

EXECUTING AGENCY: CHITTAGONG PORT AUTHORITY (CPA)

**ENVIRONMENTAL IMPACT ASSESSMENT (EIA) (PORT) FOR
JICA DATA COLLECTION SURVEY ON THE MATARBARI PORT
DEVELOPMENT**



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Final Report

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Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

FINAL REPORT

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LIST OF ABBREVIATION

AER	:	Agro-Ecological Region
AQM	:	Air Quality Management
BARC	:	Bangladesh Agricultural Research Council
BBS	:	Bangladesh Bureau of Statistics
BCT	:	Bay Container Terminal
BFRI	:	Bangladesh Forest Research Institute
BETS	:	BETS Consulting Services Ltd.
BEZA	:	Bangladesh Economic Zones Authority
BIG-B	:	Bay of Bengal Industrial Growth Belt Initiative
BMD	:	Bangladesh Meteorological Department
BWDB	:	Bangladesh Water Development Board
CDL	:	Chart Datums are Lowest
CITES	:	Convention on International Trade in Endangered Species
CPA	:	Chittagong Port Authority
DAE	:	Department of Agricultural Extension
DC	:	Deputy Commissioner
DG	:	Director General
DoE	:	Department of Environment
DOF	:	Department of Fisheries
DOF	:	Department of Forest
DTW	:	Deep Tube Well
DWT	:	Dead Weight Tonnage
EA	:	Environmental Assessment

ECA	:	Ecologically Critical Area
ECA	:	Environmental Conservation Act 1995
ECR	:	Environment Conservation Rules 1997
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
EPZ	:	Export Processing Zone
EQS	:	Environmental Quality Standards
ESMS	:	Environmental Safety and Management System
EZ	:	Economic Zones
FGD	:	Focus Group Discussion
FIDC	:	Forest Industries Development Corporation
GCB	:	General Cargo Berths
GIS	:	Geographical Information System
GO-NGO	:	Governmental-Non-Governmental Organization
GOB	:	Government of Bangladesh
GPS	:	Global Positioning System
ICTP	:	International Conventions, Treaties and Protocols
IEC	:	Important Environmental Component
IEE	:	Initial Environmental Examination
IFC	:	International Finance Corporation
IMS	:	Information Management System
IOF	:	Institute of Forestry
IUCN	:	International Union for Conservation of Nature and Natural Resources or the World Conservation Union

JICA	:	Japan International Cooperation Agency
KCT	:	Karnaphuli Container Terminal
KII	:	Key Informant Interview
LGED	:	Local Government Engineering Department
MoEF	:	Ministry of Environment and Forest
MoL	:	Ministry of Land
NCS	:	National Conservation Strategy
NCT	:	New-Mooring Container Terminal
NEC	:	National Economic Council
NGO	:	Non-governmental Organization
NOC	:	No Objection Certificates
NWMP	:	National Water Management Plan
NEMAP	:	National Environmental Management Action Plan
NSDS	:	National Sustainable Development Strategy
OECD	:	Organization for Economic Co-operation and Development
PAP	:	Project Affected Person
PPP	:	Policy, Plan and Program
PPP	:	Public Private Partnership
RAP	:	Resettlement Action Plan
SDG	:	Sustainable Development Goals
SEA	:	Strategic Environmental Assessment
SRDI	:	Soil Resource Development Institute
TEU	:	Twenty Foot Equivalent Unit

TOR	:	Terms of Reference
UNDP	:	United Nations Development Program
WB	:	World Bank Group

GLOSSARY

Adverse impact: An impact that is considered undesirable.

Ambient air: Surrounding air.

Aquatic: Growing or living in or near water.

Arsenic: Arsenic is a chemical element with symbol As and atomic number 33. Arsenic occurs in many minerals, usually in conjunction with sulfur and metals, and also as a pure elemental crystal. Arsenic is a metalloid.

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. It 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 micro Organisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity

Biological Oxygen Demand (BOD): The amount of dissolved oxygen, consumed in a biological process, which degrades the organic matter in water.

Consultation: the process of seeking the views of interested or affected stakeholders and engaging them in constructive two-way dialogue.

Ecology: Science, which studies relationships and interaction between organisms and their environment.

Ecological factor: Any part or condition of the environment that influences the life of one or more organisms.

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 enhancement: An intentional change, which amplifies the anticipated positive impact of the project on an environmental component.

Environmental and Social impact assessment (ESIA)/Environmental assessment: The systematic, reproducible and interdisciplinary identification, prediction and evaluation, mitigation and management of

impacts from a proposed development and its reasonable alternatives, sometimes known as environmental assessment.

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

Environmental 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.

Flood Plain: Areas of relatively low-lying land seasonally inundated by over spill from adjacent rivers, lakes and natural depressions.

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

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

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.

Initial Environmental Assessment/ Evaluation: Preliminary analysis undertaken to ascertain whether there are sufficient likely significant adverse impacts to warrant a “full” ESIA. In some countries, use of initial assessment forms a meaning of “screening” proposed projects.

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 a village revenue unit.

Magnitude: The degree of change in an important environmental component that results from a project activity. It refers to the size of the impacts and could be either beneficial or adverse.

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

Natural Gas: Flammable gas, consisting largely of methane and other hydrocarbons, occurring naturally underground (often in association with petroleum) and used as fuel.

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

pH: pH is a measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water.

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).

Risk analysis: A technique used to determine the likelihood or chance of hazardous events occurring (such as the release of a certain quantity of a toxic gas) and the likely consequences.

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 take an interest in it.

Social impact assessment: The component of ESIA concerned with changes in the structure and functioning of social orderings. In particular the changes that a development would create in: social relationship; community (population, structure, stability etc.); people's quality and way of life; language; ritual; political/economic processes; attitudes/values.

Socio-economic: The human environment, which includes social and economic components that are not termed biophysical.

Sustainability: Applied to positive impacts only and could be of three different types sustainable, sustainable with mitigation and non-sustainable

Taka: Unit of Bangladeshi currency.

Terrestrial: Living on land.

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

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

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

Wildlife: Organism that can survive without any artificial help. The four general types are: mammals, amphibians, reptiles and birds.

Wildlife Habitat: An area maintained as an undisturbed breeding ground for wild fauna. The habitat is protected for the continued well-being of the resident and migratory fauna.

Zila: Bengali word of district

ACKNOWLEDGEMENT

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EXECUTIVE SUMMARY

E-1 INTRODUCTION

The Government of Japan and the GoB has initiated the Bay of Bengal Industrial Growth Belt Initiative (BIG-B), and under this initiative, JICA has implemented the “Data Collection Survey on Integrated Development for Southern Chittagong Region” since 2015 which assessed the potentiality of the development of infrastructure, energy and power, industrial and urban development in the region. Through this survey, the need to conduct “Data Collection Survey on the Matarbari Port Development in the People’s Republic of Bangladesh” for the further detailed plan of Matarbari port development has been recognized. In this study, the Environmental Impact Assessment (EIA) is pursued due to the requirement of the Department of Environment (DOE) to avoid negative impacts of the port development along the coast of the Matarbari Island or other measures.

The detailed scope of the EIA study is as outlined below:

- Screening of the Project derived from applicable reference framework based on reconnaissance survey and desk based review of Project documents;
- Scoping for the EIA study;
- Identification of the Project components;
- Development of a regulatory, policy and administrative framework relevant to the Project;
- Monitoring, analysis and reporting of the environmental and social baseline data of the study area including consultation with local communities and other stakeholders;
- Assessment of the environmental impacts of the Project in the study area;
- Assessment of social impacts on the local community as well as project affected people if any and any other stakeholders, which have been identified during the social consultation process;
- Risk assessment and consequence analysis of the Project;
- Formulation of an Environment Management Plan and associated/specific mitigation plans for identified impacts; and
- Formulation of Stakeholder Consultation and Grievance Redress Mechanism for the Project.

E-2 DESCRIPTION OF THE PROJECT

As per the criteria of DOE, the Port project falls under the Red Category and the same requires Environmental Impact Assessment (EIA). Though the project has some environmental impact but of lesser degree as will be revealed from the successive chapters. It is to be mentioned here that as per JICA guideline the proposed project falls under Category-A.

Matarbari area is expected to play the leading role in the realization of the BIG-B initiative. To be more precise, this development will lead to an increase in export industries and hence reduce the trade deficit due to the importation of coal and oil as a source of energy. Furthermore, these developments will also lead to short and long term regional economic stability.

The port development will be in the Hamidkhali, Bonjamari Ghuna and Nasir Mohammad Dail villages of Dhalghata Mouza under Ward#03 and Ward# 01 of Dhalghata Union with 70.5Ha of land. In the first phase of the project the port terminal area shall be a target of utilizing 35.5 Ha of land and for the route purpose 35 Ha.

The components of the port project are:

- Construction of Multi-purpose terminal (17ha, quay length 300m) and container terminal (18ha, quay length 480m);

- Procurement of Cargo handling Equipment (3 Quay Crane);
- Procurement of relevant facility and equipment (tug boat, pilot boat, lighthouse etc...)
- Consulting services (F/S review, DD, TA, CS, assistance to environmental and social safeguard, technical transfer)

The detail design of the project will start from December 2018 and the construction work will be completed in march 2024. CPA will start the partial operation of the port in July 2022. The project cost would be 799,766,000.00 USD excluding the contingency and price escalation cost.

E-3 LEGAL AND LEGISLATIVE FRAMEWORK

This document focuses on policy, regulations and the administrative framework under the purview of which the proposed project will fall and this EIA study will be governed, namely:

- ✓ Bangladesh national and local, legal and institutional framework;
- ✓ JICA Guidelines for Environmental and Social Consideration Guideline

The following sections review the relevant National legislative, regulatory and policy requirements along with some international ones. In addition to review of these policies, the gaps between National Laws and JICA Guidelines for Environmental and Social Considerations (April 2010) has been addressed.

E-4 STUDY OF ALTERNATIVE OPTIONS

Four options were analyzed minutely considering the technical, social, environmental and current status of the project area. Fourth Option has been selected as the best option comparing the other options because of the following characteristics:

- ⇒ Land acquisition would be minimum
- ⇒ Insignificant homestead area i.e. almost zero settlement would be in the selected option
- ⇒ No river encroachment is required for this selected option
- ⇒ Port construction activities would be much easier
- ⇒ A moderate accessibility to the site through onshore and offshore would be possible
- ⇒ Soil condition seems moderate for construction work
- ⇒ There would be minimum chances of having landless people in the selected option
- ⇒ Land development cost would be minimum comparing the land acquisition and construction accessibility consideration of the port
- ⇒ No relocation/resettlement would be needed for the selected option
- ⇒ No indigenous people will be affected by the selected port option
- ⇒ No cultural property will be affected by the selected port option
- ⇒ Loss of productive land will be minimum and will not impacted the national economy
- ⇒ Cumulative and long-term effect seems to be insignificant
- ⇒ Effect on Fish yielding capacity would be insignificant
- ⇒ No forest area would be affected due to the selected port option
- ⇒ Loss of indigenous species would be insignificant
- ⇒ Loss of biodiversity would be insignificant

E-5 ENVIRONMENTAL AND SOCIAL BASELINE

An overview of the land use and land cover pattern has been studied based on the satellite images and presented using Geographical Information System (GIS). The total land of the study area is 31,415 hectares.

The land cover of the study area is derived from multi-spectral color Rapid Eye satellite images. The major classes extracted from the images are as follows: agricultural land, char land/sandbars, forest, industrial area, road, rural settlement with homestead vegetation, built-up area and water bodies.

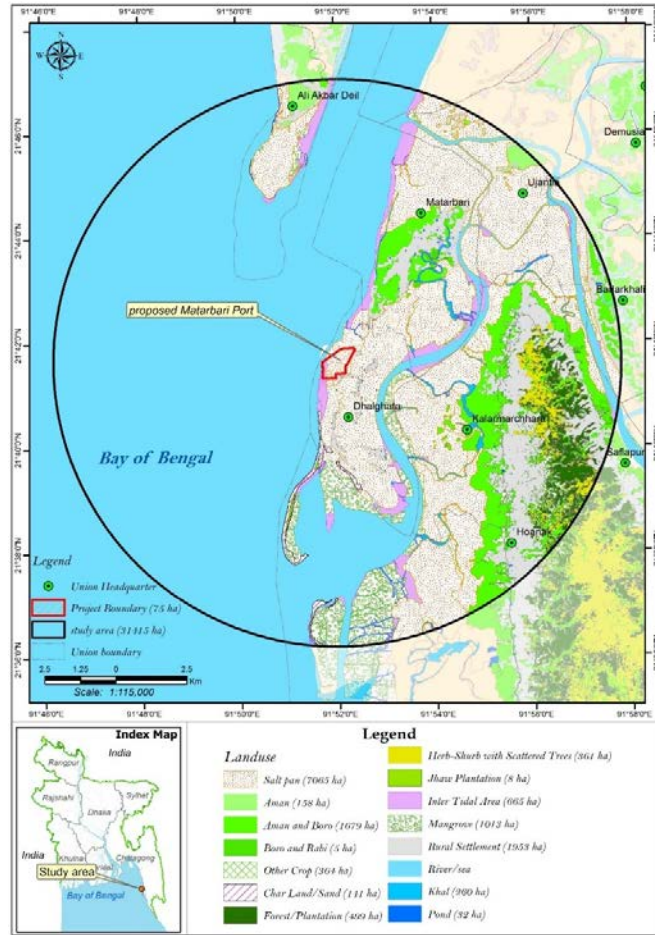


Figure-E-1 General Landuse Map

The ambient mean temperature of the study area is found as 19°C-20°C in winter and 27°C-28°C in summer. On the other hand, the annual average rainfall in this region varies from 2500 mm – 3000 mm, which is relatively higher than the western areas of the county. Southwest monsoon occurs in this region from June till September; during this period heavy rainfall takes place for which the project area experiences tidal and coastal flood.

Besides, tropical storms i.e. Kalbaishakhi and cyclone occur during summer in the month from April to June and then from September to December. These cyclones occur almost every year in the Chittagong coastal areas with varied intensity and magnitude.

The study area falls in the South-Eastern climatic zone of Bangladesh. Meteorological data for the last thirty years was collected from the nearest BMD stations in Kutubdia (BMD Station ID: 11925) which is analyzed to get the overall micro-climatic conditions of the study area. Figure-5.3-3 shows the nearby meteorological station of the project area. Summary of the analysis of climatic parameters is given in the following sections.

The last 35 years data of Kutubdia BMD station (Station ID: 11925) shows that the annual average rainfall is recorded as 2824.2 mm/yr, according to the data analyzed (Figure5.3-6) monthly average maximum rainfall occurred in July (approximately 763.7mm/month) and monthly average minimum rainfall occurred

in winter season (December to February) which indicates that the rainy season is very prominent in this region. The ever maximum daily rainfall recorded is 422mm in the 16th July 1998 and ever maximum annual rainfall was recorded as 4587mm in the year of 1998. It is also observed that, the annual rainfall in this area is gradually decreasing at a rate of 10.8 mm/year.

The Project and the study area fall within the Chittagong Tidal Plain Physiographic units of Bangladesh. More precisely, the project area falls under the sub-region namely South Chittagong Tidal floodplain. The greater part of this region is underlain by sediments washed out from the adjoining hill ranges. The landscape and soils in this sub-region are very different from those in the other sub-regions. This is a complex compound unit which includes different landscapes. The entire sub-region is badly exposed to cyclones and associated storm surges, and affected by a tsunami caused by an earthquake in the eastern half of the Indian Ocean.

The Project has medium vulnerability in terms of earthquake compared to the other parts of Bangladesh. In such, the Bangladesh building code should be strictly followed during designing of the civil structure for the proposed Power Plant.

The proposed project area is adjacent to the Bay of Bengal and located in the southeast of Kutubdia Island. The Kutubdia channel, Matamuhuri River and Kohaliariver are the main rivers close to the project area. The project area is approachable by road from Chittagong district and water way through the “Bay of Bengal”. Heavy construction materials/ machineries can be transported through water way.

Tides of the Bay of Bengal regularly inundate large area of land mass along the shore side of the project area. During monsoon, huge quantity of rainfall runoff flows to the Kutubdia channel through creeks and rivers which ultimately falls into the Bay of Bengal. The level of salinity is relatively lower due to monsoon. However, the surface water quality in the study area is influenced by monsoon rainfall. Moreover, the offshore zone of the project is influenced by the estuary environment.

Tides in Bangladesh coastal areas originate from the Indian Ocean. It enters into the Bay of Bengal through the two submarine canyons, the ‘Swatch of No Ground’ and the ‘Burma Trench’. Tide arrives with semi diurnal features all over the coastal zones of Bangladesh as the shoreline experience two almost equal high tides and two low tides each day. The periods of oscillations are 12 hours 25 minutes respectively.

The coastal area of Bangladesh has three tidal zones. These are:

- Macro Tidal Zone: Isotidal fluctuation >4 m
- Meso Tidal Zone: Isotidal fluctuation 2 m to 4 m
- Micro Tidal Zone: Isotidal fluctuation <2 m

The proposed Port project area falls under the Meso Tidal Zone where tidal fluctuation occurs regularly and the eastern region regulates the level of inundation within the project area. The yearly average tidal fluctuation is around 3 m to 4 m.

According to the Tsunami Vulnerability Map of Bangladesh (Figure: 5.3-24), the project area is situated in the Tsunami Vulnerability Coastal Belt I, indicating high population vulnerability in case of a tsunami event. The coastline is close to the tectonic interface of the Indian and Burmese plates.

The study area and its surrounding comprise different landforms having varied vegetation patterns which create different habitats. The project area is located very near to the Bay of Bengal. Regular tidal flow, salinity intrusion through the canals and tidal surge is changing the land use pattern. The study area has been occupied by sea, saltpan, canal, forest, stream, shrimp farm, mudflat, pond, homestead, agriculture land etc. The area has been demarcated under certain bio-ecological zone from physiographic and biodiversity points of view.

E-6 STAKEHOLDER ENGAGEMENT

Public opinion has been collected through stakeholder meetings and focus group discussion. For better understanding the socio-economic and environmental condition focus group discussions were held with the local people in the closest settlement area of the Matarbari Island. Stakeholder meetings were twice held in the Upazila levels as well as the local levels i.e. Union level of the project study area.

E-7 SCOPING AND TOR FOR THE SURVEY ON NATURAL AND SOCIAL ENVIRONMENT

The scoping of the proposed Port project has been narrated in Table-E-1 considering the scoping as well as addressed the results based on the survey results.

Table-E-1 Scoping Results of the Proposed Port Project

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air Quality	B-	B-	B-	B-	Construction phase: - dust dispersion occurs. - machinery will exhaust polluted gas emissions. Operation phase: Air pollution caused by exhaust gas generated from the vessels using the port is predicted. - Cumulative impacts are expected with the surrounding areas.
	2	Water Quality	B-	B-	B-	B-	Construction phase: - diffusion of turbidity expected when excavating the land area, - Turbid water from the land will be expected. Operation phase: - Dredging cause turbidity. - The ballast water pollution is expected.
	3	Waste	B-	B-	B-	B-	Construction phase: -Sand and silt from dredging work of the navigation channel and the port will be re-used for land preparation of the port and others are disposed by sea and land dumping. -there emerge both general and hazardous waste Operation phase: - Dredged materials are generated by maintenance of the port.
	4	Soil Contamination	B-	B-	B-	B-	Construction phase: Generation of the construction waste and waste materials is assumed. Operation phase: Some pollutants are assumed to be generated from vessels entering and leaving ports such as oil and chemical material spills.
	5	Noise and Vibration	B-	B-	B-	B-	Construction phase: - Noises and vibrations from construction machinery and vehicles will be caused regularly. Operation phase: - Construction machinery and vehicles will cause noises regularly.
	6	Subsidence	C	C	D	D	Construction/Operation phase: There is no groundwater use during construction/operation phase:

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
	7	Odor	D	D	D	D	Construction/Operation phase: There is no material creating odors during construction/operation phase:
	8	Sediment	D	D	B-	B-	Construction phase: Both in ocean dumping place of the dredged sediment and the route areas of dredging, there are some negative impacts on benthos. Operation phase: Because of the maintenance dredging, benthos are affected.
Natural Environment	9	Protected Areas	C	C	D	D	Construction and Operation phases: Sonadia ECA has been designated pursuant to the Environmental Protection Law in Bangladesh, located 15km south of the proposed site.
	10	Protected Areas	B-	B-	B-	B-	Construction/Operation phase: There is no protected area in the planned site, but there could be some negative environmental impact in the peripheral changes due to the project site.
	11	Ecosystem	B-	B-	B-	B-	Construction phase: The sandy beach of the intertidal zone disappears for the construction of the harbor facility. Impacts on surrounding ecosystems (birds, sea turtles, dolphins) due to overseas line change and construction activities are assumed. Operation phase: There were no threatened species such as birds, sea turtles, and dolphins. However, maintenance dredging and the influence on the coastline of the drilling waves due to the navigation of large vessels gradually progresses, and adaptation of these changed is expected.
	12	Hydrology	B-	B-	B-	B-	Construction/Operation phase: It is assumed that changes in the hydrology will occur due to the addition of port facility.
Social Environment	13	Resettlement and Land Acquisition	A-	D	A-	D	Pre-Construction: Approximately 56ha of private land including residential area and salt farm need to be acquired. 45 HHs will be resettled. Construction: No impact is expected, as relocation will be completed before construction begins. Operation: No impact is expected, as relocation will be completed before construction begins.
	14	Poor Classes	B- /B+	B- /B+	B- /B+	B- /B+	Pre-Construction: There are poor households among those to be resettled and/or lose their livelihood means. Construction: They will have job opportunities at the construction site. Operation: Resettled people may experience the deterioration of their household economies and loss of livelihood following relocation. Positive impact will be expected due to job opportunity at port facilities, improvement of local economy facilitated by livelihood of port workers.

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
	15	Ethnic Minorities and Indigenous Peoples	C	D	D	D	<p>Pre-Construction: Neither ethnic minorities nor indigenous peoples live in the project affected area.</p> <p>Construction: Neither ethnic minorities nor indigenous peoples live in the project affected area.</p> <p>Operation: Neither ethnic minorities nor indigenous peoples live in the project affected area.</p>
	16	Local Economy such as Employment and Livelihood, etc.	B-/B+	B-/B+	A-/B+	B-/B+	<p>Pre-Construction: Employers/ employees of salt farms, shrimp farms, fishermen, farmers and some ferry boat workers may lose their means of livelihood or their jobs.</p> <p>Construction: Local people will be employed for construction work. The sandy beach will not additionally disappear due to the dredging activities for the port's construction and maintenance. Cumulative impact from the adjacent project on salt and shrimp farm will be expected.</p> <p>Operation: Means of livelihood in salt farming and shrimp farming could be lost. Cumulative impact from the adjacent project will be expected. The construction of port will benefit the lives of local people through job opportunity and improvement of local economy due to livelihood of port works.</p>
	17	Land Use and the Utilization of Local Resources	A-	A-	A-	A-	<p>Pre-Construction/ Construction: The implementation of this project will change the traditional land use pattern. Local resources can get stringent.</p> <p>Operation: Influx of port workers may change the traditional land use pattern and utilization of local resources.</p>
	18	Water Usage and Water Rights	A-	B-	B-	B-	<p>Pre-construction: No activities are expected to give any impact on water usage.</p> <p>Construction phase: Local economy may be affected by the turbid water discharged from the construction site. Outflows of street dust and oil while it rains, may also cause certain effects.</p> <p>Operation phase: Local economy may be affected by the discharged water into the sea which requires management plan for water quality.</p>
	19	Existing Social Infrastructure and Services	B-	B-	B-	B-	<p>Pre-construction: Some social infrastructure may subject to relocation. Access to social infrastructure and social service may be affected due to resettlement of project affected persons.</p> <p>Construction: Construction work will not disturb access to existing social infrastructure and social services.</p> <p>Operation: Increased marine traffic may disturb the existing marine traffic (traffic of fishing boats).</p>
	20	Local Communities and Decision-	B-	D	B-	D	<p>Pre-construction: Displacement may affect the existing network of local communities and decision-making</p>

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
		making Institutions					institutions. For mitigating this, relocation site needs to be secured near the current residence. Construction: No impact is expected as relocation will be completed before construction begins. Operation: No impact is expected as relocation will be completed before construction begins.
	21	Unequal Distribution of Benefits and Damages	B-	B- /C	B-	B-	Pre-Construction: There may be feelings of resentment, because people living around the project site will benefit through the improvement of social infrastructure and services. People to be resettled and those who lose their means of livelihoods will receive certain damages. Construction: Local resident may not receive benefits if external workers are employed at construction site. Operation: Local resident may not receive benefits if external workers are employed at port facility.
	22	Local Conflicts of Interest	B-	B-	B-	B-	Pre-Construction: Local conflicts of interest may occur between residents, and between local administration bodies and local political leaders. Construction: Conflicts between local residence and external workers may occur because of changes in local customs if the external workers cannot understand local customs. Operation: Conflicts between local residence and external port workers may occur because of changes in local customs if the external port workers cannot understand local customs.
	23	Cultural Heritage	C	C	D	D	Pre-Construction/ Construction: There is no historical/ cultural/archaeological properties nor heritage sites at the project site. Operation: There is no historical/ cultural/archaeological properties nor heritage sites at the project site.
	24	Landscape	B-	D	D	D	Pre-construction: No activities are expected to give any impact on landscape. Construction: No significant impact will be expected as there is no scenic spot near the site. Operation: No significant impact will be expected as there is no scenic spot near the site.
	25	Gender	B-	B+ / B-	B-	B+ / B-	Pre-construction: Unequal distribution of compensation can be occurred within households. Construction: Unequal employment opportunity can be provided at construction site. Operation: Improvement of local economy will give positive impact. Unequal employment opportunity can be provided at port facility.

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
	26	Children's Rights	B-	B+ / B-	B-	B+ / B-	<p>Pre-construction phase: There are children among households to be resettled and/or lose their livelihood means. Children from households losing their land or jobs may suffer from adverse impact on their household economy, such as dropping-out of school.</p> <p>Construction phase: Access way to their schools will not be physically blocked by the construction site. Child labour can be provoked at the construction site because of the huge demand for unskilled workers.</p> <p>Operation phase: Improvement of local economy will give positive impact. Child labour can be provoked at the port facility.</p>
	27	Infectious Disease such as HIV/AIDS	B-	B-	B-	B-	<p>Pre-construction: No impact is expected as no influx of migrant labor is expected at this phase.</p> <p>Construction: A temporary influx of migrant labor during the construction period may increase the risk of infectious diseases.</p> <p>Operation: Influx of migrant port worker may increase the risk of infectious diseases. For mitigating this risk, measure for prevention of infection shall be taken.</p>
	28	Work Environment (Including Work Safety)	B-	B-	B-	B-	<p>Pre-construction: No activities are expected to give any impact on work environment.</p> <p>Construction phase: Accidents may be caused by construction work.</p> <p>Operation phase: Accidents may be caused by the entry and departure of vessels and loading-unloading of cargo.</p>
Others	29	Accidents	B-	B-	B-	B-	<p>Pre-construction: No activities are expected to cause accidents.</p> <p>Construction phase: Accidents may be caused by construction work.</p> <p>Operation phase: Accidents may be caused by increased marine traffic.</p>
	30	Cross-boundary Impact and Climate Change	C	C	D	B-	<p>Construction phase: CO2 emissions due to construction activities is a temporary impact on climate change.</p> <p>Operation phase: CO2 emissions due to the operation of vessels entering and leaving port affects climate change in the long term, and adaptation measures are necessary.</p>

Note:

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

E-8 RESULTS OF THE SURVEY ON NATURAL ENVIRONMENT

Detail survey on the natural condition has been conducted in consideration of Pollution control i.e. Air, Noise & vibration, Water Quality, Sediment quality etc. Whereas Natural biological condition survey was conducted to understand the flora, fauna of the project study area.

Sea bottom Sediment (Heavy Metal)

Sediment Bangladesh does not have standard values for heavy metals contained in sea bottom sediment. Globally, ERL (Effects Range-Low) and ERM (Effects Range-Median) are proposed by the NOAA (National Oceanic and Atmospheric Administration, U.S.) as the guidelines to help categorize the range of concentrations of heavy metals and organic chloride compounds in sediment which affect benthic organisms.

In a series of data of ascending levels of contaminants and their toxicity effects, the 10th percentile and the 50th percentile (median) of the effects database were identified for each substance. The 10th percentile values were named the “Effects Range-Low” (ERL), indicative of concentrations below which adverse effects rarely occur. The 50th percentiles values were named the “Effects Range-Median” (ERM) values, representative of concentrations above which various effects frequently occur. The EPA uses ERL and ERM values as a type of sediment “benchmark”. They define a benchmark as a concentration that, when exceeded, has the potential to cause harm or significant risk to humans or animals in the environment. The EPA has also used ERL and ERM values for sediment contamination studies. Assessment categories defining the condition of sampled sediments have been used by the EPA in the past. Categories have been characterized as “good” for zero ERL exceedances, “intermediate” if there are ERL exceedances but zero ERM exceedances, and “poor” for any ERM exceedance. The EPA credits the ERL and ERM as valuable benchmarks that assist in providing a uniform context for evaluating contaminant levels within estuaries (Ref: Wikipedia). The result shows that all the parameters are within the NOAA guidelines standards and there is no sediment contamination in the project area. The results are listed in the table E-2.

Table E-2 Results of Sea bottom Sediment Survey (Heavy Metals) of the project study area

Parameters	Unit	Result (19-03-2018 to 04-04-2018)				Guideline of NOAA	
		0.5m depth	1mdepth	5m depth	10m depth	ERL	ERM
pH	-	7	7.5	7	7		
Arsenic (As)	mg/Kg	5.43	3.94	8.65	8.87	8.2	70
Copper (Cu)	mg/Kg	9.1	4	9.2	9.5	34	270
Zinc (Zn)	mg/Kg	41.2	23.5	26.3	41.7	410	410
Mercury (Hg)	mg/Kg	0	0	0	0	0.15	0.71
Chromium (Cr)	mg/Kg	25.3	11.70	13	21.1		
Lead (Pb)	mg/Kg	17.2	14.90	17.8	18.3	46.7	218
Nickel (Ni)	mg/Kg	16.2	8.8	9.4	16.4		
Cadmium (Cd)	mg/Kg	0.1	0.10	0	0	1.2	9.6
Iron (Fe)	mg/Kg	18400	15000	21000	32800	-	-
Organic Matter (Wet Combustion method)	%	2.4735	1.35	2.62	2.12		
Moisture Content	%	22.39 (28.86)	20.36 (25.57)	25.47 (34.18)	21.38 (27.19)		

Phytoplankton

Higher abundance of phytoplankton occurred in Kuhelia River. Most of Kuhelia river species are Aphanizomenon, Cochlodinium, Dynophysis, Planktothrix, Protopteridinium, Pseudo-nitzschia etc. Due to lake of transference (dredging fact) and excess rolling of the sea water the phytoplankton growth is minimum in sea site.

Two layers of results of the phyto-plankton has been observed from the field investigation. The Bottom Water phytoplankton abundance is zero as because of the lack of sunlight penetration to the bottom layers. It has evident that the phytoplankton doesn't grow in the bottom layer.

Table E-3 Results of the phyto-plankton survey

Surface Water (0.5m depth)

Genera	Sampling sites	
	Sea	Kuhelia
	(individuals/L)	(individuals/L)
Aphanizomenon	-	777.667
Asteromphalus	-	-
Aulacoseira	-	1,811
Boreadinium	-	500
Coscinodiscus	-	1,111
Cochlodinium	-	500
Cylindrotheca	-	477.67
Ditylum	300	1,276.67
Dynophysis	-	1,000
Dissdenium	-	-
Euglena	-	-
Entomoneis	-	777.667
Gloeocapsa	-	2,666.67
Gyrodinium	-	-
Leptocylindrus	-	-
Monoraphidium	291.5	-
Navicula	-	-
Planktothrix	-	1000
Pleurosigma	-	-
Protoperidinium	-	-
Pseudo-nitzschia	-	-
Rhizoselenia	290	2,788.67
Spirulina	287.5	-
Scenedesmus	-	-
Stephanopyxis	-	-
Total	1,169	14,687.01

Middle (1/2 depth)

Genera	Sampling sites	
	Sea	Kuhelia
	(individuals/L)	(individuals/L)
Ditylum	27.5	-
Dynophysis	-	-
Dissdenium	-	-
Euglena	-	-
Entomoneis	-	-
Gloeocapsa	-	-
Leptocylindrus	-	-
Monoraphidium	-	-
Navicula	-	-
Planktothrix	-	-
Pleurosigma	-	800
Pseudo-nitzschia	-	-
Rhizoselenia	80	766.667
Spirulina	8.25	-
Total	107.75	1,566.67

E-9 ENVIRONMENTAL AND SOCIAL IMPACT EVALUATION

A simple semi-quantitative descriptive checklist method has been applied to evaluate the potential environmental impacts. Firstly, the activities during construction and operation were identified and listed in the impact table. Then the corresponding impacts on the specific ecological components (terrestrial and flora), socio-economic parameters and physico-chemical environment attributes were evaluated based on the baseline scenario and an assessment of the typical interactions with project activities. Assessments were made as to whether the impacts were positive (beneficial) or negative (harmful), short-term (short recovery time) or long-term (extended recovery time); and of high or low/moderate intensity. The results of the assessment of Ecological Impacts are summarized in Tables E-4.

Table E-4 Evaluation of ecological impacts ensuing from different project activities

Ecological Issues

Sources of Potential Impacts	Flora		Fish	Fauna							
	AQ	TR		Amphibian		Reptile		Bird		Mammal	
			AQ	TR	AQ	TR	AQ	TR	AQ	TR	AQ
A. Construction Phase											
Camp Setting	0	-1S	0	0	-1S	0	-1S	0	-1S	0	-1S
Land Clearing	0	-1S	0	0	-1S	0	-1S	0	-1S	0	-1S
Soil Excavation	0	-1S	-2S	0	-1S	0	-1S	0	-1S	0	-1S
Generation of Noise	0	0	-2S	0	-1S	0	-1S	0	-1S	0	-1S
Deterioration of Water Quality	-1S	0	-2S	0	-1S	0	0	0	0	0	0
Sewage Discharge on Soil/Water	-1S	0	-1S	0	-1S	0	0	0	0	0	0
B. Operation Phase											
Treated Waste Water Disposal	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S
Ship Traffic	-1S	-1S	-2S	-1S	0	0	0	0	-1S	-1S	-1S
Cargo Operations and Waterfront Industry	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S

[Legend :AQ = Aquatic; TR = Terrestrial; 0 = No impact (negligible impact), 3 = High impact, 2 = moderate impact, 1 = Low impact, S = Short term impact, L = Long term impact, +/- = positive/negative impact]

E-10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The environmental management and monitoring implementation structure in accordance with the reporting flow diagram during the construction phase.

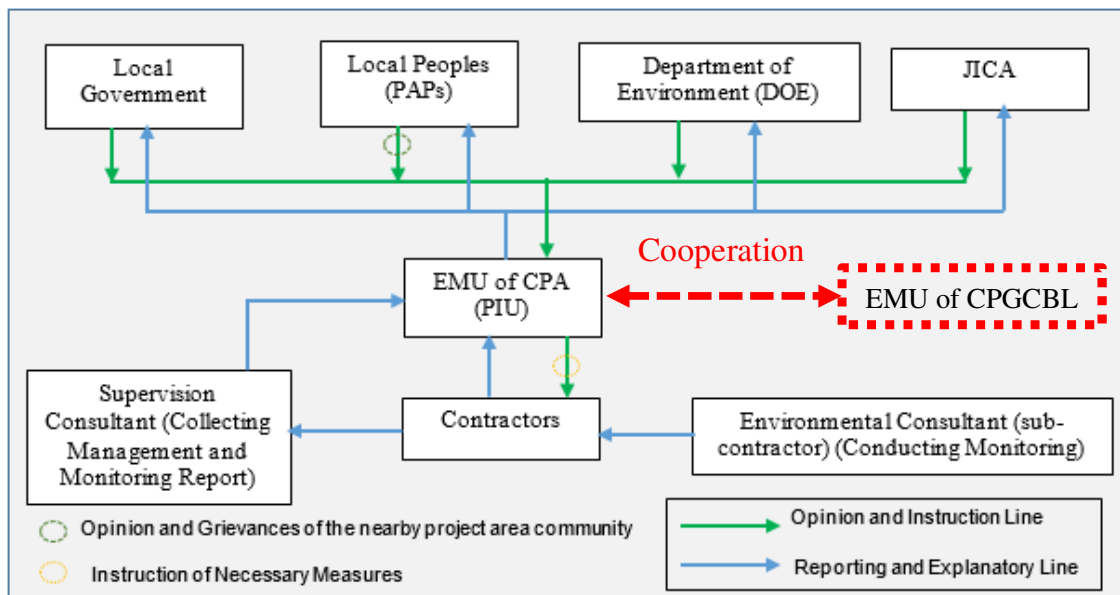


Figure E-2 EMP Implementation Structure in the Construction Phase

Figure E-3 describes the environmental management and monitoring implementation structure with the reporting flow during the operation phase

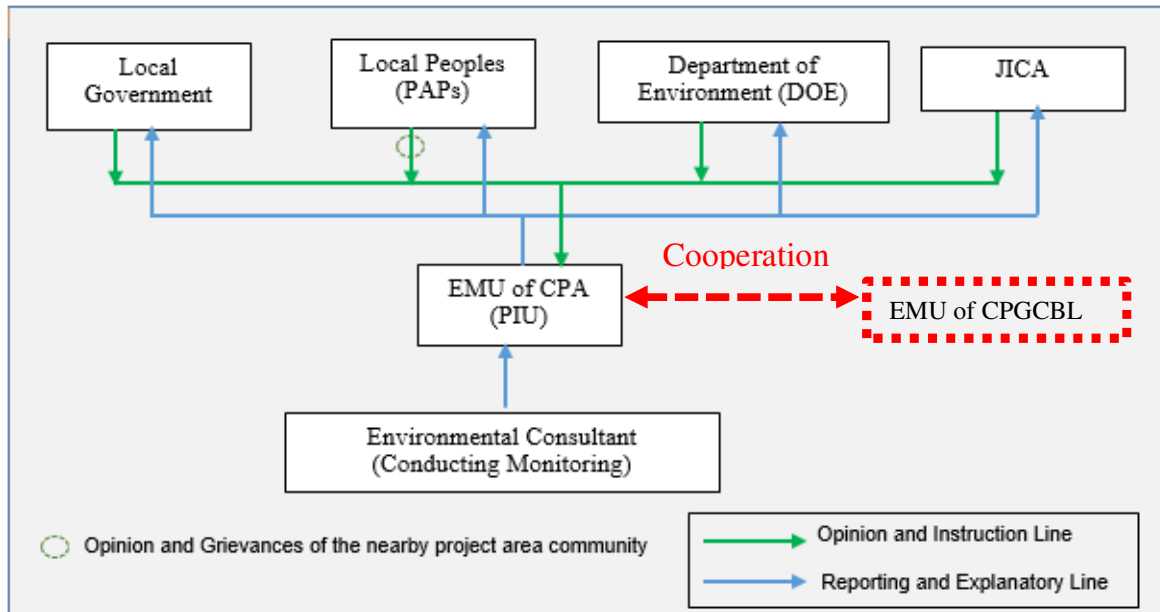


Figure E-3 EMP Implementation Structure in the Operation Phase

Table E-5 Environmental Management Plan

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
A. Preconstruction Phase									
1	Land acquisition	i) Loss of private land ii) Loss of salt fields, shrimp farms and fishing ground for push net iii) Loss of residential /commercial structures iv) Loss of trees, home gardens, fish ponds and fruit	i), ii), iii) & iv) - The Acquisition and Requisition of Immovable Property Act of 2017 - JICA Guideline (2010)	i) Consideration for land owners ii) Consideration for persons losing their livelihoods iii), iv) Consideration for persons losing their property	i), ii), iii) & iv) - Developing an appropriate LARAP - Land acquisition should be conducted in compliance with the relevant laws and regulations - The cost related to relocation will be given to relocated residents - Employ local residents, especially loss of salt fields, shrimp farms, and fishing ground for push net as much as possible	i), ii), iii) & iv) - At the site	i), ii), iii) & iv) During land acquisition process	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
2	Disturbance to poor classes	- Poor households among those who are to be resettled.	- JICA Guideline (2010)	- Consideration for burden on vulnerable groups	- Developing “livelihood restoration program”, including job training programs to persons who want the training.	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
3	Deterioration of Local Economy such as Losses of	- Loss of existing livelihood, employment and business	- Income level	- Maintaining or Improvement of living standards of local residents	- Developing an appropriate LARAP - Compliance with relevant law for land acquisition	- At the site	- During land acquisition process	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
	Employment and Means of Livelihood	opportunities			- Appropriate implementation of compensation				
4	Land Use and Utilization of Local Resources	- Changing the traditional land use patterns and utilization of local resources	- Land Use Pattern - Use of Local Resources	- Mitigation of land use change and Prevention of local resource depletion	- Ditto	- near the site	- During land acquisition process	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
5	Disturbance to Existing Social Infrastructure and Services	- Loss of access to social infrastructure	- Accessibility to Social Infrastructure and social services -GRM cases	- Ensuring access to social infrastructure and social services	- Ditto	- near the site	- During land acquisition process	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
6	Disturbance to Local Communities and Decision making Institutions	- Loss of access to social infrastructure - community severance due to resettlement	- Accessibility within community -Perception of local residents	- Ensuring accessibility within community and maintaining Local Decision making Institutions	- Ditto	- near the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
7	Unequal Distribution of Benefits and Compensation	- It can occur among residents, workers, government officers and local politicians	- Perception of local residents	- Consideration for unequal distribution of benefits and losses	- Implement the same mitigation measures as those outlined in "Social infrastructure"	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
8	Local Conflicts of Interest	- It can occur among residents, workers,	-Perception of local residents	- Consideration to affected peoples' emotions	- Implement the same mitigation measures as those outlined in "Social	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		government officers and local politicians			infrastructure”				
9	Gender	- Inappropriate distribution of compensation within HHs	- distribution of compensation within HHs	- Appropriate distribution of compensation within HHs	- Awareness and monitoring for appropriate distribution of compensation within HHs	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
10	Children's Rights	- Deterioration of livelihood due to resettlement and land acquisition	- enrollment rate	- ensuring education opportunity	- Ditto	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
B. Construction Phase									
1	Air Quality	i) Dust resulting from construction work ii) Exhaust gas from construction machinery and vehicles used for mobilization of equipment iii) Air pollution arising from incineration of construction materials and waste	i) ii) & iii) - Ambient Air Quality Standard - IFC guideline values for ambient air quality (General/ 2007)	i) ii) & iii) - Prevention of air pollution in the surrounding area	i) Dust prevention ii) Watering access road and construction site, especially in the dry season iii) Using cover sheets on trucks for the transportation of soil Gas emission prevention - Periodic maintenance and management of all the construction machinery and vehicles Waste management	i) ii) & iii) - Construction area	i) ii) & iii) - During construction phase	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					- Prohibit open burning and illegal dumping				
2	Water Quality	i) Dredging Landfill for land preparation ii) Raising for leveling iii) Runoff water from construction area iv) Domestic wastewater of workers v) Inappropriate disposal of waste vi) Leakage oil and chemical materials from construction activity	i) dredging laws ii)-vi) Wastewater standards for industrial activity	i) - vi) - Prevention of water pollution in the surrounding coastal area	i) Dredging Conducting dredging at sea area with pump dredger or grab dredger and setting film preventing the diffusion of contamination When dredging terrestrial area, firstly driving steel sheet pile at the sea side ii) Levelling Managing the rainwater by collection and draining wastewater to port iii) Runoff water - Excavate channels, ditches and temporary settling pond around construction area - Install oil separator for treatment of oily wastewater - Construct silt basin - Domestic wastewater	i) ii) Dredging area iii)-vi) Port site	i) During the dredging activities ii)-vi) During landfill activities	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					<ul style="list-style-type: none"> - Install wastewater treatment facility for workers such as septic tanks iii) Wastewater management - Prohibit illegal dumping iv) Oil and chemical materials leakage - Storage of oil and chemical materials in an appropriate storage site and appropriate method to prevent permeation into ground and dredging with pump or grab after sea water penetrates the land v) Landfill - Treating turbid water from land, such as rainwater runoff, with precipitation process and discharging the remaining water into the excavated part of the port 				
		vii) Sediment caused by the embankment	vii) Water quality environmental standard	vii) Minimize pollution from stagnant water	vii) Installation of pipe type seawater introduction workers and seawater introduction works with submerged	vii) Embankment	vii) During construction phase	vii) Implementation: Contractor/ Environmental Consultant - Supervisor:	vii) Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					breakwater			CPA/ Supervision Consultant	
3	Waste	- Dredging material for the channel	- Waste Management Rules	- Prevention of inappropriate waste disposal	Dredging material - Sand: Use for leveling the site	i) Dredging area ii) Port site	- During construction phase	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
4	Noise and Vibration	i) Noise and vibration caused by construction machinery ii) Noise caused by vehicles used or mobilization of equipment and workers	Noise level standards IFC guideline values for noise (General/ 2007)	- Reduction of noise levels from construction activities	i) Optimizing construction schedule - Perform construction work during daytime, especially piling work - Using low-noise/ low vibration equipment as much as possible ii) Mobilization - Transportation of material and equipment for construction by shipping - Determine a traffic control plan including route-setting - Limit truck speed especially around residential areas	i) & ii) Construction area	i) & ii) During construction phase	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
5	Odor	- Domestic wastewater of workers	- Wastewater standards	- Prevention of generating odor	- Taking appropriate measures for handling general waste - Prohibit illegal waste disposal	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor.
6	Soil	i) Leakages of oil and chemical materials from construction activity ii) Inappropriate disposal of waste	i), ii) - Drinking water quality standards	i), ii) - Prevention of water and soil pollution in the surrounding area	i) Leakages of oil and chemical materials - Storage of oil and chemical materials in an appropriate storage site and method to prevent permeation into the ground ii) Waste management - Prohibit illegal dumping	i), ii) - Construction Area	i), ii) - During construction phase	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
7	Sediment	i) Runoff water from construction area ii) Domestic wastewater of workers iii) Inappropriate disposal of waste iv) Leakages of oil and chemical materials from construction	i) ii) iii) & iv) - Wastewater standards	i) ii) iii) & iv) - Prevention of water pollution in the surrounding area	i) ii) iii) & iv) - Implement the same mitigation measures as those addressed in “Water quality”	i) ii) iii) & iv) - Construction area	i) ii) iii) & iv) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		activity							
8	Ecosystem	i) Existence of endangered species v) Spawning of sea turtles	i) & ii) - Bangladesh Wild Life Preservation (Amendment) Act, 1974 JICA Guideline	i) & ii) - Protection of endangered species	i) Existence of endangered species - Prohibit disturbance, harassment, and hunting, especially the Spoon billed Sandpiper, by workers - Replace to nearby sites if needed. ii) Spawning of sea turtles - Turning off unnecessary lights during the nesting season - Using a smaller number or lower wattage of lights - Using red and yellow lights (as sea turtles are less affected by these colors) - Using low noise machinery Planning construction activities to minimize adverse effects during the nesting season	i) Construction area Construction site adjoining sand beach	i) & ii) - During construction phase	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
9	Deterioration of Local Economy	- Loss of existing livelihood,	- Income level, Number of	- Maintaining or Improvement of the local	- Employ local residents as much as possible	- Villages near the site	- During construction phase	- Implementation: Contractor/ Environmental	Expense is included in contract cost

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
	such as Losses of Employment and Means of Livelihood	employment and business opportunities	employment opportunities for local residents and number of businesses around the construction area	economy - Maintaining or Improvement of living standards of local residents - Consideration to local residents' feelings	- Use the services (i.e., laundry and catering services, etc.) and products offered by the local community. - Developing "livelihood restoration program", including job training programs to persons who want the training.			Consultant - Supervisor: CPA/ Supervision Consultant	by Contractor - Hire local residence: 1,000Tk./person-day
10	Land Use and Utilization of Local Resources	- Changing the traditional land use patterns and utilization of local resources	- Land Use Pattern - Use of Local Resources	- Mitigation of land use change and Prevention of local resource depletion	- Implement the same mitigation measures as those addressed in the "Local economy"	- Villages near the site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
11	Disturbance to Water Usage, Water Rights, etc.	i) Adverse impact due to water pollution ii) Usage of underground water	i) Water pollution - Same as those addressed in "Water quality" ii) Ground water - Drinking water quality standards	i) Water pollution - Same as those addressed in "Water quality" ii) Ground water - Consideration to local residents' living	i) Water pollution - Implement the same mitigation measures as those addressed in "Water quality" ii) Ground water - Monitoring of water levels and water quality at wells in residential areas	i), ii) - Construction area	i), ii) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
12	Unequal Distribution	- Unequal distribution of	- Consciousness	- Consideration of the attitudes	- Employ local residents as much as possible	- Villages near the site	- During construction	- Implementation: Contractor/ Environmental	Expenses included in

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
	of Benefits and Damages	benefits and damages between local residents and external workers	s of local residents	of local residents to the project	- Promote communication between external workers and local people (e.g., join in local events)		phase	Consultant - Supervisor: CPA/ Supervision Consultant	contract cost by Contractor
13	Local Conflicts of Interest	- Conflicts between local residents and external workers	- Change in local customs	- Consideration of the attitudes of local residents to the project	- Employ local residents as much as possible - Promote communication between external workers and local people (e.g., join in local events)	- Villages near the site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
14	Gender	- Unequal opportunity of employment	- Opportunity of employment	- Equal opportunity of employment	- Opportunity of employment shall be properly provided both for male and female	- Construction Site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
15	Children's Rights	- Child labor	- Child labor	- Banning child labor	- Prohibit labor contracts between subcontractor and children - Patrolling periodically to check for any child labor	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
16	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during construction may increase	- sanitation for local residents	- Consideration for sanitation for local residents	- Implementation of periodic medical check-ups by temporary medical team - Education and	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/	Expenses included in contract cost by Contractor - Medical checkups:

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		risk of infection			training on health care of workers			Supervision Consultant	45,000Tk./ person (Full Medical Checkup) - Safety education and training: 150,000Tk./20 person
17	Work environment (including work safety)	i) Labor accidents ii) Diseases caused by air pollutants, water pollutants, and noise by construction work	i) Labor accidents - Handling heavy loads - Working at heights - Electric shocks ii) Environment pollution Ambient Air Quality Standards - Noise level standards - Waste management rule - IFC guideline values for ambient air quality and noise (General/ 2007)	i) & ii) - Prevention of labor accidents, traffic accidents, and health problems	i) Labor accidents - Prepare a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate during the period of construction - Use equipment that protects against electric shock	i) & ii) - Construction area	i) & ii) - During construction phase	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					ii) Environment pollution - Observe related standards and provide workers with appropriate facilities				
18	Accidents	- Traffic accidents	i) Marine traffic accidents ii) Land traffic	i), ii) - Prevention of traffic accidents	i) Marine Traffic: Setting marking buoys around the construction area for marine safety - Informing vessel schedules to local fishermen, etc. ii) Land traffic: - Informing bus schedules to the surrounding villages - Determining a traffic control plan - Training safe operation of vehicles	i) Sea area around the construction site for port facility ii) Area around the construction site for port facility	i), ii) - During construction phase	- Implementation : Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
19	Cross-boundary impact and climate change	- CO ₂ will be produced by construction work	-	- Reduce CO ₂ emissions as much as possible	- Periodic maintenance and management of all construction machinery and vehicles	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
C. Operation Phase									
1	Air Quality	-Exhaust gas from vessels	-MARPOL 73/78 treaty	- Prevention of air pollution	Gas emission from vessels - Hire vessels	- Port facility	- During unloading	CPA/ Environmental Consultant	Expenses by CPA/ Vessel

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
				caused by vessels	compliant to MARPOL 73/78 treaty - Stop engines in the port		activity		owners
2	Water Quality	- Dredging material for the maintenance of the navigation channel	- Regulations relating to dredging	- Minimization of water pollution by dredging	- To choose dredging method and equipment that will minimize turbidity	- Dredging area	- During the dredging activities	CPA/ Environmental Consultant	Expenses by CPA
		i) Leakages of oil from oil tankers ii) Wastewater from vessels will cause water pollution	i) & ii) - MARPOL 73/78 treaty (Annex I- V) ii) Wastewater from vessels - International Convention for the control and management of Ships' Ballast Water and Sediments (BWM), 2004	i) & ii) Prevention of water pollution caused by vessels	i) Leakages of oil from oil tankers - Installation of oil fence ii) Wastewater from vessels - Prohibition of dumping any contaminated materials - Hire vessels compliant to MARPOL 73/78 treaty and BWM - Any waste will be treated by the port facility	i) & ii) - Port facility	i) & ii) - During unloading activity		Expenses by CPA/ Vessel owners
3	Waste	- Dredging material for the maintenance of the channel	- Waste management rules	- Prevention of inappropriate waste disposal	- Sand: To use for construction material	- Dredging area	- During the dredging activities.	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		- Waste from vessels	- Waste management rules - MARPOL 73/78 treaty	- Appropriate waste management	- Prohibition of dumping any contaminated materials - Hire vessels compliant to MARPOL 73/78 treaty - Any waste will be treated by the port facility	- Port facility	- During unloading activity		Expenses by CPA / Vessel owners
		- Sewage and garbage from workers	- Waste management rules	- Management of waste, especially hazardous waste - Prevention of inappropriate waste disposal	Waste management - Waste management program consisting of reduction, reuse, and recycling of materials - Systematic collection and protected storage - Waste disposal at appropriate location - Hazardous waste shall be treated under the related regulations - Prohibition of dumping any contaminating materials	Ditto	During operation of the Port	CPA	Expenses by CPA
4	Noise and Vibration	- Noise from Cargo handling activity at the port	- Noise standards - IFC guideline values for noise	- Mitigation of noise generated by the unloading activity	- Maintenance of equipment. - Installation of low noise type equipment - Optimizing	- Port facility	- During unloading activity	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		- Noise caused by vehicles used for mobilization of equipment and workers	(General/2007)		unloading schedule				
5	Odor	- Domestic wastewater of workers	- Wastewater standards	- Prevention of generating odors	- Taking appropriate measures for handling general waste - Prohibit illegal waste disposal	- Port Area	- During the operation of power plant	CPA	Expenses by CPA
6	Soil	-Leakages of oil and chemical materials	- Ground water (Drinking water quality standards)	- Prevention of soil and water pollution in the surrounding area	Oil and chemical materials leakage - Storage of oil and chemical materials in an appropriate tank with retaining wall and method to prevent permeation into ground	Port Area	- During cargo unloading activity Movement of vehicles	CPA	Expenses by CPA
7	Ecosystem	i) Existence of endangered species ii) Spawning of sea turtles	i) & ii) - Bangladesh Wild Life Preservation (Amendment) Act, 1974 - JICA Guideline (2010)	i) & ii) - Protection of endangered species	i) Existence of endangered species - Prohibit disturbance, harassment, and hunting, especially of the Spoon billed Sandpiper, by workers ii) Spawning of sea turtles - Turning off	- Around the port facility	- During the operation of the Port	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					unnecessary lights during the nesting season - Using a smaller number or lower wattage of lights - Using red and yellow lights (as sea turtles are less affected by these colors) - Using low noise machinery				
8		i) Leakage oil from oil tanker ii) Wastewater from vessels will cause water pollution	i), ii) MARPOL 73/78 treaty ii) Wastewater from vessels International Convention for the control and management of Ships' Ballast Water and Sediments (BWM), 2004	i), ii) Prevention of water pollution caused by vessels	i) Leakages of oil from oil tankers - Installation of oil fence ii) Wastewater from vessels - Prohibition of dumping any contaminated materials - Hire vessels compliant to MARPOL 73/78 treaty and BWM Any waste will be treated by the port facility	i) & ii) - Port facility	i) & ii) - During unloading activity - During oil storage activity	CPA	Expenses by CPA/ Vessel owners
9	Hydrology	- Potential impact to tidal currents caused by construction of the port facility	- Tidal currents	- Minimization of change of tidal currents	- Conducting tidal current simulation to assess any changes in tidal currents	- Sea area port facility	- During operation of the port facility	CPA	Expenses by CPA

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
10	Topography and Geology	- Potential impact on coastal line caused by changing tidal currents	- Coastal line	- Minimization of change of coastal line	- Conducting tidal current simulation to assess the change of drift sand movement	- Sea area around construction area for port facility	- During operation of the port facility	CPA	Expenses by CPA
10	Disturbance to poor classes	- Poor households among those who are to be resettled.	- JICA Guideline (2010)	- Consideration for burden on vulnerable groups	- Implementing “livelihood restoration program”, including job training programs to persons who want the training.	- At the site	- During operation	CPA and Environmental Consultant	Expenses by CPA
11	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Loss of existing livelihood, employment and business opportunities	- Income level, Number of employment opportunities for local residents and number of businesses around the construction area	- Maintaining or Improvement of the local economy - Maintaining or Improvement of living standards of local residents - Consideration to local residents’ feelings	- Employ local residents as much as possible - Use the services (i.e., laundry and catering services, etc.) and products offered by the local community. - Developing “livelihood restoration program”, including job training programs to persons who want the training.	- Villages near the site	- During operation	CPA and Environmental Consultant	Expenses by CPA
12	Land Use and Utilization of Local Resources	- Changing traditional land use patterns and utilization of	- Land Use Pattern - Use of Local Resources	- Mitigation of land use change and Prevention of local resource depletion	- Settlement of port workers shall be made in the organized manner.	- Villages near the site	- During the operation of port	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		local resources							
13	Disturbance to Water Usage, Water Rights, etc.	- Adverse impact due to water pollution	- Same as those addressed in “Water quality”	- Same as those addressed in “Water quality”	- Implement the same mitigation measures as those addressed in “Water quality”	- Port Area	- During the operation of port	CPA	Expenses by CPA
14	Disturbance to the Existing Social Infrastructure and Social Services	i) Increase in the number of vessels ii) Traffic jams caused by increased vehicles	i) ii) - Interference to other tankers or barges -Interference with local transport	i) ii) - Minimize disturbance to the local peoples - Minimize increase of traffic volume	i) vessels - Setting water routes after consultation with related authorities. ii) Traffic volume - Minimizing traffic volume by using buses for employees	Sea area around port facility	- During unloading activity	CPA	Expenses by CPA
15	Unequal distribution of Benefits and Compensation	- It can occur among residents, workers, government officers and local politicians	- Perception of local residents	- Consideration to affected peoples’ emotions	- Developing an employment plan that is fair to every affected person	- Villages near the site	- During the operation of port	CPA	Expenses by CPA
16	Local Conflicts of Interest	- Conflict between local residents and workers	- Change in local customs	- Consideration of the attitudes of local residents to the project	- Employ local residents as much as possible - Promote communication between workers and local people (e.g., join in local events)	- Villages near the site	- During the operation of port	CPA	Expenses by CPA - Hire local residence: 1,000Tk./person-day
17	Gender	- Unequal opportunity of	- Opportunity of employment	- Equal opportunity of employment	- Opportunity of employment shall be properly	- Port Area	- During the operation of port	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		employment			provided both for male and female				
18	Children's Rights	i) Child labor ii) Improved access to education	i) Child labor ii) Access to education	i) Banning child labor ii) Improved access to education	i) Child labor - Prohibit labor contracts between subcontractor and children - Patrolling periodically to check for any child labor ii) Improved access to education - Livelihood restoration program in LARAP shall be properly conducted	i), ii) - Port Area	i), ii) - During the operation of Port	CPA	Expenses by CPA
19	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during operation may increase risk of infection	- sanitation for local residents	- Consideration for sanitation for local residents	- Education and training on health care of workers	- Port Area	- During operation phase	CPA	Expenses by CPA
20	Work Environment (Including Work Safety)	i) Labor accidents ii) Diseases caused by air pollutants and noise by unloading activity	i) Labor accidents - Handling heavy loads - Working at heights ii) Environmental pollution - Ambient air quality standards - Noise	i), ii) Prevention of labor accidents and health problems	i) Labor accidents - Prepare a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting	i), ii) Port facility	i), ii) - During unloading activity	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
			standards - Waste management rules - IFC guideline values for ambient air quality and noise (General/ 2007)		devices, such as cranes, are appropriate for expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate ii) Environment pollution - Observe related standards and provide workers with appropriate equipment				
21	Accidents	- Traffic accidents	- Marine traffic	- Prevention of traffic accidents	- Consulting with related authorities on vessel schedules - Determining water routes after consultation with related authorities - Setting course buoys around navigation channel area for marine safety - Informing operation schedule to local fishermen etc.	- Sea area around port facility	- During unloading activity	CPA	Expenses by CPA

E-11 MONITORING PLAN

Key environmental impacts, monitoring methods, responsible organizations, and expenses for each environmental item in the preconstruction, construction and operation phases for the power plant are listed in Table E-6.

Table-E-6 Environmental Monitoring Plan of the Project

Sl. No	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method		Duration and Frequency	Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location			
A. Preconstruction Phase									
1.	Land acquisition	i) Loss of private land ii) Loss of salt fields, shrimp farms and fishing sites iii) Loss of residential structures iv) Loss of trees and pond	i), ii), iii) & iv) - The Acquisition and Requisition of Immovable Property Ordinance of 2017 - JICA Guideline (2010)	i), ii), iii) & iv) - Confirmation of compensation process	i), ii), iii) & iv) - Attendance at compensation payment - Record of compensation agreements	i), ii), iii) & iv) - Areas eligible for compensation	i), ii), iii) & iv) - During land acquisition process	- Office of the Deputy Commissioner - CPA	Expenses by CPA - Witness: 8,500Tk./person/day
2.	Disturbance to poor people	i) Poor households among those who are to be resettled ii) Loss of salt fields, shrimp farms and fishing sites	i), ii) - JICA Guideline (2010)	i), ii) - Same as those addressed in “Land acquisition”	i), ii) - Interviewing affected people	i), ii) - Affected people	i), ii) - Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses by CPA - Interviewer: 7,500Tk./ Person/day
3.	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	- Changing peoples` thinking through interacting with local government officers, local residents and others	-	- Confirmation of affected peoples` feelings	- Interviewing affected people	- Affected people	- Once a year	Implementation: Contractor/ Environmental Consultant Supervisor: CPA/Supervision Consultant	Expenses by CPA

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method Method of Collecting and Analysing Data	Monitoring Method Location	Duration and Frequency	Responsible Authority	Monitoring Cost
		in the land acquisition procedure							
4.	Misdistribution of Benefits and Compensation	- It can occur among residents, workers, government officers and local politicians	-	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Implementation: Contractor/Environmental Consultant - Supervisor: CPA/Supervision consultant	Expenses by CPA
5.	Local Conflicts of Interest	- It can occur among residents, workers, government officers and local politicians	-	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	-Implementation: Contractor/Environmental Consultant -Supervisor: CPA/Supervision Consultant	Expenses by CPA
B. Construction Phase									
1.	Air Quality	i) Dust resulting from construction work ii) Exhaust gas from construction machinery and vehicles used for mobilization of equipment iii) Air pollution arising from	i, ii) & iii) -PM₁₀ - Ambient Air Quality Standard - IFC guideline values for ambient air quality (General/2007)	i, ii) & iii) - Evaluation of effect of the mitigation measures towards air pollution	i, ii) & iii) - Collecting samples and analyzing at a lab - Measuring meteorological data	i, ii) & iii) - 2 points Residential area around the Port	i, ii) & iii) - Once every three months	- Implementation: Contractor/Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor Sampling: 50,000Tk./sample Analyzing: 45,000Tk./sample

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method Method of Collecting and Analysing Data	Location	Duration and Frequency	Responsible Authority	Monitoring Cost
		incineration of construction materials and waste	Meteorological Condition (Temperature, Moisture, Wind)						
2.	Water Quality (Soil) (Sediment)	i) Runoff water from construction area ii) Domestic wastewater of workers iii) Inappropriate disposal of waste iv) Leakages of oil and chemical materials from construction activity	i, ii) iii) & iv) pH, BOD, TSS, Oil, Coliforms, etc. - Wastewater standards - Ambient water quality standards (inland surface water) - Ground water (Drinking water standards)	i), ii) iii) & iv) - Evaluation of effect of the mitigation measures towards water pollution	i), ii) iii) & iv) - Collecting samples and analyzing at a lab	i), ii) iii) & iv) - 1 point: Foreside of the drain outlet - 1 point: Surface water near the construction area - 1 point: Ground water from existing wells - 4 points: Sea water near the construction area	i), ii) iii) & iv) - Once every three months	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor Sampling: 50,000Tk./ sampling - Analyzing: 100,000Tk./ all sample
3.	Wastes (Odor) (Sediment)	i) Construction waste from construction work ii) Domestic waste from workers iii) Hazardous waste such as dry batteries, etc.	i), ii) & iii) - Waste Management Rules	i), ii) & iii) - Evaluation of effect of the mitigation measures for waste	i), ii) & iii) - Record of kinds and quantity of waste, and the disposal method	i), ii) & iii) - Construction area	1) - 4) - Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
4.	Noise and Vibration	i) Noise and vibration caused by construction machinery ii) Noise caused by vehicles used for mobilization of equipment and workers	i), ii) Noise level - Noise level standards - IFC guideline values for noise (General/ 2007)	i), ii) - Evaluation of effect of the mitigation measures towards noise levels	i), ii) - Measurement using noise level meter	i), ii) - 3 points: On the border of the site near the residential areas	i), ii) - Once every three months	-Implementation: Contractor/ Environmental Consultant -Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor - Measurement: 50,000Tk./ session
5.	Ecosystem (Endangered Species)	i) Existence of endangered species ii) Spawning of sea turtles	i), ii) Species, Number - Bangladesh Wild Life Preservation (Amendment) Act, 1974 - JICA Guideline (2010)	i) Evaluation of existence of endangered species ii) Evaluation of spawning of sea turtles	i), ii) - Observation	i) Endangered species - 1 point: Construction area ii) Sea turtle - 2 lines: Beach in front of the site and the sandbar	i) Endangered species - Bird: Once a week in migration season - Others: Twice a year in dry and rainy seasons ii) Every 3 days in spawning season	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor -Observation: 400,000Tk./ Researcher/year
	Ecosystem (Marine Biota)	i) Potential impact due to the degradation of water quality caused by civil engineering work ii) Domestic wastewater of workers	i), ii) & iii) Species, Number - Phyto and Zoo Plankton - Benthos (Sea bottom)	i), ii) & iii) - Evaluation of effect of the mitigation measures towards water pollution - Confirming the	i), ii) & iii) - Collecting samples at the site, analyzing at a lab	i), ii) & iii) - 4 points: Sea area in front of construction area	i), ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expenses included in contract cost by Contractor - Sampling & analyzing: 200,000Tk./ season (Same as “water quality”)

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method		Duration and Frequency	Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location			
		iii) Inappropriate disposal of solid waste		population and change in types of marine organisms					
	Ecosystem (Mud Flat, Fish & Nekton)	i, ii) & iii) Ditto	i, ii) & iii) Species, Number, Weight - Benthos (Mud flat) - Fish and Nekton	i, ii) & iii) Ditto	i, ii) & iii) - Collecting samples at the site, analyzing at a lab	i, ii) & iii) - 1 point: In front of the site	i, ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expense is included in contract cost by Contractor - Sampling & analyzing: 200,000Tk./season
6.	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Increase in employment and business opportunities	- Number of employment opportunities for local residents and number of businesses around the construction area	- Improvement of the local economy - Improvement of living standards of local residents - Consideration to local residents' feelings	- Information from related institutions - Interviewing residents	- Related institutions - Villages near the site	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor - Interviewer: 5,500Tk./researcher (Same as "Poor people")
7.	Land Use and Utilization of Local Resources	- Changing the traditional land use patterns and utilization of local resources	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method		Duration and Frequency	Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location			
8.	Disturbance to Existing Social Infrastructure and Services	i) Increase in the number of vessels ii) Increase in the number of cars	i), ii) - Traffic volume by construction	i), ii) - Evaluation of effect of construction schedule	i), ii) - Record of numbers of vessels and cars being used	i), ii) - Project site	i), ii) - Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
9.	Local Conflicts of Interest	- Conflict between local residents and external workers	- Change in local customs	- Confirmation of the attitudes of local residents to the project	- Interviewing residents	- Villages near the site	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor - Interviewer: 7,500Tk./researcher (Same as "Poor People")
10.	Gender	i) Gender among those who are to be resettled ii) Loss of salt fields, shrimp farms and fishing sites	i), ii)	i), ii) - Same as those outlined in "Poor people"	i), ii) - Same as those outlined in "Poor people"	i), ii) - Same as those outlined in "Poor people"	i), ii) - Same as those outlined in "Poor people"	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
11.	Children's Right	- Child labor	-	- Evaluation of effect of banning child labor	- Checking the labor contracts between subcontractor and workers - Patrolling construction area for child labor	- Construction area	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method		Duration and Frequency	Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location			
12.	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during construction may increase risk of infection	-	- Evaluation of sanitation for labor	- Labor health records	- Related institutions	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
13.	Work Environment (Including Work Safety)	- Labor accidents	- Handling heavy loads - Working at heights - Electric shock	- Evaluation of effect of the work safety plan	- Record of accidents	- Contractor's office	- Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
14.	Accidents	- Traffic accidents	-Marine traffic -Land traffic	- Evaluation of effect of traffic schedules	- Record of accidents	- Contractor's office	- Continuous records	- Implementation: Contractor/Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
15.	Cross-boundary Impact and Climate Change	- CO ₂ will be produced by construction work	-	- Efforts to reduce CO ₂	- Record of machinery maintenance	- Contractor's office	- Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor

C. Operation Phase

1.	Air Quality	i) Exhaust gas from vehicles used for mobilization of equipment and workers ii) Dust from cargo handling	i), ii) & iii) SO₂, NO₂, PM₁₀ - Emission on gas standards - Ambient air quality standards - IFC guideline values for gas	i), ii) & iii) - Evaluation of effect of the mitigation measures towards air pollution	Set up CEMS (Continuous Emission Monitoring System) i), ii) & iii) - Collecting samples at the site, analyzing at a lab - Measuring the	Installation of CEMS at the gate of the Port. -2 points measurements Residential area around the port	-Continuous measurement -two points measurement shall be once in every 3 months	- CPA/ Environmental Consultant	- CEMS (Expenses included in contract cost by Contractor) Expenses by CPA - Sampling: 50,000Tk./staff - Analyzing:
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Sl. No .	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method Method of Collecting and Analysing Data	Location	Duration and Frequency	Responsible Authority	Monitoring Cost
		activity at jetty and yard iii) Exhaust gas from vessels	emission and ambient air quality (General/ 2007) i), ii) & iii) Meteorological Condition (Temperature, Moisture, Wind) - MALPOL 73/78 treaty		meteorological				45,000Tk./ sample
2.	Water Quality (Soil) (Sediment)	i) Dredging material for the maintenance of the navigation channel ii) Wastewater from port area iii) Leakages of oil and chemical materials iv) Wastewater from vessels will cause water pollution	i), ii) iii) & iv) Water temperature, TSS, pH, DO, SS, oil, BOD, COD, Heavy metals - Wastewater standards - IFC guideline values for wastewater - Ground water (Drinking water quality standards) iii) & iv) - MALPOL 73/78 treaty iv) International Convention for the control and	i), ii) iii) & iv) - Evaluation of effect of the mitigation measure towards water pollution	i) Collecting samples at the site, analyzing at a lab temperature profile with CTD meter ii), iii) & iv) - Collecting samples at the site, analyzing at a lab - Continuous measurement using a sensor - Record of vessels log - Record of oil leakages	- 4 points: Sea area around Dredging area and disposal of wastewater from the Port to the sea. - 2 points: One Ground water from existing well inside the port and another ground water of the deep tube-well from the nearby residential area	- Once every 3 months for the sea water testing - Sampling and analyzing: SS, Oil, BOD, Heavy metal etc.(as necessary) - Continuous measurement : pH - Drinking water quality measurement for the Ground water	- CPA/ Environmental Consultant	- Continuous sensor (Expenses included in contract cost by Contractor) and Expenses by CPA Sampling: 100,000Tk./ staff - Analyzing: 200,000Tk./sample

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method		Duration and Frequency	Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location			
			management of Ships' Ballast Water and Sediments (BWM), 2004 -Ground water (Drinking water quality standards)						
3.	Waste (Odor) (Sediment)	i) Sewage and garbage from workers ii) Waste from vessels	i) & ii) - Waste management rules - MALPOL 73/78 treaty	i) & ii) - Evaluation of effect of the waste handling	i) Record of the amount garbage ii) Record of the amount of waste from vessels	- Port office	- Continuous record	- CPA/ Environmental Consultant	Expenses by CPA
4.	Noise and Vibration	i) Noise and vibration from port generators, and pumps, etc. ii) Noise caused by vehicles used for mobilization of equipment and workers iii) Noise from cargo handling activity at jetty and the port area	i), ii) & iii) Noise level - Noise standards - IFC guideline values for noise	i), ii) & iii) - Evaluation of effect of the mitigation measures towards noise levels	i), ii) & iii) - Measurement using noise level meter	i), ii) & iii) 3 points: On the border of the site near the residential area	i), ii) & iii) - Once every 3 months	- CPA/ Environmental Consultant	Expenses by CPA - Measurement: 100,000Tk./ season

Sl. No .	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
5.	Ecosystem (Endangered Species)	i) Existence of endangered species (migration bird) ii) Spawning of sea turtles	i) & ii) Species, Number - Bangladesh Wild Life Preservation (Amendment) Act, 1974 - JICA Guideline (2010)	i) Evaluation of existence of endangered species (migration bird) ii) Evaluation of spawning of sea turtles	i) & ii) - Observation	i) Endangered species (migration bird) - 1 point: Port Area ii) Sea turtles - 2 lines: Beach in front of the port site and the sandbar	i) Once a week in migration season ii) Every 3 days in spawning season	CPA/ Environmental Consultant	Expenses by CPA -Observation: 250,000Tk// researcher
	Ecosystem (Marine Biota)	i) Potential impact due to the degradation of water quality caused by civil engineering works ii) Domestic wastewater of workers iii) Inappropriate disposal of solid waste	i), ii) & iii) Species, Number - Phyto and Zoo Plankton - Benthos (sea bottom)	i), ii) & iii) -Evaluation of effect of the mitigation measure towards water pollution -Confirming the population and change in types of the marine organisms	i), ii) & iii) - Collecting samples at the site, analyzing at a lab	i), ii) & iii) - 4 points: Sea area in front of the site	i), ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expenses by CPA - Sampling & Analyzing: 400,000Tk./ all sample
	Ecosystem (Mud Flat, Fish & Nekton)	Ditto	i), ii) & iii) Species, Number, Weight -Benthos (mud flat) -Fish and nekton	i), ii) & iii) Ditto	i), ii) & iii) - Collecting samples at the site, analyzing at a lab	i), ii) & iii) -2 point: In front of the port site	i), ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expenses by CPA - Sampling & Analyzing: 350,000Tk./ all sample

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method		Duration and Frequency	Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location			
6.	Disturbance to Poor People	- Improved road along with the power plant	-	- Evaluation of access to social services	- Information from related institutions - Interviewing residents	- Related institutions - Villages near the site	Once a year	- CPA/ Environmental Consultant	Expenses by CPGCBL - Interviewer: 7,500Tk./researcher
7.	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Increase in employment and business opportunities	-	- Evaluation of increase in employment and business opportunities	Ditto	Ditto	Ditto	- CPA/ Environmental Consultant	Expenses by CPA
8.	Land Use and Utilization of Local Resources	- Changing traditional land use patterns and utilization of local resources	-	- Confirmation of local residents' feelings	- Interviewing residents	- Villages near the site	- Once a year	- CPA/ Environmental Consultant	Expenses by CPA - Interviewer: 7,500Tk./researcher (Same as "Poor people")
9.	Disturbance to the Existing Social Infrastructure and Services	i) Increase in the number of vessels ii) Increase in the number of cars	i), ii) - Traffic volume	i) & ii) - Evaluation of effect of traffic schedules	i), ii) - Record of numbers of vessels and vehicles being used	i) & ii) - Project site	i) & ii) Continuous records	- CPA/ Environmental Consultant	Expenses by CPA

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
10.	Misdistribution of Benefits and Compensation	- It can occur among residents, workers, government officers, and local politicians	-	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- CPA/ Environmental Consultant	Expenses by CPA
11.	Local Conflicts of Interest	- Conflict between local residents and workers	-	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- CPA/ Environmental Consultant	Expenses by CPA
12.	Gender	i) Loss of salt fields, shrimp farms and fishing sites ii) Improved road along with the power plant	-	i), ii) - Same as those addressed in "Poor people"	i), ii) - Same as those addressed in "Poor people"	i), ii) - Same as those addressed in "Poor people"	i), ii) - Same as those addressed in "Poor people"	- CPA/ Environmental Consultant	Expenses by CPA
13.	Children's Rights	i) Child labor ii) Improved road along with the power plant	i) Child labor ii) -	i) Evaluation of effect of banning child labor ii) Same as those addressed in	i) Child labor - Checking labor contracts between subcontractor and workers - Patrolling	i) Working area ii) Same as those addressed in "Poor people"	i) & ii) Once a year	- CPA/ Environmental Consultant	Expenses by CPA

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method		Duration and Frequency	Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location			
				“Poor people”	construction area for child labor				
				ii) Same as those addressed in “Poor people”					
14.	Work Environment (Including Work Safety)	- Labor accidents	- Labor accidents - Handling heavy loads - Working at heights - Electric shocks	- Evaluation of effect of the work safety plan	- Record of accidents	- Port area	- Continuous records	- CPA/ Environmental Consultant	Expenses by CPA
15.	Accidents	i) Traffic accidents ii) Fire	i) Traffic accidents - Land traffic - Marine traffic ii) Fire - Record	i), ii) - Evaluation of effect of the work safety plan	i), ii) - Record of accidents and fire	i), ii) - Power plant	- Continuous records	- CPA/ Environmental Consultant	Expenses by CPA
16.	Cross-boundary Impact and Climate Change	- CO ₂ emissions	- Amount of CO ₂ emissions	- Efforts to reduce CO ₂	- Calculate the CO ₂ emissions from fuel consumption	- Port area and the vessels	- Once a year	- CPA/ Environmental Consultant	Expenses by CPA

E-12 OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational health and safety means preventing accidents and work related ill health. Improved health and safety management can bring significant benefits to the business. It reduces individual and human costs of accidents and ill health, direct and indirect cost to the business, improves customer perception and company profile and workers' morale. Under occupational health hazards, one can group several categories of working conditions impairing the health conditions of workers, though this impairment is slow. Safety relates more to health hazards that results from accidents and can cause instantaneous impairment of the workers' health. The proposed project has several phases' the construction of infrastructure and operation.

