3.3.3 Labor Management Acts

3.3.2.1 The Factories Act, 1965 and the Factories Rules 1979

This act is generally applicable to any `factory'. `Factory' means any premises including the precincts thereof whereon 10 or more workers are working or were working on any day of the preceding twelve months and in any part of which a manufacturing process is being carried on with or without the aid of power, but does not include a mine.

This act defines worker as "a person employed in any manufacturing process or in cleaning any part of the machinery or premises used for a manufacturing process, or in any other kind of work incidental to or connected with, the manufacturing process, but does not include any person solely employed in clerical capacity in any room or place where no manufacturing process is carried on".

Manufacturing process as defined by the act stands for any process for –

A. Making, altering, repairing, ornamenting, painting and washing, finishing, or packing, or otherwise treating any articles or substances with a view to its use, sale, transport, delivery, display or disposal. Or
B. Pumping oil, gas, water, sewerage or other fluids or slurries. Or
C. Generating, transforming or transmitting power or gas. Or

D. Constructing, reconstructing, repairing, refitting, finishing or breaking up of ships or vessels. Or
E. Printing by letter press, lithography, photogravure or other similar work or book-binding which is carried on by way of trade or for purposes for gain or incidental to another business so carried on.

This act prescribes the requirements of safety and health to be maintained, and covers:

a) Maintenance of standards of cleanliness.

b) Adequate lighting, ventilation & temperature.

c) Control of elements hazardous to health like dusts, gases, fumes, etc. associated with particular operations.

d) Requirement of certificate of fitness for young persons from certifying surgeons.

e) Requirement of periodical medical examination for persons engaged in hazardous operations.

f) Requirement for making available adequate first-aid facilities.

g) Requirement of a dispensary manned by a medical practitioner for units employing 500 or more workers.

h) Length of working hours & night work for young persons and women, and prohibition of employment for operating dangerous machines

i) Prohibition of employment of women and children near cotton openers

j) Requirement of precaution against fire and explosions.

k) Requirement of fencing and guarding of machinery, casing of new machinery

l) Requirement for work on or near machinery in motion, striking gear and devices for cutting off power, self-acting machine

m) Requirement for cranes and other lifting machinery, hoist and lift, revolving machinery, pressure plant

n) Requirement of safety measures for buildings.

o) Requirement of precautions against dangerous fumes.

p) Maximum weight to be lifted carried or moved by adult men, women and young persons.

q) Requirement for floors, stairs and means of access; pits, sumps, opening in floors, etc.

r) Requirement for protection of eyes

s) Requirement for explosive or inflammable dust, gas, etc.

t) Reporting of accidents and occupational diseases.

u) Sanitary conveniences- requirement of latrine, urinals, spittoons, drinking water

v) Requirement of canteen, eating place, washing facilities, rest room, child room

w) Requirement for appointment of welfare officer for units employing 500 or more workers.

Responsible authorities-

Department of Inspection for Factories and Establishment under the administrative control of the Ministry of Labor and Manpower is responsible for enforcement of the legislation. It is the responsibility of the employer to provide facilities to employees as asked for by the law and it is the obligation of the workers to abide by the provisions of the Act.

3.3.2.2 Workmen's compensation Act, 1923, and rules thereunder

This act has been last amended in 1987 and applies to factories, docks, construction work, railways, transport workers, excavation, gas and electricity workers, etc.

It holds liable an employer to pay compensation for death and injury or disablement caused by accident arising out of and in the course of employment. And it considers contraction of occupational diseases peculiar to the nature of the work done as an injury like accident.

The act provides –

- A list of injuries that is considered to result in permanent partial disablement.
- A list of persons considered as workmen.
- A list of occupational diseases, and includes a list of employments for the purpose of such diseases.
- Means of calculating compensation payable for disablement or death.

Responsible authorities-

Department of Inspection for Factories and Establishment is responsible for enforcement of the legislation.

The Chairman of the Labor courts is also the Commissioner of Workers' Compensation.

Comment-

The act covers a wide range of workers spells that the employer is not liable for compensation if workers remove or disregard any safety guard or devices provided for securing safety.

3.3.4 Bangladesh Explosive Act, 1884

Power to make rules as to licensing of the manufacture, possession, use, sale, transport and importation of explosives:

Rules under this section may provide for all or any of the following, among other matters, that is to say:-

(a) The authority by which licenses may be granted;
(b) The fees to be charged for licenses, and the other sums (if any) to be paid for expenses by applicants for licenses;
(c) The manner in which applications for licenses must be made, and the matters to be specified in such applications;
(d) The form in which, and the conditions on and subject to which, licenses must be granted;
(e) The period for which licenses are to remain in force; and
(f) The exemption absolutely or subject to conditions of any explosives from the operation of the rules.

Rules made under this section may impose penalties on all persons manufacturing, possessing, using, selling, transporting or importing explosives in breach of the rules, or otherwise contravening the rules:

(a) In the case of a person so manufacturing, using or importing an explosive, an imprisonment for a term which may extend to ten years and shall not be less than two years, and also a fine which may extend to fifty thousand Taka in default of which a further imprisonment for a term which may extend to one year,
(b) In the case of a person so selling or transporting an explosive, an imprisonment for a term which may extend to seven years and shall not be less than one year and also a fine which may extend to thirty thousand Taka in default of which a further imprisonment for a term which may extend to one year,
(c) In the case of a person so possessing an explosive, an imprisonment for a term which may extend to five years and shall not be less than six months, and also a fine which may extend to twenty thousand Taka in default of which a further imprisonment for a term which may extend to six months,
(d) In any other case, an imprisonment for a term which may extend to two years and shall not be less than three months, and also a fine which may extend to ten thousand Taka in default of which a further imprisonment for a term which may extend to three month.

3.4 OTHER LEGISLATIONS

3.4.1 ENVIRONMENTAL REQUIREMENTS OF THE ASIAN DEVELOPMENT BANK (ADB)

The ADB Safeguard Policy Statement 2009 sets out the requirements for ADB's operations to undertake an environmental assessment for projects funded by the bank. The environmental assessment requirements for projects depend on the significance of impacts on the environment by the project. Each proposed project is scrutinized as to its type; location; the sensitivity, scale, nature, and magnitude of its potential environmental impacts; and availability of cost-effective mitigation measures.

A project is classified as one of the environmental categories (A, B, C, or FI).

Category A: A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An ESIA is required.

Category B: A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An IEE is required.

Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

Category FI: A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI.

Categorization based on the Most Environmentally Sensitive Component.

Categorization is to be based on the most environmentally sensitive component. This means that if one part of the project is with potential for significant adverse environmental impacts, then project is to be classified as Category A regardless of the potential environmental impact of other aspects of the project. Of course only those aspects of the project with potential for significant adverse environmental impacts need to be assessed in detail. The scoping for the ESIA and the TOR for the ESIA report should focus on the significant environmental issues.

Basic Environmental Assessment Requirements

Category A. ESIA is required to examine the project's potential impacts, and to recommend an environmentally sound project by comparing all possible alternatives. Public consultation must be undertaken at least twice during the ESIA process, once

during the early stage of the ESIA field studies and after the draft ESIA report has been prepared. The ESIA should recommend mitigation measures for minimizing the adverse impacts and identify environmental monitoring requirements. The mitigation measures and proposed monitoring are to be incorporated into the EMP. An ESIA report must be prepared following the recommended format in Appendix 2. The SESIA shall be circulated to the Board at least 120 days prior the Board consideration. The ESIA and SESIA are to be made available for public (and published it on ADB's web-site). The Borrower should translate the SESIA into the local language.

Category B. An IEE is required for Category B projects to determine whether or not significant environmental impacts warranting an ESIA are likely. If an ESIA is not needed, the IEE is regarded as the final environmental assessment report. Public consultation must be undertaken during the IEE process**.** An IEE report is required to follow the recommended format. For Category B projects deemed environmentally sensitive, the SIEE should be submitted to the Board at least 120 days prior to the Board consideration. In addition to the SIEE, IEE will be made available to Board members upon request. The Bank may make the SIEE available to locally affected groups and NGOs, upon request, through the Board Member of the DMC concerned, or through the Bank's Depository Library program, except where confidentiality rules would be violated.

Category C. No ESIA or IEE is required but environmental implications of the project still need to be reviewed and mitigation measures if any should be directly integrated into the project design.

Category FI. Environmental Assessment of the financial intermediation and equity investments is required. A due diligence assessment of the financial intermediary and its environmental management system (EMS) is required, except in the where the subproject involves only small loans with insignificant impacts. In the cases where there will be on lending through credit lines, an environmental assessment and review procedures for subprojects are required. The environmental assessment and review procedures are similar to that for sector loans and the requirements for public involvement, information disclosure, and in some cases, clearances by ADB apply.

A comparison between ADB and DOE requirements are given in the Table below:

Table 3.6: A comparison between ADB and DOE requirements

ADB		**DOE**	
Category	Requirements	**Category**	Requirements
Category A	- ESIA to examine potential impacts - Public consultation (atleast twice during ESIA process) - Recommendation of mitigation measures and	**Green**	- No Environmental clearance is needed as project is pollution free - No environmental study is required

	proposed monitoring in EMP		
Category B	- IEE is required to assess possible impact - Public consultation to be incorporated in IEE - IEE report to be written in recommended format	**Orange A**	- General information - Process flow diagram - ETP facilities.
Category C	- No EIA and IEE is required - Environmental implication of the project is required to be reviewed - Mitigation measures (if any) to be incorporated	**Orange B**	- General information - Process flow diagram - ETP facilities.
Category FI	- Environmental Assessment of the financial intermediation and equity investments is required. - A due diligence assessment of the financial intermediary and its environmental management system (EMS) is required.	**Red**	- IEE report to be submitted followed by the ESIA report - General information - Process flow diagram - ETP facilities.

3.4.2 ENVIRONMENTAL AND SOCIAL GUIDELINES OF THE INTERNATIONAL FINANCE CORPORATIONIFC/WB GROUP

As a member of the World Bank Group, the International Finance Corporation (IFC) has the environmental and social guidelines for projects funded by it following those of the World Bank. The World Bank procedures for EA study cover policies, guidelines and good practices. Such guidelines therefore follow the national best practices in undertaking any development project in Bangladesh. The environment safeguards policies applicable to the proposed project are the following:

• *Environmental Assessment (EA) (OP 4.01/BP/GP 4.01)*: An Environmental Assessment isconducted to ensure that IFC-financed projects are environmentally sound and sustainable,and that decision-making is improved through appropriate analysis of actions and of theirlikely environmental impacts. Any IFC-funded project that is likely to have potentialadverse environmental risks and impacts in its area of influence requires an EA indicatingthe potential risks, mitigation measures and environmental management framework or plan.

• *Natural Habitats (OP/BP 4.04)*: Natural habitats are land and water areas where most of theoriginal native plant and animal species are still present. Natural habitats comprise manytypes of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightlymodified by human activities, but retaining their ecological functions and native species.The Natural habitats policy is triggered by any project

(including any subproject under asector investment or financial intermediary loan) with the potential to cause significantconversion (loss) or degradation of natural habitats, whether directly (through construction)or indirectly (through human activities induced by the project). The policy has separaterequirements for critical (either legally or proposed to be protected or high ecologicalvalue) and non-critical natural habitats. World Bank's interpretation of "significantconversion or degradation" is on a case-by-case basis for each project, based on theinformation obtained through the EA.

• *Forestry (OP/GP 4.36)*: This policy is triggered by forest sector activities and World Banksponsoredother interventions, which have the potential to impact significantly uponforested areas. The World Bank does not finance commercial logging operations but aimsto reduce deforestation, enhance the environmental contribution of forested areas, promoteafforestation, reduce poverty and encourage economic development.

• *Cultural Property (OPN 4.11)*: Physical cultural resources are defined as movable or
immovable objects, sites, structures, groups of structures, natural features and landscapesthat have archaeological, paleontological, historical, architectural, religious, aesthetic, orother cultural significance. Physical cultural resources may be located in urban or ruralsettings, and may be above ground, underground, or underwater. The Bank seeks to assistcountries to manage their physical cultural resources and to avoid or mitigate adverseimpact of development projects on these resources. This policy is triggered for any projectthat requires an EA.

• *Policy on Disclosure of Information, 2002*: There are disclosure requirements at every partof the project preparation and implementation process. Consultation with affected groupsand local community should take place during scoping and before Terms of references(ToRs) are prepared; when the draft EA is prepared; and throughout project implementationas necessary. The Borrower makes the draft EA and any separate EA report available incountry in a local language and at a public place accessible to project-affected groups andlocal community prior to appraisal.Besides, IFC has set out 8 (eight) performance standards in respect of various parameterspertaining to a proposed project. These eight performance standards of IFC with theircorresponding parameters as under:

• Performance Standard 1: Social and Environmental Assessment and Management System
• Performance Standard 2: Labour and Working Conditions
• Performance Standard 3: Pollution Prevention and Abatement
• Performance Standard 4: Community Health, Safety and Security
• Performance Standard 5: Land Acquisition and Involuntary Resettlement
• Performance Standard6: Biodiversity Conservation and Sustainable Natural ResourceManagement
• Performance Standard 7: Indigenous Peoples

• Performance Standard 8: Cultural Heritage.

Of the above eight performance standards set by IFC, the Performance Standard 1 envisagesestablishing the importance of: (i) integrated assessment to identify the social andenvironmental impacts, risks and opportunities; (ii) effective community engagement throughdisclosure of project-related information and consultation with local communities on mattersthat directly affect them; and (iii) the client's management of social and environmentalimpacts throughout the life of the project.The rest seven of the performance standards, i.e., Performance Standards 2 through 8 seek toascertain establishing requirements to avoid, reduce, mitigate or compensate the impacts onpeople and the environment, and to improve conditions where appropriate.

Table 3.7: WHO Ambient Air Quality Guidelines

	Averaging Period	Guideline value in µg/m^3
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 3.8: Noise Level Guidelines

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

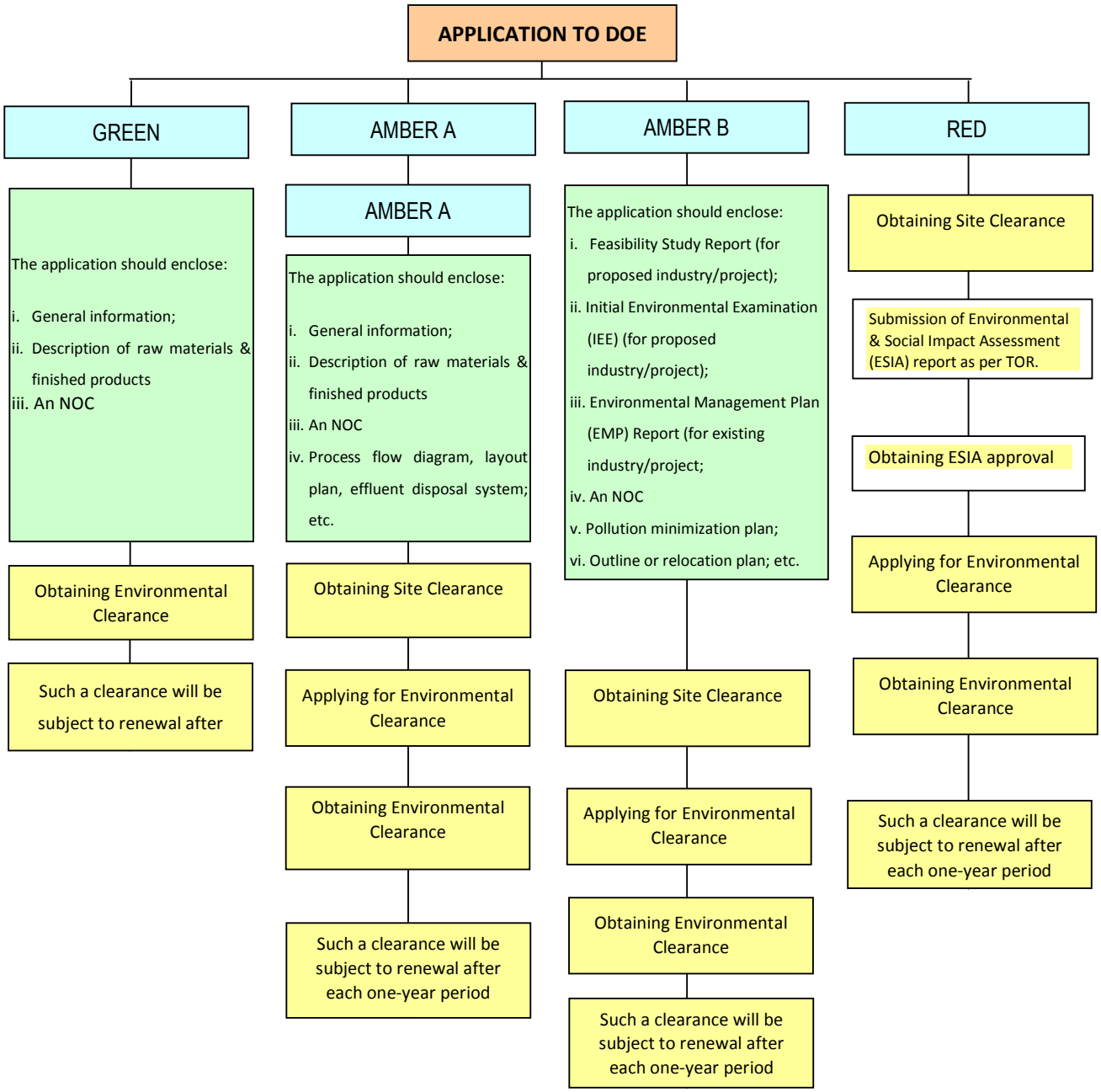
Table 3.9: Emission Guidelines for Combustion Turbines (in mg/Nm^3)

Combustion Technology / Fuel	Particulate Matter (PM)		Sulfur Dioxide (SO_2)		Nitrogen Oxides (NOx)	Dry Gas, Excess O_2 Content (%)
Combustion Turbine			NDA/DA		NDA/DA	
Natural Gas (all turbine types of Unit > 50MWth)	N/A	N/A	N/A	N/A	51 (25 ppm)	15%
Fuels other than Natural Gas (Unit > > 50MWth)	50	30	Use of 1% or less S fuel	Use of 0.5% or less S fuel	152 (74 ppm)[a]	15%

3.5 ENVIRONMENTAL CLEARANCE

Formal ESIA guidelines in Bangladesh are set out in "Rules and Regulations under the 1995 Environmental Protection Acts" as published in the official Gazette on August 27, 1997. Any proponent planning an industrial project is currently required under Paragraph 12 of the Environmental Protection Acts, 1995 to obtain "environmental clearance letter:" from the Department of Environment.

The first to obtain environmental clearance is for the project proponent to complete & submit an application form which may be obtained from the appropriate DoE regional offices as per the category. The application is accompanied by other supporting documents (i.e. project profile, lay-out plan, NOC from local authority, Govt fees etc.) reviewed by the divisional and district offices of DOE who has the authority to request supporting documents as applicable. The divisional office has the power to take decision on Green and Amber-A & B category projects and the Red category projects are forwarded to head office for approval. The proposed projects receive an environmental site clearance at the beginning and the environmental clearance subject to the implementation of the project activities and all mitigation measures suggested in the IEE report or in the application. In case of Red category, the client needs to submit an IEE report for site clearance and ESIA to obtain ESIA approval and environmental clearance.


APPLICATION TO DOE
GREEN
AMBER A
AMBER B
RED
The application should enclose:
i. General information;
ii. Description of raw materials & finished products
iii. An NOC
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after
AMBER A
The application should enclose:
i. General information;
ii. Description of raw materials & finished products
iii. An NOC
iv. Process flow diagram, layout plan, effluent disposal system; etc.
Obtaining Site Clearance
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period
The application should enclose:
i. Feasibility Study Report (for proposed industry/project);
ii. Initial Environmental Examination (IEE) (for proposed industry/project);
iii. Environmental Management Plan (EMP) Report (for existing industry/project;
iv. An NOC
v. Pollution minimization plan;
vi. Outline or relocation plan; etc.
Obtaining Site Clearance
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period
Obtaining Site Clearance
Submission of Environmental & Social Impact Assessment (ESIA) report as per TOR.
Obtaining ESIA approval
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period

3.6 POWER SCENARIO AND MASTER PLAN IN BANGLADESH

Power and energy are vital factors that determine the growth path of a developing country like Bangladesh whereas; electricity is the major source of power for country's most of the economic activities. Consistent supply of power and energy can ensure development of the economy. Nonetheless the huge demand supply gap prevailing in the power sector has turned out to be a hurdle for the economic expansion of the nation.

The per capital electricity consumption in Bangladesh remains one of the lowest in the Asian region, At present, only about 47% of the total population of Bangladesh has access to electricity. Even though power has reached many urban areas, approximately 53,000 of the 68,000 villages are connected to power. Further, one million retail electricity connections are pending. The contribution of power sector to GDP ratio has been stagnant around 1.3% for last 5 years with the power generation being increased annually by 2.8% during this period. The majority of power produced in the country is used for commercial purposes. Hence, the electricity supply to households remains delicate which is also a politically sensitive issue. The demand for electricity in the rural areas has experienced significant growth over the years mainly driven by agriculture and small & medium enterprises.

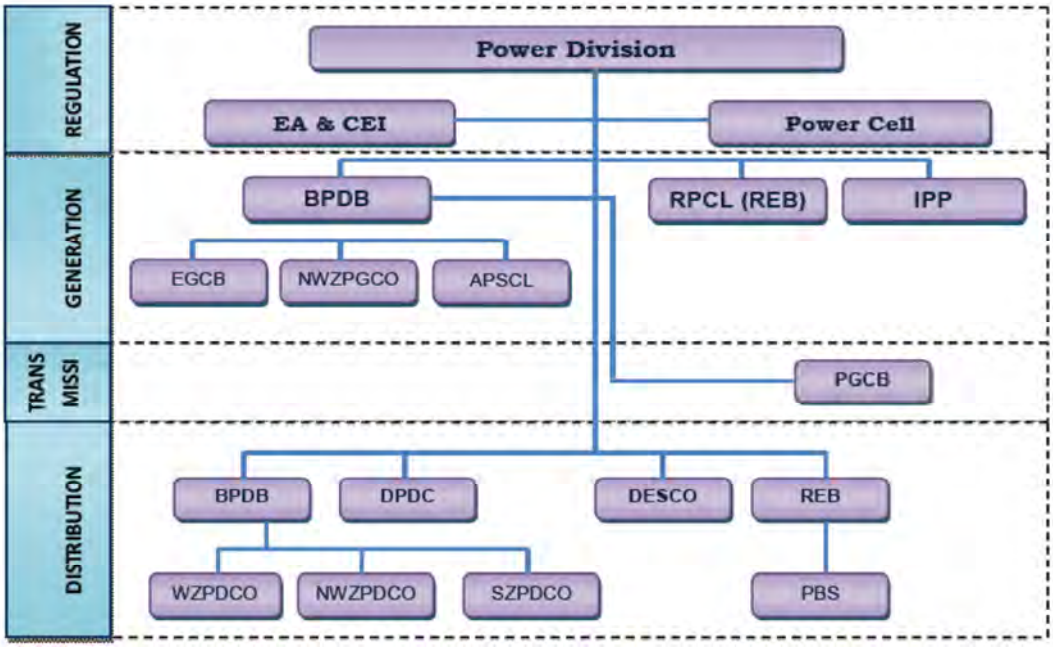
According to Bangladesh Power Development Board (BPDB) presently the installed capacity as on December 2013 in the power sector is 10,213.00 MW, whereas the derated generation capacity is 9,599.00 MW. According to a demand projection analysis, the peak electricity demand is 9,268 MW in 2014, 10,283 MW in 2015 and 11,405 MW in 2016. So, the generation of electricity should be increased for the following years to fulfill the upcoming increasing demands.

Because of the critical nature, the Government of Bangladesh has given highest priority to the power sector to enhance the generation capacity. BPDB has come up with a comprehensive plan to meet the surging demand in power. Accordingly, the government plans to eliminate the demand supply gap and achieve the ultimate goal of providing "electricity to all" by 2021 by having generation capacity of 20,000 MW. To ensure overall and balanced development of the sector government has devised immediate, short term, medium term and long term generation plans. The plans have been developed based on a techno-economic analysis and least cost options.

However, the timely implementation of above plans is a concern as there are issues with regards to availability of finance, competency of project sponsors and inherent bureaucracies and other bottlenecks in the system. Further, the demand estimates for power may also be understated to some extent. Strategies have been made to meet the investment requirement by involving private sector with Government through Public Private Partnership (PPP) initiatives. A successful IPP model has been designed with a lot of comforts and protection to investors.

3.7 INSTITUTIONAL STRUCTURE OF POWER SECTOR IN BANGLADESH

Power Division is responsible for formulating policy relating to power and supervise, control and monitor the developmental activities in the power sector of the country. To implement its mandate, the Power Division is supported by a number of organizations, related with generation, transmission and distribution. The overall organizational structure and linkage is shown below:



CHAPTER FOUR: DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

4.0 BASELINE ENVIRONMENTAL CONDITIONS

4.1 GENERAL CONSIDERATION

Baseline condition of environment states the present status of different components of environment i.e. physical, biological, cultural, economic and social environmental characteristics in absence of the project. Environmental baseline study by examining the existing environment, serves as the basis of the project site against which potential impacts from development activities of the project both during implementation and in operation phases can be compared. Mainly there are two principal objectives in examining and defining the existing environment:

- To recognize potential environmental impacts of the project and enable mitigation measures to be identified.
- To provide a base line against which environmental conditions in the future project may be measured and to document conditions which were either existing or developing before the introduction of the project and not due to the project.

The baseline environmental quality is assessed through field studies within the impact zone for various components of the environment, viz. air, noise, water, and land and socio-economic.

4.2 BOUNDING THE IMPACT AREA

The study area covers the Reliance Meghnaghat CCPP and the immediate surrounding extended area of about 5 km radius, considered as “Area of Influence (AoI)”.The proposed power plant will be located atMeghnaghat, which has been acquired byBangladesh Power Development board (BPDB) on the river bank of Meghna on Governmentkhas land. Sonargaon is located on the bank of the Meghna River about 36 kilometers southeast and is connected by highway with Dhaka. There also exists good waterways connection of the site with seaports of Chittagong and Mongla. The project locates in Meghnaghat mauza of SonargaonUpazila. Dhaka-Chittagong highway is just 1km away from the project area. Primary and Secondary data has been generated and collected for conducting Baseline Study. The monitoring details are outlined in **Table-4.1.**

Table-4.1: Details of Monitoring

Sr. No.	Attribute	Parameters	Frequency of Monitoring
1	Ambient air quality	SPM, SO_2, NO_x,CO and Particulate matter ($PM_{2.5}$& PM_{10})	The monitoring was carried out at 6 locations, monitored twice a week at each location for 24 hours starting from September to December.
2	Meteorology	Wind Speed, Direction, Temperature, Relative Humidity, Rainfall & duration and other non-instrumental observations	a] Continuous hourly recording through setting up of site meteorological station; b] Data collected from secondary sources like Meteorological Station.
3	Water quality	Physical, Chemical and Bacteriological Parameters	Once during the study period at 6 locations (for 3 ground water and 3 surface water)
4	Ecology	Existing terrestrial and aquatic flora and fauna	Once during study period through field visits
5	Noise levels	Noise levels in dB(A)	Once during study period continuously for 24 hours through field visits at 6 locations
6	Soil characteristics	Soil profile, characteristics, soil type and texture, heavy metal, NKP value etc.	Once during the study period at 4 locations
7	Land use	Land use for different categories	Based on information given by BWDB and satellite imagery
8	Socio-economic aspects	Socio-economic characteristics, labour force characteristics	Based on data published in latest census.
9	Geology	Geological history	Based on data collected from secondary sources
10	Hydrology	History of HFL of the river Meghna and the existing groundwater level	Based on Data collected from secondary sources
11	Risk assessment, Disaster Management Plan and Occupational Health and Safety	Identify areas where disaster can occur and identify areas of occupational hazards	Based on assessment

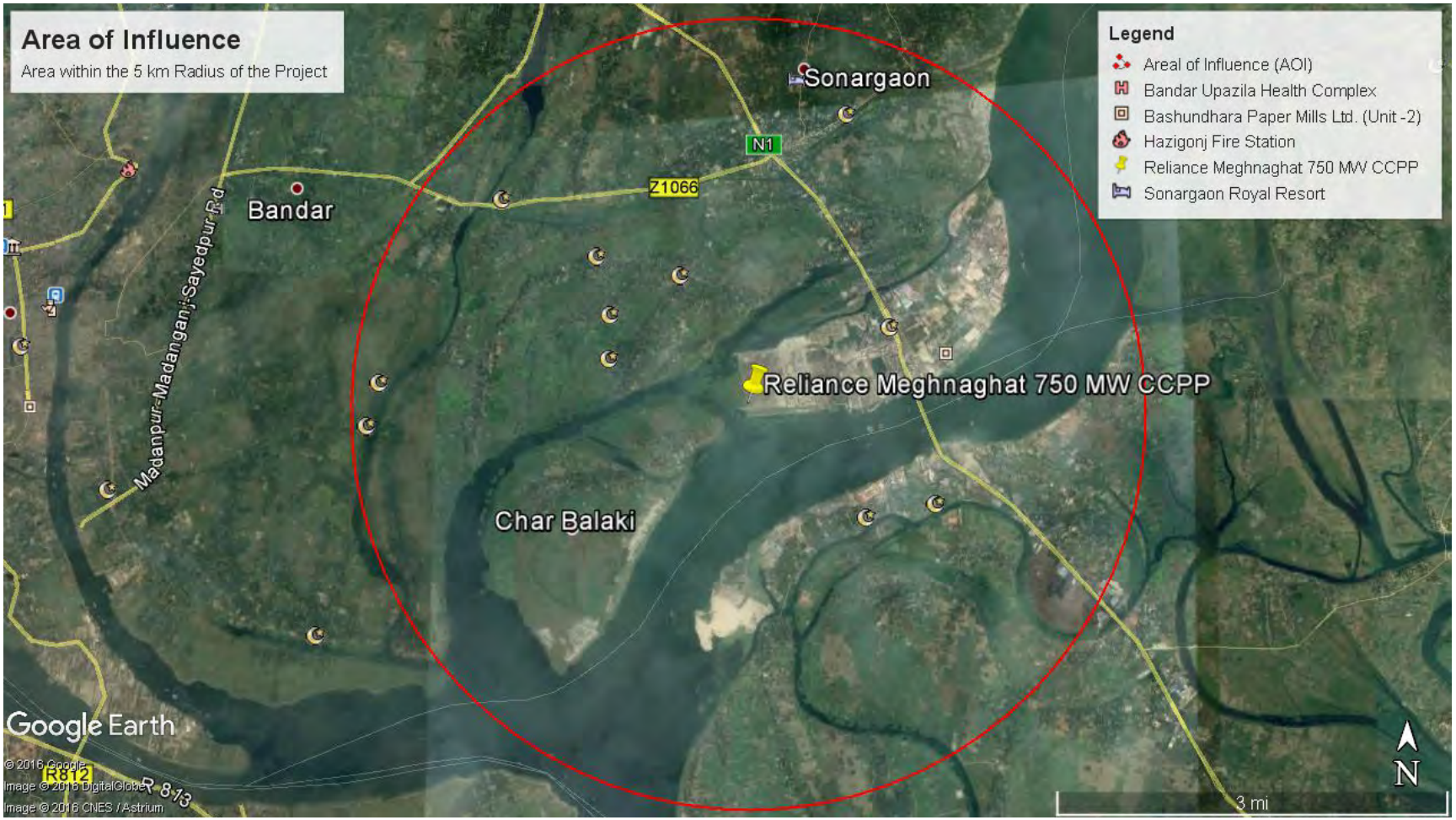


Fig 4.1: Area of Influence (AoI)

4.3 CLIMATE

The climate of this region is tropical, with monsoons, characterized by a change of four seasons: pre-monsoon (March to May), monsoon (June to September), post-monsoon (October to November) and dry season (December to February). High air temperature is observed all throughout the year; daily air temperature variations are insignificant; air humidity is high with abounding rains. Typical parameters of the weather elements, as recorded for the period of last few years of observations (2007-2013) at Dhaka Meteorological Station are presented in table 4.2 to 4.13 below.

4.3.1 Rainfall

The annual rainfall is about 2347mm and approximately 80% of it occurs during the monsoon. Average monthly rainfall during monsoon period varies between 300mm to 450mm.

The rainfall follows the general climate pattern with the highest rainfall in the summer month of June to September and minimum rainfall in the cooler and drier months of November to March. It is evident that extreme rainfall events occurred during the monsoon (June-September). Average monthly rainfall values for Dhaka (As there is no Meteorological station in Narayanganj) area since 2001 are presented in **Table - 4.2**.

Table - 4.2 Monthly Average Rainfall in the project area (2001- 2013)

Year	Rainfall in mm											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2015	3	17	4	166	185	375	623	395	346	51	0	1
2014	0	12	10	80	147	342	212	391	156	49	0	0
2013	0	8	26	32	378	325	302	212	172	131	0	4
2012	10	1	37	269	137	175	226	282	81	38	68	5
2011	0	0	20	123	235	314	356	409	207	112	0	0
2010	0	48	22	37	177	308	167	340	169	174	0	81
2009	1	1	43	14	168	170	676	482	298	74	4	0
2008	23	56	45	91	205	577	563	319	279	227	0	0
2007	0	30	11	163	185	628	753	505	179	320	0	0
2006	0	0	0	181	185	326	331	167	663	61	5	0
2005	1	3	155	91	291	259	542	361	514	417	3	0
2004	0	0	9	167	162	496	295	191	839	208	0	0
2003	0	25	96	123	140	473	191	202	264	134	0	45
2002	22	4	51	111	272	373	446	272	156	52	36	0
2001	0	1	33	46	402	386	202	205	209	177	18	0

Source: BMD

4.3.2Relative Humidity

As would be expected, relative humidity during the wet season is significantly higher than those occurring at other period of the year. This is well depicted by the data as shown in the **Table - 4.3** for relative humidity of Dhaka (As there is no Meteorological station in Narayanganj) during the period 2006 – 2015.

Table-4.3 Average Monthly Relative Humidity of the Project Area in years 2007-2013 (source: BMD)

Humidity in %	Monthly Mean Humidity												
Year	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Annual**
2006	69	65	53	67	72	81	80	77	80	76	68	69	71
2007	68	68	54	69	70	81	84	80	80	78	77	69	73
2008	69	61	67	64	70	80	83	81	81	77	69	79	73
2009	72	55	53	66	72	74	80	82	81	73	66	69	70
2010	71	56	59	67	71	79	77	78	79	74	68	66	70
2011	69	54	57	64	76	80	79	82	77	73	67	73	70
2012	66	52	57	69	70	77	79	78	79	71	68	77	70
2013	65	55	55	63	78	76	77	80	81	78	66	72	70
2014	72	62	52	56	68	78	77	82	76	72	66	77	69
2015	70	63	52	68	71	77	81	79	78	73	69	68	70

Source: BMD

4.3.3 Wind Speed

According to Bangladesh Meteorological Department the average wind speed at Dhaka (As there is no Meteorological station in Narayanganj) within March to September is 2.05 knots in 2015.

Table - 4.4: Monthly Prevailing Wind Speed and Direction in Knots of Dhaka for the period of 2007-2013

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2006	3.0 N	3.6 S	5.0 NNW	3.8 S	3.8 S	2.1 S	2.2 SE	4.5 SE	5.4 SE	2.3 N	2.1 NW	2.4 NW
2007	2.9NW	3.1NW	4.2NW	3.8S	3.5S	3.1S	3.1S	3.1S	3.2S	4.1NE	5.5NE	2.9NW
2008	3.6N	3.2N	3.8S	3.4S	3.4S	3.3S	3.4S	2.8S	2.8S	9.6NE	2.5NE	3.3W
2009	3.3W	4.1W	4.0W	4.1S	3.8S	3.1 S	4.3SE	2.8S	4.2SE	2.3E	2.8N	2.4NW
2010	2.9NW	3.3W	3.8S	4.1S	3.7S	3.0S	2.4S	2.2S	2.6SE	2.0NE	2.9N	2.4N
2011	2.2W	2.4W	3.8S	2.4S	3.0S	2.7SE	2.4SE	2.4SE	2.6SE	2.0NW	2.3W	2.1NW
2012	2.4W	3.0W	2.5S	2.6S	2.5S	3.0S	2.7SE	2.5SE	2.2E	2.0S	2.2W	2.3W
2013	2.3W	2.2W	2.6W	2.8S	3.2E	2.3S	2.7SE	2.7SE	2.2S	2.9SE	2.1N	2.3W
2014	2.5 W	2.5 W	2.4 NW	2.2 S	2.8 S	2.1 S	2.4 SE	2.4 SE	2.1 SE	2.1 W	2.1 W	2.2 W
2015	2.2 W	2.4 W	2.2 W	2.5 S	2.3 S	2.6 S	2.4 E	2.7 S	3.0 SE	1.9 S	2.5 N	2.1 W

SOURCE: BMD

4.3.4 Ambient Air Temperature

The temperature of the country has the relationship with the period of rainfall. In general cool seasons coincide with the period of lowest rainfall. Table 4.5 - Table 4.13 respectively shows the monthly average maximum and minimum temperature at Dhaka (As there is no Meteorological station in Narayanganj) for the period 2007-2013. During this period maximum average temperature of 37.0 degree Celsius was observed in May, 2009 where average minimum temperature was 5.3 degree Celsius in January, 2013.

Table - 4.5 Monthly Ambient Temperature of the Project Area in 2007

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	18.0	28.8	9.6
Feb	21.5	30.8	12.6
March	25.4	36.7	15.0
April	28.1	35.9	18.1
May	30.0	37.5	22.5
June	28.7	35.9	22.0
July	28.2	34.8	23.4
Aug	29.1	35.9	24.2
Sep	28.7	34.9	24.5
Oct	27.1	35.6	19.5
Nov	23.9	31.8	16.8
Dec	19.8	28.2	11.3

Source: BMD

Table - 4.6 Monthly Ambient Temperature of the Project Area in 2008

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	19.0	29.0	10.5
Feb	20.3	30.6	10.8
March	26.6	34.6	16.5
April	29.2	36.9	19.6
May	29.3	36.7	20.3
June	28.7	35.4	22.5
July	28.5	34.0	24.6
Aug	28.8	36.0	23.6
Sep	28.9	34.8	24.4
Oct	27.1	34.8	18.0
Nov	23.7	32.3	16.3
Dec	20.4	29.0	13.0

Source: BMD

Table - 4.7 Monthly Ambient Temperature of the Project Area in 2009

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	19.7	28.1	9.8
Feb	23.3	33.9	11.2
March	27.0	36.0	15.6
April	30.1	39.6	19.0
May	29.1	37.8	19.8
June	30.2	36.5	23.2
July	29.0	35.7	23.8
Aug	28.9	34.3	23.7

Sep	28.8	35.3	23.0
Oct	27.6	35.8	19.8
Nov	24.6	33.9	13.2
Dec	20.0	29.7	8.7

Source: BMD

Table - 4.8 Monthly Ambient Temperature of the Project Area in 2010

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	17.6	29.0	9.6
Feb	22.3	31.2	12.0
March	28.2	37.3	18.4
April	30.4	37.9	20.8
May	29.7	36.9	21.3
June	29.3	35.8	23.2
July	29.7	35.1	25.3
Aug	29.5	35.1	25.0
Sep	28.9	34.0	24.8
Oct	28.3	35.7	21.5
Nov	24.9	33.2	16.6
Dec	20.1	29.7	11.0

Source: BMD

Table - 4.9 Monthly Ambient Temperature of the Project Area in 2011

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	17.3	27.8	8.2
Feb	22.5	31.0	13.0
March	26.4	34.5	16.0
April	28.0	35.8	20.2
May	28.4	35.3	21.3
June	29.1	36.0	23.2
July	29.2	35.4	23.9
Aug	28.5	35.0	24.5
Sep	29.1	36.2	23.7
Oct	28.1	34.5	22.0
Nov	23.9	32.4	17.2
Dec	19.3	30.0	11.0

Source: BMD

Table - 4.10 Monthly Ambient Temperature of the Project Area in 2012

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	18.9	28.5	9.0
Feb	22.1	33.0	9.8

March	27.1	37.3	16.2
April	28.1	37.1	17.6
May	30.1	36.2	20.5
June	29.7	36.7	22.2
July	29.1	34.3	24.8
Aug	29.2	34.5	24.0
Sep	29.0	36.5	24.5
Oct	27.9	34.4	19.2
Nov	23.5	32.4	12.9
Dec	18.4	28.5	8.8

Source: BMD

Table - 4.11 Monthly Ambient Temperature of the Project Area in 2013

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	17.6	28.1	5.3
Feb	22.8	32.4	12.9
March	27.5	36.0	15.2
April	29.0	37.0	19.2
May	28.0	37.1	19.2
June	30.1	36.4	23.8
July	29.3	34.6	24.8
Aug	28.7	35.0	24.6
Sep	28.9	35.7	24.0
Oct	27.2	35.2	20.7
Nov	23.8	32.1	15.1
Dec	20.2	30.5	10.2

Source: BMD

Table - 4.12 Monthly Ambient Temperature of the Project Area in 2014

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	18.3	28.5	10.3
Feb	21.0	30.4	11.6
March	26.5	38.0	16.0
April	30.7	40.2	18.9
May	30.2	38.0	21.1
June	29.6	37.0	23.2
July	29.5	35.8	24.0
Aug	28.8	34.4	24.3
Sep	29.2	34.8	24.2
Oct	27.7	36.0	19.5
Nov	24.3	33.8	15.4

Dec	19.0	29.2	12.3

Source: BMD

Table - 4.13 Monthly Ambient Temperature of the Project Area in 2015

Month	Mean temp (°C)	Max temp (°C)	Min temp (°C)
Jan	19.1	29.9	11.4
Feb	22.4	32.2	12.8
March	26.3	36.4	15.0
April	27.9	35.5	19.5
May	29.7	36.4	20.1
June	29.3	36.5	23.2
July	28.4	35.5	23.6
Aug	29.2	34.7	23.8
Sep	29.0	36.5	24.0
Oct	27.7	35.5	20.3
Nov	24.5	32.9	17.5
Dec	20.4	30.3	11.5

Source: BMD

4.3.5 WEARTHER MONITORING REPORT

Genesis of Weather Monitoring

The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as for input prediction models for air quality dispersion. Historical data on meteorological parameters will also play an important role in identifying the general meteorological regime of the region.

The year may broadly be divided into four seasons:

- Winter season : December to February
- Pre-monsoon season : March to May
- Monsoon season : June to September
- Post-monsoon season : October to November

Methodology

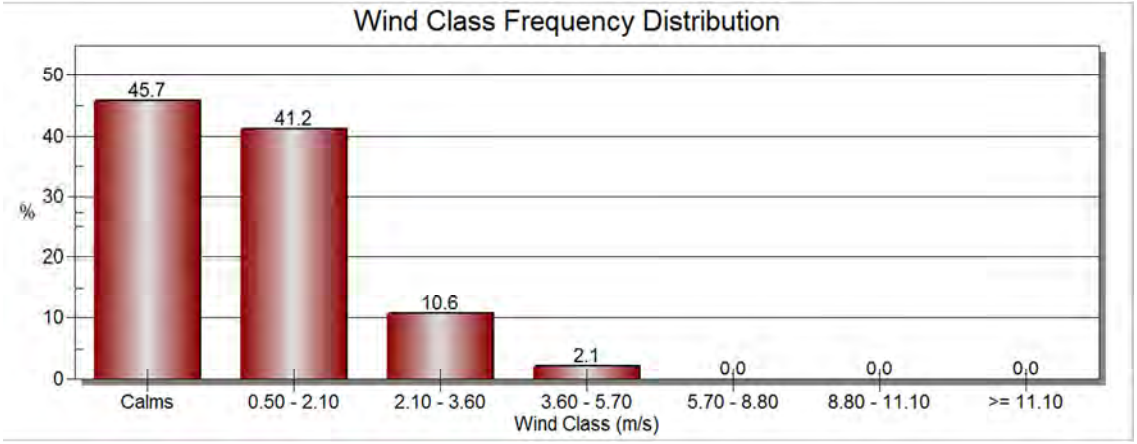
A comprehensive weather monitoring has been conducted using Meteorological stations (**Figure: 4.2**).The meteorological parameters were recorded on hourly basis during the study period and include parameters like wind speed, wind direction (from 0 to 360 degrees), temperature, relative humidity, atmospheric pressure, rainfall and cloud cover.