E-13 EMERGENCY RESPONSE/MANAGEMENT PLAN

It has recommended that an Emergency Response Cell (ERC) adequately equipped with highly trained manpower and appropriate gears is established within the factory complex in order to effectively implement the emergency response plan.

The main functions of the emergency response cell should include the following:

- Identification of various types of emergencies;
- Identification of groups, communities, and areas those are vulnerable to different kinds of emergencies;
- Preparing service teams for various operations within the organization through extensive training;
- Establishment of early detection system for emergencies;
- Developing reliable, instant information communication system;
- Mobilizing all units in the complex within a very short time to address any emergency.

E-14 GRIEVANCE REDRESS MECHANISM

Two levels of grievance redress mechanism for the project, viz. Grievance redress Cell (GRC) at the project level and another at Union level committee (ULC) have been recommended. The aim of having two levels of grievance redress mechanism is to provide a higher forum to the aggrieved party, if the same is not satisfied with the decision of GRC.

GRC will be driven internally by Matarbari Port Authority and shall have the following representation to ensure fair and timely solution to the grievances:

- Community officer serving as grievance officer;
- Port Authority Environment and social officer
- Project management representative;
- CPA EHS representative;

The composition of ULC will have the following members:

- Dhalghata Union Parishad Chairman or his representative
- Project Manager of the Matarbari Port
- Environment and social officer of Matarbari Port
- Local elected Ward Member (s)
- Representative of affected people and women

E-15 CONCLUSION AND RECOMMENDATION

CONCLUSION

The demand of international trade with Bangladesh is increasing every year. To satisfy the future international trade demand through enhancement of cargo handling capacity as well as to ease the

congestion of Chittagong Port, the development of a deep sea port in the Chittagong region is a must. The deep sea port is really important to correspond to trend of increasing size of vessels and to facilitate trade with neighboring countries through securing ship water depth of 16m where big container vessel with 8,000TEU can navigate. In this connection, the “Data Collection Survey on the Matarbari Port Development in the People’s Republic of Bangladesh” has identified the suitable location for development of a deep sea port in the in the Matarbari Island. This EIA study for this port project is to understand the environmental aspects due to the project activities as well as to prescribe suitable EMP for its sustainability.

The EIA study has covered the construction and operational phases of the project. The detailed EIA of the proposed port was conducted following the guideline (GoB, 1997) of the Department of Environment (DoE) of GoB and the JICA guidelines.

In this study, the effects of the project activities on physico-chemical, ecological and socio-economic (i.e., human interest related) parameters during preconstruction, construction and operation phases have been assessed. The impacts have been identified, predicted and evaluated, and mitigation measures suggested for preconstruction, construction and operation phases of the proposed project. The important physico-chemical environmental parameters that are likely to be affected by the project activities include air quality and noise level.

The study suggests that most of the adverse impacts on the physico-chemical environment could be offset or minimized if the mitigation measures are adequately implemented. Noise level has been identified as a significant potential impact of the proposed port project during both the construction and operation phases. The project workers should not be exposed to the noise produced by the construction equipment for a prolonged period to prevent permanent hearing loss. A rotational work plan is advised for the workers and operators of this equipment.

The proposed project will be constructed within the acquired land. So a comprehensive land acquisition and resettlement action plan (LARAP) shall be prepared. Additionally, this area is an income generating area considering Salt/Shrimp cultivation. Therefore, people will be displaced and for them resettlement will be required for the construction of the port, and loss of income is associated with the proposed project.

During operation phase, no significant negative impact is anticipated on socioeconomic environmental parameters. Significant positive impacts are expected due to huge no of employment generation associated with the port activities. During public consultations carried out as a part of the EIA study, people welcomed the proposed project at their locality.

RECOMMENDATION

The environmental assessment carried out for the proposed port project suggests medium to minor scale of adverse impacts, which can be reduced to acceptable level through recommended mitigation measures as mentioned in the EMP. It is therefore recommended that the proposed port provided the suggested mitigation measures are adequately implemented. It is also recommended that the environmental monitoring plan be effectively implemented in order to identify any changes in the predicted impacts and take appropriate measures to offset any unexpected adverse effects.

Apart from risks associated with noise generation, solid waste, hazardous waste and wastewater disposal as a result of construction activities, the CPA may have certain degree of risk of accident and sometime loss of life. An emergency response plan (ERP) for the proposed project has been developed listing various actions to be performed in a very short period of time in a predetermined sequence if it is to deal effectively and efficiently with any emergency, major accident or natural disaster.

It will be the obligation of the contractor to submit their Environmental Management Action Plan (EMAP) before commencement of work. The EMAP should specify all affected environmental values, all potential impacts on environmental values, mitigation strategies, relevant monitoring together with appropriate

indicators and performance criteria, reporting requirements and, if an undesirable impact or unforeseen level of impact occurs, the appropriate corrective actions available.

CHAPTER-1 INTRODUCTION

1.1 INTRODUCTION

The Government of Japan and the GoB has initiated the Bay of Bengal Industrial Growth Belt Initiative (BIG-B), and under this initiative, JICA has implemented the “Data Collection Survey on Integrated Development for Southern Chittagong Region” since 2015 which assessed the potentiality of the development of infrastructure, energy and power, industrial and urban development in the region. Through this survey, the need to conduct “Data Collection Survey on the Matarbari Port Development in the People’s Republic of Bangladesh” for the further detailed plan of Matarbari port development has been recognized.

The Government of Bangladesh (GOB) has achieved secure economic growth of 6% (approx.) per annum in the recent years. Thus, export and imports per year have increased by 10% in the past 5 years. At present, Bangladesh has two major ports i.e. Chittagong Port and Mongla Port. Of the two the Chittagong Port handles the vast majority of traffic in the country. It is a river port along the Karnaphuli River. Due to the limited land area of the Chittagong port, it is anticipated to reach its capacity soon. Keeping this projected situation in mind, GoB is giving precedence to port development such as further expansion of the Chittagong Port as well as new port development in the 7th five year plan.

In this study, the Environmental Impact Assessment (EIA) is pursued due to the requirement of the Department of Environment (DOE) to avoid negative impacts of the port development along the coast of the Matarbari Island or other measures.

1.2 BACKGROUND

The economic growth and development of the GOB has been growing steadily over the past years, and was recently labelled as one of the “Next Eleven” countries along with the BRICs. This is mainly attributed to an increase in foreign investment in light manufacturing industries, a shift from China and other South-East Asian countries due to a rise in production costs.

As a result, in Bangladesh, coal is increasingly important as the major source of energy instead of natural gas. In line with this, the Matarbari ultra super coal-fired power is to be constructed in the district of Cox’s Bazar which is to be funded by the Japanese government. With this power plant, Matarbari area will have a deep sea port, coal centre as well. Then, these accumulations will prompt a regional development including that of an energy base, industries and a trade and logistics terminal.



Figure-1.1-1 Proposed Port in the Matarbari Island

1.3 PROJECT CATEGORIZATION

Matarbari Port development activities can result in a large variety of adverse environmental impacts causing damage to natural, physical and ecological resources and to human, economic and quality of life values. To minimize possible adverse impacts and to utilize natural resources properly, as per the existing Environmental Conservation Rules (ECR), 1997 this port development project has categorized as “Category Red” project, requiring preparation of an IEE and EIA, and issuance of a Site Clearance Certificate (SCC), and thereafter an Environmental Clearance Certificate (ECC) by the DoE. Chittagong Port Authority (here in after, CPA) the project proponent needs to obtain an environmental clearance (EC). CPA has already got the approved Terms of Reference (TOR) of EIA from the DOE for carrying out the in detail Environmental Impact Assessment of this project (Appendix-A).

In contrast, JICA categorizes all projects according to the magnitude or scale of their anticipated environmental impact. Projects classified as ‘A’ with significant adverse environmental impacts that are sensitive, diverse and unprecedented. Whereas the project classified as ‘B’ if potential adverse environmental impacts are less adverse than ‘A’ classified projects. The Port project has some pollution potential for physical, physico-chemical, biological and socio-economic environment in and around the project area and the impacts would be major during construction and operation phase of the project if proper implementation of Environmental Management Plan (EMP) is ensured by the project authority. Therefore, in accordance with JICA policy the Port development project will fall in category ‘A’ project and for this type of project Environmental Impact Assessment (EIA) is mandatory. As per JICA Guidelines 2010, CPA is also required to prepare an appropriate assessment report for the JICA’s financing appraisal.

1.4 OBJECTIVE OF THE EIA

Matarbari Port Development Project is now a formulated project after passing through the preparation of policies, plans and necessary programs (Figure 1.3-1). So, port project specific EIA shall be dealt in this study report. An Environmental Impact Assessment (EIA) is a very effective tool, which delineates what needs to be done to make a development activity suitably located and operated in an environment friendly way. It is a formal process to be used to examine the environmental consequences of a proposed project and suggest relevant management actions. Impact assessment is not meant for examining adverse consequence only; it should also look into the plausible positive effects by the project activities and identify ways of enhancing them further by carrying out modifications in the project. EIA process involves study of the plausible changes of the physical, biological and socio-economic environment as the consequence of the proposed project activities, and formulating a suitable Environmental Management Plan (EMP) to minimize or abate adverse effects and to enhance or augment positive effects.

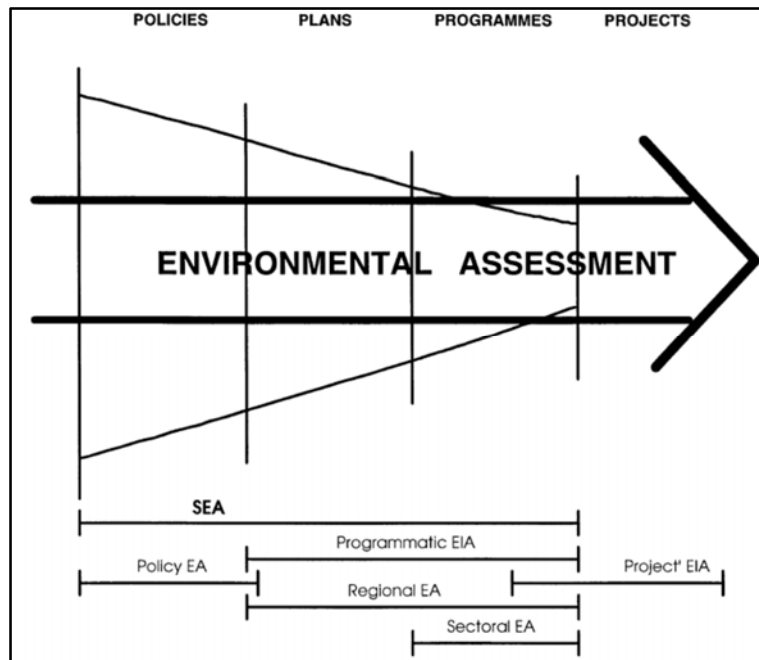


Figure: 1.3-1 EIA in the Project

The objective of an EIA is to understand that potential problems that are foreseen and addressed at an early stage in the project's planning and design. To achieve this, assessment findings are communicated through an EIA report to all the groups who will make decisions about the proposed project, that is, the project developers, their investors, as well as regulating authorities and planners. Design, execution and operation of the project can be planned in light of the findings of EIA, so that the expected benefits can be sustained with minimum and acceptable adverse environmental impacts. Thus essentially, the objective of the EIA is to-

- ❖ Review the proposed site of the port and identify potential environmental impacts to be considered in the planning and design and implementation stage of the project;

- ❖ Identify sources of impacts of the project activities, during construction and operational stages, on the various environmental components and recognizes those which are critical to the changes resulting from the project development or its operation phase;
- ❖ Recommend an Environmental Management Plan (EMP) to avoid or mitigate the adverse environmental impacts and enhance positive contributions of the project;
- ❖ Prepare implementable Environmental Management Plan (EMP) integrating the measures for minimizing the identified impacts with suggested mitigation measures and an appropriate monitoring and supervision mechanism to ensure EMP implementation; and
- ❖ Recommend suitable institutional mechanisms to monitor and supervise effective implementation of the EMP.

1.5 SCOPE OF WORK

The detailed scope of the EIA study is as outlined below:

- Screening of the Project derived from applicable reference framework based on reconnaissance survey and desk based review of Project documents;
- Scoping for the EIA study;
- Identification of the Project components;
- Development of a regulatory, policy and administrative framework relevant to the Project;
- Monitoring, analysis and reporting of the environmental and social baseline data of the study area including consultation with local communities and other stakeholders;
- Assessment of the environmental impacts of the Project in the study area;
- Assessment of social impacts on the local community as well as project affected people if any and any other stakeholders, which have been identified during the social consultation process;
- Risk assessment and consequence analysis of the Project;
- Formulation of an Environment Management Plan and associated/specific mitigation plans for identified impacts; and
- Formulation of Stakeholder Consultation and Grievance Redress Mechanism for the Project.

1.6 APPROACH AND METHODOLOGY

At the first step, project screening and scoping exercise was undertaken to identify the parameters needed to be considered for the study and to outline the activities for collecting data on each parameter. Data pertaining to all facets of the environment and social viz. physical, ecological and socioeconomic environment were collected from the study area through both primary and secondary sources.

The stepwise activities are detailed in the following subsections:

1.6.1 Preliminary Discussions

- Discuss with JICA Study team to understand the proposed project, current status of the Project Study, Project milestones, legal requirements and scope; and
- Collation of relevant project documents such as the Inception report of the body project (JICA Data Collection Survey on the Matarbari Port Development), Final report of Data Collection Survey on Integrated Development for Southern Chittagong Region, Strategic Environmental Impact Assessment (SEA) report, relevant port related EIA study reports etc.

1.6.2 Screening and Scoping Exercise

- Desk based review of the relevant documents and available imagery of the project site and its surroundings;
- Reconnaissance survey of the site, surrounding areas, approach road and preliminary discussions with locals, stakeholders;
- Meetings and discussions with Key Informants i.e. Department of Forest (DOF), Department of Environment (DOE), Department of Fisheries (DOF), Chittagong Port Authority (CPA), Local Administrations etc. to understand sensitivities and regulatory requirements associated with the proposed project;
- The outcome of the screening was then used to identify the study area, key data to be collected and the categorization of the project; and
- A preliminary stakeholder mapping exercise was also undertaken to identify key stakeholders from the Government, relevant Governmental Agencies, Non-Governmental Organizations (NGOs) as well as the community at the local, regional and national level. This information has used for consultation during different stages of the project.

Categorization

Categorization of the Project was completed based on the screening assessment, reconnaissance survey, environmental and social sensitivities, limited consultation and the DOE categorization; JICA categorization criteria based on environmental assessment (EA) checklists.

This project is a “Category Red” project, requiring preparation of an IEE and EIA, and issuance of a Site Clearance Certificate (SCC), and thereafter an Environmental Clearance Certificate by the DoE. In accordance with the JICA policy the port project is in category ‘A’ project and for this type of project Environmental Impact Assessment (EIA) is mandatory.

Scoping

The categorization with respect to JICA classifications was further used as a basis for defining scope for the impact assessment, planning and implementation of mitigation, monitoring and reporting mechanisms for the project to meet potential lender’s requirements as well as those of the GOB.

1.6.3 Baseline Data Collection

- The baseline data collection, monitoring and analysis for environmental parameters are dynamic process. The major baseline data collection has been completed from secondary sources;
- Secondary data was also collected from different government departments, local bodies and through literature surveys etc.
- In depth primary data collection particularly focused on the monitoring of Air Quality, Noise, Soil, Sedimentation, flora & fauna, sediment survey for benthos etc. has been planned and some of them has already monitored as environmental baseline information and in particular the Socio-economic baseline survey has been conducted for getting the primary socioeconomic baseline data of the project; and
- All the gathered data has been compiled and compared with applicable standards where relevant, and presented in **Chapter-5** of this report.

1.6.4 Stakeholder Consultation

- Extensive consultation was conducted with key stakeholders' including the local population, government departments/agencies, fishermen, and NGOs;
- A Stakeholder consultation was completed with the intent of collecting baseline information on the environmental and social conditions and sensitivities, developing a better understanding of the potential impacts, informing the public of the proposed project and to gain an understanding of the perspectives/concerns of the stakeholders;
- As per the TOR an initial Stakeholder Meeting (SHM) of the project has been conducted on 27th January 2018 to disseminate the project message to the stakeholders. A final stakeholder meeting shall be conducted after completing the Draft EIA of the project.
- A summary of the stakeholder engagement process and the profile of the groups and their opinions forms a part of the Information Disclosure, Consultation and Participation Chapter of this report (Chapter 6); and
- Information gathered was used for formulating mitigation measures.

1.6.5 Impact Assessment and Mitigation Measures

- Analysis of the baseline results and the incremental impacts of the project were assessed in accordance with the Bangladesh national guidelines for air, water and noise emissions; standards stipulated in the Environment Conservation Rules (ECR), 1997 and amendments thereof and with reference to the JICA guidelines;
- The impact assessment involved the prediction and evaluation of impacts from the project in different phases, including site preparation, construction and operation phase and included consideration of mitigation measures towards the same;
- Impact prediction covered residual impacts (impacts remaining after all possible mitigation has been incorporated) and took into account control measures that are part of the project design (e.g. acoustic enclosures for major equipment). Additional measures aimed at further avoiding, minimizing and compensation were proposed where necessary or appropriate; and
- Impacts have been further classified as insignificant, minor, moderate or major based on the criteria for rating of impacts.

1.6.6 Analysis of Alternatives

Analysis of alternative four options was considered to minimize impacts of the project while undertaking the EIA study. The alternative options assessment in the study will be ranged from technology, project site and operations, including the no project alternative. Alternatives are considered in terms of their potential environmental impacts, the feasibility of mitigating these impacts alternatives for mitigation measures for high residual impact/risk, if any etc.

1.6.7 Management Plans and Grievance Redress Mechanism

- Environmental Management Plan (EMP) is under preparation for addressing the mitigation measures suggested and included defined roles and responsibilities for implementation;
- A grievance redress mechanism is to be developed to address any complaints and concerns from all stakeholders;
- Based on the risk assessment, risk reduction measures and recommendations for a disaster management plan (DMP) is to be developed; and

- Institutional review and finalization of the EMP and grievance redress mechanisms.

1.6.8 Information/Data Sources

Key relevant information sources have been summarized in Table 1.6-1.

Table 1.6-1 Key Data Sources

Parameters	Information sources	Remarks
Project Background, Technical details on project and associated components	<ul style="list-style-type: none"> • JICA Study Team 	JICA Study Team has provided information required during the course of the study
Study area features and sensitivities	<ul style="list-style-type: none"> • Ground physical Survey • Satellite imageries • National web portal of Bangladesh: www.bangladesh.gov.bd 	Details of the satellite data used is included in Baseline Chapter
Legal framework	<ul style="list-style-type: none"> • JICA Guidelines • Department of Environment • Department of Forest • Department of Fisheries 	In discussion with the DOE, DOF and local Govt. departments etc.
Land use /Land cover	<ul style="list-style-type: none"> • Ground Physical Survey • GIS based land-use analysis 	Details of the satellite data used is included in Baseline chapter
Details, Meteorology and climatic conditions	<ul style="list-style-type: none"> • Bangladesh Meteorological department • Observatory Surface Meteorological Data 	
Geology, Topography, Hydrology and drainage	<ul style="list-style-type: none"> • Location Map of JICA Study team • Bangladesh water development board • Web portal of National Encyclopedia of Bangladesh (Banglapedia) 	In association with field Observations
Natural hazards	<ul style="list-style-type: none"> • Web portal of National Encyclopedia of Bangladesh (Banglapedia) • Bangladesh Meteorological Department 	Included in consultation with locals
Environmental baseline as Air quality, water quality, soil and sediment quality	<ul style="list-style-type: none"> • Secondary data sources • Applicable Standards from DOE, Bangladesh 	Different project study reports in and around the proposed project area.
Ecological parameters	<ul style="list-style-type: none"> • Secondary data collection, observations, surveys and local consultations • Department of Environment • Department of Forest 	Different study report of the proposed project area. Endangered, critical status was

Parameters	Information sources	Remarks
	<ul style="list-style-type: none">• Websites of birdlife international• IUCN Data base	checked from the website www.iucnredlist.org
Social-economic parameters	<ul style="list-style-type: none">• Primary data collection surveys, extensive consultations, meetings and discussions held with stakeholders• Bangladesh population Census for 2011 for Cox's Bazar District• Fisheries Census data• Land Regulation Policy, Bangladesh• Land Acquisition and Compensation data for the project site• OPD data from local Healthcare Department• Website of Department of Social Services• Web portal of National Encyclopedia of Bangladesh (Banglapedia)	Details provided in baseline environmental and social conditions chapter.

1.7 CONTENT OF SEA REPORT

The content of the EIA has been largely structured based on the Scope of work of TOR. The layout of the Report is as follows:

- Chapter 1 Introduction
- Chapter 2 Description of the Project
- Chapter 3 Legal and Legislative Framework
- Chapter 4 Study of Alternative Options
- Chapter 5 Environmental and Social Baseline
- Chapter 6 Stakeholder Engagement
- Chapter 7 Scoping and tor for the survey on natural and social environment
- Chapter 8 Results of the survey on natural environment
- Chapter 9 Environmental and social impact evaluation
- Chapter 10 Environmental and social management plan
- Chapter 11 Monitoring plan
- Chapter 12 Occupational health and safety plan
- Chapter 13 Emergency response/management plan
- Chapter 14 Grievance Redress Mechanism
- Chapter 15 Conclusions and Recommendations

CHAPTER-2 DESCRIPTION OF THE PROJECT

2.1 GENERAL

Based on the industrial policy 2015 and 7th five years plan, Bangladesh Economic Zones Authority (BEZA) is planning to establish 47 Economic Zones (EZ) all over Bangladesh in addition to the existing 8EZs. With this situation in mind, the GoB is prioritizing port development such as further expansion of Chittagong Port as well as new port development in the 7th five year plan. It also mentions the development of a new port in the Payra and Matarbari areas. From a broader perspective, Matarbari area plays an important role in “The BIG-B Initiative” supported by Japan. The BIG-B initiative is intended to establish an economic corridor from Dhaka to Cox’s Bazar via Chittagong through industrial growth and development.

2.1.1 Project Category

As per the criteria of DOE, the Port project falls under the Red Category and the same requires Environmental Impact Assessment (EIA). Though the project has some environmental impact but of lesser degree as will be revealed from the successive chapters. It is to be mentioned here that as per JICA guideline the proposed project falls under Category-A.

2.1.2 Project Justification

Matarbari area is expected to play the leading role in the realization of the BIG-B initiative. To be more precise, this development will lead to an increase in export industries and hence reduce the trade deficit due to the importation of coal and oil as a source of energy. Furthermore these developments will also lead to short and long term regional economic stability.

2.2 PROJECT LOCATION

The port development will be in the Hamidkhali, Bonjamari Ghuna and Nasir Mohammad Dail villages of Dhalghata Mouza under Ward#03 and Ward# 01 of Dhalghata Union with 70.5Ha of land (Blue Marked Area in the Red Circle of Figure-2.2-1). In the first phase of the project the port terminal area shall be a target of utilizing 35.5 Ha of land and for the route purpose 35 Ha. Detailed location of the project area is shown in the Table-2.2-1.

Table-2.2-1: Project Location Table

District	Name of Affected Thana	Name of Affected Union	Name of Affected Villages
Cox’s Bazar	Moheshkhali	Dhalghata	Bonjamira Ghuna Nasir Mohammad Dail Hamidkhali

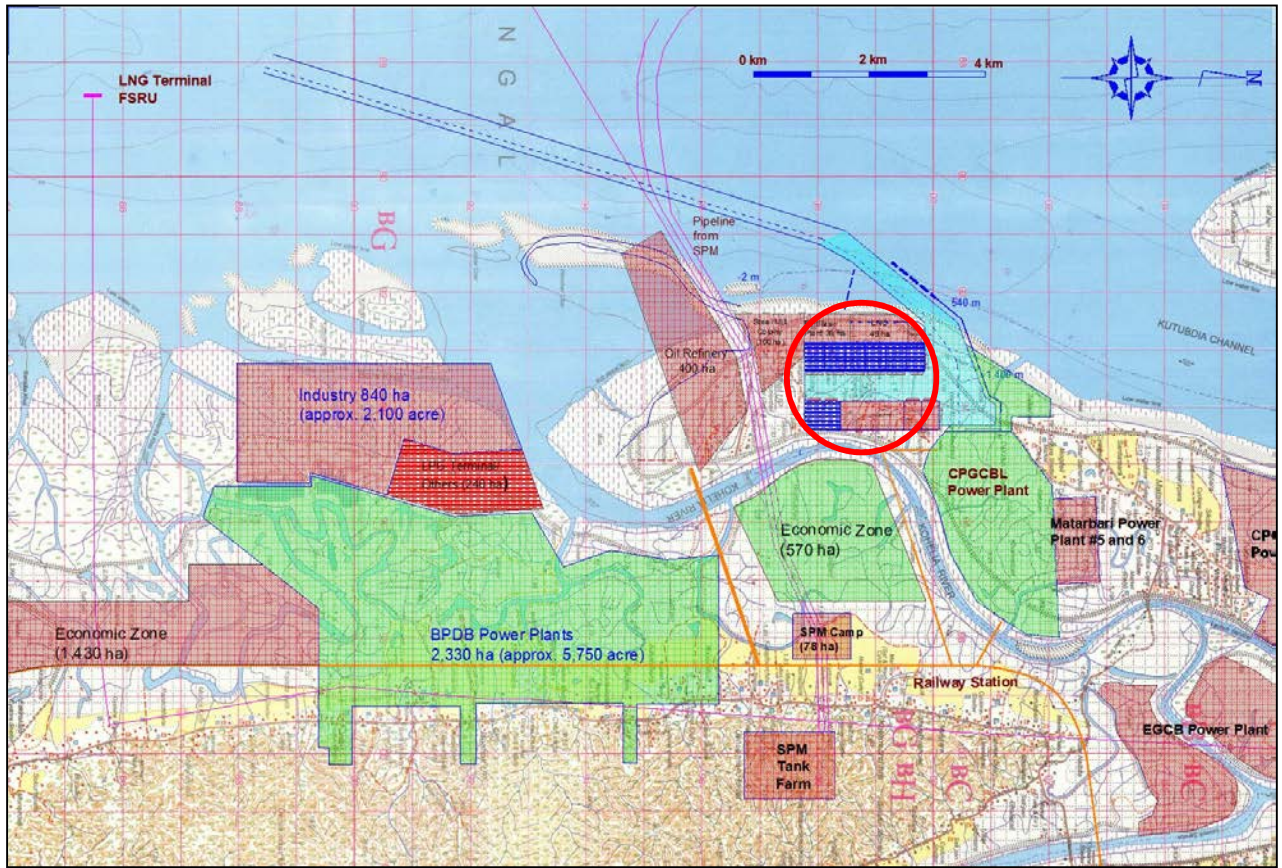


Figure-2.2-1 Project Area in the Moheshkhali Island



Figure-2.2-2 Proposed Matarbari Port Area in Satellite Image

2.3 COMPONENTS OF THE PROJECT

The components of the port project are:

- Construction of Multi-purpose terminal (17ha, quay length 300m) and container terminal (18ha, quay length 480m);
- Procurement of Cargo handling Equipment (3 Quay Crane);
- Procurement of relevant facility and equipment (tug boat, pilot boat, lighthouse etc...)
- Consulting services (F/S review, DD, TA, CS, assistance to environmental and social safeguard, technical transfer)

2.4 ACCESS ROAD TO CHITTAGONG-COX'S BAZAR HIGHWAY

Securing the good accessibility from port to inland area is indispensable for full operation of this commercial Port. Therefore, an access road from the proposed Matarbari Port to Chittagong-Cox's Bazar Highway is planning at the same time. About 25km length with 90m width of access road has been finally selected by the JICA study team. Figure-2.4-1 has shown the study routes of the access road of port.

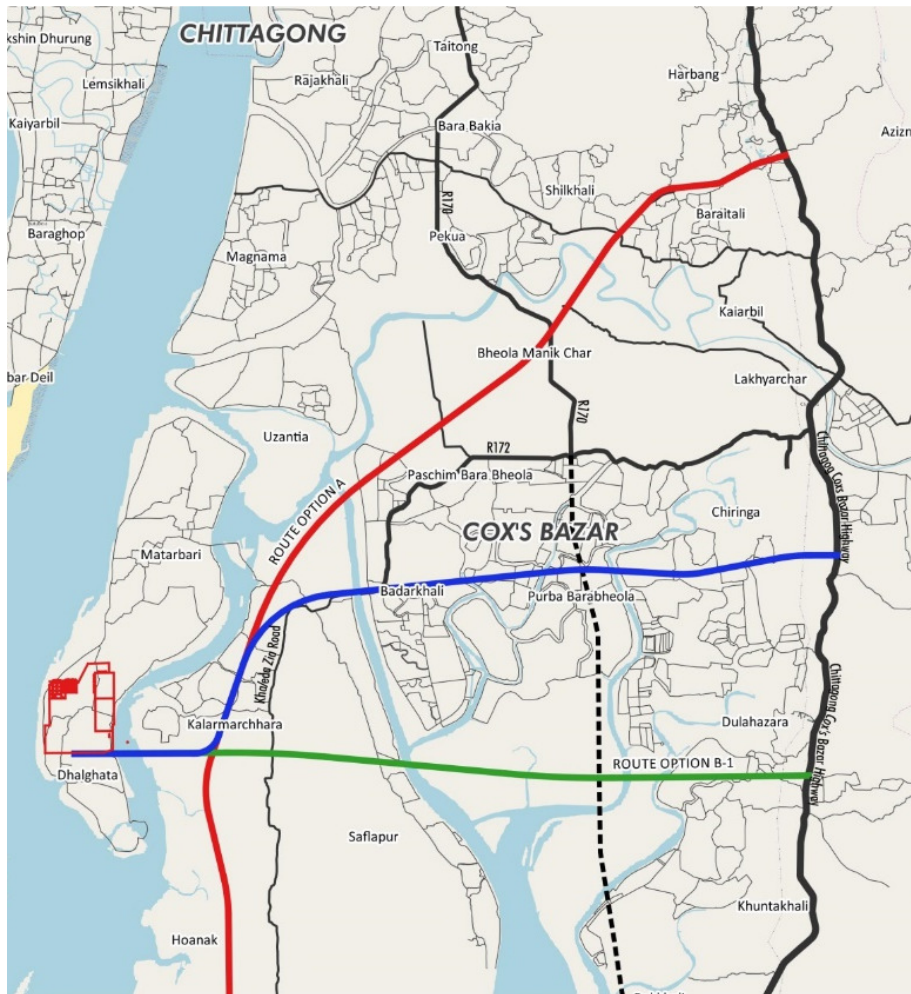


Figure-2.4-1 Access Road Study Options of the Port Project

2.5 BASIC DATA

Basic data of the project are furnished in Table-2.5.1.

Table-2.5-1: Basic Data of the Project

1.	Name of the Project	Matarbari Port Development Project	
2.	Executing Agency	Chittagong Port Authority	
3.	Project Location	Union: Dhalghata, Upazila: Moheshkhali, District: Cox's Bazar	
4.	Port Area	70.5 Hectares	
5.	Draft	-16m	
6	Physical Work	a) Survey	- Port Area survey - Soil Survey - IEE/EIA and LARAP
		b) Multi-Purpose Terminal	Berth 300m, Terminal 17ha Vessel: Max 70,000 DWT Cargo: 2.25 mil. tons/year
		c) Container Terminal	Berth 460m, Terminal 18ha Vessel: Max 8,000 TEU Cargo: 0.6~1.1 mil. TEUs/year Future Expansion: Berth 1,850m, Terminal 18ha Vessel: Max 8,000 TEU Cargo: 1.4~4.2 mil. TEUs/year
		d) Sea Channel	Depth 14.5m, Width 350m Dredging: 11 mil.m3 North Breakwater: 790m / 1,850m (CFPP Pj) South Breakwater:700m Future Expansion: Depth 14.5m Extension for new berth Dredging 20 mil.m3
7	Land Requirement	a) Acquisition	70.5 Hectares In the First phase: (a) Utilizing 35.5 Ha of land and (b) Route purpose 35 Ha.
8	Project cost	799,766,000.00USD	
9	Project Implementation Period	December 2018 to March 2024	
10	Operation	Partial Operation would be July 2022	

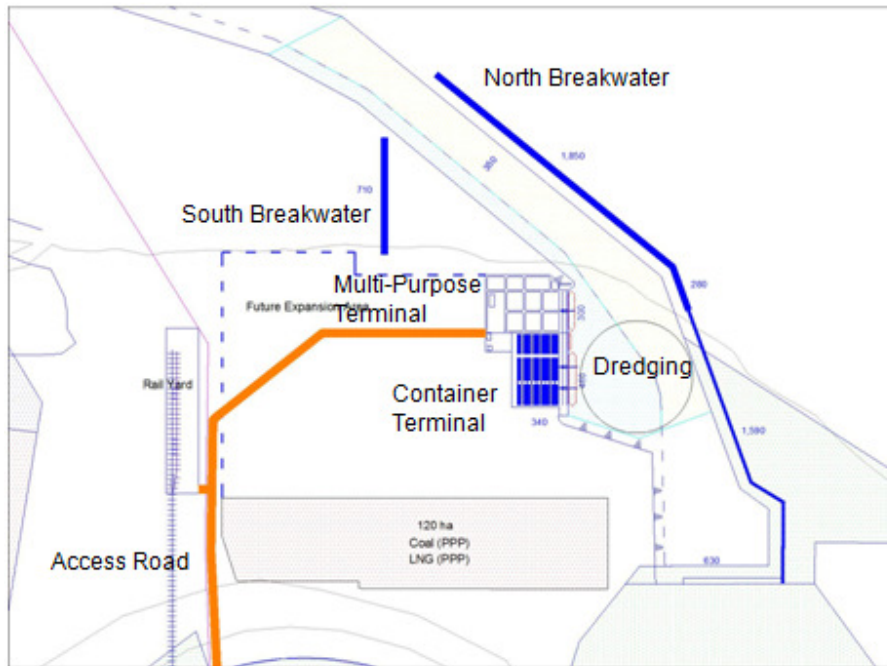


Figure-2.5-1 Project Layout (Scope of the Project)

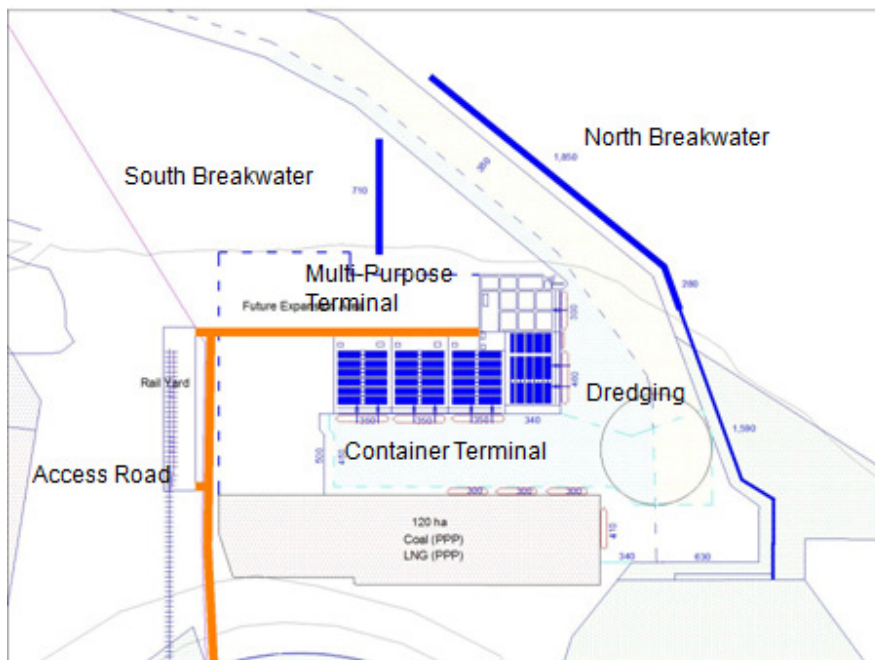


Figure-2.5-2 Future Expansion Plan

2.6 WORK SCHEDULE

The detail design of the project will start from December 2018 and the construction work will be completed in march 2024. CPA will start the partial operation of the port in July 2022. All over Schedule for the Port Development project would be:

- JICA Preparatory Survey: Nov 2017 to Sept 2018
 - ✓ Natural Condition
 - ✓ Preliminary Engineering Study
 - ✓ Preliminary Design & Cost Estimation
 - ✓ Construction Planning
 - ✓ Social & Natural Environmental Considerations
- Detailed Design: Dec 2018 to Sep 2019 (10 months)
- Tendering: Oct 2019 to Sep 2020 (12 months)
- Construction: Oct 2020 to Mar 2024 (36-42 months)
- Partial Operation July 2022

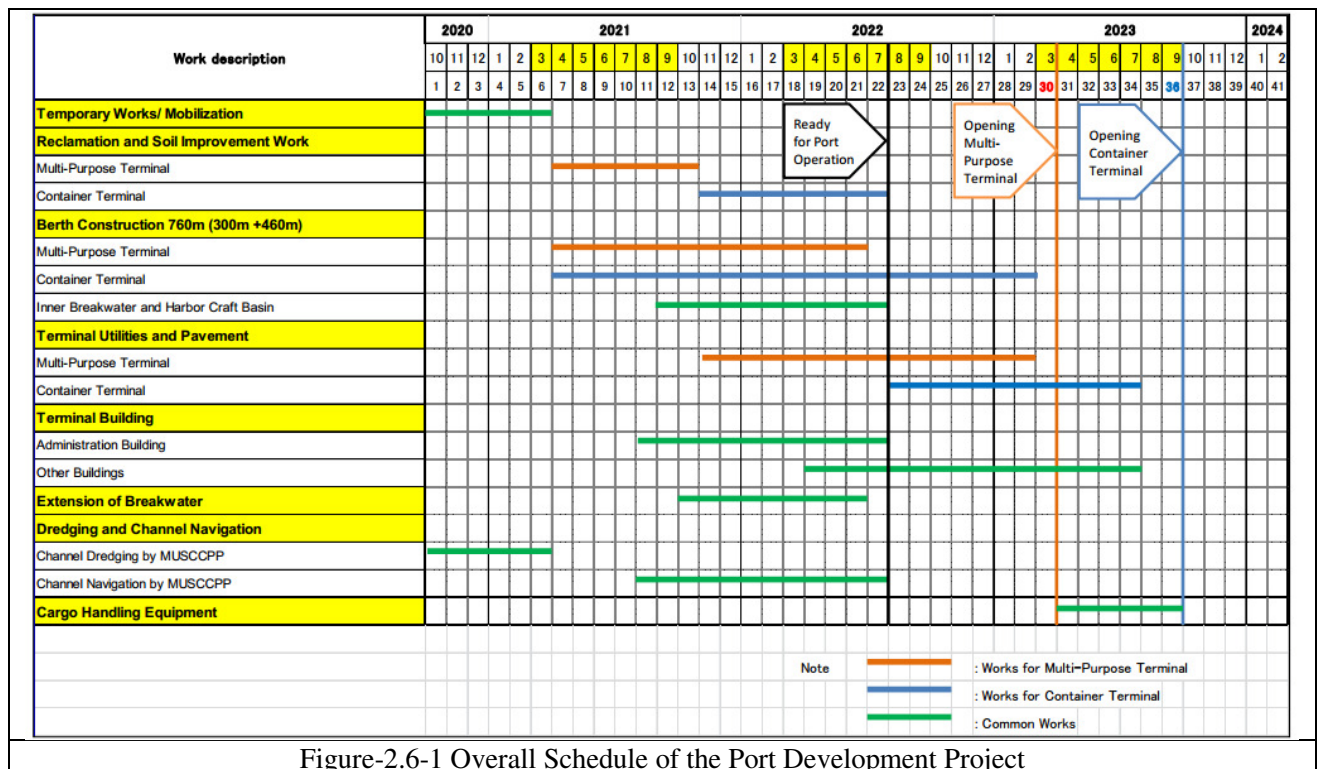


Figure-2.6-1 Overall Schedule of the Port Development Project

2.7 ESTIMATED PROJECT COST

The project cost would be 799,766,000.00 USD. This estimated cost is estimated without including the contingency and price escalation. The detail cost breakdown is listed in Table 2.7-1.

Table 2.7-1 Project Cost estimate of the Port development Project

Work Description	Unit	Quantity	USD (1,000)
Land Acquisition and Resettlement	L.s.	1	25,089
Mobilization/Demobilization and Temporary Works	L.s	1	50,000
Reclamation Works	m3	2,900,000	31,900
Berth Construction	m	760	127,484
Soil Improvement Works	m2	320,000	27,200
Terminal Utilities	L.s	1	13,000
Terminal Pavement Works	m2	360,200	57,070
Seawall Works	m	1,100	55,000
Terminal Buildings	L.s	1	12,000
Cargo Handling Equipment	L.s	1	98,027
Breakwaters	m	397	131,963
Dredging and Disposal	m3	11,396,000	148,148
Sub-Total			776,881
Consultancy Services	%	3.1	22,885
Grand-Total without VAT			799,766

CHAPTER-3 LEGAL AND LEGISLATIVE FRAMEWORK

3.1 INTRODUCTION

To address the environmental and social risks of any proposed Project and its associated components; any protect and conserve the environment from any adverse impacts, the GoB has specified regulations, policy and guidelines. Potential lenders' also have their own set of requirements (such as the JICA Guidelines for Environmental and Social Considerations (2010)) to which any project funded by them must operate.

This document focuses on policy, regulations and the administrative framework under the purview of which the proposed project will fall and this EIA study will be governed, namely:

- ✓ Bangladesh national and local, legal and institutional framework;
- ✓ JICA Guidelines for Environmental and Social Consideration Guideline

The following sections review the relevant National legislative, regulatory and policy requirements along with some international ones. In addition to review of these policies, the gaps between National Laws and JICA Guidelines for Environmental and Social Considerations (April 2010) has been addressed.

3.2 ENVIRONMENTAL AGENCIES

3.2.1 Ministry of Environment and Forest

The Ministry of Environment and Forest (MoEF) is the key government institution in Bangladesh for matters relating to national environmental policy and regulatory issues. Realizing the ever-increasing importance of environmental issues, the MoEF was created in 1989 and is presently a permanent member of the executive committee of the National Economic Council (NEC). This group is the major decision-making body for economic policy and is also responsible for approving public investment projects. The MoEF oversees the activities of the following agencies:

- Department of Environment (DoE);
- Department of Forest (DoFo);
- Forest Industries Development Corporation (FIDC);
- Bangladesh Forest Research Institute (BFRI) and Institute of Forestry (IoF);
- Forestry division of the Bangladesh Agricultural Research Council (BARC); and
- National Herbarium.

Of the above agencies a precise description of the first two departments including other pertinent ones are presented below as considered relevant.

3.2.2 Department of Environment

The Department of Environment (DoE), established in 1989 under the jurisdiction of the MoEF, is the executing agency for planning and implementing environmental issues including, but not limited to, the following activities:

- Reviewing environmental impact assessments and issuing environmental clearance where appropriate;

- Implementing environmental monitoring programs and enforcement measures;
- Developing and maintaining environmental data bases; and
- Coordinating international events with the MoEF (e.g., representing Bangladesh in international seminars, workshops, etc.).

The DoE is headed by a Director General (DG) who is supported by a team of directors, deputy directors, assistant directors, engineers, and other technical staff (e.g., chemists and laboratory technicians). The DoE has regional offices, monitoring stations and several laboratories. Figure-3.3-1 shows the organizational set-up of DoE.

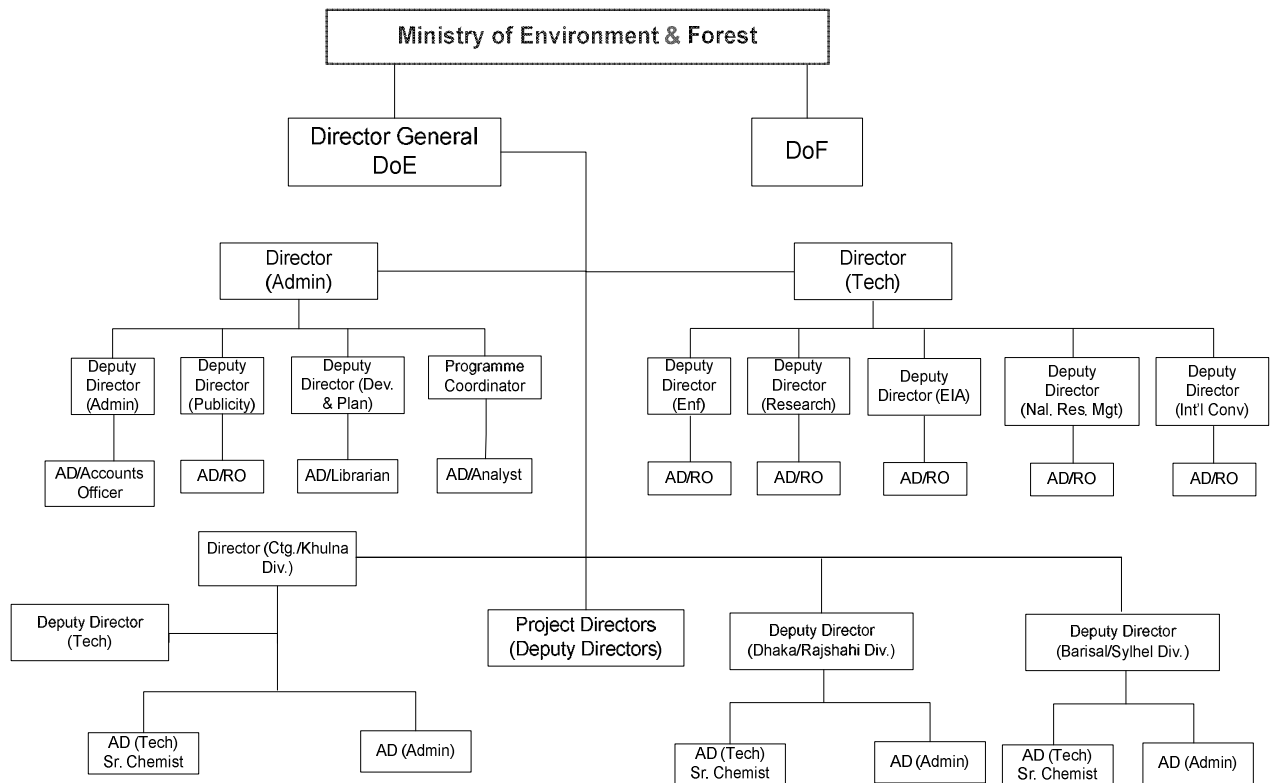
3.2.3 Department of Forest

The Department of Forest (DoFo), under the MoEF, is responsible for protection and management of the reserve forests in the country. The department manpower extends down to union levels in areas where reserve forest exists. Officers of the DoF are responsible for protection of wildlife in these forest areas.

3.2.4 Ministry of Land - Land Reform and Land Acquisition Directorate

The Ministry of Land (MoL) manages revenue generation for government-owned land (called khas), excluding agency-owned lands controlled by the BWDB, roads and highways, etc. The MoL controls open water bodies (rivers, beels, haors) above a specified size, except for those that were transferred to the Ministry of Fisheries (MoF) and livestock under the new fisheries management policy.

The MoL approves the process where the government acquires private land with regard to private development program.



Source: MOEF AD: Asstt. Director, RO: Research Officer

Figure-3.2-1 Organizational Setup of DOE

3.3 RELEVANT NATIONAL POLICIES AND LEGISLATION

The GoB has developed a policy framework that requires environmental issues to be incorporated into economic development planning. The key tenets of the various applicable policies are detailed in the following subsections.

3.3.1 National Conservation Strategy (NCS) 1992

In 1987, the National Conservation Strategy (NCS) was formulated by the Bangladesh Agricultural Research Council in cooperation with the IUCN. The NCS was drafted in late 1991 and submitted to the government in early 1992. It aims to:

- assess the usage patterns of natural resources and the future needs and possibilities of major development activities in order to set a feasible and sustainable strategy to conserve limited natural resources; and
- reconcile development and the environment in order to ensure the sustainable use of resources, species and ecosystems in the future. In particular, it underlines the importance of ecosystems in coastal areas, hilly forests and the Sundarban wetland.

3.3.2 National Environmental Management Action Plan (NEMAP) 1995

The NEMAP 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 for a period from 1995 to 2005 and sets out the framework within which the recommendations of the NCS 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; and
- Improvement in the quality of life of the people.

To attain the above mentioned objectives, the plan groups all the relevant necessary actions under four headings, namely: institutional, sectoral, location-specific and long-term issues.

The institutional aspects reflect the need of inter sectoral cooperation to tackle environmental problems which need new and appropriate institutional mechanisms at national and local levels. The sectoral action reflects the way the ministries and agencies are organized and makes it easier to identify the agency to carry out the recommended actions. The location-specific action focuses particularly on acute environmental problems at local levels that need to be addressed on a priority basis. The long-term actions include environmental degradation to such degree that might become even more serious and threatening, if cognizance is not taken immediately.

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

3.3.3 Seventh Five-Year Plan (2016-2020)

This is the last five-year plan of the country. The PSMP 2010 includes coal-fired power plant projects (both domestic and imported) totalling around 20,000 MW. Given the present status of domestic coal, the implementation of these projects will require imported coal for fuel. The total coal requirement would be approximately 60 million ton per year. Handling this massive volume of coal import will require huge port, rail transport and coal stocking infrastructure. However, so far there is only one on-going deep-sea port project in Matarbari island which will be able to cater ships having 80,000 tonnes capacity. This is currently dedicated for Matarbari Ultra Super Critical Coal-fired Power Plant, one of the six national high prioritized projects under Prime Minister’s direct supervision. In the near future, however, the Government intends to expand this deep-sea port and develop a coal Centre as “An Energy Hub” for the whole country. The coal Centre will be carried out through PPP (Public Private Partnership) scheme.

The development of port facilities for coal imports will be given top priority in order to support the power generation plan. The 1200 MW Matarbari Ultra Super Critical Coal-fired Power Plant project funded by Government of Japan contains the important component: the deep sea port for the coal import, which will

provide the opportunity for generation companies planning to develop the coal-fired power plants to procure the international coal in relatively cheaper price compare to the individual purchased coal from foreign countries. JICA is also examining the possibility to set up the large coal transshipment terminal at the Matarbari port to cater the demand of nearly 3,500MW of power generation by 2020. The Matarbari deep sea port and the associated transshipment terminal are critically linked to the Government's successful implementation of the power generation plan and would have the highest priority in the public investment Programme for transport infrastructure during the Seventh Plan.

The present Seventh Plan's articulation of a sustainable development strategy involves a large array of actions under three key themes: (i) Climate Change Management and Resilience (comprised of adaptation and mitigation) (ii) Environmental Management; and (iii) Disaster Management. These actions are aligned with the overall framework and strategies of National Sustainable Development Strategy (NSDS), and are broadly consistent with the scope of the post-2015 Sustainable Development Goals (SDGs). Some of the objectives and activities that were considered under the Sixth Plan but were not addressed or implemented have also found consideration under Seventh Plan, provided they have an instrumental role in aiding the key objectives of the Plan. This chapter is focused on Climate Change Management and Resilience and Environmental Management mostly. The detail of Disaster Management is discussed in Chapter 14 of Part 2 as the Ministry of Disaster Management and Relief is within the purview of Social Welfare and Security sector.

SEA in the 7th Five Year Plan (FY2016 – FY2020)

Sector 8: Environment and Climate Change

Chapter 8-Sustainable Development: Environment and Climate Change (Page(s)-485-486)

8.6 Internal Environment Management

Activities proposed under 7th Five Year Plan for Environment Management

Issue 3: Strengthening EIA system as environment management tool

Under ECA '95, EIA has been accepted as a mandatory tool to identify and predict impacts and undertake proper mitigation measures in a project scale. There is another concern that, most of the developing Ministries and agencies escape the process. There is also a need for introducing strategic EIA as a planning tool for sectoral level planning.

Programme:

- Strengthening the EIA processing & implementation through institutional capacity building.
- Issuance of location clearance after approval of EIA report for Red category projects.
- No land development activity to take place prior to environment clearance.
- Gazetting and publicizing EIA guidance manual & sectoral EIA guideline prepared.
- Enlistment of competent EIA consulting firms by the DoE for conducting EIA.
- Immediate framing of detailed rules on EIA as mandated in section 12 of BECA
- Strategic EIA/SEA for all sectoral planning including for exclusive economic zones.
- Achieving compliance to EIA practices by all development Ministries & agencies.

- Public consultation on EIA report of Red category projects

3.3.4 National Forest Policy (NFP) (1994)

The NFP of 1994 is the amended and revised version of the NFP of 1977 in the light of the National Forestry Master Plan (NFMP). The major target of the policy is to conserve the existing forest areas and bring about 20% of the country's land area under the forestation program and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of governmental-NGOs and active participation of the people.

Amendments of the existing laws (acts, rules and regulations) relating to the forestry sector and creation of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The forestry policy also recognizes the importance of fulfilling the responsibilities and commitments under International Conventions, Treaties and Protocols (ICTPs).

3.3.5 The Bangladesh Forestry Act 1927

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

Other Forest Acts

The supplementary rules of 1959 empower the concerned governmental bodies to restrict totally and for a specified period, the shooting, hunting or catching of various birds, animals and reptiles in the controlled and vested forests. The private forest ordinance of 1959 provides for the conservation of private forests and for the forestation, in certain cases, of wastelands in Bangladesh.

3.3.6 National Industrial Policy (1999)

The National Industrial Policy (NIP) of 1999 aims to ensure a high rate of investment by the public and private sectors, a strong productive sector, direct foreign investment, development of labour intensive industries, introduction of new appropriate technology, women's participation, development of small and cottage industries, entrepreneurship development, high growth of export, infrastructure development and environmentally sound industrial development.

World Trade Organization (WTO) guidelines were proposed to be followed in the NIP. Guidelines for mitigating eventual conflicts of intellectual property rights are absent in the policy document. No specific guidelines are given for sustainable extraction and utilization of raw materials for different industries.

One of the 17 objectives of the policy (Section 2.12; Chapter II) is "To ensure a process of industrialization which is environmentally sound and consistent with the resource endowment of the country". However, none of the 24 strategies of the policy relate to the environment.

This Project under consideration fulfils entirely the requirements and objectives of this policy.

3.3.7 National Water Policy (1999)

The National Water Policy (NWP) of 1999 was passed to ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply

and sanitation and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

The NWP, however, fails to address issues like consequences of trans-boundary water disputes and watershed management.

3.3.8 National Tourism Policy (1992)

One of the aims of the National Tourism Policy (NTP) of 1992 is “Development of tourism resources of the country and their maintenance”. Two special sections of the policy focus on ‘archaeological and historical sites’ and ‘conservation of wildlife’.

3.3.9 National Energy Policy (1995)

The National Energy Policy (NEP) of 1995 provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy sources and environmentally sound sustainable energy development programs. The NEP highlights the importance of protecting the environment by requiring an EIA for any new energy development project and introducing economically viable and environmentally friendly technology.

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

Seven specific policy recommendations are listed under Chapter 1.9. Of those, the following three are relevant to the present Project:

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

3.3.10 Bangladesh National Environmental Policy (1992)

Bangladesh National Environmental Policy (BNEP) of 1992 sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. The BNEP provides the broader framework of sustainable development in the country. It also states that all major undertakings, which will have a bearing on the environment, (including setting up of an industrial establishment) must undertake an IEE / EIA before they initiate the Project.

The BNEP delineates the DoE, as the approving agency for all such IEE / EIA's to be undertaken in the country.

Policies of fifteen sectors are described in the BNEP. Under the energy and fuel sector, the use of fuel that has the least environmental impact is encouraged in Section 3.4.1. conservation of fossil fuel is stressed in Section 3.4.5 and the need for conducting EIA's before implementation of projects for fuel and mineral resources is stressed in Section 3.4.6.

Under the Environmental Action Plan (EAP) Section of the BNEP and sub-section ‘Fuel and Energy’, it is suggested that:

- The use of gas, coal, kerosene and petrol as fuel will be expanded in the rural areas, so that fuel wood, agricultural residues, and cow dung is conserved. This will help the use of agricultural residues, and cow dung etc. as manure; and
- Appropriate measures will be taken to ensure that extraction; distribution and use of natural resources such as oil, gas, coal, peat etc. do not adversely affect air, water, land, the hydrological balance and the ecosystem.

Section 3.7 "Forest, Wildlife and Biodiversity" requires:

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

3.3.11 Bangladesh National Environmental Policy (2017) (Upcoming)

National Environmental Policy-2017 has been placed to the Honourable Prime Minister for Approval. This policy has stated the following points regarding the SEA.

- All the fields required confirmation of the execution of Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA)
- Environmental Policy
 - o Land Resources Management
 - Ecosystem and Regional-Ecosystem based land zoning have to be planned and Regional-Ecosystem based SEA execution should be ensured.
 - o Organizational Set-up
 - Relevant all ministries and offices shall formulate SEA on their sectoral policy, plan and program.
 - o National Environment Policy Compliance
 - Accommodation, Housing and Urbanization
 - EIA and SEA should be carried out before formulation of all National Regional Projects and Master Plan proposed for housing and urbanization
 - For the separation of residential, commercial and industrial areas, the zoning should be made through SEA. Preparation and implementation of environmentally-friendly and regional urban planning.
 - In order to set up industrial establishments in a planned manner, SEA guided land zoning would be required for building the subject based industrial Area. Restricted establishment of industrial factories in residential areas and Transfer existing industrial factories of the residential areas to the scheduled areas.

3.3.12 Bangladesh Wildlife Preservation Act (1973; Amended in 1974)

The Bangladesh Wildlife Preservation Act (BWPA) of 1973 provides for the preservation, conservation and management of wildlife in Bangladesh. The earlier laws on wildlife preservation, namely, the elephant preservation act of 1879, the wild bird and animals protection act of 1912, and the rhinoceros preservation act of 1932 have been repealed and their provisions have been suitably incorporated in the BWPA.

The BWPA encompasses a range of different activities including hunting and fishing although the provisions of greatest significance relate to the establishment of national parks, wildlife sanctuaries and game reserves by the MoEF. Such designations have enormous significance for the types of developments that may take place.

This legislation does not provide scope for creation of a strong organization, which can adopt appropriate measures to protect wildlife. The importance of wildlife could have been highlighted in the legislation, which it does not do. Punitive provisions are not readily usable. The types of endangered and ecologically valuable animals/birds could have been highlighted in the legislation. It should have asked for active participation and specific action from local administration to protect wildlife. It also does not prescribe seasons when certain animal/birds cannot be hunted or captured.

An executive order issued in June 1998, in relation to the Bangladesh Wildlife Preservation Order (BWPO) of 1973 has imposed a ban for the next five years on hunting of any form of wildlife.

3.3.13 Environmental Conservation Act (1995, Amended in 2000, 2002 and as amended till October 5, 2010)

The Bangladesh Environment Conservation Act (ECA) of 1995 is currently the main legislation in relation to environment protection in Bangladesh. The ECA is promulgated for environment conservation, environmental standards development and environment pollution control and abatement. It has repealed the environment pollution control ordinance of 1977.

The main objectives of ECA are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main strategies of the ECA can be summarized as:

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

Before any new project can go ahead, as stipulated under the rules, the project promoter must obtain environmental clearance from the DG. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 3 years imprisonment or a maximum fine of Tk. 300,000 or both. The DoE executes the ECA under the leadership of the DG.

The amendments (2000, 2002 and as amended till October 5, 2010) of the ECA focus on:

- Ascertaining responsibility for compensation in cases of damage to ecosystems;
- Increased provision of punitive measures both for fines and imprisonment; Fixing authority on cognizance of offences;

- Restriction on polluting automobiles;
- Restriction on the sale and production of environmentally harmful items like polythene bags;
- Assistance from law enforcement agencies for environmental actions; and
- Break up of punitive measures and (5) authority to try environmental cases.

3.3.14 Environmental Conservation Rules (1997)

These are the first set of rules, promulgated under the ECA of 1995 (so far there have been three amendments to this set of rules-February and August 2002 and April 2003). The Environment Conservation Rules (ECR) of 1997 has provided categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects.

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

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

The proposed Project, according to the DoE, is considered under the Red Category of the ECR (Item 65: Exploration, extraction and distribution of mineral resources) [Page 3122 of the Bangladesh Gazette of 28 August 1997].

3.3.15 Explosives Act, 1884

As per section 4 of the legislation,

- (1) "Explosives" include:
 - Means, gun powder, nitro-glycerine, dynamite, gun-cotton, blasting powders, fulminate of mercury or of other metals, coloured fires and every other substance, whether similar to those above-mentioned or not, used or manufactured with a view to produce a practical effect by explosion, or a pyrotechnic effect; and
 - Fog-signals, fireworks, fuses, rockets, percussion-caps, detonators, cartridges, ammunitions of all descriptions, and every adaptation or preparation of an explosive as above defined.
- (3) "Vessel" includes every ship, boat and other vessel used in navigation, whether propelled by oars or otherwise;
- (4) "Carriage" includes any carriage, wagon, cart, truck, vehicle or other means of conveying goods, or passengers by land, in whatever manner the same may be propelled;
- (6) "Import" means to bring into (Bangladesh) by sea or land.

Section 6 of the Explosives Act (EA) of 1884 provides punishment for contravening notifications issued under the provisions of this law, which may extend to imprisonment of ten years with or without fine amounting to fifty thousand taka. Section 8 provides for punishment for failing to notify the chief inspector of explosives in Bangladesh and also to the officer-in-charge of the nearest police station in case of an

accident due to explosion of any explosives either during manufacturing, possession, usage or carriage. The punishment extends to three months of imprisonment and to a fine of up to five thousand taka.

Under the provisions of explosives rules, 2003 (rules made under the provision of section 5 of the EA), will be required to obtain licenses for explosive related activities i.e.: import, transport and possession and for such Port Authority will apply for a license to import explosives from the chief controller of imports and exports with the clearance from the chief inspector of DoEx. Application for transport and possession must be sought from the chief inspector of DoEx.

3.3.16 Explosives Substances Act, 1908

In this statute in section 2 an “explosive substance” has been defined as follows –2. In this Explosives Substances Act (ESA) of 1908 the expression “explosive substance” shall be deemed to include any materials for making any explosive substance; also any apparatus, machine implement or material used, or intended to be used, or adapted for causing, or aiding in causing, any explosion in or with any explosive substance; also any part of any such apparatus, machine or implement.”

Section 3 provides for maximum punishment of a life jail term for causing any explosion “...unlawfully and maliciously...to endanger life to cause serious injury to property...“, however, this statute does not come within the purview of this Project as there will be no unlawful or malicious intention whatsoever.

3.3.17 Marine Fisheries Ordinance (MFO), 1983

Section 28 – Provisions:

The government may, by notification in the official gazette declare any area of the Bangladesh fisheries waters and as appropriate, any adjacent or surrounding land, to be a marine reserve where it considers that special measures are necessary:

- To afford special protection to aquatic flora and fauna of such areas and to protect and preserve the natural breeding grounds and habitats of aquatic life with particular regard to flora and fauna in danger of extinction;
- To allow for the natural regeneration of aquatic life in areas where such life has been depleted;
- To promote scientific study and research in respect of such areas; or
- To preserve and enhance the natural beauty of such areas.

Section 29 – Provisions:

- (1) Any person who, in any marine reserve declared under section 28, without permission granted under this section dredges, extracts sand or gravel, discharges or deposits waste or any polluting matter, or in any other way disturbs, alters or destroys fish or other natural breeding ground of habitats; or shall be guilty of an offence and shall be liable to a fine not exceeding taka one lakh.
- (2) The director may give permission to do any of the things prohibited under this section where the doing of such thing may be required for the proper management of the reserve or for any of the purposes referred to in section 28.

Section 30 – Provisions:

This Section deals with the granting of permission for scientific research.

The government may, in writing and subject to such terms and conditions, if any as may be specified therein, exempt from all or any of the provisions of this Ordinance or the rules made there under any vessel or person undertaking research into marine fisheries or other marine living resources in the Bangladesh fisheries waters.

3.3.18 Coast Guard Act, 1994

Amongst the functions of the coast guards as embodied in section 7 of the Coast Guard Act (CGA) of 1994, it also embraces to – “investigate into the activities causing pollution to the environment in the maritime zone of Bangladesh and taking measures for their prevention”.

As such no specific permission from the coast guard authority is required; however, information was given prior to offshore surveys and studies.

3.3.19 Compliance with Bangladesh Labour Act, 2006

Matarbari Port will employ workers in the field for the purposes of the survey and as such must comply with the Bangladesh Labour Act (BLA) of 2006. In this statute definition of labour is provided in section 2, whilst classification of a labour is entailed in section 4(1). Every labourer must be provided with a contract and an identification card (section 5). Whilst child labour is clearly defined in section 34, the nature of the activities will inherently exclude any child (section 40) or women labourers (section 45). Compliance to health and safety is provided in Chapters V (sections 51-60) and VI (sections 61-78), and special provisions regarding health and safety are provided in chapter VII (sections 79-85).

With regard to welfare of the labourers, chapter VIII states that first aid materials (section 89) are mandatory.

Regarding working hours for the labourers, chapter IX sections 101 and 102 and section 105-108 (overtime) are required to be followed. Payment of wages of the labourers is provided for in Chapter X (section 120-123 and 137 must be looked at specifically). Compensation for accidents during work (Chapter XII) is contained in sections 150-153 and 155. Schedule IV provides specific mention of labourers engaged in handling explosives and working in mines.

3.3.20 East Bengal Protection and Conservation of Fish Act (1950)

The East Bengal Protection and Fish Conservation Act (EBPFCA) of 1950, as amended by the protection and conservation of fish (amendment) ordinance of 1982 and the protection and conservation of fish (amendment) act of 1995, provides provisions for the protection and conservation of fish in inland waters of Bangladesh. This is relatively unspecific and simply provides a means by which the Government may introduce rules to protect those inland waters not in private ownership.

This is framework legislation with rule making powers. Among others, some of these rules may prohibit the destruction of, or any attempt to destroy, fish by the poisoning of water or the depletion of fisheries by pollution, by trade effluent or otherwise.

3.3.21 The Protection and Conservation of Fish Rules (1985)

These are a set of rules in line with the overall objectives of the EBFPCA. Section 5 of the Protection and Conservation of Fish Rules (PCFR) of 1985 requires that “No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters”. Section 6

of the PCFR states that –“No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters”.

3.3.22 The Bangladesh Penal Code (1860)

[Chapter XIV of offences affective Public health, safety, convenience, decency and morals]

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

These articles are important in line with the Carriage of raw materials (Explosive Substance) by Port Authority.

3.3.23 Acquisition and Requisition of Immovable Property Ordinance (1982) (amended in September 21, 2017)

This Acquisition and Requisition of Immovable Property Ordinance (ARIPO) of 1982 has replaced the land acquisition act of 1894 and the east Bengal (emergency) requisition of property act of 1948. The ARIPO governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous acts (i.e. Act XIII of 1948), the ARIPO deals only with immovable property.

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

The ARIPO has again been amended in 2017 with a provision of 100% premium instead of 50% premium (amendment 1994) on average transacted deeds in a particular Mouza/vicinity of the proposed site. The amendment has a provision to acquire community property (places of worship, graveyard and cremation grounds) for development purposes in consultation with the community people.

(2) In case of acquisition of land for any government requirement, a person belonging to the interest shall be paid an additional percentage of 200 (two hundred) compensation on the market price as mentioned in clause (a) of sub-section (1):

Provided that in case of acquisition of land for a private company, the amount of compensation will be 300 percent on the market price.

(3) In case of damage mentioned in clause (b), (c), (d) and (e) of sub-section (1), an additional 100% compensation will be provided on the market value.

(4) In addition to the compensation mentioned in this section, due to the acquisition, necessary action may be taken to rehabilitate the displaced family.

3.3.24 Property (Emergency) Acquisition Act, 1989

The Property (Emergency) Acquisition Act (PAA) of 1989 was formulated to expedite the emergency acquisition of land to enable the government 'to control inundation, flood and upsurge caused by natural calamity and to prevent river erosion.' The PAA was not meant to replace the 1982 ordinance, but to complement it for special circumstances. Normally, acquisition of land for development purposes would not come under the 1989 act. Use of PAA to acquire land for development would require extremely compelling reasons.

3.3.25 Administrative and Regulatory Guidelines and Instructions

In addition to the provisions in the law, the land acquisition process is regulated by certain administrative instructions and procedural requirements. The most important of these are summarized here:

- In 1976, the government constituted land allocation committees at the district, divisional and central levels to control what was regarded as too lavish taking of land for public purposes. The committees were charged with ensuring 'the most rigid measures of economy in the use of land for purposes other than agriculture.'
- The District Land Allocation Committees (DLACs) are chaired by the DC and have seven other members. These members include executive engineers of the R&H department and the public works department, and the civil surgeon. They are entrusted with land allocation within the district not exceeding two acres.

The divisional LACs are chaired by the divisional commissioner and have technical representation at the superintending engineer and deputy director level. These committees consider land acquisition cases involving between two and five acres of land. All cases of more than five acres go to the Central Land Allocation Committee (CLAC). This committee is chaired by the Minister of Land Administration (MoLA) and has technical representation at the secretary level. In 1989, the government ordered that in all cases involving the acquisition of land exceeding 10 bighas, the president would have to give consent.

3.3.25 Framework for Leasing of Government (Khas) Agricultural Land

The rules for managing and leasing government-owned (Khas) land are framed in two notifications in the Bangladesh Gazette: (1) Notification: Bhumo/Sho-8/Kha-jo-bo/46/84/261, Bangladesh Gazette Extra Edition, May 12, 1997, pp 1527-1536; and (2) Notification: Shuno/Sho-4/Kri-kha-jo--bo-1/98-264, Bangladesh Gazette, September 15, 1998.

Under these regulations, the government leases cultivable agricultural land in the rural areas to landless farming households. The allotments cannot be more than one acre, except in the southern districts where up to 1.5 acres of char land can be allotted. A landless family is defined as one that works in agriculture and may own a homestead, but has no arable land of its own. Given this basic definition, five groups of landless families are given priority in the allotment of leases:

- Families of freedom fighters;
- Families who have lost all their land due to erosion;
- Widows with an adult son capable of working the land;

- Farmers with homesteads but no land; and
- Farmers who have lost all their land due to land acquisition under the eminent domain laws.

The regulation further defines the structure and responsibilities for the management and leasing of Khas Lands at the national, district, and Thana levels.

3.3.26 Bangladesh Water Act, 2013

A National Water Resources Council (NWRC) to be established for implementing the provisions of the Act. A National Water Policy shall be adopted by the Council addressing the following issues:

- Purpose and sectors of water use;
- Affordability of water users;
- Actual cost of water abstraction and distribution;
- Financial ability and backwardness of water users of any group thereof;
- Water demand and supply;
- Any other issues considered relevant by GoB;
- An Executive Committee of the Council shall be established or ensuring efficient performance of the Council;
- The GoB can declare certain areas as Water Stress Areas for the protection of water sources or aquifers;
- Water zone demarcation (industrial, agricultural, brackish water aquaculture and hatchery water zones) through gazette notification and issuance of protection order for efficient water management in such zones.
- Declaration of flood control zone and its management. Restriction on abstraction of total water from any water source.

3.3.27 Bangladesh Energy Regulatory Commission Act, 2003 (as amended in 2010)

As per section 27 of the Bangladesh Energy Regulatory Commission Act (BERCA) of 2003, no person shall engage himself in activities like power generation, energy transmission, and energy supply and energy storage, without a license from Bangladesh Energy Regulatory Commission (BERC), which has been constituted under the BERCA for its implementation.

3.3.28 Public Procurement Rule, 2008

The Public Procurement Rule (PPR) of 2008 includes the adequate measure regarding the “Safety, Security and Protection of the Environment’ in the construction works. This clause includes mainly, the Contractor shall take all reasonable steps to (i) safeguard the health and safety of all workers working on the site and other persons entitled to be on it, and to keep the site in an orderly state and (ii) protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.

3.3.29 Bangladesh National Building Code

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

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

Section 1.4.1 of chapter-1, part-7 of the BNBC, states the general duties of the employer to the public as well as workers. According to this section, “All equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run way, barricade, chute, lift etc. shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them”.

Part-7, Chapter -1 of the BNBC clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen. According to the Section 1.2.1 of Chapter-1 of part 7, “in a construction or demolition work, the terms of contract between the owner and the Contractor and between a consultant and the owner shall be clearly defined and put in writing. These however will not absolve the owner from any of his responsibilities under the various provisions of the BNBC and other applicable regulations and byelaws.

The terms of contract between the owner and the Contractor will determine the responsibilities and liabilities of either party in the concerned matters, within the provisions of the relevant acts and codes (e.g. the Bangladesh Labor Act (BLA)).

To prevent workers falling from heights, the BNBC in section 3.7.1 to 3.7.6 of Chapter 3 of part 7 sets out the detailed requirements on the formation and use of scaffolding.

3.3.30 Constitution of Bangladesh

Article 24 of the Constitution of Bangladesh (CoB) says that the state shall adopt measures for the protection against disfigurement, damage or removal of all monuments, objects or places of special artistic or historic importance or interest.

3.3.31 National Information and Communication Technology Policy, 2002

Information Communication Technology (ICT) encompasses the broad fields of data/information processing, transmission and communications by means of computer and telecommunication techniques and these modern tools are being increasingly used for organizational/personal information processing in all sectors of economy and society. The National Information and Communication Technology Policy (NICTP) of 2002 presents the guidelines for the development of the ICT sector in Bangladesh. The

NICTP includes a specific section related to the importance of ICT in mitigating environmental issues and disseminating information on environmental problems and their causes in order to create awareness about environment among the common people.

The NICTP encourages information system for making a complete inventory of existing flora and fauna of Bangladesh, their habitats and other natural communities whose existence has been endangered. Use of GIS and other ICT-based systems are promoted for planning at the national level, for agricultural crops estimation, conservation of nature while accommodating compatible land use to maintain the ecological balance. The NICTP also promotes use of ICT to help solve the most pressing problems of environment in the urban areas like toxic emissions from vehicles, industries and other sources.

3.4 OTHER POLICIES RELEVANT TO ENVIRONMENT

Additional Bangladesh policies, their key features and applicability to the subject Project are detailed in Table 3.4-1.

Table 3.4-1 Policies Relevant to Environment

Policy	Key Features	Applicability
The National Forest Policy, 1994	<ul style="list-style-type: none"> • Afforestation of 20% land • Bio-diversity of the existing degraded forests • Strengthening of the agricultural sector • Control of Global warming, desertification • Control of trade in wild birds and animals • Prevention of illegal occupation of the forested land, tree felling and hunting of wild animals 	Applicable when considering global warming and the protection of forests
National Land Transport Policy, 2004	<ul style="list-style-type: none"> • All new roads and major improvements will be subjected to an EIA • Funding will be provided for mitigation measures • The Government will publish environmental standards for new roads and new design standards addressing environmental issues 	Not directly applicable, however, the standards may apply for the new approach road
The National Water Policy, 1999	<ul style="list-style-type: none"> • Protection, restoration and enhancement of water resources • Protection of water quality, including strengthening regulations concerning agrochemicals and industrial effluent • Sanitation and potable water • Fish and fisheries • Participation of local communities in all water sector development 	Applicable for the preservation of water quality
National Land use Policy, 2001	<ul style="list-style-type: none"> • Deals with several land uses including: agriculture (crop production, fishery (using ponds, lake etc.) and livestock), housing, 	Applicable as land use change from agricultural to industrial

Policy	Key Features	Applicability
Draft Wetland Policy, 1998	<p>forestry, industrialization, railways and roads, tea and rubber</p> <ul style="list-style-type: none"> • Identifies land use constraints in all these sectors • Establishment of principles for the sustainable use of wetland resources • Maintenance of the existing level of biological diversity • Maintenance of the functions and values of wetlands • Promotion and recognition of the value of wetland functions in resource management and economic development 	Applicable
National Fisheries Policy, 1998	<ul style="list-style-type: none"> • Preservation, management and exploitation of fisheries resources in inland open water • Fish cultivation and management in inland closed water. • Prawn and fish cultivation in coastal areas • Preservation, management and exploitation of sea fishery resources 	Applicable
National Agriculture Policy, 1999	<ul style="list-style-type: none"> • The act deals with the programs related to make the nation self-sufficient in food through increasing production of all crops, including cereals, and ensure a dependable food security system for all 	Not applicable
The Energy Policy, 1996	<ul style="list-style-type: none"> • Provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy source and environmentally sound sustainable energy development programs • Highlights the importance of EIA's for any new energy development project 	Not applicable
The Power Policy, 1995	<ul style="list-style-type: none"> • Is an integral part of the Energy Policy and deals with policy statement on demand forecast, long term planning and project implementation, investment terms, fuels and technologies, load management, institutional issues, private sector participation, technology transfer and research program, environmental policy and legal issues 	Not applicable

Policy	Key Features	Applicability
Industrial Policy, 1999	<ul style="list-style-type: none">• Deals with industrial development, direct foreign investments, investment by public and private sector, introduction of new appropriate technology, women's participation, infrastructure development and environmentally sound industrial	Applicable as this Project will encourage the public and private partnership, industrial development

3.5 RELEVANT NATIONAL LEGAL INSTRUMENTS FOR THE PROJECT

Table 3.5-1 presents an outline of other National legal instruments that will have relevance to the proposed Project with respect to the social and environment considerations.

Table 3.5-1 National Legal Instruments relevant to the Project

Act/ Rule/ Law/ Ordinance	Enforcement Agency – Ministry/ Authority	Key Features	Applicability to proposed Project
The Environment Conservation Act, 1995 and subsequent amendments in 2000 and 2002	Department of Environment Ministry of Environment and Forests,	<ul style="list-style-type: none"> • Define Applicability of environmental clearance • Regulation of development activities from environmental perspective • Framing applicable limits for emissions and effluents • Framing of standards for air, water and noise quality • Formulation of guidelines relating to control and mitigation of environmental pollution, conservation and improvement of environment • Declaration of Ecologically critical areas 	Applicable
Environmental Conservation Rules, 1997 and subsequent amendments in 2002 and 2003	Department of Environment Ministry of Environment and Forests	<ul style="list-style-type: none"> • Declaration of Ecologically critical areas • Requirement of environmental clearance certificate for various categories of projects • Requirement of IEE/EIA as per category • Renewal of the environmental clearance certificate within 30 days after the expiry • Provides standards for quality of air, water and sound and acceptable limits for emissions/discharges from vehicles and other sources 	Applicable Projects falls under Red Category and require environmental clearance
Environment Court Act, 2000 and subsequent amendments in 2002	Ministry of Environment and Forests and Judiciary	<ul style="list-style-type: none"> • GOB has given highest priority to environment pollution • Passed ‘Environment Court Act, 2000 for completing environment related legal proceedings effectively 	Applicable for completing environmental legal requirements effectively
he Vehicle Act, 1927; The Motor Vehicles Ordinance, 1983; and The Bengal Motor Vehicle Rules, 1940	Bangladesh Road Transport Authority	<ul style="list-style-type: none"> • Exhaust emissions • Vehicular air and noise pollution • Road/traffic safety • Vehicle Licensing and Registration • Fitness of Motor Vehicles • Parking by-laws. 	Applicable for proposed Project in relation to road transport
The Removal of Wrecks and Obstructions in inland Navigable Water Ways Rules 1973	Bangladesh Water Transport Authority	<ul style="list-style-type: none"> • Removal of wrecks and obstructions in inland navigable waterways 	Applicable as canal- inland navigable waterway will be used for transport of equipment for the Project
Water Supply and Sanitation Act, 1996	Ministry of Local Government, Rural Development and Cooperatives	<ul style="list-style-type: none"> • Management and Control of water supply and sanitation in urban areas. 	Not directly applicable, however, indirectly applicable when considering water usage management and sanitation facilities
The Ground Water Management Ordinance, 1985	Upazila Parishad	<ul style="list-style-type: none"> • Management of ground water resources • Installation of tube-wells at any place after license from Upazila Parishad only 	Proposed Project will use surface water source however, should groundwater also be required then licenses will need

Act/ Rule/ Law/ Ordinance	Enforcement Agency – Ministry/ Authority	Key Features	Applicability to proposed Project
The Forest Act, 1927 and subsequent amendments in 1982 and 1989	Ministry of Environment and Forests	<ul style="list-style-type: none"> • Categorization of forests as reserve, protected and village forests • Permission is required for use of forest land for any non-forest purposes 	to be obtained prior to installation of any tube-wells. Not applicable as proposed Project is not on forest land
The Private Forests Ordinance Act, 1959	Regional Forest Officer, Forest Department`	<ul style="list-style-type: none"> • Conservation of private forests and for the afforestation on wastelands 	Not Applicable
Bangladesh Wild Life (Preservation) Act, 1974	Ministry of Environment and Forest; Bangladesh Wild Life Advisory Board	<ul style="list-style-type: none"> • Preservation of Wildlife Sanctuaries, Parks, and Reserves 	Not applicable as the Project study area does not have any wildlife areas
National Biodiversity Strategy and Action Plan (2004)	Ministry of Environment and Forest Bangladesh Wild Life Advisory Board	<ul style="list-style-type: none"> • Conserve, and restore the biodiversity of the country for well being of the present and future generations • Maintain and improve environmental stability for ecosystems • Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations • Guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country • Stop introduction of invasive alien species, genetically modified organisms and living modified organisms 	Applicable for conservation of bio-diversity
National Water Bodies Protection Act, 2000	Town development authority/Municipalities	<ul style="list-style-type: none"> • The characterization of water bodies as rivers, canals, tanks or flood plains identified in the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of concerned ministry 	Applicable due to the proximity to and use of surface water bodies
The Protection and Conservation of Fish Act 1950 subsequent amendments in 1982	Ministry of Fisheries and Livestock	<ul style="list-style-type: none"> • Protection and conservation of fish in Government owned water bodies 	Applicable for the conservation of fish as the intake and outfall point will be the canal
The Embankment and Drainage Act 1952	Ministry of Water Resources	<ul style="list-style-type: none"> • An Act to consolidate the laws relating to embankment and drainage and to make better provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion and other damage by water 	Applicable due to the site location
Antiquities Act, 1968	Ministry of Cultural Affairs	<ul style="list-style-type: none"> • This legislation governs preservation of the national cultural heritage, protects and controls ancient monuments, regulates antiquities as well as the maintenance, conservation and restoration of protected 	Not applicable as the study area does not have any likely cultural heritage or ancient monuments of national or international significance. However in case, any such evidence of

Act/ Rule/ Law/ Ordinance	Enforcement Agency – Ministry/ Authority	Key Features	Applicability to proposed Project
The Acquisition and Requisition of Immovable Property Ordinance 1982 and subsequent amendments in 1994, 1995 and 2004	Ministry of Land	<ul style="list-style-type: none"> • sites and monuments, controls planning, exploration and excavation of archaeological sites • Current GOB Act and Guidelines, relating to acquisition and requisition of land 	archaeological findings arise, the Project will act in consonance to the Act Applicable
Administrative and Regulatory Guidelines and Instructions for Land Acquisition	Ministry of Land	<ul style="list-style-type: none"> • Regulation of land acquisition process by certain administrative instructions and procedural requirements 	Applicable
Framework for Leasing of Government (Khas) Agricultural Land	Ministry of Land	<ul style="list-style-type: none"> • The rules for allotting and leasing Government-owned (khas) land to land less families 	Not directly applicable but indirectly if a family becomes landless in the process of acquisition Applicable
The Building Construction Act 1952 and subsequent amendments	Ministry of Works	<ul style="list-style-type: none"> • This act provide for prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh 	Applicable
The Factories Act, 1965 Bangladesh Labour Law, 2006	Ministry of Labour	<ul style="list-style-type: none"> • This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions 	Applicable
Ozone Depleting Substances (Control) Rules, 2004	Ministry of Environment and Forests	<ul style="list-style-type: none"> • Ban on the use of Ozone depleting substances • Phasing out of Ozone depleting substances 	Applicable
Noise Pollution (Control) Rules 2006	Ministry of Environment and Forests	<ul style="list-style-type: none"> • Prevention of Noise pollution • Standards for noise levels 	Applicable

Source: Websites of DOE, Legislative and Parliamentary Affairs Division:: Bangladesh Laws and Bangladesh Board of Investment: Business laws

3.6 ADMINISTRATIVE FRAMEWORK RELATED TO ENVIRONMENT IN BANGLADESH

The Ministry of Environment & Forests (MoEF) is the nodal agency in the administrative structure of the GoB, for overseeing all environmental matters relating to national environmental policy and regulatory issues in the country. The MoEF oversees the activities of the following technical/implementing agencies:

- ✓ Department of Environment (DOE);
- ✓ Forest Department (FD);
- ✓ Bangladesh Forest Industries Development Corporation (BFIDC);
- ✓ Bangladesh Forest Research Institute (BFRI); and
- ✓ Bangladesh National Herbarium (BNH).

Other Related Organizations

There are several other organizations under the administrative framework which would govern social and environmental functions related to the proposed Project, namely:

- ✓ Forest Department;
- ✓ Ministry of Land: Land reform and land acquisition directorate;
- ✓ Ministry of Water Resources: Bangladesh Water Development Board; and
- ✓ Local Government Engineering Department (LGED)

3.6.1 DEPARTMENT OF ENVIRONMENT (DOE)

The DOE has been placed under the MoEF as its technical wing and is statutorily responsible for the implementation of the Environment Conservation Act, 1995. The Department was created in 1989, to ensure sustainable development and to conserve and manage the environment of Bangladesh.

The principal activities of the DOE are:

- Defining EIA procedures and issuing environmental clearance permits the latter being the legal requirement before the proposed Project can be implemented;
- Providing advice or taking direct action to prevent degradation of the environment;
- Pollution control, including the monitoring of effluent sources and ensuring mitigation of environmental pollution;
- Setting the Quality Standards for environmental parameters;
- Declaring Ecologically Critical Areas (ECAs), where the ecosystem has been degraded to a critical state; and
- Review and evaluation of Initial Environmental Examinations (IEEs) and EIAs prepared for projects in Bangladesh.

3.6.2 ENVIRONMENTAL CLEARANCE PROCESS

As mentioned in the Section 2.3.2, ECR has classified projects to be assessed by the DOE in four categories based on the severity of impacts on IECs:

- Green: Nil;
- Orange A: minor;
- Orange B: medium; and
- Red: severe.

The applicability of Environmental clearance and the process in Bangladesh is described in Figure 3.6-1.

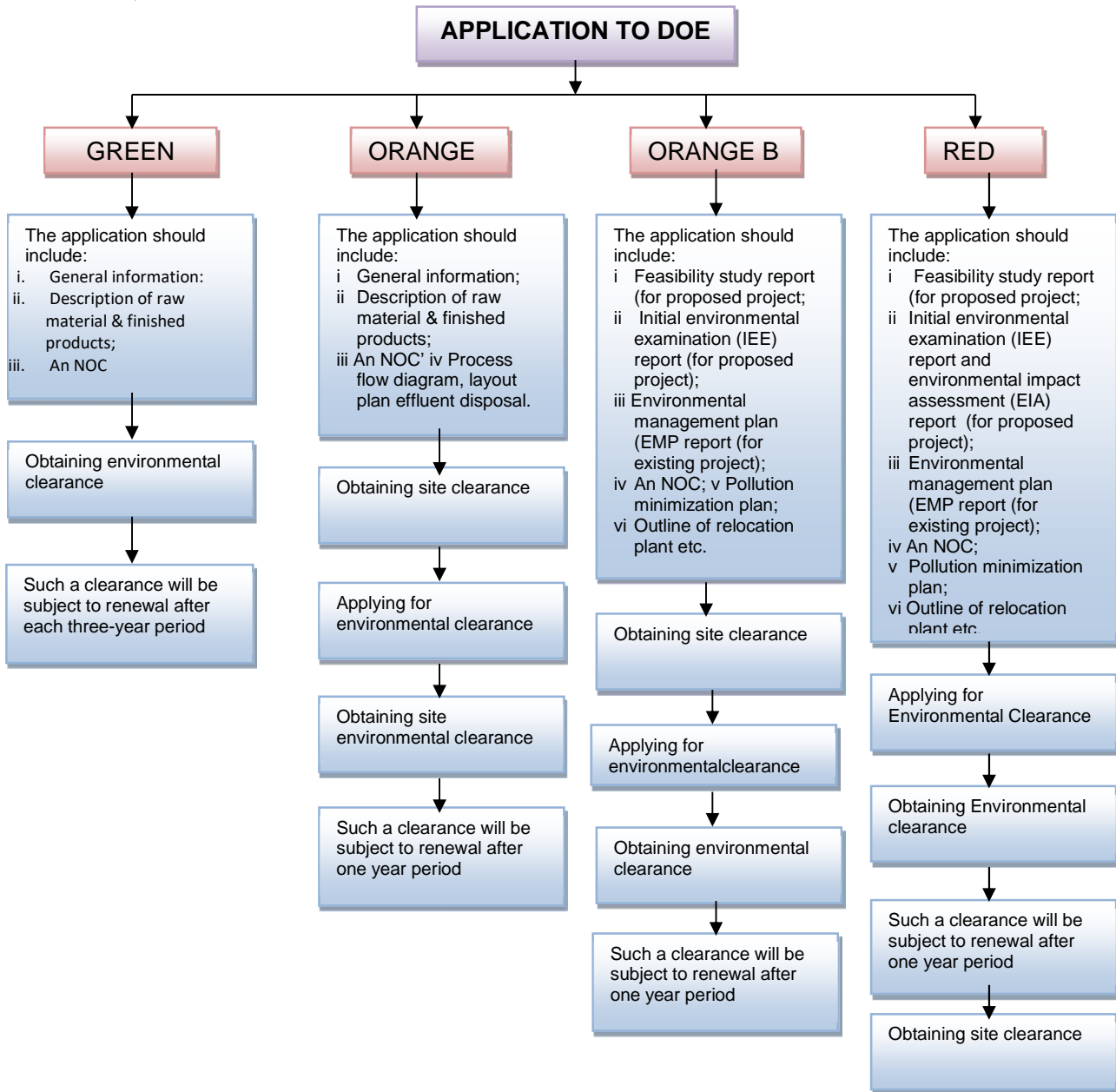


Figure 3.6-1 DOE Environmental Clearance Applicability and Procedure

The EIA process consists of three stages, screening, IEE, and detailed EIA:

- Projects categorized as Green and Orange-A requires no IEE or EIA for environmental clearance however, the proponent has to submit an application in a prescribed format along with specified documents;
- Projects categorized as Orange-B require an IEE to be submitted to the DOE along with an application in a prescribed format and other specified documents; and

- Red category projects require both IEE and EIA. An IEE is required for the location clearance and an EIA is required for the environmental clearance.

The process for obtaining an Environmental Clearance Certificate (ECC) for the proposed project is outlined in Figure 3.6-2.

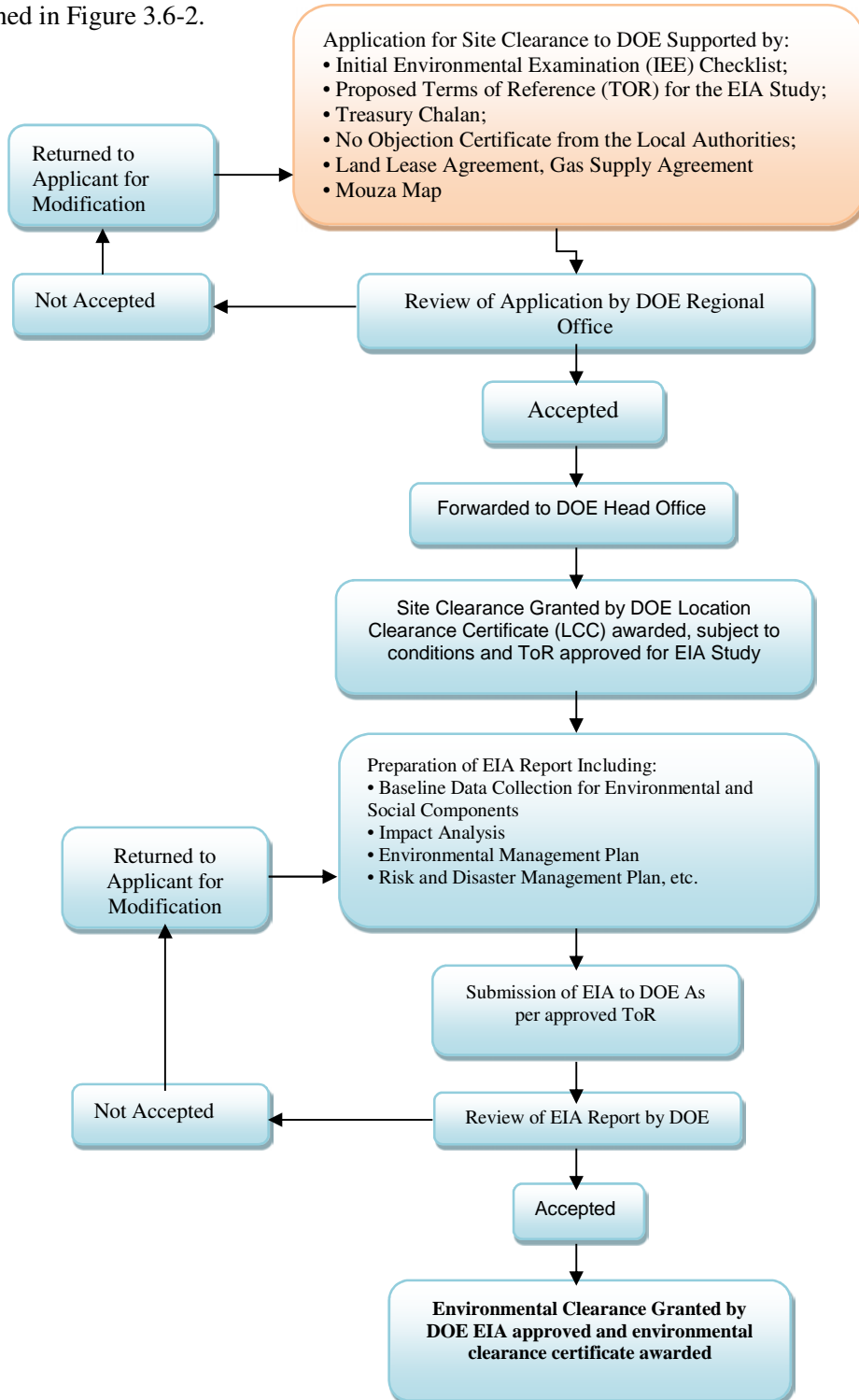


Figure 3.6-2 Flowchart of EIA Process Applicable to the Proposed Project

3.7 INSTITUTIONAL ARRANGEMENTS RELATED TO LAND ACQUISITION IN BANGLADESH

The administrative set up for land acquisition has two tiers under the Ministry of Land Administration. At the Division level, there is an Additional Commissioner dealing with land administration under the Commissioner. At the district level, there is an Additional Deputy Commissioner in charge of land administration. Under him, there is at least one Land Acquisition Officer and several Assistant Land Acquisition Officers. The number of officers depends on the size of the District. Non-gazette officers in the land administration include Kanungos and surveyors.

3.8 COMPLIANCE WITH INTERNATIONAL REQUIREMENTS

Bangladesh already had accessed to, ratified or signed a number of major international treaties, conventions and protocols related to environment protection and conservation of natural resources which shall have to be complied with during implementation of any project. The Environment related International conventions, protocols, treaties signed/ratified by Bangladesh are listed below.

3.8.1 International Convention for the Prevention of Pollution of the Sea by Oil London, 1954 (as amended on 11 April 1962 and 21 October 1969)

The main objective of this convention is to take action to prevent pollution of the sea by oil discharged from ships. This Convention applies to all ships, except tankers of under 150 tons gross tonnage and other ships of under 500 tons gross tonnage, registered in the territory of, or having the nationality of, a Party. Naval ships and ships engaged in whaling are also excepted (art. 2). Discharges are prohibited, except when a ship is proceeding en route or when the instantaneous rate of discharge does not exceed 60 litres per mile. The prohibition is not applicable when the following conditions are satisfied: in the case of a ship-the oil content of the discharge is less than 100 parts per million parts of the mixture, or the discharge is made as far as practicable from land; in the case of a tanker - the total quantity of oil discharged on a ballast voyage does not exceed one fifteen-thousandth of the total cargo-carrying capacity, or the tanker is more than 50 miles from the nearest land (art. 3); Exceptions to article 3 are provided in cases of necessity to secure safety of ships, save life or prevent damage to cargo, or where leakage is unavoidable and all measures have been taken to minimize it (art. 4). Ships are to be fitted within 12 months to prevent escape of oil into the bilges (art. 7). Parties undertake to provide appropriate facilities at ports and oil-loading terminals (art. 8). All ships covered by the Convention are to carry an oil record book in a form specified in the annex, to be completed whenever certain operations take place (art. 9). Parties agree to send texts of laws, decrees, orders and regulations giving effect to the Convention to the United Nations.

3.8.2 Rio Declaration

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

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

3.8.3 Convention on Biological Diversity, Rio de Janeiro, (1992)

The Convention on Biological Diversity, Rio de Janeiro, 1992 was adopted on 05 June 1992 and entered into force on 29 December, 1993. Bangladesh ratified the Convention on 20 March, 1994.

The Contracting Parties of the Convention have committed to:

- Introducing appropriate procedures requiring environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where appropriate allow for public participation in such procedures; and
- Introducing appropriate arrangements to ensure that environmental consequences of its programmes and policies, that are likely to have significant adverse impacts on biodiversity, are duly taken into account.

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

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

This convention is also known as the Ramsar Convention. It was adopted 02 February, 1971 and entered into force on 21 December, 1975. Bangladesh has ratified the Convention 20 April, 2002. This provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are 127 Parties with 1085 wetland sites designated as 'Wetlands of International Importance'.

This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitats. Obligations for Contracting Parties include the designation of wetlands to the "List of Wetlands of International Importance", the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves.

Bangladesh has two Ramsar sites- Parts of Sundarbans Reserved Forest (Southwest of Bangladesh) and Tanguar Haor (Northeast of Bangladesh).

3.8.5 United Nations Convention on the Law of the Sea

This Convention was adopted on 10 December 1982 at Montego Bay, Jamaica. Bangladesh has ratified this Convention.

Main objectives of the convention are:

- To set up a comprehensive new legal regime for the sea and oceans, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment; and
- To establish basic environmental protection principals and rules on global and regional cooperation, technical assistance, monitoring, and environmental assessment, and adoption and enforcement of international rules and standards and national legislation with respect to all sources of marine pollution.

3.8.6 Others (Convention and Agreements)

The following conventions and agreements may include provisions relevant to different aspects of oil and gas operations for environmental management, nature protection, and biodiversity conservation:

- Convention relative to the Preservation of Fauna and Flora in their Natural State 1933;

- International Convention for the Protection of Birds, Paris, 1950;
- International Plant Protection Convention, Rome. 1951;
- Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972: This convention has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties). These are the 'Jewels in the Crown' of conservation;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 (Popularly known as CITES): This provides a framework for addressing over harvesting and exploitation patterns which threaten plant and animal species. Under CITES, governments agree to prohibit or regulate trade in species which are threatened by unsustainable use patterns; and
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn. 1979 (Amended 1988): This provides a framework for agreements between countries important to the migration of species that are threatened.

Bangladesh is a party to MARPOL 73/78 with all its annexes. However, the country has not enacted any enabling act to give effect to the MARPOL Convention in the domestic arena. It is completely undesirable that after a long period of signing and ratifying MARPOL and other IMO Conventions, Bangladesh is yet to enact necessary enabling domestic laws to give effect to these international legal instruments.

Along with the MARPOL, Bangladesh is party to a number (30) of international environmental convention, treaties and agreements. The Project relevant international treaties and conventions relevant to the project signed, ratified and in the process of ratification by Bangladesh are detailed in Table 3.9-1.

Table3.8-1 Project Relevant International Treaties and Conventions

<u>Environment related International convention and Treaties</u>	<u>Status</u>
International Plant Protection Convention (Rome, 1951.)	01.09.78 (ratified)
International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969.)	28.12.81 (entry into force)
Plant Protection Agreement for the South East Asia and Pacific Region (as amended) (Rome, 1956.)	04.12.74 (accessed) (entry into force)
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (Brussels, 1969.)	04.02.82 (entry into force)
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) ("Ramsar Convention").	20.04.92 (ratified)
Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972.)	03.08.83 (accepted)03.11.83 (ratified)
Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) ("CITES Convention")	18.02.82 (ratified)
United Nations Convention on the Law of the Sea (Montego Bay, 1982.)	10.12.82 (ratified)
Vienna Convention for the Protection of the Ozone Layer (Vienna, 1985.)	02.08.90 (accessed) 31.10.90 (entry into force)
Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987.)	02.08.90 31.10.90 (accessed) (entry into force)
London Amendment to the Montreal Protocol on substances that Deplete the Ozone Layer (London, 1990)	18.03.94 (accessed) 16.06.94 (entry into force)

<u>Environment related International convention and Treaties</u>	<u>Status</u>
Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992	27.11.2000 (accepted) 26.2.2001 (entry into force)
Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1997	27.7.2001 (Accepted) 26.10.2001 (Entry into force)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989.)	01.04.93 (accessed)
International Convention on Oil Pollution Preparedness, Response and Cooperation (London, 1990.)	30.11.90 (signed) In the process of ratification
United Nations Framework Convention on Climate Change, (New York, 1992.)	09.06.92 (signed) 15.04.94 (ratified)
Convention on Biological Diversity, (Rio De Janeiro, 1992.)	05.06.92 (signed) 03.05.94 (ratified)
International Convention to Combat Desertification, (Paris 1994.)	14.10.94 (signed) 26.01.1996 (ratification) 26.12.1996 (entry into force)
Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, (Geneva, 1976.)	03.10.79 (accessed) (entry into force)
Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (New York, 1994.)	28.07.96 (signed)
Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Paris, 1993.)	14.01.93 (signed)
Convention on persistent Organic Pollutants, Stockholm	23.5.2001 (signed) 12.03.2007 (ratified)
Kyoto protocol to the United Nations Framework Convention on Climate Change	21.8.2001 (accessed)
International Convention for the Prevention of Pollution from Ships (MARPOL)	Adoption: 1973 (Convention), 1978 (1978 Protocol), 1997 (Protocol - Annex VI); Entry into force: 2 October 1983 (Annexes I and II)

Source: DOE

3.9 GAPS BETWEEN LOCAL LAWS AND JICA GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS (APRIL 2010)

The gaps between local laws and JICA guidelines are listed considering three aspects. The aspects are:

- a) Environmental Assessment;
- b) Involuntary Resettlement; and
- c) Indigenous Peoples.

3.9.1 Gaps between Relevant Regulations in Bangladesh and JICA Guidelines considering Environmental Assessment (EA)

Sl. No.	Features	JICA Guidelines	Government Laws	Gaps
1.	Objectives	To ensure transparency, predictability, and accountability in its support for an examination of Environmental and social considerations.	To make decisions in respect to the following: i) Whether site clearance could be given to the project, given the residual significant project impacts on the various environmental components (physical, biological, and socio-economic); and, ii)	The governmental laws pay less attention to transparency, predictability, and accountability. Because the EIA is conducted within the framework of the Environmental Clearance Certificate

Sl. No.	Features	JICA Guidelines	Government Laws	Gaps
			Which conditions may be prescribed for compliance by the project proponents during design, construction, and operation of the project.	(ECC), the EIA tends to be accepted due to its consistency with the ECC.
2.	Procedure of EA	JICA supports and examines appropriate environmental and social considerations undertaken by project proponents etc. to avoid or minimize development projects' impacts on the environment and local communities, and to prevent the occurrence of unacceptable adverse impacts. (1.4).	An EIA is conducted within the framework of the Environmental Clearance Certificate (ECC). The project proponent's application of ECC initiates the EA process.	Although overt classification used to screen the development projects exists, the procedure of EA is relatively vague because it is conducted within the framework of ECC issuance.
3.	Criteria of EA	“Environmental and social considerations” means considering environmental impacts including air, water, soil, ecosystem, flora, and fauna, as well as social impacts including involuntary resettlement, respect for the human rights of indigenous people, and so on.(1.3.1) JICA confirms that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries; it also confirms that projects conform to those governments' policies and plans on the environment and local communities. (2.6.2) JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies, and refers as a benchmark to the standards of international financial organizations; to internationally recognized standards, or international standards, treaties, and declarations, etc.; and to the good practices etc. of developed nations including Japan, when appropriate. (2.6.3)	i) Are the beneficial and adverse impacts properly explained? ii) What are the risks (probability of occurrence and magnitude of consequences) of adverse impacts; are they properly evaluated? iii) What impacts would the project have on environmentally sensitive areas, endangered species and their habitats, and recreational as well as aesthetic areas? iv) Is the "No Project" scenario acceptable? v) Are any of the alternative sites that are suggested in the report considered suitable from an environmental angle, though it may increase the cost of the project? vi) Did similar projects implemented earlier cause significant adverse impacts and, if so, have the present proposals incorporated adequate measures to minimize adverse impacts at the proposed site? vii) Which are the unavoidable adverse impacts? viii) Are the concerns expressed by likely affected people genuine, and has the EIA/Initial Environmental Examination	Less focus is placed on social consideration.

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Features	JICA Guidelines	Government Laws	Gaps
			(IEE) project addressed these concerns adequately? ix) Are the mitigation measures, as proposed, reasonably feasible, and are they likely to be implemented (particularly those which have to be implemented during the operational phase)? x) What are the parameters that need to be monitored during project construction and operation so that the state of the environment can be studied throughout the project life?	
4.	EA Instruments	JICA conducts an environmental review in accordance with the project category, and refers to the corresponding environmental checklists for each sector when conducting that review as appropriate.	The required documents include: feasibility report, IEE report, EIA report, Environmental Management Plan (EMP), No Objection Certificates (NOC), emergency plan, and relocation/rehabilitation plan.	No significant gaps were identified between JICA Guidelines and governmental laws.
5.	Environmental Screening	Category A: Project proponents etc. must submit EIA reports. JICA publishes the status of host countries' submission of major documents on environmental and social considerations on its website. Prior to its environmental review, JICA also discloses the following: (1) EIA reports and environmental permit certifications, (2) RAPs for projects that will result in large-scale involuntary resettlement, and (3) IPPs for projects that address issues of indigenous people. Specifically, JICA discloses EIA reports 120 days prior to concluding agreement documents. JICA undertakes its environmental reviews based on the EIA and other documents submitted by project proponents etc. Category B: The scope of environmental reviews for Category B projects may vary from project to project, but it is narrower than that of Category A projects. JICA discloses the following: (1) EIA	Industrial projects have been divided into four categories: Green, Orange-A, Orange-B, and Red, according to the environmental significance and the location of proposed development. Green projects do not require either an IEE or an EIA. At the other extreme are the Red category projects, for which both IEE and EIA are necessary.	The category equivalent to the JICA's FI Category does not exist in governmental legislation.

Sl. No.	Features	JICA Guidelines	Government Laws	Gaps
		<p>reports and environmental permit certifications, (2) RAPs for projects, and (3) IPPs for projects that will require measures for indigenous people, when these documents are submitted by project proponents etc. Category C: For projects in this category, environmental review will not proceed after categorization. Category FI: JICA examines the related financial intermediary or executing agency to see whether appropriate environmental and social considerations as stated in the guidelines are ensured for projects in this category.</p>		
6.	EA for Special Project Types	<p>JICA examines the related financial intermediary or executing agency to see whether appropriate environmental and social considerations as stated in the guidelines are ensured for projects in this category. JICA also examines institutional capacity in order to confirm environmental and social considerations of the financial intermediary or executing agency, and, if necessary, requires that adequate measures be taken to strengthen capacity. The financial intermediary or executing agency examines the potential positive and negative environmental impacts of sub-projects and takes the necessary measures to avoid, minimize, mitigate, or compensate for potential negative impacts, as well as measures to promote positive impacts if any such measures are available. (3.2.1(4)) Measures Taken in an Emergency. In an emergency-which means a case that must be dealt with immediately, such as restoration after natural disasters or post-conflict restoration-when it is clear that there is no time to follow the procedures of environmental and social considerations mentioned in the guidelines, JICA reports at an early</p>	No specification	No specification is identified under Bangladeshi law.

Sl. No.	Features	JICA Guidelines	Government Laws	Gaps
		stage to the Advisory Committee for Environmental and Social Considerations on categorization, judgment of emergency, and procedures to follow, and discloses a result. JICA asks advice from the Advisory Committee when it is necessary.		
7.	Institutional Capacity	JICA provides support for and examinations of the environmental and social considerations that project proponents etc. implement in accordance with Sections 2 and 3 of the guidelines, depending on the nature of cooperation projects. (1.5)	Department of Environment (DOE) has the responsibility of conducting EA within the frame of an ECC issuance.	No indication of request for external resources has been noted in the Governmental Laws.
8.	Public Consultation	Project proponents etc. consult with local stakeholders through means that induce broad public participation to a reasonable extent, in order to take into consideration the environmental and social factors in a way that is most suitable to local situations, and in order to reach an appropriate consensus. JICA encourages project proponents etc. to publicize in advance that they plan to consult with local stakeholders, with particular attention to directly affected people, in order to have meaningful meetings. In the case of Category A projects, JICA encourages project proponents etc. to consult with local stakeholders about their understanding of development needs, the likely adverse impacts on the environment and society, and the analysis of alternatives at an early stage of the project, and assists project proponents as needed. (2.4) Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared. (Appendix 2)	Although providing information to local residents, community consultation, and public involvement has been recognized as important in major documents, specific legislation to implement such processes is yet to be enacted.	Significant gaps are found.

Sl. No.	Features	JICA Guidelines	Government Laws	Gaps
		In the case of Category B projects, JICA encourages project proponents etc. to consult with local stakeholders when necessary. (2.4)		
9.	Disclosure	Information about the environmental and social considerations of their projects. JICA encourages project proponents etc. to disclose and present information about environmental and social considerations to local stakeholders. Project proponents etc. disclose information well in advance when they have meetings with local stakeholders in cooperation with JICA. On these occasions, JICA supports project proponents etc. in the preparation of documents in an official or widely used language and in a form understandable by local people. (2.1/1, 6,7) For Category A project, JICA publishes the status of host countries' submission of major documents on environmental and social considerations on its website. Prior to its environmental review, JICA also discloses EIA reports and environmental permit certifications 120 days prior to concluding agreement documents. JICA discloses a translated version of EIA reports, subject to approval by project proponents etc. For Category B project, JICA discloses EIA reports and environmental permit certifications, when these documents are submitted by project proponents etc. (Sec.3/3.2/3.2.1/(1), (2))	No overt requirements of information disclosure, let alone public hearings or comments. GoB passed the Environment Court Act, 2000 (Act No. 11 of 2000) to allow appeals to be made by the public on non-compliance with the ECA (1995) and ECR (1977).	No legal requirements on disclosure of information are present in government laws, while others set clear recommendations/ requirements for information disclosure; significant gaps are identified.
10.	Monitoring Implementation	JICA confirms with project proponents etc. the results of monitoring the items that have significant environmental impacts. This is done in order to confirm that project proponents etc. are undertaking environmental and social considerations for projects that fall under Categories A, B, and FI. The information necessary for monitoring	There is a process of ECC renewal that requires monitoring and assessment. DOE has the responsibility of following up and monitoring ECC conditions. DOE makes the proponent compliance reports available to the public on its website. There are no formal provisions to obtain	No legal requirements on monitoring are present in government laws, while others define monitoring as a part of their assessment activities.

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Features	JICA Guidelines	Government Laws	Gaps
		confirmation by JICA must be supplied by project proponents etc. by appropriate means, including in writing. When necessary, JICA may also conduct its own investigations. JICA discloses the results of monitoring conducted by project proponents etc. on its website to the extent that they are made public in project proponents etc. (3.2.2/1, 2, 7)	independent assessment of EIA reports if found necessary. There is also no formal mechanism or programme at DOE that conducts an independent audit of approved projects. Third-party monitoring is recommended through approved laboratories.	

3.9.2 Gaps between Relevant Regulations in Bangladesh and JICA Guidelines considering Involuntary Resettlement

No.	JICA Guidelines (A)	Acquisition and Requisition of Immovable Property Ordinance-1982	Acquisition and Requisition of Immovable Property Ordinance-2017 (B)	Gaps between (A) and (B)	Project Policy
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	No formal laws, act or ordinance but common practice	No formal laws, act or ordinance but common practice	There is practice but not legally bound	Project shall be planned to avoid involuntary resettlement and loss of means of livelihood as much as possible.
2	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	No formal laws, act or ordinance but common practice; compensation by DC as Cash compensation under law(CCL);50% premium on calculated amount (ARIPO 1982, Part II, section (8(2))	No formal laws, act or ordinance but common practice; compensation by DC as Cash compensation under law(CCL); additional percentage of 200% on calculated amount in government projects (300% premium on calculated amount in private projects) (ARIPO 2017, Part II, section 9(2)) In addition to the compensation, it is also stipulated that necessary action may be taken to rehabilitate the displaced family (ARIPO 2017, Part II, section (9(4))	Minimization of the impact is not stipulated. It might be insufficient in terms of 100% premium on actual market price as replacement value.	Minimization of the impact shall be examined.
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	No legal provision	The amount of compensation for the immovable property shall be paid in consideration thereof In addition to the compensation mentioned in this section, due to the acquisition, necessary action may be taken to rehabilitate	Insufficient compensation, support and practice to restore pre-project living standard and production level.	Compensation and rehabilitation assistance shall be provided to restore pre-project living standard and production level.

No.	JICA Guidelines (A)	Acquisition and Requisition of Immovable Property Ordinance-1982	Acquisition and Requisition of Immovable Property Ordinance-2017 (B)	Gaps between (A) and (B)	Project Policy
			the displaced family. (ARIPO 2017 (9(4)))		
4	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	In addition to the market value of the property as provided in sub-section (1), the Deputy Commissioner shall, in every case award a sum of 50% (fifty per centum) on such market value in consideration of the compulsory nature of the acquisition. (ARIPO 1982, Part II, section 8(2))	In case of acquisition of land for any government requirement, a person belonging to the interest shall be paid an additional percentage of 200 (two hundred) compensation on the market price. (As for a requirement of private company the additional amount will be 300 (300) percent.) (ARIPO 2017 (9(2))) Valuation of structure is made by PWD where depreciation will be considered if the structures are older than ten years. Compensation of trees and is made by market values which is assessed by Forest department and Agricultural Department respectively.	Compensation by ARIPO 2017 might be below the replacement cost.	Compensation to be provided at full replacement cost or 200 % of market price, whichever higher.
5	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	No legal provision	No legal provision	Normally displaced before getting compensation and support	Compensation and other kinds of assistance shall be provided prior to displacement.
6	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	Not such legal bindings in the law	Not such legal bindings in the law	Though no legal provision but practice in donor funded project	RAP will be prepared.

No.	JICA Guidelines (A)	Acquisition and Requisition of Immovable Property Ordinance-1982	Acquisition and Requisition of Immovable Property Ordinance-2017 (B)	Gaps between (A) and (B)	Project Policy
7	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	No such arrangement in the law, even no scope of RAP	No such arrangement in the law, even no scope of RAP	Preparation of RAP is a social reality	Consultations will be held with the affected people and their communities
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	No provision of consultations in the law but there is a practice of consultations in donor project	No provision of consultations in the law but there is a practice of consultations in donor project	In fact when consultations held, it is clearly understandable to the affected in their local language	Explanation in consultation will be made in Bangali language.
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	No provision and guideline in law	No provision and guideline in law	Stakeholders normally remain in dark regarding project formulation, implementation and monitoring issues	Participation of affected people will be promoted through consultation and FGDs.
10	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	There is a scope of arbitration regarding payment related issues for titled owner (ARIPO 1982, Part IV)	There is a scope of arbitration regarding payment related issues for titled owner (ARIPO 2017, Part IV)	This is not easy for common people and doesn't ensure compensation at the rate of full replacement cost, also for non-titled owners do not get any compensation and not get income restoration support	Appropriate and accessible grievance mechanisms will be established.
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to	Whenever it appears to the District Commissioner that any property is needed for any public purpose/interest, he shall cause a notice to be published at convenient places on or near the property (ARIPO 1982, Part II, section 3)	Whenever it appears to the District Commissioner that any property is needed for any public purpose/interest, he shall cause a notice to be published at convenient places on or near the property, before Joint	In Bangladesh law, cut-off-date is declared at DD stage after submission of F/S with Land Acquisition Plan from executing agencies while cut-off-date in JICA Projects is declared at the	Cut-off-date for Project Affected Person eligible for compensation in ARIPO 2017 is declared before Joint Verification Survey at DD stage. Cut-off-date for Project Affected Person not covered by in ARIPO

No.	JICA Guidelines (A)	Acquisition and Requisition of Immovable Property Ordinance-1982	Acquisition and Requisition of Immovable Property Ordinance-2017 (B)	Gaps between (A) and (B)	Project Policy
	take advance of such benefits. (WB OP 4.12 Para. 6)	No provisions of early identification of affected persons, there is act in case of Jamuna Bridge Project (land acquisition) (Compensation Refusal Laws)-1994(Act No-14); for refusal of compensation of fake structure.	Verification Survey (ARIPO 2017, Part II, section 4(1)) Before the issue of the notice, the actual condition and nature of the immovable property proposed for acquisition, the structure and the infrastructure, crops and trees, everything else and videos of the project or other by using any technology, its statement will be prepared (ARIPO 2017, Part II, section 4(3)(a))	commencement of census.	2017 is considered to be the one at the commencement of census.
12	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP 4.12 Para. 15)	The compensation will be paid to the bargadar, a person who cultivate the land of another person (ARIPO 1982, Part II, section 10) though no compensation for non-titled owner and squatter in the law	The compensation will be paid to the bargadar, a person who cultivate the land of another person (ARIPO 2017, Part II, section 12), though no compensation for non-titled occupants and squatter in the law	Vulnerable and squatter are deprived	All non-titleholders (as identified on date of census survey) will also be eligible for resettlement and rehabilitation benefits
13	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP 4.12 Para. 11)	No support in the law	No support in the law though land will be provided under the responsibly of the executing agency in practice	Lack of legal support, but in donor supported project there is example of Resettlement Site (RS) specially for vulnerable homestead loser	Land will be provided under the responsibly of the executing agency.
14	Provide support for the transition period (between displacement and livelihood restoration). (WB OP 4. 12, para.6)	No support in the law	No support in the law	Lack of livelihood restoration support	Transition benefits to be provided to non-titleholders (displaced and livelihoods impacted) who have

No.	JICA Guidelines (A)	Acquisition and Requisition of Immovable Property Ordinance-1982	Acquisition and Requisition of Immovable Property Ordinance-2017 (B)	Gaps between (A) and (B)	Project Policy
					been identified as per census survey
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP 4.12 Para. 8)	No guideline in the line	No guideline in the line	No distinction or priority in Bangladesh's law regarding vulnerability	Special assistance shall be provided to the vulnerable groups.
16	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	No such guideline in the law	No such guideline in the law	Bangladesh law is not clear	RAP will be prepared.

CHAPTER-4 STUDY OF ALTERNATIVE OPTIONS

4.1 PORT SITE SELECTION FACTORS

Identification of a suitable port area is very important for minimizing the plausible adverse impacts on the environment. Four options for the port have been developed. The site selection analysis of the Matarbari Port has been conducted to select and recommend the most preferable site for the new sea port development among the four options. Technical, environmental and economic aspects were considered for the best site selection. Factors which were taken into account includes:

- Minimal hindrance to habitation;
- Avoidance of forest area;
- Avoidance of homestead, schools, graveyard, mosque, church/ temple, cremation yards etc.;
- Avoidance of environmental sensitive areas, historic and archaeological sites as much as possible; and
- Avoidance of areas with high geo-hazard risk.

Apart from the above factors, the following considerations were made during the port area selection process:

Port Area Selection:

The critical and attentive issues for selection of port area are:

- Selection of Port area avoiding the following Ecologically Critical Areas: Human Settlements, Forest Sanctuaries, National Parks, Game Reserves, Mangroves, Forest Areas, Wetlands, Wildlife Habitats, Archaeological Sites, Ancient Monument Sites, Biodiversity Areas and Similar Other Areas.
- Considering and weighing up these issues, the preferred Port Area out of the selected four options is at present under study.

Preference of Non-productive Land:

- The non-productive land as an alternative just near the proposed agriculture land is preferable for environmental soundness.

Analyses of the Alternatives:

- A comparative integrated (technical, social, economical and environmental) analysis has been performed to reach the conclusion which Port Area option with alternatives shall be selected.
- The route alternatives are shown in **Figure-4.1-1**.



Option-1



Option-2



Option-3



Option-04
Figure-4.1-1 Four Options Maps

4.2 COMPARATIVE ANALYSIS

In the Table-4.2-1 and 4.2-2 the comparative analysis are tabulated considering the analysis parameters Current Status of the Options, Technical, Social and Environmental baseline of the options.

Table-4.2-1 Comparative Analysis of Port Area Options including zero Option

Main Causes	Zero Option	Option-1	Option-2	Option-3	Option-4
Concept	Not developing new port	Combination of industrial port and commercial port	Solo development of a commercial port; and Separation of river Flow	Full expansion of the CPGCBL coal port to EZ and BPDB power Plant	Minimum Zero investment and early opening of the port, and Utilization of CPGCBL coal port
Location	N/A	Estuary of Kohalia River	Estuary of Kohalia River	Expansion of the coal port to Dhalghata	Adjacent to the coal port
Initial Investment	None	Large investment in breakwaters and channel dredging		Medium investment in expansion of channel	Smaller than other plans
Channel Maintenance	None	Largest	Large	Large	Medium/Small
Port Capacity	0	0	Small	Large	Small
Residence	0	Large initial investment Relatively near to Sonaida and Mangrove forest	Large initial investment Large dredging having negative environmental impact Resettlement of Residents River port, same as Chittagong Port	Large Number of relocation of residents	Resettlement of residents is the minimum.

Table-4.2-2 Comparative Analysis of Port Area Options

Analyses Parameter	Option-1	Option-2	Option-3	Option-4
Current status of Options	1. Agricultural Area*: a. significant <input checked="" type="radio"/> insignificant c. Zero Hectare 2. Fisheries Area: a. significant <input checked="" type="radio"/> insignificant 3. Homestead Area: a. significant <input checked="" type="radio"/> insignificant c. Zero Hectare 4. River Encroachment if any: a. significant <input checked="" type="radio"/> insignificant c. Nil	1. Agricultural Area*: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. 96.11 Hectares 2. Fisheries Area: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. 96.11 Hectares 3. Homestead Area: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. Zero Hectares 4. River Encroachment if any: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. Nil	1. Agricultural Area*: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. 455.6 Hectares 2. Fisheries Area: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. 455.60 Hectares 3. Homestead Area: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. 31.22 Hectares 4. River Encroachment if any: a. significant <input checked="" type="radio"/> insignificant b. insignificant	1. Agricultural Area*: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. 30.73 Hectares 2. Fisheries Area: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. 30.734 Hectares 3. Homestead Area: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. Zero Hectares 4. River Encroachment if any: a. significant <input checked="" type="radio"/> insignificant b. insignificant c. Nil
Technical	1. Port Area: 339.83 Hectares 2. Port Construction Activities: a. easy <input checked="" type="radio"/> difficult c. moderate 3. Accessibility (Access to the Port for construction work): a. easy <input checked="" type="radio"/> difficult c. moderate 4. Soil Condition of the Port: a. Good b. Bad <input checked="" type="radio"/> Moderate	1. Port Area: 866.81 Hectares 2. Port Construction Activities: a. easy <input checked="" type="radio"/> difficult c. moderate 3. Accessibility (Access to the Port for construction work): a. easy <input checked="" type="radio"/> difficult c. moderate 4. Soil Condition of the Port: a. Good b. Bad <input checked="" type="radio"/> Moderate	1. Port Area: 687.922 Hectares 2. Port Construction Activities: a. easy b. difficult <input checked="" type="radio"/> moderate 3. Accessibility (Access to the Port for construction work): a. easy b. difficult <input checked="" type="radio"/> moderate 4. Soil Condition of the Port: a. Good b. Bad <input checked="" type="radio"/> Moderate	1. Port Area: 30.734 Hectares 2. Port Construction Activities: a. easy <input checked="" type="radio"/> difficult c. moderate 3. Accessibility (Access to the Port for construction work): a. easy b. difficult <input checked="" type="radio"/> moderate 4. Soil Condition of the Port: a. Good b. Bad <input checked="" type="radio"/> Moderate

Analyses Parameter	Option-1	Option-2	Option-3	Option-4
Social	<p>A.</p> <p>1. Does the Port Require Land Acquisition? (√Yes/No)</p> <p>If yes: Area: 339.83Hectares</p> <p>If yes, how many family/people will be displaced: Nil</p> <p>2. Has the Land Owner become landless due to Port land acquisition? (Yes/√No.)</p> <p>If yes, note the no.:</p> <p>3. Does Compensation include actual and “Top-up”? : (√Yes/No.)</p> <p>B.</p> <p>1. Land Cost: 3357.52 Million (BDT)</p> <p>2. Land Income: Officially at present no income</p> <p>3. Owner: Woman/Widow/Disabled (gender issue would be taken into special consideration):</p> <p>4. Does the project require? (Please Tick) Relocation/Loss of shelter/ Loss of asset/Loss of income sources (e.g., shops, agricultural, small industry, large scale industry, water body etc.) Not Applicable</p> <p>5. Does the project affect? (Please Tick) Indigenous people/Indigenous Ethnic Minorities/ Tribal groups/ Others vulnerable groups/ individuals/ Poorest and Landless community/ Disaster Prone</p>	<p>A.</p> <p>1. Does the Port Require Land Acquisition? (√Yes/No)</p> <p>If yes: Area: 866.81Hectares</p> <p>If yes, how many family/people will be displaced: Nil</p> <p>2. Has the Land Owner become landless due to Port land acquisition? (Yes/√No.)</p> <p>If yes, note the no.:</p> <p>3. Does Compensation include actual and “Top-up”? : (√Yes/No.)</p> <p>B.</p> <p>1. Land Cost: 8564.083Million (BDT)</p> <p>2. Land Income: 0.75million BDT/Hectare/Year</p> <p>3. Owner: Woman/Widow/Disabled (gender issue would be taken into special consideration)</p> <p>4. Does the project require? (Please Tick) Relocation/Loss of shelter/ Loss of asset/Loss of income sources (e.g., shops, agricultural, small industry, large scale industry, water body etc.) Not Applicable</p> <p>5. Does the project affect? (Please Tick) Indigenous people/Indigenous Ethnic Minorities/ Tribal groups/ Others vulnerable groups/ individuals/ Poorest</p>	<p>A.</p> <p>1. Does the Port Require Land Acquisition? (√Yes/No)</p> <p>If yes: Area: 687.922Hectares</p> <p>If yes, how many family/people will be displaced: 9091nos.</p> <p>2. Has the Land Owner become landless due to Port land acquisition? (√Yes/No.)</p> <p>If yes, note the no.: need to assess during the feasibility study.</p> <p>3. Does Compensation include actual and “Top-up”? : (√Yes/No.)</p> <p>B.</p> <p>1. Land Cost: 6796.669 Million (BDT)</p> <p>2. Land Income: 0.75million BDT/Hectare/Year</p> <p>3. Owner: Woman/Widow/Disabled (gender issue would be taken into special consideration)</p> <p>4. Does the project require? (Please Tick) √Relocation/Loss of shelter/ Loss of asset/Loss of income sources (e.g., shops, agricultural, small industry, large scale industry, water body etc.)</p> <p>5. Does the project affect? (Please Tick) Indigenous people/Indigenous Ethnic Minorities/ Tribal groups/ Others vulnerable groups/ individuals/ √Poorest and Landless community/</p>	<p>A.</p> <p>1. Does the Port Require Land Acquisition? (√Yes/No)</p> <p>If yes: Area: 30.734Hectares</p> <p>If yes, how many family/people will be displaced: Nil</p> <p>2. Has the Land Owner become landless due to Port land acquisition? (Yes/√No.)</p> <p>If yes, note the no.:</p> <p>3. Does Compensation include actual and “Top-up”? : (Yes/No.)</p> <p>B.</p> <p>1. Land Cost:303.6519 Million (BDT)</p> <p>2. Land Income: 0.75million BDT/Hectare/Year</p> <p>3. Owner: Woman/Widow/Disabled (gender issue would be taken into special consideration)</p> <p>4. Does the project require? (Please Tick) Relocation/Loss of shelter/ Loss of asset/ Loss of income sources (e.g., shops, agricultural, small industry, large scale industry, water body etc.) Not Applicable</p> <p>5. Does the project affect? (Please Tick) Indigenous people/Indigenous Ethnic Minorities/ Tribal groups/ Others vulnerable groups/ individuals/ Poorest and Landless community/</p>

Analyses Parameter	Option-1	Option-2	Option-3	Option-4
	areas (Char, Embankment, Coastal) Not Applicable If yes provide number of indigenous people/ ethnic community/Poorest and Landless covered..... 6. Does the project affect cultural property? (Please Tick) Graveyard/ Mosque/ Temple/ Pagoda/ Girja/ Archeological/ Paleontological/ Historic/ Others Not Applicable	and Landless community/ Disaster Prone areas (Char, Embankment, Coastal) Not Applicable If yes provide number of indigenous people/ ethnic community/Poorest and Landless covered..... 6. Does the project affect cultural property? (Please Tick) Graveyard/ Mosque/ Temple/ Pagoda/ Girja/ Archeological/ Paleontological/ Historic/ Others Not Applicable	Disaster Prone areas (Char, Embankment, Coastal) Applicable If yes provide number of indigenous people/ ethnic community/Poorest and Landless covered 6. Does the project affect cultural property? (Please Tick) Graveyard/ Mosque/ Temple/ Pagoda/ Girja/ Archeological/ Paleontological/ Historic/ Others Not Applicable	Disaster Prone areas (Char, Embankment, Coastal) Not Applicable If yes provide number of indigenous people/ ethnic community/Poorest and Landless covered..... 6. Does the project affect cultural property? (Please Tick) Graveyard/ Mosque/ Temple/ Pagoda/ Girja/ Archeological/ Paleontological/ Historic/ Others Not Applicable
Environmental	1. Loss of productive land: Yes/√ No If Yes: Area:.....Hectare 2. Loss of Agri. Yields: Yes/√ No If Yes: Area:.....Hectare 3. Increase of Agri. Yields: Yes/√ No If Yes: Area:.....Hectare 4. Effect on national food production: Yes/√ No If Yes: Amount :.....MT 5. Cumulative and long-term effect: a. significant <input checked="" type="radio"/> insignificant 6. Fish-yielding Capacity: a. significant <input checked="" type="radio"/> insignificant 7. Loss of Forest: √ Yes /No If Yes: Area:93.486Hectare	1. Loss of productive land: √ Yes /No If Yes: Area: 96.11Hectare 2. Loss of Agri. Yields: √ Yes /No If Yes: Area: 96.11Hectare 3. Increase of Agri. Yields: Yes/√ No If Yes: Area:.....Hectare 4. Effect on national food production: Yes/√ No If Yes: Amount :.....MT 5. Cumulative and long-term effect: a. significant <input checked="" type="radio"/> insignificant 6. Fish-yielding Capacity: a. significant <input checked="" type="radio"/> insignificant 7. Loss of Forest: √ Yes /No If Yes: Area: 149.05Hectare	1. Loss of productive land: √ Yes /No If Yes: Area: 455.60Hectare 2. Loss of Agri. Yields: √ Yes /No If Yes: Area: 455.60Hectare 3. Increase of Agri. Yields: Yes/√ No If Yes: Area:.....Hectare 4. Effect on national food production: Yes/√ No If Yes: Amount :.....MT 5. Cumulative and long-term effect: a. significant <input checked="" type="radio"/> insignificant 6. Fish-yielding Capacity: a. significant <input checked="" type="radio"/> insignificant 7. Loss of Forest: √ Yes /No If Yes: Area:43.098Hectare	1. Loss of productive land: √ Yes /No If Yes: Area: 30.734 Hectare 2. Loss of Agri. Yields: √ Yes /No If Yes: Area: 30.734Hectare 3. Increase of Agri. Yields: Yes/√ No If Yes: Area:.....Hectare 4. Effect on national food production: Yes/√ No If Yes: Amount :.....MT 5. Cumulative and long-term effect: a. significant <input checked="" type="radio"/> insignificant 6. Fish-yielding Capacity: a. significant <input checked="" type="radio"/> insignificant 7. Loss of Forest: Yes/√ No If Yes: Area:.....Hectare

Analyses Parameter	Option-1	Option-2	Option-3	Option-4
	<p><input checked="" type="radio"/> a. significant b. insignificant</p> <p>8. Loss of indigenous species:</p> <p><input checked="" type="radio"/> a. significant b. insignificant</p> <p>9. Loss of Biodiversity:</p> <p>a. significant b. insignificant</p>	<p><input checked="" type="radio"/> a. significant b. insignificant</p> <p>8. Loss of indigenous species:</p> <p><input checked="" type="radio"/> a. significant b. insignificant</p> <p>9. Loss of Biodiversity:</p> <p><input checked="" type="radio"/> a. significant b. insignificant</p>	<p><input checked="" type="radio"/> a. significant b. insignificant</p> <p>8. Loss of indigenous species:</p> <p><input checked="" type="radio"/> a. significant b. insignificant</p> <p>9. Loss of Biodiversity:</p> <p><input checked="" type="radio"/> a. significant b. insignificant</p>	<p>a. significant b. insignificant</p> <p>8. Loss of indigenous species:</p> <p>a. significant <input checked="" type="radio"/> b. insignificant</p> <p>9. Loss of Biodiversity:</p> <p>a. significant <input checked="" type="radio"/> b. insignificant</p>

N.B.: 1. Circle mark is the options choice * Agricultural area includes the Salt cultivation and Shrimp Culture on the same land for six months duration of sharing in each year.