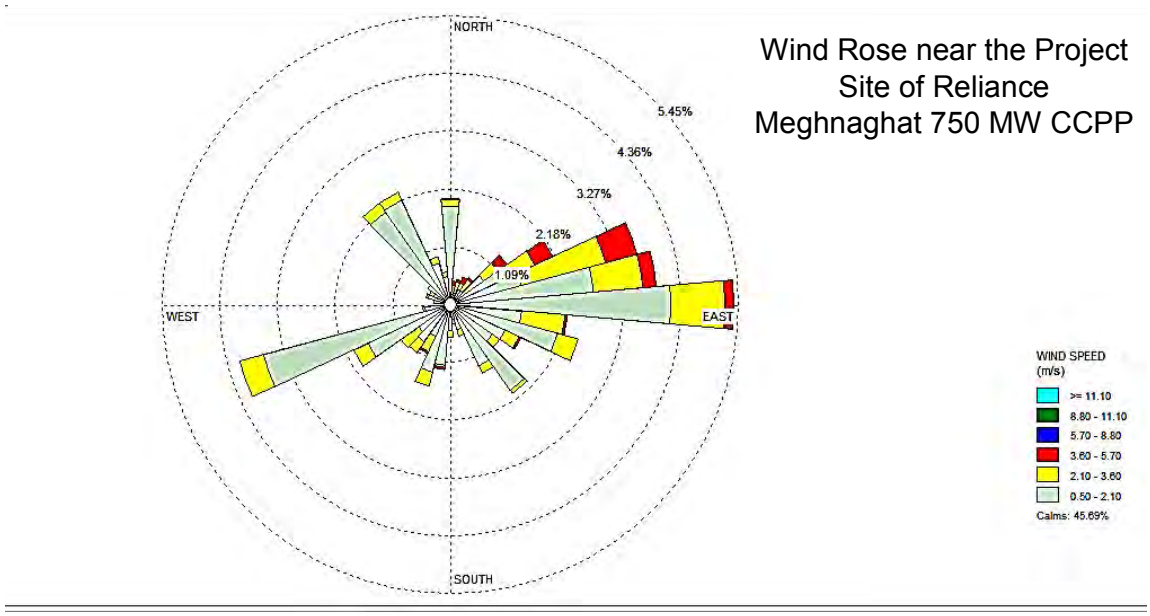
Findings from the Weather Monitoring Data

The weather data from 09/08/2016 to 15/12/2016 has been recorded. During this time, the rainfall has been significantly low and therefore the weather is relatively dry. The summery of the weather report is given in the Table belowand the details of the weather report have been given in the **Annexure 7**.

Month	Temperature (^{0}C)		Relative Humidity (%)		Maximum DailyRain fall (mm)	Maximum Wind Speed (mtrs/sec)
	Max	Min	Max	Min		
August 2016	36.36	26.14	94.26	66.64	14.2	10.9
September 2016	44.03	27.02	95.41	63.83	11.2	7.8
October 2016	35.66	24.96	95.95	65.43	5.8	10.4
November 2016	31.16	19.88	97.75	42.81	17.8	12.2
December 2016	31.77	16.02	95.87	35.52	0	5.6

After the analysis of the complete data, followings have been found as wind class distribution and wind rose (relative frequency of wind directions at a place) near the project site of Reliance Meghnaghat 750 MW CCPP:



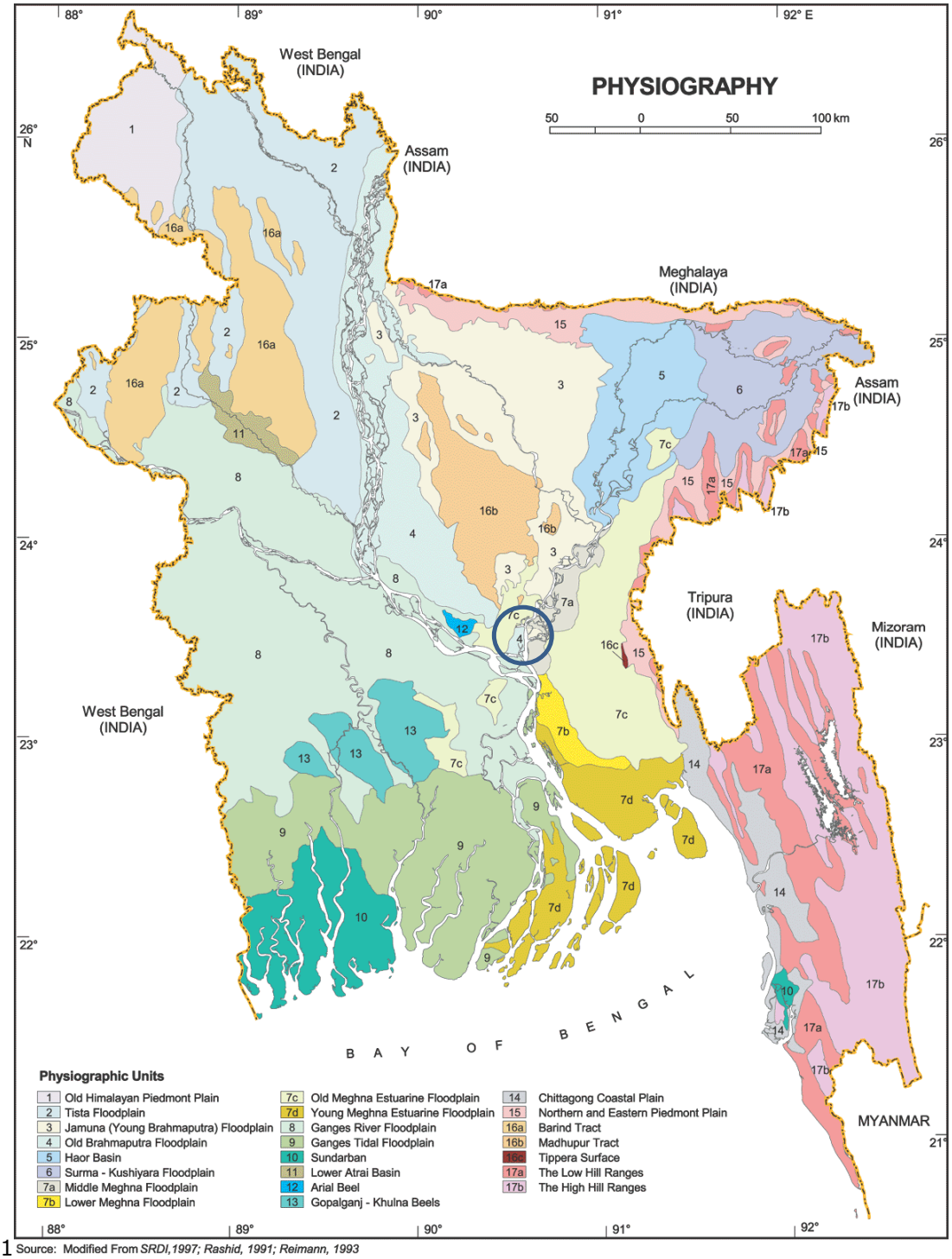


Wind Rose near the Project Site of Reliance Meghnaghat 750 MW CCPP

Most of the area of Bangladesh is a vast, low-lying alluvial plain, sloping gently to the south and southeast. According to Bangladesh Agricultural research council's Agro-Ecological Zoning map of Bangladesh, the proposed project area falls in the Old Meghna Estuarine Floodplain. This region occupies abandoned channel of the Brahmaputra River on the border between Bandar and Narayanganj Upazila. This region includes islands-former Brahmaputra chars within the Meghna River as well as adjoining parts of the mainland as shown in **Figure4.3**.

Proposed project site belongs to the Old Brahmaputra Floodplain area of the National Classification. Soils of the area are grey, loamy on the ridges and grey to dark grey clayey in the basins. Grey sands to loamy sands with compact silty topsoil, occupying areas of old Brahmaputra char. Dominant general type is Non calcareous Grey Floodplain soils. Top soils are strongly acidic and sub soils slightly acidic to slightly alkaline. General fertility level is medium. The physiographic map of Bangladesh is shown in **Figure 4.3**. Within this area, elevations are about5m above sea level, which is shown in **Figure 4.4**.

Fig 4.2: Meteorological Atmospheric Turbulence (MAT) Station



1 Source: Modified From *SRDI,1997; Rashid, 1991; Reimann, 1993*

Fig. 4.3: Physiographic Map of Bangladesh

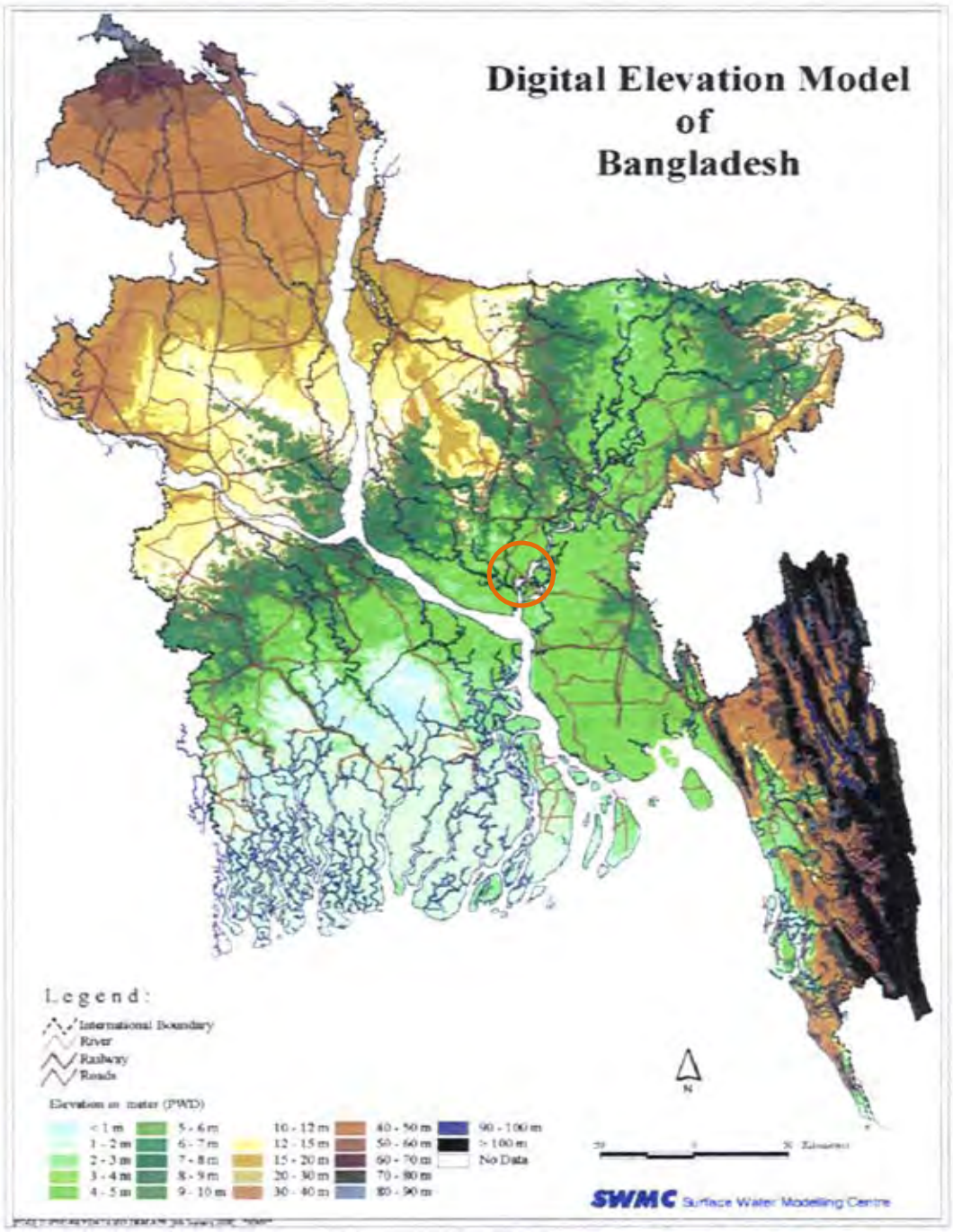


Figure 4.4: Digital Elevation Model of Bangladesh

4.3.6 EFFECT OF CYCLONE IN THE BOUNDING AREA

Bangladesh is prone to cyclone in some areas and cyclones can have serious impact in the lives of the people. The coastal areas are more prone to cyclone than any other areas of the country. As this area is far away from the coastal area, no

cyclone has been recorded in the past. So, the effect of cyclone in this area is nonexistent. The area faces thunderstorms every once in a while but those storms are not as destructive as a cyclone by any means. The cyclone prone area are shown in **Figure4.5.**

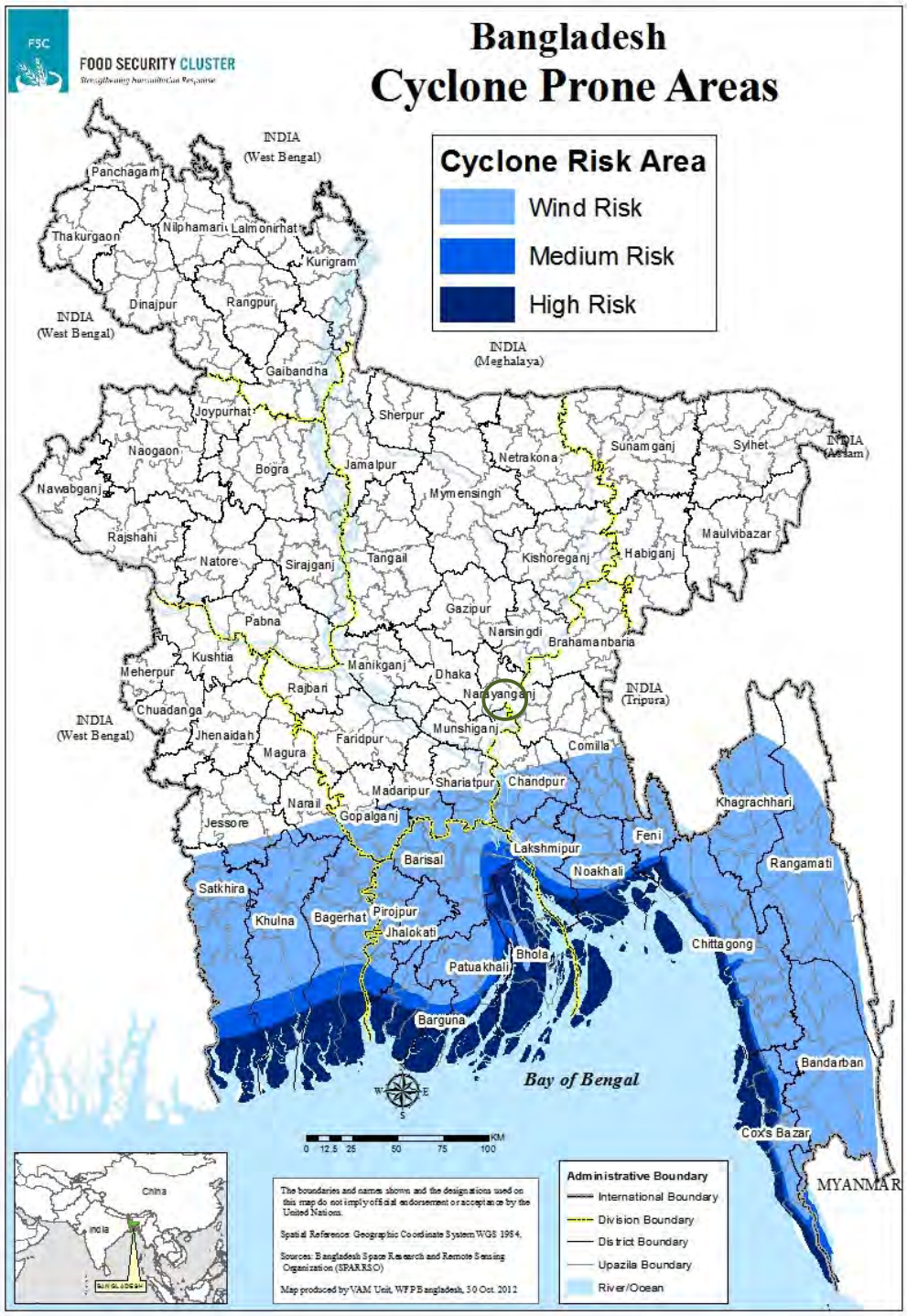


Figure 4.5: Cyclone Prone Areas of Bangladesh.

4.4 GEOLOGY AND SOIL

4.4.1 Soil Quality

To assess the soil quality of the project area, soil samples were collected from different points in and around the project site. The description of the soil sampling points is given below and has been shown in **Fig 4.6**:

Name of Sampling Point	Coordinate	Elevation in meter (From MSL)
Mugrapara	23°37'59.10"N 90°35'5.98"E	8.5
Jamaldi	23°35'49.82"N 90°37'0.69"E	4.25
Project Site	23°36'27.70"N 90°35'40.50"E	1.2
Char Balaki	23°35'17.30"N 90°34'38.60"E	4.5

Findings of Soil Test

The soil samples have been tested for different parameters.The soil quality parameters and their concentration of the samples near and around the project siteare given in **Table- 4.15**:

Table- 4.14: Soil Quality Parameters and Their Values

SL.	Parameters		Analytical Results				Analytical Methods
			Project Area	Char Balaki	Mograpara	Jamaldi	
	Physical Parameters						
1	Particle Size Distribution	Sand (%)	94	88	45	47	Hydrometer Method
		Silt (%)	4	8	38	38	
		Clay (%)	2	4	17	15	
2	Texture		Sand	Loamy Sand	Loam	Loam	Marshal's Textural Triangle Method
3	Permeability (cm/hr)		6.1	5.3	2.5	1.6	Constant Head Method
4	Porosity (%)		53	52	49	48	Core Method
5	pH		7.22	7.33	7.33	6.95	pH Meter 1:2.5
6	Electrical Conductivity (µS/cm)		16.2	12.3	225.2	74.5	EC Meter 1:5
	Chemical Parameters						
7	Nitrates (mg/kg)		2.11	3.20	11.20	12.45	KCl extraction and ion chromatography
8	Phosphates (as PO_4^{-3}) (mg/kg)		43.21	48.23	112.06	147.37	Olsen extraction and ion chromatography
9	Iron (Fe) (%)		0.083	0.013	1.56	1.58	Acid digestion and AAS
10	Lead(Pb) (mg/kg)		2.00	*BDL	11.0	10.50	Acid digestion and AAS
11	Manganese (Mn) (mg/kg)		147.5	8.55	375.5	330.4	Acid digestion and AAS

12	Nickel (Ni) (mg/kg)	7.70	1.30	18.30	22.55	Acid digestion and AAS
13	Barium (Ba) (mg/kg)	1226	1145	1736	1875	Acid digestion and AAS
14	Zinc (Zn) (mg/kg)	25.74	5.97	108.72	95.05	Acid digestion and AAS
15	Copper (Cu) (mg/kg)	2.20	0.050	13.55	14.80	Acid digestion and AAS
16	Cadmium (Cd) (mg/kg)	BDL	BDL	BDL	BDL	Acid digestion and AAS
17	Chromium (Cr) (mg/kg)	11.65	2.60	26.15	29.60	Acid digestion and AAS
18	Arsenic (As) (mg/kg)	1.62	0.29	2.56	1.70	Acid digestion and AAS
19	Cation Exchange Capacity (cmol/kg)	0.92	1.88	11.0	10.12	NH_4OAc method

Source: Department of Soil, Water and Environment, University of Dhaka. *BDL: Below Detection Limit

It can be seen that the soils in the area are slightly basic in nature with pH values ranging from 7.22-7.33. On Jamaldi, the soil is slightly acidic (pH: 6.95). Electrical conductivity values in the samples varied from 12.5 to 225.2µS/cm. Nitrates in all the four soil samples were found to be from 2.11 (Project Site) to 12.45 (Jamaldi) mg/kg whereas the Manganese ranged from 8.55 (Char Balaki) – 375.5 (Mograpara) mg/kg. Phosphate levels were observed to be 43.21 - 147.37 mg/kg. Thus the soils in the region can be concluded as neutral and suitable for construction.

The iron levels in soil samples collected from the study area vary from 0.083 to 1.58%. Concentration of Leadranges from untraceable in Char Balakito 11.0 in Mograpara. The other heavy metals like Cadmium and Chromium were found to be untraceable and ranging from 2.6 (in Char Balaki) to 29.6 (in Jamaldi) respectively. The Cation exchange capacity of soil samples ranges from 0.92 to 11.0meq/100gm; the lesser the value, the sandier the soil gets. Arsenic found in the soil sample ranges from 0.29 to 2.56 mg/kg which is very little.

Fig 4.6: Soil Sampling Points

4.5 SEISMICITY

Bangladesh, a densely populated country in South Asia, is located in the north-eastern part of the Indian sub-continent at the head of the Bay of Bengal. Tectonically, Bangladesh lies in the north-eastern Indian plate near the edge of the Indian craton and at the junction of three tectonic plates – the Indian plate, the Eurasian plate and the Burmese micro plate. These form two boundaries where plates converge– the India-Eurasia plate boundary to the north forming the Himalaya Arc and the India-Burma plate boundary to the east forming the Burma Arc (**Fig. 4.7)**.

Active faults of regional scale capable of generating moderate to great earthquakes are present in and around Bangladesh. These include the Dauki fault, about 300 km long trending east-west and north-south situated between Madhupur Tract and Jamuna flood plain, Assam-Sylhet fault located along the southern edge of Shillong Plateau (Meghalaya- Bangladesh border), the 150 km long Madhupur fault trendinlt, about 300 km long trending north east southwest located in the southern Surma basin and the Chittagong-Myanmar plate boundary fault, about 800 km long runs parallel to Chittagong-Myanmar coast (**Fig. 4.8**).

Fig. 4.7: Regional tectonic setup of Bangladesh with respect to plate configuration

The Chittagong- Myanmar plate boundary continues south to Sumatra where it

ruptured in the disastrous 26 December 2004 Mw 9.3 earthquake (Steckler et al. 2008). These faults are the surface expression of fault systems that underlie the northern and eastern parts of Bangladesh. Another tectonic element, the 'Himalayan Arc' is characterized by three well defined fault systems (HFT, MBT and MCT) that are 2500 km long stretching from northwest syntaxial bend in Pakistan in the west to northeast syntaxial bend in Assam in the east. It poses a great threat to Bangladesh as significant damaging historical earthquakes have occurred in this seismic belt (Bilham et al., 2001; Mukhopadhyay et al., 2004 and Mullick et al., 2009). The tectonic set-up and the plate motions together place Bangladesh potentially vulnerable to earthquake.

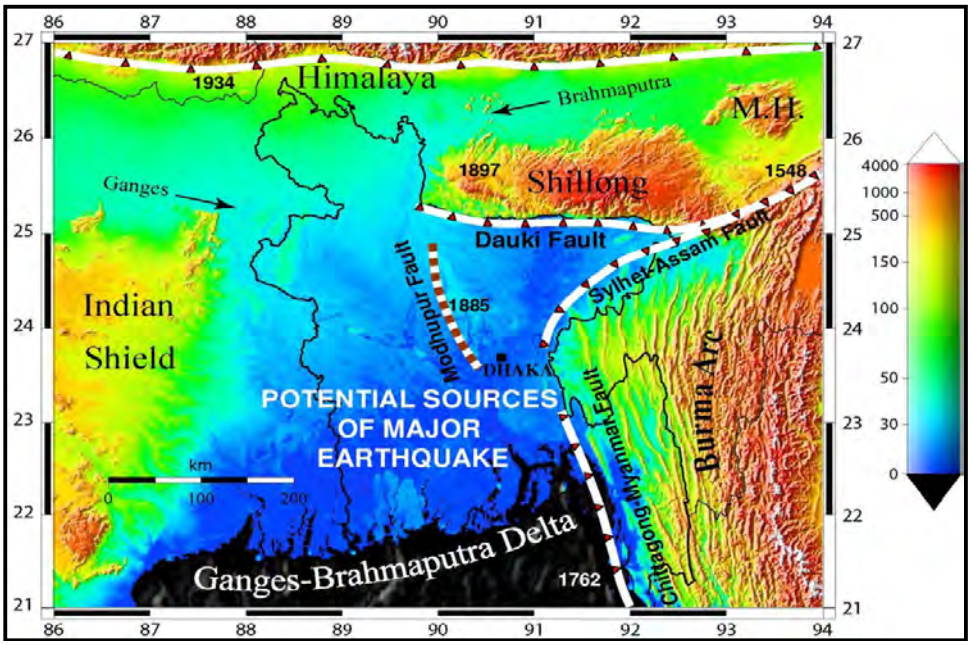


Fig. 4.8: Digital Elevation Model (DEM) of Bangladesh and surroundings showing geological faults – potential sources of major earthquakes in Bangladesh.

On the basis of distribution of earthquake epicenters and morphotectonic behaviour of different tectonic blocks Bangladesh has been divided into three generalized seismic zones (**Fig 4.9**). Zone-II comprising the central part of Bangladesh represents the regions of recent uplifted Pleistocene blocks of the Barind and Madhupur Tracts, and the western extension of the folded belt. The zone II consists of the regions of recent uplifted Pleistocene blocks of the Barind and Madhupur and the western extension of the folded belt and the Bask coefficient for this zone is 0.05. Sonargaonarea within the vicinity of Narayanganj falls in seismic zone II of the seismic zoning map of Bangladesh.

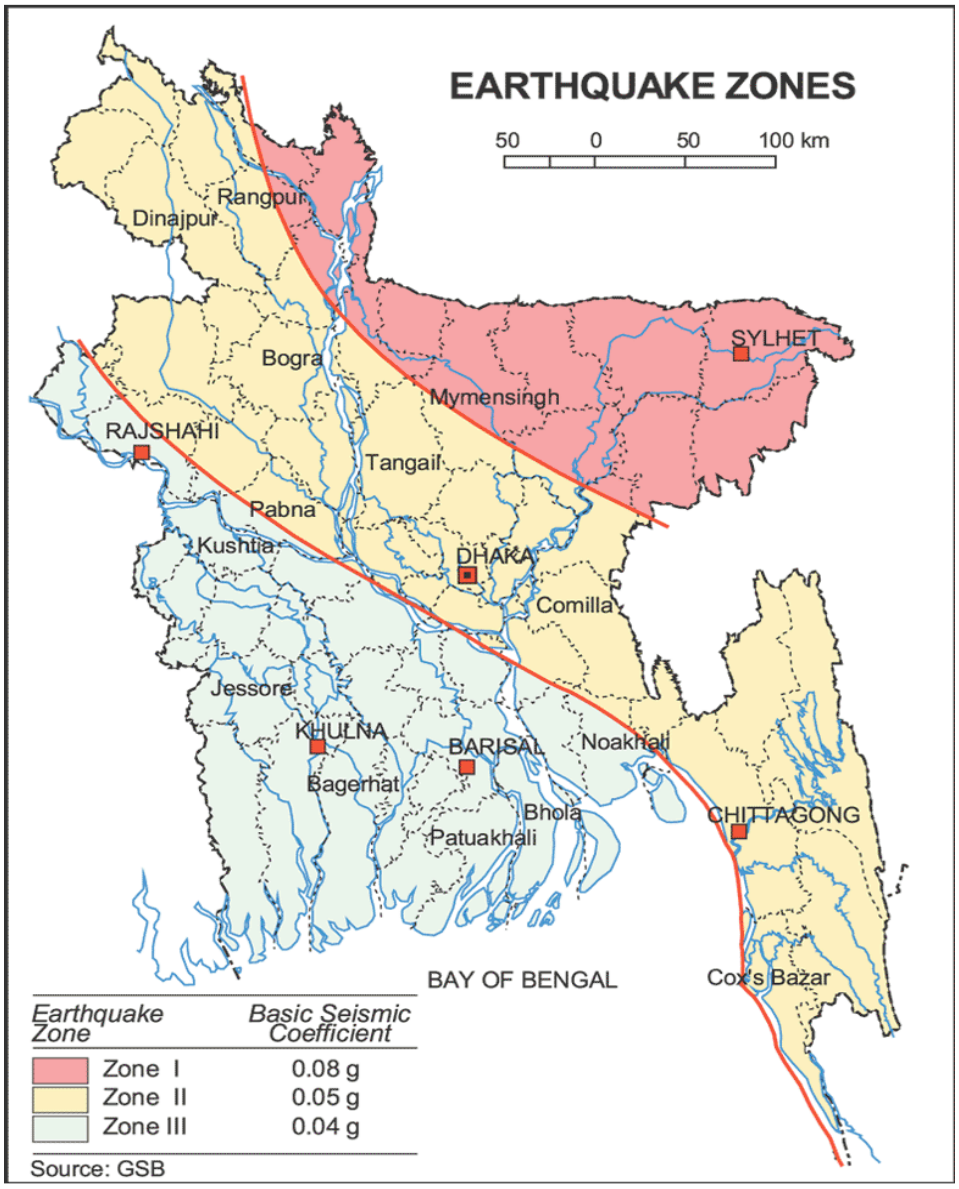


Fig 4.9: Earthquake Zoning Map of Bangladesh

Table 4.15: Seismic Zonation of Bangladesh

Zoning	Area Mercalli Scale	Modified
I	North and eastern regions of Bangladesh (Seismically most active)	IX
II	Lalmai, Barind, Madhupur Tracts, Dhaka, Comilla, Noakhali and western part of Chittagong Folded belt.	VIII
III	Khulna division S-E Bangladesh (Seismically relatively quiet)	VII

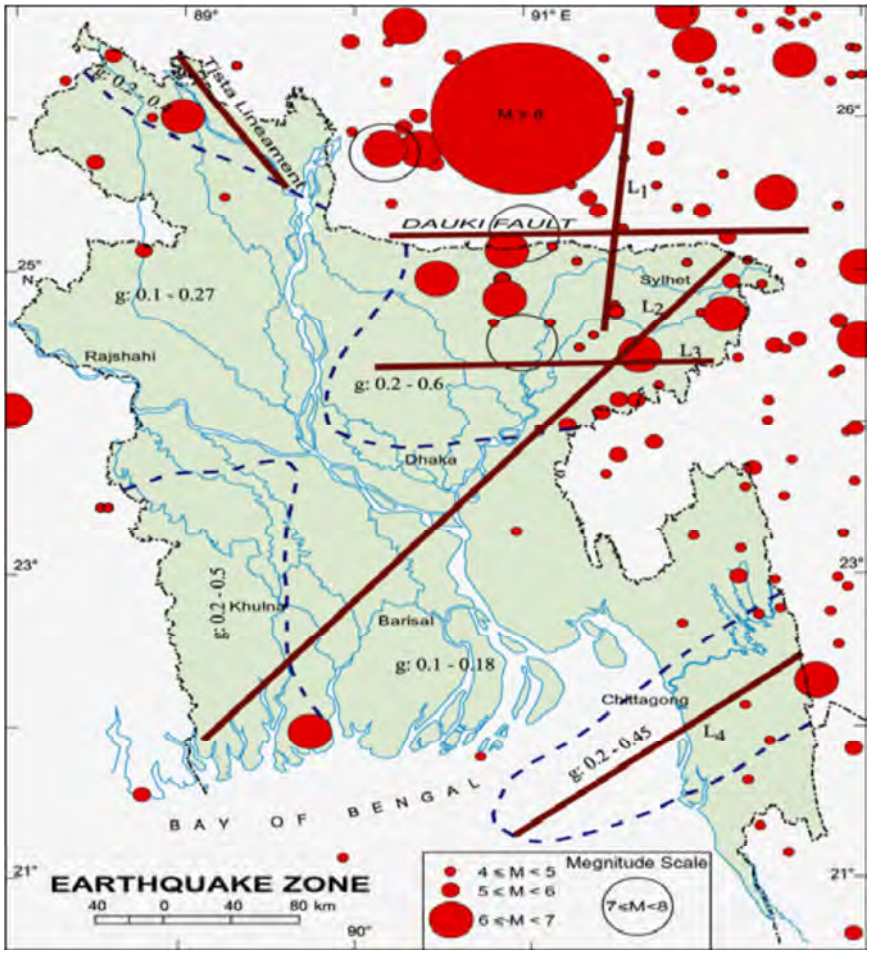


Fig. 4.10:Seismic Activity of Bangladesh

4.6 AMBIENT AIR QUALITY

Genesis of the Air Quality Monitoring Station

Major atmospheric pollution is caused by man induced activities like - burning fossil fuels, industrial processors, construction works and agriculture, transportation industry. The air monitoring study is done in order to understand the existing condition of the surrounding air.

In the rural areas however the ambient air quality is relatively good. It is assumed that accepting the small areas near the urban growth center air quality in the most of the area would be far below the Environmental Quality Standards of Bangladesh.

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality-monitoring network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- Meteorological conditions on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status; and
- Representatives of likely impact areas.

Selection of the Station and Duration

For this particular project, air monitoring has been conducted at six different locations (24 Hour Basis) and twice a week. The air monitoring study was carried out from 4th September, 2016 to 3rd December, 2016. The locations of the stations were selected in such manner so that the study points will surround the project area. The basis, on which the site selection of the air monitoring stations were set are given below:

- Wind direction of that area
- Accessibility of monitoring site
- Resource availability
- Security for the equipment

The air monitoring was started at the end of the monsoon season and ended in the begging of winter. Another air monitoring study is suggested to be conducted at the end of the winter or dry season to get an idea about the overall air quality of that area.

Description of the Stations

Ambient Air Quality Monitoring (AAQM) stations were set-up at six locations from September 2016 to December 2016 covering post monsoon season of 2016. **Table4.16** gives the location details of the selected AAQM stations with reference to the project site and shown in **Figure 4.11**.

Table 4.16: Description of the Air Monitoring Stations

Name of the Station	GPS Coordinate	Distance from the project site (km)	Direction from the project site
Pachani, MongolerGaon, Sonargaon, Narayanganj	N 23° 36' 29.81" E 90º 34' 35.21"	1.62	West
Mograpara, Sonargaon, Narayanganj	N 23º 38' 6.66" E 90º 35' 18.01"	3.12	North
Boiddarbazar, Sonargaon, Narayanganj	N 23º 39' 0.17" E 90º 37' 28.23"	5.68	North East
VatiBalaki, Hossaindi, Gazaria. Munshiganj	N 23º 35' 22.07" E 90º 34' 39.52"	2.70	South West
Jamaldi, Hossaindi, Gazaria, Munshiganj	N 23º 35' 44.03" E 90º 36' 54.72"	2.51	South East

Gowalgaon, Gazaria, Munshiganj	N 23º 34' 21.64" E 90º 35' 22.22"	3.82	South

Parameters Primary of Air Monitoring

The Air quality monitoring data has being collected for the following parameters:

- $PM_{2.5}$,
- PM_{10},
- SPM,
- SO_2,
- NOx and
- CO.

Presentation of the Primary Data

The collection of data went on for of 12weeksnear and around the proposed plant site. It shows that the ambient air quality of major three parameters SPM, NOx and SO_2, were found in different ranges. Almost all the parameters were within the national and international limitsexcept the SPM, $PM_{2.5}$ and PM_{10} crossed the national standardat 23 and 24th of November in Goal Gaon and VatiBalakimonitoring locations.It was an exception and may be occurred due to any incidental reason. The NOx is the main concern to this power project and have been measured within a range of 3-17 µg/m^3 in different locations throughout the monitoring period. The above ambient NO_x level is far below than the IFC/WB and Bangladesh standards for NO_x even after there are other 3 power projects in operation in the vicinity. Based on that we can conclude the air shed is as non-degraded nature as per IFC/WB definition. The summery of the ambient air quality have been provided in the Table below and the details have been provided in the **Annexure 8**.

Parameter (Maximum found in the study area)		**September**	**October**	**November**	**December**
$PM_{2.5}$	Pachani	21	41	46.1	43.2
	Mograpara	22.3	34.9	41.2	40.6
	Boiddarbazar	19.7	30.3	45.1	49.6
	Gowalgaon	18.3	33.5	49.8	31.7
	Jamaldi	17.0	23.6	90.2	58.4
	VatiBalaki	23.6	27.4	57.2	51.7
PM_{10}	Pachani	70.1	101.9	197	132
	Mograpara	41.7	105.3	122.9	106.9
	Boiddarbazar	63.2	72.6	94.5	118.7
	Gowalgaon	58.4	82.1	104.6	119.4
	Jamaldi	28.6	62.9	73.8	125.8
	VatiBalaki	31.8	34.5	88.2	155.4
SPM	Pachani	52.7	171.1	201.6	132
	Mograpara	62.7	173.2	120.8	106.9

	Boiddarbazar	63.2	152.0	319.5	142.6
	Gowalgaon	123.3	245.4	226	175.8
	Jamaldi	74.2	111.6	147.0	169.3
	VatiBalaki	45.8	101.4	129.0	203.2
SO_2	Pachani	7.2	13.1	9.5	4.8
	Mograpara	4.1	12.2	6.2	5.8
	Boiddarbazar	5.8	12.3	9.2	7.8
	Gowalgaon	5.6	10.1	8.7	4.8
	Jamaldi	6.8	9.0	8.6	5.4
	VatiBalaki	7.6	11.4	9.0	7.1
NO_x	Pachani	7	11.2	5.7	6.5
	Mograpara	6.2	9.4	6.3	8.2
	Boiddarbazar	6.6	15.7	7.5	7.8
	Gowalgaon	9.0	8.7	6.8	6.1
	Jamaldi	6.7	6.3	8.9	5.4
	VatiBalaki	4.8	5.1	11.9	6.3
CO	Pachani	185	177	154	172
	Mograpara	164	223	169	201
	Boiddarbazar	161	158	189	223
	Gowalgaon	181	179	164	197
	Jamaldi	175	162	196	159
	VatiBalaki	185	184	209	206

The above monitoring has been conducted for 24 hourly sampling basis which represents NO_x as 24 hr basis. But Bangladesh National Ambient air quality standard NO_x level set for annual average. As the primary data is not available throughout the year to measure at an annual basis, DOE Continuous Air Monitoring Station (CAMS) secondary data available from Narayanganj CAMS station for annual average of NOx for the following months:

Annual average of NO_x	
Month	Annual average
January, 2017	35.67
December, 2016	29.0
November, 2016	32.7
October, 2016	41.8
September, 2016	15.7
August, 2016	12.6
July, 2016	13.3

Source: The CASE project on behalf of Department of Environment, Bangladesh.

Figure 4.11: Air Monitoring Locations near the Project

4.7 NOISE

Genesis of Noise Monitoring

Being a heavy industrial area, noise pollution can be quite prominent near the project site. To test this out, noise monitoring stations were set up to assess the present noise level of the project site. After the construction, sophisticated machineries will be installed in the project area when the industries will be set up after allocation, which will produce little significant noise.

The impact of noise sources on surrounding community depends on:

- Characteristics of noise sources (instantaneous, intermittent, or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness;

- The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance; and

- The location of the noise source, with respect to noise sensitive land use, which determines the loudness and period of exposure.

It is suggested that the project authority will create necessary green belt around the project site, administrative building and other services buildings, which would reduce the noise level significantly.

Selection of the Noise Monitoring Stations

Noise monitoring stations were set up in accessible, convenient and secured position; both near the streets and the river. There were six locations surrounding the project site where noise was monitored to determine hourly equivalent noise levels. The noise sampling was done once during the study period continuously for 24 hours at the six locations, selected on the basis of the site sensitivities within the project area.

Parameters of Noise Monitoring Study

The results of the findings shall be analyzed to work out as follows:

- L_{eq} hourly,
- L_{eq} day and
- L_{eq} night.

Description of the Noise Monitoring Stations

The details of the noise monitoring stations are discussed in **Table 4.17**.

Table 4.17: Description of Noise Monitoring Station

Name of the Station	GPS Coordinate	Distance from the project site (km)	Direction from the project site	Remarks
Pachani, MongolerGaon, Sonargaon, Narayanganj	N 23°36'29.66" E 90°34'35.30"	1.62	West	Near the Road
Mograpara, Sonargaon, Narayanganj	N 23° 38' 8.93" E 90°35'41.36"	3.21	North	Near the Highway
Boiddarbazar, Sonargaon, Narayanganj	N 23°38'57.69" E 90°37'28.22"	5.74	North East	Near the Road
VatiBalaki, Hossaindi, Gazaria. Munshiganj	N 23°34'50.23" E 90°34'0.39"	3.92	South West	Near the River
Jamaldi, Hossaindi, Gazaria, Munshiganj	N 23°35'44.06" E 90°36'54.17"	2.63	South East	Near the Road
Gowalgaon, Gazaria, Munshiganj	N 23º 34 21.64 E 90º 35 22.22	3.83	South	Near the River

Findings of Noise Monitoring

The permitted noise level assigned bythe IFC/World bank is 70dBA. The Noise monitoring data of all six stations has been summarized in the Table below and the detail has been attached in **Annexure 13.**

Name of the Station	Minimum	Maximum	Average
VatiBalaki, Hossaindi, Gazaria. Munshiganj	38.6	59.4	54.6
Pachani, Sonargaon, Narayanganj	39.2	57.7	55.8
GowalGaon, Gazaria, Munshiganj.	56.1	88.4	74.8
Mograpara, Sonargaon, Narayangonj	56.9	84.8	74.8
Jamaldi, Hossaindi, Gazaria, Munshiganj	42.7	75.1	66.1

Boiddarbazar, Sonargaon, Narayangonj	39.2	75.1	67.1

In **Figure 4.12** theNoise monitoring locations are shown. The farthest monitoring at Boiddar Bazar is aerially at 5.79 km distance from the project site. The red squared area is the proposed project location and the yellow icons are the monitoring locations.

Figure 4.12: Noise Monitoring Locations near the Project

4.8 TRAFFIC STUDY

Traffic Volume

Information has been collected on trafficvolume for this project for roads near the project site by conducting traffic volume monitoring at one location and river traffic in another location. The locations are **Mograpara Bus Stop** and **Char Balaki** respectively. The traffic volume counts have been recorded continuously for 24 hours at one time during the study period to assess the existing total daily traffic, peak hour traffic and traffic composition. The full data of the traffic survey is listed in the Tables below as well as in **Annexure 11**.

Passengers Car Unit Factors in Bangladesh

Vehicle Type	PCU Factor
Car	1.0
Bus	3.0
Truck	3.0
Auto Rickshaw	0.5
Bicycle	0.3
Rickshaw	1.0
Motor Cycle	0.3
Tempo	1.0
Bullock Card	4.0

Source: Transport Research Laboratory (UK) Overseas Road Note 13

Traffic Volume Data (Road Traffic, Location: Mograpara Bus Stop)

Hours	Truck /Lorries	Truck PCU (3)	Bus Minibus	Bus PCU (3)	Car / Jeep /Microbus	Car PCU (1)	Motor-cycles /Auto rickshaw	Motorcycle/Auto PCU (.5)	Truck PCU
06:00 PM	108	324	245	735	70	70	15	7.5	1136.5
07:00 PM	105	315	40	120	40	40	15	7.5	482.5
08:00 PM	151	453	46	138	48	48	63	31.5	670.5
09:00 PM	99	297	28	84	38	38	14	7	426
10:00 PM	113	339	40	120	49	49	15	7.5	515.5
11:00 PM	190	570	26	78	43	43	11	5.5	696.5

12:00 AM	157	471	37	111	40	40	8	4	626
01:00 AM	104	312	75	225	50	50	4	2	589
02:00 AM	85	255	35	105	50	50	2	1	411
03:00 AM	99	297	60	180	40	40	3	1.5	518.5
04:00 AM	65	195	66	198	65	65	4	2	460
05:00 AM	105	315	70	210	50	50	9	4.5	579.5
06:00 AM	80	240	78	234	50	50	12	6	530
07:00 AM	76	228	68	204	95	95	19	9.5	536.5
08:00 AM	96	288	45	135	110	110	19	9.5	542.5
09:00 AM	87	261	53	159	77	77	22	11	508
10:00 AM	96	288	32	96	48	48	22	11	443
11:00 AM	115	345	72	216	53	53	42	21	635
12:00 PM	131	393	128	384	95	95	38	19	891
01:00 PM	134	402	97	291	68	68	38	19	780
02:00 PM	131	393	80	240	93	93	26	13	739
03:00 PM	108	324	97	291	66	66	16	8	689
04:00 PM	101	303	62	186	71	71	15	7.5	567.5
05:00 PM	123	369	100	300	70	70	15	7.5	746.5
Total	**2659**	**7977**	**1480**	**5040**	**1479**	**1479**	**447**	**223.5**	**14719.5**

Traffic Volume Data (River Traffic, Location: Char Balaki)

Hour	Direction	Oil Tanker	Goods Ship	Speed boat	Engine Boat	Fishing Boat	Others
01:00PM	Up		1		1	5	
	Down		1		1	3	

02:00PM	Up		4		2	5	
	Down		3		1	8	
03:00PM	Up	1	4				
	Down		2				
04:00PM	Up		2			5	
	Down		5		1	2	
05:00PM	Up		3			4	
	Down		2			3	
06:00PM	Up		2		3	2	
	Down		4			4	
07:00PM	Up		2		1	3	
	Down		1		1	2	
08:00PM	Up		1				
	Down		3				
09:00PM	Up						
	Down						
10:00PM	Up						
	Down						
11:00PM	Up						
	Down						
12:00AM	Up						
	Down						
01:00AM	Up						
	Down						
02:00AM	Up						
	Down						
03:00AM	Up						
	Down						
04:00AM	Up						
	Down					1	
05:00AM	Up	1	1		5	4	
	Down				2	3	
06:00AM	Up				4	3	
	Down				2	3	
07:00AM	Up				3	2	
	Down				1	1	
08:00AM	Up				3	2	
	Down				1	1	
09:00AM	Up		3		3	5	
	Down		5		1	4	
10:00AM	Up		1		4	3	
	Down		1		6	4	
11:00AM	Up		3		1	1	
	Down		1			1	
12:00PM	Up		2			3	

	Down		1			1	
Total		**2**	**61**		**45**	**89**	

4.9HYDROLOGY

4.9.1 River Water Flow

The flow of Meghna River at Sonargaon is less affected by tides. The maximum discharge of 16558m^3/sec was measured on 9th September 2002; while the minimum discharge of 2050m^3/sec was recorded on 10th June, 1998. The water data collected from BWDB for the period from 1998 to 2006 is attached in **Table – 4.18.**

Table 4.18: Flow at the Meghna River (m^3/s)

Year	Maximum	Minimum
1998	14669	2050
2000	12109	3197
2001	11630	3135
2002	16558	4448
2003	13229	2938
2004	10571	3742
2005	10786	3658
2006	9463	4230

Source: BWDB

4.9.2 Groundwater Hydrology

Groundwater Level

Groundwater hydrological conditions are established by the availability of developed ground water horizon everywhere, adapted to dust foams and sand lenses. The water is closely connected with the Meghna River and during flooding practically is occurred on surface.