4.3 SELECTION OF BEST OPTION

In a nutshell the **Option-04** has been selected as the best option comparing the other options because of the following characteristics:

- ⇒ Land acquisition would be minimum
- ⇒ Insignificant homestead area i.e. almost zero settlement would be in the selected option
- ⇒ No river encroachment is required for this selected option
- ⇒ Port construction activities would be much easier
- ⇒ A moderate accessibility to the site through onshore and offshore would be possible
- ⇒ Soil condition seems moderate for construction work
- ⇒ There would be minimum chances of having landless people in the selected option
- ⇒ Land development cost would be minimum comparing the land acquisition and construction accessibility consideration of the port
- ⇒ No relocation/resettlement would be needed for the selected option
- ⇒ No indigenous people will be affected by the selected port option
- ⇒ No cultural property will be affected by the selected port option
- ⇒ Loss of productive land will be minimum and will not impacted the national economy
- ⇒ Cumulative and long-term effect seems to be insignificant
- ⇒ Effect on Fish yielding capacity would be insignificant
- ⇒ No forest area would be affected due to the selected port option
- ⇒ Loss of indigenous species would be insignificant
- ⇒ Loss of biodiversity would be insignificant

CHAPTER-5 ENVIRONMENTAL AND SOCIAL BASELINE

5.1 INTRODUCTION

The environmental and social baseline description has been prepared using both primary and secondary data collected for the study area defined 10 km buffer areas from the proposed Matarbari Port Project area. The baseline condition has been delineated in respect of physical environment (e.g. including meteorological, hydrological, morphological components and processes), land resources (e.g., including land use pattern and soil quality), biological environment (e.g., including flora, fauna, fisheries resources and other ecosystems goods and services), socio-economic condition (e.g., including livelihood patterns, historical, cultural and archaeological sites, economic status, etc.) and hazardous events of the study area.

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; and
- To provide a baseline against which environmental conditions can be measured throughout the Project lifetime.

The proposed Matarbari Port Project is confined within the Dhalghata Union of Moheshkhali Upazila of Cox's Bazaar District. The Port will cover the Dhalghata mouza of Dhalghata union. Figure-5.1-1 shows the location of the port area.

Table-5.1-1 Project Location

District	Upazila	Unions	Mouza	Port Area
Cox's Bazar	Moheshkhali	Dhalghata	Dhalghata	75 ha

5.2 OBJECTIVES AND METHODOLOGY

The primary objective of the environmental and social baseline condition study is to provide an environmental and social baseline against which potential impacts from the operation of Matarbari Port area can be compared. The geographical boundary of the "Project Area" and the Potential "Impact Area" is delineated as a requirement of the environment assessment study. The "Project Area" is the physical location of the proposed Matarbari Port area while the "Impact Area" covers the geographical extent of the environmental and socioeconomic impacts resulting from implementation of the proposed port infrastructures during pre-construction, construction and post-construction periods. It is recognized that the benefits of the proposed port will extend to the national scale. However, the focus of the EIA study of the proposed Matarbari Port area will be limited to the area where the physical impacts of the activity will be directly felt.

The methodology adopted for collecting the baseline data was as follows:

- Study area of 10 km radial zone from the centre of the Matarbari Port area location was selected for the baseline studies.
- Primary data collection was through environmental monitoring and field survey for water, air and noise.
- Social baseline of the study area was captured through social surveys involving field consultations, interviews, meeting with stakeholders, discussions with government departments and secondary data review etc.

- Secondary data was collected from government reports, academic institutes, websites, published literature, interactions with government department and stakeholders etc.

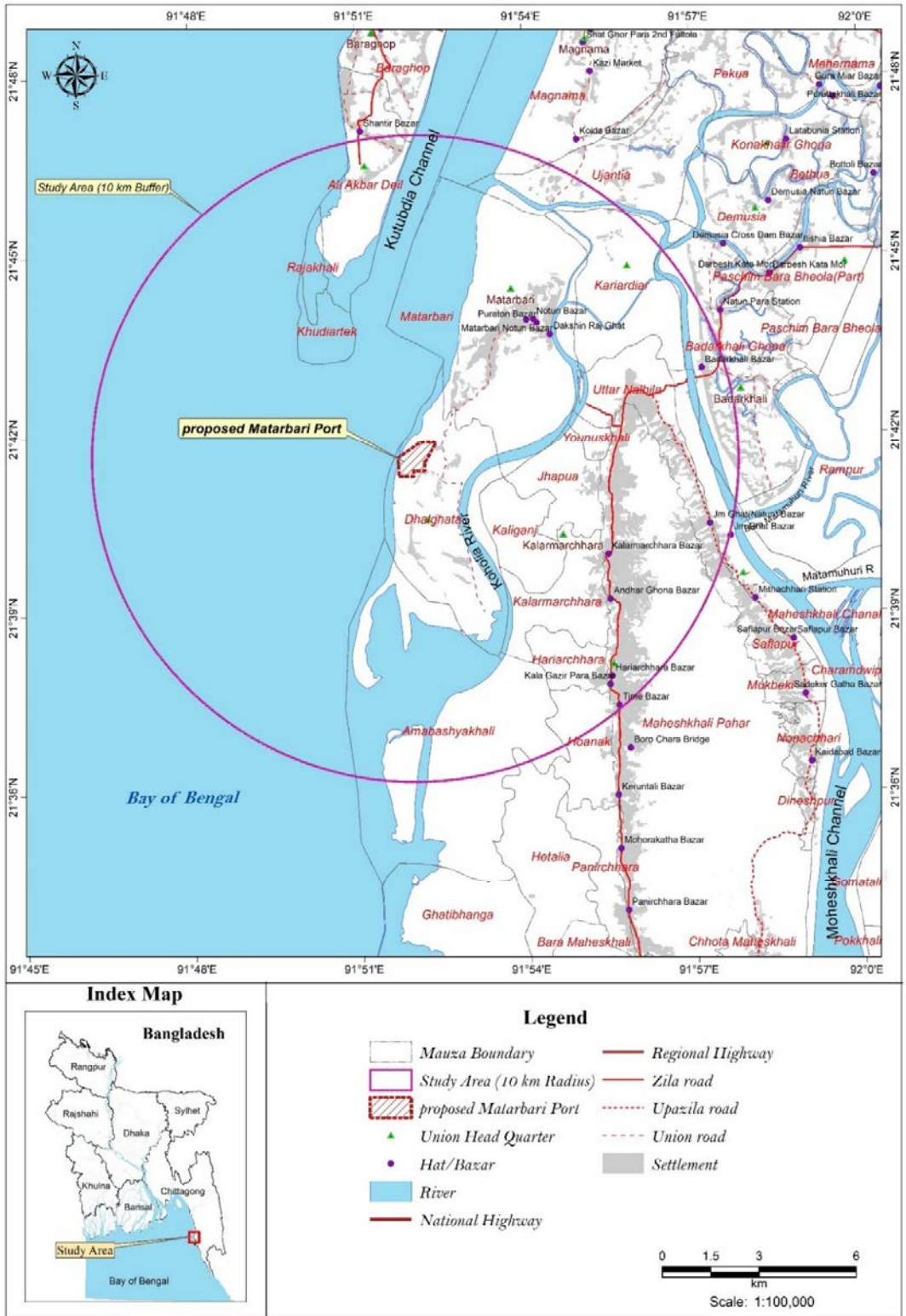


Figure-5.1-1: Location of the port area

5.3 PHYSICAL ENVIRONMENT

5.3.1 Landscape and Topography

An overview of the land use and land cover pattern has been prepared based on the satellite images and presented using Geographical Information System (GIS). The total land of the study area is 31,415 hectares. The land cover of the study area is derived from multi-spectral colour Rapid Eye satellite images. The major classes extracted from the images are as follows: agricultural land, char land/sandbars, forest, industrial area, road, rural settlement with homestead vegetation, built-up area and water bodies. **Figure 5.3-1** shows the detailed general land use map of the study area.

The study area is mostly surrounded by Salt Pan (7,065 ha, which is 22.5% of the total area) followed by rural settlement with homestead vegetation of 6.2% and agricultural land of 6%. The detail area coverage of each class and sub class is given in the **Table-5.3-1**.

Table 5.3-1: Land Covers Classification

Major Class	Sub-Class	Area (ha)	(%)
Agricultural Land	Salt Pan	7065.0	22.5
	Aman	158.6	0.5
	Aman and Boro	1679.2	5.3
	Boro and Rabi	51.2	0.2
	Other Crop	364.3	1.2
Settlement	Rural Settlement with Homestead Vegetation	1953.4	6.2
Forest Land	Forest/Plantation	499.0	1.6
	Herb-Shurb with Scattered Trees	361.1	1.1
	Mangrove	1013.0	3.2
	Jhaw Plantation	7.7	0.0
Water Bodies	Pond	32.1	0.1
	Khal	260.4	0.8
	Pond	149.49	0.5
	River / Sea	17156.0	54.6
Other Land Uses	Inter Tidal Area	665.0	2.1
Total		31415.8	100.0

Source: Satellite image analysis

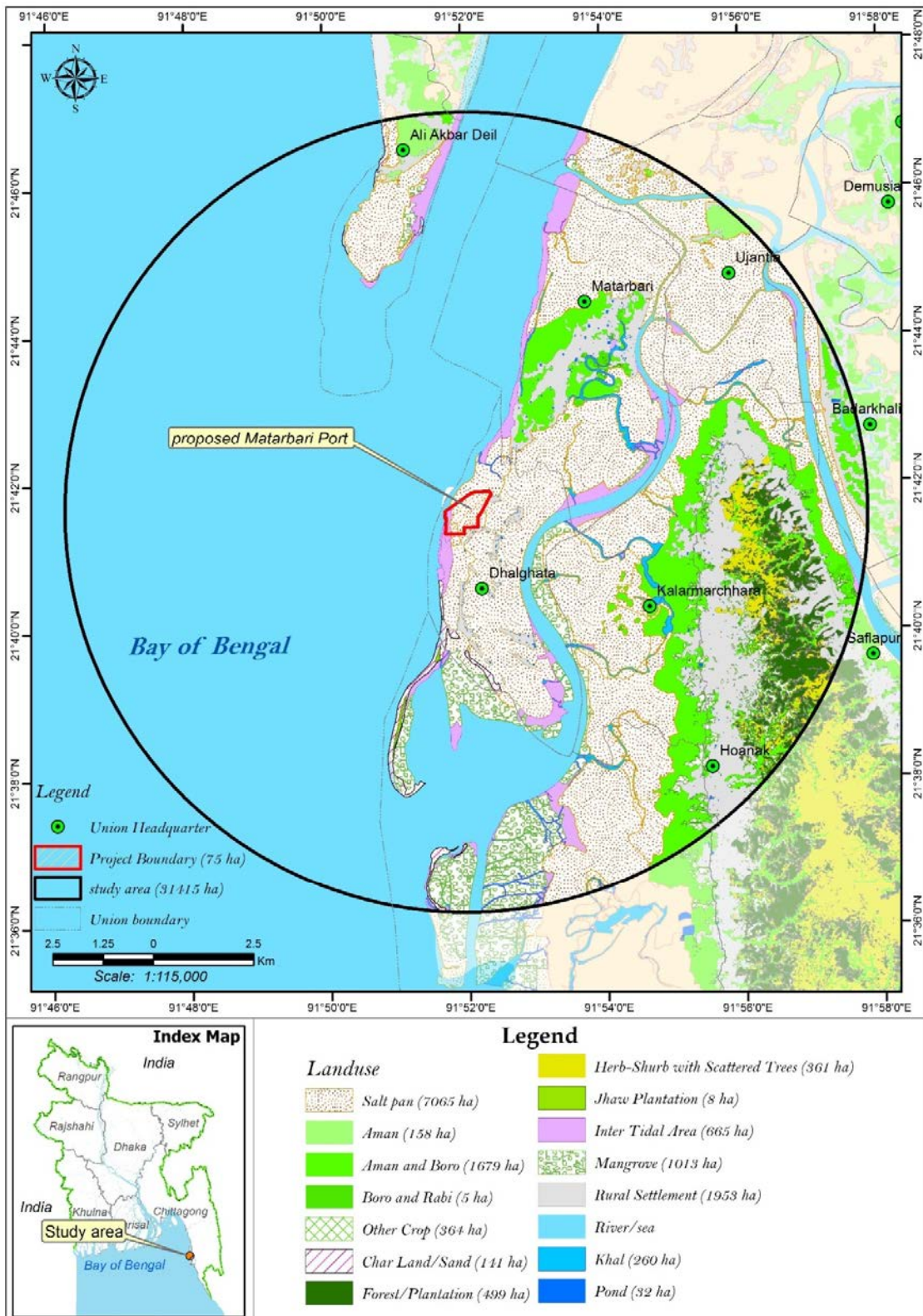


Figure 5.3-1: General Land Use Map

The proposed Port Project is located at the Cox's Bazar coastal area where the land is gently sloped towards the sea. From digital elevation model (DEM) analysis it is found that the Project area is located over a land which is 2.5m to 3.0m PWD (Figure-5.3-2). Land elevation increases towards the hills and decreases towards the Bay of Bengal. Most of the communities reside near the foot hill areas occupied by crop cultivable land to the lower areas. The shrimp farm or salt farms of this area are regularly flooded by tidal water entering through the sluice gates. The slope of the western part of the proposed Project site is very mild towards the sea.

5.3.2 Climate and Meteorology

5.3.2.1 Background

In order to investigate the climatic condition of the project study area different meteorological parameters have been collected from multiple secondary sources. The proposed port area falls under tropical climate. Basically this region has a distinct monsoonal season which influences all other climatic parameters. Figure-5.3-2 shows the location of the study area in the climatic sub-regions of Bangladesh.

The ambient mean temperature of the study area is found as 19°C-20°C in winter and 27°C-28°C in summer. On the other hand, the annual average rainfall in this region varies from 2500 mm – 3000 mm, which is relatively higher than the western areas of the county. Southwest monsoon occurs in this region from June till September; during this period heavy rainfall takes place for which the project area experiences tidal and coastal flood.

Besides, tropical storms i.e. Kalbaishakhi and cyclone occur during summer in the month from April to June and then from September to December. These cyclones occur almost every year in the Chittagong coastal areas with varied intensity and magnitude.

The study area falls in the South-Eastern climatic zone of Bangladesh. Meteorological data for the last thirty years was collected from the nearest BMD stations in Kutubdia (BMD Station ID: 11925) which is analyzed to get the overall micro-climatic conditions of the study area. Figure-5.3-3 shows the nearby meteorological station of the project area. Summary of the analysis of climatic parameters is given in the following sections.

5.3.2.2 Temperature

Ambient temperature of Kutubdia Station is recorded for this project study Area (Figure-5.3-3). Data of last 23 years (1991-2013) shows that the monthly maximum temperature varies from 29.7°C to 34.9°C and May is the warmest month in pre-monsoon period. The monthly minimum temperature varies within a range of 11.7°C to 23.7°C and January is the coldest month. The highest recorded maximum temperature during last 23 years is 34.9°C occurred in May, 1994 and the lowest ever recorded minimum temperature was in January, 1994. The monthly maximum and minimum temperature of last 23 years (1991-2013) are given in Figure-5.3-4. Figure-5.3-5 shows the trend of annual maximum and minimum temperature at Kutubdia.

5.3.2.3 Humidity

Humidity is directly related with temperature fluctuation of a region. The atmosphere of coastal zone is always enriched with humidity because of high evaporation over the sea surface. Kutubdia BMD Station has been selected in order to delineate the situation of humidity of the study area. The monthly

average relative humidity near the Kutubdia station varies seasonally from 76% to 89%. Monsoon period (June to September) is the most humid month while during winter season i.e. December to February it remains lower. Figure-5.3-6 shows monthly maximum, minimum and average humidity of last 28 years (1985 to 2013) of Kutubdia station.

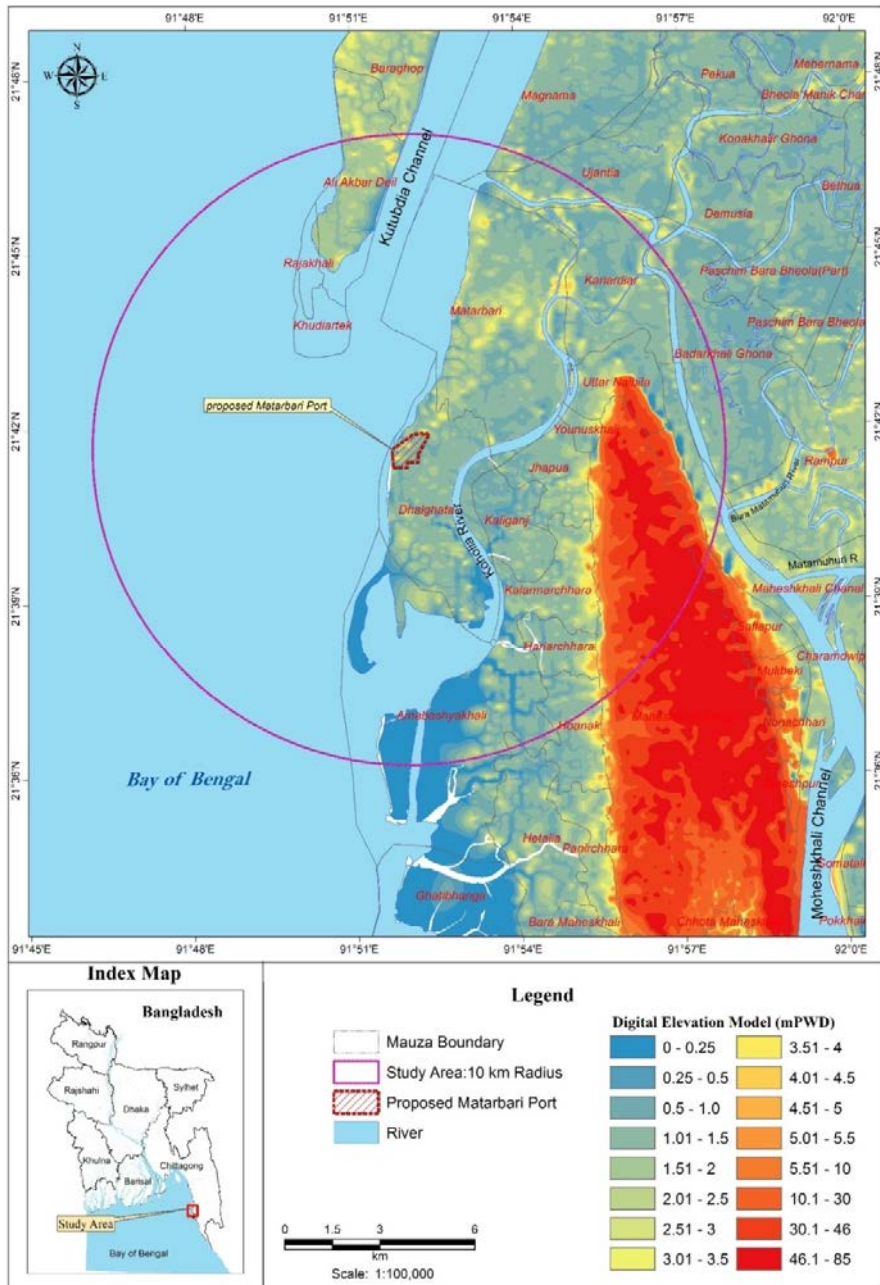


Figure-5.3-2 Digital Elevation Model of the Project Area

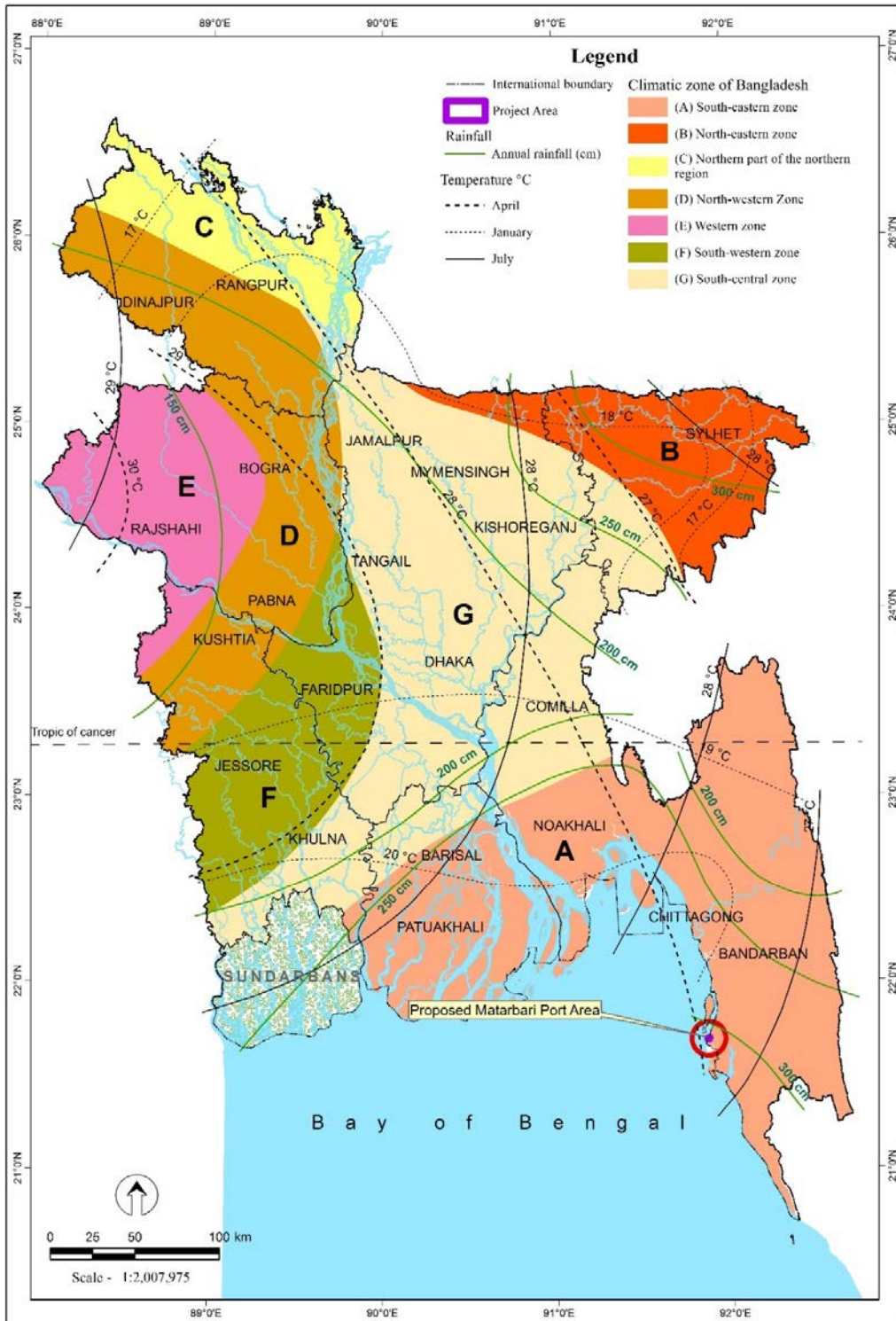


Figure-5.3-3 Study area in the climatic sub-regions of Bangladesh



Figure-5.3-4 Locations of Nearby Meteorological Stations

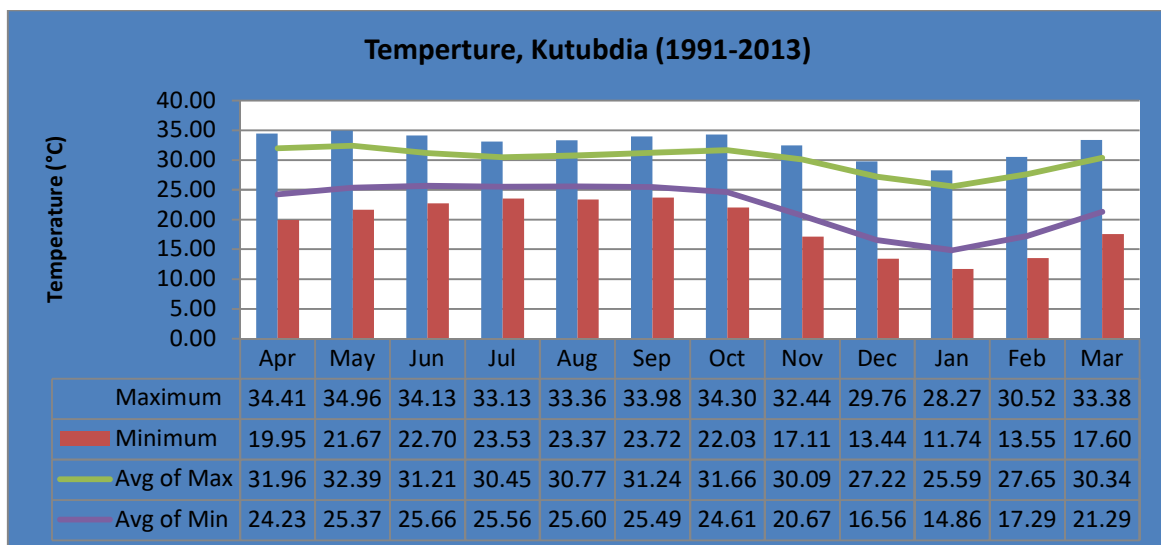


Figure-5.3-5 Monthly maximum and minimum Temperatures (Source: BMD 2013)

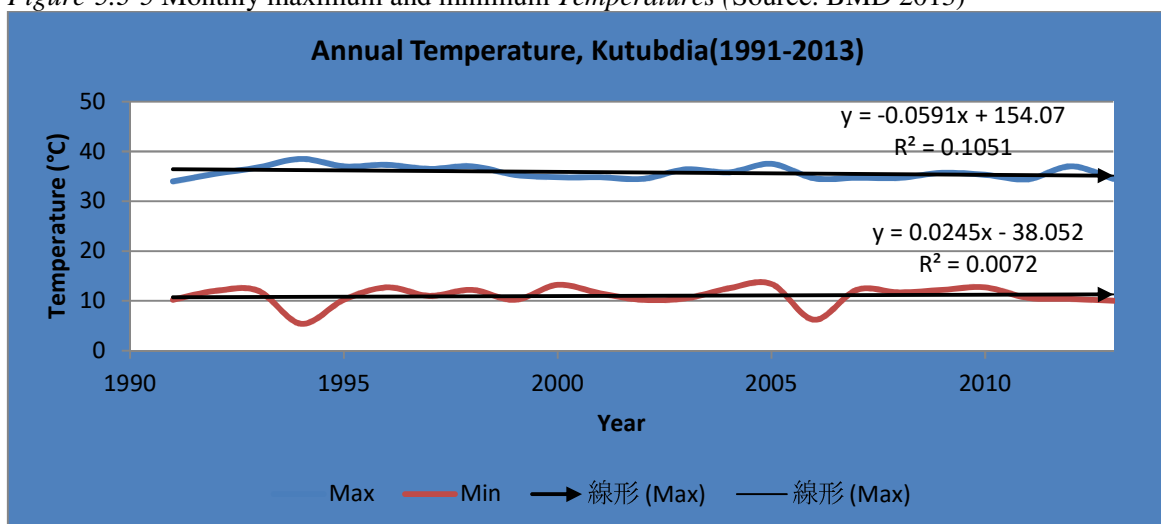


Figure-5.3-6 Trend of annual maximum and minimum Temperature (Source: BMD 2013)

5.3.2.4 Rainfall

The last 35 years data of Kutubdia BMD station (Station ID: 11925) shows that the annual average rainfall is recorded as 2824.2 mm/yr, according to the data analyzed (Figure 5.3-6) monthly average maximum rainfall occurred in July (approximately 763.7mm/month) and monthly average minimum rainfall occurred in winter season (December to February) which indicates that the rainy season is very prominent in this region. The ever maximum daily rainfall recorded is 422mm in the 16th July 1998 and ever maximum annual rainfall was recorded as 4587mm in the year of 1998. It is also observed that, the annual rainfall in this area is gradually decreasing at a rate of 10.8 mm/year. Average monthly rainfall of thirty years is presented by a graph in Figure 5.3-7 and Figure 5.3-8 which shows that the Monsoon period (June to September) has maximum rainfall of the year. On the contrary, December to February shows negligible amount of rainfall. For this analysis time series rainfall data of Kutubdia station (BMD station ID: 11925) has been used. Figure-5.3.9 shows the Rainfall Map of the study Area.

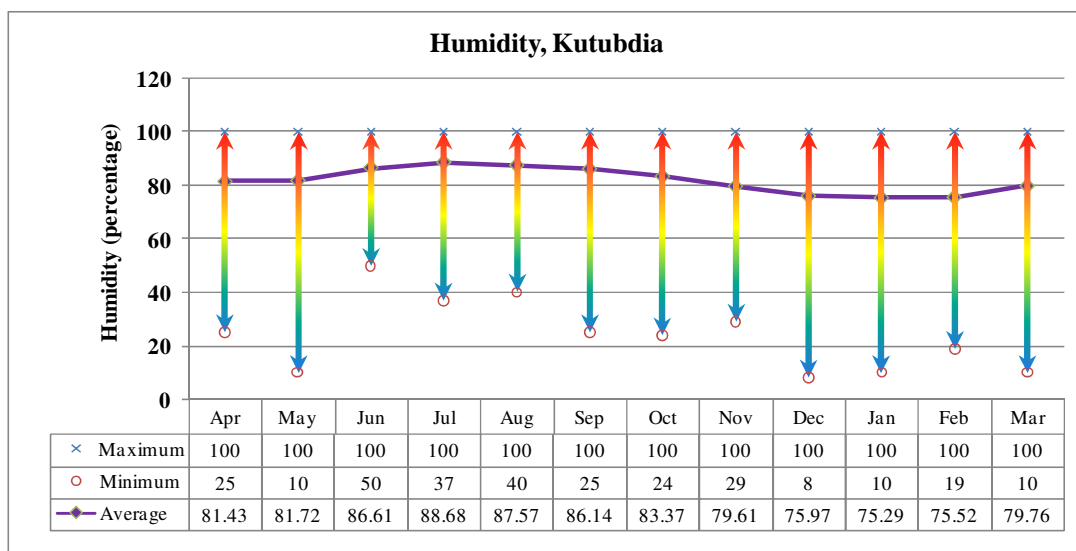


Figure-5.3-7 Average of monthly maximum and minimum humidity (1985-2013)

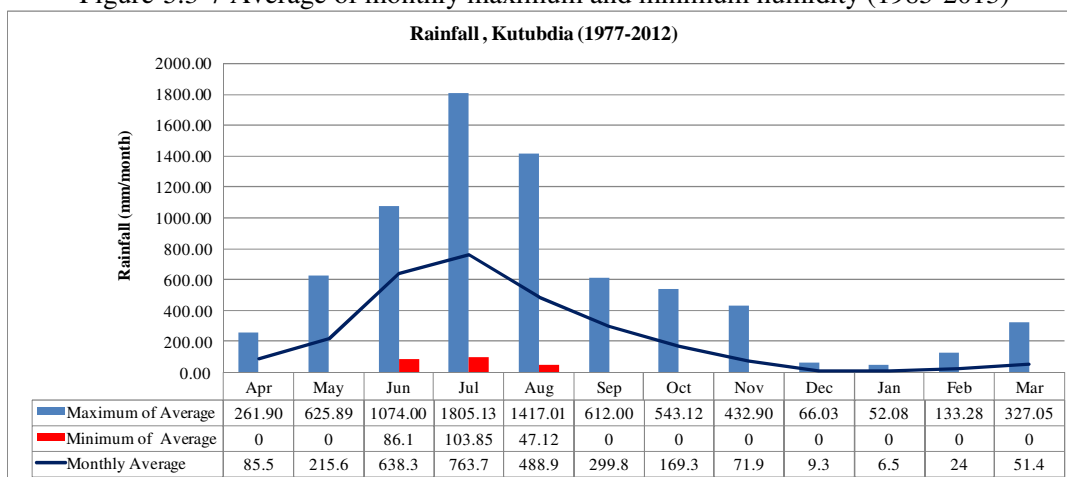


Figure-5.3-8: Average monthly maximum and minimum Rainfall (1977-2012)

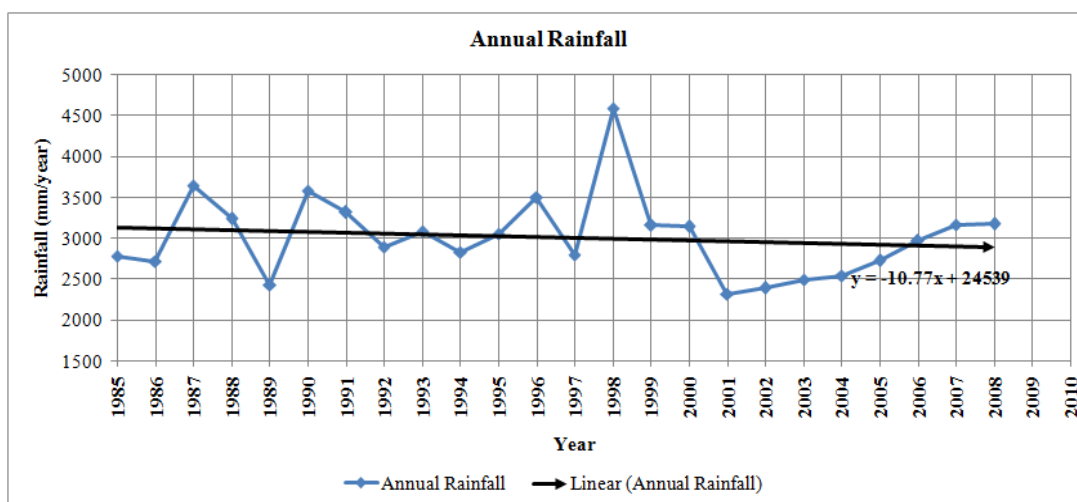


Figure-5.3-9: Trend of annual maximum and minimum Rainfall

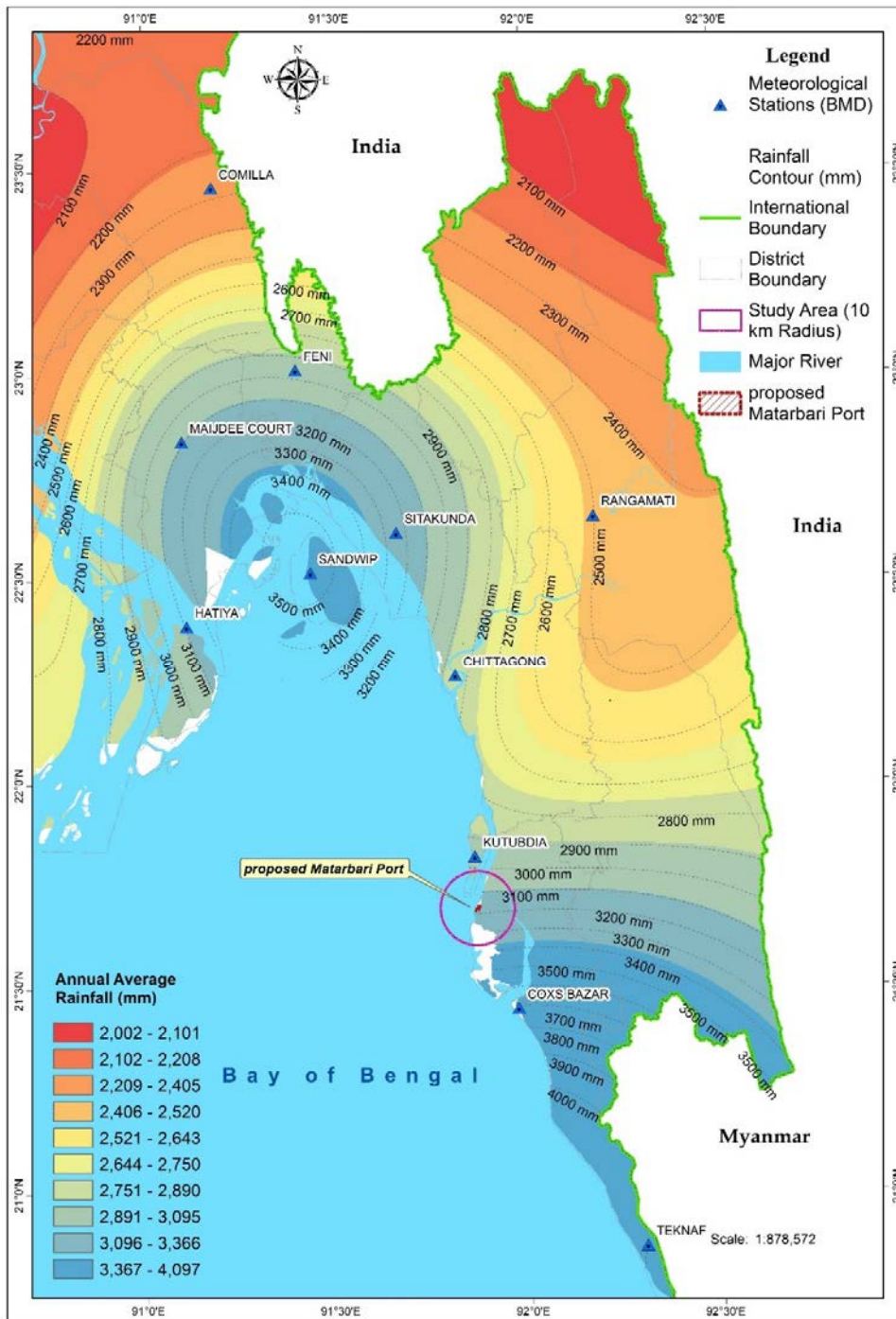


Figure-5.3-10 Rainfall map of the Project Area

5.3.2.5 Sunshine Hour

Sunshine hour is a climatological indicator, measuring the duration of sunshine for a given location and period which indicates the total energy delivered by sunlight. In order to investigate the sunshine hour over the study area, sunshine hour records (1985-2013) of Kutubdia BMD station has been

analyzed. The monthly average sunshine hour in Kutubdia varies from 4:00 to 8:30 hour/day in a year. The monthly highest sunshine hours occur in July i.e. 13:00 hour/day when the average daily sunshine is only 4 hours. Except monsoon the average of daily sunshine retain around 8 hours due to dearth of cloud coverage. Length of the sunshine hour reduces during winter season. Figure-5.3-11 shows the daily sunshine hour condition of the study area in different months.

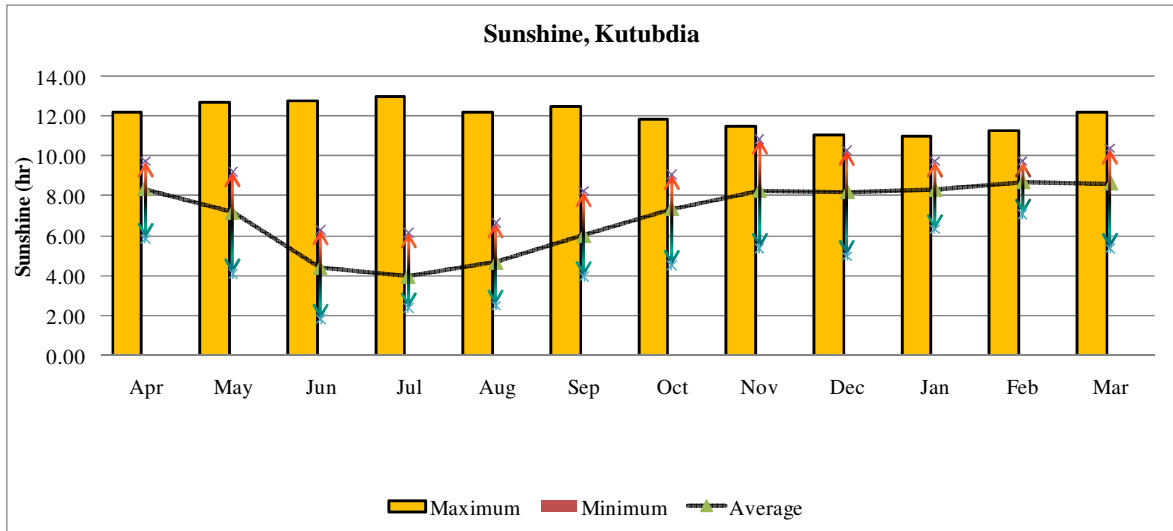


Figure-5.3-11: Sunshine hour condition of the study area (BMD, 1985-2013)

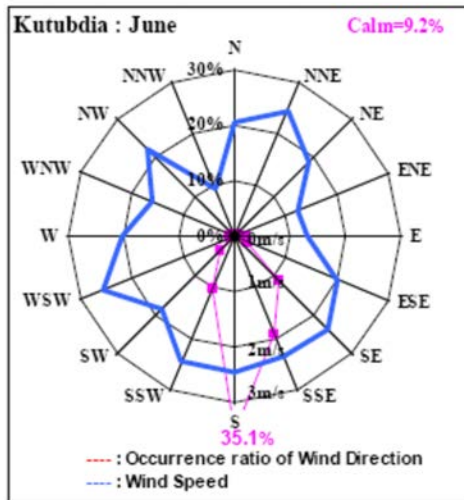
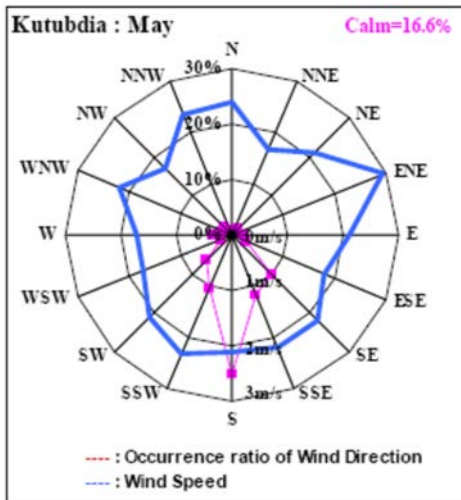
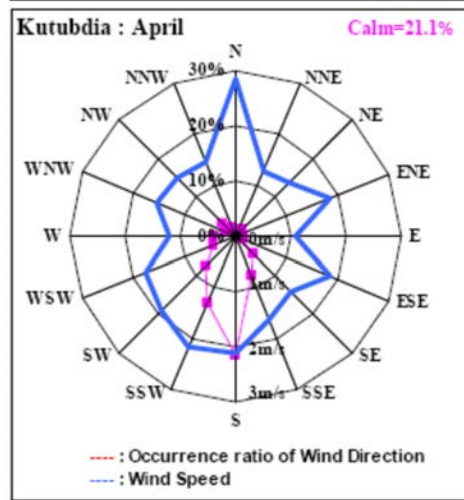
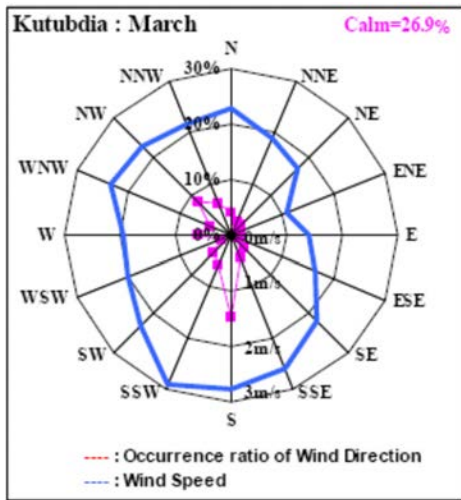
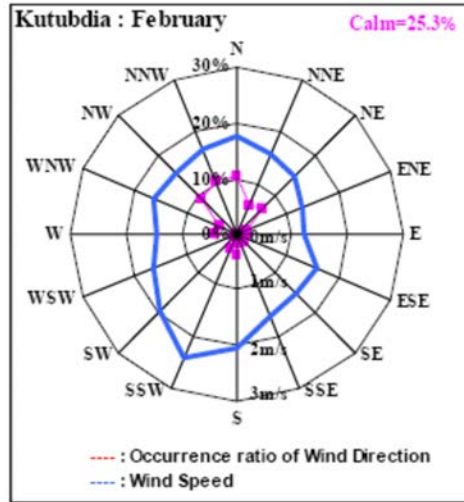
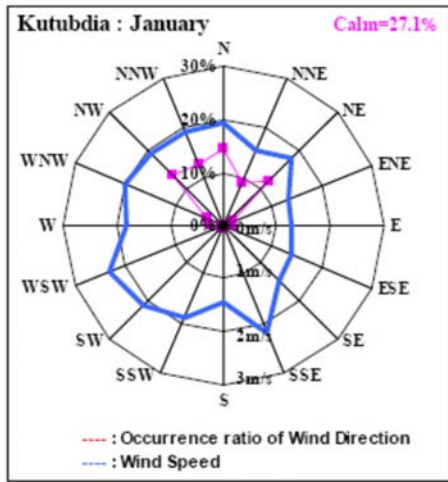
5.3.2.6 Wind Speed and Direction

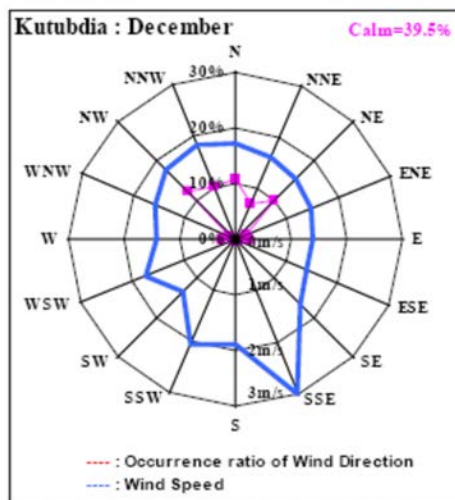
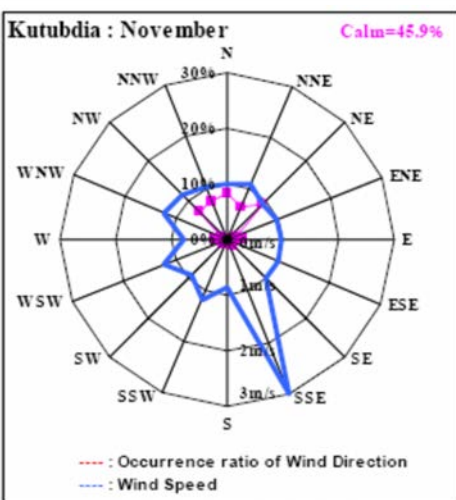
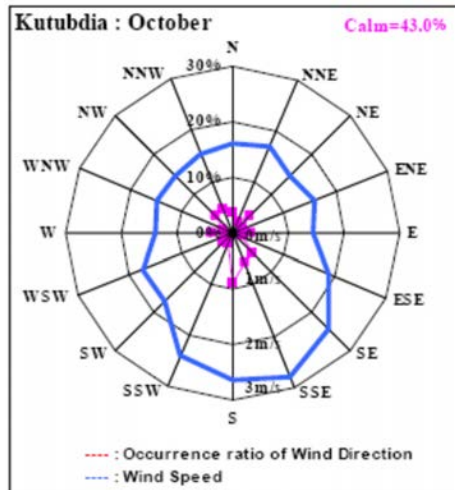
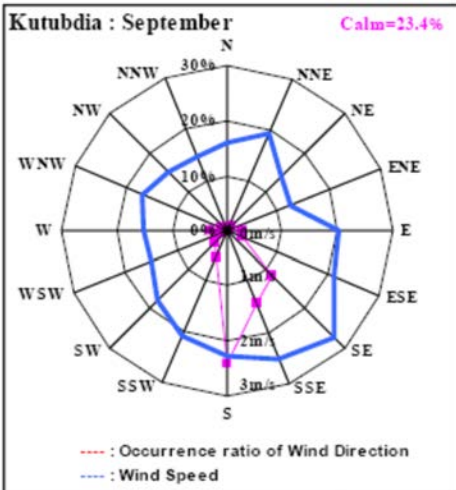
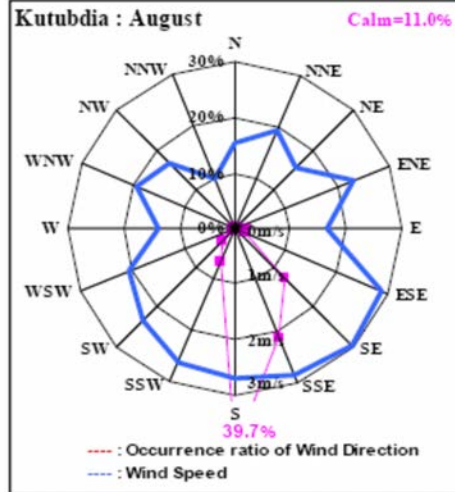
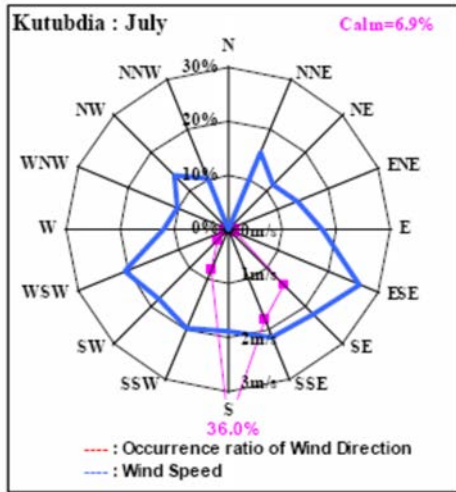
The tropic of cancer passes through the central part of Bangladesh. Therefore, the south-eastern hilly region of Bangladesh lies in the tropical atmosphere. The climate of Bangladesh is governed by monsoon wind which possesses reverse direction in specific seasons.

The study area is influenced by the interaction of sea breeze and hilly topography. Wind flow and direction is not only important for atmospheric status but also for oceanic tides, waves and currents.

Figure-5.3-12 shows wind speed, direction and duration of wind blowing in the study area. From the wind rose diagram, it can be comprehended that maximum wind is directed from south to north of the project site. The data has been collected for full one year of 2014. About 11% of the total wind flows over the study area which is remarked as calm wind (i.e. speed <1 m/s). The study area is dominated with the wind speed between 4-6m/s. Similarly, type of wind has been experienced i.e. passing toward north-western away during field investigation.

It is observed that the proposed project site is highly windy. Wind data of Kutubdia station has been sorted out to represent the highest wind speed, wind direction and duration of wind flow of this area (Table-5.3-2).





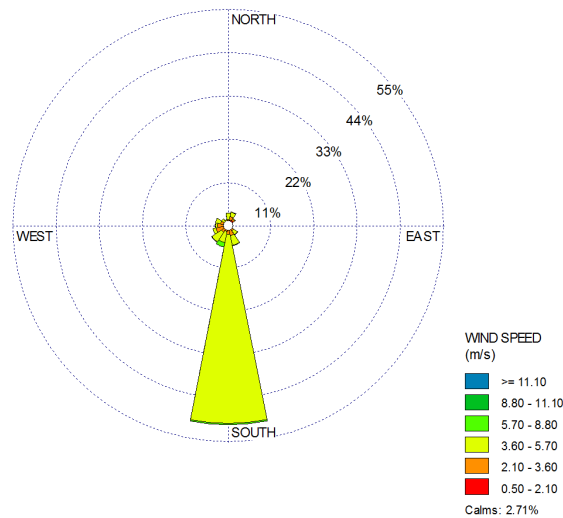


Figure 5.3-12 Wind Rose Diagram (1st January-31stDecember, 2014)

Table-5.3-2Yearly Highest Wind Record

Year	Time	Wind speed (knots)	Wind Direction (degree from North)	Wind Duration (hour)
25/08/1987	9:00PM	23	230	6
30/11/1988	12:00AM	30	130	6
29/04/1989	9:00AM	26	360	3
04/04/1990	9:00AM	30	180	6
01/06/1991	9:00AM	45	180	15
01/05/1992	9:00PM	20	360	3
09/05/1993	9:00PM	40	300	3
09/08/1994	9:00AM	20	180	18
11/06/1995	6:00AM	38	230	15
20/01/1996	6:00AM	30	40	3
19/05/1997	9:00AM	95	210	3
15/05/1998	9:00AM	68	160	3
29/05/1999	3:00AM	25	180	3
13/03/2000	3:00AM	20	180	15
08/05/2001	3:00AM	32	150	9
03/04/2002	3:00AM	20	30	3
12/03/2003	9:00AM	25	40	6
24/06/2004	6:00AM	24	360	3
17/05/2005	3:00PM	30	360	3
05/06/2006	9:00PM	18	160	3
14/05/2007	3:00PM	25	360	9
Maximum		95	-	18
Minimum		18	-	3
Average		32.6	-	6.6
Median		26	-	3
Mode		30	-	3

5.3.2.6 Air Quality

Agriculture and fishery are the main industry of the Matarbari Island. There is no industry in this area. The Primary air quality data indicates that the air quality in the dry season is clean, with a slightly high concentration of dust (SPM) and a low concentration of SO_x and NO_x. Appendix-B shows the Air quality test report of the project.

Sampling Date		PM ₁₀	PM _{2.5}	SO _x	NO _x	CO
		µg/m ³ (24h average)			mg/m ³ (1h average)	
16/02/18		43.2	32.1	<10	<0.012	<0.3
BNAQS	24h average (µg/m ³)	150	65	365	-	40 mg/m ³
	Annual (µg/m ³)	50	15	-	100	-
WHO	24h average (µg/m ³)	50	25		200 (1h average)	10,000
	Annual (µg/m ³)	20	10		40	-

5.3.2.7 Acoustic Environment

The Matarbari Island is quiet in nature as there are no industrial activities in and around the Island. But due to the project work of the Matarbari Coal Powered Project, there is some movement of the vehicles and dredging activities noises are sometimes prominent though the activities are quite controlled environmental conditions. Appendix-C shows the Noise level test report of the study area.

Monitoring Point	Bangladesh Standard	Test Time	Result
Southeast	Day Time 60 dBa	Day	49.3±2.0dBa
	Night Time 50 dBa	Night	42.1±1.9 dBa
Northeast	Day Time 60 dBa	Day	47.8±2.7dBa
	Night Time 50 dBa	Night	38.7±0.2 dBa
Southwest	Day Time 60dBa	Day	57.8±1.1 dBa
	Night Time 50 dBa	Night	44.5±2.1 dBa
Northwest	Day Time 60 dBa	Day	52.7±3.7 dBa
	Night Time 50 dBa	Night	45.1±2.1dBa



Air Quality Monitoring Location in Satellite Image

5.3.3 Geology and Seismicity

Physiography

The Project and the study area fall within the Chittagong Tidal Plain Physiographic units of Bangladesh (Figure-5.3-13). More precisely, the project area falls under the sub-region namely South Chittagong Tidal floodplain. The greater part of this region is underlain by sediments washed out from the adjoining hill ranges. The landscape and soils in this sub-region are very different from those in the other sub-regions. This is a complex compound unit which includes different landscapes. The entire sub-region is badly exposed to cyclones and associated storm surges, and affected by a tsunami caused by an earthquake in the eastern half of the Indian Ocean.

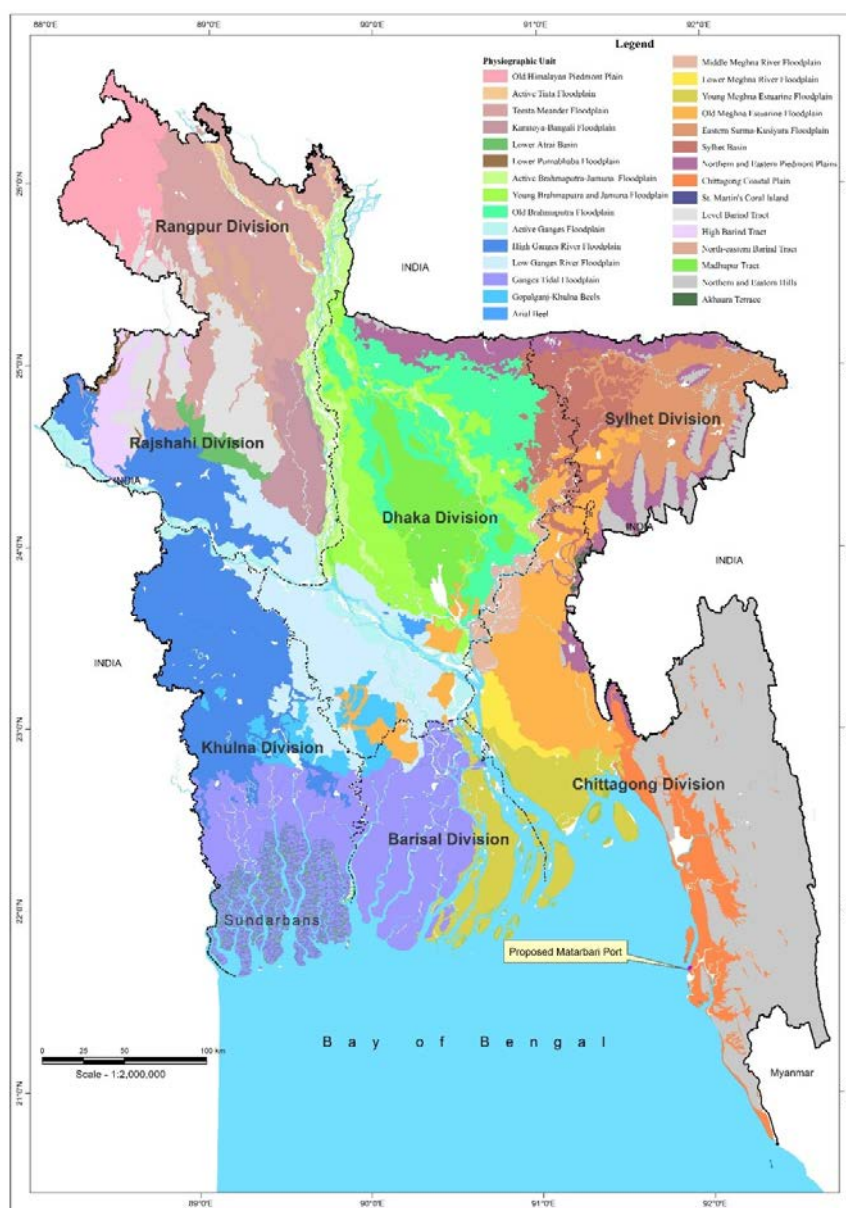


Figure 5.3-13: Physiographic Map of Bangladesh showing the Project Area

Tectonic Setting

Bangladesh consists of nine tectonic elements, which are listed as below and spatial distribution of the elements are the shown in map of **Figure 5.3-14**.

Sl. No.	Tectonic Elements	Sl. No.	Tectonic Elements
1	Barisal-Chandpur Gravity High	6	Calcutta-Mymensingh Hinge
2	Faridpur-Sylhet Trough (Separated by Tripura- Madhupur thrash hold)	7	Rangpur Platform
3	Hatiya Trough	8	Himalayan Fore Deep
4	Bogra Shelf	9	Sylhet Trough
5	Chittagong Folded belt/Indo-Burman Ranges		

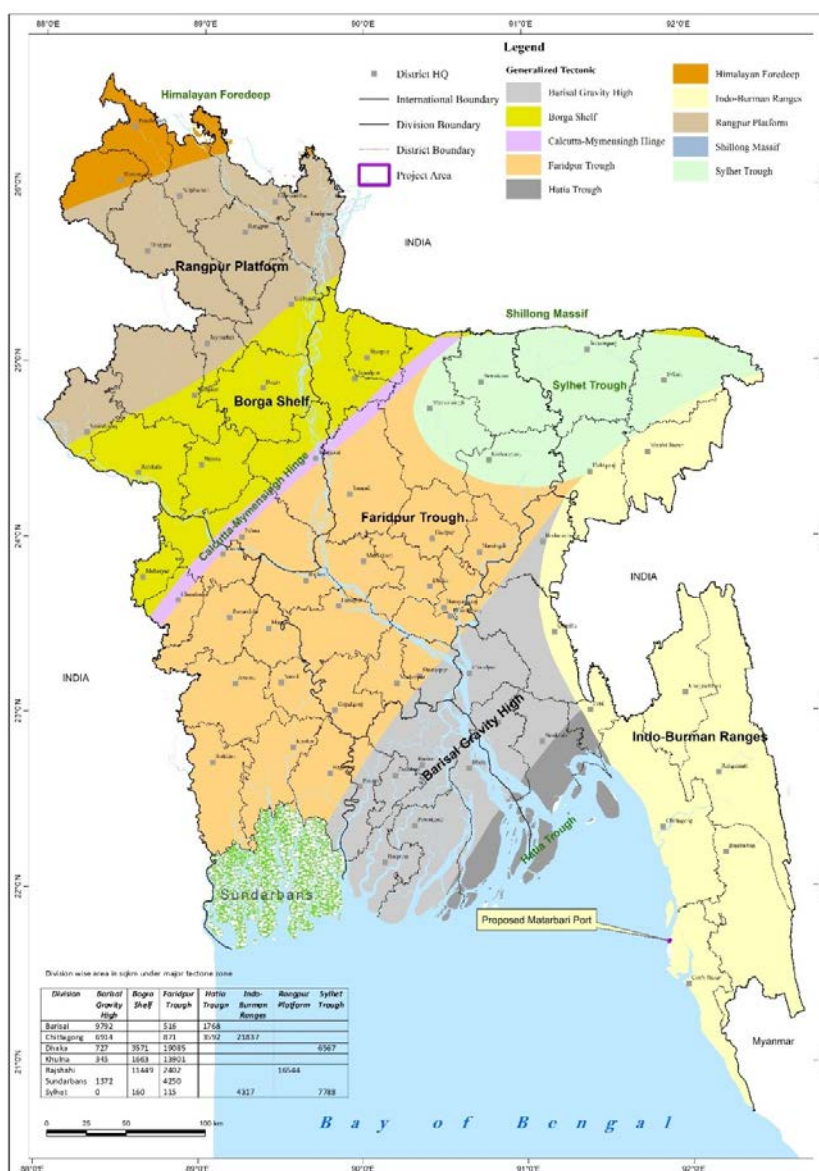


Figure 5.3-14: Tectonic map of Bangladesh showing the Project area

The proposed Matarbari Port lies within the Indo-Burman hill ranges. It is also situated to the South-East of Hatiya Trough/Patuakhali depression. The project is located in the Syncline of Jaldhi-Kutubdia anticline.

Stratigraphy

The study area of the Project is situated to Moheshkhali and immediate west of Kutubdia Island. The stratigraphy of the study area is expected to be identical to Kutubdia and Moheshkhali area.

Sedimentological, palynological data indicate that mangrove community has been developed under transgressive condition in and around the Maheshkhali and the Kutubdia Island areas during Mid Holocene time (7000 to 5500 years BP) leading to the locally wide spread deposition of organic-rich sediments. Global rise and fall of eustatic sea level played an important role not only on the depositional environment but also in creating a geomorphic feature on the island (Md. GolamKibria *et al.*) during Holocene time.

Holocene sediment sample indicate that the Maheshkhali and the Kutubdia Islands and their surrounding areas were intertidal environment occupied by mangrove community (Md. GolamKibria *et al.*).

Table5.3-3: A generalized Stratigraphic Succession of the Kutubdia and Moheshkhali Islands

<i>Age</i>	<i>Formation</i>	<i>Lithology</i>
Holocene	Beach sand	Medium grained, sub-rounded, containing heavy minerals.
	Alluvium	Silt and clay
	Peaty and swampy deposits	Black clay with plant roots and twigs
Plio-Pleistocene	Dupi Tila	Whitish and gray medium grained massive sandstone with clay and shale. Poorly sorted
Pliocene	Girujan clay	Bluish gray clay with subordinate shale, siltstone and sandstone
	Tipam sandstone	Yellow, massive, ferruginous sandstone, alternating with shale, claystone. Cross-bedding, ripple marks and fossil wood present
Mio-Pliocene	Boka Bil (Base not seen)	Alternation of sandstone and bluish gray shale with subordinate siltstone and calcareous sandstone

Source: (Md. GolamKibria *et al.*)

5.3.3 Geology

High hill ranges striking towards North-south occupy the entire districts of Chittagong, Cox's Bazar and the three Hill Tract districts. The anticlines form the hills and synclines the valleys. The lowest ranges generally follow the eastern coast of the Bay of Bengal from Feni River to Naf River. However, a narrow strip of coastal plain about 96.5 km long averaging about 9.66 km wide, developed due to a fault along the Sitakund anticline (Hussain and Abdullah, 2001).

The project area falls under the Chittagong plain as per physiographical classification of Bangladesh (Rashid 1991). The coastal plain includes generally narrow strip of land between the Chittagong hills and the sea, together with the Halda, lower Karnaphuli and lower Sangu river floodplains, and the greater part of the off-shore islands. The unit consists of gently sloping, mainly loamy, alluvial flats adjoining the hills, and extensive level clay plains adjoining the three main rivers. Tidal clay plains

occupy most of the off-shore islands in the south. Most of the area is subject to shallow flooding and to flash floods from the hills. It is also exposed to cyclone.

The Neogene sedimentary sequence developed here are largely un-fossiliferous and consists mainly of the alteration of shales, clays, clay stones, siltstones and sandstones with occasional intra-formational conglomerates.

The geology of the Chittagong Hill Tracts in south-east Bangladesh is distinctive: sediments exposed in this region are dominantly older (Tertiary) folded and indurate deposits of sandstone, silt and limestone. Figure-5.3-15 shows the simplified Geology and Geomorphology of Bangladesh. The Project area covers Dupi Tila and Beach and Dune geology. Dupi Tila Formation consists of yellowish-brown to brown, fine to medium grained pebbly and cross-bedded sandstone with subordinate clay stone and siltstone. Dune is a hill of sand built either by wind or water flow. Dunes occur in different forms and sizes, formed by interaction with the flow of air or water. Most kinds of dunes are longer on the windward side where the sand is pushed up the dune and have a shorter "slip face" in the lee of the wind. In the coastal area the dunes formatted the beach and Dunes formation. Figure-5.3-13 shows the generalized Geology and Geomorphologic map of the Project area.

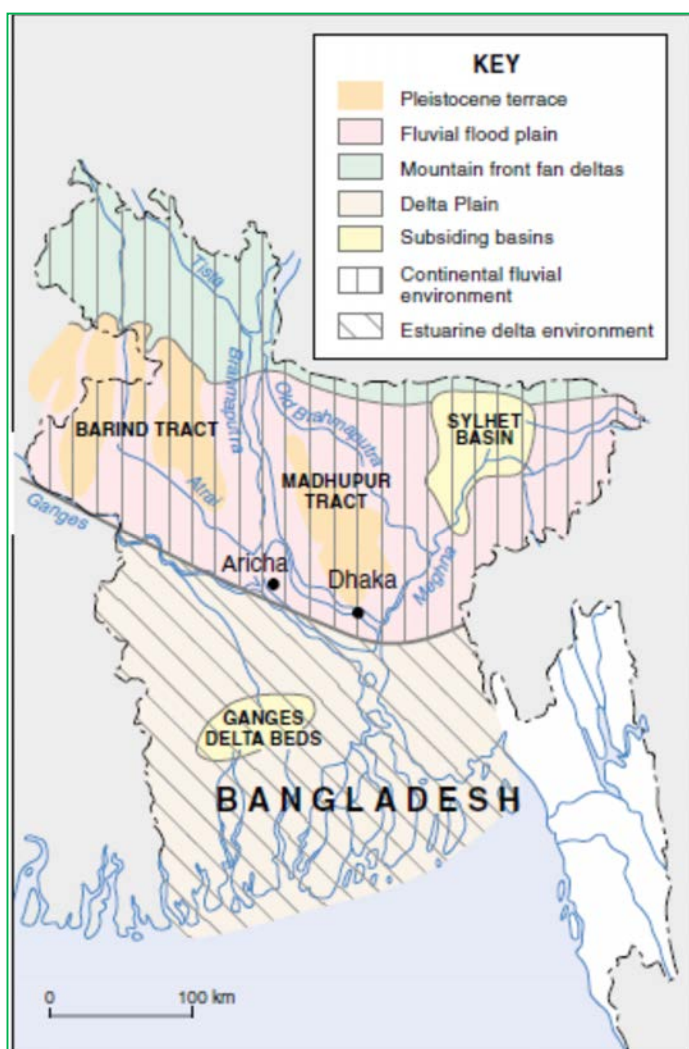


Figure-5.3-15 Simplified Geology and Geomorphology of Bangladesh

5.3.4 Seismicity

Earthquake is one of the most deadly natural disasters that may affect the human environment. Even a relatively moderate earthquake can cause a very large number of deaths. Although in recent past no major earthquake has affected this country, a major event may affect the country at any moment. To analyze the earthquake entire Bangladesh is subdivided into four seismic zones where port project is located in the earthquake zone III (Figure-5.3-16) according to the draft of Bangladesh National Building Code (BNBC) updated in 2012 (Sarraz A., et. al. 2015). This zone-III comprises of NNW-SSE area including Chittagong-Tripura folded belt where the basic seismic coefficient is 0.28. There is a possibility of earthquake in this region as because the region is located adjacent to the Burmese Arc, where a large number of shallow depth earthquakes originate. On 22 July, 1999 a notable earthquake occurred at Moheshkhali Island with the EPC enter in the same place. The Richter scale magnitude of that earthquake was 5.2 and the surface wave magnitude was 4.2 feeling severely around Moheshkhali Island and adjoining areas. In that incident fatalities were explored as: death 6 persons, injury 200 persons, a number of houses faced crack while some has been collapsed (SADKN, 2012).

The Project has medium vulnerability in terms of earthquake compared to the other parts of Bangladesh. In such, the Bangladesh building code should be strictly followed during designing of the civil structure for the proposed Power Plant. Details of seismic intensity and the historical records of earthquake in and around Bangladesh, occurred during last 450 years are presented in Table 5.3-4 and earthquake location map is shown in Figure 5.3-17.

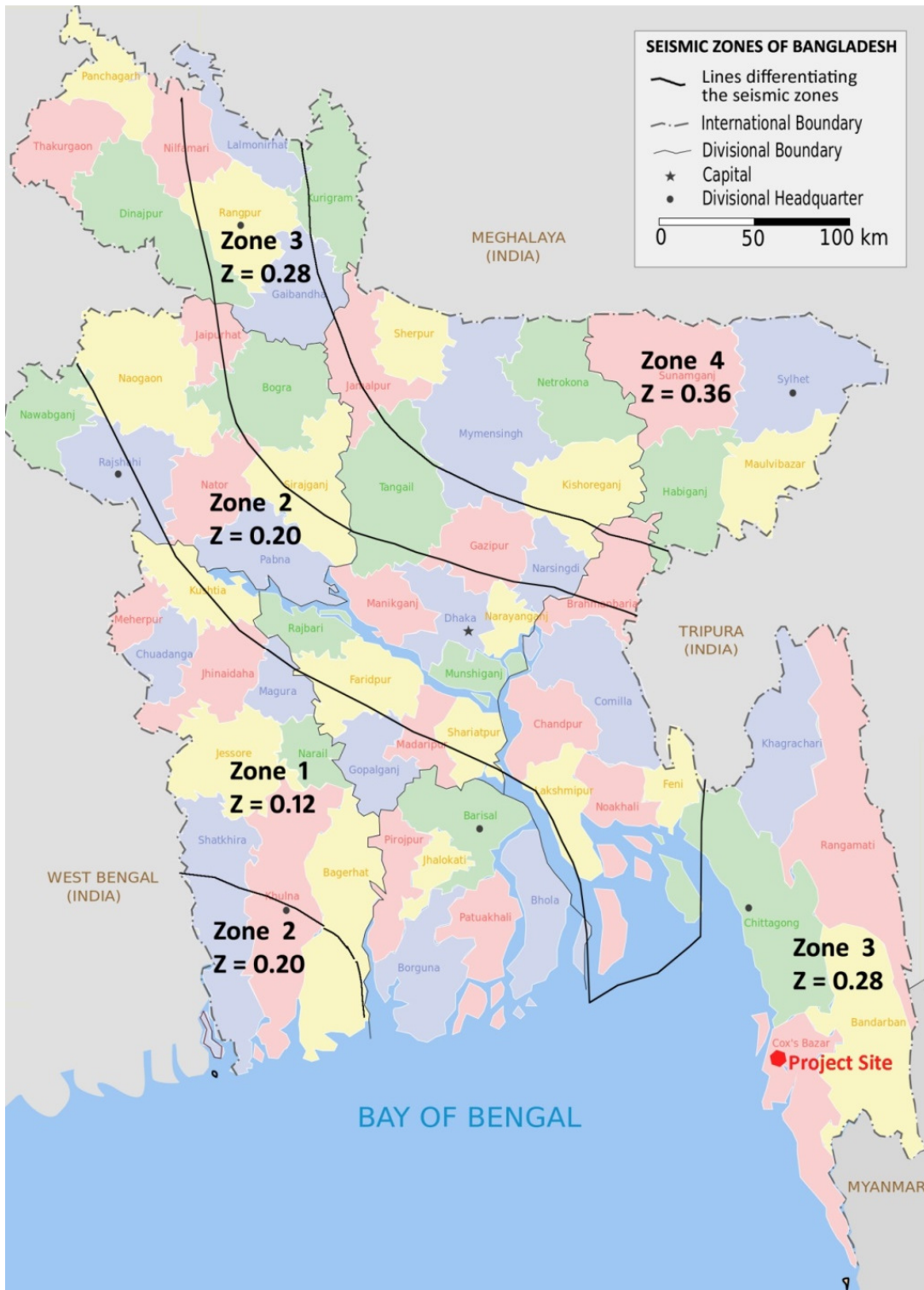


Figure 5.3-16: Earth quake zone of Bangladesh

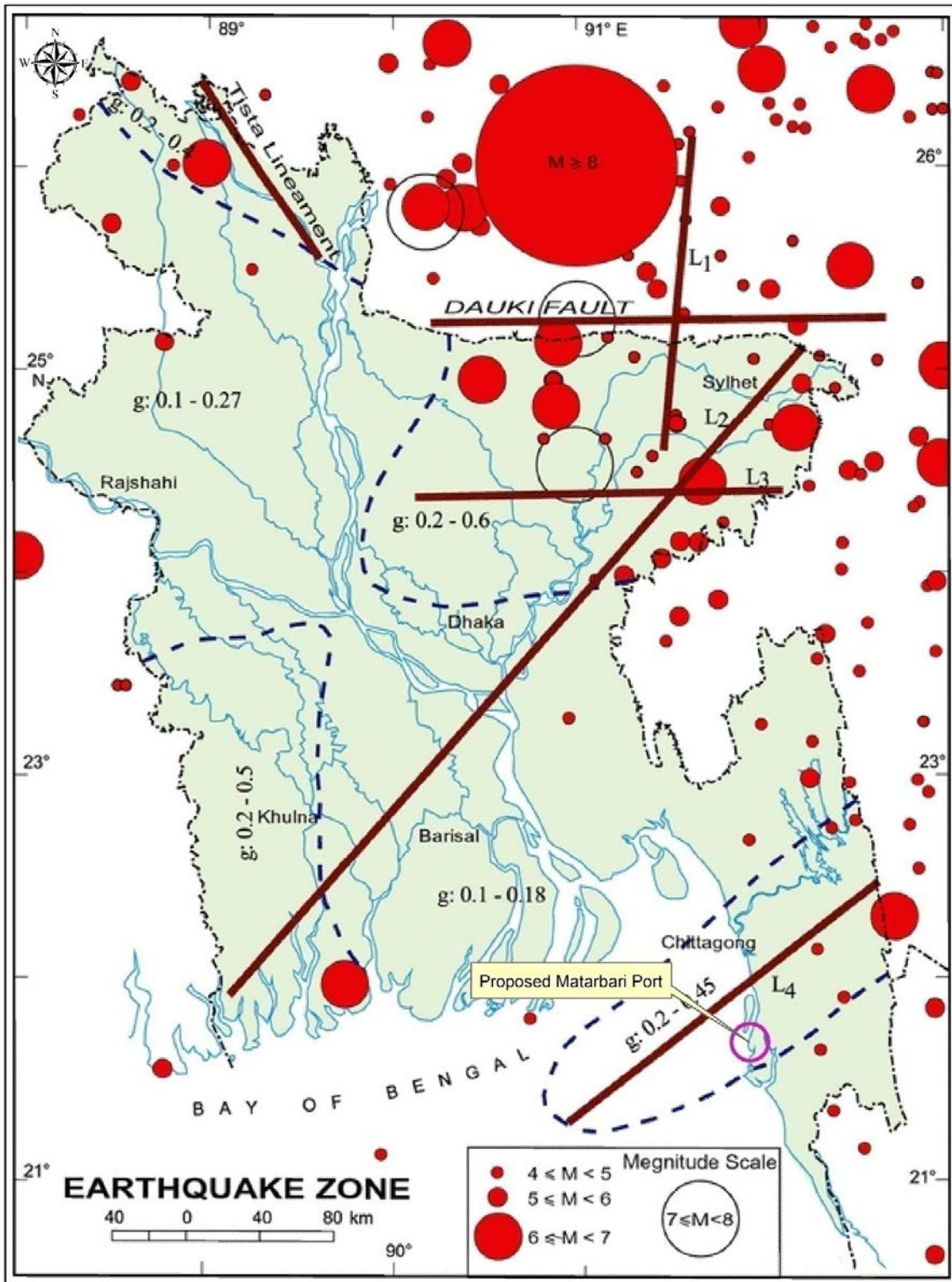


Figure-5.3-17:- Earthquake location map of Bangladesh and surrounding area

Table5.3-4: List of major earthquakes during last 450 years

SL	Year	Source Area	Magnitude (Richter Scale)	Depth (Km)
1	1548	Sylhet	-	-
2	1664	Shillong-Plateau	-	-
3	1762	Chittagong-Arakan	-	-
4	1858	Sandway, Myanmar	6.5	-
5	1869	Cachar, India	7.5	48
6	1885	Sirajganj, Bangladesh	7	72
7	1897	Assam, India	8.1	60
8	1906	Calcutta, India	5.5	-
9	1912	Mandalay, Myanmar	7.9	25
10	1918	Srimangal, Bangladesh	7.6	14
11	1930	Dhubri, India	7.1	60
12	1934	Bihar, India-Nepal	8.3	33
13	1943	<u>Numaligarh, Assam, India</u>	7.2	13
14	1938	Mawlaik, Myanmar	7.2	60
15	1950	Assam, Himalaya	8.6	25
16	1950	Chittagong, Bangladesh	6	-
17	1954	Manipur, India	7.4	180
18	1975	Assam, India	6.7	112
19	1984	Cachar, India	5.7	4
20	1988	Bihar, India-Nepal	6.6	65
21	1988	Phek, Manipur, India	7.3	90
22	1995	Monipur, India	6.4	-
23	1997	Sylhet, Bangladesh	5.6	35
24	1997	Bangladesh-Myanmar	5.3	56
25	1999	Moheshkhali, Bangladesh	4.2	10
26	2003	Rangamati, Bangladesh	5.6	-
27	2011	Sikim, India	6.9	-
28	2015	Gorkha, Nepal	7.8	8.2
29	2016	Imphal, India	6.7	-
30	2016	Baniachang, Sylhet, Bangladesh	4.4	30

5.3.5 Hydrology

5.3.5.1 Surface Water Resources

The proposed project area is adjacent to the Bay of Bengal and located in the southeast of Kutubdia Island. The Kutubdia channel, Matamuhuri River and Kohaliariver are the main rivers close to the project area. The project area is approachable by road from Chittagong district and water way through the “Bay of Bengal”. Heavy construction materials/ machineries can be transported through water way.

Tides of the Bay of Bengal regularly inundate large area of land mass along the shore side of the project area. During monsoon, huge quantity of rainfall runoff flows to the Kutubdia channel through creeks and rivers which ultimately falls into the Bay of Bengal. The level of salinity is relatively lower due to monsoon. However, the surface water quality in the study area is influenced by monsoon rainfall. Moreover, the offshore zone of the project is influenced by the estuary environment.

5.3.4.2 River Network

A number of rivers in and around the project area (Figure-5.3-13) carry fresh water from the eastern hilly areas and ultimately fall into the Bay of Bengal. Number of creeks (Chorra) originates from the hill ranges meet with each other and finally fall into the Bay of Bengal. These rivers, channels, khals carry significant amount of coarse sediment and deposit to the rivers and sea shelf.

Hydrologic Connectivity

Tides of the 'Bay of Bengal' regularly inundate large areas of land mass along the shore side of the project area. During dry season, lack of rainfall is the main reason of high salinity in water of the surrounding rivers and khals. During dry season, the level of salinity is relatively higher. Moreover, the offshore zone of the project is influenced by the estuary environment.

The Matamuhuri and Kohalia River carry salt water and ultimately fall into the Bay of Bengal and Kutubdia Channel. The Matamuhuri River is located at the East side of the project area. Kariardiarkhal originates from the Matamuhuri River and meets with the Kohalia River. Finally, Kohalia River meets the Kutubdia Channel and falls into the 'Bay of Bengal'.

Kutubdia Channel:

The Kutubdia Channel lies in-between the mainland of Cox's Bazar and Kutubdia Island. The length of the channel is 24 km. The channel is connected with the Bay of Bengal at its both ends; as such it is a tidal channel and is affected by ebb and flow of ocean tides.

Thus this portion of the stream has variable salinity over the tidal cycle. There is temporal variability of water quality parameters within the tidally influenced zone. The channel may often dry up to a muddy channel with little or no flow during low tide, but often with significant depth of water during high tide.



Kutubdia Channel

Matamuhuri River:

Matamuhuri River originates from the Sangu River in the ranges of hills that divide Arakan from Chittagong. This river also flows northwest in the Hill Tracts and enters Cox's Bazar district from the east. Flowing in the west it falls into the Bay of Bengal at 21°45'N and 91°57'E forming a broad delta at its mouth extending from BholaKhal to Khuta Khali. The delta is of the same character as the Sundarbans, consisting of groups of channels intersected by a network of tidal creeks and covered by vegetation. The principal Upazila adjoining this river is Chakaria. The length of the river is about 287 km.



Matamuhuri River

Kohalia River:

Kohalia River originates from the Kutubdia channel and finally meets the Bay of Bengal. The length of the river is around 12 km and is located about 2 km of the south-east direction of the project area.



Kohalia River

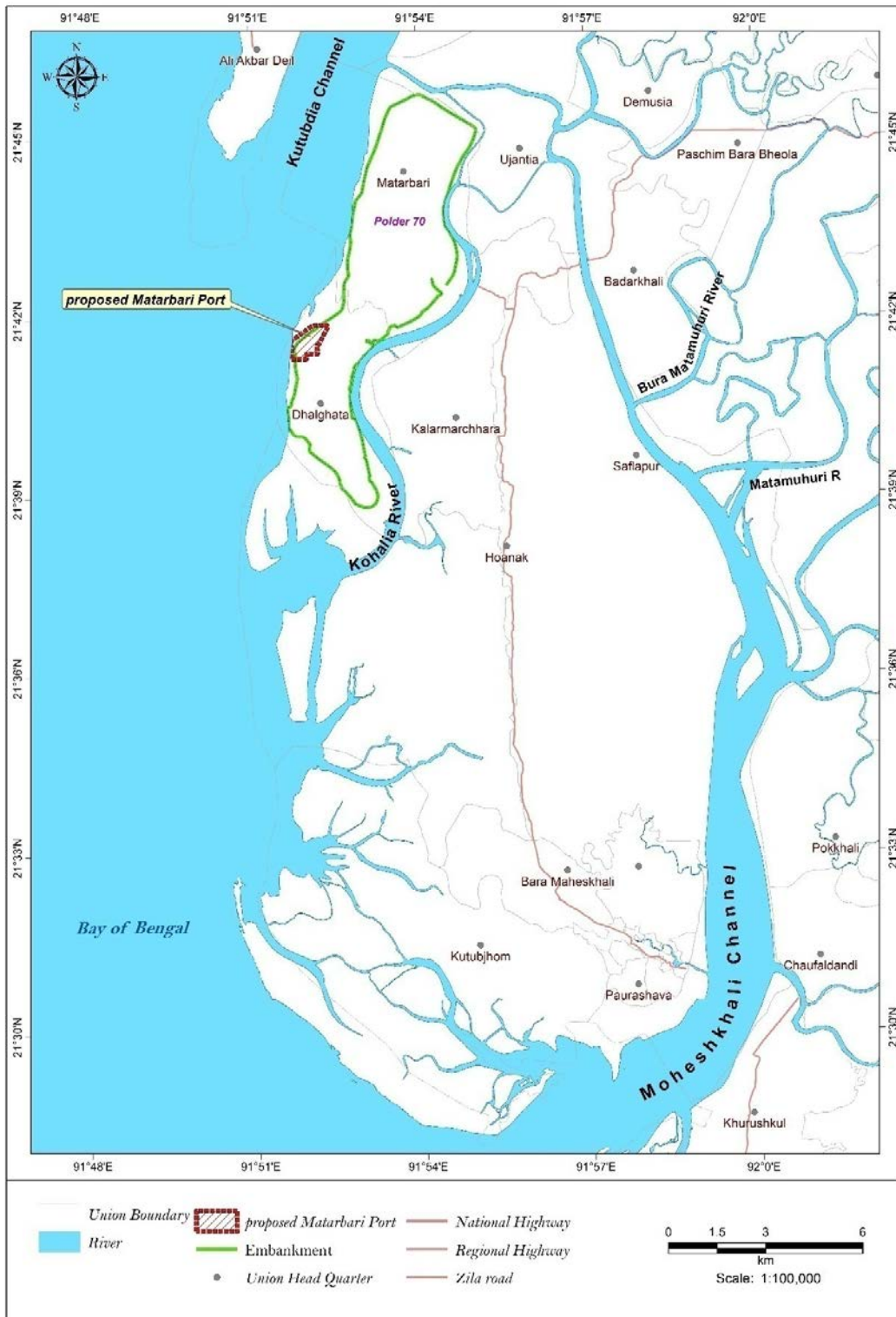


Figure-5.3-18 River System Map of the Project Area

5.3.4.3 Ground Water System

Geographically the average rate of recharge within the study area is about 550-600 mm per annum (Figure-5.3-19). Ground water is available at a depth of 100–450 ft (30.48 m-137.16 m) for using hand tube wells which fluctuates with temporal and spatial variation. Again, the farmers use groundwater from a depth ranging from 600-700 ft (182.9 m - 213.4 m) for irrigation. In some of the places, ground water table is depleted up to 100-150 ft (45.7 m) during dry seasons.

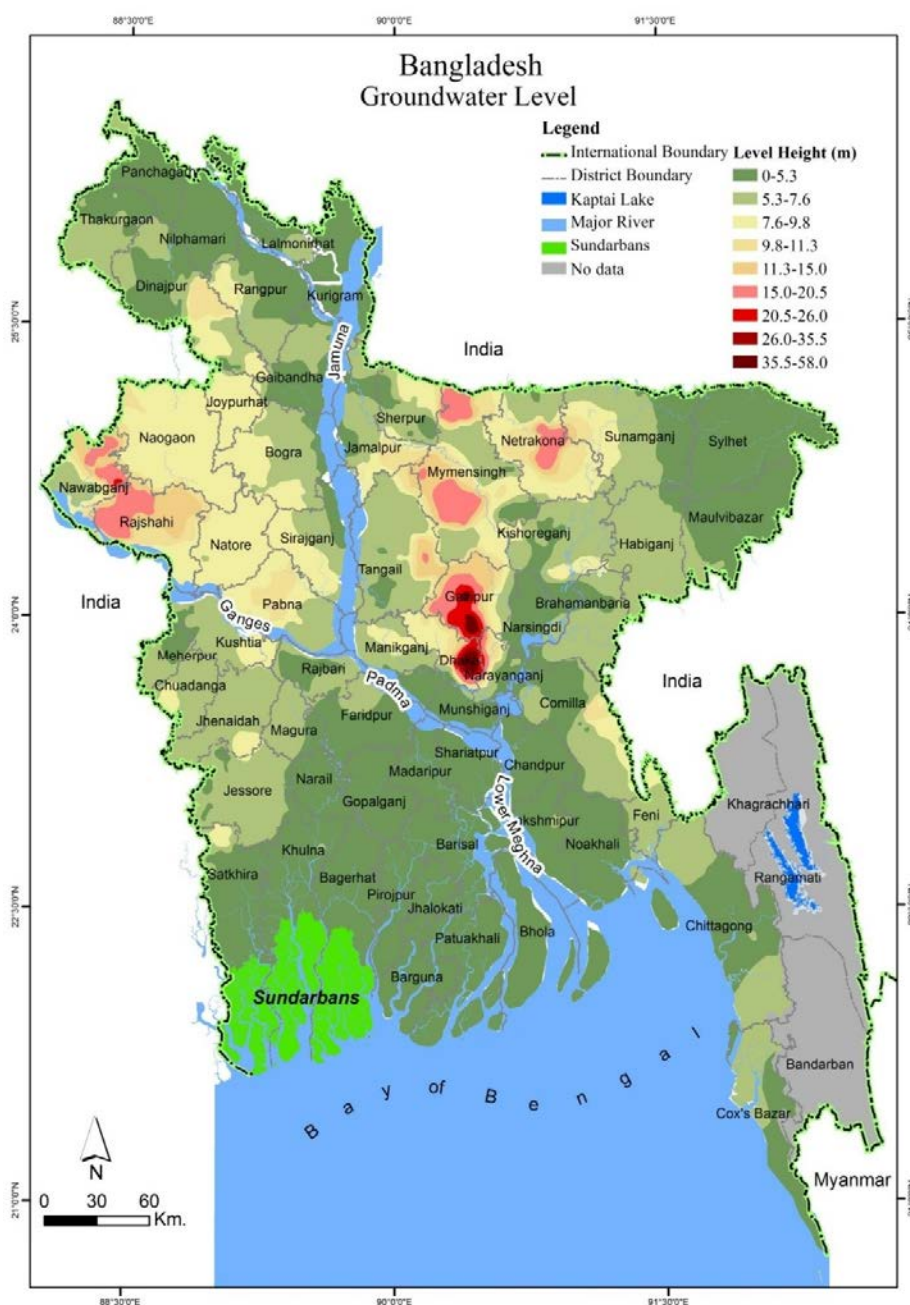


Figure 5.3-19: Potentiality of Recharging Ground Water (MPO, 1986)

The groundwater data of BWDB observation well around the study area (station COX009) was collected for the period from 1984 to 2013. The station COX009 is located at Gorakghata of Moheshkhali Upazila. It is observed that the groundwater level goes down in dry season and depth

reaches highest in March. On the other hand, water table rises in monsoon and the lowest depth attains in September due to recharge by rain water. Figure 5.3.20 shows the monthly variations of groundwater depth in the study area. Local people of the study area opined that they need to sink tube-well at about 20 to 30 feet depth from the ground surface for fresh drinking water.

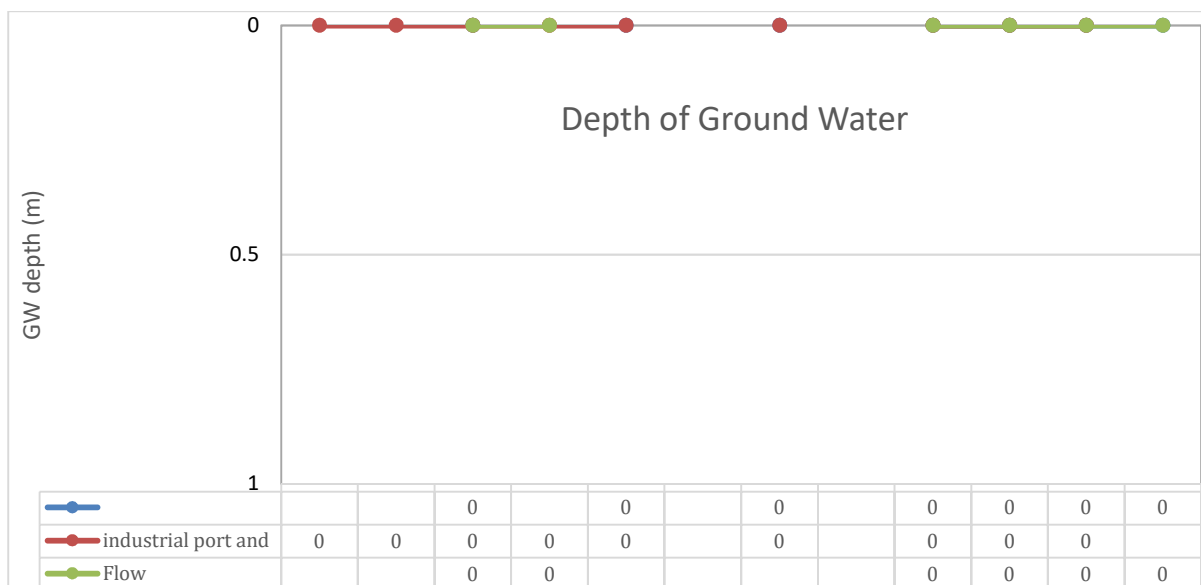


Figure 5.3-20: Depth of Ground Water of the Study Area

5.3.4.4 The Marine Environment

Coastal Zone

Bangladesh coastline is 710 km out of which approximately 81.28km are in our project area. Table below shows the coastline of the project area:

Table-5.3-5 Project areas Coastline data

Sl. No.	District	Upazila	Coastline (Km)
1	Cox's Bazar	Moheshkhali	81.28

Exclusive Economic Zone (EEZ)

The earliest use of the oceans by humans was probably for food. Early human populations living along the oceans captured various shore fishes and shellfishes for consumption with the advent of vessels and nets. In the decades of this century, the old ships and gear have been replaced by much larger and more powerful vessels, more effective nets and traps and electronic devices for detecting fish schools.

The result has been a significant reduction in many fish populations and the disappearance or over exploitation of others at a time when increasing human populations are demanding more food.

The decline of many world fisheries due to common access and the pressures of an increased demand for food by an ever increasing human population have led to friction among fishing nations and various attempts to regulate fishery resources.

Following the Third United Nations Conference on the Law of the Sea, a standard 200 nautical miles wide fishing areas from the 'base lines' called economic zone (EEZ) was established for the waters of each coastal nations. This means that individual nations now have full control of all fishery activity

within 200 miles of their shores and they have sovereign rights over the resources of their continental shelves that, in some cases, can extend even further.

The physical resources of offshore fisheries of Bangladesh are endowed with 480km long coastal line and approximately one million hectares of territorial waters extending 19km up to the sea. The National Economic Zone extends 320 km out into the sea from the coast line.

Continental Shelf Area

The Continental shelf area supports abundant benthic fauna and flora – the shelf communities. The water above the continental shelves and its fauna and flora are described as neritic. Neritic waters tend to be richer in plant nutrients and more productive than water of corresponding depths in the open sea. One reason for this is the greater mixing that occurs here as a result of turbulence, wave action, up-welling caused by offshore currents, winds etc., and bringing plant nutrients into all strata of the water.

Also additional nutrients are led from the substrate and washed in to the sea by rivers and streams from the adjacent land. Where the substrate is suitable for attachment, the shallow waters also support a rich growth of seaweed, turtle grass, and eelgrass and in some areas, other plants. The increased plant growth is reflected in an increase in animal life.

The continental shelf of Bangladesh covers an area of 66,440 sq.km of which 37,000 sq.km is no deeper than 50 m. in these areas operate fleets of small scale fishing craft and gear such as the motorized boats, set bag sets, trammel nets, beach seines, long lines, grill net etc.

5.3.6 Morphology

5.3.6.1 Tidal Behavior

Tides in Bangladesh coastal areas originate from the Indian Ocean. It enters into the Bay of Bengal through the two submarine canyons, the ‘Swatch of No Ground’ and the ‘Burma Trench’. Tide arrives with semi diurnal features all over the coastal zones of Bangladesh as the shoreline experience two almost equal high tides and two low tides each day. The periods of oscillations are 12 hours 25 minutes respectively.

The coastal area of Bangladesh has three tidal zones. These are:

- Macro Tidal Zone: Isotidal fluctuation >4 m
- Meso Tidal Zone: Isotidal fluctuation 2 m to 4 m
- Micro Tidal Zone: Isotidal fluctuation <2 m

The proposed Port project area falls under the Meso Tidal Zone where tidal fluctuation occurs regularly and the eastern region regulates the level of inundation within the project area. The yearly average tidal fluctuation is around 3 m to 4 m.

The following Figure-5.3-15 shows the daily tidal level at Kutubdia, which is adjacent to the project area. The tide level is routinely observed by Bangladesh Water Development Board.

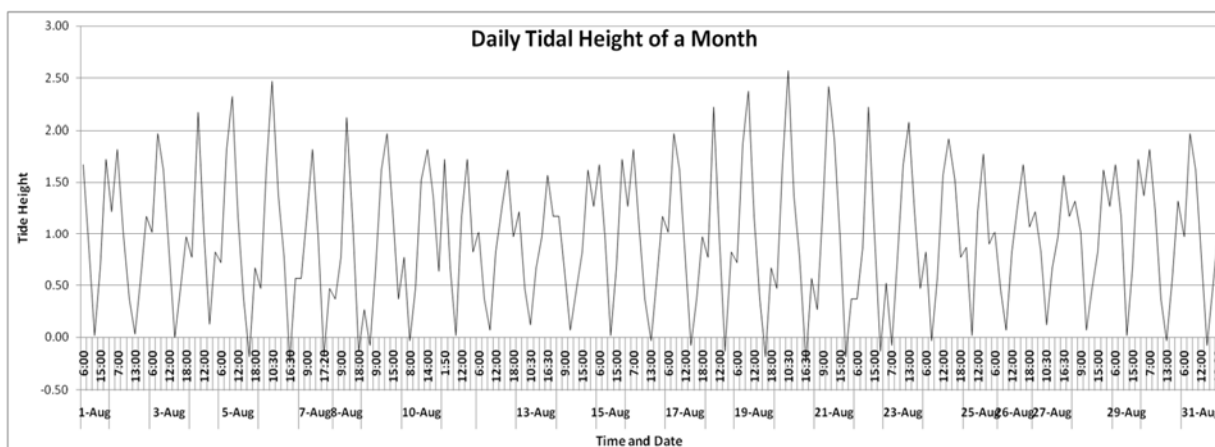


Figure-5.3-21 Daily tidal height of August, 2013

There is a significant difference between consecutive wave crests or troughs due to the effect of semi diurnal process of tides. Tidal height rise at the peak during spring tides and least during neap tide.

The shape of the shoreline and the ocean floor changes propagates tides, so there is no simple or general rule that predicts the time of high water from the Moon's position in the sky. Coastal characteristics such as underwater bathymetry and coastline shape indicate that individual location characteristics affect tide forecasting; actual high water time and height may differ from predictions as the coastal morphology effects on the tidal flow.

Flow of surface water influences the tidal level to a great extent. Tide interrupts discharge of the surface water. Generally, tides enter into the channel or river through the estuaries and obstruct the discharge of fresh water. As a result, sea water penetrates to the inland and back water effects simultaneously increase the water level and flooding to the adjacent flood plain.

5.3.6.2 Wave Conditions

Waves are basically generated at sea due to the wind. Small ripples originate on the water as though wind blows across the ocean's surface. The size of waves depends on:

The duration of the wind;

- The strength of the wind; and
- The fetch, or the distance over water across which the wind blows.

Wave height is also very important for the navigation of vessels. It is also important for shaping coastal sea beach. The waves are generally low and show distinct relation with the wind. Maximum wave heights over 2 m were recorded only for few days during small parts of days. The wave periods vary between 3 to 4 seconds of waves of about 0.5 m and about six seconds for waves of 2 m. Flash floods are expected in the month of May to October and are caused by the normal velocity of flow of ebb tide augmented by flow of additional volume of water that drains into the river from the catchment area. Flash floods are expected when rainfall intensity reaches 200 mm in 24 hours. Table 5.3-3 represents different features of wave height for the last 20 years and Table 5.3-4 shows the annual maximum wave height through statistical distribution.

Table 5.3-6: Annual maximum wave height and period for last 20 years

Year	Deep Water Wave			Shallow Water Wave		
	Wave Height H_o (m)	Wave Period T_o (Sec)	Direction of H_o	Wave Height H_o (m)	Wave Period T_o (Sec)	Direction of H_o
1987	4.999	11.77	230	4.83	11.77	244
1988	5.9853	12.80	310	5.95	12.80	325
1989	5.9070	9.72	150	5.87	9.72	192
1990	5.9873	10.75	130	5.95	10.75	193
1991	6.5771	9.21	180	6.03	9.21	192
1992	3.7807	10.24	360	3.54	10.24	272
1993	6.0640	12.80	180	6.03	12.80	195
1994	3.7807	10.24	180	3.54	10.24	193
1995	6.0438	12.80	180	6.01	12.80	195
1996	6.0586	12.28	360	5.95	12.28	374
1997	6.2349	11.26	130	6.20	11.26	223
1998	6.1343	12.80	180	6.10	12.80	195
1999	5.9070	12.80	180	5.87	12.80	195
2000	3.7807	10.24	180	3.54	10.24	193
2001	6.0892	12.28	160	5.98	12.28	174
2002	3.7807	10.24	30	3.54	10.24	193
2003	5.9070	12.80	40	5.87	12.79	195
2004	5.4438	12.28	360	3.53	12.28	374
2005	6.0586	12.28	360	5.95	12.28	374
2006	3.0620	9.21	160	2.82	9.21	172
2007	5.9079	12.80	360	5.87	12.80	375

Source: Feasibility Study Report of Deep Sea Port (PCI, 2009) and BN

Table 5.3-7: Statistical distribution of the annual maximum wave height

Return Period	Deep Water Wave		Shallow Water Wave	
	Wave Height H_o (m)	Wave Period T_o (Sec)	Wave Height H_o (m)	Wave Period T_o (Sec)
25 years	7.48	12.4	7.48	12.4
50 years	7.95	13.1	7.98	13.1
100 years	8.38	13.7	8.46	13.7

Source: Feasibility Study Report of Deep Sea Port (PCI, 2009) and BN

5.3.6.3 Cyclones

In meteorology, a cyclone is an area of closed, circular fluid motion rotating in the same direction as the Earth. This is usually characterized by inward spiraling winds that rotate anti-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere of the Earth. Most large-scale cyclonic circulations are centered on areas of low atmospheric pressure. It is a natural phenomenon which is unpredictable in terms of timing, intensity and the actual track. Obviously, no measure of design consideration can influence any of those three factors. The only option is to try to predict, as early as possible, the track and intensity of the cyclone storm. Figure-5.3-16 shows the track of the cyclone and maximum wind speed during the last 1960 to 2007.

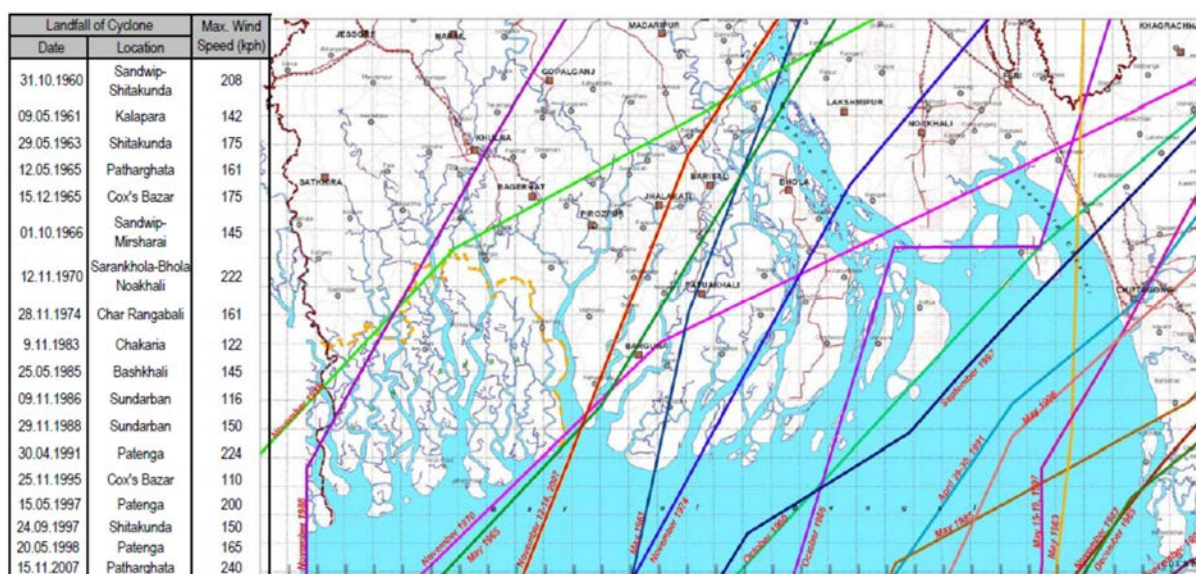


Figure 5.3-22 Tracks of major cyclones that crossed Bangladeshi coast from 1960-2007 Source: BMD 2007

Bangladesh Meteorological Department (BMD) regularly monitors the tropical cyclones and the Table 5.3-6 below shows the enlisted major historical cyclones that occurred in and around Bangladesh from 2005 to 2015. Table 5.3-7 below shows the major cyclones crossed Bangladesh Coastal Area, and their maximum wind speed.

Table 5.3-6: Historical Cyclone

Sl. No.	Cyclone Name	Status	Landfall Area	Landfall Date
1	BAAZ	Cyclonic Storm	Weakened into a well-marked low pressure area over southwest Bay	02.12.2005
2	AKASH	Cyclonic Storm	Crossed south Bangladesh coast close to south of Cox's Bazar	14.05.2007
3	SIDR	Very Severe Cyclonic Storm	Crossed Bangladesh coast near Baleshwar River	15.11.2007
4	RASHMI	Cyclonic Storm	Crossed Bangladesh coast near Khepupara	26.10.2008
5	BIJLI	Cyclonic Storm	Crossed Bangladesh coast near Chittagong	17.04.2009
6	MAHASAN	Cyclonic Storm	Crossed Bangladesh coast between Chittagong and Feni	16.05.2013

Source: Bangladesh Meteorological Department, 2014

Table 5.3-7: Major Cyclones in Bangladesh

Date of landfall	Nature of Phenomenon	Landfall Area	Max. Wind Speed (kph)
11.10.1960	Severe Cyclonic Storm	Chittagong	160
31.10.1960	Severe Cyclonic Storm	Chittagong	193
09.05.1961	Severe Cyclonic Storm	Chittagong	160
30.05.1961	Severe Cyclonic Storm	Near Feni	160

Date of landfall	Nature of Phenomenon	Landfall Area	Max. Wind Speed (kph)
28.05.1963	Severe Cyclonic Storm	Chittagong- Cox's Bazar	209
11.05.1965	Severe Cyclonic Storm	Chittagong-Barisal Coast	160
05.11.1965	Severe Cyclonic Storm	Chittagong	160
15.12.1965	Severe Cyclonic Storm	Cox's Bazar	210
01.11.1966	Severe Cyclonic Storm	Chittagong	120
23.10.1970	Severe Cyclonic Storm	Khulna-Barisal	163
12.11.1970	Severe Cyclonic Storm with a core of hurricane wind	Chittagong	224
28.11.1974	Severe Cyclonic Storm	Cox's Bazar	163
10.12.1981	Cyclonic Storm	Khulna	120
15.10.1983	Cyclonic Storm	Chittagong	93
09.11.1983	Severe Cyclonic Storm	Cox's Bazar	136
24.05.1985	Severe Cyclonic Storm	Chittagong	154
29.11.1988	Hurricane wind	Khulna	160
18.12.1990	Cyclonic Storm	Cox's Bazar Coast	115
29.04.1991	Severe Cyclonic Storm with a core of Hurricane wind	Chittagong	225
02.05.1994	Severe Cyclonic Storm with a core of Hurricane wind	Cox's Bazar-Teknaf Coast	204
25.11.1995	Severe Cyclonic Storm	Cox's Bazar	140
19.05.1997	Severe Cyclonic Storm with a core of hurricane wind	Sitakundu	232
27.09.1997	Severe Cyclone with Hurricane wind	Sitakundu	150

Flooding

The project area is mostly covered by tree plantation and salt production. The area for salt production is protected by earthen levees, which is the common practice to prevent tidal inundation. Saline water is entered in these areas through tidal creeks regulated by indigenous wooden water control structures for salt production.

5.3.6.4 Storm Surges

A storm surge is a coastal flood phenomena of rising water commonly associated with low pressure weather systems, the severity of which is affected by the shallowness and orientation of the water body relative to storm path. Most casualties during tropical cyclones occur as the result of storm surges.

The coastal areas of Bangladesh are the most vulnerable areas which experience and often experience very high cyclonic storm surge. The tracks of different cyclonic storm are shown in Table 5.3-7.

The intensity and height of the coastal surge largely depends upon the pressure fall in the sea level. The most severe pressure fall was recorded as 918 mbar, occurred in 1991 and has radius strength of 74 km. The cyclone hits the eastern coast of the Bay of Bengal around Chittagong. The consequent maximum surge was 4.73m (15.18 ft) MSL which was a result of combination of astronomical tide and the storm surge. It is advisable to consider storm surge height in design the port and other infrastructure in the project area. Some safety margin should also be added. However, a more precise calculation should be performed in the process of design of the port. The worst condition occurs due

to the combination of the astronomical tide and the storm surge. Table 5.3-8 shows surge height for 16 cyclones that are recorded in the last 25 years.

Table 5.3-8: Major storm surge incidents hitting the Bangladesh Coast

Date	Year	Maximum Wind speed (km/hr)	Storm Surge height (m)
30 October	1960	211	4.6-6.1
30 May	1961	160	6.1-8.8
28 May	1963	203	4.2-5.2
11 May	1965	160	6.1-7.6
15 December	1965	211	4.6-6.1
01 November	1966	146	4.6-9.1
23 October	1970	163	3.0-4.9
12 November	1970	224	6.1-9.1
25 May	1985	154	3.0-4.9
29 November	1988	160	3.0-4.0
29 April	1991	225	6.0-7.5
02 May	1994	210	2.0-3.0
25 November	1995	140	2.0-3.0
19 May	1997	220	3.1-4.2
15 November	2007	240	up to 10
25 May	2009	120	3.0

Source: MCSP, 1993 and Bangladesh Meteorological Department

5.3.6.5 Seal Level Rise

Sea level rise is a crucial issue of climate change and has various impacts on Bangladesh. Its potential threats will come even more strongly in the future. Shore line erosion, river bank erosion, salinity intrusion, flood, damage to infrastructures, crop failure, destruction of fisheries, loss of biodiversity may be caused due to the sea-level rise etc.

The average increase in temperature of Bangladesh would be 1.3°C and 2.6°C by the year 2030 and 2075 respectively with respect to the base year 1990 (Ahmed and Alam, 1999). Two estimations of potential future sea level rise for Bangladesh are 0.30-1.5 m and 0.30-0.50 m for 2050 (DoE, 1993). Analysis of historical data from 1977 to 1998 shows annual sea level rise at the rate of 7.88 mm, 6 mm and 4mm respectively in Cox's Bazaar (Shamsuddoha and Chowdhury, 2007). Figure-5.3-23 shows the Erosion and Accretion Map of the project Area.

Erosion and Accretion map of the Study area (From 1999 to 2017)

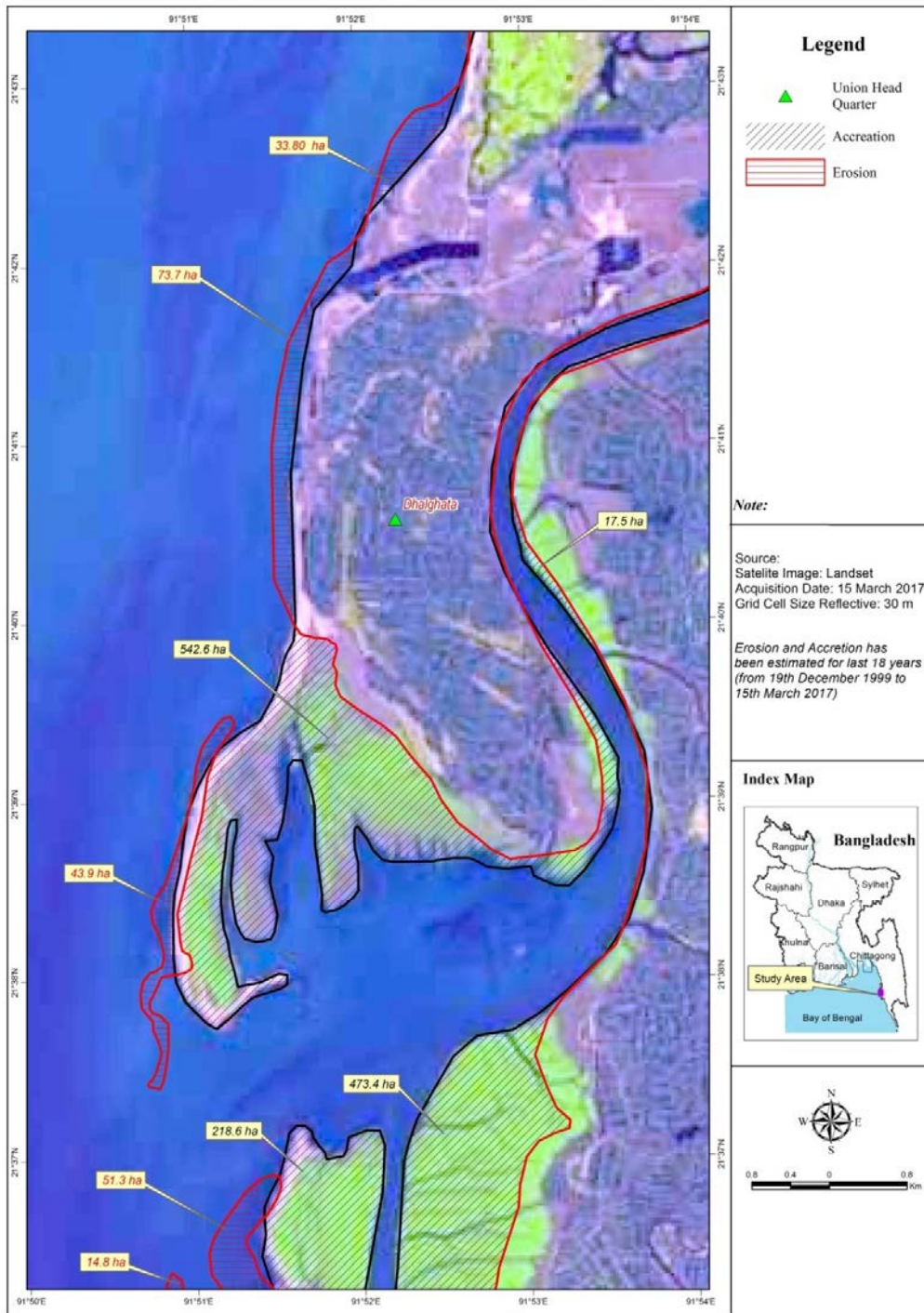


Figure-5.3-23 Erosion and Accretion Map of the project Area

5.3.7 Oceanography

5.3.7.1 Tsunami

According to the Tsunami Vulnerability Map of Bangladesh (Figure: 5.3-24), the project area is situated in the Tsunami Vulnerability Coastal Belt I, indicating high population vulnerability in case of a tsunami event. The coastline is close to the tectonic interface of the Indian and Burmese plates.

The active Andaman – Nicobar fault system is capable of generating tsunami waves (Islam, 2006).

Even though the risk of a tsunami hitting south-eastern Bangladesh is given, it is stated in Islam (2006) that “the 2004 Indian Ocean tsunami caused no significant damage to the coast”. The author furthermore explains that “the hydrostatic pressure increased, and that resulted in water surges in different water bodies across the country”. According to information received from the NASA Earth Observatory web page the 2004 tsunami resulted in wave heights of 2m maximum (Figure:5.3-25).(<http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=14404>).

Ioualalen et al. (2005) investigated, through a simulation study, the reasons for the low impact on the Bangladesh coast. They noted that mitigation was attributable to the presence of the extended Bangladesh continental shelf, the non-radioactive direction of propagation onto the Bangladesh coast that was reached mainly by edge waves, and possible delocalization by the Nicobar and Andaman islands.

The shallow Bangladesh continental shelf and the flat coastal land are amplifying cyclonic storm surges. Surges usually exceed normal tide levels by 3 m, in extreme cases 6 m to 9 m (Islam, 2006).

Summarizing the recurrence interval of storms / cyclones vs. tsunamis, the recurring storm surges are of greater concern than an occasional tsunami (Mascarenhas, 2006).

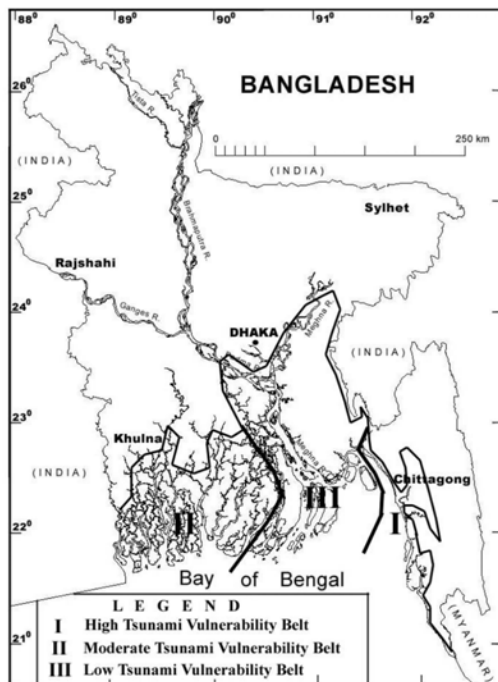


Figure 5.3-24: Tsunami Vulnerability Map of Bangladesh. (Source: Islam, 2006)

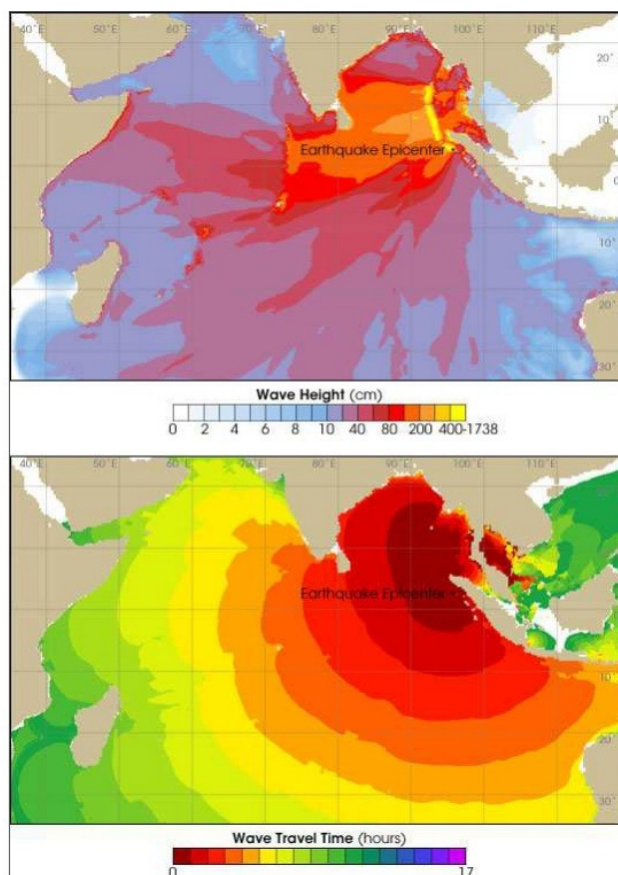


Figure 5.3-25: Modeled for the Indian Ocean Tsunami of December 26, 2004
(Source: NASA Earth Observatory 2004)

5.3.7.2 Marine Sediment

A sedimentation/erosion assessment in the natural channel, for the period of 1990 to 2005, has been performed, based on the available nautical charts, in order to define the geo-morphological conditions of Matarbari Island Area for the SPM project of Eastern Refinery Limited. It was evident from that project study that the natural channel is affected by an erosive pattern.

Sea bottom sediment (heavy metals) Study of Construction of Matarbari 600X2MW Coal Fired Power Plant and Associated Facilities:

Bangladesh does not have standard values for heavy metals contained in sea bottom sediment. Globally, ERL (Effects Range-Low) and ERM (Effects Range-Median) are proposed by the NOAA (National Oceanic and Atmospheric Administration, U.S.) as the guidelines to help categorize the range of concentrations of heavy metals and organic chloride compounds in sediment which affect benthic organisms.

In a series of data of ascending levels of contaminants and their toxicity effects, the 10th percentile and the 50th percentile (median) of the effects database were identified for each substance. The 10th percentile values were named the “Effects Range-Low” (ERL), indicative of concentrations below which adverse effects rarely occur. The 50th percentiles values were named the “Effects Range-

Median” (ERM) values, representative of concentrations above which various effects frequently occur.

The measurement results of the CPGCBL power plant study indicated that ERL was not exceeded in any of the parameters except for mercury (Hg), and even then it did not exceed ERM. The sea bottom sediment quality is not contaminated in the project study area.

Table-5.3-9 Results of Sea bottom sediment survey (Heavy metals) of the Project Study Area

Parameter	Unit	Results		Guideline of NOAA	
		15/October /2012	28/January /2013	ERL	ERM
Hg	mg/kg	0.142	0.456	0.15	0.71
Cd	mg/kg	0.032	0.05	1.2	9.6
Pb	mg/kg	11.6	3.39	46.7	218
As	mg/kg	4.45	2.91	8.2	70
Cu	mg/kg	23.8	3.75	34	270
Zn	mg/kg	63.7	20.2	410	410
Fe	mg/kg	27,400	11,183	-	-

(Source: JICA Study Team)

Samples of bottom sediment has been taken from the sea bottom surface by the NIPPON KOEI and the sediment quality has been analysed (19-03-2018 to 04-04-2018) from BRTC, BUET laboratory a reputed laboratory of Bangladesh. Two locations i.e. one on the Route and the other in the Berth area have been taken for the depth of 0.5m, 0.5, 1, 5, 10m each.

The results are listed in the table 5.3-10 and the Test report is appendices in [Appendix-D](#).

Table 5.3-10 Results of Sea bottom Sediment Survey (Heavy Metals) of the project study area

Parameters	Unit	Result (19-03-2018 to 04-04-2018)				Guideline of NOAA	
		0.5m depth	1mdepth	5m depth	10m depth	ERL	ERM
pH	-	7	7.5	7	7		
Arsenic (As)	mg/Kg	5.43	3.94	8.65	8.87	8.2	70
Copper (Cu)	mg/Kg	9.1	4	9.2	9.5	34	270
Zinc (Zn)	mg/Kg	41.2	23.5	26.3	41.7	410	410
Mercury (Hg)	mg/Kg	0	0	0	0	0.15	0.71
Chromium (Cr)	mg/Kg	25.3	11.70	13	21.1		
Lead (Pb)	mg/Kg	17.2	14.90	17.8	18.3	46.7	218
Nickel (Ni)	mg/Kg	16.2	8.8	9.4	16.4		
Cadmium (Cd)	mg/Kg	0.1	0.10	0	0	1.2	9.6
Iron (Fe)	mg/Kg	18400	15000	21000	32800	-	-
Organic Matter (Wet Combustion method)	%	2.4735	1.35	2.62	2.12		
Moisture Content	%	22.39 (28.86)	20.36 (25.57)	25.47 (34.18)	21.38 (27.19)		

The result shows that all the parameters are within the NOAA guidelines standards.

5.3.8 Land Resources

Land comprises natural resources such as soil, water, minerals and biota. These components are organized in ecosystems which provide a variety of services essential to the maintenance of the integrity of life–support systems and the productive capacity. Land resources are used for various which include organic agriculture or crop production, reforestation, and water resource management.

Baseline condition of land resources has been established through collection of secondary data from FAO/UNDP:1988, BARC and image analysis data.

5.3.8.1 Agro-Ecological Zone (AEZ)

In Bangladesh, thirty agro-ecological zones and 88 sub-zones have been identified by adding successive layers of information on the physical environment which are relevant for land use and assessing agricultural potential. These layers are: Physiography (land forms and parent materials), Soils, Depth and duration of seasonal flooding and Agro-climatology [It comprises four elements: length of kharif and rabi growing seasons, length of pre-kharif transition period, number of days below certain winter critical temperatures (<15⁰C) and number of days with extremely high summer temperature (>40⁰C)](FAO,1988).

Agro-ecological zones and sub-zones are very broad units. Fertility status of these zones varies greatly. Individual farmers have fragmented the land into small pieces causing wide variation in the management of each and every piece of land. This leads to the large variation in the fertility levels even between adjacent plots. Realizing the difficulties agro-ecological zones based fertilizer recommendations for cropping patterns have been developed (BARC, 2012).

The proposed project area is comprises under two agro-ecological zones (AEZs) namely(i) Chittagong Coastal Plains (AEZ-23) and (ii) Northern and Eastern Hills (AEZ-29). The former Agro-Ecological Zone is occupying the major part of the project, and the later one is occurring in minor areas. The locations of agro-ecological zones are shown in Figure-5.3-20. The descriptions of Agro-Ecological Zones are described briefly as below:

Chittagong Coastal Plains (AEZ- 23)

This region occupies the plain land. It is a compound unit of piedmont, river, tidal and estuarine floodplain landscapes. The major problem in these soils is high salinity during dry season (October to May).

Grey silt loams and silty clay loam soils are predominant. Acid Sulphate soils which are potentially strongly acidic occur in mangrove tidal floodplains. Non calcareous Grey Floodplain soils, non-calcareous Alluvium and Acid Sulphate soils are the major components of the General Soil Types of the area. General fertility level of the soils is medium, and N and K are limiting. Status of S is low to optimum. Organic matter content is low to medium. The status of Zn and B is low to medium and that of N and P is very low to low. Detailed physic-chemical properties of soils of AEZ-23 are presented in the Table 5.3-11.

Table 5.3-11: Detailed physic-chemical properties of soils of AEZ-23

Major land type	Soil pH	Soil OM	Nutrients status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland	4.3-6.0	L-M	L	VL-L	L-opt	L-opt	M-Opt	L-opt	L-M	L-M	M
Medium highland	4.4-6.2	L-M	VL-L	VL-L	L-opt	L-opt	M-Opt	L-opt	L-M	L-M	M
Medium low land	4.5-6.2	L-M	VL-L	VL-L	L-M	L-opt	L-M	L-M	L-M	L-M	M

OM=Organic matter; VL=Very low; L=Low; M=Medium; Opt=Optimum; Source: Fertilizer Recommendation Guide, BARC, 2012

Northern and Eastern Hills (AEZ -29)

This region includes the country's hill areas. Hills have been dissected to different degrees over different rocks. In general, slopes are very steep and few low hills have flat summits.

The major hill soils are yellow-brown to strong brown, permeable, friable, loamy; very strongly acidic and low in moisture holding capacity. However, soil patterns generally are complex due to local differences in sand, silt and clay contents of the underlying sedimentary rocks and in the amount of erosion that has occurred. Brown Hill soils are the predominant General Soil Types of the area. Organic matter content and general fertility level are low to medium with very low to low status of N and P. Detailed physic-chemical properties of the soils of AEZ-29 are presented in the Table 5.3-12.

Table 5.3-12: Some physic-chemical properties of soils of AEZ-29

Major land type	Soil pH	Soil OM	Nutrients status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland	4.0-7.0	L-M	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	L-M	L-M

OM=Organic matter; VL=Very low; L=Low; M=Medium Source: *Fertilizer Recommendation Guide, BARC, 2012*

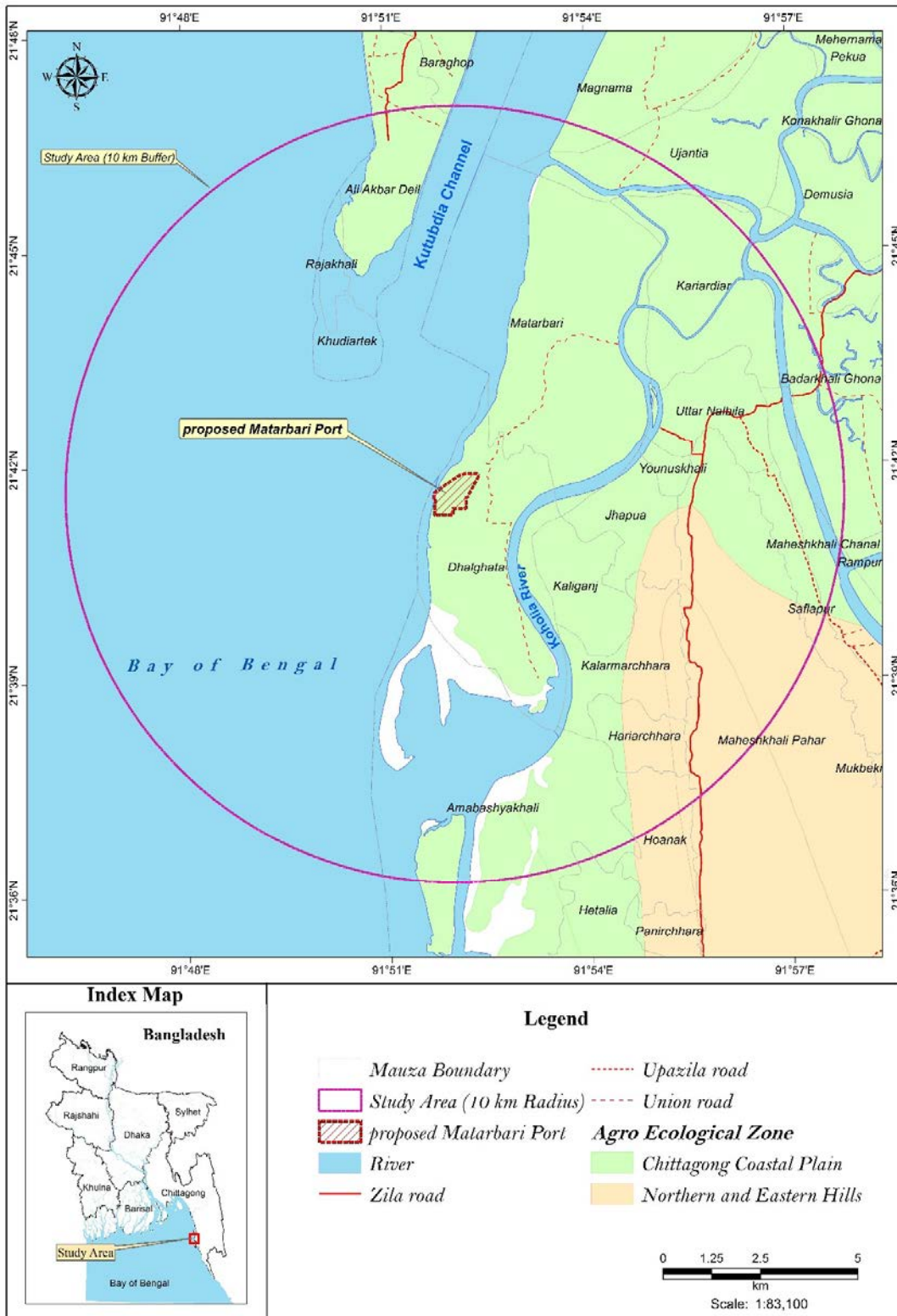


Figure-5.3-26 Agro-Ecological Region of the Study Area

5.3.8.2 Soil Texture

Soil texture is the relative proportions of sand, silt and clay. It may be described as the percentage distribution of sand, silt and clay in a soil particle is called soil texture. It is very important for tillage operation/agricultural crop production. Most of the area (both project and study area) is covered with clay loam.

5.4 AGRICULTURAL RESOURCES

The project area is full of farming, livestock and fishery resources. There is no industry in the Matarbari Island even in the Moheshkhali upazila. So there is no source of serious pollution in the study area.

5.4.1 Farming Practices

Farming practices in the study area are largely controlled by physical, biological, climatologic and socioeconomic factors. Agricultural crops are grown by cropping seasons. There are two distinct cropping seasons in a year. They are the Kharif and the Rabi seasons. The Kharif season starts from March and ends in October while the Rabi season starts from November and ends in February. Based on crop adaptability and crop culture, the Kharif season has been further sub-divided into Kharif-I (March-June) and Kharif-II (July-October) season.

The Kharif-I is characterized by high temperature, low humidity, high evaporation, high solar radiation and uncertainty of rainfall of low alternating dry and wet spells. In this season, mainly Aus rice and Vegetables are grown. The Kharif-II season is characterized by high rainfalls, lower temperatures, high humidity, low solar radiation and high floods that recede towards the end of the season. Rice is the predominant crop grown during this season due to the submergence of soil. Excessive soil moisture also restricts other crops suitable for a high temperature regime. High Yielding Varieties of transplanted Aman (HYV Aman) rice is grown in Kharif-II season in the study area. The Rabi/Boro season are favored with high solar radiation, low humidity and temperature, but lack of adequate soil moisture depresses the crop yield because of very low or even no rainfall throughout the season. Wide ranges of crops can be grown in this season. Major crops grown in this season of the study area are HYV Boro, Potato, Chilli, Cowpea, and Vegetables. Farmers of the respective area culture salt in dry season by entering saline water through JalkadarKhal. However, there are occasional overlaps such that the Kharif-I season crops (Aus rice) are harvested in Kharif-II season, the Kharif-II season crops (Aman rice) are harvested in Rabi season and Rabi season crops (Boro, cowpea, Vegetables and Chilli) are harvested in Kharif-I season.

5.4.2 Cropping Pattern and Intensity

In the study area, the most dominant cropping patterns are Boro (HYV)-Fallow-T. Aman (HYV), RC-Fallow-T.Aman (HYV) and Fallow-Fallow-T.Aman (HYV). More than 50% of the union area is under Salt-Shrimp cultivation. The soil pH is 4.4-6.5 and is affected by different degrees of salinity (12-16dS/m). Acid sulphate soils occurs in mangrove tidal floodplains. The project area is mostly highland followed by medium high land and low land which indicates that the area is not deeply flooded by monsoon and is suitable for T.Aman cultivation in Kharif-II season when both water and soils become salinity free. Figure 5.4-1 and 5.4-2 shows the land types and Cropping Pattern of the project study area.

Soil fertility is an important factor for crop production. Local people reported that in general the study area is quite low in soil fertility. The organic matter content of the top soils is low to medium. The low organic content in soils indicates poor physical condition of the soils of the study area. Thus in addition to salinity, plant nutrients in soils affect plant growth. Seed, labor, fertilizer, pesticide and irrigation are the major inputs for crop production.