Ground water table in major portion of Bangladesh exists at a shallow to moderate (Generally below 3.0 m) depth with confined, semi-confined and unconfined aquifers which is being recharged by major river systems and by infiltration of rain water. The ground water table fluctuates with seasons approaching near ground surface (within 1.0m) over most of the country during wet seasons (July-September).

Like other parts of the country, ground water is a stable source of water for various activities including irrigation (both shallow and deep tube wells), domestic purposes (hand pumps) and industrial applications (deep wells) in the project area. The fluctuation of ground water in the area in the dry season is lowered to about 6.0m below the ground level. However, groundwater levels return their original position before the end of monsoon. This condition is referred to as an 'aquifer full' response, where ground levels are controlled by rivers or other forms of surface drainage.

Under natural condition the ground water level reflects the wet and dry season as noticed in all the water level stations. The levels are lowest in late April or early May and rise to field capacity during the rainy season. The field capacity is then

maintained to the end of the rainy season till the dry season recession conveniences. In general, dry season use of ground water is extensive in most of the project area.

4.9.3Water Environment

Selected water quality parameters of ground and surface water resources within 10-km radius of the study area has been studied for assessing the water environment and evaluate anticipated impact of the proposed expansion. Understanding the water quality is essential in EIA studies to identify critical issues with a view to suggest appropriate mitigation measures for implementation.

The purpose of this study is to:

- Assess the water quality characteristics for critical parameters;
- Evaluate the impacts on agricultural productivity, habitat conditions, recreational resources and aesthetics in the vicinity; and
- Predict impact on water quality by this project and related activities.

4.9.3.1Surface Water Quality

The Points of Surface Water Sample Collection

To assess the existing surface water condition, numerous parameters need to be tested. During the period of conducting the study, water has been collected from 3 points; one in the upstream, one in the downstream and another near the project site where water will likely be withdrawn for power plant operation. Then the parameters were tested to assess the quality of the river water. The details of water sampling points are given below:

Name of Sampling Point	Coordinate	Temperature	Remarks
Towards the Meghna Bridge	23°36'13.30"N 90°36'25.60"E	27.5º C	Upstream **(Location 1)**
Near Project Site	23°36'11.24"N 90°35'31.78"E	27.3º C	Probable intake point of Power Plant **(Location 2)**
VatiBalaki	23°35'12.10"N 90°34'44.80"E	27.3º C	Downstream, **(Location 3)**

Findings of Surface Water Quality Assessment

The existing water quality of the Meghna Rivernear the project area seems to be really good. Three other power plants are located in the same area (Meghnaghat

Power Limited, Summit Meghnaghat Power Company Limited and Orion Power Meghnaghat Limited) as well as two cement plants which are 3km upstream of the plant viz. Holcim Cement plant and United Cement plant. In all three locations, the values of different parameters are within the limit of national and international standards.

In addition to the point sources, the discharge from non-point sources include those from engine boats, shipping (oil and grease) and run off from agricultural activities containing pesticides and chemical fertilizer residues are also drained into the river.

The water quality parameters investigated were within the Bangladesh standards. The surface water quality test of the river Meghna is shown in **Table 4.19**.

Table-4.19:Meghna River water quality

SL No	Name of Parameters	Concentration Present			DoE (Bangladesh) Standard *	IFC/World Bank Standard	Unit	Method of analysis
		Location 1	Location 2	Location 3				
1	pH	7.18	7.18	7.26	6-9	6-9	-	pH Meter
2	DO	8	8	5	4.5-8	NF	mg/L	DO meter
3	TDS	38	38	37	2100	NF	mg/L	TDS meter
4	Conductivity	19	19	18.3	NF	NF	µS/cm	Conductivity Meter
5	Alkalinity	66	66	63	NF	NF	mg/L	Standard Titrimetric method
6	Iron	0.038	0.038	0.03	2	3.5	mg/L	Colorimetric
7	Chloride	165	165	140	600	NF	mg/L	Mercuric nitrate titration
8	Hardness	117	117	125	200-500	NF	mg/L	EDTA titrimetric method
9	Color	50	72	52	15	15	Pt-Co	USEPA 110.2; SM 2120 C
10	Temperature	27.3	27.3	27.5	40	NF	^{0}C	Mercury filled thermometer
11	Arsenic	<0.003	<0.003	<0.003	0.02	NF	mg/L	AAS
12	TSS	19.5	19.5	11.2	150	50	mg/L	Dried at 103-105
13	Turbidity	18.7	18.7	9.6	NF	NF	NTU	Nephelometric
14	Salinity	<100	<100	<100	NF	NF	mg/L	Potentiometry
15	Manganese	<0.1	<0.1	<0.1	5	NF	mg/L	AAS
16	Cadmium	<0.002	<0.002	<0.002	0.50	0.1	mg/L	AAS
17	Calcium	30.2	30.2	35.5	NF	NF	mg/L	AAS
18	Chromium	<0.02	<0.02	<0.02	0.5	0.5	mg/L	AAS
19	Zinc	<0.005	<0.005	<0.005	5	1	mg/L	AAS
20	Copper	0.08	0.08	0.5	0.5	0.5	mg/L	AAS
21	Lead	<0.05	<0.05	<0.05	0.1	0.5	mg/L	AAS
22	Magnesium	46.5	46.5	23.7	NF	NF	mg/L	AAS
23	Fluoride	0.5	0.5	0.5	2	NF	mg/L	Potentiometry

24	Nitrate	5.3	5.3	9.7	10	NF	mg/L	Potentiometry
25	Sulphate	13.5	13.5	8.2	NF	NF	mg/L	Nephelometric
26	Phosphate	<0.07	<0.07	0.11	NF	NF	mg/L	Photometric
27	COD	21.8	21.8	33.2	200	250	mg/L	Open Reflux
28	BOD_5 at 20°C	7.4	7.4	12.6	50	50	mg/L	5-Day BOD test
29	TC	>160	>160	>160	0	NF	#/100 mL	Membrane Filter Technique
30	FC	52	52	62	0	NF	#/100 mL	Membrane Filter Technique
31	Mercury (Hg)	<0.0001	<0.0001	<0.0001				

Source: AECL Lab, NGO Forum, BUET& BCSIR (sample collected on 21.11.2016 and reporting on 22.11.2016)

*Standard for inland surface water.
*NF-Not Found.

4.9.3.4 Ground Water Quality

The Points of Groundwater Sample Collection

Ground water level exists at a moderate (Generally below 8.0 m) depth, which is being recharged mainly by infiltration of rainwater. According to Bangladesh Water Development Board, the ground water level of SonargaonUpazila is about 7.0 m. Ground water is the source of water for domestic use in this area. Water from underground source is assumed to be available as most of the period of the year the area remains under water. That means the recharge capacity of the ground water level seems to be adequate.

To assess the quality of that region surrounding the project site, water samples were collected from 3 locations so that the points surround the project site. The details of the sampling locations are given below and have been shown in **Fig 4-14**:

Name of Sampling Point	Coordinate	Direction from Project Site
Pachani (Location 1)	23°36'31.54"N 90°34'40.62"E	E
Mograpara(Location 2)	23°37'58.47"N 90°35'3.67"E	NW
Jamaldi(Location 3)	23°35'50.51"N 90°37'1.90"E	SW

Findings of the Groundwater Quality Test

Different parameters of the groundwater near and around the project site were tested. Water sampleswere collected from the tube wells of nearby places shown in Fig 4-11.The results of ground water quality test shows that all the parameters remain within the allowable limit of drinking water value as per as Environmental Quality Standards for Bangladesh. The parameters which have been analyzed during this study are presented below in **Table 4.20**.

Table-4.20: Ground Water quality near the Project Area

SL No.	Name of Parameters	Concentration Present			DoE (Bangladesh) Standard	IFC/World Bank Standard	Unit	Method of analysis
		Location 1	Location 2	Location 3				
1.	pH	7.05	7.04	7.16	6-9	6-9	-	pH Meter
2.	DO	5.01	5.08	5.50	4.5-8	NF	mg/L	DO meter
3.	TDS	353	386	304	2100	NF	mg/L	TDS meter
4.	Conductivity	176.2	193	151.8	NF	NF	µS/cm	Conductivity Meter
5.	Alkalinity	240	186	165	NF	NF	mg/L	Standard Titrimetric method
6.	Iron	0.06	0	0.02	2	3.5	mg/L	Colorimetric
7.	Chloride	120	130	125	600	NF	mg/L	Mercuric nitrate titration
8.	Hardness	240	198	220	200-500	NF	mg/L	EDTA titrimetric method
9.	Temperature	25.8	25.8	25.8	40	NF	^{0}C	Mercury filled thermometer
10	Arsenic	0.047	0.006	0.017	0.02	NF	mg/L	AAS
11.	TSS	8	6.5	5.5	150	50	mg/L	Dried at 103-105
12.	Turbidity	5.9	4.9	1.8	NF	NF	NTU	Nephelometric
13.	Salinity	400	400	300	NF	NF	mg/L	Potentiometry
14.	Manganese	0.2	0.1	<0.1	5	NF	mg/L	AAS
15.	Cadmium	<0.002	<0.002	<0.002	0.50	0.1	mg/L	AAS
16.	Calcium	85.3	87.5	78	NF	NF	mg/L	AAS
17.	Chromium	<0.02	<0.02	<0.02	0.5	0.5	mg/L	AAS
18.	Zinc	<0.005	<0.005	<0.005	5	1	mg/L	AAS
19.	Copper	0.01	<0.01	<0.01	0.5	0.5	mg/L	AAS
20.	Lead	<0.05	<0.05	<0.05	0.1	0.5	mg/L	AAS
21.	Magnesium	96.5	109.2	88.3	NF	NF	mg/L	AAS
22.	Fluoride	<1	<1	<1	2	NF	mg/L	Potentiometry
23.	Nitrate	14.5	3.5	2.2	10	NF	mg/L	Potentiometry
24.	Sulphate	25.1	9.6	9.4	NF	NF	mg/L	Nephelometric

25.	Phosphate	0.28	<0.07	<0.07	NF	NF	mg/L	Photometric
26.	COD	5.6	5.8	8.3	200	250	mg/L	Open Reflux
27.	BOD_5 at 20^oC	2.3	1.7	3.7	50	50	mg/L	5-Day BOD test
28.	TC	14	4	14	0	NF	#/100 mL	Membrane Filter Technique
29.	FC	0	0	1	0	NF	#/100 mL	Membrane Filter Technique

Source: AECL Lab, NGO Forum & BCSIR (sample collected on 21.11.2016 and reporting on 22.11.2016)
*NF-Not Found.

Fig 4.13: Water Sampling Points

4.10 BIOLOGICAL RESOURCES

4.10.1 THE FAUNA

The variety of life on Earth, its biological diversity is commonly referred to as biodiversity. The number of species of plants and animals, the enormous diversity of genes in these species, the different ecosystems on the planet is all part of a biologically diverse Earth. It represents the wealth of biological resources available to us. Humans cannot breathe unless both flora and fauna survive and thrive on the earth. Fauna is a significant part of the ecosystem. All the animals are connected in one way or another, mainly through food chains. As the usage of the land is getting more and more intensive throughout the country, there is a threat for natural habitat to vanish, also many populations of different species has declined. Some of the animal populations that have been abundant earlier now are vanishing or are almost disappeared. For the reasons, conservation of global biodiversity has become the issue of prime importance in recent decades (Turner *et al*., 1990; Ehrlich and Wilson, 1991). Conservationists around the globe are battling with conservation challenges under the ever accelerating threats of anthropogenic disturbances to biodiversity. Bangladesh has realm number of biological diversity for its geographical location and favorable climatic condition for life. Biodiversity is facing unprecedented levels of threat due to unwise industrialization. For the reasons, It has become imperative to assay diversity prior to any big set up.

Understanding biological diversity in terms of the processes by which ecosystems and their components function, be it at community, species, population or genetic levels, is critical to informing its sustainable use and safeguarding it for the benefit of future generations. Sustainable ecosystem and sustainable development is intensely interrelated (**Fig. 4.14**).

Identifying and monitoring biological diversity is a huge and potentially infinite task given its variability in time and space and its spectrum of levels. Biodiversity estimation applying short span studies are becoming ever popular and in this regard preparation of checklists of birds on a wider scale has been given much importance (Roy *et al*., 2011). The reliance Group of Bangladesh is planning to construct a 750 MW Combined Cycle Power Plant at Meghnaghat, Sonargaon, Narayanganj. The GPS position of the site is 23036’25.56’N, $90^0$35’32.16”E. A rapid faunal diversity

assessment was carried out at different locations of the proposed site to get idea about the biodiversity of the area. Though, the short study does not reflect complete biodiversity of that area. Detail investigation is necessary to have a complete list.

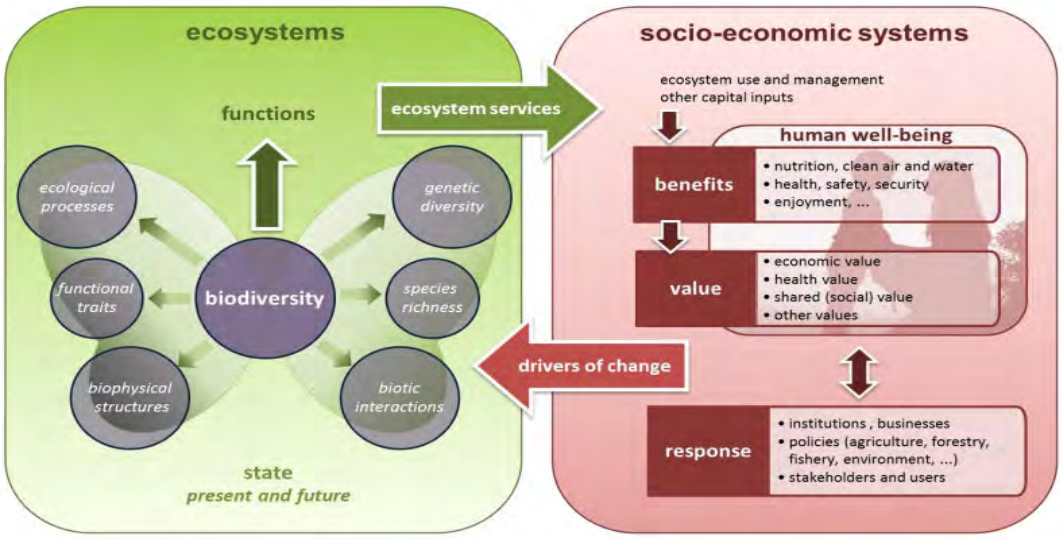


Figure4.14: Conceptual framework for ecosystem assessment

Indicator species assessment of different biotypes and habitats has been used as tools to assess the biological health of habitats. They are also considered model organisms to assess the effects of global climate change. We made a quick survey on some bioindicator species viz, Odonate, Butterfly, Mollusc, Plankton, Fish and Avifauna. Diversity of these indicator species will give an idea about the health of that specific area.

INDUSTRIALIZATION IN THE STUDY AREA

We cannot avoid demand of industrialization for the better development of the country. But careful decision should be taken prior to any new set up. If any such set up create threat to the biodiversity, country development would not be sustainable. Fisherman of the river near study area informed that they can catch lesser quantity of fish from the river nowadays than they used to years before the industrialization of the area. There are some industries already existed near the study are. Such industries should be very careful for their effluent and byproduct.

Plate 1: Industry near study area

Plate 2: Industry near study area

Plate 3: Dust coming out from an industry made shade over the industry building, may also be harmful for all biodiversity

Plate 4: Making carrier ship near the bank of river

Plate 5: Water coming out from an industry

Plate 6: Carrier vessel in the river

Plate 7: Carrier vessel in the river

Methods of sample collection

A comprehensive survey was conducted at the vicinity of proposed Reliance Meghnaghat 750 MW CCPP on December 2, 2016 to get an idea about the status of the diversity of animals in that area. Water samples of the river were collected from all the TWO locations around the proposed power plant. Different physical parameters of thewater samples were checked and recorded. Phytoplankton and Zooplankton nets were used to collect different types of planktons available in each type of water sample. Different types of fishes, macro and micro-invertebrates were collected from each of the location. Several types of fishing nets were utilized for this purpose. To get an idea about the biodiversity of each location, water samples were collected around 40 meter radius of each sampling location. The collected specimens were identified instantly or brought to the laboratory for further confirmation. Proper keys, Journals, books and encyclopedia were consulted for identification of the collected specimens. Fishermen were interviewed to get an idea about the present status and past records of the availability and abundance of fish population of the river. Fish sellers of the local fish market were also interviewed to collect their opinion about the present and past status of the abundance of fishes in the area.

For phytoplankton and Zooplankton survey 10 lit of water (two liters each time) was collected from each sampling location and was sieved by plankton net. 45 ml of sieved water was collected in a 50 ml Falcon tube. Then 5 ml of alcohol was added in each Falcon tube as preservative so that the microorganisms are not damaged before identification, in this way 5 samples were collected from each sampling location 1 ml of water from each 50 ml sample was studied in a “rafter cell counter” under microscope.

Observations

Huge number of floating water hyacinth was trapped by the local people. They use bamboo poles for trapping. They use this place to attract different kinds of fishes as shelter place. Fishermen encircle this area after every 15-20 days with nets and capture fish. During interview with the local people, they informed that during each fishing huge quantity of different kinds of fishes are captured. Water quality includes various physical and biological parameters which has direct influence on the aquatic organisms and vegetation. Abundance of fishes and their growth are dependent on the quality of water and availability of food. Few physical parameters of water samples of each sampling location examined and presented in Table 1:

Plate: 8

Plate: 9

Plate: 10

Plate: 11

Plate: 12

Plate: 13

Plate: Showing different sampling locations and collection of samples

FINDINGS

Odonates found during the survey are recorded in the following tables:

Sl. No.	Common Name	Scientific name
1.	Coral Tailed Cloud Wing	*Tholymistillarga*
2.	Skimmer	*Rhodothemisrufa*
3.	Wandering Glider	*Pantalaflavescens*
4.	Green Marsh Hawk	*Orthetrumsabina*
5.	Fulvous Forest Skimmer	*Neurothemisfulvia*
6.	Ruddy Marsh Skimmer	*Crocothemisservilia*
7.	Ditch Jewel	*Brachythemiscontaminata*
8.	Common Clubtail	Ictinogomphusrapax

Table: List of fish fauna recorded during the survey as mentioned by the local people and fishermen

Common English name	Local Name	Scientific Name	Abundance
Rohu	Rui	*Labeorohita*	+
Catla	Katla	*Catlacatla*	+
Black Rohu	Kalibaush	*Labeocalbasu*	+
Freshwater Shark	Boal	*Wallagoattu*	+
Long-whiskered Catfish	Ayre	*Sperataaor*	+
Tire-track Spiny Eel	Bain	*Mastacembelusarmatus*	+
Humped Featherback	Chital	*Chitalachitala*	+
Dwarf Chamelonfish	Meni	*Badisbadis*	+
Dwarf Catfish	Batashi	*Batasiotengana*	+
Pama Croaker	Poa	*Otolithoidespama*	+
River Shad	Ilish	*Tenulosailisha*	+
GangeticHairfin	Fasha	*Setipinnaphasa*	+
SilondiaVacha	Shilong	*Siloniasilondia*	+
BatchwaVacha	Bacha	*EutropiichthysVacha*	+
GangeticLotia	Kala Bata	*Crossocheiluslatius*	+
Ghora-chela	Ghora Chela	*Securiculagora*	+

The details finding of the Ecological fauna has been given in the **Annexure 15**.

4.10.2 THE FLORA

The first phase, a 750 MW power plant, will be set up on 35 Acres of land at Meghnaghat (Sonargaon, Narayanganj district), around 40 km south east (GPS coordinate 23º36'25.56˝N, 90º35'32.16") of Dhaka, along with the FSRU (floating storage and re-gasification unit) terminal at Maheshkhali Island in Cox's Bazar district of Bangladesh. The water requirement will be 1076 m^3/hr and quantity of discharged water will be about 206 m^3/hr. Both procurement source and discharge site will be the Meghna River.

Methodology

The present baseline ecological survey was conducted during December 2016. The basic methodological approaches which were followed for the present baseline work are-

- Field survey,
- Site selection for sampling,
- Plant samples collection,
- Identification of plant samples,
- Data analysis and interpretation.

Field survey

A comprehensive field survey was conducted almost throughout the designated sites of the proposed power plant areas at Reliance Meghnaghat 750 MW CCPP area during December 2016.

Site selection for sampling

All types of ecological habitats like aquatic/wetland, cultivated land, fallow land, homestead area, road side, forest area and salt/shrimp culture area etc. of the designated sites/locations within 2 km radius of the project area were selected for sampling of both qualitative and quantitative data collection.

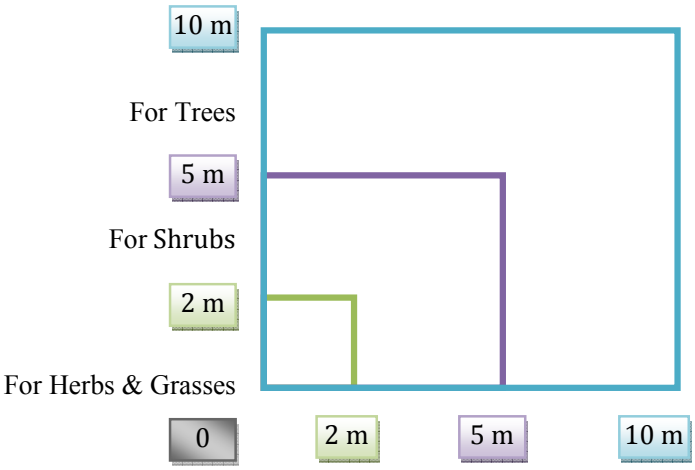


Figure 4.15: Quadrat size applied for quantitative analysis of different categories of plants.

Plant samples collection

Plant samples of different species, observed in the visited sites were collected following standard quadrat method (Braun-Blanquet, 1932; Raunkiaer, 1934). The quadrat size- 2m×2m for herbs and grasses, 5m×5m for shrubs and 10m×10m for trees were standardized on the basis of species-area-curve method (Cain, 1938).

Identification of plant samples

All the collected plant specimens found in the selected sites of Proposed Power Plant area was identified by taxonomic expertise and through cross-checking with herbarium specimens preserved at BNH/JUH and also matching the taxonomic description, keys or the photographs/illustrations in the relevant literatures, especially the recent Floras and Manuals of Hooker, 1872-1897; Prain, 1903; Khan, 1972-1987; Khan andHalim, 1987; Siddiqui, 2007a, b; Ahmed, 2008a,b, c, d; 2009a,b etc.

In each selected sites/location, ten quadrats were randomly applied in diversified habitats. Collected plant samples were processing and preparation of herbarium sheets following standard herbarium techniques (Jain and Rao, 1977).

Data analysis and interpretation

Abundance and Frequency of the recorded species was determined by using formulae described as Shukla and Chandal (1993), and Verma and Agarwal (1986).

Abundance: No. of individuals per quadrat of occurrence.

$$A = \frac{\text{Total no. of individuals of a species in all the quadrats}}{\text{Total no. of quadrats in which the species occurred}}$$

Frequency: This is described as the % of quadrats occupied by a given species.

$$F\,(\%) = \frac{\text{Total no. of quadrats in which the species occurred}}{\text{Total no. of quadrats studied}} \times 100$$

According to the values of abundance as well as frequency, the recorded plant species were recognized and categorized as their existing status following DAFOR scale (described as Shukla and Chandal, 1993; and Kent and Coker, 1992).

The categorization of threatened plant species in this project has followed the IUCN Red List categories, where the species are classified in nine groups based on the criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation. Each of these groups has been defined according to the followings:

1. **Extinct** (EX): No individuals remaining.
2. **Extinct in the Wild** (EW): Known only to survive in captivity, or as a naturalized population outside its historic range.
3. **Critically Endangered** (CR): Extremely high risk of extinction in the wild.
4. **Endangered** (EN): Very high risk of extinction in the wild.
5. **Vulnerable** (VU): High risk of extinction in the wild.
6. **Near Threatened** (NT): Likely to become endangered in the near future.
7. **Least Concern** (LC): Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
8. **Data Deficient** (DD): Not enough data to make an assessment of its risk of extinction.

9. **Not Evaluated** (NE): Has not yet been evaluated against the criteria.

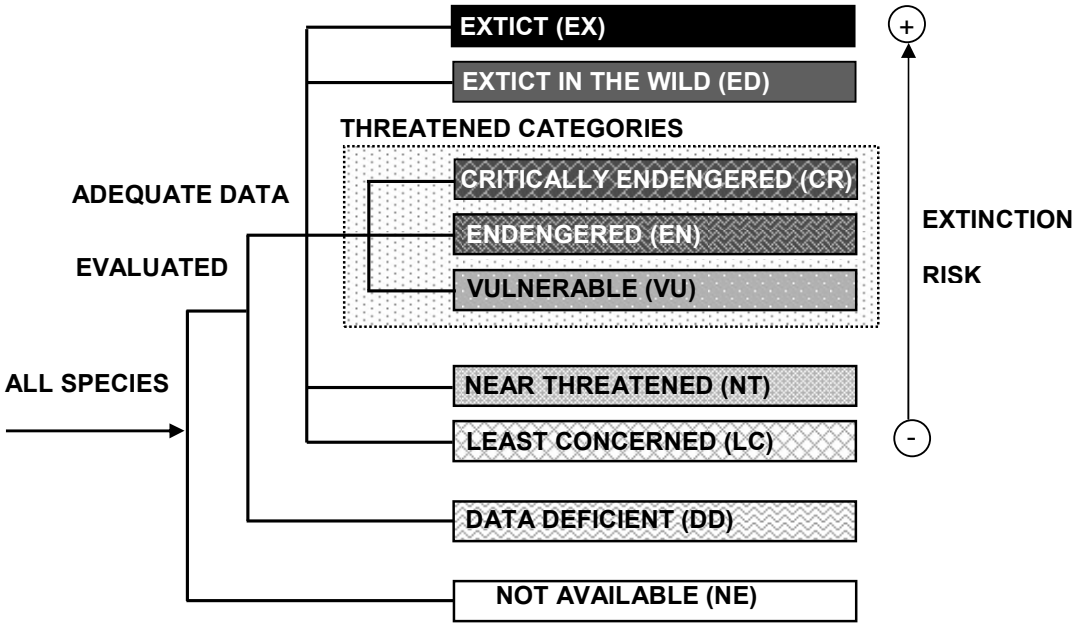
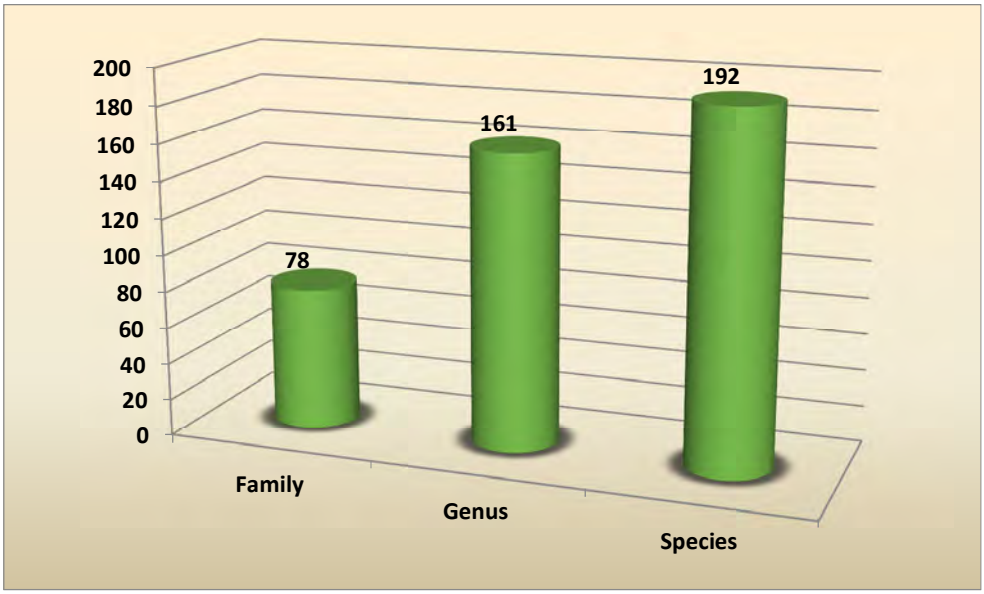


Figure 4.16: Correlation of IUCN Red List categories based on the extent of extinction risk.

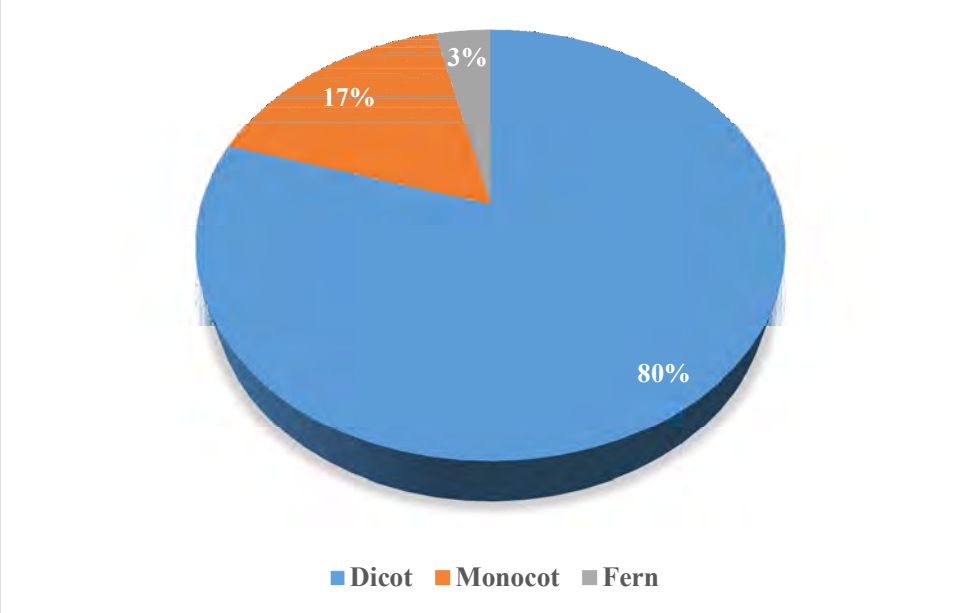
Observations

A total of 192 vascular plant species belonging to 161genera under 78 families have been recorded from the proposed LNG-based power plant area (Table 1 and Figure 3) where the maximum 153 (80%) plant species belonged to the dicotyledonous group, followed by 32 (17%) and 7 (3%) plant species belonged to the monocotyledonous and pteridophytes (ferns) groups, respectively (Figure 4).

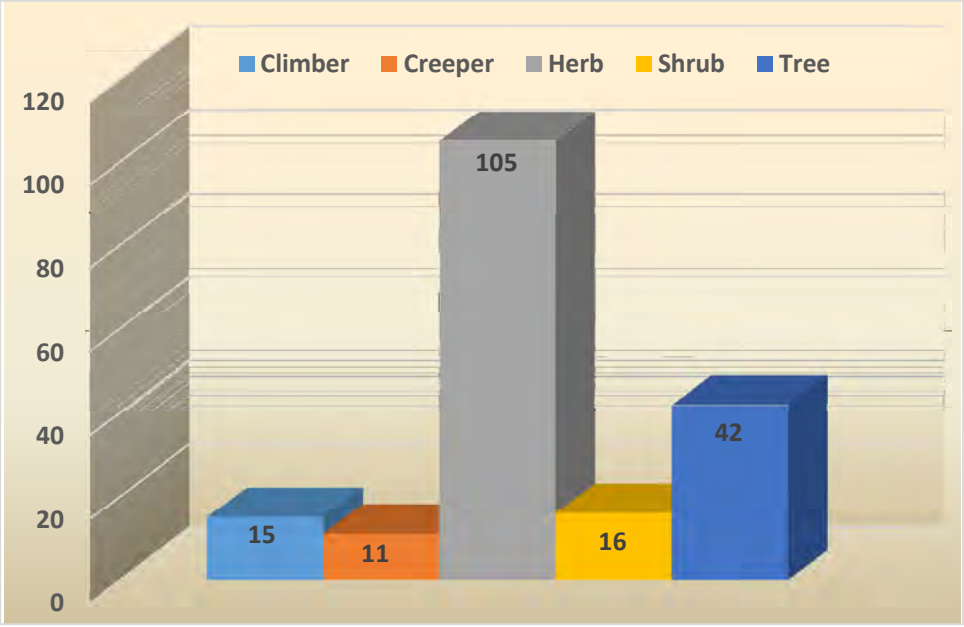
Among the habit categories, the highest number of species 105 (54.69%) were herbs, followed by 42 (21.88%), 16 (8.33%) and 15 (7.81%) species were trees, shrubs and climbers, respectively whereas the lowest number of plant species 11 (5.73%) were recorded as creeper (Figure 5).



Species composition of the the proposed LNG-based power plant area.

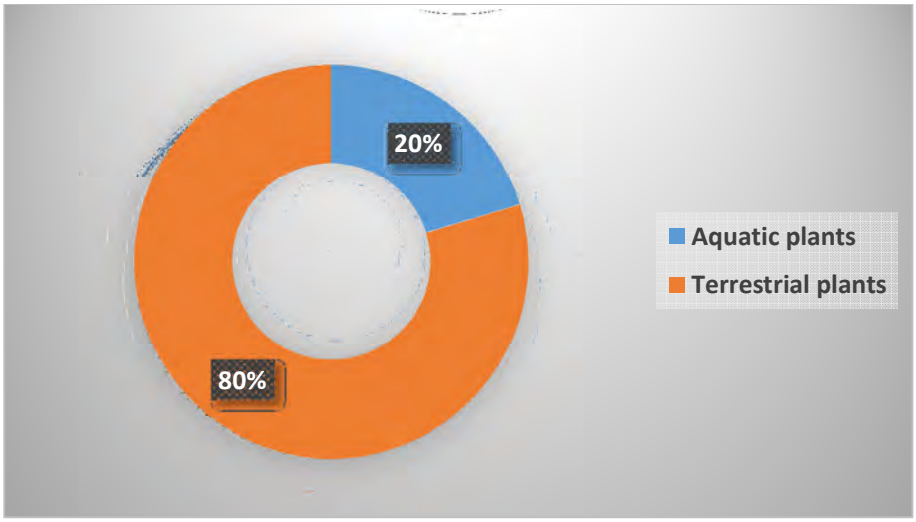


Cotyledonary status of the recorded plant species in the proposed LNG-based power plant area.



Habit categories of the recorded plant species of the present power plant sites.

From the present study, out of 192 recorded plant species, terrestrial habitats represent 153 (79.69%) species whereas the aquatic /or wetland habitats harbored 39 (20.31%) species in the present power plant project sites (Figure 6).



Habitat categories of the recorded plant species of the present power plant sites.

The observation infers that in this area Kalmi Leaves, Patajahangi, Lota Tree and Notey are rare, occasional, abundant & dominant flora species respectively.

The detailed findings of the aquatic flora have been given in the **Annexure 16**.

4.11 SOCIOECONOMIC BASELINE DESCRIPTION

The project area is an industrial site beside and adjacent to the Dhaka Chittagong highway and is surrounded by Meghna River in the north, west and south direction. Economically the area is very active. The River Meghna is the main navigation route near the project site which connects Dhaka with north eastern region of the country via Sonargaon river ports .Different types of commodities including quarry, cementand paddy etc. are carried through the river route. So cargo vessel is seen frequently in the river.

Other than the industrial site, remaining areas are low lying agricultural land. Southern part of the project site across the Meghna River is under GazariaUpazila of Munshiganj district and east part is under SonargaonUpazila of Narayanganj district. The project is located in MeghnaghatMouza of NarayanganjUpazila. Bangladesh UK Friendship Bridge across the river Meghna (Meghna Bridge) connects both the banks of Soanrgaon and Gazaria. The Bridge lies on the Dhaka Chittagong Highway. The project site locates in the North West direction of the highway. Beside the project site, there other power plants are located namely Meghnaghat Combined Cycle Power Plant (450 MW), Summit Meghnaghat Power Company Ltd. (335 MW) and Orion Power Meghnaghat Power Plant (100MW). On both banks there are residential areas. During monsoon low lying paddy field is submerged by the flood water. Boro crop is the main crop in the dry season.

4.11.1 Population and Demography

Population and demographic characteristics of the Zila, 4 Upazilas and nearby Zila Munshiganj in the study area have been presented in **Table 4.21 & 4.22.** The table shows that the population density per/sq. km. varies significantly among the different Upazilas and Zila/districts. Population and demographic profiles of the concerned unions have been presented Union and Upazila wise in **Tables 4.32 and Table 4.33.**

Table 4.21: Population and demographic characteristics surrounding the project area (Zila, Upazilas and Paurashavas)

Sl	Population Characteristics	Narayanganj District	Narayanganj Sadar Upazila	*Sonargaon Upazila	Araihazar Upazila	RupganjUpazila	Munshiganj District
1	Total Area (Sq.km.)	683.14	100.75	171.66	183.5	247.97	954
2	Total Household	675652	313312	89565	77462	122140	313258
3	Total Population -	2948217	1323600	400358	376550	534868	1445660
	Male - Female	1521438	690641	204438	188324	279544	721552
		1426779	632959	195920	188226	255324	724108
5	Household Size	4.3	4.2	4.4	4.8	4.4	4.6
	-Rural	4.4	4.2	4.4	4.8	4.6	4.6
	-Urban	4.2	4.3	4.4	4.7	4.0	4.5
6	Literacy Rate %	57.1	62.7	54.6	41.0	54.8	56.1
	(7 years+) -Male -	59.5	65.3	56.7	42.1	57.5	56.4
	Female	54.6	60.0	52.5	39.8	51.9	55.7
7	Sex Ratio	107	109	104	100	109	100
8	Total Mouza	785	56	351	182	144	642
9	Total Village	1342	132	487	317	285	911
10	Total Union	47	10	11	12	9	67
11	Total Upazila	5	1	1	1	1	6
12	Pourashava	2	1	-	-	-	2

Source: Population Census 2011

Table 4.22: Population and demographic characteristics surrounding the project areaunions of Sonargaon

Sonargaon Upazila					
SL	**Population Characteristics**	***Pirojpur**	***Mugra Para**	**Shambhupura**	**Baidyer Bazar**
1	Total Area (Acres)	4239	2089	3859	2251
2	Total Household	9917	7736	5967	4802
3	Total Population-Male - Female	45440 24707 20733	33506 17299 16207	23035 11658 11377	17523 8166 9357
4	Sex Ratio	119	107	96	102
5	Household Size	4.5	4.3	4.5	4.8
6	Literacy Rate % (7 years +)	55.0	60.5	53.5	41.8

Source: Population Census 2011

4.11.2 Population

As per Population Census 2011, population and other relevant information are as follows (**Table 4.23**).

Table 4.23: Population of the Project Upazila

Upazila	Area (km_2)	Total Household (No)	Population (No)	Male (No)	Female (No)	Literacy7+ (%)
Sonargaon	171.66	89565	400358	204438	195920	54.6

The above Table shows that there are (104) males compared to 100 females. Sex Ratio (2001, BBS) in the Dhaka district is 109.5. But the ratio is different in the urban area, namely, 121.9 and the same in the rural area it is 103.6.
Density of population of Narayanganj district is 4308 per square km.

4.11.3 Religion

Religious feature of the manpower are presented in **Table 4.24**. The community is predominantly Muslim.

Table 4.24: Type of Religion of the sample households Sonargaon Upazila Adjacent to Project Area

Upazila	Total H.H	Muslim	Hindu	Buddhists	Christian	Others
Sonargaon	Sonargaon	3,85,539	14,484	67	235	33

Source: census 2011

From the above Upazilla records shows that in Sonargaon 96.3% are Muslim and rest are mainly Hindu communities in the sample area mainly Muslims are residing. Hindu communities are very minor.

4.11.4Housing Pattern and Ownership

In the project area maximum people live on their own houses but a few in rented houses. As more urbanization more households will reside in the rented house in future. The area is a semi urban area; moreover, it has also a rural character. Most people live in inherited land. **Table-4.25** below shows the pattern of the ownership of residence.

Table 4.25Main house of the dwelling household by type of structure

Upazla	Jhupri (thatched)	Kutcha	Semi Pucca	Pucca
Sonargaon	0.4%	63.7%	22.6%	13.4%

Source: census 2011

4.11.5Access to Health Facilities

There are government Health complex in the Upazila. Health centers can be found abundantly and the proximity is pretty convenient.There are 1Upazila health complex, 11 health and family planning centers, 3 satellite clinics, and 10 clinics.

Main diseases are waterborne diseases via diarrhea, dysentery, typhoid and sexually transmitted disease (STD). Also Acute Respiratory Infection (ARI) is predominantly seen in the area. The STD is of abundance due to migratory people and workers in the area.

4.11.6 Source of Drinking Water and Sanitation

As reported by DPHE, SonargaonUpazila has attained 100% sanitation coverage. Total sanitary latrine is 1722. No of total TW is 1539. On average 17.35 households fetch water from a single Tube well. There is no water supply system in the study site. The people are dependent on tube well water for drinking purpose. But the workers, employees and residents of the plant residential areas use treated water from the water treatment plant of RBLPL. No tube well is placed within the 100 meters of the project area.

Sanitation practice is very important for a community. It is a part of social behavior to use soap after toilet use. Earlier it is mentioned that the area has both urban and rural character. **Table-4.26&4.27** above shows the sanitation coverage in SonargaonUpazila. Sanitary latrine coverage was 38.19% of the households in SonargaonUpazila. But present situation has been drastically improved. Sonargaon is at present under 100% sanitation coverage.

Table- 4.26 Access of Drinking Water

Upazila	Household%	Tap%	TW%	Pond%	Others%
Sonargaon	89565	2.03	93.36	0.60	4

Source: BBS,Census 2011

Table- 4.27 Access of sanitary Latrine in percentage

Upazila	Sanitary Latrine	Non Sanitary Latrine	No latrine
Sonargaon	38.19% 42.03% (urban) 38.13% (rural)	57.21% 57.24%(Rural) 55.30% (Urban)	4.60%

Source: BBS,Census 2011

4.11.7 Literacy

Education rate is rapidly increasing in the project area. According to the Upazila education office, about 90% enrollments are in the SonargaonUpazila. Current year, 25,000 students have been new enrollment in the primary schools excluding kindergarten School. The Number of household in the Upazila is 89,565 (Census2011), that means almost from each family one student is enrolled in the primary classes except ultra-poor family of the Upazila.

According to BBS 2001 census in SonargaonUpazila the literacy rate for both sexes is 54.6%, for male is 56.7% and for female is 52.5%. So it is assumed that near plant site education rate is high to some extent, roughly 65%. Education rate is also increasing among the female.

Table: 4.28 Rate of literacy for male and Female

Upazila	Both	Male	Female
Soanrgaon	54.6%	56.7%	52.5%

Source: BBS,Census 2011

The above **Table-4.28** shows that, literacy rate is 54.6% in the project area for 7+ populations in SonargaonUpazila.

4.11.8Electricity Facility

In the project area nearly 99% the households have electricity connection. The area may be considered as largely dependent on electricity due to growing business in the area .**Table 4.29** verifies this statement.

Table 4.29Electricity Facility

Area (Upazila Basis)	Electricity Facility Available in Household (No)
Sonargaon	77.63%

Source: BBS, 2011 census

4.11.9Occupational Pattern

Table 4.30 below gives present and previous situation of the occupational pattern of the people living in the study area. In Table reveals that in Sonargaon, farming is decreasing as occupation. At present farming as occupation is 25.95% at Sonargaon of total households. Pirojpur Union have urban characteristic but some partis predominantly rural. Agriculture activities and business are the main occupation of the area.

Table 4.30Occupational Patterns of the Households of Sonargaon Upazilla

Occupation	(%) of Total
Agriculture	25.95
Industry	4.27
Commerce	23.74
Non -Agricultural	2.60
Transport and communication	4.51
Service	20.31
Construction	1.61
Overseas Work	4.68
Religious service	0.31
Others	3
Total	100

Source: BBS, 2011 census

4.11.9.1 Fishing

Meghna River is enriched with different kinds of fishes and many people around the area depend on fishing across Meghna River for their living. The river Meghna is flowing beside the project area. Production of cultured fish is 250kg/Acre (0.25 metric ton) and open water fish production is 500 kg/Acre (0.5 ton.). Major fish varieties are Ruhi, Katla, Taki, Kai, Magur, Singhi and Boal etc. Kai and Singhi are nearly extinct varieties. And rare fishes like River Pangas, Rani, Raia, Mahashail and Lacho fish are totally extinct varieties.
Three kinds of fishermen can be found in that area.

- Recreational/Amateur: These fishermen catch fish for recreation or just to have one or two meal. They don't depend on fishing for their living.
- Intermittent: These fishermen catch fish as a part time profession to add a little in their overall income.

- Professional: These fishermen catch fish almost everyday and their livelihood depends on it. Fishing is considered to be their main source of income.

At present, there is some professional fishing community or fisherman across the river of the project. There are no specific data available of their exact numbers but according to fishermen, around 40-50 fishermen families live in Charbalaki and nearly 150 fishermen fish around the area. During monsoon season, some people catch fishes in the Upper Meghna River Fish is an important resource of the area.

4.11.9.2 Agriculture

The area is low- lying especially Sonargaon portion. Main crops grown in the study area are Aus, Aman and Boro. The paddy is grown in the main three seasons of the year. Besides these, potatoes, sweet potatoes, oil seeds, vegetables, arum, til (sesame), wheat, sugarcane, mustard, bottle gourd etc. are cultivated in the study area. Fruits like, jackfruit, lemon, watermelon are also produced. Further information will be collected on a later date and in details.

4.11.9.3 Cow Grazing

There are no professional cow farms owners in the area but people keep a few numbers of cows in their home as a part time income source. Most of the cow owners work in various industries near the project site and keep cows as a source of additional income. These cows graze near the project site and will find another grazing ground after the completion of the project as the number of cows is very few (25-30).

Fig 4-17: Grazing Activities near the Project Site

The project site, to this day, is used by local cow owners although not allocated by any branch of the government. After the completion of the construction of this

project, plenty of empty filed will still be left near and adjacent to the project site. The local dwellers are supposed to graze their cows in those areas as the number of cows is very few.

4.11.10 Archeological, Cultural Heritage and Religious Site

No known remarkable archeological or historically important structure or sites are reported in the survey area. But at about six to seven kilometer distance from the project site, the historical Panam City is situated. However, there will not be any impact on this historic archeological site due to the project. The probability of finding significant cultural resources in the designated areas is low. Any impacts that may occur as a result of the project would be in future and the overall severity of impact will be low.

There are few other historically significant places situated in the Sonargaon Upazila namely Single domed mosque built by JalaluddinFatheh Shah, Tomb of Sultan GhiyasuddinAzam Shah, single domed mosque built by AlauddinHussain Shah, Tomb of Shah Langar, PanchPirDargah, grand trunk road, Khasnagardighi, Company Kuthi, Yusufganj mosque, Goaldi mosque andLangalband (holy bathing spot). None of these places are close enough to be adversely affected by the project.

There are only few sites of significant archaeological value or sites of tourist interest in and around the survey area. However, people from all over the country usually visit the area but the commercial tourism is not yet developed. A map of the religiously, archaeologically and historically important places is shown in **Fig 4-18**.

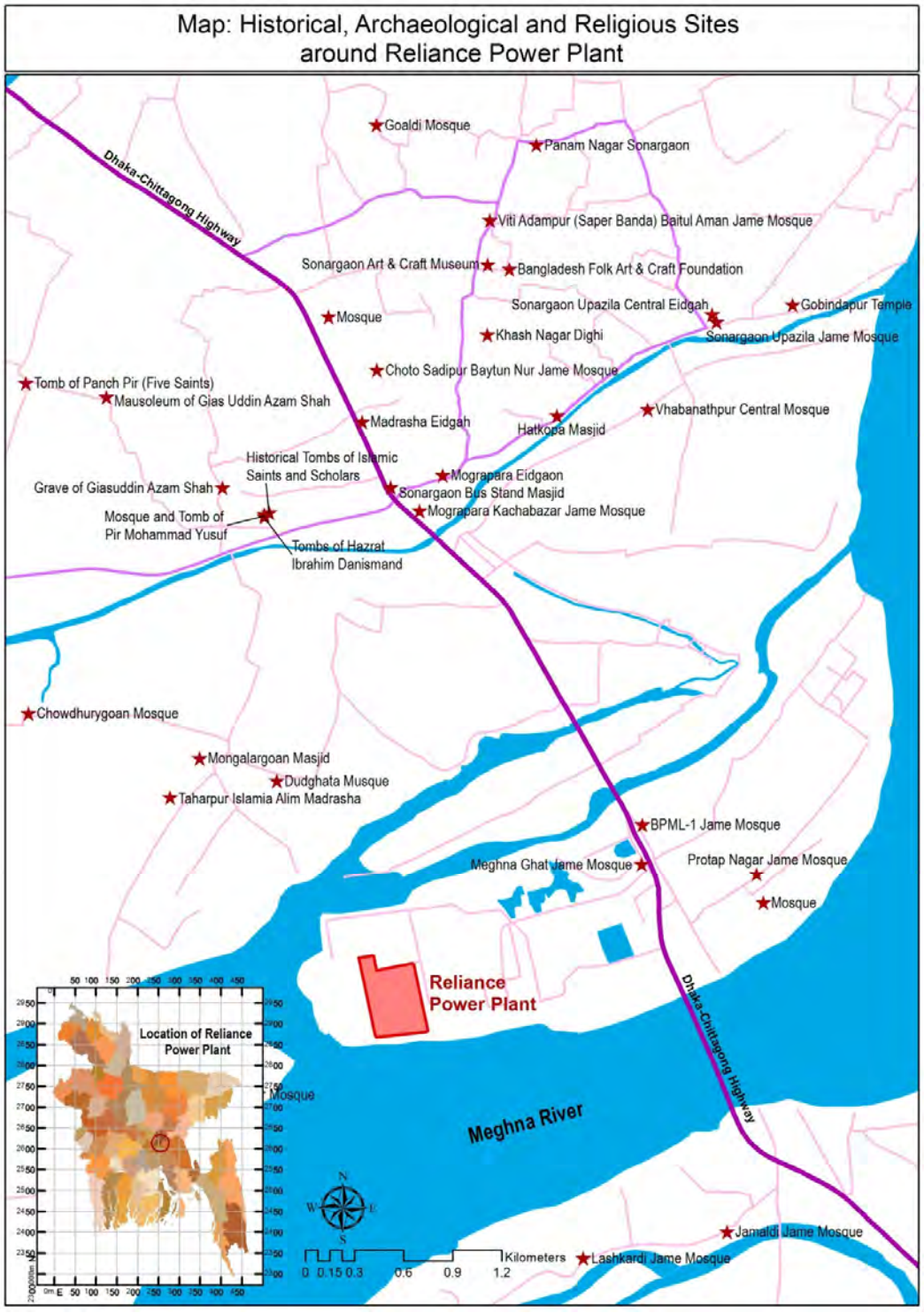


Figure 4-18: Map of Historical, Archaeological and Religious Sites around the project Site

4.11.11 Industry

Now Narayanganj and especially Sonargaon is an industrial zone. There are already three power plants adjacent to the project area namely Meghnaghat Power Limited, Summit Meghnaghat Power Company Limited (SMPCL) and Orion Power Meghnaghat Power Plant (OPML). Within three kilometer radius of this project, there are shipyards, 3 cement plants, a print and packaging industry to name a few. Manychatal (rice husking mills) are found in this bank of the Meghna River. So, many local workers are getting employment in the chatal for husking rice. And most of them are female workers. Across the river from the project site, there are many more industries, e.g. shipbuilding industry, chemical factory, refinery etc. making the area around the project industrially significant at a highest level.

4.11.12 NGO Activities

Different NGOs are working in the area. Name of the major NGOs are ASA, BRAC, Grameen Bank,Proshika,ThengamaraMahilaSabujSangha, Uddipan and Disa etc.

CHAPTER FIVE: IDENTIFICATION OF POTENTIAL IMPACTS

5.1 GENERAL CONSIDERATIONS

In case for most industrial projects, potential negative impacts sometime could be far more numerous than beneficial impacts. The regional and national economic benefits associated with the implementation of any development project are considered to fall outside the scope of an ESIA, and therefore not considered here. However, it is generally expected that these long-term benefits will ultimately trickle down to the local population and will make a contribution to an improvement in the quality of life.

Likewise, the indirect benefits of strengthening of technical capabilities of local persons through association with foreign experts and other training elements that may form part of a project have been considered to fall outside the scope of ESIA.

5.2 SCOPING OF IMPACTS

The potential impacts due to implementation of Project are identified by using simple checklists. This method is described below:

5.2.1 Checklist

Checklist is comprehensive lists of environmental effects and impacts indicator designed to stimulate the analysts to think broadly about possible consequences of contemplated actions (Munn, 1979). **Table 5.1** represents the checklists developed for the present plant. In this checklist, actions, which may affect at the various stages of the project activities, are listed and the degrees of Significant Environmental Impacts (SEIs) are shown. The terms none, minor, moderate and major are used in the checklists to evaluate the magnitude of SEIs. In the checklist, both the construction and operational phases of the proposed development are considered separately in order to distinguish the short term and long-term impacts. As can be observed from the checklists, major environmental components, which will be adversely affected by activities of the project, are air quality, water quality and socio-economic environment. All these impacts will arise in operation phase of the project. It should be noted that identification indicated in the Checklist relates to the significant level of impact.

Table 5.1 Impact Identification Checklist for Proposed Power Project

Project Phase	Action Affecting Environmental Resources & Values	SEIs without Mitigation Measures				Type		Comments
		None	Minor	Medium	Major	Adverse	Beneficial	
Plant Location/ Pre-Construction Stage	Land value depreciation	x						No land value changes anticipated
	Loss of and displacement from homestead land	x						No loss of and displacement from homesteads land; no impact
	Loss of and displacement from agricultural land	x						No loss of and displacement from agricultural land
	Damage to nearby operation	x						No impact anticipated
	Disruption to drainage pattern		X			x		Land development may create problem in local drainage pattern
	Inadequacy of buffer zone			x		x		Buffer strip is inadequate, medium impact
	Encroachment into precious ecological	x						No precious ecological issues; no impact
Construction Stage	Run off erosion		X			x		Cutting and filling may create runoff erosion during rainy season
	Worker accident		X			x		Irregularly may occur during construction period
	Air Quality		X			x		Dust emission may occur during construction activity, minor impact
	Solid Waste		X			x		Solid waste may generate during construction, minor impact
	Sanitation diseases hazard		X			x		Concentration of labor force may create un-hygienic condition
	Noise/vibration hazard		X			x		Piling/equipment installations may generate noise
	Traffic congestion		X			x		Carrying of construction materials will create traffic congestion
	Blockage of wildlife passage	x						No wildlife in the area; no impact
	Employment			x			x	Major employment opportunity during construction
Post Construction and Operation	Pollution from liquid discharge			x		x		Process water will be discharged through the WWTP, WTP and cooling tower blowdown,

Stage								medium impact
	Pollution from solid waste			x		x		Significant solid waste may generate; medium impact
	Air quality				x	x		NOx and heat emission may occur, major impact if no mitigation measures are taken,
	Occupational health hazard			x		x		Inherently will occur
	Odor hazard	x						No obnoxious odor will be generated; no impact
	Traffic congestion	x						No traffic congestion may occur: no impact
	Noise hazard				x	x		Heavy noise may be generated, major impact;
	Employment			x			x	Medium Employment opportunity during operation
	Flora		x					
	Fauna		x					
	Fishery			x				
	Forestry	x						
	Wildlife	x						
	Archaeological & cultural heritage		x					

CHAPTER SIX: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.0 EVALUATION OF IMPACTS

6.1 GENERAL CONSIDERATIONS

The Impacts, which are likely to be occurred in the different phases of the project, are identified in section 5.0. In this section, evaluation of these impacts will be done mentioning their origin and characteristics along with their possible mitigation/enhancing measures. At the end of each sub section, status of residual impact will also be mentioned.

6.2. ADVERSE IMPACTS AND MITIGATION

6.2.1 Impact due to project location

6.2.1.1 Impact on Land use

Impact Origin

As discussed earlier the RBLPL authority has got allocation of 35 acres of developed land for the 750 gas turbine CCPP. In general, land acquisition may affect the environment and peoples by the following ways

i. Loss of Homestead land
ii. Loss of Agricultural Land
iii. Cultural, historical and Aesthetic Loss
iv. Loss of sensible places
v. Corruption and partiality during acquisition and Reacquisition process, etc.

Mitigation Measures

The proposed project didn't require any rehabilitation or relocation of homestead since the project will be established on the Meghnaghat power village allocated by PDB where there are already three other functional power stations viz. Meghnaghat Combined Cycle Power Plant (450 MW), Summit Meghnaghat Power Company Ltd. (335 MW) and Orion Power Meghnaghat Power Plant (100MW).

The land of the project area is a Government property which was acquired in 1995 and handed over to BPDB. The proposed 750 MW CCPP will be established adjacent west side of Summit Meghnaghat 335 MW CCPP. There is no homestead falls inside the proposed project site. There was no cultural, historical and Aesthetic interest in the project land and no loss of sensible place. So the above mentioned impacts are absent.

6.2.1.2 Loss and Displacement from Agricultural Land

Impact Origin

The proposed project land is an empty piece of government property. There is no agricultural land in the project area. So, there was no loss of agricultural land hence agricultural product in the country.

Although the land is empty Govt. land, people living near the site depends on the land for grazing their cows. The number of cows grazing in this land is roughly 25-30 and can be grazed elsewhere easily. It's not permitted but since the land has been empty for years, people use it for grazing anyway.

Mitigation Measures

Since there is no agricultural land falls inside the project area, no mitigation measures suggested in this regard. When it comes to grazing, it is suggested that an alternate site must be chosen as a grazing land.

6.2.1.3 Disruption of Earth Surface

Impact Origin

As mentioned earlier that the land is flat and developed earlier before planning for this project. So, there is no land filling required for this project.

Mitigation Measure

Since there is no land development or earth filling required, no mitigation measures required in his regard.

6.2.1.4 Change in Landscape

Impact Origin

A landscape is a subjective concept that cannot be precisely quantified. However, in general, any project when not designed considering the local landscape, then it creates visual intrusion to the people. The proposed project may change the local landscape to some extent.

Mitigation Measure

Any built up part of the plant should be designed considering key criteria of landscape like coherence, readability, hierarchy and stability. It is understood that **Reliance Meghnaghat750 MW CCPP** will have a modern architectural view, which does not provide any significant visual intrusion. One simple way by which the altered green area can be turned into its original visual quality is the plantation of trees around the project area.

Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.2 Impacts during Construction

6.2.2.1 Disruption of Earth surface-Site preparation and Clearing and Earthworks

Impact Origin

Each development project more or less requires site preparation. The preparation works generally done during constriction stages includes

- Biomass Removal
- Biomass Disposal
- Property removal
- Construction of access road
- Cut and fill operation
- Soil Export and Import
- Drainage works etc.

The impacts generally arise from the above activities are as follows:

- Noise
- Fugitive dust
- Runoff and flooding
- Soil erosion: Land erosion along the uncovered space due to soil removal and excavation.
- Water Pollution through runoff and sedimentation
- Social concerns
- Infrastructure disruption
- Safety Concerns

However the proposed site is of the nature that it will cause negligible impacts in the pre-construction stages. The site will not require some land filling. The proposed site has no homestead land so impact from property removal activities.

Mitigation Measures

Cutting and filling operation should be kept at a minimum level. The project authority should ensure the construction of proper drainage facility. Regular water sprinkle should be used to minimize fugitive dust emission. Safe working procedures should be ensured by the contractor. The construction work (Cutting and filling) must be undertaken during dry seasons.

6.2.2.2 Impact due to Construction of Associated Facilities

6.2.2.2.1 Impact due to Construction of Jetty

Impact Origin

A temporary jetty will be built adjacent to the project site to transport the construction material and heavy equipment during the construction period of the power project. The jetty may obstruct the regular navigation activity or create impact on the river traffic movement.

Mitigation Measures

Cutting and filling should be avoided during jetty construction at the river bank to avoid the river erosion. Construction of permanent structure should be avoided. There is no regular navigation path way for the river traffics in the Meghna River near the project site so there will not have possibility of obstructing the river way by the loading unloading vessels in the jetty. The vessels that would be berthed on the jetty should not cause any oil or solid waste pollution while loading and unloading. The project authority should obtain proper permission from the Bangladesh Inland Water Transport Authority prior to construct the temporary jetty.

6.2.2.2.2 Construction of Labour Shed and Site Office

Impact Origin

It is contractor's responsibility to construct offsite labour camp for the labour and technician who will not from local resident. The contractor will also build temporary site office at the construction site. These will create harm to the environment if not properly built or follow standard procedure.

Mitigation Measures

IFC/WB guideline of labour camp management should be followed to construct and operate the labour camp and the site office which should focus on the following:

- Proper ventilation and space between two building
- Adequate Toilets for male & female workers
- Safe drinking water supply
- Take care about social acceptability and social conflict
- Proper recreational facility
- Proper Sanitation and Solid waste disposal facility
- Emergency medical treatment facility
- proper security and fencing

6.2.2.2.3 Impact due to Construction of Access Road

Impact Origin

The project area has in built access road. Since the PDB power hub village is isolated from the locality, the RBLPL situated at the dead end of the access road. Since the construction materials and equipment will be carried through river way, the existing access road will be adequate to meet the requirement of the power project. The access road will be used for the transportation of staff, engineers &technicians and labourer during the construction and operation period. The existing access road should be maintained in proper way and the following mitigation measures should be followed:

Mitigation Measures

- Regular sprinkling of water to ensure reduced level ofroad dust.

- Any damaged portion of the road should be repaired as soon as possible.
- Heavy equipment and construction materials should not be transported through access road.

6.2.2.2.4 Impact due to Construction of Transmission Line

Impact Origin

It has been mentioned earlier that RBLPL authority will use a temporary power evacuation line to be constructed at the west and north side to the project site and connected to PDB's existing 400 KVA transmission line which is passing adjacent to the PDB power village. So,for the evacuation of electricity, the construction of transmission line is necessary and may have some impacts if not properly managed.

Impact	**Construction of Transmission Line**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			

Mitigation Measures

The construction of the power evacuation line may not involve any land acquisition or resettlement issues since the tower for transmission line would be within the PDB's own land. Temporary intervention in private lands in small area would be required during the connection period with the 400 kva high tension power line. The following mitigation suggestions to be followed:

- Need to ensure that the number of trips while transporting the construction materials is as low as possible. No storage of any construction material to any private land.
- Proper compensation of damaged crop or rent for the temporary intervention period should pay to the land owners where necessary.
- After completion of the job, the site should be cleaned and restored to its original condition.

6.2.2.3 Impacts on Air Environment

Impact Origin

The air quality in the project area may slightly deteriorate for the time being during the construction. The major construction activities from which air emission mostly dust emission may occur are;

- Poorly paved service lane;
- Ground excavation;
- Delivery of building materials to site;
- Handling and mixing of cement

Poorly Paved Service

The access road to the proposed project should be perfectly paved. Dust nuisance from unpaved or partly paved road is of concern because:-

- There will be increased traffic driving in and out of the proposed site to deliver construction material;
- If soil moisture content becomes very low; it could create increasing quantity of loose particulate matter on road surface;
- There could be no or little vegetation cover to act as dust trap.

Ground Excavation

Site preparation in readiness for construction work may require vegetation clearance stripping off of overburden material, ground levelling and compaction. These activities will open-up the ground to wind action and thus potentially resulting in dust generation. This is because:-

- Vegetation clearance will directly expose the ground to agents of erosion;
- Stripping off of overburden material will loosen soil aggregates thus making them easily susceptible to wind action;
- Removal of tree stumps and roots will weaken soil bounding and thus can easily be blown by wind

Delivery of Building Materials to Site

Construction materials such as building blocks, cement, sand, steel bars, ballast will be bulky and thus will require to be delivered on site by a fleet of trucks driving in and out of the construction site. During this exercise dust is likely to be generated from the following:-

- Handling of cement which is dusty by nature of the way it is;
- Handling of ballast which could contain loose dust particles;
- Site clearing of area of holding ballast , building blocks and sand will expose the site to wind action;
- Handling of building blocks especially coral limestone blocks can be a source of dust.

Handling and Mixing of Cement

The powdery nature of cement will be a potential source of dust especially during handling and mixing it with other materials such as sand and gravel. Cement dust will likely be of concern during:-

- Opening-up of cement bags and emptying the cement in order to mix with other construction material;
- During loading and offloading of cement.

6.2.2.3.1 Potential Environmental Impacts of Dust

Dust produced will potentially adversely affect the following:

1) Employees generally construction workers;
2) Immediate neighbours and general public; and
3) Vegetation.

1. Effects of Dust to Employees

Cement dust can affect plant employers in the following way:

- ✓ Eye irritation;
- ✓ Skin irritation;
- ✓ Impairment of normal sweating of the skin as it blocks pores on the skin;
- ✓ chocking of the throat;
- ✓ Respiratory difficulties;
- ✓ Difficulty in breathing;
- ✓ Potential course of chest complication and ailment.

2. Dust Impacts to Immediate Neighbours and General Public

- ✓ Reduced visibility; emission of high particulate matter to the environment will reduce local visibility;
- ✓ Continuous exposure of people to dust will likely affect ones eye sight that can potentially
- ✓ result in an outbreak of eye infection;
- ✓ Chest related aliment; continuous exposure of people to dust will likely result in chest complications and respiratory disorders.

3. Dust Impacts to Vegetation

- ✓ Dust settling on plant leaf surface will block leaves stoma hence interfering with normal respiration of the plants;
- ✓ Dust settling on plants will reduce the evapo-transpiration of plants; and;
- ✓ Animals such as butterflies, caterpillars, grasshoppers who feed of foliage will be affected as the dust settled on foliage will render the foliage unpalatable;
- ✓ Heavy dust settling on plant matter will impair on normal growth of the plant; and
- ✓ Heavy dust settled on plants will choke and kill plants.

Impact	**Dust Due to Construction**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			

6.2.2.3.2 Proposed Mitigation Measures

Following mitigation measures are proposed to minimize the air pollution during the construction stage:-

- ✓ The Project authority should ensure complete the paving of the service road
- ✓ Regular sprinkling of water to be done on open surface and dust grounds until paving is done;
- ✓ Transport of materials in tarpaulin- covered trucks
- ✓ The sand and other such dispersible material will be stored at site for minimum working period.
- ✓ Removal of soil/mud from trucks and other appliances prior to leaving the project area.
- ✓ Storage of top-soil in a safe space and creation of top-soil on filled land utilizing this preserved soil
- ✓ Only trees which on exact proposed position of the building should be cleared any other vegetation outside proposed building position should be maintained;
- ✓ Plantation of trees in the construction yard as quickly as possible. Any open area should be planted with appropriate vegetation (trees, flowers and grasses) ;
- ✓ Project management and contractor to enforce strict use of personal protective clothing;
- ✓ Complains of dust related ailments among employees and neighbours to be given access to medical attention.
- ✓ The construction activity will be carried out during day time only.

The emissions are temporary and not expected to contribute significantly to the ambient air quality and will be within prescribed limits for industrial regions by National Ambient Air Quality Standards.

Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.2.4 Impacts on Acoustic Environment

Noise is likely to be generated from the following activities/areas:

- ❖ During ground preparation;
- ❖ During assembly of building materials on site;
- ❖ During construction of the various components of the proposed power plant.

A brief elaboration of each of the potential source/cause of noise is as follows:-

Ground Preparation

Ground preparation is another activity that will potentially result in noise nuisance. Activities of ground preparation that are likely to result in noise nuisance include:-

- ✓ Use of heavy machinery such as excavators, caterpillars in ground excavation will be a source of noise nuisance; and
- ✓ Transportation of excavated earth material from site by use of dump trucks will result in noise nuisance. The noise will be mainly from the trucks.

Assembly of Building Materials

Building materials to be used in construction site will first be gathered and assembled on site. These include building blocks, timber, steel bars, sand, gravel cement. Possible courses of noise nuisance when assembling construction material on site include:-

- Offloading of building materials on site especially steel bars, gravel and building blocks can result in noise;
- Trucks ferrying in building materials can be a source of noise;
- Employees involved in offloading of building material can be a source of noise.

Construction of the Various Components of the Proposed Power Plant

Construction of the civil work structures for the proposed power plant will be labour intensive. This will involve engaging a large workforce, also during construction some machines and equipment will be in use. Possible sources of noise during construction work may include the following:-

- Loud talking, shouting and conversation among employees;
- Noise from equipment such as cement mixers;
- Noise from machines such as welding machines and wood working machines;
- Increased machine and equipment activity on site.

6.2.2.4.1 Potential Environmental Impacts of Noise

Impacts of noise will potentially affect the following:-

a. Immediate neighbors; and
b. Employees.

a. Impacts of Noise to Immediate Neighbors

- ✓ Continuous exposure of neighbors to noise nuisance may result in noise induced hearing lose;
- ✓ Noise nuisance may reduce concentration of neighbors in their private matters.

b. Noise Impacts to Employees

- ✓ High noise level will force employees to shout laud when communicating to one another;
- ✓ Exposure of employees to high noise level (above 85dB) continuous for 8hours per day may result in noise induced haring lose;
- ✓ Exposure of ear to peak sound level instantaneously may result to deafness.

Impact	**Acoustic Environment**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			

6.2.2.4.2 Proposed Mitigation Measures for Noise Nuisance Management

- ✓ Noisy construction works to be limited to daytime hours
- ✓ Immediate neighbours to be notified in writing on the date of commencement of construction work at one month in advance;
- ✓ All employees likely to be exposed to ear noise to be provide with ear protectors;
- ✓ The project Proponent and contractors to ensure strict enforcement on user of ear protectors;
- ✓ Where applicable and possible exceptionally noisy machines to be fitted with noise reduction devices;
- ✓ Any employee who may complain about ear related pain and or complication while at work to access medical attention at the expense of the contractor or project proponent;
- ✓ Fitting noise reduction devices in the noisy machines;
- ✓ Providing suitable hearing protection to all workers exposed to noise levels above 85dB(A);
- ✓ Noise protection wall or barrier should be constructed in case of long term noisy construction.

The noise impacts will be local; limited to the premises and very short – term.

6.2.2.5 *Sanitation Hazard &Drinking Water*

Impact Origin

The health of the project personnel and construction workers could be affected if arrangement of sanitation and drinking water is not ensured adequately and properly. During construction stage, lot of local labors will work and hence generate considerable amount of human waste. These are the potential source for spread of diseases, as various insects will play dominating role in the spread of diseases. There are chances for the spread of water borne diseases also.

Mitigation Measures

Proper sanitation system should be provided and at the same time, regular, proper and safe disposal of human waste should be ensured. Contractors and workers should obey appropriate means of waste removal and sanitation measures (Health consultation, HIV talks, etc. are recommended). Adequate number of toilets and bathrooms should be made for the workers, and proper disposal system of sewage waste should be implemented for sanitation purpose and the workers should be aware to practice those facilities. The minimum numbers of facilities for the workers are shown in the following:

Toilets used by for mixed use (or women only):

Number of people at work	Number of toilets	Number of washbasins
1-5	1	1
6-25	2	2
26-50	3	3
51-75	4	4
76-100	5	5

Toilets used by men only:

Number of men at work	Number of toilets	Number of urinals
1-15	1	1
16-30	2	1
31-45	2	2
46-60	3	2
61-75	3	3
76-90	4	3
91-100	4	4

It is recommended to use separate toilets for men and women.

For drinking purpose, the workers and employees of the plant will use treated water supplied from the water treatment plant owned by RBLPL. The plant will use deep tube well water for the drinking purpose after necessary treatment. The treated water is periodically tested for ensuring the quality. Therefore the plant water consumption does not impact the community.

Residual Impact

If, the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.2.6 Overland Drainage and Impact on surface water

The potential impacts on local hydrology are principally those of altered patterns as a result of onside construction and earthwork activities. The proposed project will affect natural drainage, surface and ground water quality if not managed the construction works properly. There could be Siltation of water system or drainage from uncovered piles of soil.

Proposed Mitigation Measures

- Surface drainage shall be controlled to divert surface runoff away from the construction area, and designed to include allowance for climate change;
- Laying barrier net
- At 100 m safe distance for stockpiles to waterbody
- Undertaking construction work during dry seasons*:*
- Completed areas should be restored/re-vegetated as soon as practicable;
- Temporary silt-trap or digging of pond toward siltation prevention
- Stockpiling of spoil soil at a safe distance from the drainage system
- Utilizing spoil soil in land-fill
- Regular testing conducted of discharge water
- Strict supervision should be maintained to avoid blockage of natural creeks during the construction period, and
- Containment of sanitary waste should be adequately disposed of to avoid surface and ground water contamination.
- Making provision for temporary disposal of wastes inside construction yard and disposal of solid wastes in an appropriate manner:
- Adequate provision has to be retained for the treatment and disposal of cuttings, drilling fluids and other chemicals and lube oil wastes generated during drilling, testing and commissioning stage. Inlet structure construction in river shouldn't be done in the breeding season of fishes.
- During the period of in-river works, daily water quality testing is recommended to ensure no increase in suspended solids.

6.2.2.7 Social acceptability of Construction workers to the host communities

The differences in the cultures of workers (in case hiring is required) and local community may create some problems. In the rural area, the local people especially the religiously conservative section of the community will not accept the foreign workers in general. However the proposed project site is situated inside the RBLPL complex where there is entry restriction for the local people.

Mitigation measures

Reliance Bangladesh LNG & Power Ltd. Has practice of working with the workers of different cultures. It is recommended to aware the foreign workers (if any) about the social & religious actability in the area so that they could maintain those when they will have touch with local community. The construction workers will be mainly local people. In cases if there are some non-local workers, they will reside outside the power plant complex in nearby residential areas by their own. There will be no construction camp inside the plant area.Legality of employees should be ensured.

6.2.2.8 *Accidents or Occupational Health Hazard*

Impact Origin

Under controlled situation, accident is not expected. However, occasionally it occurs during construction works. Accident may occur during earth cutting, casting, construction works and installation of heavy machinery. The protection of head, eye, ear, and hand, foot of the workers, labors and project personnel could be affected if proper and adequate arrangement is not ensured.

Mitigation Measures

An H&S plan will be prepared prior to construction. H&S training will be conducted, including good housekeeping, clean-up of debris and spills, and working in confined spaces and at height. The workers should wear PPE (Personal Protective Equipment), safety goggles, and other necessaries. Harnesses and scaffold barriers for work at height will be provided. Segregation of pedestrians and traffic on-site will be segregated.

For community Health and Safety, EHS guidelines should be planned and documented. Public access to the site must be restricted. Disease prevention and traffic safety measures should be adopted.

6.2.2.9Increase in Vehicular Traffic in the Area

Increase in vehicular traffic in the area is likely to be experience during construction phase of the power plant. During the construction phase, increase in vehicular traffic in the area is likely to be because of-

- Trucks ferrying construction material to site;
- Trucks ferrying waste material from site; and
- Ferrying in of construction tools and equipment.

6.2.2.9.1 Potential Negative Environmental Impacts Likely to Result From Increased Vehicular Traffic in the Area

- ✓ Possible traffic congestion of local roads and lanes;
- ✓ Possible of occasional experience of delays on the said local roads;
- ✓ Increased number of vehicles on local roads will result in increased wear and tear of local roads thus reducing lifespan of affected roads;
- ✓ Cost of maintaining local roads will increase;

- ✓ Pedestrians and cyclists using local roads will have to exercise more care with increase of vehicular traffic on the said roads; and
- ✓ There will be an increase of exhaust emission from vehicles, which will pollute local atmospheric air.

6.2.2.9.2 Proposed Mitigation Measures to Mitigate Increase in Vehicular Traffic in the Area

The following measures can be put in place to mitigate possible negative impacts likely to result from increase in vehicular traffic in the area:

- ✓ Management to provide for adequate internal parking, for all vehicles coming to the plant premises;
- ✓ Management to pave the dilapidated service road with tarmac or more durable material;
- ✓ All users of said roads to always observe traffic rules this will give pedestrians and cyclist their space and safety while using the road; and
- ✓ Marking of the roads to be clearly done.
- ✓ The traffic route should be selected such that passing through residential areas is avoided as much as possible.
- ✓ The traffic management plan should minimize inconvenience to community by choosing the best alternative routes with l community disturbance, by restricting the unnecessary use of horns while passing any sensitive areas (hospitals, schools, residential areas etc.)

6.2.2.10 Impact due to Hazardous material in the site

Impact Origin

Hazardous waste that may be generated during the construction phase of the proposed project includes small amounts of contaminated soil or other solids, small volumes of waste oil, cleaning fluids, solvents, paints, batteries, lighting lamps, and welding materials. Flushing and cleaning waste liquid will be generated when pipes and boilers are cleaned and flushed. Passivating fluid waste is generated when high temperature pipes are treated with either a phosphate or nitrate solution. The volume of flushing, cleaning and passivating liquid waste generated is estimated to be one to two times the internal volume of the pipes cleaned. The quantity of welding, solvent, and paint waste is expected to be minimal.

E Waste

A variety of E-wastes will be generated during the execution and operation of power plant. The quantity/volume and characteristics of e-waste depend on many factors such as nature and scale of operation and maintenance activities. Proper handling and Management of E-Waste is required to avoid any damage to human health, local environment including land, water and air.

Kinds of E-wastes generated from different sources/ activities at division/ unit offices/ operational areas are:

- Used and obsolete IT and telecom equipment: electronic and electrical hardware/ components, PC peripherals, etc.
- Faulty/scrap meters and metering equipment, electronic timers;
- PCBs,
- Faulty/used electronic and electrical equipment,
- Defunct Television, Refrigerator, Air-conditioners,
- Capacitors i.e. electrolytic capacitors and capacitors containing Polychlorinated Biphenyls;

Battery Waste

In the construction period, there's a chance that battery waste will be generated and if not handled properly, battery can release hazardous substance harmful for human health at the end of its life.

- Batteries are one of the most common forms of industrial hazardous waste, containing metals toxic to human health and the environment.
- As batteries start to break down in landfill, the heavy metals they contain can leach into surface and groundwater, polluting soil and water, and harming humans and wildlife.

Impact	**Hazardous Waste**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			

Mitigation Measures

World Bank EHS guidelines on Hazardous Materials Management and Waste Management will be followed. Many of these wastes would be recycled. The construction contractor should have adequate knowledge about the generation of hazardous waste at construction site, and will be responsible for proper handling of hazardous waste in compliance with all applicable law. The contractor will provide

personnel training to the construction workers to handle the hazardous waste, accumulation limits and times, and reporting and recordkeeping. The wastes that require disposal would be characterized based on generator knowledge or analytical testing to determine the appropriate management and handling procedures. Once properly characterized, the wastes would be temporarily stored at the site in appropriate containers and impermeable storage areas according to all applicable hazardous waste storage law. Impermeable surface should also be used for refuelling area whilst there should be training of workers for spill response and provision of keeping spill equipment on site such as bunds, soaking material etc. Oily waste and chemicals should be stored in a tank have sufficient secondary containment (110% more than its capacity).

All the hazardous waste should be properly levelled, where the following information should be added:

1. Name & type of waste
2. Quantity of waste
3. Date of waste generation (period of waste generation)
4. Waste generation site
5. Disposal site
6. Responsible authority who handles this waste.

The waste will be removed from the site with a regular interval for safe disposal at designated permitted facility.

6.2.3 Impact during Operation Stage

6.2.3.1 Impact on Air quality

Impact Origin

Ambient air quality may be affected due to emission of flue gases from the gas turbine stack. Incomplete burning of gases from the operation of gas turbine may also affect the air quality. The situation becomes aggravated when gas contains high percentage of impurities like sulphur, hydrocarbon, nitrogen etc. The high temperature of flue gas also produces impacts on the air quality in terms of thermal pollution. The combustion of fossil fuels for power generation inevitably results in emission of gaseous pollutants to the atmosphere. The major pollutants of potential concern are sulphur dioxide (SO_2), oxides of nitrogen (NO_X), carbon monoxide (CO) and Carbon dioxide (CO_2). CO_2emissions cause greenhouse gas emission responsible for rise to global temperature.

Sulphur dioxide (SO_2) emission: The emissions of sulphur dioxide are dependent on the sulphur content of the gas. Since there is no sulphur content in the natural gas to be used as may be seen from the analysis of natural gas. Therefore, there would be no sulphur dioxide emission from the plant.

Nitrogen Oxides (NOx) emissions: Burning of fossil fuels at high temperature (above1600^{0}C) generally produces two forms of nitrogen oxides-nitric oxide (NO) and nitrogen dioxides (NO_2); commonly referred to as nitrogen oxides (NOx). Since the gas turbine intakes excess air to the tune of 127% more than required for combustion, and if a fully premixed burner (dry low NOx burner DLN) is used there will be no NOx since the combustion temp is much less (2402^{0}F ≈ 1317^{0}C) in the case of such a turbines. The proportion of NOx and NO_2 varies depending on the combustion technology, and in the case of gas turbines approximately 90 percent of the nitrogen oxides is present as NO with the remaining being NO_2. Once the NO enters the atmosphere, it reacts with oxygen in the air and oxidises to NO_2 with passage of time.

Carbon monoxide (CO) emission: Carbon monoxide (CO) is generated when incomplete combustion takes place. As per design, the emission of CO from the gas turbine would be an issue. So the impact due to emission of CO would not be significant for the proposed power plant.

Carbon dioxides (CO_2) emission: Emission of CO_2 is associated with global warming. CO_2 gas emission depends on the fuel burned and the carbon content of the fuel. The natural gas contains a significant portion of carbon, which reacts with oxygen to produce CO_2 and heat; at full capacity CO_2 emission due to the project operation, with its present quantum will not have much impact on global warming.

Impact	**Impact on Air Quality**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			

Mitigation Measures

It has been discussed earlier that the proposed power plant would be constructed with a modern design and sophisticated machinery setting. The power plant would be operated by natural gas, so CO, Particulate Matter and SO_2 would not be a concern in terms of emission. The NOx emission from the power plant would be kept at a minimum level with optimum designed cycle efficiency in order to maximize the MW output. Mitigation and monitoring measures in the World Bank EHS guidelines on Air Quality and Ambient Air Quality and Thermal Power will be followed.

Stack Emission

It has been discussed earlier that the proposed power plant would be constructed with a modern design and sophisticated machinery setting. The proposed

RelianceMeghnaghat750 MW CCPP powerplant will be of advanced design with dry low NOx (DLN) burner with premix burning system which restricts the combustion temperature which is much below the NOx forming temperature (1600^0C). The proposed power plant will produce 25 ppm NOx emission from the gas turbine which will be within the IFC/WB emission limit of 51 mg/Nm3 (25ppm)with15% O_2, for gas turbine power plants more than 50 MW located in the degraded or non-degraded air shed. As per Bangladesh ECR 1997, the NOx emission standard of gas turbine power plant of 500 MW or above is 50ppm irrespective of O_2 content which is also higher than 25ppm.

Ambient Air Quality

An effect on ambient air quality has been assessed based on preliminary air quality modelling results. An advanced air emission dispersion modelling has been conducted for determining the ground concentration of pollutants from the stack and turbine emission. In the study, the NO_2 emissions for the gas turbine stack exhaust system were modelled to obtain maximum possible downward ground concentration. USEPA approved AERMOD view version 9.2.0model was used to estimate emission concentration from the plant.AERMOD view is a Gaussian plume model that incorporates source-related factors, meteorological factors, receptors, terrain and building downwash factors to estimate pollutant concentration from continuous point source emission.

The use of site-specific meteorological data has been collected from the Lakes Environmental, Canada, who has provided 1 Year of MM5-Preprocessed site specific Meteorological data for the period of Jan 01, 2015 to Dec 31, 2015 at Latitude: 23°36'25.56"N, Longitude: 90°35'32.16"E, Time Zone: UTC +6. These data contain hourly value of wind speed & direction, wind velocity, surface roughness, Bowen ratio, albedo, temperature & reference height, precipitation rate, relative humidity, surface pressure and cloud cover over the period mentioned above. The data then have been analysed and processed through MET processing model AERMET View which uses Samson format to process the data and create surface met data file & profile met data file computable to the AERMOD 9.2.0 view dispersion model. These surface met data file & profile met data file were then used in AERMOD view as Met input data for calculation.

The proposed power project will have a 2X255 MW gas turbine fitted with 2 HRSG and a 240 MW steam turbine and the model calculates the values in different configurations by considering individual stack emissions with 70m stack height of NO_2 emissions. The model assumes the stack tip downwash with receptors on flat terrain and no flagpole receptor heights. The NO_2 concentration contour has been analysed with 500 m interval with a radius of 5000m from the point source. The NO_2 concentration contour of 24 hour and annual average of maximum concentration have been analysed.

The parameters and corresponding values are summarized in Table 6.1

Table 6.1-The exhaust specifications and stack parameters

Parameters	Values
Stack height (m) =	70m
Stack inside diameter (m) =	6.30m
Stack gas exit velocity (m/s) =	25 m/s
Exhaust temperature (K) =	(365+305) = 670
Exhaust flow rate (m3/sec) =	615
NO_2 emission rate as NO_2 (g/s) =	25 ppm (51 mg/m3) = 31.37 mg/sec
Ambient temperature (K) =	305
Receptor height above ground=	0.000

Dispersion Model results:

A. Stack emission results:

The NO_X concentration contour of 1 hour and annual average of maximum concentration have been analysed. The maximum of 1 hour concentration of NO_X (8-10 µg/m^3) have been predicted in 4 pockets at a radius of 2000-5000m at all the sides to the power projects. The concentrations will be less than 6 µg/m^3at the other sides of the project within the study area. The maximum annual concentration of NO_x has been detected as 0.10-0.09µg/m^3 at 50-3000m at the north-west of the project, whereas the concentration are varies from 0.06-0.03 µg/m^3 at the either sides further down to the project site up to 5000m.

Review of modelling results:

The modelling result shows the 1 hour concentration of NO_x(8-10 µg/m^3)has been predicted at a radius of 2000-5000m in different pockets around the project site which is within the IFC standard (200 µg/m^3) for 1 hour concentration. The maximum annual concentration of NO_2 has been found 0.10-0.09 µg/m^3 at 50-3000m north-west to the project which are also less than the Bangladesh, WHO/IFC and USEPA standard. These indicate that the expected power plant does not have major significant adverse impact on the prevailing air quality of that area.

Bangladesh National Ambient air quality standard NOx level set for annual average. As the primary data is not available throughout the year to measure at an annual basis, Continuous Air Monitoring Station (CAMS) secondary data is available from Narayanganj CAMS station (Article 4.6) of DOE. The Narayanganj CAMS station (23.63N and 90.51E) is around 10km away from the project site and the concentration of Narayanganj is much higher than the project area considering the volume of industrial activity and emission level. Even considering the highest concentration of NOx at Narayanganj CAMS, still the aggregated NOx concentration is within the limit of IFC/WB and Bangladesh standard. But the maximum & minimum 24hr NOx concentration has been found in our baseline study at Vatibalaki as 11.9 µg/m^3 on Nov and 5.1 µg/m^3 on October respectively.