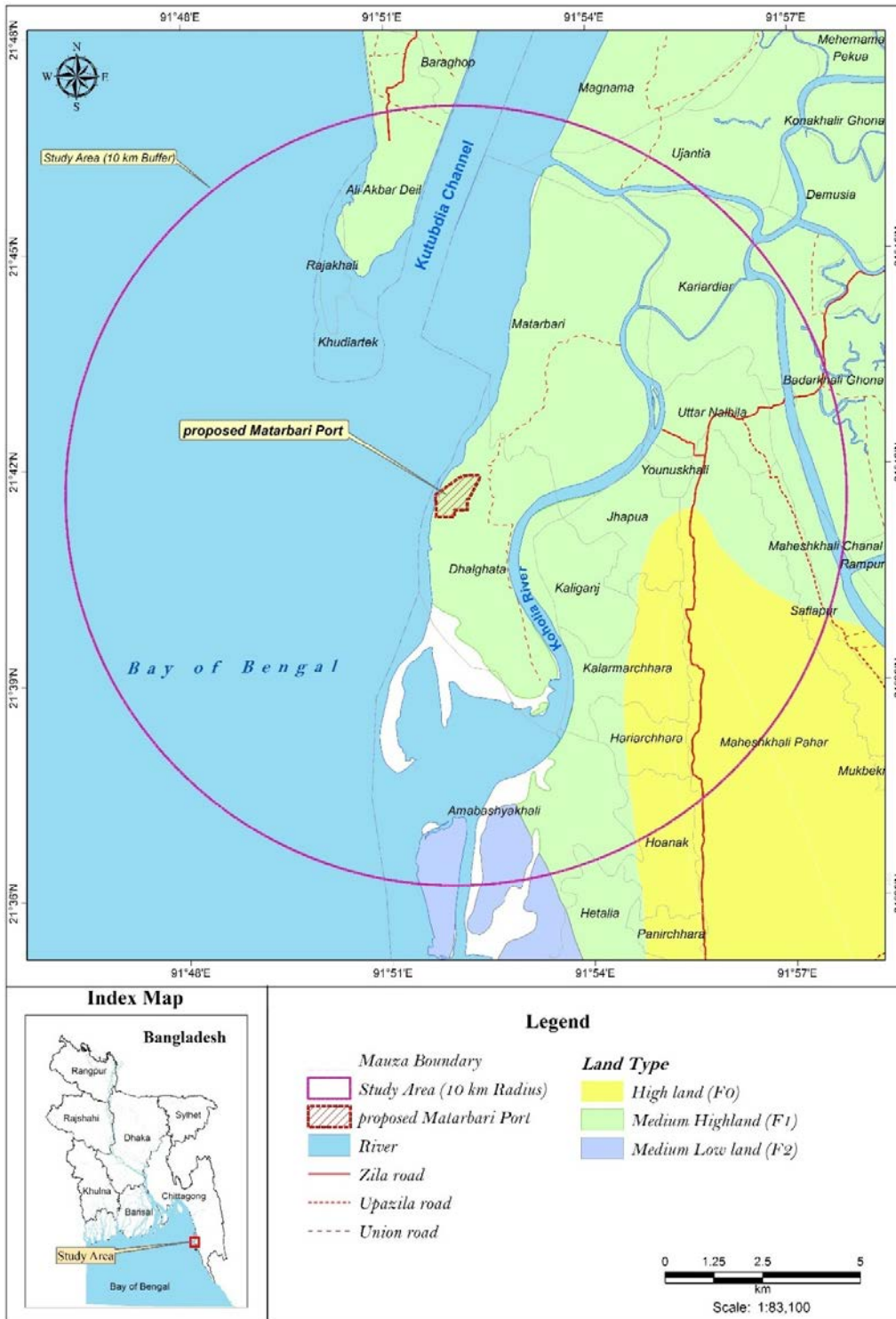


Figure-5.4-1 Land types map of the Project Area

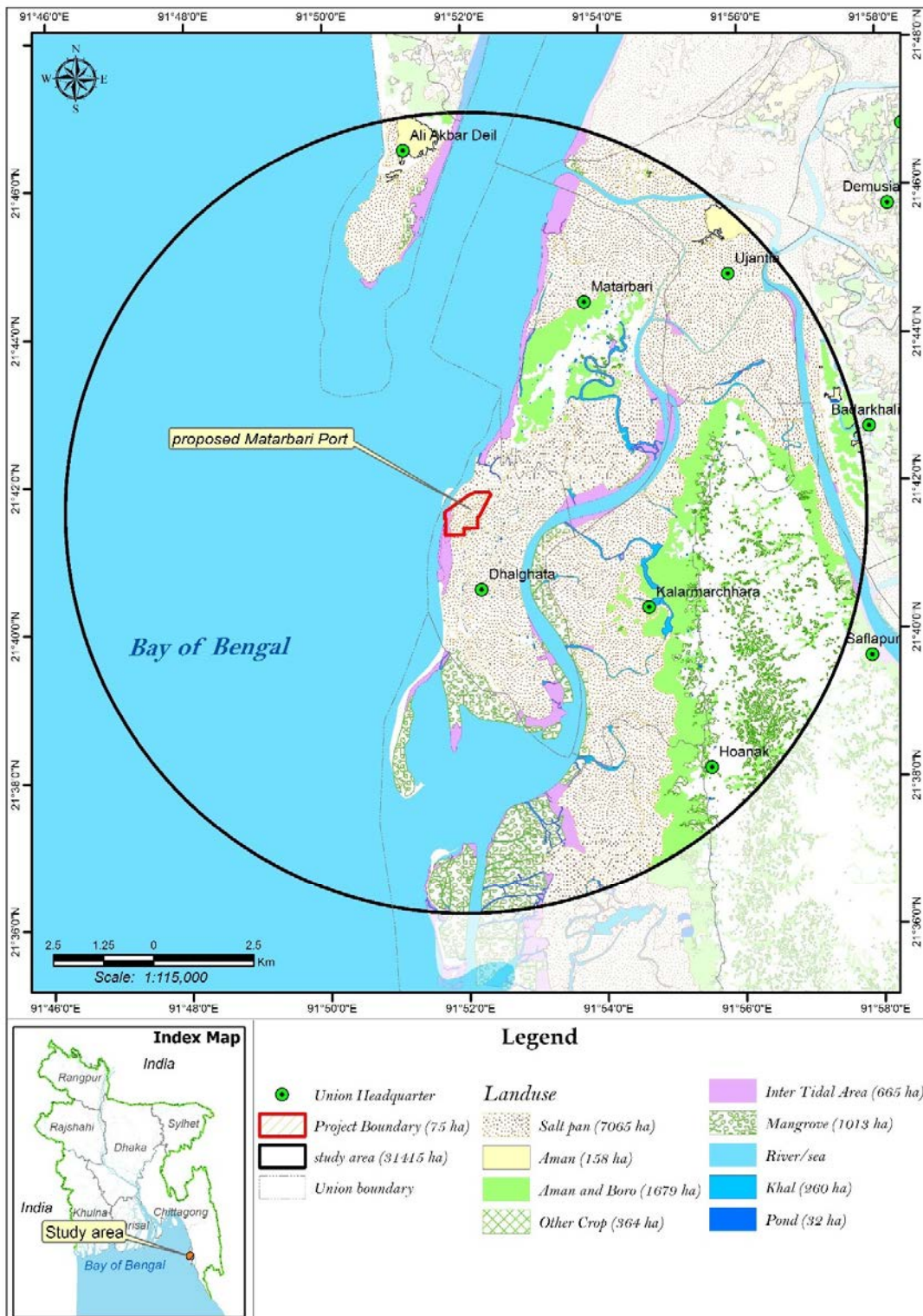


Figure-5.4-2 Cropping Pattern of the Project Area

5.4.3 Livestock Resources

5.4.3.1 Status of livestock and poultry

Livestock and poultry, being an essential element of integrated farming system, play an important role in the economy of the study area. Livestock provides significant draft power for cultivation, threshing of rice crop; cow dung is used as a source of manure and fuel; a ready source of funds and meat, milk and eggs for human consumption. Most of the households raise poultry and livestock, which significantly reduce poverty through generating income. About 40%, 2%, 30% 5%, 40% and 60% of households of the study area are rearing cows/bullock, buffalo, goat, Sheep, Duck and chicken respectively.



Livestock in the Project Area

The owner of the livestock population in the project area is facing problems in respect of non-availability of fodder and feeds during the month of July to November due to unavailability of grazing land. Rice straw is used as the main source of fodder. Besides oil cake and rice barns are also used as fodders. Poultry population at family level survives by scavenging and generally no feed supplements are provided. However, at times kitchen waste becomes feed to the poultry.

Productions of livestock and poultry are mainly constrained due to diseases and death of the population. Sometimes diseases are seen as epidemic form causing a considerable economic loss in livestock farming. Every year livestock population is affected by different diseases like Foot and Mouth Disease (FMD), Anthrax (Torka), Black leg (Badla), Golafula (HemorrhagicSepticemia), Pet fula (Enterotoxaemia), Diarrhea, Mastitis(Olan fula), Peste Des Petits Ruminants (PPR) etc. The goat cyst in head is a common disease of goat. Major poultry diseases are New Castle (Ranikhet), Fowl pox, Duck plague, Chronic Respiratory Disease (CRD) and Dysentery, etc. The most vulnerable period is June to October (rainy season) months for spreading diseases to livestock and poultry populations. The duck plague generally occurs in summer. However, some diseases are found round the year. During monsoon season, the soggy condition of the animal shelter promotes various kinds of diseases to the bullocks and cows.

5.4.3.2 Fisheries Resources

The project area is situated on the eastern side of the Bay of Bengal and the Kutubdia Channel. The area is highly potential for shrimp farming during wet season and in dry season it is replaced by salt pan. Shrimp is a highly valued foreign currency earning product and it earned 2.12% of country total

export earnings in 2011-12 fiscal years while country’s export earnings from the fisheries sector is 2.46%. This sector contributes 4.39% to the national GDP and almost one-fourth to the agriculture GDP, 22.76% (Bangladesh Economic Review, 2012). The study area falls in Cox’s Bazar districts has alone the potential of contributing around 0.07% of export earnings through shrimp. The growth rate of this sector over the last 10 years is almost steady and encouraging, varying from 4.76% to 7.32% with an average 5.61%. During field investigation following habitats have been identified in the study area. These are: (i) Canal/Khal/Chhara, (ii) Mangroves and (iii) Intertidal area broadly under inland capture fishery; (iv) Pond, (v) Lake, (vi) Ditch, and (vii) Shrimp farms, broadly under inland culture fishery; and (viii) Marine capture fishery. Habitats are highly diversified in the range of fresh water to saline water condition having variety fish species.

5.4.3.3 Fish Productivity Assessment

Analysis of the data obtained from the concerned Upazila Fisheries Offices (UFOs) and FRSS, 2011-12 (published in 2013), suggest that yearly fish production rate of Canal (Considered as river productivity) of the study area is 150 kg/ha which is lower than that of national average, 171 kg/ha. Similarly, productivities of Mangrove habitat (Considered as Sundarbans productivity), Fish Pond, Shrimp farm and Marine are quite lower than that of national average for respective ones as illustrated in Figure5.4-3. Productivities of other non-conventional habitats are also shown in the following figure without comparison.

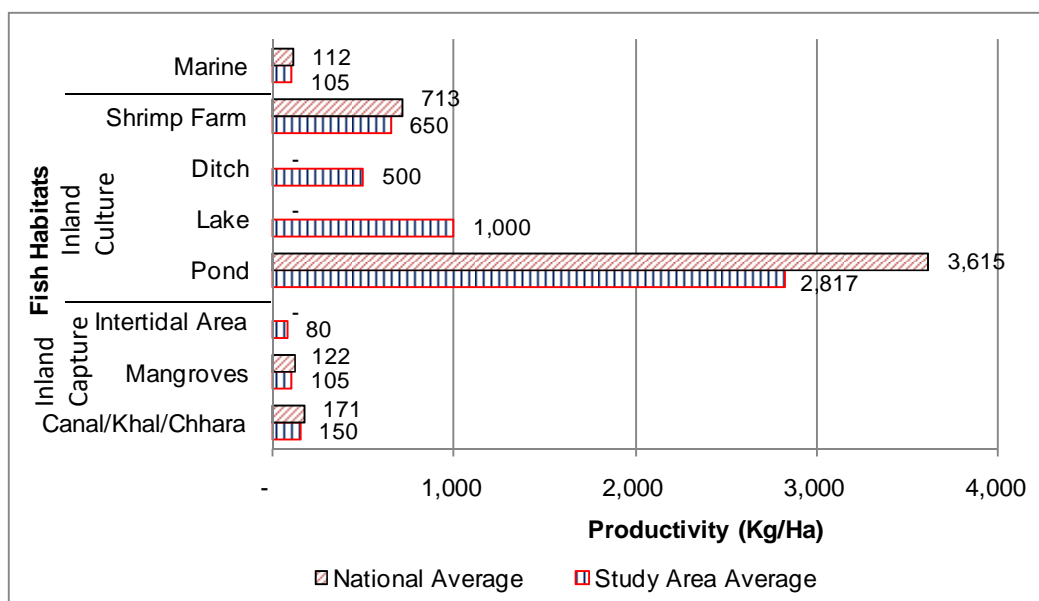


Figure5.4-3: Fish production rate (kg/ha/year) of different habitats

For the port project the fish habitat (Shrimp Farm) for inland culture will be 75 Hectares of land. Whereas the offshore soil dumping area would be approximately 10,015.00Hectares of marine area. Dredging of port would take place for about 25 hectares of marine area. So the fish production loss calculation will be:

Table-5.4-1 Fish Production Assessment

Sl. No.	Type	Fish Production Rate (Kg/ha/year)	Area	Production (MT/Year)
1	Shrimp Farm	650	75	48.75

2	Marine	105	10040	1054.2
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5.4.3.4 Fish Production Assessment

Open water fish depend on primary productivity like phytoplankton, zooplankton and benthos for their food. Almost all fish take plankton as food in their early stage of life. The abundance and species of primary productivity varies in dry season and wet season. Generally, the habitat remains rich in primary productivity during wet season and reduces gradually up to the next dry season. The most common primary productivity found in the study area is given in Table5.4-1.

Table5.4-1: Primary productivity of the marine and inland riverine habitat

Category	Species/ Group	
	Rainy season	Dry season
Phytoplankton	Diatom, <i>Thalassiothrix</i> sp, <i>Biddulphi</i> asp, and <i>Pleurosigma</i> sp	Diatom, <i>Biddulphi</i> asp., <i>Thalassiothrix</i> sp, <i>Coscinodiscus</i> sp. and <i>Rhizosolenia</i> sp.
Zoo plankton	Copepoda and <i>Sagitta</i> sp	Copepoda and <i>Sagitta</i> sp
Benthos (sea-bottom)	Crustacea, Polychaeta, Bivalvia and Gastropoda	Polychaeta and Gastropoda
Benthos (mud flat)	Nematoda, Polychaeta, Bivalvia and Gastropoda	Polychaeta, Bivalvia and Gastropoda

5.4.3.5 Fish Migration

The Kutubdia channel, Matamuhuri River and Kohaliariver and other internal khals having tidal influence serve as a major corridor of fish and shrimp migration of the study area. Both anadromous and catadromous fishes migrate through these rivers and khals for meeting different biological requirement throughout the year at each stage of their lifecycle. The major migratory fish species of the study area are Ilish, Koral, Mochh, Gula, Bata/Khorsula, Tailla, Bagda, etc. Forced movement of fresh water fishes occur through the hill streams to the study area from the nearby fish habitats within the forest.

5.4.3.6 Fishing Tools

The study area has the characteristics of a mixture of marine, coastal and inland fishing. Fishing in such habitats is carried out using diversified gears and appliances for catching different fish species. Gears and gear specific fish species are as follows: (i) Ilishjal (Chikon)- Ilish, Mitty, SurmaMitty, Chhuri, Loitya, Lakhya etc.; (ii) Behundijal- Gurachingri, Bele etc.; (iii) Sorijal/Berjal- Icha, Uluamach, Kachki etc.; (iv) Current jal- Koral, Tailla etc.; (v) Toungajal/Thelejajal- Baishatjal- Post Larvae of shrimp, other hatchlings; (vi) Sot jal/Charpatajal- Gulitengra, Bhol, Kala Poa, Icha, Bele etc.; (vii) Jhakijal- Chiring, Icha, Bata, Telapia, Koral etc.; (viii) Kondrajal- Loitya, Pairsa, Bele, etc; (ix) Laljal- ChhabaMitya, Keda, Bommach etc.; and Borshi- Koral, Kainmagur, Kala Poa, Koirmach, etc. Ilish fish is caught in warm weather in Boishakh (i.e. first month of Bengali year) when the habitat experiences more salinity.

5.4.3.7 Fish Biodiversity and Composition

The study area fish habitats are still moderate rich in species diversity and composition as represented by the low species dominance. This area is believed to have about 90-100 species of fish and shrimp. Among the saline and brackish water fishes like Hilsa, Choikka, Loitya, Surma, Puka (Poa), Keda/Chamfula, Pairsa (Chouka), Dome Machh, Bhara, Kauwa, TekChanda, Ayer Chanda, Foilya/Rupchanda, Bagda, Lobster, Chhuri, Koral, SadaDatina, Chiring etc. are abundant in the study

area and the composition of the species is illustrated in Figure 5.4-4. Fish species like Koral, Bata (Kharul), GulaTengra (Guillya), Bhol, etc and shrimp species such as Chaka Chingri, LoilyaChingri, and Bagda PL are regularly caught in different nets set in the confluence of Kutubdia Channel, Sangu River, Matamuhuri River and Karnaphuli River. Bagda post larvae (PL) are still abundant in these Channels and sea shore. Crabs are also harvested using bamboo made small cages locally called chai/doghair. The crab harvesters set crab trap in spring tide and harvest crab in the neap tide. Crabs are caught largely in warm weather while less in the cold weather. Small fish species like Punt, Kholisha, Bele, Kakila, Taki, Shingh etc. are the main species of the khals and chharas which are mainly concentrated in the northern part of the study area shown in Figure 5.4-5. Fishes are mostly harvested during rainy season in the study area. It is also observed that exotic carp and perch (Tilapia) species are available in the culture system in the study area.

The dominating fish species of the open water habitat around the proposed plant site are Ilishamegaloptera, Hilsakelee, Chanoschanos, Harpadonnehereus, Mystusgulio, Mugilcephalus, Epinephelus sp., Leiognathusbrevirostris, Gerresfilamentosus, Acanthopagruslatus, Acanthopagrusberda, Acanthopagruslatus, Polydactylussextarius etc.

The shrimp gher/ghona is intruded naturally by a number of commercially important fish species like Koral, Bata, Gulitengra, Chaka Chingri, Loilyachingri, crab etc. while water entering into the Ghona. The composition of species of the shrimp gher is shown in Figure 5.4-6. Water is generally exchange in the Ghona in every 15 days interval in 'Full moon-Bharagonn'. The composition of fish pond aquaculture of this area is shown in Figure5.4-7.

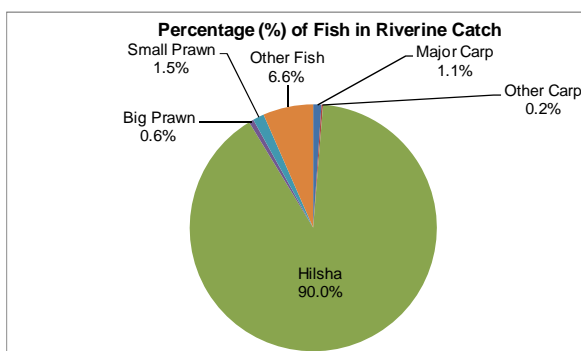


Figure 5.4.-4: Species composition of riverine catch (Source, FRSS 2011-12)

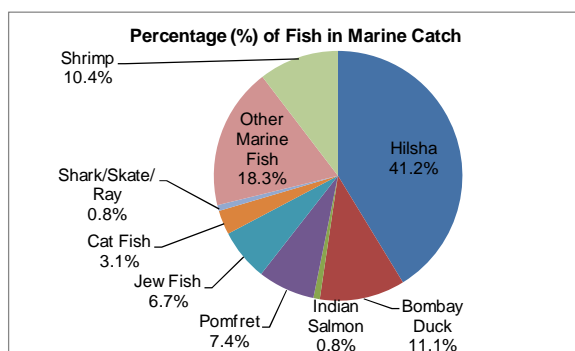


Figure5.4-5: Species composition of marine catch (Source, FRSS 2011-12)

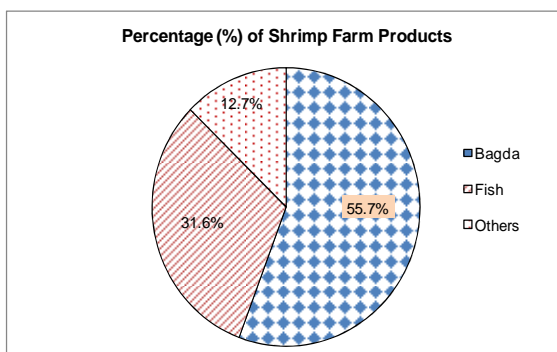


Figure5.4-6: Species composition of shrimp Farm (Source, FRSS 2011-12)

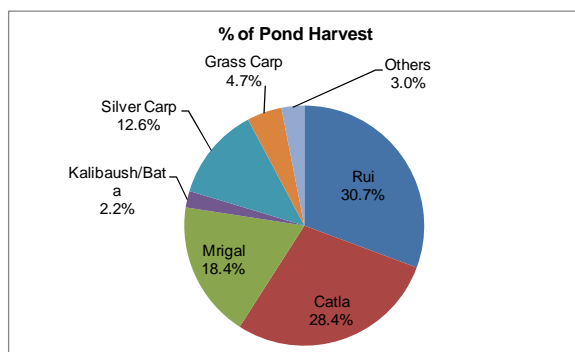


Figure5.4-7: Species composition of cultured pond (Source, FRSS 2011-12)



a. ESBN catch composition



b. Composition of shrimp farm yield



c. Other fish species



d. Composition of push net

Fish and shrimp species composition of catch

Report of local fishermen and also the catch revealed that the fish biodiversity has been declining over the years. Factors responsible for the downturn of the species diversity are: (i) narrowing down fish habitats; (ii) deteriorating water as well as habitat quality; (iii) increasing fishing pressure; (iv) collection of shrimp PL which causes the mortality of other fish fauna; (v) obstruction in fish migration routes; (vi) aggradations of riverine habitats due to geo-morphological processes; (vii) nullification of mangrove forests; (viii) alteration of fish breeding grounds; (ix) expansion of culture fishery and (x) changing of land use pattern. A list of indicative fish species of the study area is given in Table 5.4-2.

5.4-2 Indicative fish species diversity with their habitats and breeding periods

Sl. No	Scientific Name	Local Name	Common English Name	Status IUCN	Habitat				Breeding period
					Sea shore /chan	Man grove	Khal	Pond	
1	<i>Ilishamegaloptera</i>	Choikka	Big eye Hilsa	-	P	A	A	A	Aug-Sep
2	<i>Hilsakelee</i>	Bengilish	Kelee shad	-	P	A	A	A	Aug-Sep; Jan-Feb
3	<i>Chanoschanos</i>	Akharul/Chela	Milk fish	-	P	P	A	A	-
4	<i>Harpadonnehereus</i>	Loitya	Bombay duck	-	P	P	A	A	-

Sl. No	Scientific Name	Local Name	Common English Name	Status IUCN	Habitat				Breeding period
					Sea shore /chan	Man grove	Khal	Pond	
5	<i>Mystusgulio</i>	Guilla	Long whiskers catfish	-	P	P	P	A	-
6	<i>Mugilcephalus</i>	Kharulbata	Flathead mullet	-	P	P	A	A	-
7	<i>Epinephelus spp.</i>	Bole	Grouper	-	P	P	A	A	-
8	<i>Leiognathusbrevirostris</i>	Tekchanda	Shortnose pony fish	-	P	P	A	A	-
9	<i>Gerresfilamentosus</i>	Dome machh	Whipfinsilver rbidy	-	P	A	A	A	-
10	<i>Acanthopagruslatus</i>	SadaDatina	Yellow fin sea bream	-	P	P	A	A	-
11	<i>Acanthopagrusberda</i>	Kala Datina	Picnic sea bream	-	P	A	A	A	-
12	<i>Acanthopagruslatus</i>	Datina	Yellow Sea Bream	-	P	P	A	A	-
13	<i>Polydactylus extarius</i>	Surma/Taila	Blackspot threadfin	-	P	P	A	A	-
14	<i>Johniusamblycephalus</i>	Puka/Poa	Bearded craoker	-	P	P	A	A	-
15	<i>Scartelaoshistophorus</i>	Chiring	Walking goby	-	P	P	A	A	-
16	<i>Lepturacanthussavala</i>	Chhuri	Savalanihairtail	-	P	A	A	A	-
17	<i>Euthynnusaffinis</i>	Maitta/Kawa	Kawakawa	-	P	A	A	A	-
18	<i>Pampusargenteus</i>	Folichanda	Silver pomfret	-	P	P	A	A	-
19	<i>Pampuschinesis</i>	Rupchanda	Chinese silver pomfret	-	P	A	A	A	-
20	<i>Acentrogobiuscaninus</i>	Bailla	Tropical Sand Goby	-	P	P	A	A	-
21	<i>Catla</i>	Catla	Katla	-	P	A	P	P	-
22	<i>Cirrhinusmrigela</i>	Mirka	Mrigel	-	P	A	P	P	-
23	<i>Ctenopharyngodonidellus</i>	Grass carp	Grass carp	-	A	A	A	P	-
24	<i>Cyprinuscarpio</i>	Carpio	Common carp	-	A	A	A	P	-
25	<i>Hypophthalmichthysmolitrix</i>	Silver carp	Silver carp	-	A	A	A	P	-
26	<i>Labeoboga</i>	Bhangon	BogaLabio	-	P	A	A	A	-
27	<i>Labeocalbasu</i>	Calbaus	Black Rui	EN	A	A	P	P	-
28	<i>Labeorohita</i>	Rui	Rohu	-	A	A	P	P	April-August

Sl. No	Scientific Name	Local Name	Common English Name	Status IUCN	Habitat				Breeding period
					Sea shore /chan	Man grove	Khal	Pond	
29	<i>Latescalcarifer</i>	Koral	Sea Bass	-	P	P	A	A	June-July
30	<i>Lepidosephalusguntia</i>	Gutum	Guntia Loach	-	P	A	P	A	-
31	<i>Liza parsia</i>	Parse	Goldspot Mullet	-	P	P	A	A	-
32	<i>Mystus tengara</i>	Bajari-tengra	TengaraMystus	-	P	A	A	A	-
33	<i>Oreochromis niloticus</i>	Tilapia	Tilapia	-	A	A	P	P	-
34	<i>Plotosus caninus</i>	Gang magur	Canine Catfish	VU	P	P	A	A	-
35	<i>Polynemus paradoxus</i>	Tapsi	Paradise Threadfin	-	P	P	A	A	-
36	<i>Thryssa mystax</i>	Faisha	Anchovy	-	P	P	A	A	-

Here, A= Absent and P=Present, VU=vulnerable, EN=Endangered Sources: Red Book of threatened Fishes of Bangladesh, IUCN and fishermen consultation

5.5 ECOLOGICAL RESOURCES

The study area and its surrounding comprise different landforms having varied vegetation patterns which create different habitats. The project area is located very near to the Bay of Bengal. Regular tidal flow, salinity intrusion through the canals and tidal surge is changing the land use pattern. The study area has been occupied by sea, saltpan, canal, forest, stream, shrimp farm, mudflat, pond, homestead, agriculture land etc. The area has been demarcated under certain bio-ecological zone from physiographic and biodiversity points of view.

5.5.1 The Bio-ecological Zone

IUCN, The World Conservation Union, has divided Bangladesh into 25 Bio-ecological Zones (Nishat et al., 2002) in context of physiographic and biological diversity. The study area has fallen under four bio-ecological zones: i) Chittagong Hills and the CHTs, ii) off-shore island, iii) Coastal and Marine Waters, and iv) Coastal Floodplain. The area (both directly and indirectly impacted area) occupies terrestrial as well as aquatic ecosystems. Each of the bio-ecological zones represent overall ecological situation of an area of the country. A brief description of the Bio-ecological zone is presented below.

5.5.1.1 Chittagong Hills and the CHTs

This zone is composed of tropical evergreen and semi-evergreen forest. While the hills are not very high generally about 600m-they are ragged and often steep. These hill forests are the most important watershed areas of the country. The tropical evergreen and semi-evergreen forest are not very distinct, and are often intermingled and merged into one another in this zone. The majority of the species in the lower canopy are evergreen, and the upper canopy of the forest is deciduous type. Some of these deciduous tree species shed their leaves in the winter while other does it in the monsoon, so the forests appear evergreen. Tropical evergreen forest is found in the valleys of this zone. The predominant species are; Civit (*Swintonia floribunda*), Garjan (*Dipterocarpus* sp.), Chapalish (*Artocarpus chaplasha*), Chundul (*Tetrameles nudiflora*), Telshur (*Hopea odorata*). In the lower canopy important species like the Pitraj (*Aphanamixis polystachys*), Toon (*Toonaciliata*), Nageshwar

(*Mesuaferrea*), *Uriam* (*Mangiferasylvestica*) and various *Ficus* species can be found. The undergrowth is usually a tangle of shrubs, in which cane, bamboo and wild banana are the prominent species. Knowledge on the diversity of reptiles and amphibians of this zone is rather rudimentary, as few surveys of these animals have been made. This zone possesses richest avifauna population of the country mostly marine and shore birds. Out of 66 families of birds which are seen in the country, 55 are available in this zone.

5.5.1.2 Offshore Islands

This zone covers mostly mudflats. Moreover, there are extensive inter tidal mudflats composing parts of the islands. Most of these mudflats occur along the inland creeks. There are also large shoals in this area; these may consolidate into large islands by the end of this century. The vast amount of sediment brought down by the Meghna made the estuary shallow for a considerable distance (Rashid, 1991). Among the rich vegetation observed in this zone, there are man-made plantations of mangroves, such as the Keora (*Sonneratiaapetala*), and Tiyanbaen (*Avicenniaofficinale*) in the Nijhumdweep, Ghasiar char and Char batao. The vegetation in the interiors of Hatiya is similar to that of the mainland and includes: the Sadakoroi (*Albiziaprocera*), Shaora (*Streblusasper*), Gab (*Diospyrospergrina*), Babla (*Acacia nilotica*), Kadam (*Anthocephaluschinensis*), Banyan (*Ficusbengalensis*), Jam (*Syzygiumsp*, Mandar (*Erythrinaindica*), Sonalu (*Cassia fistula*), Date palm (*Phoenix sylvestris*), Toddy palm (*Borassusflabellifer*), Coconut (*Cocosnucifera*) and various bamboo species. The islands of this zone are very important staging and wintering areas for a wide variety of waterfowl, particularly the migratory shorebirds. Rashid (1989) recorded over 108,000 waterfowl of 49 species, together with 5,500 unidentified ducks and 56,500 unidentified shorebirds. Besides, some of the common reptiles of the zone include: the Common garden lizard (*Calotesversicolor*), Common skink (*Mabuyacarinata*), Bengal monitor (*Varanusbengalensis*), Yellow monitor (*V. flavescens*), Checkeredkeelback (*Xenochrophispiscator*), Binocellate cobra (*Najanaja*) and Spotted flapshell turtle (*Lissemyspunctata*). Likewise, common mammalian species of this zone include: the Ganges river dolphin (*Platanistagangetica*), Jackel (*Canisaureus*), Small Indian mongoose (*Herpestesaeropunctatus*), Clawless otter (*Aonyxcinerea*), Large Indian civit (*Viverrazibetha*) and Greater bandicoot rat (*Bandicotaindica*).

5.5.1.3 Coastal and Marine Waters

The marine area comprises the territorial waters and the Exclusive Economic Zone (EEZ) of Bangladesh. The coastline along the Bay of Bengal is 1200 kilometers long including the coastlines of numerous islands, but not measuring minor indentations. The coastal zone has its own dynamics and deserves special attention as a very distinct terrain (GoB, 1994). The coastal area, comprising of the complex delta of the Ganges-Brahmaputra-Meghna river system has immense biological resources. The river system, while flowing through Bangladesh on its way to the Bay of Bengal, carries an estimated annual sediment load of about 2.0 billion tons; these sediments are subjected to coastal dynamic processes generated mainly by river flow and tidal wind actions, leading to accretion and erosion in the coastal areas of Bangladesh. Knowledge base on the status of the biological wealth, both in terms of floral and faunal, is very rudimentary of this zone. Nonetheless, some of the faunal species which are known to occur in this zone include the Fin whale (*Balaenopteryphysalus*), Humpback whale (*Megapteranovaeangliae*), various species of dolphins: e.g. the Ganges dolphin (*Platanistagangetica*), Irrawaddy dolphin (*Orcaellabrevirostris*), Indo-Pacific hump-backed dolphin (*Sousa chinensis*), all five species of marine turtles: the Loggerhead turtle (*Carettacaretta*), Green turtle (*Cheloniemydas*), Hawksbill turtle (*Eretmochelysimbricata*), Olive ridley turtle (*Lepidochelysolivacea*), Leatherback turtle (*Dermodochelyscoriacea*), snakes, numerous migratory waterfowl, marine fishes, echinoderms, mollusks, etc.

5.5.1.4 Coastal Plains

The coastal plains are underlain by heavy marine or tidal clays but these have been buried under by more sand or salty deposits near the foot of the hills and along the courses of rivers and streams which run across the plains. The eastern coastline, extending from the mouth of the Feni River to the southern tip of mainland along Chittagong, is regular and unbroken and protected along the sea by mud floods and submerged sands. This zone is important for a wide variety of waterfowls.

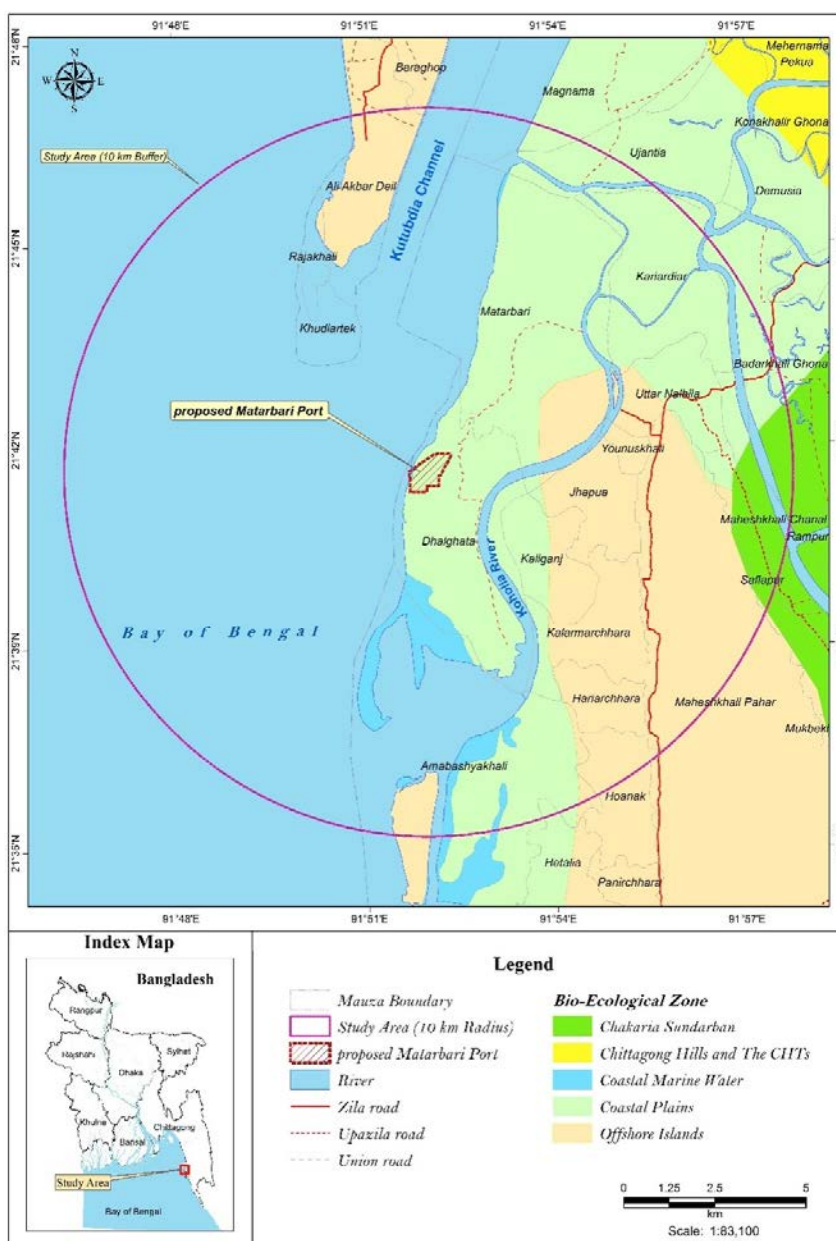


Figure-5.5-1 Bio-Ecological Zones of the Study Area

5.6 ECOSYSTEM

The study area supports different types of habitat with different species of flora and fauna. Ecosystems of the study area can be divided into four major categories, such as i) Terrestrial ecosystem, ii) Mangrove Ecosystem, iii) Aquatic ecosystem and iv) Marine Ecosystem. Each major

category is further divided into sub-categories. However, overall situation of ecological resources and ecosystems of the area are described below.

5.6.1 Terrestrial Ecosystems

The terrestrial ecosystem of the study area used to be covered agriculture land, hill vegetation, road side vegetation and homestead vegetation. The hill sides and top, which were not occupied by human habitations, were lightly covered with large growths of semi-spontaneous vegetation. These types of vegetation have a major contribution for meeting food, fodder, medicine, fuel and other household requirements to the local people. Natural vegetation includes wooded areas, grassland and other natural habitats. Human influenced vegetation includes homestead gardens, orchards, plantation, cropland and other planted or cultivated habitat. The ecosystem consists of both static (Flora) and dynamic (Fauna) life lines which are described below.

5.6.1.1 Terrestrial Flora

The terrestrial flora of the area can be categorized as i) Homestead vegetation, ii) Forest vegetation, iii) Crop field vegetation, iv) Coastal, Roadside and Embankment vegetation. Each category of vegetation has distinguished characteristics to separate them from each other. Characteristics of vegetation by category are described as follows:

Homesteads Vegetation

The Homestead are planted flora for the household benefits. Species are usually planted in the yard or periphery of the settlement with interest of financial benefits. This type of vegetation mainly contains flower, fruit timber, thatching and medicinal plants and provides facilities for earning money. The dominant plant of the study area is Eucalyptus, Khajur, Neem, Acacia, Rain tree etc. The dykes of the homestead ponds are planted with economically important plant species like Narikel, Murta, Supari, etc. Homestead vegetation is the single most important plant community in the area. The backyard of each homestead is generally cultivated with fruit and timber trees though there are also different types of naturally grown shrubs and herbs.

Forest vegetation

Under the Climate Resilient Participatory Afforestation & Reforestation Project (CRPARP) there are some afforestation programs of Jhaw and Mangrove in the project study area. This afforestation is on the accretion land formed in the coastal and bank line of the river area. Figure 5.6-1 shows the forest vegetation of the project area.

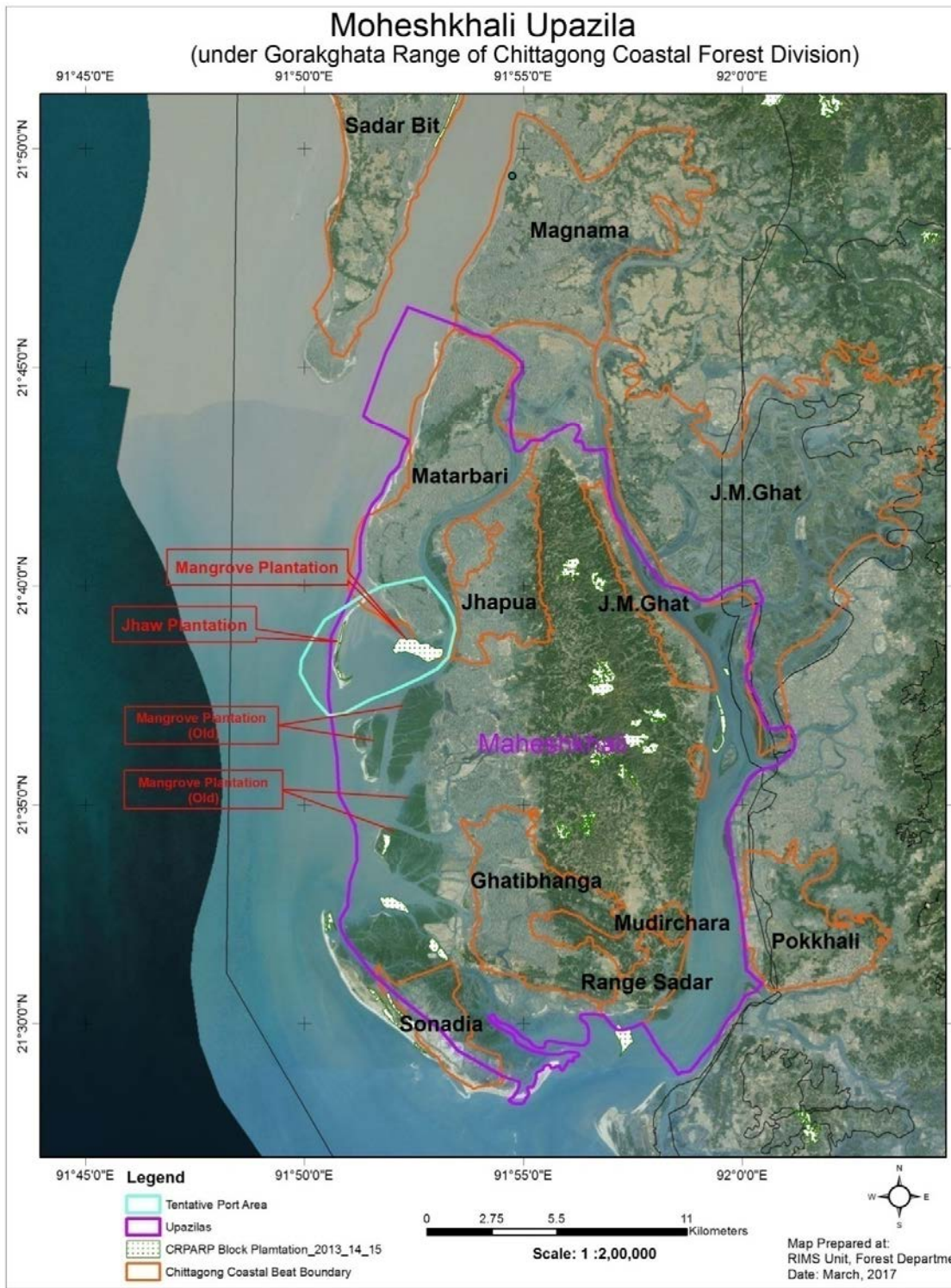


Figure-5.6-1 Afforestation Program in the Project Study Area

Crop field vegetation

The cropland vegetation is exclusively dominated by cultivated crop varieties (detailed description of crop varieties are described in agricultural portion). The crop varieties are rice and some vegetables. Different varieties of paddy are cultivated once or twice a year. Except crop varieties, numerous species of herbs and shrubs are grown with crop field which are called weeds. The cropland vegetation provides support to food-web and maintaining ecosystem function. Existing cropland vegetation generally known as weed in the study area are Shyama Gash, AraliGhash, Katanotey, Durba Ghash etc. Cropland vegetation means the plants grow in the crop field naturally as weeds and the plants that are cultivated by the farmers. The farmers mostly grow rice in the crop fields. It develops a new ecosystem with the interaction of rice plant, weeds and wild organisms live on plant leaves and other soil products. The weeds that play major role in this ecosystem include the following species, Chapra (*Elusina indica*), Shama (*Echinochloa colonum*), Durba grass (*Chynodondactylon*), Torpado grass (*Panicum repens*), Katanata (*Amaranthus spinosus*), Centipeda orbicularis, Cyperus sp., Bonjal (*Croton bonplandianum*) etc.

Roadside, Coastal and embankment vegetation

Roadside and embankment vegetation's are generally planted and develop an ecosystem which is dominated by hard wood tree species. These species are Raintree, Babla, Mahogoni, Acacia, Koroi, Neem, etc. Some plants also grow naturally in-between the planted plants and remain at the bottom levels on either sides of the road function as barrier of soil weathering. The small-sized herbs are also available and Bhat, Croton, Bondhona, Daton are found commonly everywhere in the area. A large number of Jhau tree are present within the Project area.

Terrestrial Fauna

The study area has limited faunal diversity due to lack of vegetation except forest and Bashkhali Eco Park. Land encroachment leading to expansion of settlements and agriculture, tree poaching, hunting, collection of fuel wood, bamboo and cane, and other forest products are the major causes for the degradation of the forest and its resources. The homestead and roadside vegetation are considered as secondary habitats for the terrestrial fauna. The cropland vegetation also supports insects, amphibians and some reptiles. Some small to medium-sized mammals are reported to be available in this area: Field Rat, House Rat and Indian Flying Fox etc. The commonly available terrestrial birds of the area include Black Drongo, Common Myna, Asian Pied Starling, Oriental Magpie Robin, Jungle Myna, Spotted Dove, Red-vented Bulbul, House Sparrow, Common Tailorbird, etc. The population of birds is richer than all other faunal communities. Of the terrestrial reptiles, the Indian Rat snake, Common Garden Lizard, House Gecko, Spotted House Lizard, Little Skink, Striped Keel back are reported to be found in the area. The amphibians are naturally small-sized, inhabit in various habitats from human settlement to agricultural lands and even in ditches. Though the amphibians are smaller in size but they have great contribution in the food chain and recognized as indicator species of the environment. The frog species those are commonly observed in the area are Green Frog, Common Toad, Indian Bullfrog, Common Tree Frog and Cricket Frog.

5.6.2 Mangrove Ecosystems

The study area comprises of patches of plantation mangrove forest, locally called 'Parabon'. These forest patches are mostly planted. The species diversity of the 'Parabon' is dominated by Bayen covering. Among the species of Bayen, Moricha Bayen was observed most. Other planted species include Kankra, Golpata, Chhoillya, Horgoja, Keora, Nuna etc. Along the JalkaderKhal and its suburbs lowland area consists of some mangrove vegetation and developed mangrove ecosystem. The common mangrove plant species found along the khal and surroundings lowland is Horgoja, Baien, Nona Bhat, Golpata and Gewa. The mangrove ecosystem support survival of the Crab Eating Snake (*Fordonialeucobalia*), Glossy Marsh Snake (*Geradaprevostiana*), Dog-faced Water Snake (*Cerberus rynchops*) etc.

5.6.3 Aquatic Ecosystems

The study area and its tributaries support different types of wetlands both perennial and seasonal in nature. The wetlands consist of different aquatic ecosystems. Aquatic habitat in this area includes Bay of Bengal, Kutubdia channel, Matamuhuri River, Kohalia river and other internal Khals and some seasonal wetlands and homestead ponds. The area becomes flooded during the monsoon period and these play great roles for aquatic ecosystem. Seasonal wetland is mainly floodplains, which is inundated in the monsoon.

Aquatic Flora

Diversity and density of floral species are varied according to wetland types as well as water depth and velocity. Kochuripana (*Eicchorniacrassipes*) is the most common free floating hydrophyte that covers maximum portion of water area of the ponds and ditches. Topapana (*Pistiastratotes*) are found in most of the ditches as well as ponds mixed with hyacinth. Shapla (*Nymphaeastellata*), Chandmala (*Nymphoides sp.*) are dominating the floodplain vegetation. Sedges are quite common during monsoon inside all types of wetlands. Hydrilla, valesnaria, Helencha (*Enhydrafluctuans*), Ludwgjia, Echinocola, Hygrorhyza, Ficusheterophylla are the main components of the floral composition of aquatic vegetation.

Aquatic Fauna

Population of aquatic faunal species is varied according to wetlands characteristics and surface area of water inside the water bodies. Fishes are holding the major populations among aquatic faunal species those are describe in fisheries section of this report. Among the amphibians, the green frog, skipper frog, etc. are common all over the year. They have been the most successful fauna in adapting to the all kinds of wetlands. Abundance of Bullfrogs (*Hoplobatrachustigerinus*) is generally increased in rainy season at paddy fields, ditches and other marshy places. Common aquatic snakes include the checkered keel back (*Xenocrophispiscator*) and smooth water snake (*Enhydrisenhydriis*) are observed in the area.

Different species of local birds roam on the salt field and shrimp farm within the study area during winter. The wetland dependent birds of the area are: Common Kingfisher, Little Heron, Lesser Whistling Duck, Indian Pond Heron, Little Egret, Yellow Bittern, Great Egret, Pheasant-tailed Jacana etc. Common and uncommon bird species found in the study area are India Pond Heron, Little Egret, Cinnamon Bittern, Cotton Pigmy Goose, Little Cormorant, White breasted Water Hen, Common Kingfisher, Lesser Whistling Duck, Bronzed-winged Jacana, Brhaminy Kite, Pied Kingfisher etc. Existence of Fishing Cat has been found within the area. The commonly observed snake population in water bodies are CheckeredKeelback (*Xenochropispiscator*), Common Wolf Snake (*Lycodonaulicus*) in the area. Skipper Frog is available in water body like hill stream. Among amphibians, the Skipper Frog (*Euphlyctiscyanophlyctis*) is common and found in all wetland habitats and has been the most successful in adapting to the altered habitat.

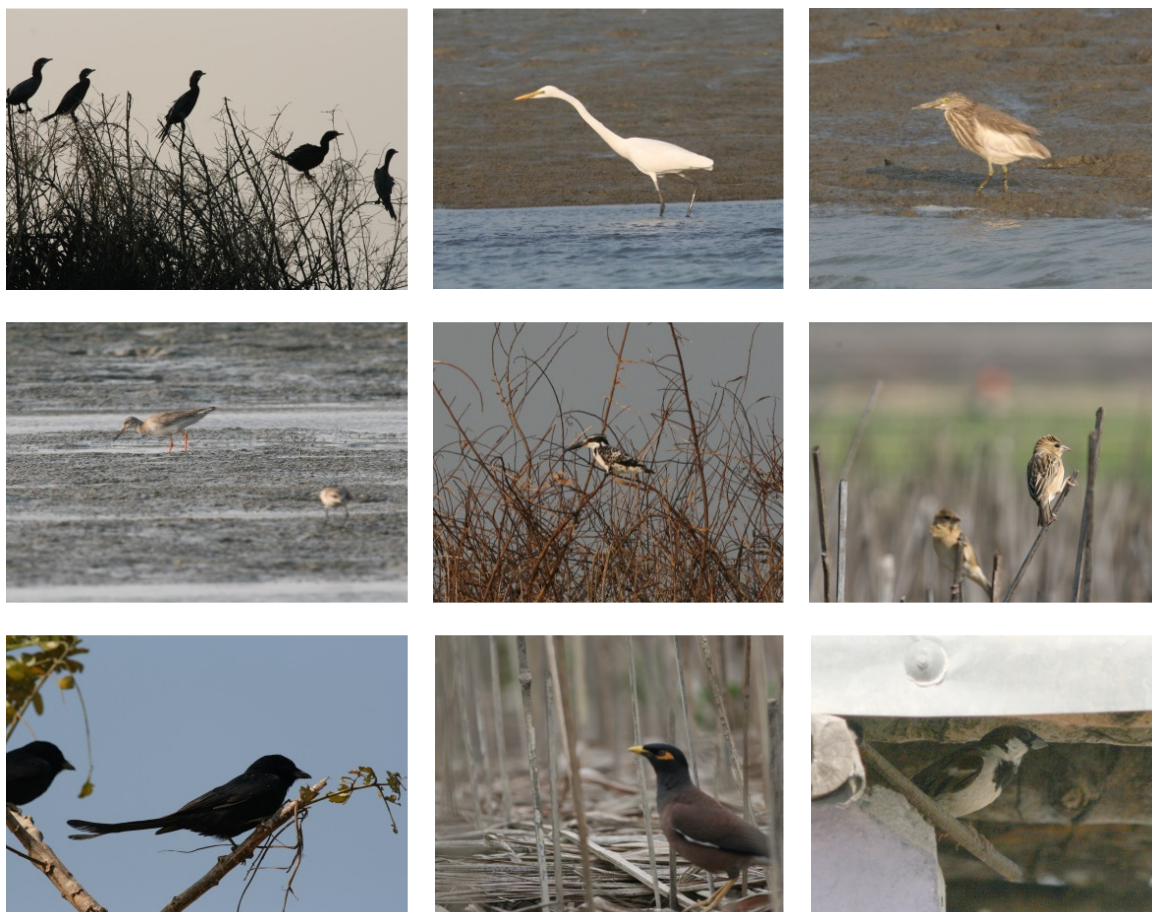
5.6.4 Marine Ecosystems

The study area is located directly on the face of Bay of Bengal and characterizes with Marine ecosystem. They include mudflats, salt marsh, sandbar, sea-shore, and in-shore, intertidal ecology, estuaries, lagoons, coral reefs, deep sea and the sea floor. Marine ecosystems are very important for the overall health of both marine and terrestrial environments.

Marine Flora and Fauna

In the sea, many kinds of marine vegetation such as algae and other aquatic plant are found. In coastal mudflat, particular plants are Ipomeapescapre, Vitextrifolia, Pandanusodoratissimus and Calotropisgigantia. Shore birds feed on mudflats and sand bars of the study area. These shore birds lay eggs on undulated mudflat during the dry season (March/April). Migratory birds gather in the on

shore mudflat during winter season. The offshore areas support four species of globally threatened coastal and macetaceans including Finless porpoise (*Neophocaenaphocaenoides*), Irrawaddy dolphin (*Orcaellabrevirostris*), Bottlenose dolphin (*Tursiopsaduncus*) and Indo-Pacific Humpback dolphin (*Sousa chinensis*). Different species of peneaid, solenocerid, sergestid and careidean prawn species have been found. The beaches and shallow shoals surrounding the site provide an excellent staging area and wintering ground for migratory waterfowl and shorebirds. The common shore bird is Bar tailed Godwit, Whimbrel, Eurasian Curlew, Common Red shank, Marsh Sandpiper, Common Green shank, Green Sandpiper, Grey Plover, Kentish Plover, Lesser sand Plover, Grater sand plover etc. The mudflats are important habitat for migratory and resident birds and mud crab. Sea turtles in the territorial area of Bangladesh are on the verge of extinction, the population having declined sharply over the past two decades. The study area is also important for globally threatened marine turtle such as Olive Ridely and Green Turtle. Benthos is a community of organisms which live on, in, or near the seabed (known as benthic zone). This community lives in or near marine sedimentary environments from tidal pools along foreshore, out to the continental shelf, and down to the abyssal depths. Many organisms adapted to deep-water pressure cannot survive in the upper parts of the water column. Animals ecologically linked to bottom include echinoderms, fishes (Tade Mullet *Liza tade*, Speigler's Mullet *Valamugilspeigleri*, crustaceans, molluscs (*Granular Ark Anadaragranosa*, Mud Crab *Scylla 105errate*, Girdled horn shell, *Cerithideacingelata*, Moon Shail *PolinicesSp*), poriferans and annelids in the study area. No sea weeds or coral reef found in marine ecosystems along the project site.



Birds of the Project Area

5.7 PROTECTED AREA/WILDLIFE SANCTUARY/FOREST

Based on the significance and ecological sensitivity, Ministry of Environment & Forest (MOEF) has declared a number of areas as "ECAs" and "Protected Areas", but there is not much information or study on the Ecologically Sensitive Area (ESA's) of different coastal and marine Ecosystem and its habitat.

Ecologically Sensitive Areas are:

- ✓ Mangroves
- ✓ Mudflats
- ✓ Salt Marshes
- ✓ Sea grass Bed
- ✓ Coral Reefs
- ✓ Marine Wildlife Protected Areas
- ✓ Turtle Nesting Grounds
- ✓ Seaweed bed
- ✓ Sandy Beaches and Sand Dunes
- ✓ Coastal freshwater bodies
- ✓ Horseshoe crab Habitats
- ✓ Nesting Ground of Bird

The proposed port project area is out of the Ecologically Critical Area (ECA).

Table 5.7-1: Protected area in the Coastal zone of Bangladesh

Type	Name	Area (ha)	Location	Effects of 1-m Sea Level Rise (SLR)
Reserved Forest	-	885,043	Khulna, Satkhira, Bagerhat, Bhola, Patuakhali, Noakhali, Chittagong, Cox's bazaar	Yes
National Park	Himchari	1,729	Cox's bazaar	No
Wild life Sanctuaries	Nijhum Deep	4,232	Hatiya, Noakhali	Yes
	Sundarban south	36,970	Khulna	Yes
	Sundarban west	71,502	Satkhira	Yes
	Char Kukri-Mukari	2,017	Bhola	Yes
	Chunati	7,761	Chittagong	No
Ramsar Site	Sunderbans	601,700	Khulna, Satkhira, Bagerhat	Yes
Environmental Critical Areas	Sonodia	4,916	Cox's Bazar	Yes
	Teknaf	10,465	Cox's Bazar	Yes
	St. Martin's Island	590	Cox's Bazar	Yes
World Heritage Site	Wild life sanctuaries of the Sunderbans		Khulna, Satkhira, Bagerhat	Yes
Marine Reserve		69,800	Bay of Bengal	Yes

(Source: Islam 2004; (in Hussain & Haq (eds.), 2010)

The Sonadia Island (Figure-5.7-1) is an identified ECA of the Cox's Bazar. Its outer boundary is almost 10 Km away from the Proposed port Area. So the project activities will not intervene the ECA.

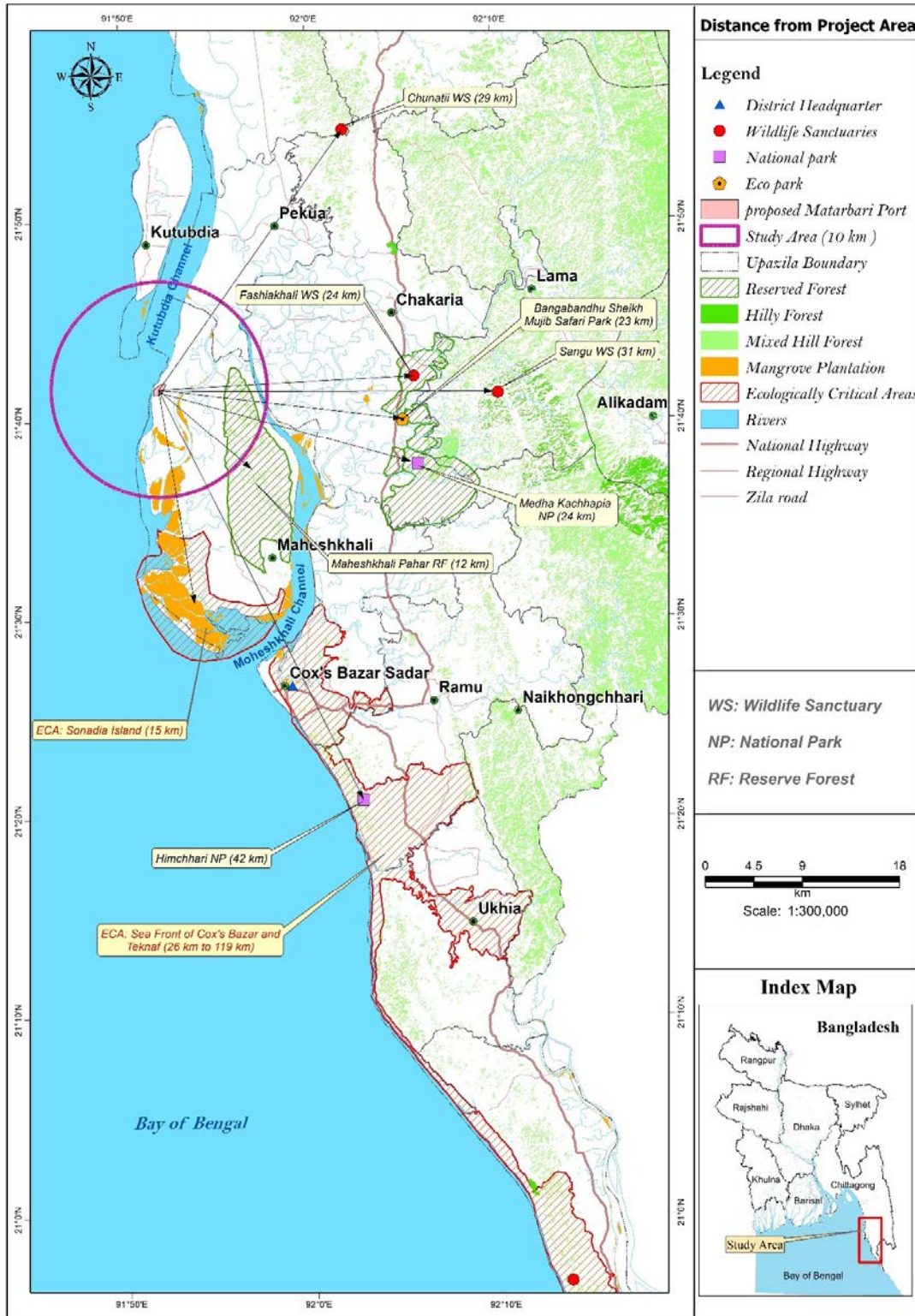


Figure-5.7-1 Comparative Position of ECA and WS

5.8 SOCIO-ECONOMIC STATUS OF THE PORT PROJECT AREA

This section presents the socio-economic condition of the proposed port project area which has been collected from secondary source (BBS report) and primary sources. The socio-economic information includes demographic, educational, employment opportunity, source of income, cultural and other characteristics of the area and these are presented in the following sub-sections. Both primary and secondary data has been used for preparation of the baseline scenario of the port study area.

5.8.1 Demographic Profile (Secondary Sources)

5.8.1.1 Household and Population

According to the Population Census of 2011, there are 2250 households consisting of 12877 members in the study area which includes 6688 (51.94%) males and 6189 (48.06%) females. Considering the above secondary data, the current population and census data is projected¹ for 2017 by multiplying with the national population growth rate (1.37). On the basis of this calculation there are 2441 households consisting of 13972 members in the study area which includes 7256 (51.13%) males and 6715 (48.87%) females. The sex ratio² of male and female of these unions is 108. The key demographic data of the project study area is presented in Table 5.8-1.

Table 5.8-1 Demographic scenario of the study area

Moheshkhali	Union	Total Households		Population 2011			Projected Population 2017			Sex Ratio
		BBS 2011	Projected 2017	Total	Male	Female	Total	Male	Female	
	Dhalghata	2250	2441	12877	6688	6189	13972	7257	6715	108

From the filed investigation the present population of the Dhalghata union is approximately 20000 and the household no. estimated 3200.

5.8.1.2 Household Size

The Bangladesh Bureau of Statistics (BBS, 2011) shows that most of the households (about 80%) in the study area comprises of four or more members in their family. Following figure (Figure-5.8-1) shows that the, average household size and proportion of family member is more or less homogenous. Findings reveal that on an average the household in the study area comprises of 5.7 members which is higher than that of the national average (4.44) and indicates that the families are larger.

5.8.1.3 Age Structure

In the study area the highest number of population (19.2%) belongs to age category of 30 to 49 years old. The lowest 2% population belongs in 60 to 64 and 65+ year's old category. Age groups of 0-14 years is defined as children, 15-24 years as early working age, 25-54 years as prime working age, 55-64 years as mature working age and 65 years and over as elderly people (source: World Fact Book, CIA3). This classification is important as the size of young population (under age 15) would need more investment in schools, while size of older populations (ages 65 and over) would call for more invest in health sector.

¹The formula to calculate a growth rate given a beginning and ending (Estimated Population) population is: $Pop_{Future} = Pop_{Present} (1+r)^n$ Where: Pop_{Future} = Future Population, $Pop_{Present}$ = Present Population, r = Growth Rate and n = Number of Years

²Number of males per 100 females in a population, using the formula: Sex Ratio: $SR = M \times 100 / F$

³ Retrieved on 19/3/2015 from <https://www.cia.gov/library/publications/the-world-factbook/docs/notesanddefs.html>

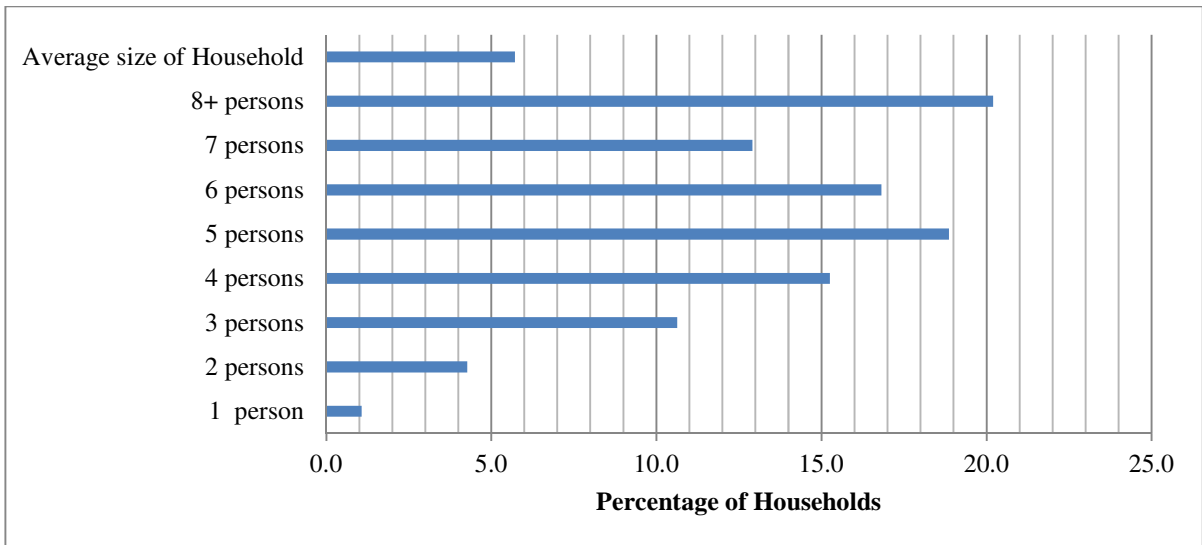


Figure-5.8-1 Households Size of the Project Area

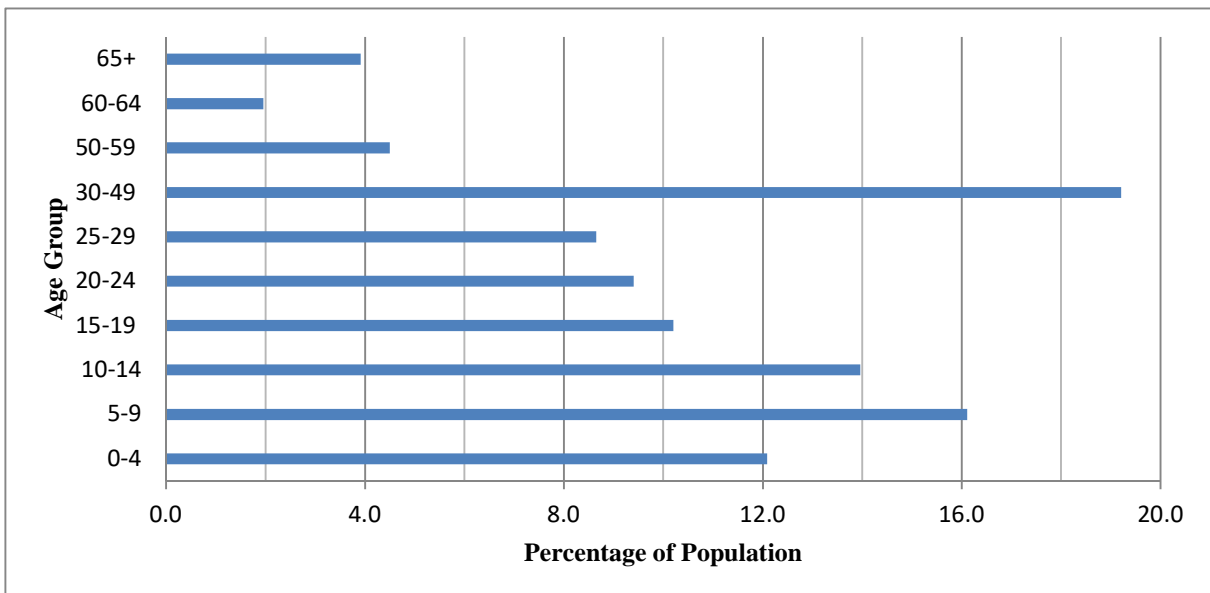


Figure-5.8-2 Population distributions by different age groups

According to the international standards, the “economically active population” comprises all persons of either sex who furnish the supply of labour for the production of goods and services as defined by the United Nations systems of national accounts and balances, during a specified time reference period (RaIfHusmannset. al, 19924). This definition is adopted by the International Labour Organization (ILO) and categorized population of 15 to 64 years category as labour force whereas as well as populations below 14 years and above 65 years are considered as dependent.

⁴RaIfHusmannset. al, 1992; *Surveys of economically active population, employment, unemployment and underemployment*; International Labour Office, Geneva.