Table 6.2: Comparison Ambient air quality guideline for NO_2

Pollutants	Average period	Ambient concentration	Concentration From RPLBL	Total	Standard in µg/m^3		
					BNAAQS***	WHO/IFC 2007*	US EPA
NO_x	1 hr	-	10	-		200**	188
	Annual	35.67****	0.10	35.77	100	40**	100

* IFC Environmental Health & Safety Guidelines 2007

** Ambient air quality standard for small combustion facility using gas fuel and spark engine

***Bangladesh National Ambient Air Quality Standard

****Maximum Annual average of NO_x as per Narayanganj CAMS

The following are the emission contour maps of the proposed project at 1 hour and annual average of NO_2 concentration:

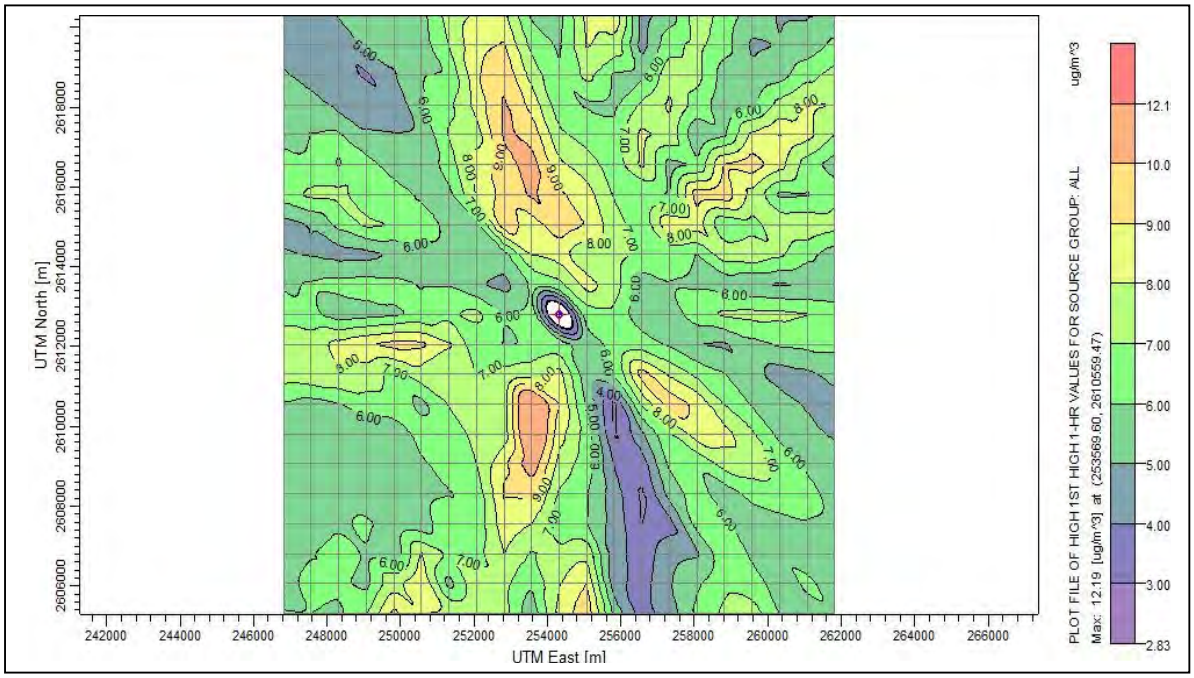


Figure 6.1: Emission contour map showing the NO_x concentration (1 hour average)

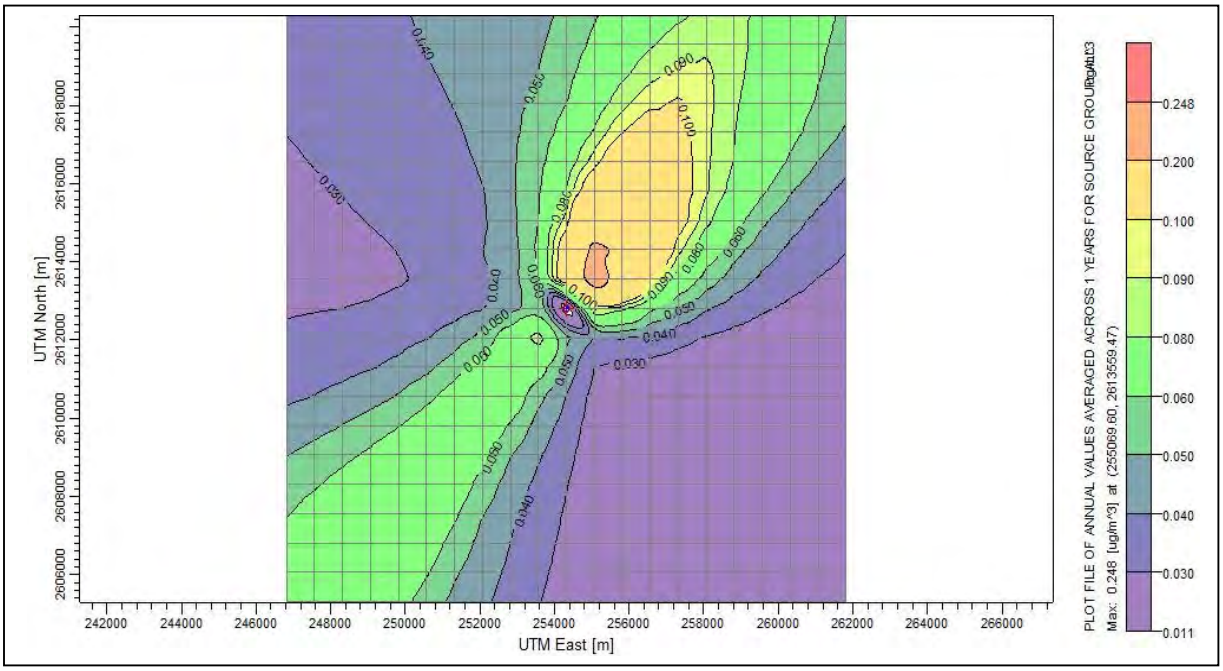


Figure 6.2: Emission contour map showing the NO_2 concentration (annual average)

B. Ambient Air Quality by considering the cumulative concentration from other existing power projects near RBPL.

An effect on ambient air quality has been assessed based on the cumulative ground concentration of NO_2 emissions together with other existing power project of BPDB power village complex. In addition to the 750 MW RBPL CCPP, there are450 MW CCPP of Meghnaghat Power Limited, 350 MW duel fuel CCPP of Summit Meghnaghat Power Company Limited (SMPCL) and 100 MW HFO based power project of Orion Power Meghnaghat Ltd (OPML) are in operation. USEPA AERMOD view version 9.2.0 model was used to estimate emission concentration from all the plant.

Orion Power neither has any NO_x emission data available at site nor has provision in their stack to measure the NO_x data. On the other hand, Summit [power didn't agree to share their emission data. So, in this calculation, we have used Meghnaghat power data, Ashuganj 400 MW Gas Turbine CCPP data (instead of Summit Meghnaghat as it is almost near to their capacity) and 750 MW CCPP of RPBL data together as point source to determine the cumulative ground concentration of NOx in the area. We didn't add 100 MW Orion HFO power plants due to shortage of data. The model assumes the stack tip downwash with receptors on flat terrain and no flagpole receptor heights. The NO_2 concentration contour has been analysed with 500 m interval with a radius of 5000m from the point source. The NO_2 concentration contour of 1 hour and annual average of maximum concentration have been analysed.

The parameters and corresponding values are summarized in **Table 6.3&6.4**

Table 6.3: The exhaust specifications of "Meghnaghat Power Company Ltd."

Parameters	Values
Stack height (m) =	60
Stack inside diameter (m) =	5.7
Stack gas exit velocity (M/S) =	20.3
Exhaust flow rate (cu.m/sec) =	517.9
Exhaust temperature (K) =	393
NO_2 emission rate as NO_2 (g/s) =	20.00
Ambient temperature (K) =	293
Receptor height above ground=	0.000

Table 6.4: The exhaust specifications of Summit Meghnaghat Power Ltd. (Data of Ashuganj 400 MW CCPP has been used)

Parameters	Values
Stack height (m) =	65m
Stack inside diameter (m) =	6.25m
Stack gas exit velocity (m/s) =	9 m/s

Exhaust temperature (K) = (90+293) = 383
Exhaust flow rate (Nm3 / h) =
NO_2 emission rate as NO_2 (g/s) = 15.38
Ambient temperature (K) = 293
Receptor height above ground= 0.000

Dispersion Model results:

The NO_2 concentration contour of 1 hour and annual average of maximum concentration have been analysed. The maximum of 1 hour concentration of NO_2 has been predicted within 20-30 µg/m^3 at a radius of 0-5000m north-west and south-east to the project, whereas the concentrations are within 10-20 µg/m^3 at the other sides within the study area. The maximum annual concentration of NO2 has been detected as 0.50-0.80 µg/m^{3}in a pocket at a radius up to of 500-200m north-west to the project whereas the concentration are within 0.10-0.08 µg/m^3 at the either sides further down to the project site up to 5000m.

Review of modelling results:

The modelling result shows the 1 hour ground level concentration of the NO2 (max 20-30 µg/m^3) is within the IFC standard (200 µg/m^3) for 1 hour concentration. The maximum annual concentration of NO_2 has been found 0.50-0.8µg/m^3 is also less than the Bangladesh, WHO/IFC and USEPA standard. These indicate that the expected power plant does not have major significant adverse impact on the prevailing air quality of that area.

Bangladesh National Ambient air quality standard NOx level set for annual average. As the primary data is not available throughout the year to measure at an annual basis, Continuous Air Monitoring Station (CAMS) secondary data is available from Narayanganj CAMS station (Article 4.6) of DOE. The Narayanganj CAMS station (23.63N and 90.51E) is around 10km away from the project site and the concentrations at Narayanganj is much higher than the project area considering the volume of industrial activity and emission level. Even considering the highest concentration of NOx at Narayanganj CAMS, the aggregated NOx concentration (36.47 µg/m^3) in the project area is still within the limit of IFC/WB and Bangladesh standard. But the maximum & minimum 24hr NOx concentration has been found in our baseline study at Vatibalaki as 11.9 µg/m^3 on Nov and 5.1 µg/m^3 on October respectively.

Table 6.5: Comparison Ambient air quality guideline for NO_2

Pollutants	Average period	Ambient concentration	Concentration From RPLBL	Total	Standard in µg/m^3		
					BNAAQS***	WHO/IFC 2007*	US EPA
NO_2	1 hr		30			200**	188
	Annual	35.67****	0.80	36.47	100	40**	100

* IFC Environmental Health & Safety Guidelines 2007

** Ambient air quality standard for small combustion facility using gas fuel and spark engine

***Bangladesh National Ambient Air Quality Standard

**** Maximum Annual average of Nox as per Narayanganj CAMS

The following are the emission contour maps of the proposed project at 1 hour and annual average of NO_2 concentration:

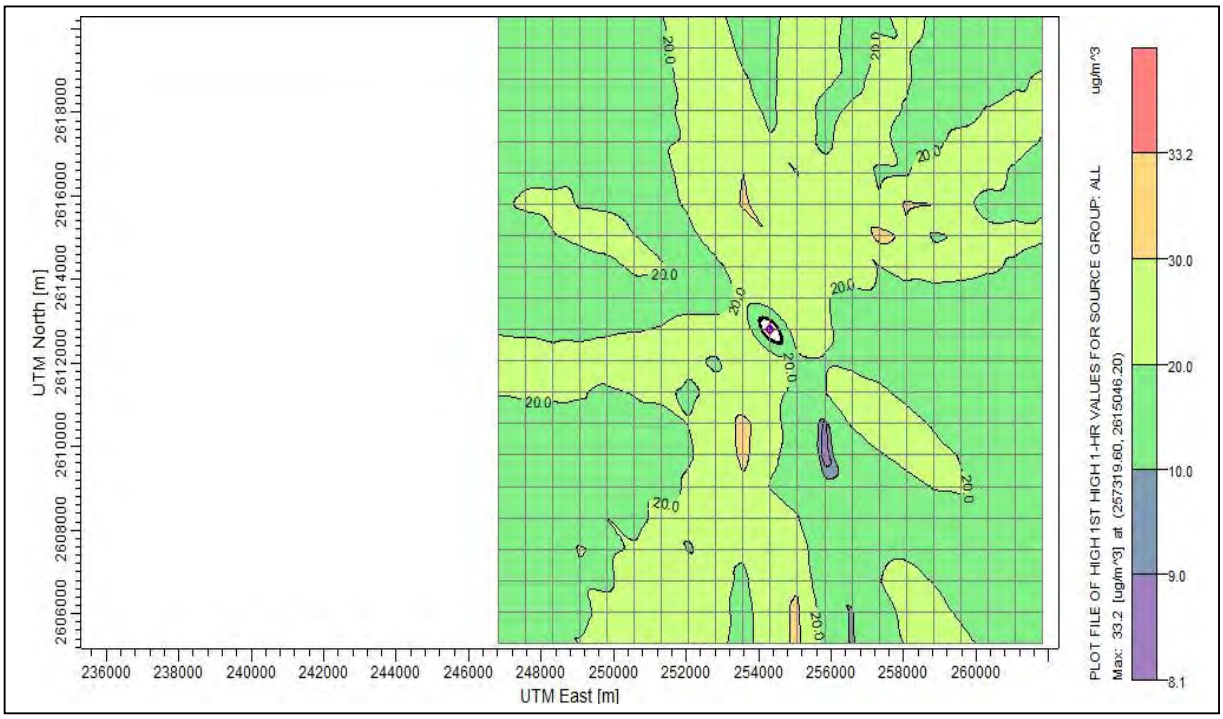


Figure 6.3: Emission contour map showing the NO_2 concentration (1 hour average) combined source

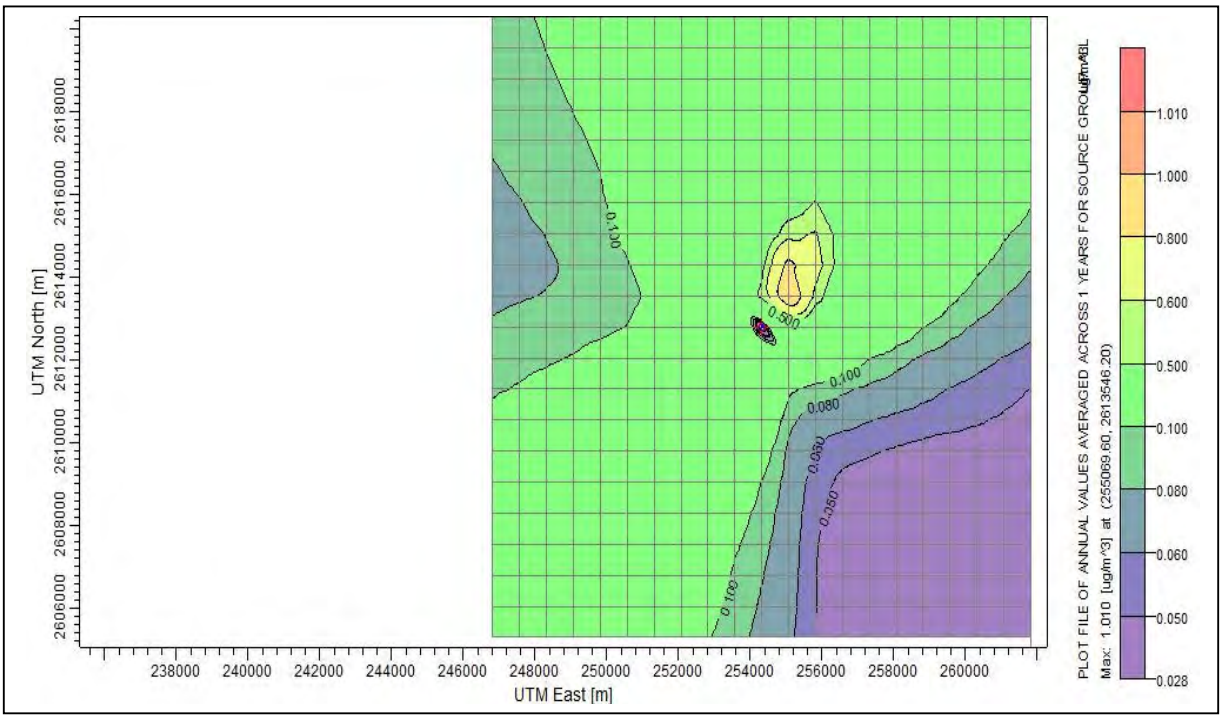


Figure 6.4: Emission contour map showing the NO_2 concentration (annual average) combined source

Residual Impact

It is clear from above study that the project proponent will adopt necessary options suitable to their needs meeting the national standards. Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.3.2 Impact due to Liquid Discharge

6.2.3.2.1 Domestic Wastewater

The wastewater collection system will collect sanitary wastewater from sinks, toilets, and other sanitary facilities, and will be managed by the septic tank. The waste water generated from the above sources will be disposed to underground septic tank and soak well system. Proposed septic tank and soak well details are shown in figure. 3cu.m/hour wastewater will flow from the building sewer line to the septic tank where both heavy and light solids are separated from the wastewater. Solids that are heavier than water settle out forming a sludge layer on the bottom of the septic tank. Solids lighter than water float to the top of the wastewater forming a scum layer. A liquid layer of water with suspended solids, nutrients, microorganisms and other pollutants separates the sludge and scum. Anaerobic bacteria — those that can live without oxygen — begin to break down waste in the septic tank. As wastewater flows into the septic tank, an equal volume of the liquid layer, called effluent, flows out of the septic tank into the effluent treatment system. In a properly designed, functioning and maintained septic tank, scum and sludge will not flow out with the effluent.

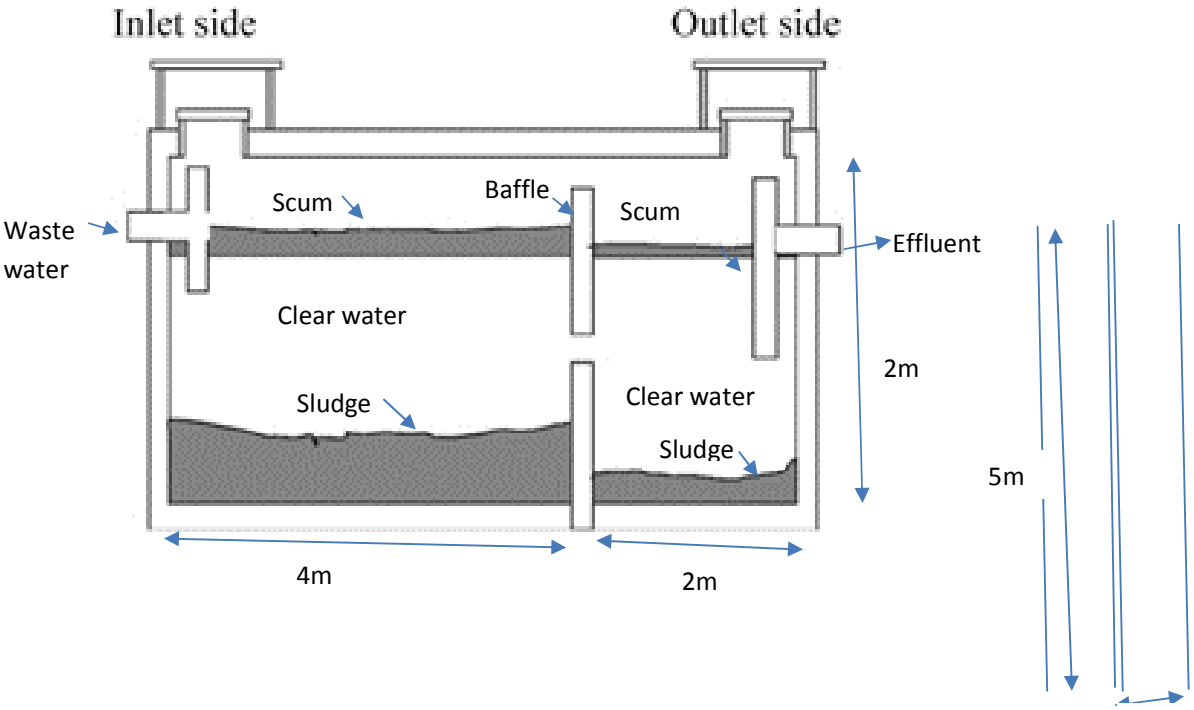


Fig. 6.3: Septic tank details

While septic tank effluent may appear clear, microorganisms such as bacteria and viruses, nutrients such as nitrate and phosphorous, dissolved materials and very small particles of suspended solids are present. To protect the environment and human health, effluent must receive additional treatment as soak well system.

Solid waste is removed from septic tank every five years interval. This anaerobically digested septic tanks solid waste/sludge is used as a soil conditioner or fertilizer.

6.2.3.2.2 Wastewater from Plant Drains

General facility drainage will consist of area cooling water blow down, occasional equipment& floor wash, service water, rejection from DM water etc. will be collected and treated in a wastewater treatment facility which has a capacity of 20cu.m/hour. Water from these areas will be collected in a system of floor drains, hub drains, sumps, and piping, and routed to the facility wastewater collection system.

Treated effluents are equalized in Guard pond before reuse and recycling within the plant. Excess treated and equalized effluent will be disposed off through plant's effluent outfall. This discharge will thus meet the permissible standards

Treated Effluent quality shall be as per the following:

pH : 6.0 – 9.0

Suspended solids : 100 mg/l

Oil and grease : 10 mg/

The Effluent Treatment Plant conceived will handle effluent from the following facilities-

- Neutralized waste from DM plant
- Cooling tower blow down
- Boiler blow down
- Waste water from the plant wash

Neutralized waste from DM Plant, Cooling tower blow down and Boiler blow down do not need any treatment except only dilution and retention of effluent in CMB is envisaged before discharging outside the plant boundary.

For waste water from the plant wash, Treatment plant is envisaged with suitable capacity before discharging through CMB. The capacity envisaged is 20 cum/hr. The following treatment will be done in the ETP:

- Collection tank
- Coagulation & Flocculation
- Solid separation by clarifier
- clean water to CMB

- Sludge thickening
- Sludge dewatering by centrifuge

Sludge generated from Pre Treatment plant shall be treated suitably and solid waste generated shall be disposed outside plant.

Drains that could contain oil or grease will first be routed through an oil/water separator and then directed to the wastewater treatment plant. The amount of wastewater generated from this system is anticipated to be minimal.

6.2.3.2.3 Wastewater from Close circuit cooling system:

The proposed Combined Cycle power project will use river water in the steam condensing unit at rate of 1100m^3/hour flow for which 821 cu.m/hour will be used as make up water in the close loop steam condensation cooling system. Recirculating cooling system with Induced draft cooling towers using fresh water being most environments friendly should be adopted. The CCCW (Closed Cycle Cooling Water) system meets the cooling water requirements of all the auxiliary equipment of the GTG, STG and HRSG units such as turbine lube oil coolers, generator coolers, BFP auxiliaries, condensate pump bearings, sample coolers and air compressors auxiliaries. About 196 cum/hr. of water is expected to discharged from the plant to the river after necessary treatment. Hence there will be no thermal discharge to the river from the proposed project.

The proposed combined cycle power plant will also use close circuit cooling water system in the lubricating engine oil cooling system and other small water cooling part at a rate of 165 cu.m/hr. This cooling water will not be discharged but will be recycled after cooling in the cooling tower, small amount of make-up water will be required in the system to be running effectively.

However, proper care will be taken in the design of water circulation system for the Combined Cycle power plant that no contamination or waste is carried to the river. Thus, the river water will remain free from any sort of negative impact originated from the power plant.

Impact	**Impact due to Liquid Discharge**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			

6.2.3.3 Impact due to Solid& Municipal Waste

Impact Origin

The operation of the plant itself would not generate any solid waste. Solid waste generated by the people working at the proposed site is paper, cartoons, bags, boxes, office wastes, pallets, empty drums etc. along with negligible quantity of domestic waste. There will have waste Air filters and waste rugs be generated occasionally which need to be properly disposed.

Mitigation Measures

All solid waste will be segregated properly. The World Bank EHS guidelines on Hazardous Materials Management, Waste Management and Thermal Power will be followed for all solid and hazardous waste management. Some solid Waste has tremendous secondary demand and sold to the secondary licensed dealers. Other solid wastes will be disposed to designated landfill facility of Sonargaon Upazilla. Records of all waste transfer will be kept. The air filters and waste rugs should be collected in a safe place and should be disposed to the land fill.

Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.3.4 Impact due to Lubricating Oil

Impact Origin

Insignificant amount of used lubricating oil would be generated from the plant. The generated waste oil will be stored in a sealed tank.

Mitigation Measures

The oil storage of the project (fresh and used) should be done on hard standing floor and roofing with a secondary containment facility of 110% bigger than the allowable maximum storage capacity. The waste lubricated oil thus collected will be supplied /sold to the venders or the Lube Oil Re-cycling plants approved by DoE at throwaway price. As there is no chance of mixing and disposal of oil onto land or water, so there is no mitigating measure to be suggested.

Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.3.5 Impact of Hazardous Waste

Hazardous waste that may also be generated during the operation phase of the proposed project includes small amounts of waste/spent oil, batteries, lighting lamps, E waste, etc.

E Waste

A variety of E-wastes will be generated during the operation of power plant. The quantity/volume and characteristics of e-waste depend on many factors such as nature and scale of operation and maintenance activities. Proper handling and Management of E-Waste is required to avoid any damage to human health, local environment including land, water and air.

Kinds of E-wastes generated from different sources/ activities at division/ unit offices/ operational areas are:

- Used and obsolete IT and telecom equipment: electronic and electrical hardware/ components, PC peripherals, etc.
- Faulty/scrap meters and metering equipment, electronic timers;
- PCBs,
- Faulty/used electronic and electrical equipment,
- Defunct Television, Refrigerator, Air-conditioners,
- Capacitors i.e. electrolytic capacitors and capacitors containing Polychlorinated Biphenyls;

Battery Waste

In the life of the plant, there's a chance that battery waste will be generated and if not handled properly, battery can release hazardous substance harmful for human health at the end of its life.

- Batteries are one of the most common forms of industrial hazardous waste, containing metals toxic to human health and the environment.
- As batteries start to break down in landfill, the heavy metals they contain can leach into surface and groundwater, polluting soil and water, and harming humans and wildlife.

Mitigation Measures

World Bank EHS guidelines on Hazardous Materials Management and Waste Management will be followed. Many of these wastes would be recycled. The EHS department of the RBPL should have adequate knowledge about the generation of hazardous waste at the project site during operation and will be responsible for proper handling of hazardous waste in compliance with all applicable law. The RBPL will provide personnel training to the related plant workers to handle the hazardous waste, accumulation limits and times, and reporting and recordkeeping. The wastes that require disposal would be characterized based on generator knowledge or analytical testing to determine the appropriate management and handling procedures. Once properly characterized, the wastes would be temporarily stored at the site in appropriate containers and impermeable storage areas according to all

applicable hazardous waste storage law. Impermeable surface should also be used for refuelling whilst there will be training of workers for spill response and provision of keeping stock of spill equipment such as bunds, soaking material etc. at projectsite. Oily waste and chemicals should be stored in a tank have sufficient secondary containment (110% more than its capacity).

All the hazardous waste should be properly levelled, where the following information should be added:

1. Name & type of waste
2. Quantity of waste
3. Date of waste generation (period of waste generation)
4. Waste generation site
5. Disposal site
6. Responsible authority who handles this waste.

The waste will be removed from the site with a regular interval for safe disposal at designated permitted facility.

6.2.3.6Noise and Vibration Impacts

Impact Origin

The gas turbine and the steam turbine will have internal noise level of around 85dBA which will be minimized by sophisticated acoustic power house building design so as to minimize the noise up to standard. The heat recovery steam generator stack will emit a noise level of 85dBA after providing the silencer. This noise will be dispersed to the surrounding atmosphere to certain extent.

Mitigation Measures

Necessary noise abatement measures will be taken as required avoiding adverse noise & vibration impact on the neighbourhood. To reduce the effect, most costlier and effective **Critical Type Silencer** will be used in the stack. In particular, significant noisy components such as the gas turbine sets are enclosed in buildings acoustically designed, providing **Styrofoam filler of 50 mm width in between 300 mm thick brick walls** around the power house building. Moreover, thick doors are provided and holes which may create sound pollution are sealed with sound proof materials. Vibration pad will also be used at the bed of all power generation units to prevent the vibration.

The following are the noise protection capacity of the material which would be used for sound insulation for the power house building:

Material	Thickness, mm	Surface density, kg/sq.m	Transmission loss,dBA
Styrofoam (Acrylic -Poly-	15	18	32

Methyl-Meta- Acrylate (PMMA)			
Brick with or without plaster	150	288	40

As per above calculation the Styrofoam filter and brick wall are capable to absorb more than 112 dBA noise from the engine room, but the approximated engine room noise is around 85dBA near the turbines, which is lower enough to minimize the engine room noise by the acoustic measurement. Moreover, Vibration pad will also be used at the bed of all power generation units to prevent the vibration.

For the measurement of the dispersion of the stack noise to surrounding environment, a noise modelling simulation has been done by using CUSTIC-3.2 noise modelling software. The model has calculated the noise from the exhaust stack of 85dBA and the result of the modelling has been given below:

The distance of the following noise level has been calculated from the center of the stack row.

Radius, m	50	100	200	300	400	500
Output Sound power level in dBA	32.16	26.80	21.44	16.08	10.72	5.36

Fig 6.4: Plot of output noise power level in dBAvs Radius in meter

The modelling result shows that the power plant will produce max noise 32.16dBA within the boundaries whereas the noise level is 5.36dBAwithin 500m radius of the project.

The following are the World Bank and Bangladesh standard for the ambient noise:

Standard	Zone	Day time dBA	Night time, dBA
World Bank EHS Guideline 2007	Residential, Institutional, educational	55	45
	Industrial, commercial	70	70
Bangladesh ECR, 1997	Mixed area	60	50
	Commercial	70	60
	Industrial	75	70

It is observed from the noise emission modelling that the max noise level within the 50m radius is 32.16dBA. If we consider 1 am (night time) noise level (max 39.2dBA) as the background noise (Article 4.7), the combined effect can be found from the link(-http://www.sengpielaudio.com/calculator-spl.htm) and applying the formula of ($\sum L = 10. \text{Log}_{10} (10^{L1/10} + 10^{L2/10})$ dBA. The calculated table is presented below:

The calculated table is presented below:

Radius, m	50	100	200	300	400	500
Output Sound power level in dBA	32.16	26.80	21.44	16.08	10.72	5.36
Ambient sound level in dBA	39.2	39.2	39.2	39.2	39.2	39.2
Summation of two sound level	39.98	39.44	39.27	39.22	39.2	39.2

Bangladesh Govt doesn't have declaration of zones for comparing the noise with standards. From the nature of the development, it is evident that the area falls under industrial zone since there are many medium and big industries are already exists in the area; moreover, there is no homestead settlement near the project site. The result clearly stipulates that the sound intensity level is within the Bangladesh and WB guideline (70 dBAat industrial zone or even 60 dBA for mixed zone) at all sides from the center of the stack and gradually reduces at further distances. Apparently there will not be effect of noise contribution from the power project beyond 300m radius from the stack. Eventually, there is no homestead settlement within 2 km radius from the project.

Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.3.7 Occupational Health

Impact Origin

The proposed project will employ around 160 people during its operational period. The workers who work inside the plant will face occupational health hazards due to different operational processes. Safe and good occupational health status of the employees and workers is important for only the persons working in the plant, but also for the better plant operation and maintenance.

Mitigation Measures

Protective clothing, earplug, helmets, shoes and accessories should be provided to the workers. Adverse impact on worker's safety would be minimized by implementing an occupational health program. Regular medical check-up would be done to ensure the soundness of health of employees and workers. Pollution control measures would duly adopt if necessary, including noise and air pollution.

Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

6.2.3.8 Impact on Ecology

Impact Origin

The proposed project will be a 750 MW combined cycle power project and may have long term impact on the ecological resources in the area if not properly addressed. Proper mitigation measures should be implemented if the negative impact identified on this issue

Mitigation Measures

The following are the ecological resources and discussed individually to address the impact and its mitigation measures:

Flora: The power plant would not emit any toxic gas or dust during operation so the impact on floral species in the area is insignificant.

Fauna: The power plant would have close circuit cooling system and will not emit thermal discharge to water body, the nominal discharge from the project would be controlled by in house WWTP and discharge quality will be within national limit, so, the impact on fauna in the area is insignificant.

Fishery: Since the project would not have thermal discharge, so, the impact on fishery in the area would not be an issue.

Forest: There is no forest in the vicinity of the project. Nevertheless, there would not be any impact on forest by this project activity since there is no toxic emission.

Wildlife: Since there is no forest in the vicinity of the project, there is no wild life passage in the area. So, there would not be any impact on wildlife by this project activity.

Agriculture: The project would not pollute surface & ground water and also no toxic emission, so, impact on agriculture by this project is insignificant.

Hydrology: The project would not pollute surface water. So, there is no negative impact. on hydrology by this project.

Groundwater: The project would neither abstract groundwater nor pollute ground water. So, there is no negative impact on groundwater by this project

Archaeological & cultural heritage: The power plant would not emit any toxic gas or dust during operation so the impact on archaeological & cultural heritage in the area is insignificant.

6.2.3.9Socio-economic Impacts

Impact Origin

Reliance Meghnaghat750 MW CCPP will contribute to cover the increasing demand of electricity which is a beneficial operation factors, e.g. for producing industries. So, the most of the socioeconomic impact from this project is beneficial impacts which have been discussed in separate sections. But there are some potential impacts which might affect the local community if not addressed properly. The following are the issues need to be mitigated properly.

Mitigation Measures

Change in local livelihood: There would a great change in local livelihood due to the project construction and operation. Sometimes it would create social conflict and problem but it would be addressed in the on-going stakeholder consultation and the village elite and local government representatives should take part to minimize the impact in the society.

Cultural change: In general, cultural change occurs due to the change of life style or livelihood. Since the project would have impact on local economy, it would also contribute to change in local culture. But those are very common in all areas in Bangladesh and people generally accept this change.

Conflict with foreign workers in the area: There will have significant migratory or foreign workers will be working in the project during the operation period. These might create impact on the local culture and behavioural heritage. The plant authority will take necessary actions to aware the foreign and migratory workers about the local cultural and social behaviour which will also be discussed in the ongoing stakeholder consultation so that local people will accept the workers access in the community.

The detail of the employment plan (Manpower detail) of Reliance Meghnaghat 750 MW CCPP is given in **Annexure19**.

6.2.3.10 Impact on Climate Change

Greenhouse gases are those that absorb and emit infrared radiation in the wavelength range emitted by Earth which eventually contributed to global warming and finally climate change. In order, the most abundant greenhouse gases in Earth's atmosphere are:

- Water vapor (H_2O)
- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Ozone (O_3)
- Chlorofluorocarbons (CFCs)

Emission of CO_2 is associated with this project which relates to global warming. CO_2 emission depends on the fuel burned and the carbon content of the fuel. The natural gas contains a significant portion of carbon, which reacts with oxygen to produce CO_2 and heat; at full capacity CO_2 emission due to the project operation, with its present quantum will not have much impact on global warming.

The following table shows the comparison of IFC CO_2 Emission rate for Combine Cycle Gas Turbine Plants and the specification of 750 MWCCPP:

	Performance of CO_2 emission as per Engine Catalogue	**IFC/WB Typical Values for CO_2 Emissions in a CCGT Plant (Natural Gas)**		
		Efficiency, (% Net, HHV)		**Efficiency, (% Net, LHV)**
		(w/o CCS*)	(with CCS*)	
Efficiency, (% Net)	58.4	50.8	43.7	54-58
CO_2 Emission, (t CO_2 / GWh)	342.1	355	39	348-374

*CCS-Carbon capture and storage

The CO_2 emission factor for RBLPL750 MWCCPP 342.1 tCO_2/GWh. Assuming 85% plant load factor, the total annual CO_2 emissions of RBLPL750 MWCCPP is estimated:

0.75 GW x 8760 hours/year x 0.85 = 5584.5GWh/year
5584.5GWh/year x 342.1 tCO_2/GWh=1,910,457.45 tCO_2/year

Note: All the calculations are done considering efficiency for combined cycle power plant

Mitigation Measures

It has been discussed earlier that the proposed power plant would be constructed with a modern design and sophisticated machinery setting. The power plant would be operated by natural gas and a combined cycle operation, so CO_2emission in this project would be minimal and as per the IFC guideline which would be at minimum level with optimum designed cycle efficiency in order to maximize the MW output.

6.3 Beneficial Impacts and Enhancement

6.3.1 During Construction

Impact Origin

During construction period, the plant will create job opportunities for many skilled, semi-skilled and unskilled labors. However, the impact will be a relatively short duration, being restricted locally to the construction period. In addition to this, all construction sites attract small traders, who supply food and other consumable to the work force. Although the numbers of people who benefited in this way are relatively small, the impacts on individuals can be disproportionately high compare to the other local people. So, the local people will be benefitted by the project as following:

- Supplying food and commodities
- growing local business near the project site
- Supplying labourer
- Supplying different construction related material & equipment
- Providing transportation and accommodation support

Benefit Enhancement Measure

Although labor recruitment is a matter of construction contractor who has the right to determine whom he shall not employ, but still the project proponent shall encourage him to hire local people wherever possible and to give preference to employment of the land less people.

6.3.2 During Operation Phase

Impact Origin

The most significant positive impact of the plant would be the generation of electricity, which will reduce the gap between supply and demand of electricity. The other important positive impact of the plant would be the employment of personnel for the operation of the plant. The project envisages employing 160 skilled and unskilled personnel during its operational phase. The following are the visible benefits from the project:

- Boasting national economy by contributing power to national grid
- Employment in the project
- Change in local livelihood
- growth of local business
- Infrastructural development in the area like roads, bridges, educational institutions etc.

Table 6.6- Summary of Environmental and Social Impact of the Construction Phase

Potential Impact	*Description of Potential Impact*	*Criteria for Determining Significance*	*Mitigations*
Environmental Issues **Construction Noise**— Disturbance to surrounding communities of power plant due to operation of construction machinery at the plant site	Disturbance to communities in surrounding areas of the proposed plant site due to construction machinery operation	The BNEQS for noise require that the sound level in industrial area should not exceed 75 dBA at day time and 70 dBA at night time, IFC guidelines for noise also require that the noise level in commercial/industrial areas should not exceed 70 dB(A) during the day and 70 dB(A) during the night	□□Reduction of equipment noise at source □□Conduct pre operation noise survey □□Prepare noise control plan □□Pre-construction noise survey of the construction equipment □□Select low noise equipment for the power plant □□Minimization of vehicular noise □□Training of all staff members for the use of PPE (Personal Protection Equipment, including hearing protective devices) □□A temporary noise barrier around the site if necessary
Emissions— Particulate matter, NO_x and SO_2 emitted during construction activities can result in deterioration of ambient air quality in the vicinity of the source, and be a nuisance to the community.	Dust—nuisance to surrounding communities of the proposed plant due to emission of dust during construction on the plant site Vehicle and equipment exhaust—Combustion exhaust from vehicles and construction can affect the ambient air quality of the Study Area	An increase in visible dust beyond the boundaries of the proposed power plant due to the activities undertaken at the plant site, or on the access road. Adverse impact on community assets, or There are persistent complaints from the community or the vehicles are not incompliance with the BNEQS for vehicles	□□Sprinkling of water on unsealed surfaces for dust suppression □□Wheel wash □□No open burning permitted □□Use of wind shield around aggregate and soil stockpiles □□Covering of material piles □□Restrictions on speed on unpaved roads □□Transportation of material in covered trucks and speed limits strictly observed □□Safe distance between the batching plant and the community □□Stockpiles will be placed at l 100 m from the community □□All vehicles and equipment will be properly tuned and maintained □□Medical attention will be free of charge
Vegetation Loss— Loss of vegetation as a result of land clearance for the power plant	Unnecessary or excessive removal of trees and shrubs	Preparation of a Reinstatement Plan; Minimization of the felling of trees and clearing of vegetation; and avoidance of the use of fuel Wood	□□Try to avoid unnecessary cutting of trees. □□Plan a proper plantation and green belt plan for creating good landscape.
Soil and Water Contamination— Different types of effluents, solid waste and hazardous material may contaminate the water and soil	Untreated wastewater and other effluents from the construction activities may contaminate the water resources of	If the run off contains visible quantities of oil and grease and contains silt above BNEQS levels or if it flows towards the community. If any BNEQS	□□Use of spill prevention trays and impermeable sheets to avoid soil contamination □□Storage of fuels, chemicals and lubricants in bounded areas with impervious flooring and secondary containment of 110%

resources of the Study Area	the study area. Hazardous materials and non-hazardous waste if disposed of into the surroundings, may contaminate the soil and water resources of the study area	and IFC non-compliant effluent is released to the Environment. If any person is exposed to hazardous waste generated from project related activities. Disposal of waste outside designated areas	capacity. Emergency Response plan will be developed for hazardous substances Equipment and material containing asbestos, poly-chlorinated biphenyls(PCBs), and ozone depleting substances (ODSs) will not be used Material Safety Data Sheet (MSDS) will be maintained
Socioeconomic Issues **Community Safety**— Safety hazards associated with the construction activity, particularly the increase in traffic on the plant site access road	The proposed construction activity can potentially be safety hazard for the community. In particular, the increase in construction related traffic on the proposed project access road.	A significant community hazard will also be considered, if a condition is created during the construction activity that would be considered a safety hazard in a standard occupational and safety health assessment	A public safety plan will be developed A speed limit of 20 km/h will be maintained on the proposed access road Night time driving of Project vehicles will be limited where possible Community complaint register and other means will be adopted for the community to complain about non-adherence of Project traffic to speed limits, safe driving and other safety-related concerns Work areas outside the proposed plant site, especially where machinery is involved will be roped off and will be constantly monitored to ensure that local people, especially children stay away
Employment Conflicts— Conflicts may arise if the nearby communities feel that they are not given substantial share in project related job opportunities	The potential employment related issue includes dissatisfaction among local communities over the number of jobs offered to them, disagreement on definition of 'local' and also on distribution of jobs within the local community	A significant impact will be interpreted if the proportion of available unskilled jobs offered to the locals in the immediate area is less than around 50%	Maximum number of unskilled and semiskilled jobs will be provided to the local communities A local labor selection criterion will be developed in consultation with the community
Hazardous and Non-Hazardous Waste Management—Improper waste management may lead to health and aesthetic issues	Exposure to potentially hazardous waste; Generation of excessive waste; Recyclable waste and reusable waste is discarded; Littering; Improper disposal.	A significant impact will be considered, if the waste are not handled and disposed properly. The BNEQS is violated for the collection, storage and disposal of hazardous and non-hazardous waste at site.	Development of a waste management plan; Separation at source of the recyclable material; Regular audits; Maintenance of a Waste Tracking Register; Separation of hazardous waste from non-hazardous waste; On-site storage facility for hazardous waste; Recyclable waste to be disposed via approved waste contractors; Dumping of non-hazardous, non-recyclable waste either to landfill or municipal disposal; Emergency response plan; Trainings; Labelling and avoidance use of asbestos, polychlorinated biphenyls (PCBs), and ozone depleting substances (ODSs)

Project and Community Interface—Inter-cultural differences between the project staff from other areas and the local community	community complaints	A community hazard may be created, if the migrated workers will have social, racial and religious conflict with the local community.	Training of the non-local project staff on local culture and norms; Avoidance of unnecessary interaction of local population with the non-local project staff; Prior notice to residents of the area before project activities

Table 6.7- Summary of Environmental and Social Impact of the Operation Phase

Potential Impact	*Description of Potential Impact*	*Criteria for Determining Significance*	*Mitigations*
Environmental Issues Plant Noise	Unacceptable increase in noise levels in the communities	The BNEQS for noise require that the sound level in industrial area should not exceed 75 dBA at day time and 70 dBA at night time, IFC guidelines for noise also require that the sound level in commercial/industrial areas should not exceed 70 dB(A) during the day and 70 dB(A) during the night	□□Low noise equipment will be preferred □□Fans for cooling tower will be of low noise type □□Silencers will be used on vents and ventilators □□Proper stack height to be maintained □□Proper acoustic design for the power house building. □□Noise levels will be monitored regularly within the communities in order to take timely corrective measures, if needed
Plant Effluents	The power plant is expected to generate liquid effluents in the form of oily water, plant cooling water, washing water, blow down water, treatment system effluent and sanitary wastewater	No discharge of untreated effluent to the environment or the canals	□□The power plant water treatment systems will be designed to ensure that the wastewater meets BNEQS before it is drained into the river.
Emission	Emission from the plant can potentially affect air quality	BNAAQS and the IFC Thermal Power Plants Emission Limits	□□Low NOx burner should be selected for turbine selection □□Proper stack height to be maintained.
Water Resources	An adverse impact on the water resources will be interpreted if it is established that the water consumed by the Project has directly affected the ability of the community to meet their water needs	The extraction of water for the power plant construction activities can affect the groundwater availability for the Study Area communities	□□Availability of ground water to be studied □□Use surface water where possible □□Initiation of a water conservation program
Hazardous and Non-Hazardous Waste	Various types of wastes such as packing waste, metal scrap, and excess materials, air filters, oily rags, will be generated during the operation phase. The waste can be a health hazard and pollute waterways, if disposed improperly	Material Safety Data Sheets (MSDS)	□□Storage and handling of hazardous materials in accordance with international standards and appropriate to their hazard characteristics. □□All hazardous waste will be separated from other wastes □□Storage of fuels, chemicals and lubricants in bounded areas with impervious flooring and secondary containment of 110% capacity □□Availability of supporting information such as the MSDS □□A Hazardous Materials Register to be in place

Waste Management	Waste generated during power plant operation can potentially damage the environment	Any person is exposed to potentially hazardous waste generated by the Project. Project generates waste that can be avoided through practicable means(waste minimization) Reusable waste generated by the Project is discarded. Recyclable waste instead of separation at the source is dumped at the trash bins. Non-recyclable and non-reusable waste ends up at any place other than the designated landfill site.	World Bank EHS Guidelines on Hazardous Materials Management, Waste Management and Thermal Power will be followed Separation of recyclable materials Regular audits of waste management system Maintenance of a Waste Tracking Register and all records will be kept Separation of hazardous waste from non-hazardous waste. On-site segregation and initial storage of hazardous waste Off-site disposal of hazardous waste in approved hazardous waste disposal facility. Recyclable waste to be disposed via licensed waste contractors Audits of the waste disposal contractors and waste disposal facilities Develop an emergency response plan for the hazardous substances Training of personnel in identification, segregation, and management of waste Appropriate labelling of all containers of hazardous waste
Occupational Health & Safety of workers	Non-ionizing radiation, Heat, Noise, Confined spaces, Electrical hazards, Fire and explosion hazards, Chemical hazards, Dust, sanitation, safe drinking water etc.	Proper monitoring for work place environment, health & safety condition of the workers, PPE check, Fire drill and training of workers	• World Bank EHS guidelines on Occupational H&S, Community H&S and Thermal Power will be followed. • Regular health check-up of workers • Proper PPE should be provided to protect from the heat, electric shock and noise protection, • Regular awareness and training should be provided for fire safety & chemical hazard, • Safe drinking water should be provided

CHAPTER SEVEN: ENVIRONMENTAL MANAGEMENT PLAN

7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Background

In the context of a project, Environmental Management Plan is concerned with the implementation of the measures necessary to minimize or offset adverse impacts and to enhance beneficial impacts. All mitigation and monitoring measures will follow the World Bank EHS Guidelines and Bangladesh national. Unless the mitigation and benefit enhancement measures that identified in the ESIA are fully implemented, the prime function of ESMP cannot be achieved. All the measures are said to be successful when they comply with the Environmental Quality Standard (EQS) of Bangladesh. Thus the objectives of ESMP for the present project would be

- Mitigation measures to reduce or eliminate negative impacts
- Enhancement measures to maximize positive impacts
- Monitoring requirement and
- Monitoring indicators

Feasible and economically expedient measures are planned to be implemented at EMP which can reduce to a reasonable level and/or exclude possible essential negative consequences of environmental impact.

At ESMP, in particular:

- Expected adverse environmental impacts at construction stage and operation are identified and generalized;
- Impact reduction measures are described;
- Interrelation with existing impact reduction plans are established;
- Parameters subject to measurement, monitoring methods to be applied, places of supervision, frequency of measurements are specified.