5.8.2 State of Education and Livelihood Situation in and Around the Project Area (Secondary Source Data)

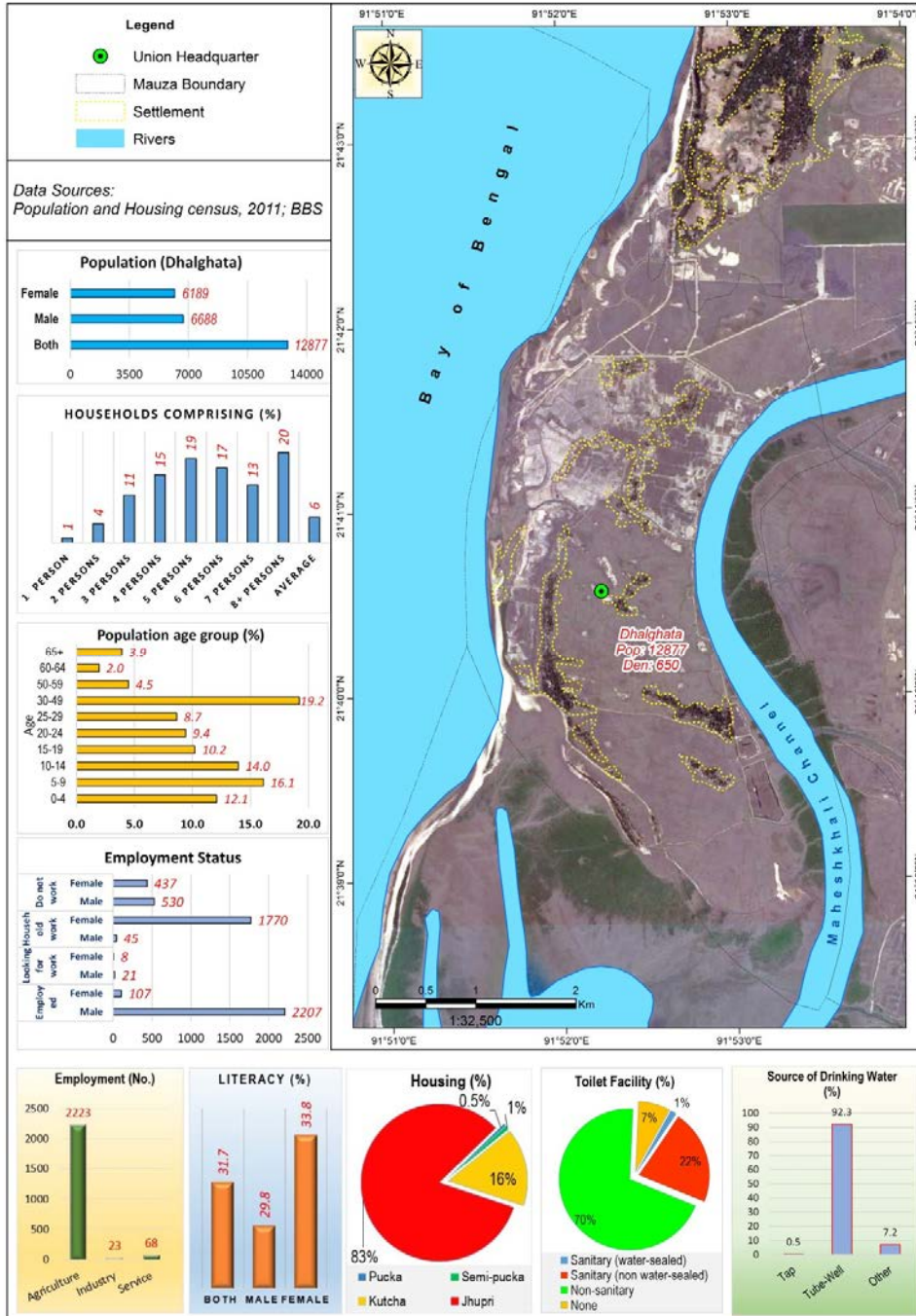


Figure-5.8-3 Dhalghata Union in Education and Livelihood Situation

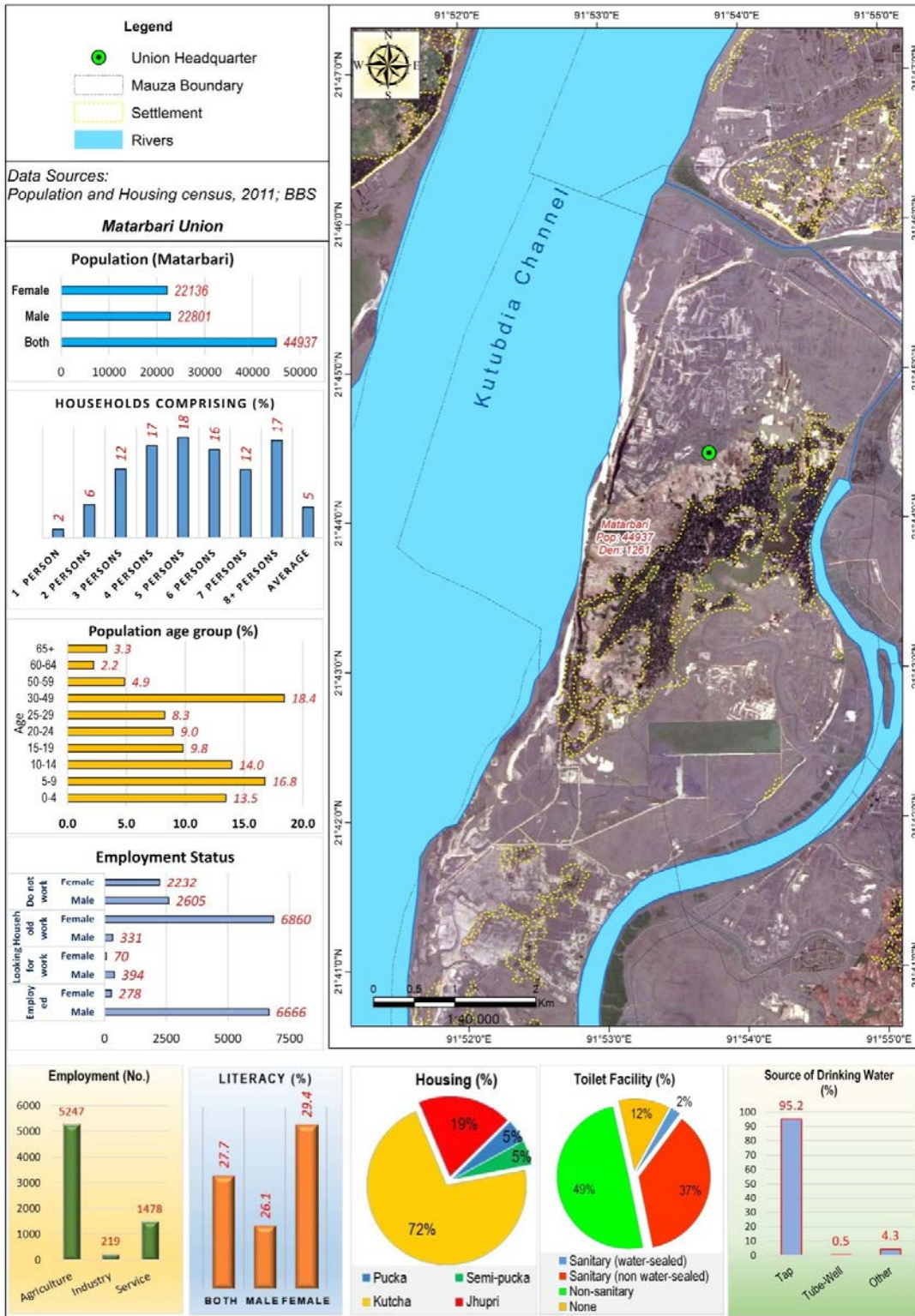


Figure5.8-4 Matarbari Union in Education and Livelihood Situation

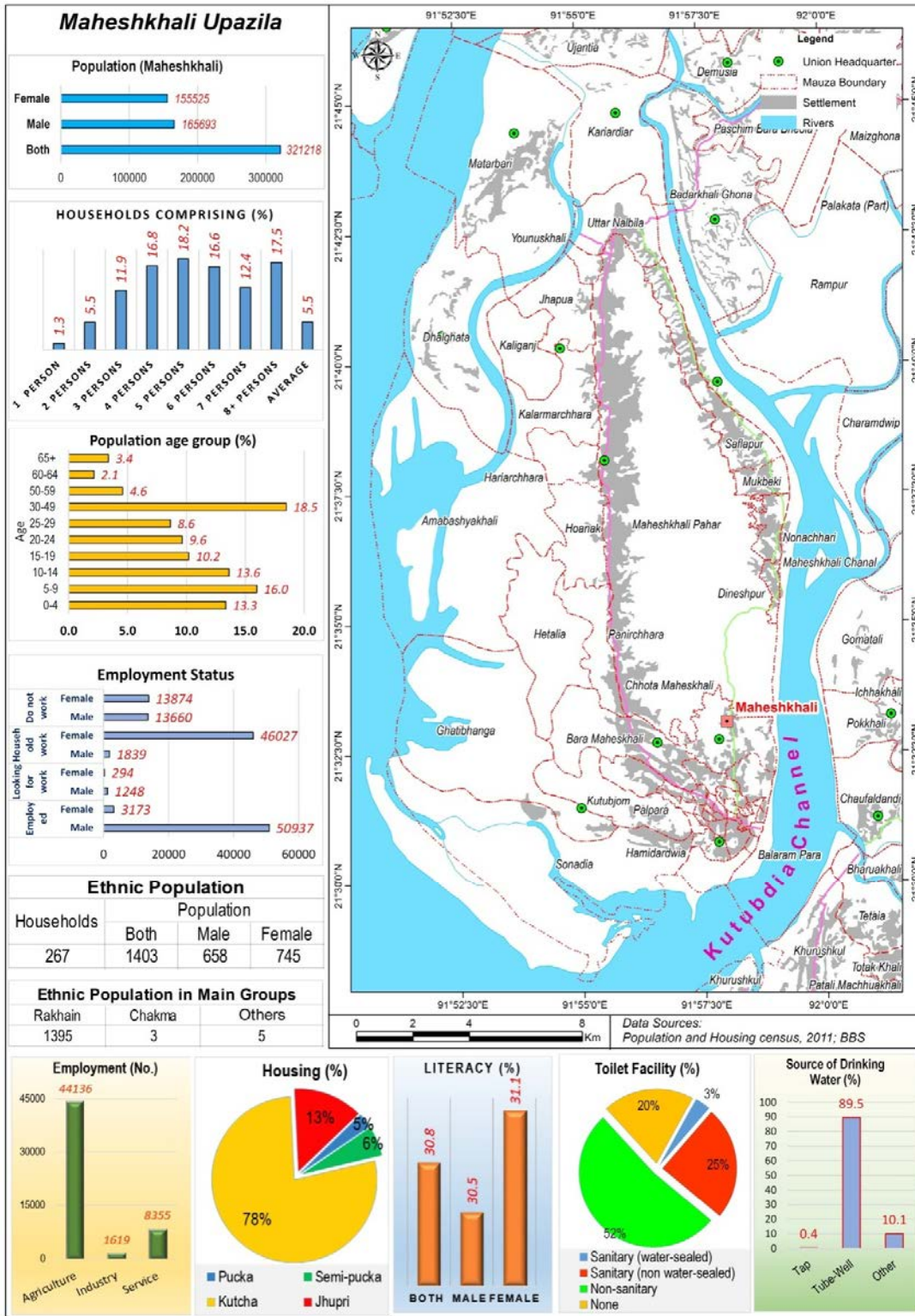


Figure 5.8-5 Socioeconomic Situation of the Moheshkhali Upazila

5.8.3 Socioeconomic Condition based on Field Survey

5.8.3.1 Demography

The survey covered wide ranging issues including socio-economic conditions of the population and attitude towards the project. In general, there is no significant difference between the affected and non-affected population, particularly the occupation, economic condition and, ethnic and religious diversity. Matarbari has relatively higher concentration of population compared to Dhalghata. The following table gives an indication of dispersion of population in the locations:

Table-5.8-2 Mouza wise surveyed household population

Name of Mouza	Type of Pop.		Total Pop.	Total pop in%	Total H/H	Avg. H/H Size
	Male	Female				
Matarbari	134	127	261	60.00	59	4
Dhalghata	95	79	174	40.00	41	4
Total population	229	206	435	100.00	100	

Source: BETS Survey 2017

5.8.3.2 Level of Education

The education rate, as presented in following table, indicate significantly higher percentage of population had access to education, given the obstacles in coastal regions to reach out to school. Out of 435 respondents, only 7.59% are illiterate. More than 36% respondents has the secondary education of the project area.

Table5.8-3 Level of Education of the household population

Educational status	Male	%	Female	%	Total pop.	Total %
Illiterate	16	6.99	17	8.25	33	7.59
Can read only	3	1.31	2	0.97	5	1.15
Can read & Write	8	3.49	8	3.88	16	3.68
Children <7 years	29	12.66	20	9.71	49	11.26
Primary (Class I-V)	33	14.41	55	26.70	88	20.23
Secondary (VI-X)	90	39.30	67	32.52	157	36.09
SSC Equivalent	26	11.35	24	11.65	50	11.49
HSC Equivalent	11	4.80	10	4.85	21	4.83
Degree	4	1.75	1	0.49	5	1.15
Masters + Honors	7	3.06	0	0.00	7	1.61
Others	2	0.87	2	0.97	4	0.92
Total:	229	100.00	206	100.00	435	100

Source: BETS Survey 2017

5.8.3.3 Economic condition and livelihood Status

The main source of livelihood of the majority of the respondents is small trade and agriculture. The agriculture is the second important mainstay. Small business, Salt cultivation, fishing and fish culture and a diversified source of income have also been mentioned by the respondents. Income opportunities are not as diverse as in mainland areas.

Agriculture:

Majority of the farmers (38%) comprises small and marginal farmers. No response (51%) of the population is involved with other occupations such as day laborer, Salt industry, shrimp industry etc.

Table 5.8-4 Type of Farmer

Type of Farmer	No. of H/H	%
Cultivation own land	38	38.00
Own and other's land	1	1.00
Only owner of land	0	0.00
Share cropper	10	10.00
Squatter	0	0.00
No Response	51	51.00
Total	100	100.00

Source: BETS Survey 2017

Table 5.8-5 Last Year Major Crops Cultivated

Name of Crop	Name of Mouza	Area of Land(Decimal)	Production(kg)	Price/Kg(Tk.)
HYB Boro	Matarbari	90	1260	19
Salt	Dhalghata	1955	350500	10
Salt	Matarbari	2580	210100	10
Fish Gher	Matarbari	540		

Source: BETS Survey 2017

The coastal zone economy is volatile and vibrant. Although agriculture is still the mainstay of the economy and livelihood of coastal belt but prospects of agriculture is depressed by multiple factors including climatic vulnerabilities. According public consultations report, the agricultural production has plummeted down from 25% to 23% over the last decade. Reliance of people on agriculture is shifting towards more off-farm activities such as shrimp cultivation and various forms of allied-agriculture. In Moheshkhali and some other areas being surveyed, serious decline in crop-cultivation has been observed.

However, the higher percentage of double and triple crops indicates that crop diversification and irrigation facilities enabled the farming households to reap up better yields and maximum utilization of agricultural land. Only within polder areas, a tiny proportion of respondents are engaged with farming.

The lands situated closer to sea, across all regions, are used for other purposes, not for paddy or vegetable cultivation. In all the regions, non-crop agriculture is increasing.

Housing structure

The walls of most of the houses are made of thatched. Only 4% houses reported to have been made of concrete bricks. The characteristics of the house are one of the key indicators of the economic condition of the households.

Table-5.8-6 Types of Housing Structures

Type of Housing Structure	No. of H/H	%
Thatched	47	47.00
Semi Pucca	10	10.00
Pucca	4	4.00
Others	39	39.00
Total:	100	100.00

Type of Housing Structure	No. of H/H	%
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Source: BETS Survey 2017

Electricity Connection:

Most of the respondent has the electricity connection through solar power system.

Table-5.8-7 Electricity Connection of the Project Area

Response	No. of H/H	%
Yes	81	81.00
No.	19	19.00
Intermittent connection	0	0.00
Others	0	0.00
Total:	100	100

Source: BETS Survey 2017

Cooking fuel:

Eighty percent peoples are depends on the wood for the cooking fuel and the rest twenty percent peoples use Cylinder Gas.

Table 5.8-8 Cooing Fuel of the Project Area

Type of Cooking Fuel	No. of H/H	%
Natural pipe gas	0	0.00
Cylinder Gas	20	20.00
Kerosene Stove	0	0.00
Electricity	0	0.00
Wood	80	80.00
Cow dung	0	0.00
Others	0	0.00
Total:	100	100

Source: BETS Survey 2017

Sources of Water and Uses

The respondents have access to safe drinking water. 5% uses deep tube- well water while 95% uses tube well water for drinking purposes. Due to salinity problem, deep tube well has been installed across the coastal region.

Table 5.8-9 Sources of Water and Uses

Type of Sources	Drinkin g No. H/H	(%) H/H	Cookin g/ Washin g No. H/H	(%) H/H	Bathin g No. H/H	(%) H/H	Cattle/Go at Washing No. H/H	(%) H/ H
Tubewell (STW)	95	95.0 0	96	64.8 6	96	64.8 6	2	1.3 5
Deep Tubewell (DTW)	5	5.00	4	2.70	4	2.70	0	0.0 0

Type of Sources	Drinkin g No. H/H	(%) H/H	Cookin g/ Washin g No. H/H	(%) H/H	Bathin g No. H/H	(%) H/H	Cattle/Go at Washing No. H/H	(%) H/ H
Supply Water	0	0.00	0	0.00	0	0.00	0	0.0 0
Well	0	0.00	0	0.00	0	0.00	0	0.0 0
Pond	0	0.00	0	0.00	0	0.00	4	2.7 0
Khal/River	0	0.00	0	0.00	0	0.00	0	0.0 0
Total No. HH:	100	100	100	67.5 7	100	67.5 7	6	4.0 5

Source: BETS Survey 2017

Disease Suffered by family in last 2 years

Despite the fact that majority of the households have access to safe drinking water, 70% reported incidence of diarrhoea and more than 16% reported occurrence of Typhoid.

Table 5.8-10 Disease suffered you and your family in last 2 years

Name of Disease	No. of Response	%
Diarrhea	70	70.0
Typhoid	16	16.0
Dysentery/Gastroenteritis	13	13.0
Jaundice	15	15.0
Skin Disease	5	5.0
Tetanus	0	0.0
TB	0	0.0
Pneumonia	5	5.0
Asthma	2	2.0
Others	1	1.0

Source: BETS Survey 2017

While responding to access to health facilities, more than eighty five per cent respondents mentioned village doctor while only 4% mentioned about MBSS doctor.

Table 5.8-11 Types of Treatment

Type of Treatment	No. of Response	%
Herbal	1	1
Homoeopathy	2	2
Village doctor/pharmacy	85	85
MBBS	4	4
No. Treatment	0	0
No ability	0	0
Unknown	1	1
Others	0	0

Income and Expenditure of the Households

Income range of the majority of the respondents (28%) is above Tk. 25,000. These 28HH are rich in income. However, 40 households could be categorized as poor within the income bracket of Tk. 5,000- Tk. 15,000.

Table 5.8-12 Monthly Income Level of the Household

Income Level	No. of Household	%
Tk. 1000 - Tk. 5000	0	0.00
> Tk. 5000 - Tk. 10000	19	19.00
> Tk. 10000 - Tk. 15000	21	21.00
> Tk. 15000 - Tk. 20000	15	15.00
> Tk. 20000 - Tk. 25000	17	17.00
Tk. 25001 and Above	28	28.00
Total:	100	100.00

Source: BETS Survey 2017

Monthly Expenditure of the households

A large number (22%) of household expenditure shows more than Tk. 25,000, indicating economic solvency. However, families spending within the range of TK. 1000-5000 are zero i.e. there is no very poor people in the area. The monthly expenditure of the highest percentage (23%) of the household's ranges between Tk. 5001-10,000 which indicates the poor livelihood status of the study area.

Table-5.8-13 Monthly Expenditure Level of Household

Expenditure Level	No. of Household	%
Tk. 1000 - Tk. 5000	0	0.00
Tk. 5001 - Tk. 10000	23	23.00
Tk. 10001 - Tk. 15000	21	21.00
Tk. 15001 - Tk. 20000	22	22.00
Tk. 20001 - Tk. 25000	12	12.00
Tk. 25001 and Above	22	22.00
Total	100	100.00

Source: BETS Survey 2017

CHAPTER-6 STAKEHOLDER ENGAGEMENT

6.1 INTRODUCTION

Participation is a process, through which stakeholders influence and share control over development initiatives, the decisions and the resources, which affects them. Participation of stakeholders in the projects is also a primary requirement in developing an appropriate management plan that addresses project's requirement and suited to the needs of the stakeholders. Stakeholder's involvement is also vastly increases the probability of successful implementation of management plan. In order to make consultation and disclosure process effective and fruitful, comprehensive planning is required to assure that local government, NGOs, host population and project team interacts regularly and purposefully, throughout all stages of the project and contribute toward a common goal.

Public opinion has been collected through stakeholder meetings and focus group discussion. For better understanding the socio-economic and environmental condition focus group discussions were held with the local people in the closest settlement area of the Matarbari Island. Stakeholder meetings were held in the Upazila levels as well as the local levels i.e. Union level of the project study area.

6.2 APPROACH AND METHODOLOGY FOR CONSULTATION

The approach undertaken for consultation involved the following key processes.

- Mapping and Identification of key stakeholders such as primary (direct project influence) and secondary (indirect project influence) stakeholders;
- Undertaking questionnaire interviews and focus group discussions (FGD) with the probable affected and non-affected persons of the proposed project area;
- Assessing the influence and impact of the project on these stakeholder groups; and
- Summarizing of key findings and observations from the consultations.

6.3 STAKEHOLDER ASSESSMENT

A stakeholder is defined as “a person, group, or organization that has direct or indirect stake in a project/organization because it can affect or be affected by the Project or its Proponent's actions, objectives, and policies”. Stakeholders vary in terms of degree of interest, influence and control they have over the Project or the proponent. In the present study, all the stakeholders have been primarily categorized into two categories that have been identified as:

- Primary Stakeholders: include people, groups, institutions that either have a direct influence on the project or are directly impacted (positively or adversely) by the project and its activities; and
- Secondary stakeholders: are those that have a bearing on the project and its activities by the virtue of their being closely linked or associated with the primary stakeholders and due to the influence they have on the primary stakeholder groups.
- Apart from categorization, the stakeholders have also been classified in accordance with the level of influence they have over the project as well as their priority to the project proponent in terms of importance.
- The influence and priority have both been primarily rates as:
 - ✓ High Influence/Priority: This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority for project proponent to engage that stakeholder.

- ✓ Medium Influence/Priority: This implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level for project proponent to engage the stakeholder who are neither highly critical nor are insignificant in terms of influence.
- ✓ Low Influence/Priority: This implies a low degree of influence of the stakeholder on the project in terms of participation and decision making or low priority for project proponent to engage that stakeholder.

Based on the above attributes, the following Table 6.3-1 delineates the stakeholders identified for the project and their analysis.

Table 6.3-1: Stakeholder Mapping for the Project

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Project Management				
Chittagong Port Authority (CPA)	Primary	CPA will be the primary project proponent own a controlling stake of 100% in the project	Highest	<ul style="list-style-type: none"> • The primary project proponent • Responsible for operation of this project • Primary financial beneficiaries • Responsible for all the project related risks and impact liabilities
Community				
Local Community	Primary	Primarily includes adjacent community to the Matarbari Island especially the Dhalghata Union	Medium	<ul style="list-style-type: none"> • No major restrictions around the project site especially with respect to Ecologically Critical Area (ECA) • Project bring development to the area • Increase in employment opportunities and preference in job • Minimize impact
Regulatory/Administrative Authorities & Agencies				
Dept. of Environment, Bangladesh	Primary	The Department of Environment is the primary government regulatory authority for Environmental protection in Bangladesh.	High	<ul style="list-style-type: none"> • Responsible for monitoring project's Environmental compliance throughout the project lifecycle.
Dept. of Forest, Bangladesh	Primary	Department of Forest is the primary government regulatory authorities for Forest Area Protection.	Medium	<ul style="list-style-type: none"> • Afforestation program of the Dhalghata union.
Other Regulatory & Permitting Authorities	Primary	Department of fisheries, Department of Public Health Engineering (DPHE), Deputy Commissioner, Cox's Bazar etc.	High	<ul style="list-style-type: none"> • Agencies required for obtaining permits and licenses for operation of the project • Primary involvement during operation phases
Political Administration				
Upazilla (sub District Level) Political Administration	Secondary	Elected representative of people at sub-district level for a fixed tenure.	Medium	<ul style="list-style-type: none"> • Key linkage between the community and the project proponent.

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Union leaders & local representatives	Secondary	Elected representative at union level i.e. village level for a fixed tenure.	Medium	<ul style="list-style-type: none"> Plays important role in providing public opinion and sentiment on the project. Empowered to provide consent and authorization for establishment of project on behalf of the community.

6.4 STAKEHOLDER MEETINGS

There were two stakeholder meetings conducted in the Project Study area. One meeting was organized in the UNO office and another was organized in local level i.e. Union Parishad office of Dhalghata Union. The SHM details are described below:

1. **SHM at the UNO Office:**

The first stakeholder meeting (SHM) was held in the Conference Room of UNO Office, Moheshkhali on 27th January, 2018. The program was hosted by Chittagong Port Authority (CPA). The meeting was presided by Md. AbulKalam, UpazilaNirbahi Officer (UNO), Moheshkhali. The Chief Guest of the SHM was AlhajAshiqullahRafique, Member of Parliament, Cox’s Bazar-2. Other key participants were Md. Hossain Ibrahim, Upazila Chairman; Md. KamrulHasan, Chairman Dhalghat Union Parishad, School Teacher, Project Affected Peoples etc. Around 51 participants were attended in the SHM. Among the participants, affected persons, UP members, School teachers, Journalists shared their views and put their valuable suggestions for the proposed port project.

Engr. Md. Nurul Alam Siddique, Environmental Specialist of JICA Survey team presented the project summary on “Matarbari Port Development Project. In the meeting, Md. Humayun Kabir, Resettlement Specialist was also present. On the Other hand, Mr. Nakamura Jun of JICA Team attended in the meeting as an International Expert. Other than the key stakeholders, in the meeting different sections of people of the project area and Moheshkhali upazila were present. The participants demanded reasonable compensation and job facilities and skill training from the project authority. They also claimed timely and hassle free payment. Mr. Abul Kalam, UNO of the upazila presided over the meeting and he thanks Mr. Nakamura and JICA for providing fund to the project. After distributing lunch packet, Upazila Nirbahi Officer (UNO) of Moheshkhali and the Chairman of meeting closed the SHM.

Highlight of the Stakeholder meeting is listed below:

- As per the location consideration the proposed port project name should be “Dhalghat Deep Sea Port” instead of “Matarbari Port Development Project”;
- Local representatives suggested that both the port and power plant authorities need to establish immediately a technical school in the area as well as the local peoples and affected peoples would be trained in the technical school and directly to be recruited in both the projects as a part of local and affected quotas;
- All the participants have requested for ensuring the top up compensation of lost assets to the project affected person (PAPs);
- Some of the participants have suggested for proper consultation with the local community before the route selection of the Port access road;
- Local level stakeholder meeting would be important for the Project affected persons;

- Proposed port project should find out the project impacts before the project launching and mitigation measures should be taken care of during the project work period;
- Some participants urged to the project authority to make the project sustainable in consideration of the fulfillment of people's future demand;
- To make this area a development hub of the nation, some participants opined that the establishment of a Medical College and a University would be needed;
- Some of the participants mentioned about the infrastructural development of the project area;
- Some participants have suggested about the proper delineation of the land details as per Mouza naming to the plot details;
- As the land price is getting higher so there should have the resettlement plan for the PAPs in consideration of land for land compensation to another mouza/area;
- Proper investigation of the project baseline should be carried out in consideration of the diversified ecology of the project area;
- Job opportunities for the local peoples should be in every stages of the project work;
- Request have been placed to the CPA to ensure hassle free proper compensation to the PAPs and also mentioned about improper compensation might create the sufferings of the project activities;
- Around 100 years salt cultivation is ongoing in the project area. And due to some mega projects, this salt land would be converted land. So, participants claimed the alternative supports from the government and adequate mitigating measures would be taken for income and other losses.
- Some mentioned about the importance of preservation of mangrove forestry like "Hansher Char" and for ensuring less damage of housing structures and to maintain existing ecology of the proposed port area;
- Some have suggested to CPA for arranging more SHM as a participatory planning for mega project by ensuring the participation of all section of local people;
- An arrangement of a local level stakeholder meeting would be helpful for sharing the project information properly with the local people;

Detail of the SHM is listed below in Table 6.4-1.

Table 6.4-1 Remarkable comments and suggestion of the SHM of UNO office

Sl. No.	Name of the Stakeholder	Remarkable Comments and Suggestion	Responses
1	Mr. Kamrul Hasan; Dhalghat Union Parishad (UP) Chairman	1. The port will be constructed in Dhalghat Mouza of Dhalghat union. So, it should be named as Dhalghat Deep Sea Port. UP Chairman in his speech affectionately mentioned that they were sacrificing the most for the national development by giving land, assets and livelihood loss. 2. Mr. Kamrul suggested that both the port and power plant authorities need to establish immediately a technical school in the area as well as the local peoples and affected peoples would be trained in the technical school and directly to be recruited in both the projects as a part of local and affected quotas. 3. Mr. Kamrul request to the project authority for making sure the proper compensation of lost assets to the project affected person (PAPs).	The organizer of the SHM meeting committed to convey the message to the higher authority.

Sl. No.	Name of the Stakeholder	Remarkable Comments and Suggestion	Responses
		4. He also suggested that for the route selection of the Port access road there must be proper consultation with the local community.	
2	Md. Hossain Ibrahim, Upazila Chairman, Moheshkhali	1. Expecting, the project authority will fulfill the commitment regarding the disturbance of the community and project affected people. The project will be implemented properly after find out the problems and mitigation measures, he reminded. 2. He also urged to the project authority to make the project sustainable and as it can fulfill the people's future demand. 3. Moheshkhali Upazila Chairman demanded, both port authority and the CPGCBL (Coal Power Generation Company Bangladesh Ltd.) will establish a technical school or institute for creating skilled technical manpower in the Moheshkhali area especially for the project affected Persons (PAPS) for getting jobs in such kind of mega project. He also demanded Medical College and university is to be established to make the area a development hub.	Ditto
3	Mr. Md. Saleh Ahmed, Commander of Freedom Fighter	Talked about the proper compensation of the project affected people as well as infrastructural development of the project area.	Ditto
4	Mr. Nurul Hoque, Freedom Fighter and Project Affected Persons	1. Suggested about the proper delineation of the land details as per Mouza naming to the plot details. 2. As the land price is getting higher so there should have the resettlement plan to another mouza or area for the PAPs.	Ditto
5	Mr. Abdul Qayyum, Site Officer, NACOM	Mentioned about the natural resources and its diversity of the Sea and suggested about the proper investigation of the project baseline considering the ecology of the project area.	Ditto
6	Alhaj Ashiqullah Rafique, Member of Parliament (MP), Cox's Bazar-2,	1. Talked about the renaming of the port as Dhalghata Deep Sea port and compensation is to be decided after consultation with the local people. 2. He expressed the resentment of Local peoples in compensation, resettlement and job opportunities of the local peoples. For the sake of the national interest they will provide all kind of support for the project. 3. Mr. MP requested to the Meeting organizer to convey the SHM's suggestions and comments rightly to the higher authority of CPA and relevant Ministry. 4. He reminded that there were high profile meeting of high officials of Government of Bangladesh (GoB) in Moheshkhali regarding present ongoing projects and local peoples are co-operating these projects. So their demand, problems, proper compensation and job facilities in these projects must be fulfilled. 5. He also highlighted the scope and potentiality of the region. As for example this region as a part of Asian highway have around two billion people which could connected up to Kunming of China and would be a development hub in future. 6. He suggested to the CPA to ensure hassle free proper compensation to the PAPs and also reminded that improper compensation will create the sufferings of the project.	ditto

Sl. No.	Name of the Stakeholder	Remarkable Comments and Suggestion	Responses
		<p>7. He informed that because of availability of required depth for navigability of big ships this area has been selected for development for deep sea port. He mentioned the PM’s pledge of an International university in the area. Around 100 years salt cultivation is ongoing in the area. And due to mega project, this salt land will be hampered. So, they claimed alternative support from the government and all mitigating measures are to be taken for income and other losses. Therefore they demanded to build a development hub and not for Bangladeshis but also for others.</p> <p>8. He urges all concerned that Bangladesh should be no more be a country for only unskilled abroad labor rather to be a country of skilled manpower and be an industrial hub and in which people of other countries will be attracted and for that the ruling government is working.</p> <p>9. He also opined about the preservation of mangrove forestry like “Hansher Char” and ensures less damage of housing structures and to maintain existing ecology of the area. Moreover, he urged to provide proper compensation of the affected assets. Also, using latest safety measures can protect the environment and develop new mangrove forestry. As a part of participatory planning for mega project like this CPA should arrange more SHM with all section of people, he added.</p>	
7	Md. Abul Kalam, UNO, Moheshkhali	Talked about in depth survey of the PAPs to understand the actual compensation estimation and resettle the affected persons in a different location with proper facilities.	Ditto
8	Ms. Senu Ara Begum, Female Ward Member, Dhalghata Union	Mentioned about the compensation issue and the job opportunities of the local peoples.	
9	Shirin Akter, Teacher, Dhalghat Adarsha High School	Talked about the Land Compensation and Job opportunities of the local peoples.	Ditto

Snippet of the SH Meeting:





List of Participant of Stakeholder Meeting of Matarbari Port Development Project

Sl. No.	Name	Designation
1.	Alhaj Ashiqul lahRafique	Member of Parliament(MP), Moheshkhali, Cox'sBazar-2
2.	Md. Hosain Ibrahim	Chairman Upazila Parishad, MoheshKhali
3.	Prodip Kumar Das	OC, Moheshkhali
4.	Kazi Aminul Hoque	Senior, Hydrographer, CPA
5.	Md. Abul Kalam	UNO, Moheshkhali
6.	Manju Mia	Mayor, Moheshkhali Pourashava
7.	Kamrul Hasan	Chairman Dhalghata Pourashava
8.	Nakamura Jun	Social Expert, JICA Survey Team
9.	Md. Abul Hosain	Senior Teacher, Dhalghata Adarsha High School
10.	Md. Rashed Kamal	Joint Convener, Kalamerchara Union Jubo League
11.	Nurul Hoque	Freedom Fighter, Dhalghata
12.	Md. Iman Ali	Sub Dvisional Engineer, BWDB
13.	Syed Jakir Hossain	Upazila Enginner, Moheshkhali
14.	Md. Sabedul Hoque	Senior Upazila Fishery Officer
15.	Md. Shahidul Islam	SAE, Road and Highway Department(RHD), Cox's Bazar
16.	Saber Ahmed	Secretary, Upazila Parishad Moheshkhali
17.	Md. Abdul Qayum	Site Officer, NACOM-Project of DOE
18.	Md. Afsarul Hoq	Superintendent, Emddia Madrasha
19.	Md. Jamir Uddin	Member Dhalghata Union Parishad (UP)
20.	Saidul Alam	President, Dhalghat Union Awami League
21.	Senu-Ara Begum	Moheshkhali Upazila Parishad
22.	Aminul Islam	Dhalghata UP
23.	NabirHosain	Memmmber Dhalghata UP
24.	Dilkush Ara	Female Memmmber, Dhalghata UP
25.	Anisul Hoque	Land owner, Project Area
26.	M. Aziur Rahman	Member, District Awami league
27.	Liaquat Ali	Vice President Upazila Awami League
28.	Md. Bashir Ullah	Local Journalist
29.	Md. Mohiuddin	DGFI
30.	ShirinAkteer	Teacher Dhalghat Adarsha High School
31.	Md. Ilias	Land Owner
32.	Md. Aminul Hoque Chowdhury	Land Owner, Dhalghata
33.	Md Golam Masud Kutubi	Upazila Cooperative Officer
34.	Md. Gaffer Uddin	Agriculture
35.	Md. Shaoqat Ali	Teacher
36.	Md. Tajjul Alam	Teacher
37.	Kaysar Hamid	Business
38.	Md. Ziabul	Business
39.	Md. Forkan	Land owner
40.	Md. Akter Hossain	Land owner
41.	Md. Jashim Uddin	Land Owner
42.	Zamal Satter	NGO Representative
43.	Md. Firoj	Assistant Union Land Officer
44.	La Mang	Secretary Dhalghata
45.	Abdul Mobin	Land owner
46.	Md. Kamal Uddin	Teacher, Dhalghata
47.	Ruhul Amin	Land Owner, Dhalghata

Sl. No.	Name	Designation
48.	Mohammad Feroz	ULAO, Upazila Land Office
49.	Md. Aminul Hoq	Bangladesh Betar, Moheshkhali
50.	Advocate Shekh Kamal	Joint Convener, Upazila Awami League
51.	Abul Basher Parvez	Staff Correspondent, The Daily Ittefaque

2. Local Level Stakeholder Meeting at Union Parishad Office:

The local level stakeholder meeting (SHM) was held in the Union Parishad (UP) Office, Dhalghata on 15th March 2018. The program was hosted by CPA. Md. Shihabuddin, Assistant Manager Land, CPA was present in the meeting as a representative of Chittagong Port Authority.

Detail of the SHM is listed below in Table 6.4-2.

Table 6.4-2 Remarkable comments and suggestion of the SHM of UP office

Sl. No.	Name of the Stakeholders	Remarkable Comments and Suggestion	Response
1	Mr. Kamrul Hasan, Chairman Dhalghat Union Parishad	<p>1.The proposed development projects in the area are blessings for the local people but the affected community is to be properly resettled;</p> <p>2. He expressed his peoples trust and confidence on JICA and urged proper compensation of lost assets especially land price and previously the compensation was Tk.1.6 to 1.7millions in Matarbari and now it is Tk.2.5millions per kani (0.40 acre). Already price has been increased substantially, that is why land transaction is temporarily declared off by the executive order in the area and they claimed the compensation price should be at least 1 crore (10 million) per kani. He mentioned that his peoples claimed per katha ⁵(0.015 acre) land in the big cities like Cox's bazar is Tk.1 to 1.5 crore (10 to 15 million) per katha. Both the naming issue and land price are to be declared before starting the work. In the acquired area land transaction is temporarily off as per verbal order of district administration in the acquired area.</p> <p>3. He also recalled that his peoples are very serious about the naming issue of port and land price. Dhalghata peoples will provide all out cooperation to the project authority if the project name is renamed as Dhalghata Port development project.</p> <p>4. He opined that his peoples wants other infrastructural support like establishment of hospital, vocational and polytechnic institute for improving their livelihood and living standard.</p>	The organizer of the SHM meeting committed to convey the message to the higher authority.
2	Md. Afid Hossain, RHD representative	<p>1. Dhalghata is a remote area and communication is very bad. Port needs link road. The existing communication system is too bad as well as risky. So, port access road will also help the local community for their smooth transportation of locally produced goods and importing other daily necessities comparatively better prices.</p>	Ditto

⁵ Katha= 0.015 acre, a traditional unit of land measurement.

Sl. No.	Name of the Stakeholders	Remarkable Comments and Suggestion	Response
3	Md. Aktaruzzaman, Dhalghat UP Member	1. Mr. Akhtar mentioned about the 100% job for the affected persons and secured livelihood. As government informal decision, no transaction of land without DC's approval. So, only mouza rate of land price will not be helpful for proper compensation. Per acre mouza rate was Tk.6,75,000 but compensation was Tk.33,00,000 per acre in previous acquisition. Now in comparison with other area expecting more prices of compensation. Without proper compensation, people's sufferings will not be relieved in case of land acquisition.	Ditto
4	Chenuara Begum, Women UP member, Dhalghat	Job opportunity for the local people should be make sure.	Ditto
5	Shamsher Ali, Pundit's Deil village	For their livelihood restoration he wanted training and job facilities.	Ditto

6.5 FOCUS GROUP DISCUSSION (FGD)

A FGD meeting was conducted with the community female affected peoples as a part of public consultation of the proposed project area. The meeting was conducted at the boundary of the project area in the Dhalghata union. The main theme of FGD meeting was to communicate about the project at the level of EIA study stage and sharing views and getting suggestions regarding Matarbari sea port in their locality. Summary of FGD program and the photograph are listed in the table below.

Findings of FGDs:

- ⇒ Project name should be renamed as Dhaghata Deep Sea Port;
- ⇒ Institutional development should be made in the locality for creating skilled people for fitting the upcoming challenge of project works of the proposed project;
- ⇒ Proper compensation for acquisition of land should be made;
- ⇒ Medical facilities should be installed in the project area to abate the loss of Child and Pregnant mother death in the project area;
- ⇒ Job Opportunity should be created for the improvement of the women empowerment of the locality;
- ⇒ Women institutions like school, college and university should be established for the proper education of the women community of the proposed project area.



Focus Group Discussion in the Project Area

During socio-economic survey of the project four FGD meetings were held in the project area in addition to the female focus group discussion. The summary of the PAPs concerns are listed below:

Findings of the FGDs are given below:

- All have expressed their concerned for proper compensation;
- DC's payment should in the project site;
- Full NGO support would be needed in getting compensation payment;
- Affected man and women need job facilities;
- For the women PAPs, skill training arrangements should be made;
- Urged about the rural road rehabilitation;
- Skill training should be provided to the affected family members;
- Support from CPA for pure drinking water and sanitary toilet facilities should be made;
- Dhalghata is out of the primary health care support. In this regards, emergency health support should be developed for the local peoples.



CHAPTER-7 SCOPING AND TOR FOR THE SURVEY ON NATURAL AND SOCIAL ENVIRONMENT

7.1 INTRODUCTION

Scoping occurs early in the project cycle at the same time as outline planning and pre-feasibility studies. It is the process of identifying the key environmental issues and is perhaps the most important step in this EIA study. This EIA study canvasses the views of groups of peoples of the project communities, particularly decision makers, the local population and the scientific community. Scoping is important for two reasons.

- First, so that problems can be pinpointed early allowing mitigating design changes to be made before expensive detailed work is carried out.
- Second, to ensure that detailed prediction work is only carried out for important issues.

The key issues are identified for the full scale EIA study of this project and then the scoping includes terms of reference for these further studies.

A major activity of scoping is to identify key interest groups, both governmental and non-governmental, and to establish good lines of communication. People who are going to be affected by this project were well communicated to understand their views, ideas, problems and suggestions. Their knowledge and perspectives were the major bearing on the focus of the EIA. Rapid rural appraisal techniques has been used a means of assessing the needs and views of the affected population.

The main EIA techniques used in scoping were baseline studies, checklists and matrices. These techniques collected and presented the knowledge and information in a straightforward way which were helpful for taking logical decisions about which impacts are most significant.

7.2 SCOPING MATRIX

Based on the field survey and the survey results of existing related materials, the environmental impact assumed in connection with port maintenance is examined. The results were organized as the scoping plan including the reason for evaluation.

Table-7.2-1 Scoping matrix of the Port Project

Item	No.	Impact	Rating		Results
			Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air Quality	B-	B-	Construction phase: Production of dust is expected from land preparation and other construction work, but the impact will be temporary. Operation phase: Air pollution is predicted caused by exhaust gas generated from the vessels using the port. Dust is also predicted, produced from loading-unloading. Some cumulative impact will be seen.
	2	Water Quality	B-	A-	Construction phase: Turbid water is expected to be produced from the dredging activity. Also, concrete wastewater and oil-containing wastewater are expected to have an effect. Operation phase: Turbid water is expected to be produced from the maintenance dredging of the navigation channel.

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					Ballast water should be properly managed and need the adequate treatment. Water pollution is also expected from the wastewater discharged from vessels using the port. Some cumulative impact will be seen.
	3	Waste	B-	A-	Construction phase: In order to make the water way, beach sand will be dredged. dredged materials will be ocean dumping and land dumping. General waste and hazardous waste will be generated by the construction work, but the impact will be temporary. Operation phase: Dredging will be periodically conducted because of maintenance of the water way. The disposal area of the dredged material is not determined yet, either onshore or offshore. Waste will be generated from the vessels using the port. Some cumulative impact will be seen.
	4	Soil Contamination	B-	B-	Construction phase: Occurrence of construction waste and waste materials is assumed. Operation phase: Pollutants are assumed to be generated from ships entering and leaving ports.
	5	Noise and Vibration	B-	B-	Construction phase: Impact of noise and vibration from the construction work is predicted but will be temporary. Operation phase: Impact of noise and vibration from the loading-unloading is predicted.
	6	Subsidence	C	C	Construction and Operation phases: The impact is unknown.
	7	Odor	D	D	Construction and Operation phases: No usage of substances that may be a potential source of foul odors is anticipated.
	8	Sediment	B-	B-	Construction Phase: The dredged sediment ocean dumping place may be affected. The influence on the benthos organisms in the area where the dredging route is conducted is predicted. Operation phase: Because of maintenance dredging, influence is assumed.
Natural Environment	9	Protected Areas	D	D	Construction and Operation phases: The protected areas are not existent in the Project area.
	10	Ecosystem	B-	B-	Construction Phase: The sandy beach of the intertidal zone of that part disappears for the construction of the port facility. Impacts on the surrounding ecosystems (birds, sea turtles, dolphins) by construction activities are assumed. Operation phase: Birds, sea turtles, dolphins and the like are expected to be inhabited. It is assumed that the influence of the ship of a large ship on the shoreline of the drill wave is assumed. Cumulative effects on the ecosystem due to surrounding development are also conceivable.
	11	Hydrology	B-	B-	Construction and Operation phases: The construction of the port facility may alter the hydrology surrounding area. Some cumulative impact will be seen.
	12	Topography and Geology	B-	B-	Construction and Operation phases: The construction of the port facility may alter the geography and geology of the area around the proposed site and cause the natural seashore to disappear. Some cumulative impact will be seen.
Social Environment	13	Resettlement and Land Acquisition	A-	D	Pre-Construction: Approximately 28ha of private land including residential area need to be acquired. Approximately 50 HHs will be resettled. Construction: No impact is expected, as relocation will be completed before construction begins. Operation: No impact is expected, as relocation will be completed before construction begins.
	14	Poor Classes	B-/B+	B-/B+	Pre-Construction: There are poor households among those to be resettled and/or lose their livelihood means. Construction: They will have job opportunities at the

				<p>construction site.</p> <p>Operation: Resettled people may experience the deterioration of their household economies and loss of livelihood following relocation if appropriate measures are not taken. Positive impact will be expected due to improvement of local economy.</p>
15	Ethnic Minorities and Indigenous Peoples	C	C	<p>Pre-Construction: There can be ethnic minority and indigenous people found in or around the project site.</p> <p>Construction: Livelihood of ethnic minority can be affected by employment in construction work if ethnic minority and indigenous people live in or around the project site.</p> <p>Operation: Livelihood of ethnic minority can be affected by employment in port operation if ethnic minority and indigenous people live in or around the project site.</p>
16	Local Economy such as Employment and Livelihood, etc.	B- /B+	B- /B+	<p>Pre-Construction: Employers/ employees of salt farms, shrimp farms, fishermen, farmers and some ferry boat workers may lose their means of livelihood or their jobs. Fishing activities around the site will also be affected due to a rise of water temperature and restriction of fishing. Cumulative impact from the adjacent project will be expected.</p> <p>Construction: Local people will be employed for construction work. The sandy beach will disappear due to the dredging activities for the port's construction and maintenance, resulting in the loss of fishing ground. Cumulative impact from the adjacent project will be expected.</p> <p>Operation: There is the possibility of loss of means of livelihood in salt farming and shrimp farming. Cumulative impact from the adjacent project will be expected. The construction of port will benefit the lives of local people through improvement of marine transport.</p>
17	Land Use and the Utilization of Local Resources	A-	A-	<p>Pre-Construction/ Construction: The implementation of this project will change the traditional land use pattern and utilization of local resources.</p> <p>Operation: Influx of port workers may change the traditional land use pattern and utilization of local resources.</p>
18	Water Usage and Water Rights	A-	B-	<p>Pre-construction: No activities are expected to give any impact on water usage.</p> <p>Construction phase: Local economy may be affected by the turbid water discharged from the construction site. Outflows of street dust and oil while it rains, may also cause certain effects.</p> <p>Operation phase: Local economy may be affected by the discharged water into the sea.</p>
19	Existing Social Infrastructure and Services	B-	B-	<p>Pre-construction: Some social infrastructure may subject to relocation. Access to social infrastructure and social service may be affected due to resettlement of project affected persons.</p> <p>Construction: Construction work may disturb access to existing social infrastructure and social services.</p> <p>Operation: Increased marine traffic may disturb the existing marine traffic (traffic of fishing boats).</p>
20	Local	B-	D	<p>Pre-construction: Partial resettlement of existing local</p>

		Communities and Decision-making Institutions			<p>communities may affect the concerned local communities and decision-making institutions.</p> <p>Construction: No impact is expected as relocation will be completed before construction begins.</p> <p>Operation: No impact is expected as relocation will be completed before construction begins.</p>
21		Unequal Distribution of Benefits and Damages	B-	B-/C	<p>Pre-Construction: There may be feelings of resentment, because people living around the project site will benefit through the improvement of social infrastructure and services. People to be resettled and those who lose their means of livelihoods will receive certain damages.</p> <p>Construction: Local resident may not receive benefits if external workers are employed at construction site.</p> <p>Operation: Local resident may not receive benefits if external workers are employed at port facility.</p>
22		Local Conflicts of Interest	B-	B-	<p>Pre-Construction: Local conflicts of interest may occur between residents, and between local administration bodies and local political leaders.</p> <p>Construction: Conflicts between local residence and external workers may occur because of changes in local customs if the external workers cannot understand local customs.</p> <p>Operation: Conflicts between local residence and external port workers may occur because of changes in local customs if the external port workers cannot understand local customs.</p>
23		Cultural Heritage	C	C	<p>Pre-Construction/ Construction: There can be historical, cultural and archaeological properties and heritage sites existing at the site, which will be confirmed through survey.</p> <p>Operation: There can be historical, cultural and archaeological properties and heritage sites existing near the site, which will be confirmed through survey.</p>
24		Landscape	B-	D	<p>Pre-construction: No activities are expected to give any impact on landscape.</p> <p>Construction: Landscape will be affected during construction.</p> <p>Operation: No significant impact will be expected as there is no scenic spot near the site.</p>
25		Gender	B-	B+/ B-	<p>Pre-construction: Unequal distribution of compensation can be occurred within households.</p> <p>Construction: Unequal employment opportunity can be provided at construction site.</p> <p>Operation: Improvement of local economy will give positive impact. Unequal employment opportunity can be provided at port facility</p>
26		Children's Rights	B-	B+/ B-	<p>Pre-construction phase: There are children among households to be resettled and/or lose their livelihood means. Children from households losing their land or jobs may suffer from adverse impact on their household economy, such as dropping-out of school.</p> <p>Construction phase: Children's ability to go to school may further deteriorate if access way to their school is physically blocked by the construction site. Child labour can be provoked at the construction site because of the huge demand for</p>

					unskilled workers. Operation phase: Improvement of local economy will give positive impact. Child labour can be provoked at the port facility.
	27	Infectious Disease such as HIV/AIDS	B-	B-	Pre-construction: No impact is expected as no influx of migrant labor is expected at this phase. Construction: A temporary influx of migrant labor during the construction period may increase the risk of infectious diseases. Operation: Influx of migrant port worker may increase the risk of infectious diseases.
	28	Work Environment (Including Work Safety)	B-	B-	Pre-construction: No activities are expected to give any impact on work environment. Construction phase: Accidents may be caused by construction work. Operation phase: Accidents may be caused by the entry and departure of vessels and loading-unloading of cargo.
Others	29	Accidents	B-	B-	Pre-construction: No activities are expected to cause accidents. Construction phase: Accidents may be caused by construction work. Operation phase: Accidents may be caused by increased marine traffic.
	30	Cross-boundary Impact and Climate Change	C	C	Construction phase: CO ₂ will be produced from construction work, but the impact on climate change will be checked. Operation phase: CO ₂ will be produced by entry and departure of vessels, but the impact on climate change will be checked.

Note: A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C: Possibility, degree or extent of impact is unknown. (Further examination is needed.)

D: No impact is expected.

Source: JICA Study Team

7.3 SURVEY TOR

7.3.1 Survey Area

The coverage of the survey is the planned site of the port described previously and its surrounding area including spoil dumps, quarries, construction yards, workers' camps, approach roads for construction equipment and related infrastructures such as power distribution and water supply facilities etc. Moreover, as for the related infrastructures grasped at the moment, after their locations and scales are established, details of evaluation, mitigation measures and monitoring will be considered. In addition, also for the infrastructures which cannot be grasped, after the impact is established, locations and scales to reduce the impact are described and the mitigation measures and monitoring details thereafter are considered.

7.3.2 Survey Method

Table-7.1-2 Survey Method and Predicted Assessment & Countermeasures of Anticipated Environmental Aspects

Environmental Items	Survey Items	Survey Method	Prediction assessment and countermeasures
Subsidence	- Usage of ground water by project activity	- Design of usage of ground water	Construction phase - Predicting ground water volume used by project activity Operation phase - The same as those addressed in "Construction phase"
Protected areas	- Current habitat status of flora, mammals, birds, reptiles, amphibians, fish, tidal land organisms, rare species (migrant birds, sea turtles, dolphins)	- Survey the distribution of flora and fauna. - Survey the operation of large vessels.	Construction phase - Predicting air pollutant and water pollutant diffusion, and noise. Assessing the environmental impact on the protected area. Operation phase - The same as those addressed in "Construction phase"
Ecosystem	- Current habitat status of ecologically valuable habitats (coral reefs, mangrove forests, or tidal flats). - Current habitat status of flora, mammals, birds, reptiles, amphibians, fish, tidal land organisms, precious species (migrant birds, sea turtles, dolphins)	- Survey the distribution of flora and fauna.	Construction phase - Estimating the degree of the impact on endangered species living near the port facility, and taking preventive measures if significant impact on the species is expected Operation phase The same as those addressed in "Construction phase"
Hydrology	- Sea bottom topography - Current status of tidal current	- Water depth measurement - Survey of tidal current (tidal direction, current speed): conducted in the rainy and dry seasons to reflect seasonal change.	Construction phase - Conducting tidal current simulation to understand change in tidal current Operation phase - The same as those addressed in "Construction phase"
Topography and Geology	- Terrestrial topography - Sea bottom topography - Tidal current	- Acquisition of information about terrestrial topography - Water depth measurement - Survey of tidal current (tidal direction, current	Construction phase - Conducting tidal current simulation to understand drift sand behavior. Operation phase - The same as those addressed in "Construction phase"
Resettlement	- Residents affected by land acquisition and involuntary resettlement. - Property of the affected residents. - Lives and livelihoods of the affected residents.	- Collate relevant laws and regulations and case studies - Population census survey - Survey of assets inventory - Socioeconomic survey	Pre-Construction phase - Establishing an appropriate LARAP

Environmental Items	Survey Items	Survey Method	Prediction assessment and countermeasures
Poor People classes	- Poor households among the affected residents	- Collate relevant laws and regulations and case studies - Population census survey - Survey of assets inventory - Socioeconomic survey	Pre-Construction phase - Developing “livelihood restoration program” Construction phase - The same as those addressed in “Pre-Construction phase” Operation phase - The same as those addressed in “Pre-Construction phase”
Local Economy such as Losses of Employment and Means of Livelihood	- Current status of occupation and livelihoods of the potentially affected households - Local economic development plan	- Collate material on local peoples’ employment and income - Interview the affected households - Collate a local economic development	Pre-Construction phase - Establishing an appropriate LARAP Construction phase - Developing mitigation measures Operation phase - The same as those addressed in “Construction phase”
Land Use and Utilization of Local Resources	- Current land use - Current status of occupation and livelihood of the potentially affected households	- Collate material on local peoples’ employment and income - Interview the affected households - Collate a local economic development	Pre-Construction phase - Developing mitigation measures Construction phase - The same as those addressed in “Pre-Construction phase” Operation phase - The same as those addressed in “Pre-Construction phase”
Water Usage, Water Rights, etc.	- Current condition of water usage and water rights	- Interview survey	Construction phase - Developing mitigation measures Operation phase None
Disturbance to the Existing Social Infrastructure and Social Services	- Operation of large vessels	- Survey the operation of large vessels.	Construction phase - Developing mitigation measures Operation phase - The same as those addressed in “Construction phase”
Social Institutions such as Social Infrastructure and Local Decision-making Institutions	- None	- None	- Same as those addressed in “Land acquisition”
Misdistribution of Benefits and Damages	- Occupation and livelihood of the potentially affected households	- Collate materials on local peoples’ employment and income Interview the affected households	- Same as those addressed in “Land acquisition”

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Environmental Items	Survey Items	Survey Method	Prediction assessment and countermeasures
Local Conflicts of Interest	- Occupation and livelihood of the potentially affected households	- Collate materials on local people's employment and income Interview the affected households	- Same as those addressed in "Land acquisition"
Gender	- Gender of the affected people	- Collate the relevant laws, regulations and case studies - Population census survey - Survey of assets inventory Socioeconomic survey	Operation phase - Construction of roads available to the local people
Children's Rights	- Number of children among the affected people - Education rate - Access to medical facilities Vaccination rate	- Collate the relevant laws, regulations and case studies - Population census survey Socioeconomic survey	Construction phase - None Operation phase Construction of roads available to the local people
Infectious Diseases such as HIV/AIDS	- None	- None	Construction phase - Developing mitigation measures
Work environment (including work safety)	- None	- None	Construction phase - Developing mitigation measures Operation phase - The same as those addressed in "Construction phase"
Accidents	- None	- None	Construction phase - Developing mitigation measures Operation phase - The same as those addressed in "Construction phase"

(Source: JICA Study Team)

CHAPTER-8 RESULTS OF THE SURVEY ON NATURAL ENVIRONMENT

8.1. Pollution Control

8.1.1 Air Quality

i) Sampling Points

Residential areas nearby the proposed port project site was selected as sampling point for air quality measurement. The survey was conducted in the dry season (15 to 16 of February 2018) and in the wet season (08 to 09 of June 2018) to reflect the influence of precipitation in the fluctuation of air quality.



Figure-8.1-1 sampling points of air quality survey

Sampling Point	Latitude (North)	Longitude (East)
AQSP	21°41'27.44"N	91°52'1.84"E

(Source: JICA Study Team)

ii) Results:

There is no industry in the Matarbari Island. A power plant construction activities are ongoing adjacent to the proposed port area. Matarbari Island has the agricultural and fishery activities, and it is not an industrial area. The air quality survey results indicated overall that the air quality in the rainy/wet season is much better than the Dry Season, with a slightly high concentration of dust (SPM) and a low concentration of SO_x and NO_x (Table 8.1-1). The reasons of higher SPM concentration in the dry season is the ongoing construction activities of the Coal Power Plant project. But the concentration was lower than the standard. Concentration of PM₁₀ & PM_{2.5} are within the IFC and National Standards.

Table-8.1-1 Results of air quality survey

Parameter	Unit	Seasonal Results		Ambient Air Quality Standards	IFC EHS Guideline (General: 2007)
		Dry	Wet		
SPM	µg/m ³	110.0	88.9	200 (8hr)	-
PM ₁₀	µg/m ³	43.2	24.5	150 (24hr) 50 (year)	150 (24hr) 70 (year)
PM _{2.5}	µg/m ³	32.1	10.9	65 (24hr) 15 (year)	75 (24hr) 35 (year)
SO ₂	µg/m ³	<12	<12	365 (hr)	125 (24hr)
NO ₂	mg/m ³	<0.057	0.057	100 (year)	200 (1hr) 40 (Year)
O ₃	mg/m ³	0.0034	0.0032	0.235 (24hr)	160 (8hr)
CO	mg/m ³	<0.30	<0.30	40 (24hr)	

(Source: JICA Study Team)

8.1.2 Water Quality

a) Sea water

i) Sampling Points

Four sampling points were selected in the sea front area of the proposed port site in consideration of the navigation channel as well as its dredging activities. The sampling was conducted in three layers, Surface (0.5m), Middle (1/2 depth), and Bottom (1m up from the bottom) in consideration of submerged discharge of thermal wastewater. Also, the survey was conducted in the rainy season (18-19 of May 2018).

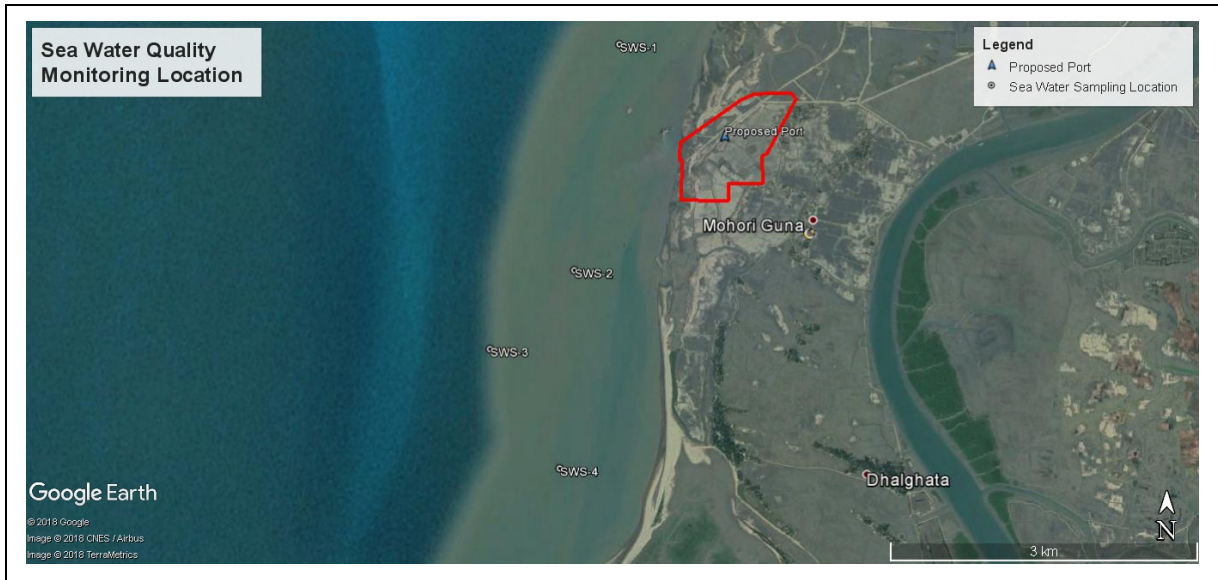


Figure 8.1-2 Sampling points of the sea water quality survey

Sampling Points	Latitude (North)	Longitude (East)
SWS-1	21°42'12.23"N	91°51'10.98"E
SWS-2	21°40'59.63"N	91°50'55.43"E
SWS-3	21°40'34.60"N	91°50'26.61"E
SWS-4	21°39'56.90"N	91°50'50.51"E

(Source: JICA Study Team)

ii) Results

Rainy Season:

The water temperature was in the range of 26.6 - 30.5 °C, with the tendency of higher temperatures near the surface layer and lowering towards the deeper layer. The salinity was in the range of 28.0 – 28.75, tending to be lower in the surface layer and becoming higher toward the deeper layer. It should be noted that, according to the database of the Japan Oceanographic Data Center⁶, salinity in the surface layer in the sea areas of 21-22°N and 91-92°E are within the range of 23.95 - 31.93. The salinity in the sea front area of the project site is assumed to be influenced by the Sangu River and other rivers. SS (suspended solids) concentration is very high (640 - 910mg/L) due to the strong effects of river water as well as the surface runoff of carrying loose soils from the hilly area. DO looks comfortable as per standard except two data. The average surface water DO level is 5.40. Concentration of heavy metals was not so high except the higher concentration of Iron (Fe).

Table 8.1-2 Results of sea water quality survey

(Rainy season: 18-19 May 2018)

Parameter	Unit	SWS-1			SWS-2			SWS-3			SWS-4		
		Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom
Depth	M	0.5			0.5			0.5			0.5		
pH	-	8.4	8.4	8.3	8.2	8.3	8.4	8.2	8.4	8.3	8.4	8.4	8.3
Salinity	-	27	28	28	28	28	28	28	29	29	29	29	30
DO	mg/L	5.714	8.575	4.999	5.714	5.71	5.714	5.71	5.71	4.286	4.29	5.0	3.571
Temperature	°C	29.8	29.7	29.5	30.1	29.8	29.1	30.1	29.8	29.2	29	29	29
TDS	g/L	27.64	27.38	27.16	29.36	32.12	27.26	31.24	29.94	40.06	28.98	27.44	30.42
SS	g/L	1.48	3.34	2.32	2.48	1.52	1.66	1.12	1.24	2	1.28	3.36	5.94
As	mg/L	0.004	0.004	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.001	0.001	0.002
Cd	mg/L	0.0002	0.00019	0.0002	0.0002	3E-04	0.0003	3E-04	3E-04	0.0004	4E-04	4E-04	0.0004
Cu	mg/L	0.26	0.26	0.26	0.26	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26
T-Cr	mg/L	0.107	0.112	0.121	0.118	0.126	0.13	0.228	0.234	0.24	0.692	0.749	0.758
Fe	mg/L	2.19	2.62	2.46	1.82	2.12	0.65	1.08	0.75	1.95	0.13	3.38	3.79
Pb	mg/L	0.007	0.011	0.042	0.031	0.033	0.04	0.029	0.051	0.036	0.027	0.044	0.048
Zn	mg/L	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

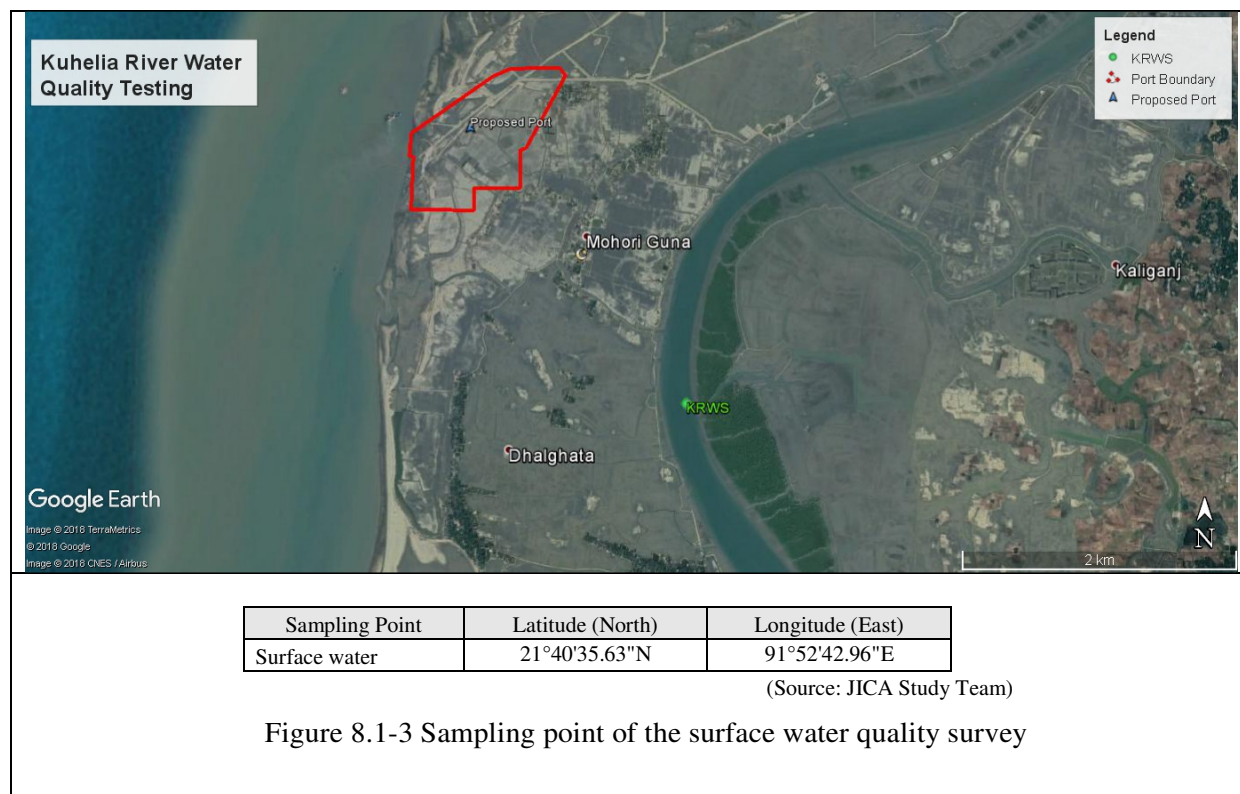
Parameter	Depth	pH	Salinity	DO	Temperature	TDS	SS	As	Cd	Cu	T-Cr	Fe	Pb	Zn	
Average	Surface	0.5	8.3	28	5.357	29.75	29.31	1.59	0.0025	0.000273	0.26	0.2863	1.305	0.0235	0.1
	Middle		8.38	28.5	6.251	29.575	29.22	2.37	0.0023	0.000303	0.263	0.3053	2.218	0.0348	0.1
	Bottom		8.33	28.75	4.643	29.2	31.23	2.98	0.002	0.000323	0.26	0.3123	2.213	0.0415	0.1

⁶ http://www.jodc.go.jp/index_j.html

b) Surface water

i) Sampling point

The river water quality of the river (Koheli River) near the proposed port site was surveyed. The survey was conducted in the dry season in the end of 30th April 2018 and the rainy season in the 18th May 2018.



ii) Results

The results of the surface water quality survey are shown in Table 8.1-3. The value of salinity suggests that the surveyed area has brackish water that is under the influence of sea water in the rainy season. SS and TDS shows high concentration levels.

Environmental standards for surface water quality are determined by 6 criteria in Bangladesh, and the survey results satisfied the defined standards.

Table 8.1-3 Results of the surface water quality survey

Parameter	Unit	Results		Standards for Inland Surface Water					
		Rainy season: 18 May 2018	Dry Season: 30 April 2018	A	B	C	D	E	F
Depth	M	0.5	0.5	-	-	-	-	-	-
Temperature	°C	30.5	25	-	-	-	-	-	-
Salinity	-	26	36.89	-	-	-	-	-	-
pH	-	8.07	7	6.5-8.5	6.5-8.6	6.5-8.7	6.5-8.8	6.5-8.9	6.5-8.9

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Parameter	Unit	Results		Standards for Inland Surface Water					
		Rainy season: 18 May 2018	Dry Season: 30 April 2018	A	B	C	D	E	F
DO	mg/L	5.95	6.1	6 or above	5 or above	6 or above	5 or above	5 or above	5 or above
BOD	mg/ L	3	2	2 or less	3 or less	3 or less	6 or less	10 or less	10 or less
COD	mg/ L	6	8	-	-	-	-	-	-
TDS	mg/ L	30750	28800	-	-	-	-	-	-
SS	mg/ L	19.5	22	-	-	-	-	-	-

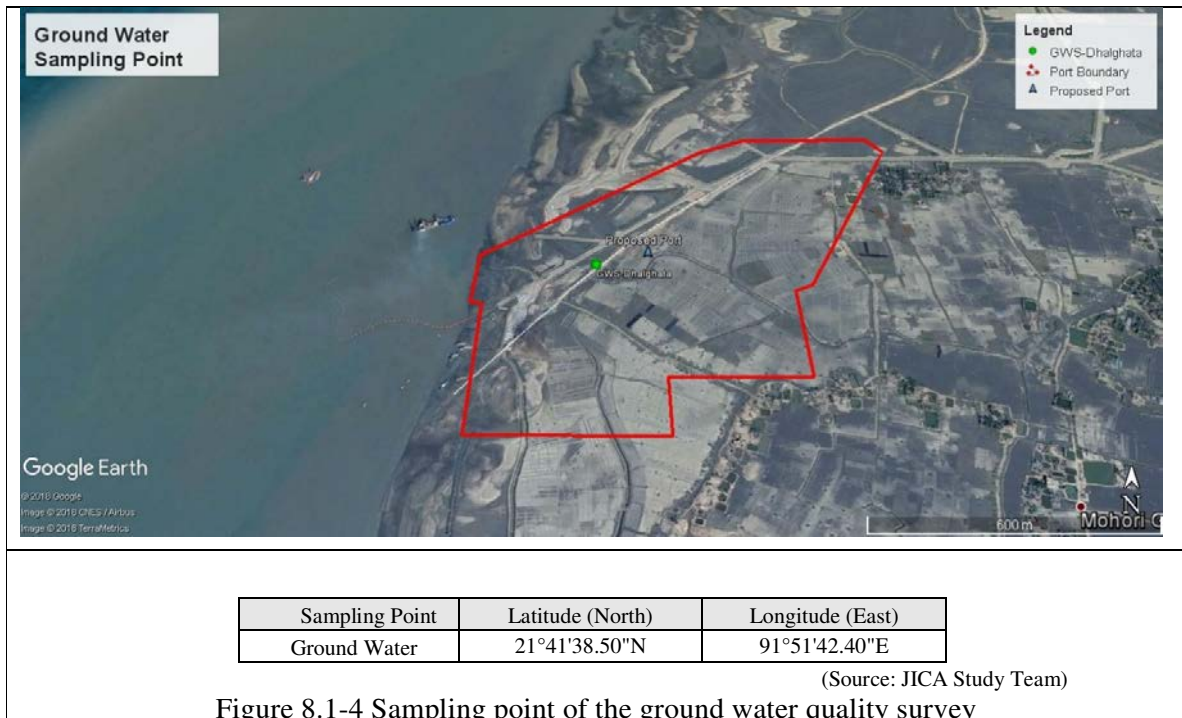
Notes: Category of water body is as below.
A: Potable water source supply after bacteria freeing only
B: Water used for recreational purposes
C: Potable water source supply after conventional processing
D: Water used for pisciculture
E: Industrial use water including chilling and other processes
F: Water used for irrigation

(Source: JICA Study Team)

c) Ground Water

i) Sampling Point

The water quality of well water around the Proposed Port project site was surveyed. The survey was conducted in the rainy season (8th June 2018) and in the dry season (28th April 2018) to reflect the seasonal change of well water quality.



ii) Results

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The results of the ground water quality survey are shown in Table 8.1-4. The results of both the rainy and dry seasons satisfied most of the drinking water standards of Bangladesh except Mn and Color.