The environmental and social management plan includes the following elements facilitating its timely and effective realization:

- Management system - reflects implementation mechanism of ESMP;
- Roles and responsibilities - identify persons responsible for realization of measures on impact reduction and monitoring;
- Impact importance assessment - is intended for timely reveal of aspects invoking particular measures on impact reduction;

- Environmental and social management plan includes the list of actions on impact decrease, monitoring, and also amount of expenses for their realization.

In case any non-compliance, change in scope, or unanticipated impact arises during project implementation, corrective action will be taken accordingly as per ADB SPS 2009 and national requirements.

Each of these elements is described below in details.

7.2 System of environmental and social management

For effective implementation of recommendations on impact reduction it is necessary to organize a system of environmental and social management.

The model of the management system consists of four basic components:

- planning includes development of particular actions and procedures on their realization;
- introduction and functioning - are direct realization of actions;
- checks and correcting actions include monitoring of environmental objects and control over execution of actions;
- Analysis includes reporting and efficiency assessment of the introduced actions.

The system of environmental and social management assumes conformity to the Standard of environmental management system ISO 14001 according to which constant improvement of the developed model (periodic updating with entering necessary revisions) is necessary. It is important to note, that special attention during management is paid to interaction with stakeholders, including submission of reporting and processing notes and offers received.

7.3 Roles and responsibility

For realization of ESMP, it is necessary to identify persons responsible for performance of impact decrease/prevention actions, and also those responsible for control over the given actions and to define their role at all stages of the project implementation.

Table 7-1: Responsibilities for EMP Implementation

Organization	Responsibility
Reliance Bangladesh LNG & Power Ltd., (Project Implementation unit (PMU) and Operation & Maintenance unit)	➢ Overall responsibility for environmental performance of 750 MW CCPP ➢ Decision-maker on applicable policies to the 750 MW CCPP ➢ Oversight supervisory role during the construction phase ➢ Overall responsibility for ESMP implementation during the operation phase ➢ Review reports of the Independent Environmental Monitoring Consultant ➢ Approves changes to the ESMP, as necessary, as part of an adaptive approach to environmental and social management of the750 MW CCPP ➢ Responsible for working with stakeholders in Different issues ➢ Develop an health, safety &environmental unit, headed by the Project Environmental Officer to implement ESMP responsibilities ➢ Management, implementation, monitoring and compliance of the ESMP, ESIA, and any approval conditions, including construction supervision and performance of all 750 MW CCPP staff, contractors and subcontractors ➢ Review of ESMP performance and implementation of correction actions, or stop work procedures, in the event of breaches of ESMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project ➢ Ensure effective communication and dissemination of the content and requirements of the ESMP to contractors and subcontractors ➢ Assisting the contractor with implementation of ESMP sub-plans ➢ Monitoring of ESMP and ESIA performance ➢ Ensuring compliance to all project social commitments, including implementation of the social management and resettlement plans ➢ Report on environmental performance to DOE, the ADB, and other regulators as required ➢ Prepare environmental reports summarizing project activities, as required ➢ Representing the project at community meetings ➢ Ensuring effective community liaison and fulfilling commitments to facilitate public consultation throughout the project cycle
Supervising Engineer	➢ Preparation and implementation of the Environmental Supervision Plan during construction ➢ Preparation and implementation of the Environmental Monitoring Plan during construction ➢ Supervision of contractor performance on implementation of the Construction and Work Camp Management Plan

	➢ Reporting any incidents or non-compliance with the ESMP to the PMU ➢ Ensuring adequate training and education of all staff involved in environmental supervision ➢ Making recommendations to the RBLPL (PMU) regarding ESMP performance as part of an overall commitment to continuous improvement
Construction Contractor	➢ Preparation and implementation of the Construction and Worker Camp Management Plan ➢ Prepare and maintain records and all required reporting data as stipulated by the ESMP, for submission to the Supervising Engineer &Consultant ➢ Ensure that all construction personnel and subcontractors are informed of the intent of the ESMP and are made aware of the required measures for environmental and social compliance and performance ➢ During construction, maintain traffic safety along access roads, with special emphasis on high traffic areas
Independent Environmental Monitoring Consultant	➢ Report to RBLPL, DOE and the Asian Development Bank on project compliance with environmental and social commitments in the ESMP, ESIA and other applicable standards
Local Authorities	➢ Local authorities, communities and individuals shall take part in the supervision of both the ESMP and ESIA, where applicable

7.3.1 Construction stage

General construction management and control over conducting technological process during construction works will be assigned to the contractor and RBLPL project management. The contractor, in turn, concludes contracts with subcontract organizations performing works at the construction site. The RBLPL authority bears responsibility under Project Implementation unit (PMU) for selection and assessment of subcontract organizations. Control functions over contract organizations activity in the field of labour safety, industrial safety and preservation of the environment are also assigned to the Consortium.

7.3.2. Operation phase

RBLPL Management will be responsible to operate the power project under Operation & Maintenance unit (O&M) during the operation phase and will be responsible to maintain the environmental and social standard of the project.

7.4 MITIGATION/BENEFIT ENHANCEMENT MEASURES

For effective and environment friendly operation of a project, a set for guiding tools and suggestions are necessary which need to be followed at various stages of plant installation, operation and maintenance. This plan generally has various components of management depending on the type of project or plant activity and types of discharge and their pollution potential. This Environmental and Social Management Plan (ESMP) once prepared forms the basis of environmental management actions from the part of the project authority may need modification or up-gradation because of changes in the plant operation or accurate pollution load/environmental problems detected afterwards.

All beneficial and adverse impacts which may likely to occur at different phases of the project have been identified in section 6.0. Predictions, evaluation, aspect of mitigation and benefit enhancement measures have also been discussed concurrently with impacts prediction and evaluation. In view of the earlier discussion summary of recommended mitigation and benefit enhancement measures are presented in Table 7.2.

Table 7.2: Identification of Impacts, Mitigation measures, Monitoring and Management during Construction period

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training
				Implementation	Supervision			
Pre-Construction and Construction	Undertake additional baseline studies for one year during construction to include: • Ambient air quality monitoring at sensitive receptors within the zone of maximum deposition. • Seasonal 24hr noise monitoring at nearest sensitive receptors (in absence of construction work) • Seasonal monitoring of river water temperature 500m upstream and downstream of the discharge point (away from the influence of the outfall channel). Detailed design for 750MW CCPP to incorporate mitigation measures set out in the ESIA and the EHS General and Thermal Power Plant Guidance. Detailed design to demonstrate: (i) emission standard of 25ppm NOx will be met through adoption of dry low NOx burner (catalytic removal will be retrofitted if necessary following review of annual ambient air quality data) with dust filters on air intake to ensure no particulate or SO2 emission, (ii) noise level of 70dB can be achieved at the site boundary and that there will be no increase in background noise levels greater than 3dB at the nearest sensitive receptors,	Before and during construction	A continuous daily visual inspection by trained staff of the contractor is needed. Weekly monitoring and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during decommissioning.	Implementation of Good Site management practices shall be the responsibility of all contractors on site under supervision of the RBLPL nominated Project Manager.	RBLPL Project Manager in collaboration with the Consultant's Site Manager& third party consultant	SPM, PM10, PM2.5, NO2, SO2 & CO.	Monthly reporting of summary results and submitted to the RBLPL and any other concerned authorities. (e.g. DOE, ADB, etc.).	RBLPL responsible basic training of persons employed to operate and maintain the monitoring system. RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.

	(iii) There will be no increase in the temperature of the river above the existing discharge temperature near the outfall. (v) structural engineering meets the applicable seismic design standards for location of the power plant, and (v) H&S measures for the EHS of Thermal Power plant guidelines are incorporated, undertake quantitative risk assessment of gas-related elements to demonstrate there will be no increase in risk level at the nearest sensitive receptors from gas leak, fire or explosion. Finalize IEE for associated facilities including grievance redress mechanism and to address hazardous materials and waste management. Prepare Construction Environment Management Plan incorporating site waste management plan and emergency response procedures, Construction Health and Safety Plan incorporating emergency response procedures, and Construction Traffic Management Plan.							

Air Quality: Dust emissions caused by construction activities, construction vehicle movements, and transport of construction materials.	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction. Emissions must be within prescribed limits of National Ambient Air Quality Standards. Mitigation practices including: • appropriate sitting and maintenance of stockpiles of materials so as to minimize dust blow (seek to achieve a distance of at least 500m from nearest sensitive receptors); • minimizing drop heights for material transfer activities such as unloading of materials; • construction phase to begin with construction of access roads; • roads will be kept damp via a water browser; • provide wheel wash for all vehicles leaving the project site; • do not permit any open burning on the project site; • roads will be compacted and graveled if necessary; • site roads will be maintained in good order; • regulation of site access; • sheeting of lorries transporting construction materials and soil; • enforcement of vehicle speed limits on nonmetal roads to <20 km/h.	Before construction and during construction	A continuous daily visual inspection by trained staff of the contractor is needed. Weekly monitoring and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction. Measurements and analysis of different pollutants to be made on a continuous basis (at least monthly) by a third party consultant and the report to be submitted to the RBLPL authority. Monitoring to be carried out on site and surrounding.	Implementation of Good Site management practices shall be the responsibility of all contractors on site under supervision of the RBLPL nominated Project Manager.	RBLPL Project Manager in collaboration with the Consultant's Site Manager& third party consultant	SPM, PM10, PM2.5, NO2, SO2 & CO.	Monthly reporting of summary results and submitted to the RBLPL and any other concerned authorities. (e.g. DOE, ADB, etc.).	RBLPL responsible for the management of the air quality monitoring system. Submission of monthly summary reports to DOE and any concerned authorities. Basic training of persons employed to operate and maintain the monitoring system. RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.

Aquatic Environment: Construction of the intake structure and water discharge structure.	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction.	During construction of intake and discharge structures	Continuous daily visual Inspection by trained staff of the contractor. Weekly monitoring and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the RBLPL the Project Manager.	RBLPL Project Director in Collaboration with the Consultant's Site Manager& third party consultant.	Temp., pH, COD. BOD, TSS, TDS, DO, oil & grease etc.	Monthly reporting of summary results and submitted to the RBLPL and any other concerned authorities. (e.g. DOE, ADB, etc.).	RBLPL to ensure that all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice. These mitigation Measures must be a condition of any construction contracts.
Contamination of the aquatic environment as a result of construction activities on land e.g. spillages, disposal of liquid wastes; surface run-off, exposure of contaminated soils.	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction. River water quality must be within prescribed limits of the national ambient water quality standards. Mitigation activities will include the following: • no discharge of effluents into the river- all effluents shall be collected and removed off site for treatment by approved firms or disposed after proper treatment at site (records of effluent transfers to be maintained); • no discharge of surface water runoff direct into the river - development of a temporary site drainage plan which reduces flow velocity and sediment load by passing discharge through a sediment pond; • protection of temporary stockpiles of soil from erosion by using a reduced slope angle where practical, sheeting and by incorporating sediment traps	During construction	Continuous daily visual inspection will be conducted by trained staff of the contractor. Weekly monitoring and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction. River water sample should be collected monthly by a third party consultant from three locations, 500m upstream and downstream of works and at the works site-outfall, if preliminary monitoring campaign shows strong variations in water quality additional locations may be required	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the RBLPL Project management.	RBLPL Project Director in collaboration with the Consultant's Site Manager& third party consultant..	Temp., PH, COD. BOD, TOC, DO, TSS, oil & grease etc.	Quarterly reporting of summary results and submitted to the RBLPL and other concerned authority, e.g. DOE, ADB, etc., if required.	RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.

	in drainage ditches; • maintenance of well kept construction site. • all fuel, oil and chemicals should be stored in bonded area 110% volume. • impermeable surface should be used for refueling • regular training of all workers in spill response • provision of spill equipment at easily accessible locations around the site Treatment of all wastewater must be consistent with the standards and measures in the EHS guidelines on wastewater and ambient water quality							
Noise: Increased noise in the project area as a result of the use of noisy machinery and increased vehicle movements.	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction. No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. And no unprotected ear should be exposed to a peak sound pressure level of more than 140 dB(C). The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reaches 140 dB(C), or the average maximum sound level reaches 110 dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85dB(A). Emissions at the site boundary and nearest sensitive receptors must be within prescribed limits of the EHS Noise Guidelines.	During construction	Continuous daily visual inspection will be conducted by trained staff of the contractor. Weekly monitoring and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction. Monitoring of 24-hr noise levels to be made on a continuous basis (at least monthly) by a third party consultant at the site boundary and nearest sensitive receptors and the report to be submitted to the RBLPL authority.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the RBLPL project management .	RBLPL Project Director in Collaboration with the Consultant's Site Manager& third party consultant.	Noise complaints register to identify concerns. Check the noise level using noise Measuring devices.	RBLPL will produce a monthly log of valid complaints and actions taken. Monthly reporting of summary results and submitted to the RBLPL and any other concerned authorities, e.g. DOE, ADB etc., if required.	RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.

	Implementation of good site practices including: • provision of noise barrier around the project site to reduce off-site noise levels; enforcement of vehicle speed limits; • strict controls of vehicle routing; • diesel engine construction equipment to be fitted with silencers; • limited noisy construction activities at night; • prohibition of light vehicle movements at night; • use of protective hearing equipment for workers.							
Flora and Fauna Site Clearance-Vegetation removal and Habitat disturbance.	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction. • Good site management practices will be observed to ensure that disturbance of habitats off-site are minimized. • Specific mitigation measures include restricting personnel and vehicles to within construction site boundaries, lay down areas and access roads.	During construction.	Continuous daily visual inspection will be conducted by trained staff of the contractor. Weekly inspection and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the RBLPL project management.	RBLPL Project Director in collaboration with the Consultant.	Good conservation of floral wealth.	Quarterly reporting No. of floral species conserved or planted, if any.	RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and Site management practices.
Soils and Hydrology: Site clearance, excavation and disposal of material, exposure of potentially contaminated soils, spillage or leakage of	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction. The potential impacts are largely dependent on management of the construction site and activities. The following mitigation measures will be implemented: • development of effective site	During construction.	Daily visual inspection is required by trained staff of the contractor to ensure the implementation of good management practices during construction. Weekly inspection and supervision by RBLPL is required to ensure the implementation of good site	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the RBLPL project management.	RBLPL Project Director in collaboration with the Consultant.	• site drainage. • access only to construction site areas. • waste materials. • oily waters.	Quarterly reporting of summary results submitted to the RBLPL and any other concerned authorities (e.g. DOE, ADB etc., if required.	RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.

substances on land, movement of equipment and vehicles on site.	drainage systems designed to include allowance for climate change; • restriction of access only to construction site areas; • disposal of waste materials unsuitable for reuse on-site, (e.g. for landfilling) at appropriately licensed sites; • provision of oil and suspended solid interceptors; • management of excavations during construction to avoid the generation of drainage pathways to underlying aquifers; • provision of impermeable bases in operational areas to prevent absorption of spillages.		management practices by all contractors during construction. Quarterly monitoring of drinking water in tube wells within 1km of a septic tank location by third party consultant to confirm that national drinking water standards are met.			• drainage pathways. • potential spillage in Operational areas. Visual Inspection		
Socio-Economic Environment: Positive impacts identified.	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction and Community Health and Safety. Public access to the site must be restricted. All activities related to the construction of the new plant will take place within the area belonging to RBLPL, i.e. there will be no off-site activities or associated land acquisition during construction. Transmission lines & gas line will connect the new power plant to the existing substations and RMS. Ensure H&S measures per the EHS electric power and distribution guidelines and EHS onshore oil and gas development guidelines are incorporated	During construction.	Record local employment provided by the project. Daily visual inspection is required by trained staff of the contractor to ensure the implementation of good management practices during construction. Weekly inspection and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction. Daily monitoring of drinking water provided to construction staff to confirm national drinking water standards are met.	RBLPL Project management	RBLPL Project Director in collaboration with the Consultant.	Workers satisfaction as measured by staff interviews and complaints reported. Visual Inspection	Quarterly reporting	Responsibility of RBLPL.

	The entire labor force will be daily commuters, thus no worker housing or associated facilities will be erected on site during construction. If any off-site accommodation for the labor force needs to be developed the ESIA and EMP should be updated accordingly. No forced or child labor (under age 18) to be employed. All employees to be legal. Regular talks on communicable diseases including HIV to be held for all workers. The contractors will be responsible for relevant temporary water / toilet facilities during construction and the need to provide appropriate services will be specified in their contracts. Provide adequate supplies of drinking water that is compliant with the national drinking water quality standards to all workers. Provide adequate sanitation facilities as outlined in the ESIA. Toilets and bathrooms must be properly equipped including hand washing facilities with hot water and with separate facilities for men and women. Regular talks on sanitation to be held for all workers to encourage cleanliness.							
Traffic and Transport: Disruption, noise and increased air	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction and Community Health and Safety.	During construction.	Daily monitoring of traffic entering the site during morning &evening peaks to ensure the implementation of good site management	Implementation of Good Site Management practices shall be the responsibility	RBLPL Project Director in collaboration with the Consultant.	Increased congestion Travel time (compared to	Quarterly reporting of summary results submitted to the RBLPL and any other concerned	RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees

pollution due to increased traffic, light loads and abnormal loads.	Standard good practice measures will be implemented as follows: • adherence of abnormal load movements to prescribed routes, outside peak hours and advance publication of movements if required; • construction shifts will be staggered; • scheduling of traffic to avoid peak hours on local roads; • routing of transport to avoid residential areas; • provision of adequate signage and flagmen along transport route and at site entrance; • transportation of construction workers by contract bus. Ensure all roads and bridges used by construction traffic are maintained in at least their current state during construction with any damage immediately repaired. Condition survey of roads and bridges to be undertaken by third party consultant prior to start of works to provide a baseline for monitoring compliance.		practices by trained staff of the contractor. Weekly inspection and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction. Quarterly monitoring of road and bridge condition by third party consultant to ensure maintenance being kept up.	of all contractors on site under supervision of the RBLPL project management.		reasonable daily commute) Visual Observation	authorities (e.g. DOE, ADB etc.), if required.	are given basic induction training on good construction and Site management practices.
Archaeology: Potential chance finds of archaeological remains during construction.	The project site does not lie on, or in the immediate vicinity of any known archaeological areas of interest. If remains are found RBLPL is committed to: • cease activities and consult archaeological department; • protection in situ if possible; • excavation of areas where protection not feasible following discussion and agreement of archaeological department;	During construction.	Daily visual inspection is required by trained staff of the contractor to ensure the implementation of good management practices during construction. Weekly supervision of construction activities by RBLPL is required to ensure the implementation of good site management practices by all contractors during	RBLPL project management will allocate responsibilities in accordance with the construction site plan.	RBLPL Project Director in collaboration with the Consultant.	Visual observation	Quarterly reporting of summary results And submitted to the RBLPL and any other concerned authorities (e.g. DOE, ADB etc.), if required	RBLPL to ensure that all workers on site are aware of the importance of archaeological remains and must report any potential finds immediately.

			construction.					
Natural Disasters Flash flooding.	Good engineering design will incorporate the following mitigation measures: • drainage system designed to direct flood water from main plant areas into the river and direct potentially contaminated waters through the oil interceptor.	During construction.	Continuous daily visual inspection will be conducted by trained staff of the contractor. Weekly monitoring and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction.	RBLPL project management	RBLPL Project Director in collaboration with the Consultant.	Visual observation	Quarterly reporting of summary results submitted to the RBLPL and any other concerned authorities (e.g. DOE, ADB etc.), if required	RBLPL to ensure that all workers on site receive training in emergency preparedness and response procedures.
Solid Waste Management	Follow mitigation measures set out in this ESIA and the EHS Guidelines on Construction and Waste Management. Good practice measures such as the following: (1) all waste taken off-site will be undertaken by a licensed contractor and RBLPL will audit disposal procedure; (2) collection and segregation of wastes and safe storage; (3) recording of consignments for disposal; (4) prior agreement of standards for storage, management and disposal with relevant authorities. It is of highest importance that final disposal of wastes shall be strictly adhered to environment friendly disposal Contract.	During construction.	Contractor to keep daily records of all waste transfers. Weekly monitoring by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the RBLPL project management	RBLPL Project Director in collaboration with the Consultant	Management contract in place, visual observation and record check	Quarterly reporting of summary results submitted to the RBLPL and any other concerned authorities (e.g. DOE, ADB etc.), if required	RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site Management practices.

Occupational Health & Safety	Good local and international construction practice (as per the ESIA and EHS Construction and Occupational H&S Guidelines) in Environment, Health and Safety (EHS) will be applied at all times and account will be taken of local customs, practices and attitudes. Regular H&S training will be conducted for all construction staff, including training on good housekeeping, cleanup of debris and spills, and working in confined spaces and at height. Measures include: • implementation of EHS procedures as a condition of contract all contractors and subcontractors; • clear definition of the EHS roles and responsibilities for all construction companies and staff; • management, supervision, monitoring and record-keeping as set out in plant's operational manual; • pre-construction and operation assessment of the EHS risks and hazards; • completion and implementation of Fire Safety Plan prior to commissioning any part of the plant; • provision of appropriate training on EHS issues for all workers; • provision of health and safety information; • regular inspection, review and recording of EHS performance; • appointment of site nurse and provision of free on-site medical care for all construction staff; • pest and vector control;	During construction.	Daily inspection is required to ensure the implementation of EHS Policies, plans and practices during construction. Weekly monitoring and supervision by RBLPL is required to ensure the implementation of good site management practices by all contractors during construction Record all fatalities, accidents and near misses that occur during construction work and implement corrective action to ensure such incidents are not repeated in future.	Implementation of good site management practices and the EHS policies shall be the responsibility of all contractors on site under the supervision of the RBLPL project management.	RBLPL Project Director in collaboration with the Consultant.	Management procedures in place. Workers health and safety as measured by number of incidents.	Daily inspection Quarterly reporting of summary results submitted to the RBLPL and any other concerned authorities (e.g. DOE, ADB etc.), if required	RBLPL to ensure all contractors and sub-contractors for workers on site include reference to the requirement of the ESMP and are aware of the EHS policies of the project. All employees will be given basic induction training on EHS policies and practices. Contractors are responsible for ensuring that a Fire Safety Plan, is prepared and implemented prior to commissioning of any part of the plant under supervision overbill project management.

	• maintenance of a high standard of housekeeping at all times. • provision of first aid equipment at easily accessible locations around the site							
Supply Chain Management	Good and international supply chain guideline should be followed to ensure: • Flow of the service of construction workers is experienced and professional to ensure the completion of the project in time. • No child labor included • Equipment supplier and sub-contractors should follow proper guideline during supplying and selecting the equipment and material at site.	Before and during construction	A continuous daily visual inspection by trained staff of the contractor is needed. Weekly monitoring and supervised by RBLPL is required to ensure the implementation of good site management practices by all contractors during decommissioning.	The contractor assigned for the project	The authority of RBLPL	Adequate propagation of the construction work and completion of each step in time	Weekly monitoring by the contractor and monthly monitoring by the RBLPL authority.	RBLPL to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.
Institutional setting and implementation arrangements	The EMP (mitigation plan) will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction	Before and during construction	A continues monitoring is needed in order to ensure the maintenance of the institutional setting	EPC Contractor	RBLPL	Obtaining statutory clearances required during pre-construction stage of the Project.	Once a week by the contractor and once a month by RBLPL	Basic instructions must be given to all the contractors and subcontractors.

Table 7.3: Identification of Impacts, Mitigation measures, Monitoring and Management during Operational period

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training
				Implementation	Supervision			
Air Quality Emissions from stack are not expected to exceed standards.	Implement mitigation as set out in the ESIA and EHS Guidelines on Air Emissions and Air Quality and Thermal Power. Emissions standards to be achieved during operation are 51 mg/m3 or 25ppm NOx.	Life time of plant operation.	Automatic monitoring of stack emissions for NOx, to be installed in the stacks. Annual stack emissions testing of NOx by third party consultant. Monitor and record annual gas consumption to calculate annual emissions of CO2.	The analyzer stations will be owned and operated by RBLPL	RBLPL Top Management & EHS department	Stack emissions of NOx concentration. Annual CO_2.	Continuous Hourly data acquisition. Quarterly reporting to RBLPL. Reports are tube available to any of the concerning Authorities (DOE, ADB, etc.).	Records must be kept and summary data (including any deviations from DOE and World bank standards) will be submitted to the DOE and ADB as regular basis.
Ambient air quality affected by emissions from the power plant.	RBLPL will implement the mitigation measures suggested in the ESIA report. If ground level concentrations are found to be above the National Ambient Air Quality Standards, options for further mitigation will need to be implemented.	Life time of plant operation.	Conduct continuous ambient air quality monitoring for NOx, SO2, CO, PM10 & PM2.5 at four different locations (sensitive receptors) located within the zone of maximum deposition.	Third party monitoring	RBLPL Top Management & EHS department Third party inspection.	Ambient air pollutants concentrations (at least PM10, $PM_{2.5}$, NO_x, SO_2, and CO).	Quarterly reporting to RBLPL. Reports are tube available to any of the concerning Authorities (DOE, ADB, etc.).	Quarterly reporting by RBLPL to Government and ADB etc. (or more frequently if required) highlighting key features and comparing results with air quality standards and prediction in ESIA report

Aquatic Environment Discharge of process water.	Implement mitigation as set out in the ESIA and EHS Guidelines on Wastewater and Ambient Water Quality and Thermal Power. Effluent discharge of process water to meet standards set out in Table 5 of the EHS Guidelines on Thermal Power. These levels should be achieved, without dilution, at least 95 percent of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours. Sanitary discharges to meet national wastewater treatment standards. Good site management practices including the following will be implemented: 1) proper treatment of contaminated water or cooling water before discharge to natural water body. 2) no disposal of solid wastes into the discharge structure; 3) regular maintenance of site drainage system to ensure efficient operation; 4) all discharges will comply with local and World Bank guidelines. • all fuel, oil and chemicals should be stored in bounded area 110% volume	Lifetime of the Plant	Third party consultant to prepare and undertake a monthly water quality monitoring program of all discharges, 500m upstream & downstream of the project site and at the outfall location to the river including: temperature, pH, COD, BOD, TSS, oil & grease and residual chlorine.	RBLPL Project management. Third party monitoring supervised by the RBLPL Management	RBLPL management & EHS department.	Basic parameters as per the ECR 1997 pH, TSS, oil and grease, total residual chlorine, temperature, BOD & COD	Quarterly reports Prepared by RBLPL or third party. Reports are tube available to any of the concerning Authorities(DOE, ADB, etc.).	Records will be kept and compared on regular basis against Bangladesh and World Bank standards and impacts predicted in ESMP. RBLPL to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and H&S procedures.

	• regular training of all workers in spill response • provision of spill equipment at easily accessible locations around the site							
Noise Quality	Implement mitigation as set out in the ESIA and EHS Guidelines on Noise and Thermal Power. No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. And no unprotected ear should be exposed to a peak sound pressure level of more than 140 dB(C). The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reaches 140 dB(C), or the average maximum sound level reaches 110 dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85dB(A). Emissions at the site boundary and nearest sensitive receptors must be within prescribed limits of the EHS Noise Guidelines. Specific design mitigation measures to minimize noise impacts include:	Life time of the plant operation.	When the plant is fully operational, quarterly noise audit measurements are to be carried out at noise sources and at the fence of the power plant as well as at sensitive noise receptors around the plant. Monitoring to be carried out on site and at the nearest receptor.	RBLPL Project management. Third party monitoring supervised by the RBLPL Management	RBLPL management & EHS department.	Power plant to comply with ESMP suggestions.	Monthly noise reports Prepared by RBLPL or by third party. Reports are to be available to any of the concerning Authorities(DOE, ADB, etc.).	Should any complaints be received regarding noise, these will be logged and the RBLPL EHS team will investigate the problem. RBLPL to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and EHS procedures.

	• gas turbines, steam turbine generators; air compressors, pumps and emergency diesel engines are enclosed in the Buildings with proper acoustic design; • provision of a noise barrier around the project site to minimize off-site noise levels.							
Flora and Fauna: Disturbance to habitats as a result of noise, vehicle and personnel movements.	The following mitigation measures will be implemented: • restrict personnel and vehicle movements to access roads and within boundaries of site only; • control of noise during operation.	Lifetime of the plant.	No monitoring is envisaged.	RBLPL Project management	RBLPL management & EHS department.	Good plantation	Yearly report prepared by RBLPL or by third party.	RBLPL to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and EHS procedures.
Visual Impact Visual image of Power plant from surrounding areas.	The visual effect of the power plant will be improved through: • creation of landscaped boundary along the fence of the power plant. • Planting sufficient amount of trees around the project site	Lifetime of the plant.	No monitoring is envisaged.	RBLPL Project management	RBLPL management & EHS department	Improved visual image		Management to consider the landscaped areas to maximize visual image and habitat creation. RBLPL to manage and maintain proper landscaped areas.
Soil and Hydrology: Spillage of oils, chemicals or fuels	Follow mitigation measures in ESIA and EHS Guidelines on Hazardous Materials Management and Waste Management.	Lifetime of the Plant	The RBLPL authority will continuously monitor application of ESMP and good site management .	RBLPL Project management	RBLPL management &EHS department	Quality of bunds and drainage systems. Efficiency of	Yearly report prepared by RBLPL EHS department Reports are to be	RBLPL to ensure all employees will receive related training.

onsite.	Good site management measures as described in the ESMP, under aquatic environment will minimize any potential risks. As part of this, regular checks of bunds and drainage systems will be undertaken to ensure containment and efficient operation. Septic systems should only be used for treatment of sanitary sewage, and are unsuitable for process wastewater treatment.		6 monthly monitoring of drinking water in tube wells within 1km of a septic tank location by third party consultant to confirm that national drinking water standards are met. See also water quality monitoring program above.			operation.	available to any of the concerning Authorities(DOE, ADB, etc.).	
Solid Waste	Follow mitigation measures in ESIA and EHS Waste Management Guidelines. Good practice measures undertaken during the construction phase will be continued into the operation phase. It is of highest importance that final disposal of wastes shall be strictly adhered to environment friendly disposal contract.	Lifetime of the plant	Daily records of waste transfers to be kept. Continuous monitoring is required to ensure the implementation of good management practices during operation.	RBLPL Project management	RBLPL management & EHS department	Efficient waste collection and disposal system should be done by either RBLPL or Contractor in place.	Quarterly reports from the EHS to RBLPL management. Reports are to be available to any of the concerning Authorities(DOE, ADB, etc.).	RBLPL to ensure all employees are given basic induction training on good operation and site management practices.

	Records of all waste transfers to be maintained.							
Occupational Health and Safety, Risks and Hazards	Follow mitigation measures in ESIA and EHS Occupational Health and Safety and Thermal Power Guidelines. Drinking Water provided to employees to meet drinking water standards. Occupational EMF exposure should be prevented or minimized through the preparation and implementation of an EMF safety program. Use of warning signs near noisy environments and high temperature surfaces and provide personal protective equipment (PPE) as appropriate, including ear muffs and insulated gloves and shoes. The stand mitigation that has been suggested in the ESMP report will be implemented and followed on site.	Lifetime of the Plant	Regular on-site training. Regular staff checks, system checks and field tests of emergency procedures by on-site management. Record all fatalities, accidents, near misses and occupational diseases that occur during operation and implement corrective action to ensure such incidents are not repeated in future. Quarterly health check of employees with respect to EMF exposure and other occupational hazards. Daily monitoring of drinking water provided to employees to confirm national drinking water standards are met.	RBLPL Project management	RBLPL management & EHS department.	Management procedures in place. Workers health and safety status, incidents, injuries, slip, trip, falls and near misses are properly documented .	Quarterly reports from the EHS to RBLPL management. Reports are to be available to any of the concerning Authorities(DOE, ADB, etc.). .	RBLPL to ensure that all employees are given basic induction training on EHS policies and procedures, Emergency Preparedness and Response Plan.
Supply Chain Management	Good and international supply chain guideline should be followed to ensure:	Life time of the project	Monthly monitoring and supervision by RBLPL is required to ensure that all	RPLBL project management	The authority of RBLPL	Record check and visual inspection	Quarterly monitoring by the RPLBL authority.	RBLPL to ensure all contractors and subcontractors working at

	• Uninterrupted generation of electricity • Continuous supply of raw materials at site. • Proper labor law followed and no child labor included • Equipment & raw material supplier and other sub-contractors should follow proper guideline during supplying and selecting the equipment, material and services at site.		supplies and services procured by RBLPL complies the international supply chain guideline.					site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.
Repair and maintenance schedules for the turbines and cooling system	The gas turbine, steam turbine and cooling system require repair and maintenance schedules for the turbines and cooling system to maximize life cycle and operation efficiency.	Lifetime of the Plant	• As per the manufacturer's schedule the gas turbine set needs timely minor, hot gas path and major inspection at specific time interval. • The repair and maintenance of steam turbine and cooling water system will be done according to the manufacturer's recommendation and as required.	RBLPL Project management	RBLPL management & EHS department.	Schedule check	Schedule for GT & cooling tower maintenance will be carried out as per manufacturer recommendation.	RBLPL to conduct the inspection with specialists as per schedule.

7.5 MONITORING PLANS AND SCHEDULES

7.5.1 During Construction Phase

The environmental monitoring program should be carried out as an integral part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. For this purpose, it is recommended that the Project Director (PD) for this specific project should take the overall responsibility of environmental management and monitoring. The PD will form a team with required manpower and expertise to ensure proper environmental monitoring, as specified in Table 7.7 below, and to take appropriate measures to mitigate any adverse impact and to enhance beneficial impacts, resulting from the project activities. The PD through its team will make sure that the Contractor undertake and implement appropriate measures as stipulated in the contract document, or as directed by the PD to ensure proper environmental management of the project activities. It should be emphasized that local communities should be involved in the management of activities that have potential impacts on them (e.g., traffic congestion in the surrounding areas). They should be properly consulted before taking any management decision that may affect them. Environmental management is likely to be most successful if such decisions are taken in consultation with the local community.

Table 7.4summarizes the potentially significant environmental impacts during construction phase, the measures needed to eliminate or offset adverse impacts and enhance positive impacts.

Table 7.4 Potentially significant environmental impact during construction phase and mitigation measures

Activity/Issues	Potentially Significant Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
Influx of Workers	• Generation of sewage and solid waste	• Construction of sanitary latrine and septic tank system (one latrine for 20 persons) • Erecting “no litter” sign, provision of waste bins/cans, where appropriate • Waste minimization, recycle and reuse • Proper disposal of solid waste (in designated waste bins)	Contractor (Monitoring By RBLPL)
	• Possible spread of disease from workers	• Clean bill of health, a condition for employment • Regular medical check-up of workers	
Transportation of equipment, materials and personnel; storage of materials	• Increased traffic/navigation • Generation of noise, especially affecting the nearby residential areas	• Scheduling of deliveries during after regular working hours • Protecting local community from traffic hazard during construction phase, with installation of proper traffic sign and warnings • Speed reduction to 10 km per hour within the RBLPL complex	Contractor (Monitoring by RBLPL)
	• Deterioration of air quality from increased vehicular movement,	• Keeping vehicles under good condition, with regular checking of vehicle condition to ensure compliance with national	

	affecting people in the surrounding areas	standards	
	• Wind-blown dust from material (e.g., fine aggregate) storage areas	• Watering unpaved/dusty roads (at least twice a day; cost estimate provided) • Sprinkling and covering stockpiles • Covering top of trucks carrying materials tithe site and carrying construction debris away from the site	
Construction activities, including operation of construction equipment	• Generation of noise from construction activities(general plant and access road construction),especially affecting the local resident	• Use of noise suppressors and mufflers in heavy equipment • Avoiding, as much as possible, construction equipment producing excessive noise during at night • Avoiding prolonged exposure to noise (produced by equipment) by workers • Creating a buffer zone between the neighbouring community and construction site	Contractor (Monitoring by RBLPL);
	• Deterioration of air quality from wind-blown dust and possible use of equipment, such as stone (aggregate crushers)	• Not using equipment such as stone crushers at site, which produce significant amount of particulate matter • Keeping construction equipment and generators in good operating condition • Using equipment, especially generators with high levels of emission control. • Immediate use of construction spoils as filling materials • Immediate disposal/sale of excavated materials • Continuous watering of bare areas	
	• Generation of construction Waste	• Hauling of construction debris away from the site and their appropriate disposal in a designated disposal site	
	• Accidents	• Regular inspection and maintenance of equipment • Environmental health and safety briefing • Provision of protective gear	
	• Spills and leaks leading topsoil and water contamination with hydrocarbon and PAHs	• Good house keeping • Proper handling of lubricating oil and fuel • Collection, proper treatment, and disposal of spills	
	• Employment of work/labour force	• Local people should be employed in the project activities as much as possible.	

7.5.2 Operation Phase

Most of the environmental parameters will experience beneficial effects during the operation phase of the power plant project. Efforts should be made to enhance these beneficial impacts, which may include incentives for proper growth of more projects in the area. The plant management authority of RBLPL should be responsible for overall environmental monitoring during the operation phase of the project.

Table 7.5 summarizes the potentially significant environmental impacts during operation phase, the measures needed to eliminate or offset adverse impacts and enhance positive impacts.

Table 7.5 Potentially significant environmental impact during operation phase and mitigation measures

Activity/ Issues	Potentially Significant Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
Power Generation	• Emission from the power plant	• Using stack as specified in the design • Using low nitrogen oxide burners, as specified in the design • Installation of stack emission monitoring equipment for major pollutants. An in-house Continuous Air Monitoring Station (CAMS) may be considered. • In stack design due consideration should be given to proper insulation • Planting of trees around the project site	RBLPL
	• Generation of noise	• Provision of silencers for generators and turbines • Planting of trees around the project site • Regular plant maintenance • Regular noise monitoring, especially at the project boundary and residential quarters located nearby • Use of ear-muffs and ear-plugs by plant personnel working in the generator and turbine facilities of the plant	
Surface Water discharge	• Increase of river water pollution	• Regular monitoring of surface water discharge and river water quality at the upstream and downstream of the discharge point	RBLPL
Waste Generation	• Inappropriate disposal of sewage causing environmental pollution • Generation of solid waste including sludge from demineralizer. • Possible water pollution	• Good housekeeping • Proper construction and maintenance of wastewater disposal system for the plant premises. • Ensuring proper storage, treatment, and disposal of all solid waste • Monitoring of effluent quality from treatment plant • Monitoring of river water quality and discharge water quality	RBLPL
Occupational Health & Safety of workers	Non-ionizing radiation, Heat, Noise, Confined spaces, Electrical hazards, Fire and explosion hazards, Chemical hazards, Dust, sanitation, safe drinking water etc.	• Regular health check-up of workers • Proper PPE should be provided to protect from the heat, electric shock and noise protection, • Regular awareness and training should be provided for fire safety & chemical hazard, • Safe drinking water should be provided	RBLPL
Turbines and cooling system inspection	Machine performance may deteriorate with time.	• As per the manufacturer's schedule the gas turbine set needs timely minor, hot gas path and major inspection at specific time interval. • The repair and maintenance of steam turbine and	RBLPL

		cooling water system will be done according to the manufacturer's recommendation and as required.	

7.6 Monitoring Parameters

7.6.1 Construction Period

There are two types of monitoring during construction, 1) Visual Monitoring and 2) Analytical Monitoring. The following are the visual monitoring, it's parameters and monitoring frequency for the RBLPL750 MW CCPP:

1. Visual monitoring and observation

Table-7.6: Monitoring plan during construction phase of the project (Visual)

Issue	Key aspects	Monitoring Frequency	Responsibility
Traffic volume	Incoming & outgoing traffic, traffic movement records	Monthly	EPC Contractor/ Consultant
Site Security	Proper fencing, isolation of site from general access, marked passage for workers and visitors	,,	,,
Personal Protective Equipment	Ensure every single person involved in the construction activity wear proper PPE	,,	,,
Incident record & reporting	Documented record of all incident, accident, near misses etc. and its remedial process.	,,	,,
Solid waste	Quantity of solid waste, segregation and disposal process	,,	,,
Oily waste generation & disposal system	Quantity of oily waste, storage and disposal process	,,	,,
Worker's health	Monitoring process of worker's health	,,	,,
Complain from neighbours	Any significant complain from neighbours and it's remedial procedure	,,	,,
Safety orientation & training of workers	Frequency of training & orientation of workers for safety	,,	,,
Sanitation & drinking water facility to workers	Availability of safe drinking water and sanitation to the workers	,,	,,
Site Drainage	Maintaining proper drainage	,,	,,

2. Analytical Monitoring during construction

Table-7.7: Monitoring plan during construction phase of the project (Analytical)

Issue	Parameters	Monitoring Frequency	Responsibility
Ambient air Quality	PM_{10} and $PM_{2.5}$	Monthly	EPC Contractor/ Consultant

River water	Water temp., DO, BOD_5, COD, Oil and Grease and heavy metals (Cr, Cd, Pb)	Monthly	,,
Groundwater	Groundwater level, p^H, TDS, Ammonia, Nitrate, Phosphate, As, Fe, Mn and Coliforms	Once in 6 months	,,
Soil quality	Cr, Cd, Pb and Oil and Grease	Once in 12 months	,,
Noise level	Noise at different locations	Monthly	,,
Drinking water	p^H, Ammonia, Nitrate, Phosphate, As, Fe, Mn and Coliforms	Monthly	,,

7.6.2 Operational Period

The following are the monitoring parameters and monitoring frequency for the RBLPL 750 MW CCPP east during operation:

Table 7.8 Monitoring plan during operational phase of the project

Issue	**Parameters**	**Monitoring Frequency**
Stack emissions	NOx, and temperature	Continuous
Ambient air quality	CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2	Quarterly at four locations, seasonal or half yearly monitoring at other sensitive receptors
River water	Water temperature and DO, PH, COD. BOD, TOC, DO, TSS, oil & grease etc.	Monthly
Effluent quality	pH, DO, Sulphate, TSS, TDS, BOD, COD, Total N, Total P	Monthly
Groundwater	pH, Colour, Turbidity, TDS, Ammonia, Nitrate, Phosphate, As, Fe , Mn and Coliforms; Groundwater level	Once in 6 months
Noise level	Noise at different locations	Once in 3months
Fisheries, Plankton, Zooplankton, Vegetation etc.	Number and Condition	Once in 6 months
Occupational health and safety	Health status and safety	Once in 3 months

Standards to be maintained during monitoring according to DOE and IFC/WB:

Parameter	DOE	IFC/WB	Unit
Air Quality			
CO	NF	10,000	$\mu g/m^3$
NO_x	200	100	$\mu g/m^3$
PM_{10}	150	150	$\mu g/m^3$
$PM_{2.5}$	75	65	$\mu g/m^3$
SO_2	125	365	$\mu g/m^3$
SPM	NF	200	$\mu g/m^3$
Ground Water			
pH	6.5-8.5	6.5-8.5	-
DO	6	NF	mg/L
TDS	≤1000 mg/L	NF	mg/L
Conductivity	NF	250	µS/cm
Alkalinity	NF	NF	mg/L
Iron	0.3-1.0	NF	mg/L
Chloride	150-600	250	mg/L
Hardness	200-500	NF	mg/L
Temperature	(20-30)ºC	NF	^0C
Arsenic	0.05	0.01	mg/L
TSS	10	NF	mg/L
Turbidity	10	NF	NTU
COD	5.6	NF	mg/L
BOD_5 at 20^oC	2.3	0.2	mg/L
TC	14	0	#/100 mL
FC	0	0	#/100 mL
Oil & Grease	54.5	0.01	mg/L
Color	5	15	Pt-Co
Surface Water			
pH	6-9	6-9	-
DO	4.5-8	NF	mg/L
TDS	2100	NF	mg/L
Conductivity	NF	NF	µS/cm
Alkalinity	NF	NF	mg/L
Iron	2	3.5	mg/L
Chloride	600	NF	mg/L
Hardness	200-500	NF	mg/L
Temperature	40	NF	^0C
Arsenic	0.02	NF	mg/L
TSS	150	50	mg/L
COD	200	250	Pt-Co
BOD_5 at 20^oC	50	50	mg/L
TC.	0	0	mg/L
FC.	0	0	#/100 mL
Color	10	10	#/100 mL

*NF= Not Found

7.6.3 Monitoring cost

The proposed monitoring parameters and the frequency to be monitored in accordance with the monitoring plan have been presented in Table 7.7& Table 7.8 during the construction and the operation of the proposed project respectively. The estimated cost of EMP, environmental monitoring and training program during the construction phase and operation phase has been given in **Table 7.9, Table 7.10 & Table 7.11**.

Table 7.9 Cost estimate for environmental monitoring and environmental management during construction

Item	Parameter	unit cost (Taka)	Unit per year	Total cost per year (Taka)
Visual	Visual monitoring	50000.00	12	600,000.00
Ambient air Quality	CO, NO_x, PM_{10} and $PM_{2.5}$	25000.00	12	300,000.00
River water	Water temp., DO, BOD_5, COD, Oil and Grease and heavy metals (Cr, Cd, Pb)	30000.00	12	360,000.00
Groundwater	Groundwater level, pH, TDS, Ammonia, Nitrate, Phosphate, As, Fe, Mn and Coliforms	30000.00	2	60,000.00
Soil quality	Cr, Cd, Pb and Oil and Grease	50000.00	2	100,000.00
Noise level	Noise at different locations	10000.00	26	260,000.00
Process waste	Solid waste	5000.00	52	260,000.00
Health	Health status of the workers	20000.00	6	120,000.00
	Total Cost			**20,60,000.00**

Table 7.10 Cost estimate for environmental monitoring during operational phase

Item	Parameter	unit cost (Taka)	Unit per year	Total cost per year (Taka)
Stack emissions	CO, NO_x, SPM, O_2 and temperature	30000.00	04	120,000.00
Ambient air quality	CO, NO_x, PM_{10}, $PM_{2.5}$,	30000.00	04	120,000.00
River water	Water temperature and DO	5000.00	12	60,000.00
Effluent quality	pH, DO, Sulphate, TSS, TDS, BOD, COD, Total N, Total P	30000.00	04	120,000.00
Groundwater	pH, Colour, Turbidity, TDS, Ammonia, Nitrate, Phosphate, As, Fe , Mn and Coliforms; Groundwater level	30000.00	02	60,000.00
Noise level	Noise at different locations	10000.00	12	120,000.00
Vegetation	Number and Condition	25000.00	01	25000.00
Occupational health and safety	Health status and safety	25000.00	02	50,000.00
	Total cost			**6,75,000.00**

Table 7.11 Cost estimate for training during operational phase

Item	Number	unit cost (Taka)	Total cost per year (Taka)
Safety and occupational health	02	200,000.00	400,000.00
Environmental management system	02	300,000.00	600,000.00
Total cost during operational phase			1,000,000.00
		Total	**2,000,000.00**

7.6.4 Corporate Social Responsibility (CSR)

Reliance Bangladesh LNG & Power believes in principle that "Growth Does Not Exist in Isolation". For Reliance, being socially responsible is not an occasional act, but it is an on-going year-round commitment, which is integrated into the very core of their business objectives and strategy. Reliance Bangladesh LNG & Power Ltd. believes that an environment of common trust and confidence building is essential during project implementation.

The main principles of RBLPL's Corporate Social Responsibilities are:

- Adopt an approach that aims at achieving a greater balance between social and economic development;
- Adopt new measures to accelerate and ensure the satisfaction of the basic needs of all people;
- Work towards elimination of all barriers to the social inclusion of disadvantaged groups- such as the poor or the disabled; and
- Give unfailing attention to children for in their hands lies the future of the society. It is for their sake that health, education and environment are given priority in their programme and investments.

The list of CSR activities will be carried out by Reliance, regularly in surrounding villages of the Reliance Meghnaghat 750 MW CCPP are as follows:

- Organized Health Camps for the villagers in tie-up with nearby hospital and / or local NGOs;
- Distributed free medicines to health sufferers;
- Organized specialized medical camps such as eye treatment, malnutrition, dental treatment, gynaecological treatment, screening cum fitment camps for People With Disabilities (PWDs);
- Distributed free spectacles, performance of cataract operation;
- Organized as Polio & Vaccination drive;
- Awareness towards child literacy and adult literacy programs;
- Distributed study material (school bag, note books, drawing books, colour box, slates, pencils, pencil box etc.);
- Organized felicitation ceremony for the students who scored higher marks in HSC/SSC examination or received any merit on educational front;
- Equipped schools with reference books, blackboards or other teaching aids, sports kits (as per requirement);
- Cooperated and coordinated in the village festivals; and
- Provided basis civic amenities like street lights, drinking water facilities etc. in the nearby villages

During and after the execution of proposed expansion project, the said CSR activities will not only continue but also be enhanced considerably.

7.6.5 Green Belt Development

Even after taking stringent measures for pollution control, in different stages, a significant amount of pollutants are produced such as dust, noise and NO_x during the operational phase. A sustainable and green solution for this problem could be minimized by developing a "Green Belt". In the surrounding areas, trees of specific species can reduce the pollution as well as can provide enhanced oxygen for the surrounding area.

The air pollution that can be emitted by the industries in the area settle on the ground and vegetation of surrounding area. The plants interact with both gaseous and particulate pollutants and to great extent absorb them and thus, remove them from the atmosphere. This pollution removal property of the plants has been known for long time. Many scientists have suggested the green belt for reducing the pollution originated from the industrial operations. (Flemming 1967; Hanson and Thorne 1970).

Suitable plant Species for "Green Belt Development"

Name of the Plant	Name in Bangla	Type	Function
Australian wattle	আকাশমণি	Tree	Reduces Particulate Matter
Bael tree	বেল গাছ	"	"
The Siris Tree	শিরিষ গাছ	"	"
White Siris	কৃষ্ণচূড়া	"	"
Sugar Apple	আতা গাছ	"	"
Kadam	কদম	"	"
Nim	নিম	"	"
Bamboo	বাঁশ	"	"
Australian Whistling Pine	ঝাউ	"	"
Rangan	রঙ্গন	Shrub	Noise Attenuation
Kamini	কামিনী	"	"
Karabi	করবি	"	"
Guava tree	পেয়ারা	"	"
Tagar	টগর	"	"
Mastered Green	সরিষা	Forb/Herb	NO_x Absorption

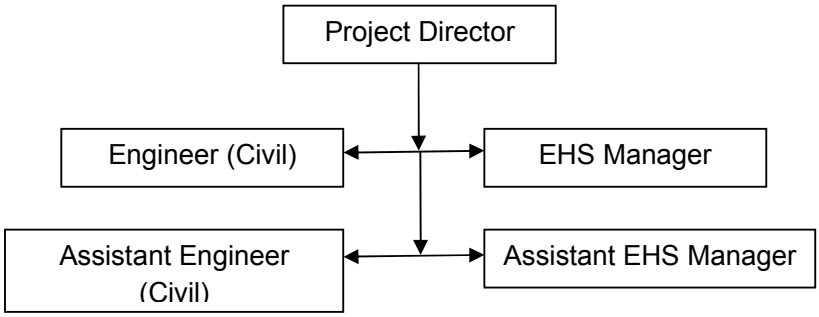
7.6.6 Resources and Implementation

The environmental parameters to be monitored during the construction and operational phases along with the monitoring schedule have been presented in the previous sections. The responsibilities for the implementation of the proposed monitoring plan may be entrusted with the external contractor in association with the RBLPL personnel and under the direct supervision of the RBLPL management.

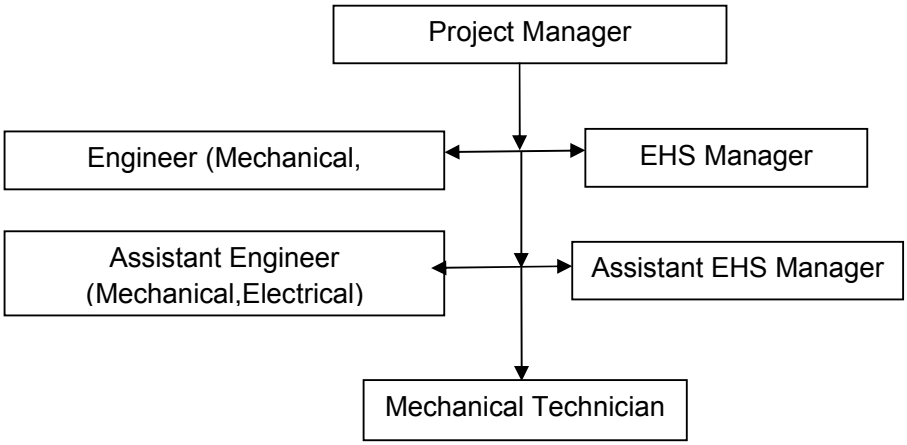
It is very important to make sure that the potentially significant impact during both the construction and operation phases are properly addresses through adaptation of the proposed mitigation and enhancement measures. It is equally important to undertake

environmental monitoring during both the construction and operation phases according to the proposed monitoring plan.

These should therefore be made integral part of the proposed power plant project. The following are the management team of RBLPL who will be responsible for the monitoring program of the proposed project during the construction and operation period; Team for Environment monitoring and ensuring compliance during construction



Team for Environment monitoring and ensuring compliance during operation



7.6.7 In house capabilities of RBLPL for Environmental Monitoring

It is important for RBLPL to create in house capabilities for Environmental Monitoring for the proper implementation of the EMP during the operational period of the project. For this RBLPL will have to establish their own laboratory with the facility to monitor the parameters that have been suggested in the Environmental Monitoring Plan of the EMP. The probable equipment list and budget for the equipment have been outlined below in Table 7.12:

Table 7.12 Cost estimate for setting Environmental Laboratory

Item	Quantity	unit cost (Taka)	Total cost (Taka)
High Volume Samplers	02	500,000.00	1,000,000.00
Fine Particulate Samplers	02	600,000.00	1,200,000.00
Online Emission Monitoring Equipment	01	2000,000.00	2000000.00
Noise Level meter	02	20,000.00	40,000.00
pH meter	02	15000.00	30,000.00
DO meter	01	50000.00	50,000.00
TDS meter	01	30,000.00	30,000.00
Turbidity Meter	01	25000.00	25,000.00
Incubator	01	250,000.00	250,000.00
Refrigerator	01	50,000.00	50,000.00
Analytical Balance (5 digit)	01	400,000.00	400,000.00
COD reactor	01	100,000.00	100,000.00
Spectrophotometer	01	500,000.00	500,000.00
Decicator	01	25000.00	25,000.00
Distilled water machine	01	20000.00	20,000.00
Magnetic Stirrer	01	50000.00	50,000.00
Burette, conical flask, BOD bottle etc.	1 lot	50,000.00	50,000.00
Other glassware	1 lot	50000.00	50,000.00
Different chemicals	1 lot	150,000.00	150,000.00
Filter papers, thimbles etc.	1 lot	150,000.00	150,000.00
Miscellaneous items		100,000.00	100,000.00
		Total	**6,270,000.00**

The above laboratory could be set up under the EHS manager and the following:

- Chemist 01 person
- Lab technician 01 person
- Sample collector 02 persons
- Lab Assistant 01 person

7.6.8 Decommissioning and Dismantling

At the stage of the project planning & implementation process, the necessity for planning and timing of the decommissioning of the construction equipment & structures after the completion of construction and end of life power project of the RPLBL 750 MW CCPP is important. RPLBL authority has planned to prepare a full scale decommissioning plan for the project after construction and after the life expectancy of the project to clean up the site.

After Completion of the Construction of Power Plant

The EPC contractor is responsible for the decommissioning of the Equipment and temporary structure at the project site. After the completion of the construction, there will have plenty of construction equipment, scrap metal, construction materials, different types of waste chemicals as well as the jetty. The EPC contractor should follow the Decommissioning plan that will be prepared by RPLBL before leaving the site.

It will be ensured by the contractor that no hazardous substance will be discharged to the atmosphere.

At the End of Plant's Life

After the power plant will reach its end of life, RPLBL authority should dismantle the entire power plant project and restore the project site back to the normal unless otherwise mentioned by the BPDB. The RPLBL will follow the detail decommissioning plan will prepared prior to this.

General principles of decommissioning

The general principles of the decommissioning of a project are detailed below. These principles must be required to be revisited and supplemented in the event of decommissioning of the power plant.

On decommissioning of the power project, EPC Contractor and RPLBL will:

- Ensure that all sites not only vegetated are vegetated as soon as possible after operation ceases with species appropriate to the area.
- All the temporary & permanent structures, foundations, concrete, and tarred areas are demolished, removed and waste material disposed of at an appropriately licensed waste disposal site.
- All equipment, vehicle and machineries should be dismantled, recycled or disposed of at an appropriately licensed disposal site.
- The aggregates, steel and other construction materials should be sold secondarily to the licensed vendor.
- All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimize the risk of erosion.
- All hazardous materials should be kept separate, documented and disposed to the safe recycling or disposal site.

A detail decommissioning and restoration of site plan should have to be developed prior to the decommissioning of the Power project by EPC contractor and RPLBL.

7.7 ESMP Monitoring and Review

The environmental unit of the RBLPL shall periodically review, monitor and audit the effectiveness of the ESMP, including all sub-plans. The audit program should adequately cover the scope, audit frequency and methods that are typically required for large infrastructure projects. The frequency of audits should reflect the intensity of activities (typically more common during construction), severity of environmental and social impacts and non-compliances raised in prior audits.

7.7.1 Review of the ESMP

The environmental unit of the RBLPL shall review the ESMP & ESIA to assess its effectiveness and relevance as follows:

- A full review shall be undertaken annually;
- Following a reportable incident, or a significant non-compliance; and
- Following an addition, up-date or change order to the ESMP, or a sub-plan.

The review of the ESMP should consider the following:

- Adequacy of data collection, analysis and review;
- Reporting;
- Non-compliances; and
- Corrective actions implemented.

The ESMP shall also be reviewed periodically to evaluate environmental controls and procedures to make sure they are still applicable to the activities being carried out. Reviews will be undertaken by the RBLPL Environmental Unit as follows:

- The full ESMP shall be reviewed at least annually;
- Relevant parts of the ESMP shall be reviewed following a reportable incident;
- Relevant parts of the ESMP shall be reviewed following the receipt of an updated sub plan;
- Relevant parts of the ESMP shall be reviewed on request of stakeholders, Contractor, Supervising Engineer, World Bank/DOE or the host communities.

The review shall include analysis of the data collection and analysis of data, monitoring reports, incident reports, complaints/grievances and feedback from stakeholders, community reports, consultation meeting minutes and training records to evaluate the effectiveness of ESMP procedures. Site visits, interviews and other auditing methods may also be used.

CHAPTER EIGHT: EMERGENCY RESPONSE AND DISASTER MANAGEMENT PLAN

8.1 INTRODUCTION

An emergency is any situation or occurrence of a serious nature, developing suddenly and unexpectedly, and demanding immediate action. An emergency can cause serious injury / loss of life / lives and may cause extensive damage to property and environment causing serious disruption both inside and outside the plant.

Emergencies have been broadly classified into two categories:

- On–site Emergency.
- Off–site Emergency.

On Site Emergency

An on-site emergency is a kind of situation, which can cause casualties / equipment / property damage, work environment damage within the site premises. It may need to take help of outside agencies to bring the situation under control.

Off Site Emergency

It is a case of emergency situation endangering human life, plant and equipment where the emergency occurs in Reliance premises but extends beyond the site premises. Help of local administration, Police, State Transport and Medical Center and Hospitals shall be required to control such situations.

At SMPL site activities there is no handling of any hazardous / toxic / flammable chemicals of a quantity which can cause an emergency as stated above, there is no need for off-site emergency planning.

This on-site emergency plan outlines actions that employers and employees must take in the event of an emergency situation to ensure employee safety and to minimize property damage.

Such procedures include:

a) Ways to alert employees;
b) Reporting emergencies;
c) Evacuation;
d) Designated assembly locations;
e) Contact people and their telephone numbers;
f) First aid and medical assistance;
g) Clean-up and business resumption;
h) Employee training;

i) Ways of testing the plan (mock drills); and

j) Communication with media, community and employees and their families.

8.2 EMERGENCY SITUATIONS AT 750 MW CCPP PROJECT SITE

Based on relevant experience and best professional judgment, SMPL believes that the following types of hazards (Source, Situation, Act, or combination thereof) have the potential to occur at the plant:

1. Excavation cave-ins
2. Explosion
3. Facility Blackout - loss of electric power
4. Fire, caused from:
    a. Bitumen
    b. Electrical short circuits
    c. Flammable materials storage areas – materials that can cause fire incident include - Adhesives (at stores), Diesel, Hydraulic oil, Lubrication oil /Grease, Paints and Paint thinners
    d. FRP Storage area (Used for cooling tower works)
    e. Oil rags/waste at work locations
    f. Shuttering material storage yard
    g. Wooden cases storage area
    h. Wooden scrap yard

Note: Possible quantity of storage has been considered while determining severity

5. Medical conditions/emergencies - Serious injuries or ill health; causes include but not limited to:
    a. Asphyxiation from lack of oxygen during working in confined space
    b. Electric shock / Electrocution (non-fatal)
    c. Fall from height
    d. Person suspended in safety harness
6. Pandemics/epidemics/outbreaks of communicable disease
7. Traffic accidents
8. Natural calamities
    a. Earthquakes
    b. Flooding (heavy rains)

8.3 RISK ASSESSMENT OF POSSIBLE EMERGENCIES AND CONTROLS MATRIX

Sl. No	Emergency	Likelihood of occurrence	Potential cause / Incident	Area	Severity of consequence	Preventive measures	Mitigation
1	Earthquake	Remote	Earthquake	Whole of project site	1) High severity 2) Effects are proportional to earthquake magnitude 3) 500 or above persons may be affected	1) Site located in Seismic Zone III; no history of such incident 2) Design of plant has considered relevant safety factors of seismic zone potential effects	Review and implementation of remedial measures after assessing the magnitude of effects – by top management
2	Excavation cave-in	Likely	Excavation cave-ins caused by unsafe work practices	Across site – varied locations	1) High severity 2) Effects localized 3) 3 to 5 persons will be affected	1) Safe work practices established and implemented 2) Work in excavated areas are supervised with prior-to work assessments of conditions for work 3) Work is always carried out under supervision from above the excavation level	Medical emergency procedures are followed

3	Explosion	Likely	Acetylene gas cylinder – accidental explosion due to pressure build-up; catch fire with nearby flame sparks (if working with)	Gas cutting works area (Max permitted storage is 20 Cylinders)	1) High severity – bodily burns 2) Effects localized 3) 3 to 5 persons will be affected	1) Safe work practices established and implemented 2) Fire extinguishers kept nearby workplace	1) Fire extinguishing by trained persons 2) Medical emergency procedures are followed for the affected personnel
Sl. No	**Emergency**	**Likelihood of occurrence**	**Potential cause / Incident**	**Area**	**Severity of consequence**	**Preventive measures**	**Mitigation**
4	Explosion	Likely	LPG Cylinders	1 or 2 Cylinders at Underground pipe coating area; used for heating coating material	1) High severity – bodily burns 2) Effects localized 3) 3 to 5 persons will be affected	1) Safe work practices established and implemented 2) Fire extinguishers kept nearby workplace	1) Fire extinguishing by trained persons 2) Medical emergency procedures are followed for the affected personnel
5	Facility Blackout	Likely	Loss of electric power	Whole project site	1) Low severity 2) Effects localized to the area 3) People may panic and may be affected of it	1) Readily available flashlights; 2) Adequate emergency lighting; 3) Alternative lighting arrangement will be in stand-by at critical work areas while working at night 4) Candles are not lit and kept near any flammable items 5) No burning candles are unattended	1) Depending upon the cause immediate measures will be taken 2) All electrical equipment, especially those will be switched off till the power is reinstated 3) Panic personnel will be counseled 4) Attention is given to the fact that the re-establishment of electrical power can be with a power surge. Heavy equipment' high electrical load factor could adversely impact

Sl. No	Emergency	Likelihood of occurrence	Potential cause / Incident	Area	Severity of consequence	Preventive measures	Mitigation
6	Fire	Likely	Shuttering material (wood) – accidental catching up fire due to sparks/ flying fire objects from nearby work area	Shuttering material storage	1. Low severity 2. Effects localized to the area 3. Around 1 or 2 people may be affected	1. The whole site is declared as no smoking zone 2. Fire extinguishers are kept near all storage area to extinguish the fire at its initial stage 3. Water hoses are provisioned which is near-by	1) Firefighting, and 2) evacuation of personnel at that location to the safe place at once
7	Fire	Likely	Bitumen – accidental catching up fire due to sparks/ flying fire objects from nearby work area while material handling	Bitumen stored in project site			
8	Fire	Likely	Oil rags/waste – accidental catching up fire due to sparks/ flying fire objects from nearby work area	Equipment / Piping erection area			
9	Fire	Likely	Leaks in 200 L Diesel drums	Stores			
10	Fire	Likely	Wooden scrap	Wooden scrap yard			
11	Fire	Likely	Wooden Materials	Wooden cases at material storage yard			

Sl. No	Emergency	Likelihood of occurrence	Potential cause / Incident	Area	Severity of consequence	Preventive measures	Mitigation
12	Fire	Likely	Due to electrical short circuit	Offices / PC Work Stations	1) Low severity 2) Localized to the area 3) Two to Five persons may be affected – small burns	1) Prevent the loose connections 2) Prevent over loading 3) Prevent multiple connections from one source 4) Prevent the overheating of the equipments 5) Keep the electrical equipments in healthy condition	1) Switch off the power supply 2) Use suitable fire extinguisher to extinguish the fire
13	Fire	Likely	Accidental catching up fire due to sparks/ flying fire objects from nearby, electrical short circuits in store room, unattended lit candles, etc.,	Stores maintaining: A) ADHESIVES B) DIESEL C) HYDRAULIC OIL D) LUB. OIL E) GREASE **F)** PAINTS AND PAINT THINNERS	1. Low severity 2. Effects localized to the area 3. Around 1 or 2 people may be affected	1) The whole site is declared as no smoking zone 2) Fire extinguishers are kept near all storage area to extinguish the fire at its initial stage 3) Water hoses are provisioned which is near-by	1) Firefighting, and 2) Evacuation of personnel at that location to the safe place at once
14	Fire	Likely	FRP – accidental catching up fire due to sparks/ flying fire objects from nearby work area	FRP Storage area (for cooling tower construction works)	1) Medium to high severity since FRP fire spreads faster 2) Can affect the surrounding area 3) Five to Ten persons may be affected – small to moderate burns	1) Prevent multiple electrical connections from one source 2) Do not keep flammable items or materials nearby 4. Fire extinguishers,	1) Switch off the power supply 2) Firefighting by trained personnel and Fire Tender help sought if required

						water hose near-by	
Sl. No	**Emergency**	**Likelihood of occurrence**	**Potential cause / Incident**	**Area**	**Severity of consequence**	**Preventive measures**	**Mitigation**
15	Flooding of water in to the site	Likely (during rainy season)	Inundation (deluge / flood) of water due to heavy rains	All work areas	1) Low severity 2) Effects mainly in the excavated area / trenches 3) None - since situation can be predicted / detected instantly	1) Pre alert given based on forecast and on situational day-to-day basis 2) Working in excavated areas, trenches, Open confined vessels or areas are provided additional vigilance 3) The drains always kept clean especially in the rainy season 4) Keep the mobile pump ready to pump out the water	1) Evacuate all personnel from areas of danger - on sensing the danger 2) Rescue team to verify and act to rescue if someone got caught inside 3) Provide medical aid as needed
16	Medical Emergency - Electrical Shock / Electrocution	Likely	Due to contact with live wires or due to electrical faults	All work areas wherever there are electrical points	1) Low to medium severity 2) Localized to the area 3) One	1) Provide double earthing to Equipment; periodical checks for effectiveness 2) Provide E L C B's 3) Provide rubber matting's in front of control panels & isolators. 4) Signage - Never touch the live circuit 5) Safe work practices - Isolating the circuit	1) Switch off the power supply 2) Administer artificial resuscitation if required 3) Provide medical aid as needed

						before carrying out the maintenance 6) Use of PPE's	
Sl. No	**Emergency**	**Likelihood of occurrence**	**Potential cause / Incident**	**Area**	**Severity of consequence**	**Preventive measures**	**Mitigation**
17	Medical Emergency	Likely	ASPHYXIATION FROM LACK OF OXYGEN	During working in confined space at Cooling water pipelines, bypass stack, and HRSG (after completion of installation)	1) Medium to high severity 2) Localized to the area 3) One or two	1) Personnel work competence ensured 2) Preventive maintenance of equipment and machinery 3) Workplace monitoring prior to task execution 4) SCBA provided where necessary 5) Availability Trained First-aiders	Follow appropriate medical procedures
18	Medical Emergency	Likely	FALL FROM HEIGHT	• Structural erection, • Bypass stack erection, • Scaffolds, • HRSG erection, • High roof at Electrical control buildings 1, 2 & 3,	1) Medium to high severity 2) Localized to the area 3) One	1) No un- protected openings on any roof ensured 2) Safety harness, safety life line provisioned while working at height 3) Only competent & medically fir persons are allowed to work at height	1) Follow rescue procedure in case person is in suspended harness 2) If panic, provide medical counseling

19	Medical Emergency	Likely	FALL FROM HEIGHT	While climbing higher heights on ladder (does not have railing) with fall protection	1) Medium to high severity 2) Localized to the area 3) One	Fall arrestor used for high rise climbing using ladders	1) Follow rescue procedure in case person is suspended harness 2) If panic, provide medical counseling
Sl. No	**Emergency**	**Likelihood of occurrence**	**Potential cause / Incident**	**Area**	**Severity of consequence**	**Preventive measures**	**Mitigation**
20	Pandemics/ epidemics/ outbreaks of communicable disease	Likely	UNPREDICTABLE OUTBREAKS FOR UNKNOWN REASONS	All personnel at site	Medium to high	HR will initiate actions immediately upon getting news from media. Health precautions from Government and Health organizations will be followed	Affected personnel will be provided with medical assistance Affected personnel will not be allowed to workplace till normal health is restored

21	Traffic accidents (within project site)	Likely	VIOLATION OF SAFETY RULES, UNFORESEEABLE ROAD /TERRAIN CONDITIONS	Throughout work site	Medium to high	1) Speed limit is restricted 2) Security watch and guide traffic at designated places 3) Road and terrain conditions inspected and attended to correct faults 4) All vehicles mandatorily use reverse horn while moving in reverse / rear direction 5) Only authorized, competent persons are allowed to drive vehicles within site premises	1) Personnel injury is dealt as per medical procedure

8.4 PLANT FACILITIES FOR EMERGENCY

a) Emergency Control Centre

b) Emergency Siren system

c) Hand held Wireless Communicator (Walkie-talikie used) - with security & operations personnel – Total quantity -15

d) 2 Fire Tenders (One at existing plant which is at less than one KM and another at site)

e) Fire hydrant and fire extinguishers at critical / identified locations (In addition, being a multi-employer work site, respective contract organizations also maintain required emergency response facilities)

f) Call points – intercom phone in all departments

g) Trained Fire Fighting team

h) Trained First-Aiders

i) First Aid facility at Occupational Health Centre at 750 MW CCPP

j) Ambulance Van 1

Following supportive resources are exclusively maintained for emergency response activities:

Sl. No.	Particulars	Qty	Sl. No.	Particulars	Qty
1	Leather glove 16”	4	12	Artificial resuscitators	4
2	PVC Glove 16”	4	13	Helmets	4
3	Rubber Glove 16”	4	14	Rain coats	4
4	Shock proof glove 16”	4	15	Gum Boots	4
5	FIRE Suite 36” 42”	4	16	Stretchers	2
6	Leather apron	4	17	Blankets	2
7	Plain glass goggles	4	18	Torch light with cells	4
8	Goggle for gas welding & cutting	4	19	Safety Belt	4
9	Welding Shield	4	20	Gas mask	4
10	Spark resistant tools	1 Kit	21	Barricade tapes	1 Roll

					of 5 Kg.
11	SCBA Sets	3			

8.5 EMERGENCY CONTROL ORGANIZATION [ECO]

8.5.1 Emergency Control Centre (ECC)

There will be an emergency control center inside the premises of the project to take action as soon as possible.

8.5.2 Emergency Siren

A wailing siren with different frequencies (short intervals) indicating that there is an emergency situation at site.

An emergency siren will be installed for the Project. If the emergency arises at proposed plant and if it is determined that situation will affect the power plant, then siren will be blown at existing plant control room as well as project site control room.

8.5.3 Emergency mitigation teams

Two teams function separately in emergency mitigation activity.

Team 1: Incident Control Team (emergency mitigating team functioning at the site of incident)

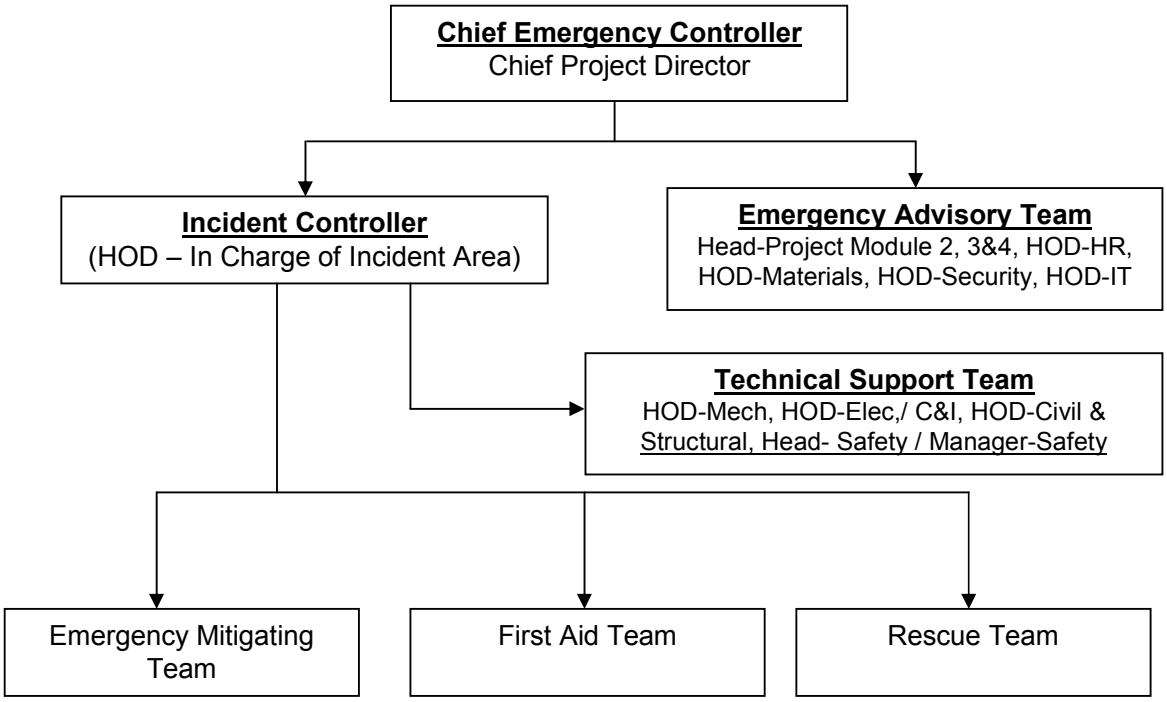
The team is headed by the incident controller (who is HOD of the concerned area, where emergency situation occurred) and he is assisted by:

- Emergency mitigating (Firefighting) team
- Emergency technical support team
- First aid team
- Rescue team

Team 2: Emergency Control Team (assists emergency mitigation activities from emergency control center)

The team is headed by CPD. In his absence Vice President (C&I) takes charge as Chief emergency Controller . (In his absence next higher official \ delegated person takes the charge as chief emergency controller). Chief emergency controller is assisted by Emergency advisory team

8.5.4 Emergency Control Organization Chart



8.5.5 Roles and Responsibilities

The roles and responsibilities described hereunder are in full. However, all elements may not be applicable to all emergencies. The responsibilities that need to be executed are specific to a type of emergency. The response procedure for each category of emergency is described in section 7.

8.5.5.1 Role of Unit Head (Chief Emergency Controller (CEC) – Project

a) Assumes charge as Chief Emergency Controller

b) Establish contact with incident controller through cell phones or public address system and other available systems, assesses the severity of the emergency.

c) Alert other CEC and rush to the spot if required.

d) In case of requirement declares emergency by arranging for blowing of emergency siren.

e) Directs the team members who are assisting him regarding

- Medical arrangements at outside hospitals if required
- Transportation for evacuation of personnel

- Contacting and interacting with statutory authorities / media / relatives of the injured persons in case of any casualty through Head - HR.
- Arranging additional outside help from the nearby fire stations and industries for mitigating the emergency through Head- HR/Security
- Necessary food supplies etc. for the emergency mitigating team.

f) Authorizes the sounding the All Clear siren after the emergency is over.

g) Arranges for investigation of the incident.

8.5.5.2 Incident Controller (HOD / In charge of the area or delegated person)

The Incident Controller will take control of handling the emergency. The responsibilities of the Incident Controller include:

a) To stop all the activities at the affected area, isolates power supply if needed

b) To assess the scale of the incident and take decisions as may be required.

c) After assessment of risk, if necessary, inform CPD / VP- Project to declare emergency.

d) To establishes contact with chief emergency controller and inform about the situation from time to time

e) To initiate the emergency procedures with the help of available facilities to secure the safety of employees, minimize the damage to plant and property and minimize the loss of material; to guide fire squad, salvage squad, first-aid squad and auxiliary team

f) To direct rescue and fire-fighting operations.

g) To search for casualties

h) To arrange for evacuation of non-essential workers to assembly areas.

i) To setup a communication point with the emergency control team within the Plant

j) To assume the responsibilities of the Chief Emergency Controller till the person arrives.

k) To provide support to the emergency services as requested.

l) To issue verbal communication to engineers for necessary isolations and precautions, this will be treated as permit to attend emergency situations.

m) To ensure that all clear siren is given in consultation with Fire squad / Combat team when emergency has been brought under control.

n) To arrange for clearing of spills and waste at the site and restoring normalcy for regular operations / activities

o) To collect evidences that will be necessary for subsequent inquiry to the root cause of the emergency and for concluding corrective measures to avoid recurrence

8.5.5.3 Role of Emergency Technical Support Team:

a) Arrange for the resources / material for controlling the emergency and to get back to normal operations

b) Arranging for cranes, required tools, equipment, electrical assistance for controlling the emergency and to get back to normalcy

c) Evaluate the technical aspects in the control / mitigation of the emergency & operational continuity

d) Carrying out the technical study and recommend as per the requirement

e) Communicate with emergency advisory team and furnish required clarification

f) Identifying and establishing contact with outside technical expertise as per requirement and getting advices or necessary help from them

8.5.5.4 Role of Emergency Advisory Team

a) In absence of CPD (CEC – Project) , VP- Project assumes responsibility as Chief Emergency controller and carries out the activities as mentioned under the role of Chief Emergency controller.

b) Others report to the Chief emergency controller guides him in controlling the situation and acts as per his instructions.

c) Log the sequence of events so that report of the emergency action can be prepared for review and for identifying flaws, so as to correct the same.

d) If required establishes contact with statutory authorities and media personnel as per the advice of Chief Emergency controller and gets outside help or to appraise about the situation and get help in case event turns off site emergency.

e) Establishes contact with outside hospitals / nursing homes for prior information and readiness in case of sending injured to the hospitals, getting additional ambulances etc.,

f) Prepare record of affected personnel with local and permanent address, establishes contact with the relatives of the injured or victimized personnel and assures them about the situation and renders necessary help as per Chief Emergency controllers' advice.

g) Keep additional vehicle with drivers as stand-by and authorized to utilize any vehicle during emergency.

h) Provide vehicles as directed by the emergency control Center.

i) Co-ordinate with state transport authorities and other transport agencies for maximum mobilization of vehicles.

j) Arranging for food, water and other requirements

k) Establishing contact with nearby / industries and appraise them about the situational requirements and agree upon mutual help during emergencies. Alert them in case they are getting affected of an emergency at site to get additional help from them.

8.5.5.5 Role of Emergency Mitigating (Fire Fighting) Team

a) Immediately after hearing the emergency siren the team will get ready to face the incident

b) After receiving the information from CEC or Incident Controller they should report to the incident controller (HOD / in charge of concerned dept.).

c) Takes directions from incident controller they should start fighting of emergency situation for general fire.

d) During firefighting shall follow :

1. Personnel Safety by wearing the required PPE.
2. Plant, Property and Environment Safety.
3. Minimum loss due to the incidence.

8.5.5.6 Role of First Aid / Rescue Teams

a) Immediately after hearing the siren they should report to the incident controller (HOD / in charge of concerned dept.).

b) To have directions from incident controller to start rescuing the entrapped personnel and give the necessary first aid before sending them to actual medical aid.

8.5.5.7 Role of Security

a) Stop entry of all external vehicles and personnel from outside the premises.

b) Shall stand in readiness for further instructions from Chief Emergency Controller and shall act as per the instructions given by him.

c) Direct all the vehicles (such as ambulances, fire tenders etc.) coming for help from outside organizations to the incident spot.

d) During nights if any incident which is alarming or which can cause emergency, security guard should immediately inform the same to the senior official available in the shift by mobile phone and act as directed by him.

8.5.5.8 Mutual Aid / Role of Nearby Companies

Role played by members of neighbouring industries

a) On receiving information and call for assistance they shall extend all possible help.

b) The place of incident shall be informed and guided by the main gate security guard once they approach for providing assistance.

c) Fire Crew In-Charge on arrival will report to the incident controller of Reliance and as per his directions, he shall go to the site of emergency and report to the incident controller and starts their activity as directed by him.

8.5.5.9 Head – HR

a) He is the only authorized person to issue public statements; coordinate & liaise with the GOVT. Officials

b) He shall coordinate & liaise with medical team for arranging medical help

c) He shall coordinate with the Chief Emergency Controller & arrange for required help from external agencies

8.6 TRAINING & MOCK DRILLS

8.6.1 Training

Emergency plan and response procedures have been prepared taking in to consideration prevailing industrial / sector safety best practices. Accordingly the roles & responsibility to the concerned personnel are assigned and they are trained to carry out tasks effectively. The following aspects have been emphasized during training:

1) Saving the life has been given top priority
2) Reducing the loss & damage to the property

The emergency response team members undergo periodical refresher program to ensure their continued ability to render services more effectively.

Mock drills are conducted to ensure ever-preparedness of the teams to respond to any identified emergencies.

8.6.2 Mock Drills

Emergency response procedures are established for the identified emergencies. Mock drills for identified potential emergencies shall be conducted as per the mock drill schedule.

Mock drill includes any of the following scenarios:

a. Fire emergencies
b. Other OH&S emergencies

Of the above emergencies, one live mock drills and a table-top mock drill are conducted alternatively. The scenario for the mock drill may be chosen from any of the above mentioned emergencies and all aspects of the emergency.

8.6.3 Review of Mock Drill

For every mock drill, the safety committee reviews the efficiency and response time of the exercise as per the following criteria:

a) Did the operations go on as per the plan?
b) Did all persons assigned with specific responsibilities perform as planned?
c) Did they experience any difficulty in performing their duties?
d) How was the cooperation between the teams?

e) Were there reasons for any confusion or conflicting instructions?

f) Were all the persons contacted in time?

g) Could they isolate plant equipment as per standard operating procedure

Rating of response to emergency is done based on the following parameters:

a) Communication

b) Equipment

c) Manpower and skill

d) Coordination within the team and with other teams.

The safety committee designates two observers for each of the Mock Drill and their Evaluation Report is discussed and corrective actions are implemented.

8.7 EMERGENCY RESPONSE PROCEDURE - FIRE INCIDENT

8.7.1 Emergency response procedural steps

a) All personnel at site – shall move out of their workplace and assemble at the nearest safe assembly point

b) Emergency mitigating (Firefighting) team – Mitigate the Fire as per procedure (Trained)

c) Emergency technical support team – Mobile resources as need for the situation

d) First aid team – Provide first-aid to the affected persons before sending them to actual medical aid

e) Rescue team – Assist and ensure all personnel in the emergency affected site are evacuated; carry out intensive search in the area to make double0sure that no person is left un attended

f) Security – Stop vehicle / personnel entry in to the site; control traffic within site

g) Head – HR - Coordinate with rescue team and arrange for additional help such as logistics and other medical arrangements for the affected personnel

h) Incident controller – Blow siren for all clear indication after the emergency is over.

i) Concerned HODs and Contractors – Shall ensure that they take stock of their personnel to determine whether anybody is missing. Coordinate with security, HR as needed

8.7.2 Clean-up and/or restoration

The Emergency mitigating (Firefighting) team and the Emergency technical support team shall ensure clean-up of affected area to enable restoration of normalcy for work– Mobile resources as need for the situation

8.7.3 Reporting

The concerned contractor organization's safety representative / safety officer (if the emergency location is SMPL office, then it will the responsibility of Manager-Safety) shall report the emergency incident. This reporting is done on completion of the emergency response.

8.8 OTHER EMERGENCIES

Action to be taken is given against each of the identified potential emergency. On observing any of the following situations, the first observer shall report it to Safety Officer. Based on the need, Safety Officer shall plan and depute competent personnel / team to mitigate the situation.

8.8.1 Excavation Cave-In

1. Raise alarm as per requirement or disperse unwanted personnel move away from sight of incident to
2. Inform the emergency to the concerned persons as per plan
3. Rush ambulance, first aid, rescue teams to the scene of incident
4. Arrange to provide artificial respiration such as oxygen masks etc., if needed
5. Check for any toxic gas presence before sending the rescue if possible
6. Give prior information to the nearby / tie up hospitals for emergency attention to the injured
7. Arrange proper equipment for removal of soil and careful rescue of trapped persons

8. Deal with the injured persons carefully in case of fractures such that the fractured portion is stabilizing and not disturbed.

9. Take roll call of persons working at the area to identify any missing persons and for continuing the search.

10. Follow Medical emergency procedures

8.8.2 Explosions

Follow Fire emergency procedures as described in section 8.7.

8.8.3 Facility Blackout - loss of electric power

Safety measures include:

a. Readily available flashlights;
b. Adequate emergency lighting; and
c. Security measures to prevent theft and vandalism.

Safety tips in case of loss of electric power:

NEVER use a generator indoors (example, small gen set in a room or like structure at site) where there are possibilities that exhaust fumes which contain carbon monoxide can be deadly if inhaled.

USE portable generators outdoors only, in a dry, ventilated area

PLUG individual appliances into the generator using heavy-duty outdoor-rated cords with a wire gauge adequate for the appliance load.

DO NOT USE wet electrical appliances.

DO NOT TURN ON damaged electrical appliances.

DO NOT PUT candles on or near anything that will burn.

NEVER leave burning candles unattended.

8.8.4 Fire, caused from other sources (with a less magnitude of severity)

Following materials used at construction site has the potential to cause fire:

A) BITUMEN,
B) ELECTRICAL SHORT CIRCUITS
C) FLAMMABLE MATERIALS STORAGE AREAS – MATERIALS THAT CAN CAUSE FIRE INCIDENT INCLUDE - ADHESIVES (AT STORES), DIESEL, HYDRAULIC OIL, LUBRICATION OIL /GREASE, PAINTS AND PAINT THINNERS
D) FRP STORAGE AREA (USED FOR COOLING TOWER WORKS)
E) OIL RAGS/WASTE AT WORK LOCATIONS
F) SHUTTERING MATERIAL STORAGE YARD
G) WOODEN CASES STORAGE AREA
H) WOODEN SCRAP YARD

Fire mitigation:

a) Use a fire extinguisher only if ALL of the following apply:
b) the fire is small, contained and not spreading beyond its starting point;
c) the exit is clear so you can exit safely;
d) you can avoid smoke inhalation;
e) a proper extinguisher is readily available; and
f) You know how to use the extinguisher.

If any of these conditions do not apply, do not use the fire extinguisher. Call on "Emergency Number" for help and leave the area immediately.

Typical extinguishers and their uses

Water extinguishers are suitable for class A (paper, wood, etc.) fires.

Dry chemical extinguishers are useful for class ABC fires and are your best all-around choice. Their advantage over CO2 extinguishers is that they leave a blanket of non-flammable material on the extinguished material which reduces the likelihood of re-ignition. Dry chemical extinguishers cause a messy residue that will need to be cleaned.

CO_2 (carbon dioxide) extinguishers are for class B and C fires. Their advantage over dry chemical is that they leave behind no harmful residue.

8.8.5 Medical Conditions/Emergencies - Serious Injuries or Ill Health; Causes Include but not Limited to:

A) ASPHYXIATION FROM LACK OF OXYGEN DURING WORKING IN CONFINED SPACE

B) ELECTRIC SHOCK / ELECTROCUTION (NON-FATAL)

C) FALL FROM HEIGHT

D) PERSON SUSPENDED IN SAFETY HARNESS

In case of any medical emergency call occupation health centre; either doctor or the paramedical staff will guide for further action. Use emergency numbers to immediately communicate the emergency and to initiate action

The rescue of a worker who has fallen and is being suspended in his/her safety harness needs to be undertaken as quickly as possible for several reasons:

1) The worker may have suffered injuries during the fall and may need medical attention.

2) Workers suspended in their safety harness for long periods may suffer from blood pooling in the lower body and this can result in "**suspension trauma**."

3) The suspended worker may panic if they are not rescued quickly.

4) The event that led to the fall may create additional risks that need to be addressed.

General Rescue Procedures:

A. If Elevating Work Platform is available on site:

- Bring it to the site and use it to reach the suspended worker.
- Ensure that rescue workers are protected against falling.
- Ensure that the EWP (Elevated work platform) has the load capacity for both the rescuer(s) and the victim.

- If the victim is not conscious, 2 rescuers will be probably be needed to safely handle the weight of the victim.
- Position the EWP platform below the worker and disconnect his lanyard when it is safe to do so.
- Treat the victim for Suspension Trauma and any other injuries.
- Arrange for transport to nearest hospital.

B. If no Elevating Work Platform is available:

- Where possible, use ladder(s) to reach the victim.
- Rig separate lifelines for rescuers to use while carrying out the rescue from the ladder(s).
- If worker is not conscious or cannot reliably help with his/her own rescue, at least 2 rescuers may be needed.
- If worker is suspended from a lifeline, where possible, move the suspended victim to an area that can be safely reached by the ladder(s).
- If victim is suspended directly from his/her lanyard or from a lifeline, securely attach a separate lowering line to the victim's harness.
- Other rescuers should lower the victim while he/she is being guided by the rescuer on the ladder.
- Once the victim has been brought to a safe location, administer First Aid and treat the person for Suspension Trauma and any other injuries.
- Arrange for transport to nearest hospital.

C. If the injured person is suspended near the work area and can be safely reached from the floor below or the area they fell from:

- Ensure that rescuers are protected against falling.
- If possible, securely attach a second line to the workers' harnesses to assist in pulling them to a safe area. (Note: at least 2 strong workers will be needed to pull someone up.)
- Ensure that any slack in the retrieving lines is taken up to avoid slippage.

- Once the victim has been brought to a safe location, administer First Aid and treat the person for Suspension Trauma and any other injuries and arrange for transport to the nearest hospital.

D. If a person has fallen and is suspended in an inaccessible area (e.g. a tower, against a building or structure that has no openings):

- Specialized rescue techniques are needed for this type of situation. It may involve a rescuer rappelling or being lowered down to the victim, it may involve using the lifeline to retrieve the fallen worker, or the use of high-reach emergency equipment.
- Due to the inherent risk to the rescuers and/or the victim, this type of rescue should not be undertaken by people without specialized training and experience.

8.8.6 Pandemics/Epidemics/Outbreaks of Communicable Disease

Generally media (Newspapers / TV) provides alerts of such situation. If any person working on SMPL site is suffering from or has symptoms of or someone else at site suspects co-worker of having pandemic / epidemic / outbreaks of communicable disease, immediately inform HR. HR and Admin will take immediate action to protect the workforce at site

8.8.7 Traffic accidents

1) Disperse unwanted personnel move away from sight of incident to the nearest assembly points
2) Inform the emergency to the concerned persons as per plan
3) Rush ambulance, first aid, to the scene of incident
4) Give prior information to the nearby / tie up hospitals for emergency attention to the injured
5) Deal with the injured persons carefully in case of fractures such that the fractured portion is stabilizing and not disturbed

8.8.8 Natural calamities

8.8.8.1 Earthquake

In case of earth quake, no siren will be given all the personnel inside the plant are instructed to shut down their operations and come out in to open yard and assemble at the assembly points. If required, transportation will be arranged for sending the people to safer places. Rescue operation will be carried out by security personnel for any possible casualties and the same are given first aid treatment and will be sent to the nearest hospitals in case of requirement.

8.8.8.2 Flooding (Heavy rains)

When there is a flood caused by heavy rain, those who are in the basements and ground floor should reach the upper floors through the exit stairways and assemble just outside main gate. Water flood will endanger building basement and low level floors. Remain in the upper floors till the water recedes or as instructed.

Actions to be taken:

De-energize equipment immediately if the flood is isolated to your facility due to sprinkler system activation, broken pipes. Cover equipment with waterproof sheeting.

a) Monitor conditions and escape routes.

b) Shut off electrical power and utilities if flooding is imminent.

c) Immediately evacuate to higher ground—flood waters often raise rapidly.

d) Call fire services if needed

Recovery action:

a) Ensure that facilities and equipment are cleaned, dehumidified, sanitized and deodorized before allowing the re-entry of employees.

b) Do not turn on utilities until the structure, appliances and utilities are dry and the building is checked for safety.

c) Be sure water supplies are safe to drink. Dispose off any food or consumables that may have been in contact with flood waters.

d) Begin mitigation planning to avoid repetition of same problems in future.

8.8.8.3 Cyclones / heavy winds

a) Know about the severity / direction of the cyclone from news bulletins / meteorological dept.

b) Review the activities / operations planned and stop operations which may create an emergency situation due to cyclone / high winds

c) Ensure emergency equipment such as batteries / torches etc., are in availability

d) Ensure food supplies to the work force

e) Ensure readiness of emergency vehicles / medicines, medical center with staff etc.,

CHAPTER NINE: ANALYSIS OF ALTERNATIVES

9.0 THE 'NO BUILD' SCENARIO

From a purely physical environmental point of view, the 'do-nothing' is preferable to any project implementation, since it would avoid creation of any of the adverse impact associated with the project. However, the potential socio-economic benefits of the nation would be foregone and solving the problem of power generation and power demand disparity would be hampered. It is concluded that the 'No Build' alternative is unacceptable, and the potential socio-economic benefits of implementation of such project far outweigh the adverse impacts, all of which can be controlled and minimize to an allowable level.

9.1 DESCRIPTION OF ALTERNATIVES

9.1.1 SITE ALTERNATIVE

a. Resettlement:

Site selection is ideal as it involves no resettlement issues.

b. Pollution Control:

As shown in subsequent sections, environmental pollution during the period of construction and also during the period of operation will be mostly insignificant.

c. Cooling System:

Closed loop cooling system is best in principle and Reliance Meghnaghat 750 MW CCPP is one of the first power plants in the country to use it as a cooling system. This system will use water from Meghna River only as make up water for steam condensation and then the water will be cooled down in a cooling tower/tank. This method of cooling is the most environmentally friendly system and will not disrupt aquatic lives in the river or anywhere else. The closed loop cooling systems have zero or near-zero discharge but present some potential impacts due to water consumption which is still insignificant compared to the impacts of other methods.

9.1.2 TECHNOLOGY ALTERNATIVE

Reliance Meghnaghat 750 MW CCPP has used the combined cycle technology to maximize the efficiency of the power generation process. The possibilities of other power generation technologies have been considered below:

a. Hydroelectricity:

The country is flat having relatively limited potential for hydroelectricity.

b. Geothermal Plant:

No active geothermal site has been found.

c. Coal-Fired Plant:

The country has about 1700 million tons of bituminous coal, most of which lie buried at depth of over 900 meters thus making extraction relatively expensive. However, coal from low-lying structure (Barapukuria) is being dug out for power generation. Coal is environmentally less friendly as it gives high emission of carbon dioxide and leads to acid rain because of high sulphur content.

d. Fuel Consumption:

The supply of gas for continuous operation of highly efficient as well as low cost generation from the new 750MW unit with efficiency of about 58.4%. The project would be operated by imported RLNG which will release the demand pressure of natural gas of the country.

9.1.3 ALTERNATIVE OF ENVIRONMENTAL INDIACATORS

9.1.3.1 AIR ENVIRONMENT

After the analysis of air quality modeling (Chapter 4, Article 4.6: Ambient Air Quality), it is evident that the air quality of the project site is satisfactory and the air quality parameters are all within limit. Better air environment is not easily found in an industrial area like Narayanganj district.

As the project site is far from locality and in a power hub, the power plant will not affect the nearby people. Also, the power plant technology will not contribute to the NO_x content of the existing air and very little CO_2 will be contributed overall.

9.1.3.2 WATER ENVIRONMENT

The power plant will use the first ever closed loop cooling system in Bangladesh and will have zero thermal discharge in the river Meghna. That leads to the conclusion that the selection of site is well calculated and no water related issue will rise in the

distant future due to the construction and operation of the Reliance Meghnaghat 750 MW CCPP.

9.1.3.3 HABITAT

The proposed power plant site is an empty government acquired land and no further land acquisition was required. The land is now used as temporary grazing ground for local cows as there is no boundary around the land. The cows will graze in the remaining land that will be left after the construction of power plant. As there is no relocation needed, no alternative is required for the proposed project site.

9.2 CONCLUSION

BPDB has acquired the land back in 1995 and since then it has been uses only for the purpose of building power plant projects. There are three other projects adjacent to the site and there is no better ground in sight for the power plant project at this moment. The project aesthetic looks are modern and environment compatible, the site is environmentally acceptable. Currently, there are some existing power plants at the area and the site area has been developed for power hub of BPDB. Therefore, the project site is suitable for the proposed **Reliance Meghnaghat 750 MW Combined Cycle Power Plant.** So there is no logical need to look into alternative sites.

CHAPTER TEN: INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

10.0 STAKEHOLDERS CONSULTATION

Stakeholder consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process in order to address their concerns, improve project design, and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability.

Community input (both of knowledge and values) on socioeconomic and environmental issues can greatly enhance the quality of decision-making. Stakeholder consultation was therefore conducted in the project area not only to satisfy the legal requirements of the ESIA process in Bangladesh but also to improve and enhance the social and environmental design of the project.

10.1 IDENTIFICATION OF THE STAKEHOLDERS

People who live near and around the project who will be directly and indirectly affected by the project are considered as the stakeholders. For this particular project, stakeholders are the fishermen, the people who live near the project, the cow owners and the workers of the nearby factory. For the sake of their interest, it is an absolute necessity to consult all primary and secondary stakeholders.

10.2 OBJECTIVES OF STAKEHOLDERS CONSULTATION

The process of public participation and consultation was endorsed in the United Nations Conference on the Environment and Development (UNCED) in 1992 through one of the key documents of the conference Agenda 21. Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding human interaction with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development.

For projects that have environmental and social impacts, consultation is not a single conversation but a series of opportunities to create understanding about the project among those it will likely affect or interest, and to learn how these external parties view the project and its attendant risks, impacts, opportunities, and mitigation measures. Listening to stakeholder concerns and feedback can be a valuable source of information that can improve project design and outcomes and help a company to identify and control external risks. It can also form the basis for future collaboration and partnerships. For stakeholders, a company's consultation process is an opportunity to get information, as well as to educate company staff about the local

context in which a project will take place, to raise issues and concerns, ask questions, and potentially help shape the project by making suggestions for the company to consider and respond to.

Through the public consultation process, the Reliance Bangladesh LNG and Power Ltd. hope to:

- Promote better understanding of the project, its objective, and its likely impact;
- Identify and address concerns of all interested and affected parties of project area;
- Provide a means to identify and resolve issues before plans are finalized and development commences, thus avoiding public anger and resentment and potentially costly delays;
- Encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities and local leadership;

10.3 CONSULTATION PROCESS

Primary stakeholders were consulted during informal and formal meetings held in the project area. The consultation process was carried out in the Bangla languages. During these meetings a simple, non-technical, description of the project was given, with an overview of the project's likely human and environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback was documented during the primary stakeholder consultation. The issues and suggestions raised were recorded in field notes for analysis, and interpretation.

By reaching out to a wider segment of the population and using various communication tools—such as participatory needs assessment, community consultation meetings, focus group discussions, in-depth interviews, and participatory rural appraisal—ESIA involved the community in active decision-making. This process will continue even after this ESIA has been submitted, as well as during future ESIAs in which similar tools will be used to create consensus among stakeholders on specific environmental and social issues in the context of a proposed project.

It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings in order to avoid undue conflict with local leaders or local administrators. The issues recorded in the consultation process were examined, validated, and addressed in the ESIA report.

10.4 STAKEHOLDER CONSULTATION TECHNIQUE

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and

'local knowledge' can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation. Therefore, the following participatory technique was employed during stakeholder consultation:

- Informal meetings with communities in surrounding areas. Men, women and local elders attended these meeting.

10.5 STAKEHOLDERS CONSULTED

In the consultation process for ESIA, there were two types of stakeholder consultation; Formal and Informal.

Informal Stakeholder Consultation

Following key stakeholders were consulted during the informal consultation process:

- **Local communities, Men, Women and local elders**

People of different age group attended the meetings. They were briefed about the project activities and its impact on the environment. The participants talked about their concerns and expectations.

- **Local Government representatives**

The local government representatives were made aware of the project and they extended their help during collecting statistics of the local establishments.

- **NGOs**

The local NGOs working in the community were consulted during the consultation process and they provided help during collecting data of the socio economic condition and the present employment statistics.

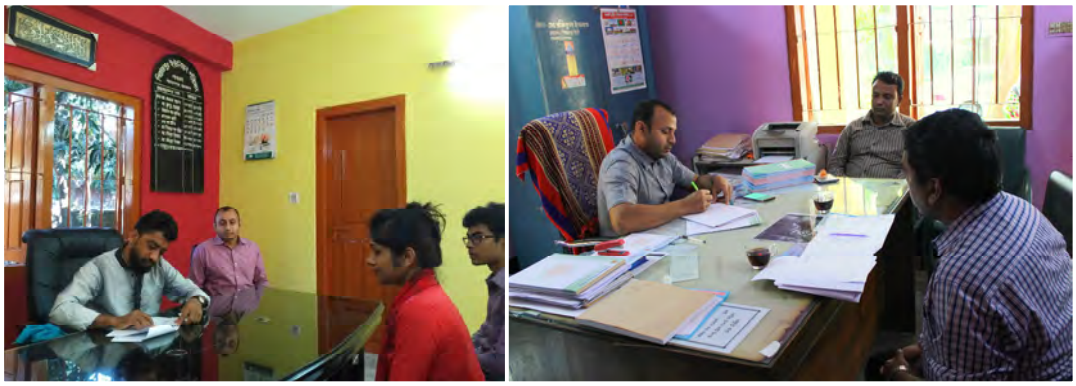
- **Local Fishermen & their family members**

The local fishermen are one of the most significant stakeholders of this project. They were consulted on multiple occasions including in two focused group discussions (FGD). They were well informed after the consultation process and they discussed about their concerns and their expectations.

- **Cow owners**

There are no formal cattle farm near the project area but some people lived near the project area use to graze some of their domestic cows on the project land due it is unprotected and have no fence. The number of cows is merely 25-30 and there are plenty of green fields around the project vicinity where they could find alternative grass land for the grazing of their cows. They are aware of the project and they informed that they will drive their cows elsewhere once the proposed land is occupied.

Consultation with Local Community



Consultation with Local Government Representative (Chairman and Secretary of Pirojpur Union Parishad)

Consultation with NGOs

Fishermen FGD (Day 1 and 2)

Fishermen FGD (Day 3)

The FGD Gathering

Fishermen FGD

The village, Char Balaki, has roughly 200 families living there nearly for many years. Most of the households depend on the fishing for their livelihood. On the aspect of livelihood currently their greatest needs are:

1) Lack of safe landing station for travellers, commodities and goods.

2) No proper communication means to reach from mainland to the char.

3) Lack of variety of fish nets.

4) Seasonal variation of number of fishes found.

Nearly 70% people in the village are poor, 20% are low middle class and 20% middle class who earn nearly BDT 5000.00-10000.00 and 10000- 20000 per month respectively as reported by the participants. They identified the major reasons of poverty is due to:

1) Lack of education,

2) Lack of capital,

3) And their involvement with fishing occupation as their forefather did it.

To reduce the poverty and to address their current problem participants suggested to

1) Provide them opportunity for safe fishing with the intervention from District and Local Administration,

2) Construct a permanent landing station in both side of the river,

3) Take protective measures to safe fishing,

4) Establish primary schools.

5) Provide them capital with easy and low interest rate,

6) Establish one cyclone shelter that can be used as primary schools during normal time,

7) Arrange income generation activities for women along with training.

8) Provide employment opportunity for the poor both men and women,

9) Provide electricity for the betterment of the people from all age

The participants including men and women were noticed from the local people about installation of Reliance Meghnaghat 750 MW CCPP and they do not find any negative impact on their livelihood/fishing. Instead they welcome the power generation activities for the betterment of the country but they regret being deprived of electricity till days. In the past, they didn't find the activities of the power plants detrimental to the fishing activity. They seek help from the "Reliance" to provide

employment to skilled and unskilled workers. They also hope that Reliance will contribute to the betterment of the locality by providing hospitals, training centres and roads for gentrification of the community.

Inventory of Fishing Activity of the Surrounding Area

Fishermen in the village do fishing within 5-6 kilo meters around the char including 40-50 meters from the outfall. Some fishermen do fishing in other areas sometimes. Each fishermen consisting of two members can catch 5-10 kg fish per day in rainy season and 1.5 - 2 kg per day in winter season. Per kg of fish is sold ranging from BDT 500.00 to 700.00 tk.

The fishermen generally catch small fish like prawn and catalee. They also catch Aiyeer, Ruhi, Ishish, Boyal, Kachki, Chapila, Cheowa etc. abundantly from this area. Some fishermen make their living entirely on catching prawns of different size. The whole surrounding area near the project site and Char Balaki is enriched with various fishes.

Types of Fishes Caught in the Area

In the entire island of Char Balaki, there are more than 100 fishermen families whose incomes are primarily dependent on fishing activity. According to the fishermen, they make somewhere between 10,000 to 20,000 tk per month depending on the season and availability of fish.

The main concern of the fishermen is that after the heavy industrialization of the area (especially chemical factories and ship breaking yards), the amount of fishes that can be caught daily has lowered than it used to be 10-15 years ago. But they stated that the power plant projects have not affected their fishing activities because the existing power plants have imposed strict regulations in terms of the discharge. The people fishing around the power plant discharge points are mainly intermittent or recreational fishermen and they have not complained about the river water near the existing power plants.

The season availability of fishes is shown in Figure 10.1 & 10.2 (according to fishermen).

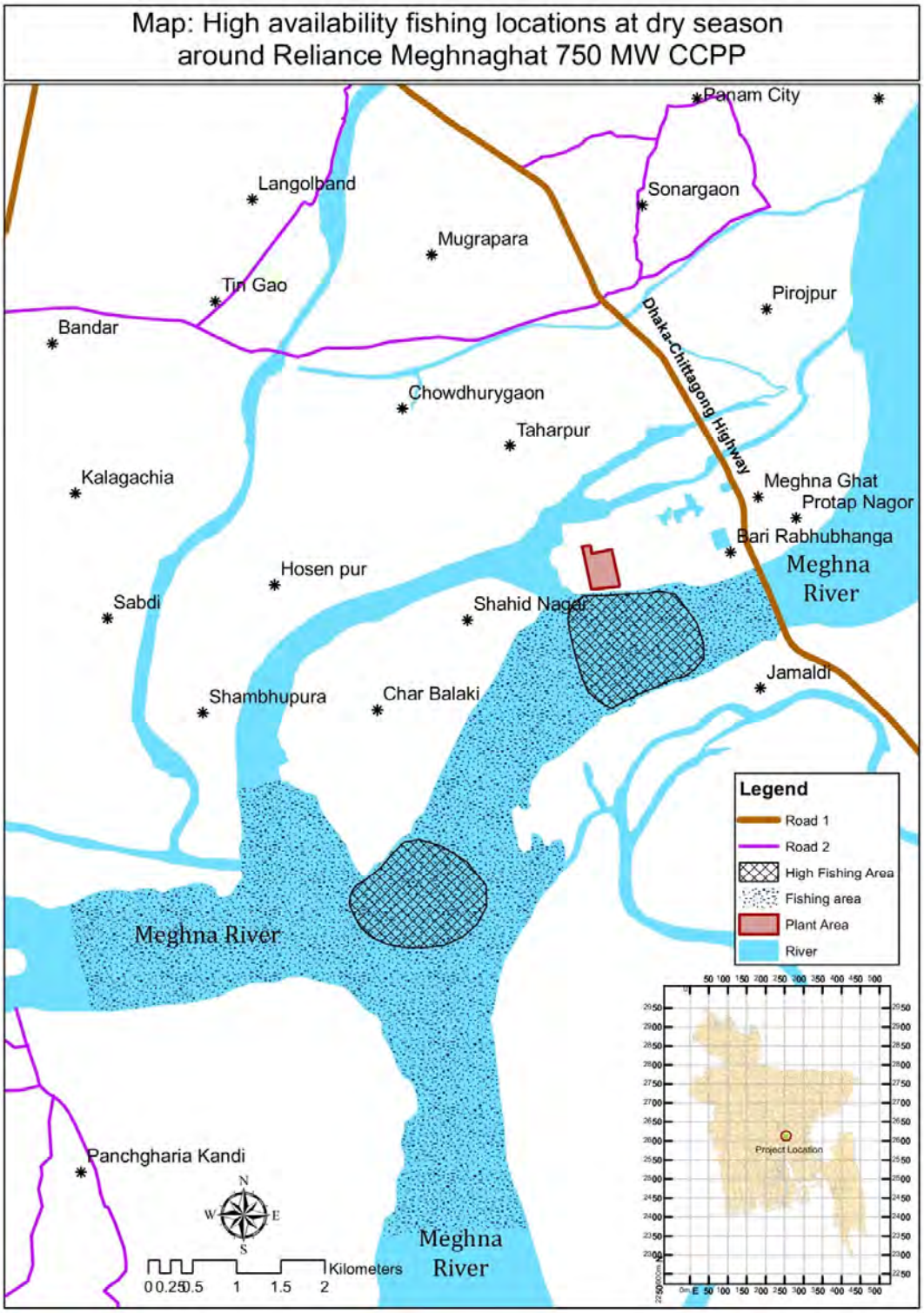


Figure 10.1: Areas of Fish availability in the Dry Season (according to the Local Fishermen)

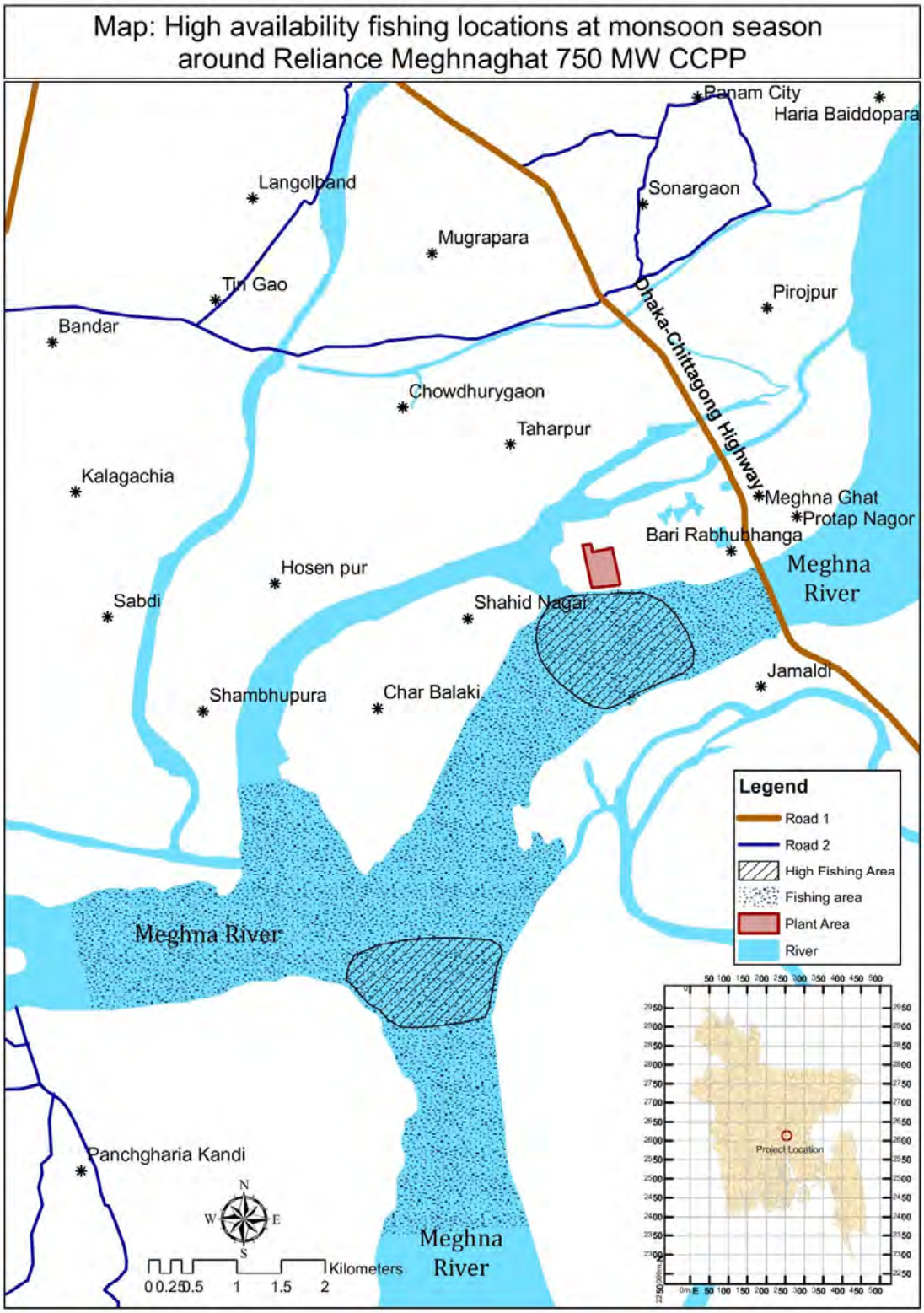


Figure 10.2: Areas of Fish availability in the Monsoon (according to the Local Fishermen)

FGD of Cow Owners

As the project site is empty at present and without any fencing, people living around the area as a cattle grazing ground. There are 25 to 30 cows that graze in the existing project site everyday. People living in the area named Mongoler Gaon are the ones who own most of these cows. It is their secondary source of income and many of them are workers of existing power plants. They have been consulted about the future of their now used grazing ground. They have been informed about how much place will be occupied by the proposed project.

After consultation they have stated a few demands:

- As the cows are their second source of income, the project authority must consider them while recruiting for the construction and operation phase.
- The road across Mongoler Gaon is in terrible shape and they what the authority to help them fix their road.

Alternate Grazing Ground

According to the cow owners, the Project site is not the only place they use for grazing their cows. They graze their cows wherever they can manage an empty piece of land covered with grass. The project will not occupy the entire land; therefore the remaining land can be used as a grazing ground. As per their indication, the future grazing ground has been shown in **Figure 10.3.**

Figure 10.3: Alternative Grazing Ground after the Completion of the Project

Consultation with Local Cow Owners (Day 1; Location: Mongoler Gaon)

Consultation with Local Cow Owners (Day 2; Location: Mongoler Gaon)

10.6 PARTICIPANTS OF STAKEHOLDER CONSULTATIONS

Informal Consultation

Table 10.1: Participants of Informal Stakeholder Consultants

SL	Name	Address	Age	Sex	Profession	Mobile No
Fishermen FGD						
01.	Nurul Haque	Bolakir Char	60	M	Fisherman	01858740836
02.	Saleh Ahmod	Bolakir Char	62	M	Business	01725886995
03.	Firoz Mia	Bolakir Char	67	M	Fisherman	
04.	Mohammd Ali	Bolakir Char	45	M	Fisherman	
05.	Delowar Hosen	Bolakir Char	52	M	Business	01987048074
06.	Nazmul Alom	Bolakir Char	42	M	Business	01821498332
07.	Monowara	Bolakir Char	60	F	Housewife	01862754207
08.	Sirajul Islam	Mugrapara	36	M	Fisherman / Worker	01849285305
09.	Md. Saidul Islam	Mugrapara	30	M	Fisherman / Business	01747690287
10.	Md. Abdul Kader	Mugrapara	30	M	Fisherman / Worker	01881554365
11.	Saroti	Chandpur	46	M	Fisherman	01860482196
12.	Tapos	Chandpur	25	M	Fisherman	
13.	Sumon	Chandpur	25	M	Fisherman	
14.	Esob Bapari	Bolakir Char	52	M	Fisherman/ Business	01852101652
15.	Rubel Rana	Bolakir Char	19	M	Student	
16.	Mohammod Rasel	Bolakir Char	20	M	Student	
17.	Jakir	Bolakir Char	17	M	Fisherman	01820894170
18.	Md. Falanur	Bolakir Char	21	M	Fisherman	01834156499
19.	Ruma	Bolakir Char	30	F	Housewife	
20.	Eiasmin	Bolakir Char	26	F	Housewife	
21.	Hazi Mahafuj Member	Bolakir Char	75	M	Retired	
22.	Ebrahim	Bolakir Char	60	M	Fisherman	
23.	Md. Akter Hosen Khan	VatiBolaki	51	M	Retired	01734240464

24.	Hannan	Char Bolaki	50	M	Fisherman	01851491846
25.	Azgor Ali	Sonarganj	61	M	Business	01986750512
26.	Munir Hosen	Char Bolaki	50	M	Retired	
27.	Israfil	Balakir Char	38	M	Fishermen	01824900450
28.	Md. Zakir	Balakir Char	42	M	Fishermen	
29.	Mokter Hosen	Shahid Nagar, Char Balaki	50	M	Fisherman	01932533351
30.	Hazrot Ali	Shahid Nagar, Char Balaki	50	M	Fisherman	
31.	Mitu	Shahid Nagar, Char Balaki	30	F	Housewife	01834460424
32.	Mamun	Shahid Nagar, Char Balaki	10	M	Student	
33.	Rashed Rasel	Shahid Nagar, Char Balaki	10	M	Student	
34.	Zulhas	Shahid Nagar, Char Balaki	50	M	Fisherman	
35.	Faisal	Shahid Nagar, Char Balaki	9	M	Student	
36.	Sumona	Shahid Nagar, Char Balaki	8	F	Student	
37.	Farjana	Shahid Nagar, Char Balaki	7	F	Student	
38.	Akas	Shahid Nagar, Char Balaki	15	M	Fisherman	
39.	Tar Hosen	Shahid Nagar, Char Balaki	7	M	Fisherman	
40.	Moinul	Shahid Nagar, Char Balaki	10	M	Fisherman	
41.	Akter Hosen	Charbalaki	36	M	Fisherman	01837385812
42.	Mokter Hosen	Dudhghata	34	M	Fisherman	01830952907
43.	Ahammod Ali	Dudhghata	32	M	Fisherman	01816788635
Cow Owners						
1.	Akter Hossen	Gonga Nagar	60	M	Cow Farmer	
2.	Tamu Mia	Gonga Nagar	70	M	Cow farmer	01862706916
3.	Wazuddin	Ganga Nagar	90	M	Cow Farmer	
4.	Md. Rasel	Gonga Nagor	27	M	Service/Cow farmer	01676799311
5.	Ali Ahmed	Gonga Nagor	42	M	Business	01814389367
6.	Sonia	Gonga Nagor	22	F	Housewife	01814973631
7.	Nurul	Gonga Nagor	40	M	Farmer	01992701571
8.	Shahinur	Gonga Nagor	35	F	Housewife	
9.	Shila	Gonga Nagor	30	F	Housewife	
10.	Rakib	Gonga Nagor	16	M	Student	01726324502
11.	Zorina	Gonga Nagor	45	F	Housewife	
Government Representatives						
1.	Matiur Rahman	Secretary pirojpur UP	35	M	Gov. Service	01933302040

2.	Masudur Rahman Masum	Meghnaghat	39	M	Chairman Pirojpur UP	01836412121
Reliance Personnel						
01.	Arun Prasad	Dhaka	31	M	Service	+917303409259
02.	Rituparn Singn	Dhaka	47	M	Service	+918587092131
03.	Mohammod Sibbir Ahmed	Dhaka	41	M	Service	01730447076
Local Dwellers						
01	Mofizul	Pachani	70	M	Store Owner	01829012664
02	Salma	Pachani	40	F	Housewife	
03	Beauty Islam	Mograpara	50	F	Housewife	
04	Harunor Rashid	Gonga Nagar	45	M	Business	01882512105
05	AmjadHossain	Gonga Nagar	35	M	Business	01714619426
06	Md. Nazrul Islam	Gonga Nagar	30	M	Meghnaghat Worker	01828655780
NGO Worker						
01.	Md. Ahsan Habib	Sonargaon	30	M	Service	01711032807
02.	Md. Arifur Rahman	Sonargaon	29	M	Branch Accountable	01837975196
03.	Jhuma Paul	Sonargaon	29	F	Branch Accountable	01733219966
04.	Md. Sarif Uddin	Sonargoan Branch	49	M	NGO Worker	01713710228

10.7 STAKEHOLDER CONCERNS AND RECOMMENDATIONS

10.7.1 Community Concerns

Project Approval

The community consultations demonstrated that goodwill towards the project proponents indeed exists; approval for project activities by the communities is evident. The proponent recognizes that benefits from the project should be distributed judiciously and equitably especially among primary stakeholders in the project area, and will continue to ensure that this principle is followed in its projects and community development program. The consultation process should include the local people with different life styles.

Resettlement/ Relocation

The proposed project is situated in the Meghnaghat mauza of Sonargaon, Narayanganj. The site is surrounded by Meghna River in the north, west and south direction. There are three major power plants situated in the east of the project site. The land was low lying char land owned by Government (Government khas land); PDB acquired the land in 1995 and developed the area as Power village. Therefore, resettlement or relocation is not an issue for this proposed project.

Local Employment

Communities in the project area emphasized that local people should be given priority when employing people for various project-related works and activities according to their skills.

Compensation

As the proposed power plant site will be established in an empty land leased by BPWD to Reliance, compensation is not required in the proposed project activities.

Interaction with Local Community

Non-Local work force coming in the project area that will not be aware of the local customs and norms, may result in conflicts with the local community, keeping in mind the sensitive law and order situation and culture of the area.

Impact on Environment & Livelihood

The public consultation should include the impact on people of their living environment and livelihood. In the public consultation meetings, people should be asked regarding this issue.

Impact on Fishing

Since the proposed project would have close circuit cooling and no thermal discharge, the temperature rise in the Meghna River not be an issue for such project; therefore, the project will not hamper aquatic life.

Impact on Grazing

The project site is currently empty, unprotected and not fenced. Currently scattered cow owners use this land to graze their cows taking the advantage of unprotected nature. After consulting the cow owners, it appeared that they are concerned about their activities and they are motivated themselves to find alternative space for the cow grazing near the river bank once the project will be implemented. They still appreciated this endeavor which will lead to the development of the surrounding area and create employment opportunities.

The Questionnaires used in the informal FGDs are attached in the **Annexure 17**.

10.7.2 Community Recommendations

1. They local community recommends and demands development of infrastructures surrounding the project area to provide better communication.
2. They demand employment of the local young manpower during construction and operation phase.
3. They want to be provided with technical and vocational training centers to help them build up their skills.

4. They want training centers for the local women so that they can join the workforce as well.
5. There is no hospital nearby the project site. A medical facility will be a great facility for the community.
6. Primary and high schools need to be built up to ensure educational facility for the local children so that they can propel towards a better future.

10.7.3 Local Government & Other Representatives

During the consultation, the proponent and Local Government representatives were present and consulted. The local NGO people were welcomed and consulted. By considering all local people, government officials and NGO people, the meetings were be run through direct queries and feedbacks.

10.8 Formal Stakeholder Consultation

A formal stakeholder consultation will be arranged after the review of the draft ESIA at the end of Jan 2017 is which the stakeholders, local authority representatives and local community people will be present. Reliance Meghnaghat Power authority along with government & donor agency representatives will also present in a formal gathering to consult with the people living near and around the project site. In this consultation, the local communities and public representatives will have scope to let the power plant authority and other concerned know about their concerns about the project and their expectation from the project.

10.8 Future Stakeholder Engagement Plan

For the betterment of the community, the Reliance Bangladesh LNG & Power Limited authority is advised to hold future stakeholder consultation during construction and operation phase in order to make sure that the dwellers are not being harmed by any means.

The consultation process must be carried out at regular interval with people near and around the project site. It can be carried out half yearly or annually and in those meetings, the Reliance authority must listen to their voices and try to solve their problems if any that will be caused for the project.

CHAPTER ELEVEN: GRIEVANCE REDRESS MECHANISM

11.0 GRIEVANCE REDRESS MECHANISM AND DISCLOSURE

11.1 GRIEVANCE REDRESS MECHANISM

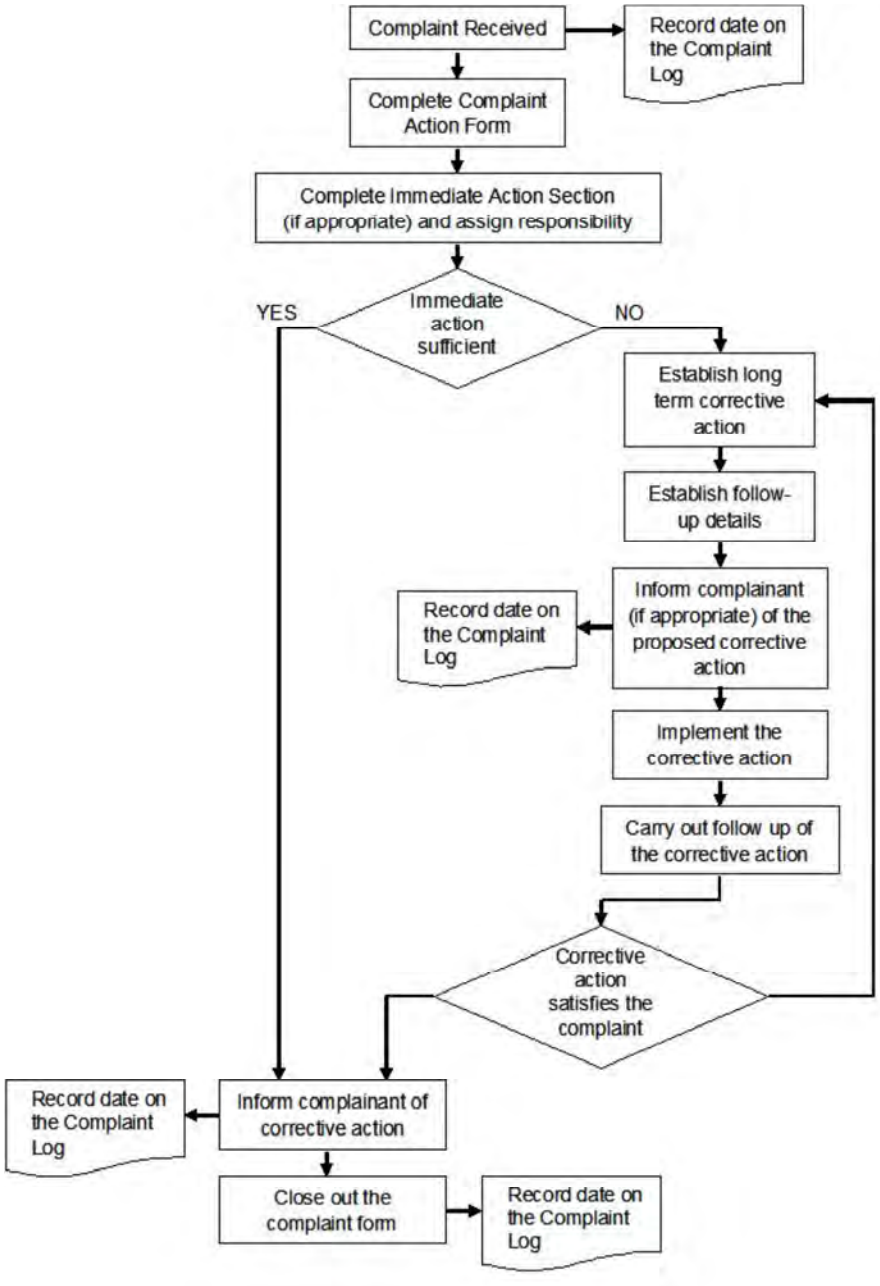
Public participation, consultation and information disclosure should be undertaken as part of the local ESIA process. Continued public participation and consultation have been emphasized as a key component of successful project implementation. As a result of this public participation during the initial stages of the project, major issues of grievance are not expected. During the construction and operational phase of the project, the complaints that may be anticipated are mostly related to dust, noise & vibration of the construction activities and turbines. However, unforeseen issues may also occur. To settle such issues effectively, an effective and transparent channel for lodging complaints and grievances will be established. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project. It should address affected people's concerns and complaints promptly, using an understandable and transparent process. It should also be readily accessible to all sections of the community at no cost and without retribution.

The Grievance Mechanism will be implemented during both the construction and operational period of the project to ensure that all complaints from local communities are dealt with appropriately, with corrective actions being implemented, and the complainant being informed of the outcome. It will be applied to all complaints from affected parties.The mechanism will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple means of using this mechanism, including face-to-face meetings, written complaints, telephone conversations should be available. Confidentiality and privacy for complainants should be honored where this is seen as necessary or important.

A grievance redress mechanism and procedures is setup to provide opportunity for project affected persons to settle their complaints and grievances amicably. The established grievances redress procedures and mechanism ensures that project affected persons are provided with the appropriate compensations and that all administrative measures are in line with the law. It also allows project affected persons not to lose time and resources from going through lengthy administrative and legal procedures. Grievances are first preferred to be settled amicably.

RBLPL shall set-up a grievance redress committee that will address any complaints during both the construction and operational period of the project.

Figure 11.1 - Flowchart of Complaints/Grievance Procedure:



The representation in the committee makes project affected persons to have trust and build confidence in the system. The grievance redress committee reports its plan and activities to the Implementation committee. The committee will be formed in near future and will be included in the final ESIA report.

GRC will maintain a Complaints Database, which will contain all the information on complaints or grievances received from the communities or other stakeholders. This would include: the type of complaint, location, time, actions to address these complaints, and final outcome.

The procedures to be followed and adopted by the grievance redress should be transparent and simple to understand or uniform process for registering complaints provide project affected persons with free access to the procedures. The response time between activating the procedure and reaching a resolution should be as short as possible. An effective monitoring system will inform project management about the frequency and nature of grievances. GRC will arrange half yearly meetings where the activities and the outcomes/measures taken according to the Complaints Database are to be monitored and reviewed by third party consultant to ensure the required transparency. In addition to the above, if there are any grievances related to environmental management issues in the project area, the GRC will record these grievances and suggestions and pass it on to the relevant consultant for necessary action and follow-up.

GRC will be responsible to response for the grievances within a time limit. The initial movement to identify the causes should be taken within 48 hours. The GRC will not take more than two weeks to take the final initiative.

In case a dispute is not resolved by arbitrational tribunal, then if any of the Party disagrees, the aggrieved party has the right to appeal to the ordinary courts of law. However, the preferred option of dispute settlement ought to be the option of settling the dispute amicably because recourse to courts may take a very long time even years before a final decision is made and therefore, should not be the preferred option for both parties.

11.2 DISCLOSURE

As part of the public disclosure, the project proponent will arrange to publish the ESIA report in their website and a hard copy will be available at site or proponent's local office for the access of local pubic and community. It is a very effective way to disclose the report for all to show the details to public for their opinion. It helps to increase the public awareness and give knowledge regarding environmental and social issues in a very easy way.

CHAPTER TWELVE: CONCLUSION

12.0 CONCLUSION

Reliance Meghnaghat 750 MW Combined Cycle Power Plant, an upcoming project of Reliance Bangladesh LNG & Power Ltd., intends to build and operate a 750 MW gas turbine combined cycle power plant at Sonargaon, Narayanganj inside Meghnaghat power village**.** An ESIA has been prepared for the project according to the requirement of DoE for necessary environmental clearances as it is made mandatory in ECA'95 for any new industrial set up. The ESIA has been prepared through identifying the potential impacts, assessing them and recommendation possible mitigating and enhancing measures for negative and positive impacts, respectively.

The environmental analysis has revealed that the project can be set-up according to the proposed design and configuration in the proposed site and location. The environmental impacts are of limited nature, whereas the benefits of the project are many.

The primary reason why the environmental impact from the plant is minimal is that the project proponent is abide by Bangladesh/ADB/ World Bank Standards and build a plant, which will meet the emission standards of Bangladesh, ADB and the World Bank. The excellent characteristics of the fuel used, equipment and machinery, which conform to international standard and good operation practices all combine to make the proposed power plant project acceptable one.

The main potential environmental problems, which may arise as a result of construction of power plant, can be grouped as follows-

- Atmospheric emissions and Air quality
- Water pollution and waste water disposal
- Noise

All these aspects have been examined and the findings are as follows:

Atmospheric Emission and Air Quality: The proposed power station will be fired on natural gas. Emission of sulfur dioxide and particulates would be insignificant as the Bangladeshi indigenous natural gas is almost free of Sulphur and particles. Emission of NO_x will also be very low as electricity will be produced using lean burn mixture of air and gas in the cylinder i.e. more air will be present in the cylinder than required for complete combustion. Based on the appropriate design of burner, dry low NOx (DLN), water injection or Selective Catalytic Reduction (SCR) and the stack of nature 70 m height, as per the emission dispersion

modeling, the NOx emission from the stack would be within the Bangladesh and WB/IFC standard.

Liquid Discharge: The estimated water consumption is 1100 m^3/hr and discharge will be 196 m^3/hr in the proposed Reliance Meghnaghat 750 MW CCPP project. The low amount of water discharge is due to the use of "Closed Circuit Cooling System". Owing to the low amount of discharge and use of closed circuit cooling, rise in river temperature will have no impact on river water temperature considering the amount of discharge from the other power plants near the project premise. The domestic liquid wastes would be disposed through a septic tank system. It has been planned that the surface drainage network would be connected with an interceptor prior to discharge to surface drainage system.

Noise: The noise impact generated by operation of the plant has been predicted by means of noise impact modeling. The results will be used to specify noise abatement measurers. Appropriate noise controls will be installed to keep the neighborhood impact due to noise emissions within the limit of DoE and international standards.

Having reviewed all the potential environmental impacts, and following our proposed mitigation measures the project is expected to proceed without having unacceptable environment. Electricity supplies could be provided to the area without much of load shedding and it will also add a significant amount of electricity to the national grid. In this context, the proposed power station, Reliance Meghnaghat 750 MW CCPP project, would be a welcome relief for the people in that area as well as for the people of Bangladesh.

Recommendation for the Project

No development can be expected without any adverse impact on the environment. The beneficial impacts on the nation as well as human beings would only be meaningful and sustainable development would only be possible if adverse impacts are minimized through strict maintenance and control measures as mentioned for this project. All this would need vigilant care and cost money, and the project authority should take these into consideration. However, the following are the recommendations should be followed by the RBLPL during the construction and operation of the project:

Follow the EMP: The Environmental monitoring Plan should be followed properly and review of the EMP should be done as per plan.

Continuation of the baseline air monitoring study: Since the baseline air monitoring study has been conducted from Sep-December, a follow up baseline air quality monitoring should be conducted at July-Aug and Jan-Feb so that the proper monsoon and dry season data would be reflected.

Continuation of the Stakeholder Consultation: To evaluate the true consequences of the project, the Stakeholder consultations should be continued during the Construction and

operation of the project in a regular interval. The stakeholder consultation should address the following issues while doing future consultations:

- Social Conflict
- Acceptance of the Foreign and migratory workers
- Change in livelihood

Post Environmental Impact Assessment: A post EIA should be conducted after the implementation of the project to compare the ESIA mitigation measure that suggested are logical and working properly.

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