Table 8.1-4 Results of the ground water quality survey

Parameter	Unit	Results		Standards for Drinking Water
		Rainy season 09/ June/ 2018	Dry season 30/May/2013	
Temperature	°C	28	25	20 – 30
pH	-	6.7	6.7	6.5 8.5
Chloride	mg/L	20	12	150 – 600
Nitrogen (NO ₃)	mg/L	5.1	3.8	0.5
Iron (Fe)	mg/L	2.06	2.98	0.3 1.0
Odor	Odourless	0	0	Odorless
Arsenic (As)	mg/L	0.001	0.001	0.05
SS	mg/L	10	5	10
Coliform	N/100mL	0	0	0
Colour	Hazen	98.3	85	15
Lead (Pb)	mg/L	0.001	0.003	0.05
Manganese (Mn)	mg/L	0.21	0.23	0.1
Phosphate	mg/L	2.4	1.48	6
Total Dissolved Solid (TDS)	mg/L	104	150	1000
Barium (Ba)	mg/L	0.06	0.045	0.01
Cadmium (Cd)	mg/L	0.00015	0.00015	0.005

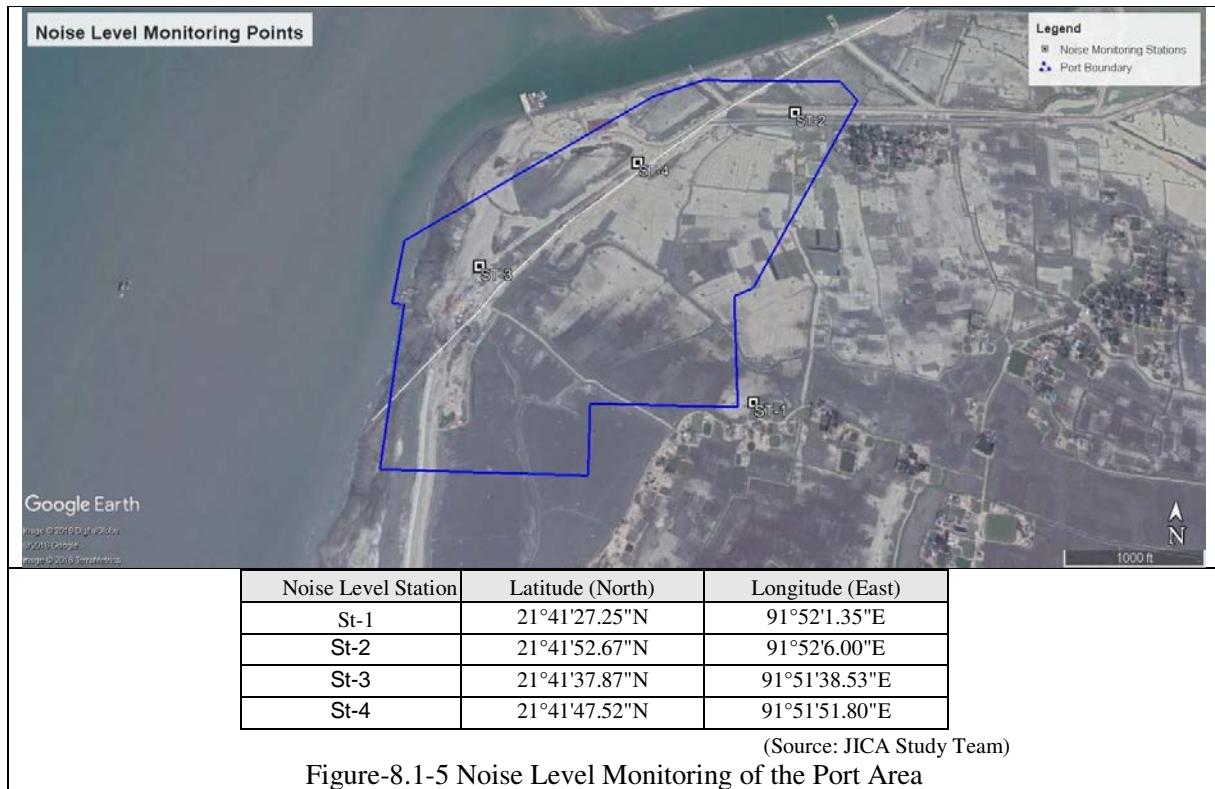
(JICA Study Team)

d) Noise

i) Sampling points

The residential areas within the site and in the corners of the site were selected as the sampling points for the noise survey. The survey was conducted in the dry season (15 to 16 of February 2018) and in the wet season (08 to 09 of June 2018) to reflect the seasonal changes of noise levels.

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ii) Results

The noise measurement results indicated that the day time noise level was above the environmental standards for residential areas consideration at two monitoring points. Adjacent to the proposed port area under the construction of Coal based power plant, therefore vehicles used for construction activities, local transportation were the noise sources. These vehicles are limited in sues at the night time but the movement of local transportation naturally has increased which has increased the noise level in compare to the Residential area.

Table-8.1-5 Noise Level data of the Study Area

Season	Results				Standards for Noise (dB) (Day: 6AM-9PM) (Night: 9PM-6AM)				
	St-1	St-2	St-3	St-4	A	B	C	D	E
Dry (Feb 2018)	49.3±2	47.8±3	57.8±1	52.7±4	Day: 45	Day: 50	Day: 60	Day: 70	Day: 70
	42.1±2	38.7±.2	44.5±2	45.1±2	Night: 35	Night: 40	Night: 50	Night: 60	Night: 70
Rainy (Jun 2018)	58.8±4	59.1±5	57.3±3	59.1±4	Day: 45	Day: 50	Day: 60	Day: 70	Day: 70
	48.2±3	47.8±4	47.5±5	48.3±4	Night: 35	Night: 40	Night: 50	Night: 60	Night: 70

Notes: Category of areas is as below.

A: Silent zone

B: Residential area

C: Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)

D: Commercial area

E: Industrial area

(Source: JICA Study Team)

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Reference: IFC/EHS guidelines

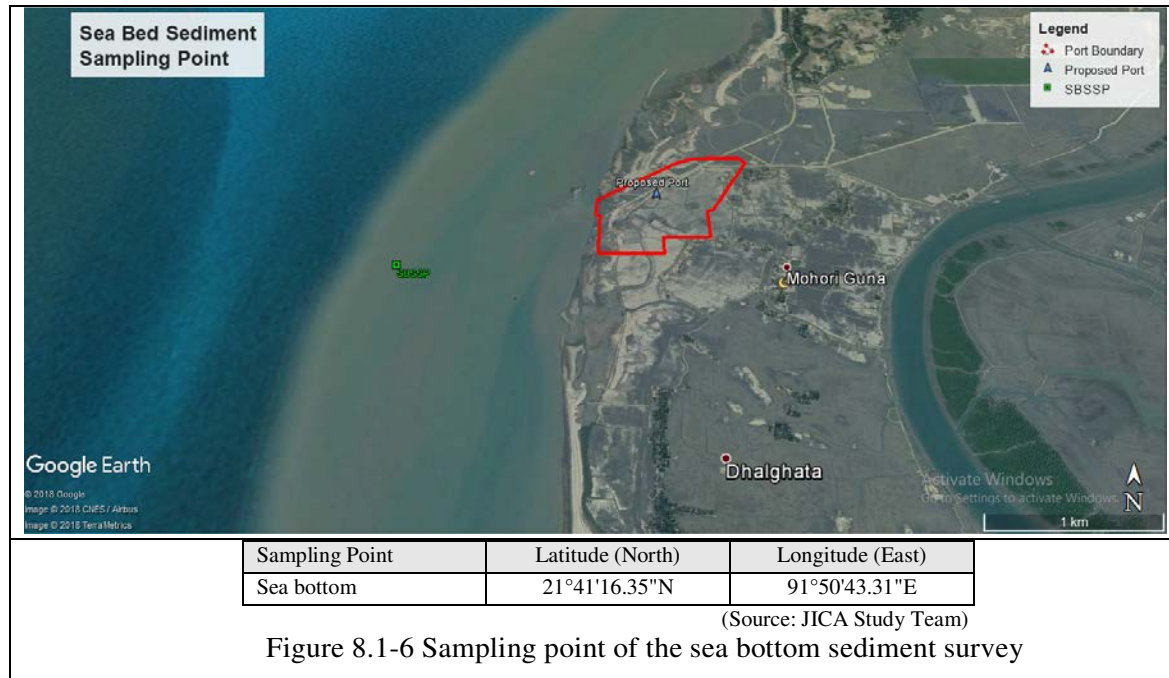
Receptor	Day 07:00-22:00	Night 22:00-07:00
Residential, institutional, educational area	55	45
Industrial, commercial area	70	70

(Source: IFC/EHS General Guidelines, 2007)

e) Sea bottom sediment (heavy metals)

i) Sampling point

The sampling point for the sea bottom sediment survey was established on the coastal side of SP-1 for the water quality survey, in consideration of sediment contamination resulting from dredging of the canal. Samples of bottom sediment has been taken from the sea bottom surface by the NIPPON KOEI and the sediment quality has been analyzed (19-03-2018 to 04-04-2018) from BRTC, BUET laboratory a reputed laboratory of Bangladesh. One sample has taken on the Route area for the depth of 0.5m, 0.5, 1, 5, 10m each.



ii) Results

Bangladesh does not have standard values for heavy metals contained in sea bottom sediment. Globally, ERL (Effects Range-Low) and ERM (Effects Range-Median) are proposed by the NOAA (National Oceanic and Atmospheric Administration, U.S.) as the guidelines to help categorize the range of concentrations of heavy metals and organic chloride compounds in sediment which affect benthic organisms.

In a series of data of ascending levels of contaminants and their toxicity effects, the 10th percentile and the 50th percentile (median) of the effects database were identified for each substance. The 10th percentile values were named the “Effects Range-Low” (ERL), indicative of concentrations below which adverse effects rarely occur. The 50th percentiles values were named the “Effects Range-Median” (ERM) values, representative of concentrations above which various effects frequently occur. The EPA uses ERL and ERM values as a type of sediment “benchmark”. They define a benchmark as a concentration that, when exceeded, has the potential to cause harm or significant risk to humans or animals in the environment. The EPA has also used ERL and

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ERM values for sediment contamination studies. Assessment categories defining the condition of sampled sediments have been used by the EPA in the past. Categories have been characterized as “good” for zero ERL exceedances, “intermediate” if there are ERL exceedances but zero ERM exceedances, and “poor” for any ERM exceedance. The EPA credits the ERL and ERM as valuable benchmarks that assist in providing a uniform context for evaluating contaminant levels within estuaries (Ref: Wikipedia). The result shows that all the parameters are within the NOAA guidelines standards and there is no sediment contamination in the project area. The results are listed in the table 8.1-6.

Table 8.1-6 Results of Sea bottom Sediment Survey (Heavy Metals) of the project study area

Parameters	Unit	Result (19-03-2018 to 04-04-2018)				Guideline of NOAA	
		0.5m depth	1m depth	5m depth	10m depth	ERL	ERM
pH	-	7	7.5	7	7		
Arsenic (As)	mg/Kg	5.43	3.94	8.65	8.87	8.2	70
Copper (Cu)	mg/Kg	9.1	4	9.2	9.5	34	270
Zinc (Zn)	mg/Kg	41.2	23.5	26.3	41.7	410	410
Mercury (Hg)	mg/Kg	0	0	0	0	0.15	0.71
Chromium (Cr)	mg/Kg	25.3	11.70	13	21.1		
Lead (Pb)	mg/Kg	17.2	14.90	17.8	18.3	46.7	218
Nickel (Ni)	mg/Kg	16.2	8.8	9.4	16.4		
Cadmium (Cd)	mg/Kg	0.1	0.10	0	0	1.2	9.6
Iron (Fe)	mg/Kg	18400	15000	21000	32800	-	-
Organic Matter (Wet Combustion method)	%	2.4735	1.35	2.62	2.12		
Moisture Content	%	22.39 (28.86)	20.36 (25.57)	25.47 (34.18)	21.38 (27.19)		

8.2 Natural Biological Resources (including Forests)

a) Ecologically valuable habitats

i) Coral Reef

Chief Scientific Officer of the Bangladesh Fisheries Research Institute in Cox’s Bazar has informed that there is no coral reef habitat around the proposed port project site. The closest coral reef to the project site is the St. Martins Island which is located approximately 120km from the proposed project site.

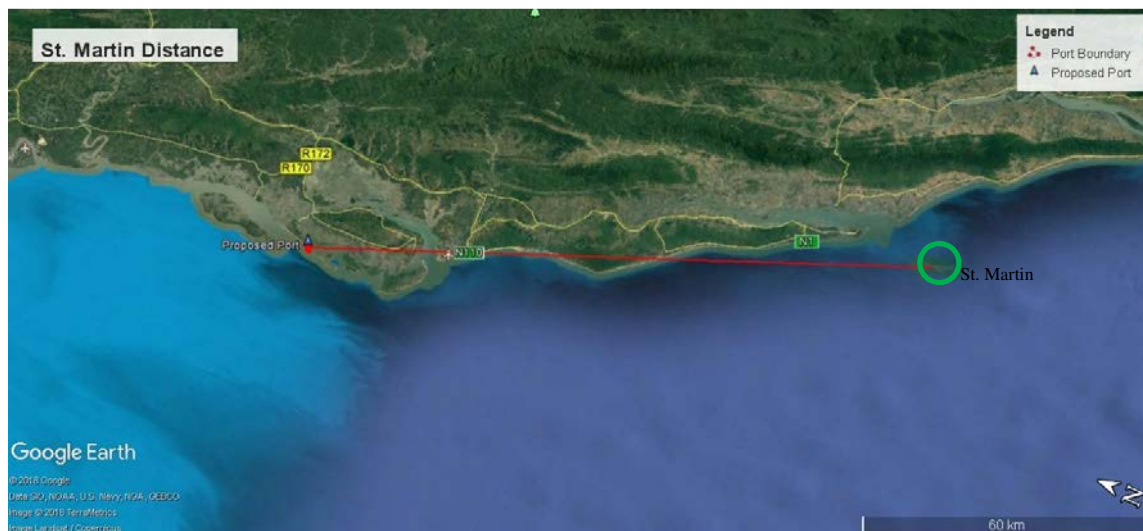


Figure 8.2-1 Project Site and St. Martins Island (Source: Google Earth)

ii) Seaweed

As said by the Chief Scientific Officer of the Bangladesh Fisheries Research Institute in Cox's Bazar, seaweed does not grow around the proposed port project site because the transparency of the sea water is low. This is applicable for both the dry and wet seasons. Prof. Dr. Abdul Aziz has mentioned that only in the outfall of the Bakkhali river to the Sea location has the environment of the seaweed culture and growth points.

The culture of a red seaweed *Hypnea* sp. in three locations of Cox's Bazar coast, Saint Martin Island, Inani and Bakkhali with net method of 4 × 4 m coir rope net was evaluated. Seaweed was partially harvested at 15 days interval during December 2015 to January 2016. Daily growth rate of cultured *Hypnea* sp. was significantly higher ($3.21 \pm 0.01\%$ day⁻¹) in Saint Martin while Inani had the lowest ($0.41 \pm 0.06\%$ day⁻¹). Biomass yield of *Hypnea* sp. (3.81 ± 0.04 kg fresh wt.m⁻²) gained highest in Saint Martin than in Bakkhali (3.34 ± 0.10) and Inani (2.70 ± 0.02). Growth rate of seaweeds had a significant correlation with NO₃-N ($p < 0.05$) but not with PO₄-P. Culture of seaweed along those sites added a new dimension of prospect and possibility of seaweed mariculture in Bangladesh coast. (Ref: Seaweed *hypnea* sp. Culture in cox's bazar coast, Bangladesh by Md. Mohidul Islam, Md. Shahzad Kuli Khan, Jakia Hasan, Debbrota Mallick¹ and Md. Enamul Hoq*)

iii) Mangrove forest

There are no mangrove forests around the proposed port facility site. They are only scattered at the riverside of the Kohelia River, which flows between Matarbari and Moheshkhali Islands. There is a mangrove forest, which is large scale and artificially established, at the south side of Matarbari Island and its opposite bank is Moheshkhali Island.

iv) Mud flats

The coastline of Matarbari Island is a long sandy beach, and the sea side of the project site, where the proposed port facility will be constructed, is also part of the beach. The slope of the sandy beach is steep, and the area of its inter-tidal zone is relatively small.

On the other hand, a sand bar and shallow sea area lie in the estuary of the Kohalia River located south of Matarbari Island due to sedimentation.

v) Marine organisms

(a) Phyto-plankton

(i) Sampling points

The phyto-plankton survey was conducted at eight sampling points, at three water layers, Surface (0.5m), Middle (1/2 depth), and Bottom (1m up from the bottom), as in the case of the sea water quality survey.



Figure 8.2-2 Marine Organism Sampling Points

ii) Method

Water samples from different depths (pre-selected) were collected by using Nenson bottles and were immediately transferred to 24 commercially available plastic bottles as is the recommended method by Sournia (1978) to obtain an accurate depiction of the quantitative composition of phyto-plankton.

The collected samples were preserved with 3% neutralized formalin. Immediately after collection, the bottles were labeled and transferred to a laboratory for further analysis.

iii) Results

(Dry Season)

The dry season survey of the year 2018 has been conducted by the CPGCBL in the month of April and there the Phytoplankton the surface and the bottom of the River (Kuhelia River) has been assessed.

Table: 8.2-1 Results of the phytoplankton survey in April 2018 (Source: CPGCL Env. Monitoring data)

Group/Species/Depth		Location-RB1		Location-RB2		Location-RB3	
		Surface	Bottom	Surface	Botto	Surfac	Bottom
Bacillariophyceae		0.5 m	3.5 m	0.5 m	1.5 m	0.5 m	1.2 m
1	<i>Amphora alata</i>	+	+				
2	<i>Chaetoceros spendulus</i>	+	+	+		++	+
3	<i>Coscinodiscus radiatus</i>	+			+		
4	<i>Cyclotella sp.</i>	++	+		+		
5	<i>Desmidium sp.</i>				+		+
6	<i>Fragellaria sp.</i>	++				+	
7	<i>Melosira sp.</i>	+		++	++		
8	<i>Navicula sp.</i>	+	++		+		
9	<i>Nitzschia acicularis</i>	+	+	+			
10	<i>Odontella sinensis</i>	+					+

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Group/Species/Depth		Location-RB1		Location-RB2		Location-RB3	
		Surface	Bottom	Surface	Botto	Surfac	Bottom
11	<i>Polycistis sp.</i>	+		++	++	+	
12	<i>Pleurosigma sp.</i>					++	
13	<i>Pleurosigma normanii</i>			+			
14	<i>Rhizosolenia setigera</i>					++	+
15	<i>Surirella fastuosa</i>	+	+			+	
16	<i>Tabellaria sp.</i>	+		+		+	
17	<i>Thalassionema nitzschiodes</i>	+					
18	<i>Thalassiosira sp.</i>					+	
19	<i>Zygnema sp.</i>	+	+	+			
Chlorophyceae							
20	<i>Chlorella sp.</i>			++	+	+	
21	<i>Closterium spaericum</i>	+	+			+	
22	<i>Pediastrum duplex</i>			+		+	+
23	<i>Oocystis pusilla</i>	+		+		+	
24	<i>Spirogyra leptocladum</i>			+			
25	<i>Staurastrum orbiculare</i>	+	+			+	
Cyanophyceae							
26	<i>Anabaena circinalis</i>			+			
27	<i>Anacystis aeruginosa</i>					+	+
28	<i>Microcystis viridis</i>	+	+	+			+
29	<i>Nostoc sp.</i>			+		+	
30	<i>Spirulina platens</i>	+				+	
Dinophyceae							
31	<i>Alexandrium sp.</i>			+		+	
32	<i>Ceratium furca</i>	+	+			+	
33	<i>C. tripos</i>			+			
34	<i>Dinophysis caudate</i>	+	+	+		+	
35	<i>Peridinium sp.</i>	+	+	+			
36	<i>Polykrikos sp.</i>		+	+			+
37	<i>Pyrocystis sp.</i>						
38	<i>Oxyphysis sp.</i>					+	
Euglenophyceae							
39	<i>Astasia cylindrical</i>	+	+	+		+	

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Group/Species/Depth		Location-RB1		Location-RB2		Location-RB3	
		Surface	Bottom	Surface	Botto	Surfac	Bottom
40	<i>Euglena spathirhyncha</i>	+			+		
Total		18x105	7.5x105	14.5x105	6x105	10x10	4.5x105

Note: ++ most dominant species (above 70% among total species in the sample), + less dominant species (less than 10% among total species in the sample) (Unit: cells/L)

(Rainy season)

Higher abundance of phytoplankton occurred in Kuhelia River. Most of Kuhelia river species are Aphanizomenon, Cochlodinium, Dynophysis, Planktothrix, Proto-peridinium, Pseudo-nitzschia etc. Due to lack of transference (dredging fact) and excess rolling of the sea water the phytoplankton growth is minimum in sea site.

Two layers of results of the phyto-plankton has been observed from the field investigation. The Bottom Water phytoplankton abundance is zero as because of the lack of sunlight penetration to the bottom layers. It has evident that the phytoplankton doesn't grow in the bottom layer.

Table 8.2-1 Results of the phyto-plankton survey

Surface Water (0.5m depth)			Middle (1/2 depth)		
Genera	Sampling sites		Genera	Sampling sites	
	Sea	Kuhelia		Sea	Kuhelia
	(individuals/L)	(individuals/L)		(individuals/L)	(individuals/L)
Aphanizomenon	-	777.667	Ditylum	27.5	-
Asteromphalus	-	-	Dynophysis	-	-
Aulacoseira	-	1,811	Dissdenium	-	-
Boreadinium	-	500	Euglena	-	-
Coscinodiscus	-	1,111	Entomoneis	-	-
Cochlodinium	-	500	Gloeocapsa	-	-
Cylindrotheca	-	477.67	Leptocylindrus	-	-
Ditylum	300	1,276.67	Monoraphidium	-	-
Dynophysis	-	1,000	Navicula	-	-
Dissdenium	-	-	Planktothrix	-	-
Euglena	-	-	Pleurosigma	-	800
Entomoneis	-	777.667	Pseudo-nitzschia	-	-
Gloeocapsa	-	2,666.67	Rhizoselenia	80	766.667
Gyrodinium	-	-	Spirulina	8.25	-
Leptocylindrus	-	-	Total	107.75	1,566.67
Monoraphidium	291.5	-			
Navicula	-	-			
Planktothrix	-	1000			
Pleurosigma	-	-			
Proto-peridinium	-	-			
Pseudo-nitzschia	-	-			
Rhizoselenia	290	2,788.67			

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Surface Water (0.5m depth)			Middle (1/2 depth)		
Spirulina	287.5	-			
Scenedesmus	-	-			
Stephanopyxis	-	-			
Total	1,169	14,687.01			

ii) Zoo-plankton

(a) Sampling points

The zoo-plankton survey was conducted at eight sampling points similar to the similar to the water quality survey at three layers; surface (0.5 m), Middle and bottom (1m up from the bottom).

(b) Method

Zoo-plankton samples were collected from the subsurface water using a Zooplankton net with mesh size 300µm and metallic circular frame with a 25cm mouth opening. A flow meter (FMC-0.3) was used at the mouth of the net to record the quantity of the water filtered through the net. Precaution was taken for clearing the net and bucket before every sampling to avoid any possible contamination. After collecting the samples, they were put into 200ml plastic jars and preserved with 5% formalin.

(b) Results

(Dry Season)

The dry season survey of the year 2018 has been conducted by the CPGCBL in the month of April and there the Zoo-plankton the surface and the bottom of the River (Kuhelia River) has been assessed.

Table: 8.2-2 Results of the zoo-plankton survey in April 2018 (Source: CPGCL Env. Monitoring data)

Group/Species/Depth		Location-RB1		Location-RB2		Location-RB3	
		Surface	Bottom	Surface	Bottom	Surface	Bottom
Calanoida							
1	Calanus sp.	+				+	
Cladocera							
2	Bosmina sp.		+	+		+	
3	Chydorus sp.	+					
4	Daphnia magna	+	+	+	+	++	++
5	Diaphanosoma sp.	+		++			
6	Macrothrix rosea					+	+
7	Moina sp.				+		
8	Lepadella cristata	++	+	+	+	+	+
9	Protoperidinium claudicans	+	+				
Copepoda							
10	Cyclops sp.	+	+			+	
11	Diaptomus sp.	+	+	+	+	++	++
12	Eudiaptomus sp.	+				+	+

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Group/Species/Depth		Location-RB1		Location-RB2		Location-RB3	
		Surface	Bottom	Surface	Bottom	Surface	Bottom
13	Mesocyclops sp.			++	++		
Decapoda				+			
14	Sergestes sp.	++	+				
Foraminiferida						+	
15	Globigerina bulloides	+		+			
Mysidacea							
16	Mesopodopsis wooldridgei		+				
17	Mysis sp.				+		
Ostracods							
18	Cypridopsis sp.	+		++		+	
Rotifers							
19	Asplanchna sp.				+		+
20	Brachionus angularis	++				++	++
21	Filinia sp.	+		+			
22	Hexarthra sp.					+	+
23	Keratella sp.		+		+		
24	Lepadella cristata	+				+	
Total		960	692	603	560	502	432

Note: ++ most dominant species (above 70% among total species in the sample), + less dominant species (less than 10% among total species in the sample) (Unit: cells/L)

(Rainy season) (Field Survey June 2018)

Seven species of zoo-plankton were observed, and *Copepod* was the largest in number of species. *Copepod* was the species that emerged most frequently, followed by *Sagitta* sp.

Table: 8.2-3 Results of the zoo-plankton survey

Taxa	Sampling Sites (Unit: Individual/m3)					
	Sea	Kuhelia River	Sea	Kuhelia River	Sea	Kuhelia River
	Surface		Middle		Bottom	
Copepod	1	10	1	3	0	2
Crab larvae	0	0	0	0	-	0
Jelly fish	-	0	-	0	-	0
Lucifer	0	0	0	0	0	0
Mysid	0	-	0	-	-	-
Sagitta	0	2	0	1	0	0

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Shrimp larvae	0	0	0	0	-	0
Total	2	12	2	5	0	2

iii) Benthos (Sea bottom)

(a) Sampling points

Samples were collected from four sea stations within two categories sea bottom (4 locations) and mudflat in the Kuhelia River.

(b) Method

For macro-benthos, samplings were collected at the selected points for bottom sediments. Samples for macro benthos for bottom sediments were collected randomly using a grab sampler of 20cmX20cm with 10cm depth.

The collected sediments were then placed in plastic buckets and washed through a sieve of mesh size 0.5mm and 0.25 mm to retain all benthic fauna. The fauna from the sieves were preserved in a pre-labeled plastic container containing 5% formalin.

(c) Result

(Dry Season)

The dry season survey of the year 2018 has been conducted by the CPGCBL in April and there the benthos of the sea bottom is higher than the river bottom (Kuhelia River). Polycheta abundance is much more than other benthic group.

Table 8.2-4 Results of the macro-benthos survey (April 2018 Source: CPGCBL Environmental Monitoring)

Benthic Group	Sea Bottom-1	Sea Bottom-2	Sea Bottom-3	MDF	River Bed-1	River Bed-2	River Bed-3
Bivalve	3	2	2	-	1	2	2
Crustacea	4	2	4	1	2	3	3
Gastropoda	18	10	12	10	10	6	4
Nematoda	2	-	3	1	2	-	3
Oligochaeta	15	13	11	13	16	14	12
Polycheta	30	22	20	12	23	11	14
Total	72	49	52	37	54	36	38

Source: CPGCBL monitoring data of April 2018

(Wet season)

Population of high individuals observed Nuculidae (Molluska-280 individual/m²) in Kohelia river and Neridae (Annelida-58 individual/m²) in sea site. Huge numbers of dead shell (211ind/m²) also found in Kohelia river.

Table 8.2-5 Results of the macro-benthos survey (Filed Survey June 2018)

Sl. No.	Taxa	Sea Bottom (individual/m ²)	Mud Flat Kuhelia River (individual/m ²)
1	Alitta	26	-
2	Antrobis	41	7
3	Nadide	5	-
4	Nadidae	36	7

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Sl. No.	Taxa	Sea Bottom (individual/m ²)	Mud Flat Kuhelia River (individual/m ²)
5	Nadiadae	10	-
6	Nereidae	15	41
7	Neridae	59	-
8	Nucula	21	-
9	Nuculidae	5	280
10	Massanoides	21	
11	Olygocheta	13	21
12	Pyrgulopsis	31	-
13	Tasserkidrilus	15	-
14	Unicidae	10	-
15	Crab	5	7
16	Lucifer	15	-
17	Myzostomidae	-	7
18	Polychaeta	-	14
19	Shrimp	-	7
20	Dead Shell	-	212
21	Fluminicola	-	62
22	Tarbeia	-	-
23	Hydrobiidae	-	-
24	Mants shrimp	-	-
25	Green muscle	-	-
26	Corbicula	-	-
27	Eunicidae	-	-
28	Naididae	-	-
29	Nadidae	-	-
30	Syllidae	-	-
Total		328	663

iv) Fish and Nekton

(a) Sampling points

The fish samples were collected from set bag nets of the Kutubdia channel, Sonadia Island and Dhalghata Union of Matarbari Island. One sample was collected from a local fish farm (Ghona) of Matarbari Island. A brief introduction of the sampling areas is shown in Figure 7.1-9.

Kutubdia Channel: The Kutubdia Channel is situated in the south eastern part of the Bay of Bengal. It lies between 21°45' N to 21°55' N latitude and 91°53' E to 91°55' E longitude. Kutubdia Channel is an important spawning and nursery ground for several species of fin fish and shrimps.

Project site: Matarbari Island is situated in the north western part of Moheshkhali Island. Many parts of this island are at stake because of unplanned shrimp farming and natural disasters. This island is rich in shrimp farming and solar salt pans. There are also many fish farms (local name: ghona) scattered on this island. The island lies between 21°41' N to 21°44' N latitude and 91°46' E to 91°52' E longitude. The survey in front of the project site was conducted at 2 sampling points (Matarbari and Dhalghata).

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Sonadia Island: Sonadia Island is an island situated in the northern part of Moheshkhali Island. It lies between 21°23' N to 21°28' N latitude and 91°48' E to 91°52' E longitude. Sonadia Island is a biodiversity hotspot and ecologically critical area as per DOE gazette.



Fishing Point	Latitude	Longitude
FNS-Kuhelia	21°39'10.31"N	91°53'26.83"E
FNS-Estuaries	21°36'55.64"N	91°50'54.72"E

Figure 8.2-3 Sampling points of fish and nekton

(b) Method

The sampling gear of fish was an estuarine set bag net, locally known as “Behundi Jal”. The set bag net is a fixed tapering net, resembling a trawl net, set in the tidal stream by attaching it to hold-fasts. It has a rectangular mouth kept open by two vertical bamboo poles. The net is held in a fishing position against the current by linking the extended sides of the net (wing tips) to hold-fasts by means of long bamboo poles and steel wires. The hold-fasts are two wooden stakes embedded some distance apart in the sea bed, so that the net is parallel to the direction of the current. The set bag net catches species of fish which drift with the current or do not swim fast enough to stem the current and maintain a fixed position in relation to the sea bed. At each slack water period, the net comes to the surface (by means of the bamboo poles used for opening of the net, the bamboos serving as sweep lines) when it is emptied; it is then reversed in the opposite direction ready for fishing. The survey was conducted from high tide in one evening up to high tide in the morning of the following day. Set bag nets at every sampling point were set up at depths of 8 to 12 meters.

(c) Results

(Dry Season) (April 2018 Source: CPGCBL Environmental Monitoring)

Fish Catch Assessment survey was carried out among the randomly selected fishing gears and data were recorded using simple structured questionnaire by the CPGCBL Environmental Monitoring Team. Procedure that was adopted in selecting Sample fishing gears is described as follows:

Type of Fishing Gears	No. of Gears found in Operation	No of selected Sample Gears Surveyed
Gill Net	2	1
Estuarine Set Bag Net	1	1
Char Jal	2	2
Cast Net	10	2

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Push Net	15	4
Long Line	6	2

Findings and Analysis Fish Diversity

During the study period, a total of 87 species of fish and fisheries resources under 43 families and 13 orders were recorded.

Among them 72 species were finfish under 38 families and 12 orders and 15 species were shellfish under 5 families and 1 order. Among the 15 species of shellfishes, prawn- shrimp and crab were 10 and 5 species respectively.

The order based relative percentage of the existing finfish species showed highest occurrence under the order perciformes (66.66 %) which was followed by Clupiformes (11.11 %), Carcharhiniformes (4.16 %), Anguiliformes (4.16 %), Myliobatiformes (2.77 %) and Siluriformes (2.77 %). Whereas, the relative percentage occurrence was lowest and same (1.38 %) for the orders viz. Rhinobatiformes, Elopiformes, Aulopiformes, Scorpaeniformes, Pleuronectiformes and Pleuronectiformes. On the other hand, 15 species shellfishes belong in only on order, Decapoda.

Recorded fishes during the study period belong to the diversified families. A total of 38 families contained 72 species of finfishes. The most dominated family was Scombridae (9.72 %) represented by 7 species.

On the other hand, highest number of species (46.66 %) comprises in Penaeidae in case of shellfishes which was followed by Portunidae (26.66 %), Sergestidae (13.33 %), Palaemonidae (6.66 %) and Ocypodidae (6.66 %) (figure below).

According to the red list of Bangladesh published by IUCN (2015), there were no threatened finfish recorded during the study period. But, 1 species was near threatened (NT) and 12 species were least concern (LC). Rest of the finfishes were recorded as not evaluated (NE) as they were marine fishes. On the other hand, in case of 15 species of shellfishes Three Spot Swimmer crab (*Portunus sanguinolentus*) was recorded as vulnerable (VU). The rest of the 13 species were least concern (LC) and only one species was data deficient (DD).

Fishing Gear and Craft

Matarbari is the one of the coastal island of Bangladesh located north-east part of the Bay of Bengal. Most of the fishermen of this island are engaged in offshore fishing with different gear and craft. Offshore fishing is mainly carried out by the seine net which is locally called vingijal (set bag net) and small mechanized boat. 8-10 fishermen are engaged in each boat with 5-10 vingijal. Besides, this another seine net like berjal and gill net (chandijal) also used to offshore fishing. Besides, this Kohelia River is rich in fish diversity. Fishermen are fishing in this river with the help of some selective fishing gear and craft. Berjal, chatjal, jhakijal, thela jal, netjal, line hook and chai (trap) are most commonly used in Kohelia River. Small boats were used as fishing craft in this river. Several fishermen were engaged to catch mud crab by using trap. The types of fishing gears used in the project site and their performance are presented in following Table below.

The Fishing Gears Used Within and Surrounding of Survey Area and Their Performance

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Local name of the gear	English name and mode of operation	Targeted Species	Brief description	Amount of fish catch
Vingi jal/ Behundi jal	<u>Estuarine set bag net (seine net)</u> Kept vertically open by a frame and held horizontally stretched by the water current. They can be kept set in water against the water current,	Guijja, Phaishya, Loitta, Shrimp(s), Churi, Ola, Hilsa, Rupchanda, Foli Chanda, Poa, Lakhya, kata mach, Taillya, Surma, Maitya, Chamila, Kailya, Datina, Korol, Bailla, Khorol bata, Tular danti, Chiring, Shapla pata mach, Hangor, Haturi hangor, Squids, etc.	These nets are usually 60-100 m long. About 3-7 fishermen operate this net and usually engine boats (12-24 HP) are used to operate this net.	15-20 Kg/ haul 2-4 haul/ day 5-10 gears in one boat
Ber jal	<u>Encircled net/ seine net</u> This type of net has very long wings and a towing rope. The nets are of various lengths and come with or without bags for catching and are locally called Bedh Jal.	Guijja, Phaishya, Loitta, Shrimp(s), Rupchanda, Foli Chanda, Poa, Datina, Korol, Bailla, Khorol bata, Tular danti, Chiring, etc.	These nets are usually 300-1000 m long. About 5-7 fishermen operate this net and usually engine boats as well as country boats are used to operate this net.	3-10 Kg/ haul 5-6 haul/ day
Net jal (as like as mosquito net)	<u>Fine mesh set bag net</u> All made of finest mesh mosquito net. It has proved to be highly damaging to biodiversity and wild fish stocks, in Particular the fixed bag net.	Shrimp Post Larvae (PL)	These nets are usually 5-10 m long. About 2 fishermen operate this net and usually country boats are used to operate this net.	2000-5000 PL/ day
Chandi jal/ Ilish jal	Gill net	Guijja, Hilsa, Rupchanda, Foli Chanda, Poa, Lakhya, Taillya, Surma, Maitya, Korol, Hangor, etc.	These nets are usually 500- 1000m long. About 5-7 fishermen operate this net and usually engine boats are used to operate this net.	10-25 Kg/ haul 3-4 haul/ day
Gill net	Mono-filamentous gill net	Guijja, Loitta, Hilsa, Poa, Lakhya, Taillya, Surma, Maitya, Korol, Hangor, etc.	-	-
Chot jal/ ghira jal	This net is set under the sediment on the beach during neap tide and allow fish to enter inside. As soon as the water starts receding, net is hang vertically with the bamboo poles. Fishermen use to pick up fishes during low tide.	Guijja, Phaishya, Loitta, Shrimp(s), Ola, Poa, Chamila, Kailya, Datina, Bailla, Khorol bata, Tular danti, Chiring, etc.	-	10-20 Kg/ haul

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Local name of the gear	English name and mode of operation	Targeted Species	Brief description	Amount of fish catch
Current jal	Entangling net - a type of gill net Rectangular, with variable length and width; net length depends on the size and depth of the water body. Length is normally 100-300 m and width may vary between 1-3 m	Phaishya, Loitta, Shrimp(s), Churi, Ola, Poa, Datina, Bailla, Khorol bata, Tular danti, Chiring, etc.		1.5-2 Kg/ day
Tana jal	Fine mesh pull net	Shrimp PL		300-500 PL/day
Chai	Trap	Crab		150-200/day

Catch Composition by Gears

During the direct catch assessment the fish and shrimp species were found mainly *Arius arius*, *Coilia dussumieri*, *Setipinna taty*, *Harpadon nehereus*, *Lates calcarifer*, *Lutjanus johni*, *Upeneus sulphureus*, *Liza spp.*, *Mugil cephalus*, *Eleutheronema tetradactylum*, *Pomadasy argenteus*, *Otolithes ruber*, *Rastrelliger kanagurta*, *Sillago domina*, *Sphyaena forsteri*, *Pampus chinensis*, *Lepturacanthus savala*, *Penaeus monodon*, *Penaeus indicus*, *Penaeus merguensis*, *Metapenaeus monoceros* and *Metapenaeus brevicornis*.

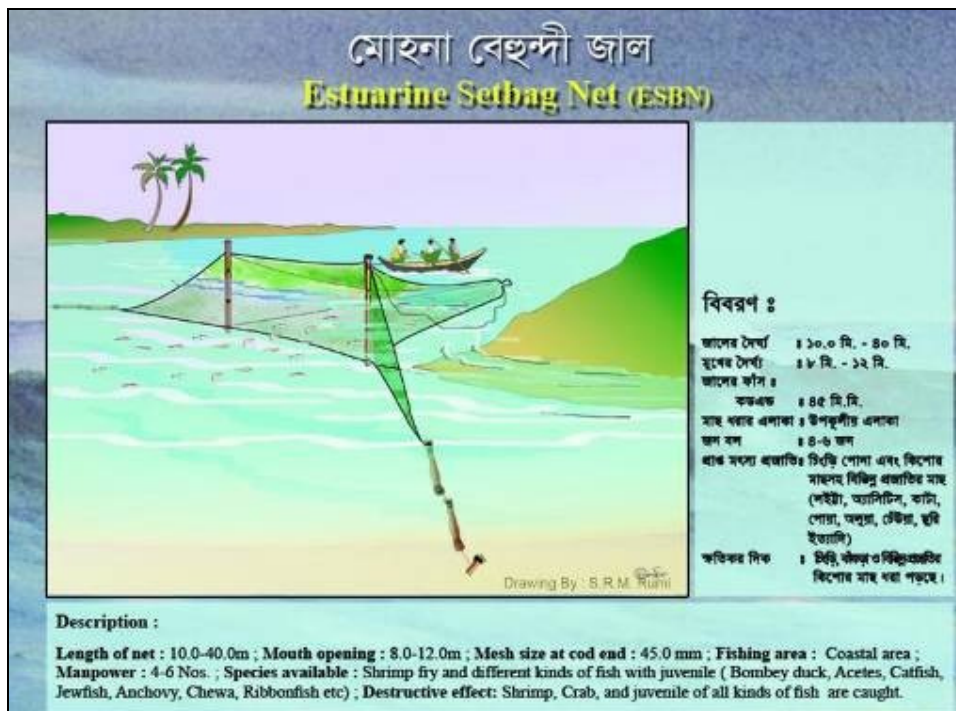
Analysis of field record revealed that the fishermen at the project site caught in an average 4.79 Kg of fish per haul by a single set bag net. In case of gill net, it was 1.49 Kg and for chat jal it was 2.33 Kg.

It is also revealed that at the sampling site, the average highest amount fish catch by weight was observed for *Arius arius*. (20.6 %) by set bag net followed by *Lutjanus johni* (11.6 %), *Lepturacanthus savala* (10.3 %), *Eleutheronema tetradactylum* (8.4 %), *illago domina* (7.7 %), *Lates calcarifer* (5.4 %) and the lowest catch was observed among the shrimp species. However, among the shrimps, the highest catch was observed for *Penaeus monodon* and *Metapenaeus monoceros* (0.8 % each). By number of fishes, it was highest for *Setipinna taty* and *Harpadon nehereus* (average 4 fish/ haul), followed by *Sillago domina* (average 3 fishes each/ haul).

Kohelia River is rich in fish diversity and fishermen are fishing in this river without any restriction. But, offshore fishing was reduced, due to entrance to offshore adjacent to the project site was strictly prohibited by the authority and has an adverse effect on livelihood of fisherman community.

(Wet Season) (Field Survey June 2018)

The result of the fish and nekton is listed in tables as different species format like fish, Crab, shell. From the seasonal survey it can conclude that there is no endangered species in the study area.



(Source: http://www.fisheries.gov.bd/album_details/507)

Figure 8.2-4 Estuarine set bag net

Table 8.2-6 Results of the fish and nekton survey Wet Season (June 2018)

Sl. No.	Family	Scientific Name	Common English Name	Local	Season (D/W)	Sea	Kuheli a River
1	Muraenocidae	<i>Congresos telabonoides</i>	Indian Pike Conger	Kamila	D & W	✓	-
2	Harpadontidae	<i>Harpodon nehereus</i>	Bombay Duck	Laitta	W	✓	✓
3	Belonidae	<i>Ablennes hians</i>	Barred Long-Tom	Thuitta	D & W	-	✓
4	Hemirhamphidae	<i>Hamirhamphus georgii</i>	Long billed half beck	Ek-Thuitta	D & W	-	✓
5	Chirocentridae	<i>Chirocentrus dorab</i>	Dorab, Wole herring		D & W	-	✓
6	Chirocentridae	<i>Chirocentrus dorab</i>		Karati chela	D & W	✓	-
7	Engrulididae	<i>Coilia neglecta</i>		Olua	D & W	✓	-
8	Engrulididae	<i>Coilia ramcarati</i>	Tapetail Anchovy	Olua	D & W	✓	-
9	Clupeidae	<i>Escualosa thoracata</i>	White Sardine	Shirshiri	D & W	✓	-
10	Orectolobidae	<i>Stegostoma fasciatum</i>			D & W	✓	-
11	Mugilidae	<i>Mugil cascasia</i>	Yellowtail Mullet	Phaisa/Bata	W	✓	✓
12	Mugilidae	<i>Liza tade</i>	Tade Mullet	Gol Bata	D & W	✓	-
13	Sparidae	<i>Acanthopagrus latus</i>	Yello Seabream	Sada Datina	D & W	✓	-
14	Gobiidae	<i>Acentrogobius masoni</i>	Masons goby		D & W	✓	-
15	Gobiidae	<i>Acentrogobius viridipunctatus</i>	Green Spotted Goby	Fool Baila	D & W	✓	-
16	Gobiidae	<i>Apocryptes bato</i>	-	Chiring	D & W	✓	✓
17	Apogonidae	<i>Apogon septemstriatus</i>	Cardinal Fish		D & W	✓	-
18	Gobiidae	<i>Beleophthalmus boddarti</i>	Goggle Eyed Goby	Chiring	D & W	✓	✓
19	Carangidae	<i>Chorinemus/Scomber lysan</i>	Talang leatherskin		D & W	✓	-
20	Gobiidae	<i>Butis melanostigma</i>	Blackspot Sleeper	Kala Baila	W	✓	✓
21	Serranidae	<i>Epinephelus coioides</i>	Orange Spotted Grouper	Bol Mach	D & W	✓	-
22	Gerridae	<i>Gerres erythrourus</i>	Deep Bidied Mojarra	Dome Mach	D & W	✓	✓
23	Gobiidae	<i>Glossogobius giurus</i>	Tank Goby	Bele/Baila	W	✓	✓
24	Sciaenidae	<i>Johinus belangari</i>		Rupali Poa	D & W	✓	-
25	Sciaenidae	<i>Johinus sp.</i>		Poka	W	✓	✓
26	Centropomidae	<i>Lates calcarifer</i>	Barramundi/Vetki	Vetki/Koral	D & W	-	✓
27	Leiognathidae	<i>Leognathus brevisrostris</i>	Short Nosed Spony Fish	Tak Chanda	D & W	✓	✓
28	Trichiuridae	<i>Lepturacanthus savala</i>	-	Suri mas	D & W	✓	✓
29	Lutjanidae	<i>Lutjanus argentimaculatus</i>	Mangrove Red Snapper		D & W	✓	-
30	Lutjanidae	<i>Lutjanus johnii</i>		Samudric Kai	D & W	✓	-
31	Menidae	<i>Mene maculate</i>		Chanda	D & W	✓	-
32	Sciaenidae	<i>Panna microdon</i>		Poka/ Poa	W	✓	✓
33	Gobiidae	<i>Parapocryptes batoides</i>	-	Dali Chaua	D & W	-	✓
34	Sciaenidae	<i>Pemahia macrophthalmus</i>		Sada Poa	D & W	✓	-
35	Gobiidae	<i>Periophthalmodon schlosseri</i>	Giant Mud Skipper	Dahuk	D & W	✓	-

Sl. No.	Family	Scientific Name	Common English Name	Local	Season (D/W)	Sea	Kuheli a River
36	Pomadasyidae	<i>Pomadasyus hasta</i>		Sada Datina	D & W	✓	✓
37	Pomadasyidae	<i>Pomadasya maculates</i>		Datina	D & W	✓	✓
38	Gobiidae	<i>Pseudapocryptes elongates / Apocryptes lanceolatus</i>		Sabuj Chewa	D & W	-	✓
39	Sciaenidae	<i>Pterolithus maculatus</i>		Poka	D & W	✓	✓
40	Platycephalidae	<i>Rogadius asper</i>		Mur Bailla	D & W	✓	-
41	Gobiidae	<i>Scartelaus histophorus / Beleophthalmus viridis</i>	Walking Goby	Chiring	D & W	✓	✓
42	Scataphagidae	<i>Scatophagus orgas</i>	Spotted Scat	Bishtara	W	✓	-
43	Leiognathidae	<i>Secutor ruconius</i>	Deep Pugnose Ponyfish	Tak Chanda	D & W	✓	-
44	Siganidae	<i>Siganus javus</i>	Streaked Spinefoot	Bish Katali	D & W	✓	-
45	Sillaginidae	<i>Sillago domina</i>	Gangetic Sillago	Tular Dandi	D & W	✓	-
46	Sillaginidae	<i>Sillago shima</i>		Sundra	D & W	✓	-
47	Gobiidae	<i>Stigmatogobius sadanundio</i>	Grey knight goby	Kalo Phota Baila	D & W	-	✓
48	Theraponidae	<i>Therapon jarbua</i>	crescent perch	Gogo/Lohabor a	D & W	✓	✓
49	Carangidae	<i>Trachinotus sp.</i>		Mouri	D & W	✓	-
50	Trichiuridae	<i>Trichiurus lepturus</i>			D & W	✓	-
51	Trypauchenidae	<i>Trypauchen vagina</i>	Burrowing Goby	Chaua	D & W	✓	✓
52	Toxotidae	<i>Toxotes chatateus</i>	Spotted Archerfish	-	W	✓	✓
53	Soleidae	<i>Brachirus pan/Euryglossa pan</i>	Pan-sole	Serbati/Pata mas	D & W	✓	-
54	Cynoglossidae	<i>Cynoglossus lingua</i>	Long Tonguesole	Jibba/pata mas	D & W	✓	-
55	Cynoglossidae	<i>Cynoglossus macrolepidotus</i>	Tonguesole	Pata Mach	D & W	✓	-
56	Psettidae	<i>Psettodes erumei</i>		Samudra sarbati/ Pata/Jibba Mas	D & W	✓	-
57	Myliobatidae	<i>Actomylaeus nichofii</i>		Sankhachil	D & W	✓	-
58	Pristidae	<i>Pristis cuspidatus</i>		Karat Hangor/ Karat mas	D & W	✓	-
59	Platycephalidae	<i>Platycephalus indicus</i>	Bartail Flathead	Moor Baila	D & W	✓	-
60	Ariidae	<i>Airu dussimieri</i>		Kata mas	D & W	✓	-
61	Lagocephalidae	<i>Gastrophysus lunaris</i>		Rupali Patka/ Potka	D & W	✓	-

Table 8.2-7 Results of the Crab Survey

Sl. No.	Class	Family	Scientific Name	Relative Abundance	Local Name	Season (D/W)	Sea	Kuhelia River
1		Grapsidae	<i>Grapsus albolineatus</i>	LC	Sally light foot crab	D & W	✓	-
2		Portunidae	<i>Charybdis japonica</i>	LC	Asian paddle crab	D & W	-	-

Sl. No.	Class	Family	Scientific Name	Relative Abundance	Local Name	Season (D/W)	Sea	Kuhelia River
3	Crustacean	Portunidae	<i>Portunus plagicus</i>	LC	Blue swimmer crab	D & W	✓	-
4		Portunidae	<i>Charybdis feriatius</i>	FC	Crucifix crab	D & W	-	✓
5		Grapsidae	<i>Episesarma versicolor</i>	FC	Tree-climbing/	D & W D & W	✓	-
					Vinegar crabs			
6		Portunidae	<i>Portunes sanguinolentus</i>	VC	Three spotted swimmer crab	D & W	✓	✓
7		Calappidae	<i>Calappa lophos</i>	FC	Box crab or shame-faced crabs	D & W	✓	-
8		Calappidae	<i>Calappa sp.</i>	R	Box crabs	D & W	✓	-
9		Calappidae	<i>Matuta victor</i>	FC	Moon crabs	D & W	-	-
10		Calappidae	<i>Matuta planipes</i>	FC	Flower Moon crabs	D & W	-	-
11		Portunidae	<i>Scylla serrata</i>	C	Mud crab	D & W	✓	✓
12		Portunidae	<i>Scylla olivacea</i>	LC	Mud crab	D & W	✓	✓
13		Ocypodidae	<i>Ocypoda ceratophalma</i>	VC	Horn-eyed ghost crab	D & W	✓	✓
14		Ocypodidae	<i>Gelasimus annulipes (Ocypoda cordimanus)</i>	C	Smooth-handed ghost crab	D & W	-	-
15		Coenobitidae	<i>Eupagurus (Birgus latro)</i>	C	Robber crab or palm thief	D & W	✓	-
16		Mactryidae	<i>Mictyris longicarpus</i>	FC	Horned ghost crab	D & W	-	-
17		Grapsidae	<i>Grapsus sp.</i>	R	Red rock crab	D & W	✓	-
18		Portunidae	<i>Uca sp.</i>	R	Fiddler crab	D & W	✓	-

Table 8.2-8 Results of the Shell Survey

Sl. No.	Family	Scientific Name	Common Name	Season (D/W)	Sea Point	Kuhelia River
1	Arcidae	<i>Anadara granosa</i>	Granular Ark	D & W	✓	-
2		<i>Anadara rhombia</i>	Blood cockle	D & W	-	✓
3		<i>Scapharca derrollie</i>	Ark Shell	D & W	✓	-
4	Carditidae	<i>Vepricardium asiaticum</i>	Asiatic cockle	D & W	✓	✓
5	Mactridae	<i>Mactra abbreviata</i>	Trough shell	D & W	✓	-
6	Ostreidae	<i>Crassostrea ariakensis</i>	Oyster	D & W	✓	✓
7	Placudidae	<i>Placuna placenta</i>	Windowpane oyster	D & W	-	✓
8	Solenidae	<i>Solen vagina</i>	Nife and razor clams	D & W	✓	-

Sl. No.	Family	Scientific Name	Common Name	Season (D/W)	Sea Point	Kuhelia River
9	Cypraeidae	<i>Cypraea sp.</i>	Cowries	D & W	✓	✓
10	Gastropods	<i>Agaronia nebulosa</i>	Cowries	D & W	✓	-
11	Melongenidae	<i>Pugilina colosseus</i>	Spiral melongena	D & W	✓	-
12	Muricidae	<i>Thais bufo</i>	Toad purpura	D & W	✓	-
13	Neritidae	<i>Nerita lineat</i>	Nerite	D & W	✓	-
14	Olividae	<i>Olivancillaria sp.</i>	olive-shaped shells	D & W	-	✓
15	Potamididae	<i>Cerithidea cingulata</i>	Girdled horn shell	D & W	✓	-
16	Tonnidae	<i>Tonna sulcosa</i>	Banded tun	D & W	-	✓
17		<i>Trochus radiatua</i>	Radiate top	D & W	✓	-
18		<i>Umboonium sp.</i>	Button top	D & W	✓	-

v) Terrestrial wildlife

The aim of the survey is to provide information on fauna and flora for the preparation of the EIA report in connection with the Port Development Project. The information has covered the issues of threatened species including critically endangered (CR), endangered (EN), and vulnerable species (VU) listed in the Red list. Every potential impact on and risk to those species has been mentioned. If the impacts are seriously negative, and the risks are quite high, appropriate countermeasures should be taken to minimize those impacts and risks. The survey was conducted in the wet season in May 2018.

(a) Location

The specimens have been collected from Port area, Haser char sandy and mangrove area, Uttar Nolibilla hill reserve forest, both side of Kuhelia, Baderkhali river identified and documented through field work during May 18-19, 2018. The present study is based on field data, department of forest and local knowledge of the community.

(b) Survey Methods

Quadrat counting method has been followed for flora counting. Mangrove species are found 15 seedling/m² in Kuhelia river, Haser char & Badarkhali site. Major Mangrove species are *Avicennia sp.* (Baen), *Acanthus ilicifolius* (Hargoja), *Aegialitis rutundifolia* (Nuinna) etc.

The field study was conducted Southern part of hill forest under Janata bazar. This forest area covers approximately 10 acres land and Quadrante wise (15X15 meters) sampling was conducted in different location of natural growing and plantation forest area in this forest. Most of the plantation forest of the study area is mixed type that is deciduous or semi deciduous or evergreen. Both the man-made plantation forest and natural forests are present in different forest lands. Department of Forest has planted the trees by steep forest or bloc system like fruit plant, medicinal plant and timber yield in plantation forest. Another observation is that a vast amount of naturally growing wild weeds like herb, shrub, climber, grasses and cades were found. 50 flora, Insects 23, 115 birds, 7 amphibian, 14 reptile, are identify from mangrove & hill region. Maximum hill species *Dipterocarpus sp.* (Gaarjan), *Acacia Auriculacformis* (Akasmoni), *Phyllanthus emblica*(Amoloki), *Terminalia arjuna*(Arjun)etc. Sandy beach area found *Akanda*, *Ipomia* (Sagor lata), *Kamli data*(omari) and *Nisinda*.

(c) List of Flora and Fauna identified by the survey in the Rainy Season

(i) Terrestrial Flora

Table-8.2-9 List of Terrestrial Flora

Sl. No.	Scientific name	Local name	IUCN Status	Local Status	Season (D/W)	Family	Habit
1.	<i>Acanthus ilicifolius</i> L.	Hargoja	LC/LR	C	W	Acanthaceae	Shrub
2.	<i>Aegialitis rutundifolia</i> Roxb.	Nuniya	Not Listed	C	D&W	Plumbaginaceae	Tree

Sl. No.	Scientific name	Local name	IUCN Status	Local Status	Season (D/W)	Family	Habit
3.	<i>Albizia odoratissima</i> (L.f.) Benth.	Jatkorai	Not Listed	C	D&W	Mimosaceae	Tree
4.	<i>Albizia procera</i> (Roxb.) Benth.	Silkorai	Not Listed	C	D&W	Mimosaceae	Tree
5.	<i>Alocasia macrorrhizos</i> (L.) G. Don	Mankachu	Not Listed	C	D&W	Araceae	Herb
6.	<i>Alocasia odora</i> (Lindl.) K.Koch*	Hatal kachu	LC/LR	C	D&W	Araceae	Herb
7.	<i>Aloe vera</i> (L.) Burm.f.	Gritakumari	Not Listed	C	D&W	Aloaceae	Herb
8.	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Helencha, Molicha	Not Listed	C	D&W	Amaranthaceae	Herb
9.	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Sachishak	LC/LR	C	D&W	Amaranthaceae	Herb
10.	<i>Avicennia alba</i> Blume	Dulia baen	LC/LR	C	D&W	Verbenaceae	Tree
11.	<i>Avicennia officinalis</i> L.	Baro baen	LC/LR	C	D&W	Verbenaceae	Tree
12.	<i>Azadirachta indica</i> A. Juss.	Nim	LC/LR	C	D&W	Meliaceae	Tree
13.	<i>Bacopa monnieri</i> (L.) Pannell	Brammishak	Not Listed	C	D&W	Scrophulariaceae	Herb
14.	<i>Bombax ceiba</i> L.	Simul tula	Not Listed	C	D&W	Bombacaceae	Tree
15.	<i>Bothriochola pertusa</i> (L.) A.Camus	Gora dubla	Not Listed	C	D&W	Poaceae	Herb
16.	<i>Calotropis gigantea</i> (L.) Ait.f.	Akand	Not Listed	C	D&W	Asclepiadaceae	Shrub
17.	<i>Cassia fistula</i> L.	Sonalu	Not Listed	C	D&W	Caesalpiniaceae	Tree
18.	<i>Casuarina equisetifolia</i> L.	Jaw, Popan	Not Listed	C	D&W	Casuarinaceae	Tree
19.	<i>Cayratia trifolia</i> (L.) Domin*	Amol lata	Not Listed	C	D&W	Vitaceae	Climber
20.	<i>Centella asiatica</i> (L.) Urban.	Thankuni	Not Listed	C	D&W	Apiaceae	Herb
21.	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Asamlata	Not Listed	C	W	Asteraceae	Herb
22.	<i>Chukrasia tabularis</i> A. Juss.	Cikrasi	LC/LR	C	D&W	Meliaceae	Tree
23.	<i>Citrus limon</i> (L.) Burm.f.	Lebu	Not Listed	C	D&W	Rutaceae	Tree
24.	<i>Citrus maxima</i> (Burm.f.) Merr.	Jambura, Santara	Not Listed	C	D&W	Rutaceae	Tree
25.	<i>Cuscuta reflexa</i> Roxb.	Sunnalata	Not Listed	C	W	Cuscutaceae	Climber
26.	<i>Delonix regia</i> (Hook.) Raf.	Krisnachura	LC/LR	R	D&W	Caesalpiniaceae	

Sl. No.	Scientific name	Local name	IUCN Status	Local Status	Season (D/W)	Family	Habit
27.	<i>Dillenia indica</i> L.	Chalta	Not Listed	R	D&W	Dilleniaceae	Tree
28.	<i>Dipterocarpus turbinatus</i> Gaertn.	Garjan	VU	R	D&W	Dipterocarpaceae	Tree
29.	<i>Elaeocarpus floribundus</i> Blume	Jalpai	Not Listed	C	D&W	Elaeocarpaceae	Tree
30.	<i>Ficus benghalensis</i> L.	Bat	Not Listed	R	D&W	Moraceae	Tree
31.	<i>Ficus comosa</i> Kurz	Mosa dumur	Not Listed	R	D&W	Moraceae	Tree
32.	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Pathorkuchi	Not Listed	C	D&W	Crassulaceae	Herb
33.	<i>Leucas indica</i> (L.) R.Br. ex Vatke	Dondokalosh	Not Listed	C	D&W	Lamiaceae	Herb
34.	<i>Mentha arvensis</i> L.	Pudina	LC/LR	R	D&W	Lamiaceae	Herb
35.	<i>Mimosa pudica</i> L.	Lajjabati	LC/LR	R	D&W	Mimosaceae	Herb
36.	<i>Oryza rufipogon</i> Griff.	Uri dan	LC/LR	R	D&W	Poaceae	Herb
37.	<i>Pandanus odorifer</i> (Forssk.) Kuntze	Keya	LC/LR	R	D&W	Pandanaceae	Tree
38.	<i>Phyllanthus emblica</i> L.	Amloki	Not Listed	C	D&W	Euphorbiaceae	Tree
39.	<i>Portulaca olearacea</i> L.	Nunashak	Not Listed	C	D	Portulacaceae	Herb
40.	<i>Smilax ovalifolia</i> Roxb. ex D.Don	Kumairra lata	Not Listed	C	W	Smilacaceae	Climber
41.	<i>Sonneratia apetala</i> Buch.-Ham.	Keowra, Kerpa	LC/LR	VR	D&W	Sonneratiaceae	Tree
42.	<i>Sterculia foetida</i> L.	Keron	Not Listed	C	D&W	Sterculiaceae	Tree
43.	<i>Suaeda maritima</i> (L.) Dumort.	Sagorsuda	Not Listed	C	W	Chenopodiaceae	Shrub
44.	<i>Swietenia mahagoni</i> (L.) Jacq.	Mehagoni	Not Listed	VC	D&W	Meliaceae	Tree
45.	<i>Terminalia arjuna</i> (Roxb. ex DC.)	Arjun	Not Listed	C	D&W	Combretaceae	Tree
46.	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Bahera	Not Listed	R	D&W	Combretaceae	Tree
47.	<i>Terminalia catappa</i> L.	Katbadam	Not Listed	C	D&W	Combretaceae	Tree
48.	<i>Terminalia chebula</i> (Gaertn.) Roxb.	Horitoki	Not Listed	R	D&W	Combretaceae	Tree
49.	<i>Acacia Auriculacformis</i>	Akasmoni	Not Listed	R	D&W	Fabaceae	Tree
50.	<i>Eucalyptus citriodora</i>	Eucaliptus	Not Listed	R	D&W	Myrtaceae	Tree

Sl. No.	Scientific name	Local name	IUCN Status	Local Status	Season (D/W)	Family	Habit
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IUCN Status: CR – Critically Endangered, EN - Endangered, VU – Vulnerable, LR – Lower Risk/LC-Least Concern, DD- Data Deficient, NT-Near Threatened, NA- Not Assessed
 Local Status: VC – Very Common C – Common, R – Rare, VR – Very rare

(ii) Terrestrial Fauna (Insects)

Table 8.2-10 List of Terrestrial Fauna (Insects)

Sl. No.	Species Name	English Name (Local Name)	Habitat	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area/Port area	Kuhelia Riverside	Badarkhali Riverside	IUCN	Local Status	
1	<i>Gryllus</i> spp.	Cricket (Urchunga)	Rice field	D & W	-	√	√	-		Agricultural pest
2	<i>Oxya chinensis</i> (Thunberg)	Small Rice (Grasshopper) (Ghas Foring)	Rice field	D & W	-	√	√	-		Agricultural pest
3	<i>Periplaneta Americana</i> Linn.	American/ Cockroach (Telapoka)	Restaurant	D & W	-	√	√	-		Household pest
4	<i>Agromyza</i> spp.	Miner flies	Bush bean	D & W	√	√	√	-		Leaf miner pest of vegetables
5	<i>Bactrocera cucurbitae</i> (Coquillett)	Melon fly	Bottle gourd	D & W	√		√	-		Pest of vegetables
6	<i>Eristalinus</i>	Hoverfly	Cucumber	D		√		-		Pollinator
7	<i>Agriocnemis femina</i> (Brauer)	Narrow-winged/ Damselfly (Foring)	Bush bean (Near the pond)	D & W		√		-		Predator and Bioindicator
8	<i>Agriocnemis pygmaea</i> (Rambur)	Damselfly (Foring)	Common bean (Near the pond)	D & W	-	√	√	-		Predator and Bioindicator
9	<i>Ceriagrion cerinorubellum</i> (Brauer)	Damselfly (Foring)	Woods of vegetation	D & W	-	√	√	-		Predator and Bioindicator
10	<i>Tholymis</i> sp.	Evening Skimmer (Foring)	Woods of vegetation	D & W				-		Predator and Bioindicator
11	<i>Episyrphus</i> spp.	Hover fly	Cucumber field	D & W		√		-		Predator and pollinator in most cases
12	<i>Musca domestica</i> Linn.	House fly	Restaurant	D & W	√	√	√	-		Pathogen carrier and

Sl. No.	Species Name	English Name (Local Name)	Habitat	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area/Port area	Kuheli Riverside	Badarkhali Riverside	IUCN	Local Status	
				D & W						pollinatr in few cases
13	<i>Chrysomya megacephala</i> (Fabricius)	Oriental latrine fly	Dry fish	D & W	√	√	√	-		Pest of dry fish and pollinatr in few cases
14	<i>Eurema hecabe contubernalis</i> Moore	Common Grass/Yellow/ (Holud)	Common bean	D & W	√	√	√	-		Pollinator in adult aged
15	<i>Delias descombesi descombesi</i> (Boisduval)	Red spot jezebel (Kanka)	Secondary forest	D & W	√		√	-		Pollinator in adult aged
16	<i>Junonia atlites</i> (Linn.)	Chandnori	Agricultural field	D & W	√	√	√	-		Pollinator in adult aged
17	<i>Melanitis phedima bela</i> Moore	Dark Evening Brown	Agricultural field	D & W	√	√	√	-		Pollinator in adult aged
18	<i>Parnara guttatus mangala</i> Moore	Straight Swift (Nillbijuri)	Snake gourd	D & W		√		-		Pollinator
19	<i>Oriens goloides</i> Moore	Smaller Darlet	Agricultural field	D	√	√		-		Pollinator
20	<i>Aulacophora foveicollis</i> Lucas	Red pumpkin beetle	Pumpkin field	D & W	√	√	√	-		Agricultural pest
21	<i>Aulacophora frontalis</i> Baly	Pumpkin beetle	Pumpkin field	D	√	√	√	-		Agricultural pest
22	<i>Nephotettix cincticeps</i> Matsumura	Spotted jassid	Rice field	D & W	-		√	-		Pest of rice
23	<i>Leptocorisa acuta</i> Thunb.	Rice bug	Rice field	D & W	-		√	-		Pest of rice
24	<i>Rhopalosiphum</i> sp.	Aphis	Common bean	D & W	√			-		Agricultural pest
25	<i>Amegilla</i> spp.		Brinjal	D & W	√		√	-		Pollinator
26	<i>Lasioglossum</i> sp.	Solitary Bee	Cucumber field	D & W	-	√	√	-		Pollinator and bioindicator
27	<i>Trigona</i> sp.	Sweat bee	Cucumber field	D & W	-			-		Pollinator

Sl. No.	Species Name	English Name (Local Name)	Habitat	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area/Port area	Kuheli a Riversi de	Badarkh ali Riversid e	IUC N	Loc al Stat us	
28	<i>Apis mellifera</i> Linn.	Western Honey bee (Momachhi)	Cucumbe r field	D	√		√	-		Pollinator and Bioindica tor
29	<i>Micraspis crocea</i> (Mulsant)	Lady beetle	Rice	D	-	√	√	-		Rice pest
Total					15	21	22			

(iii) Terrestrial Fauna (Amphibians and Reptiles)

Table-8.2-11 List of Terrestrial Fauna (Amphibians and Reptiles)

Sl. No.	Species Name	English Name (Local Name)	Habitat	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Statu s	
Amphibians										
1	<i>Duttaphrynus (Bufo) melanostictus</i>	Southeast Asian toad	Kono bang	D & W	√	√	√	LC		Very common throughout the county
2	<i>Euphlyctis cyanophlyctis</i>	Green Forq	Kotkoti bang	D & W	√	√	√	LC		Very common
3	<i>Fejervarya limnocharis</i>	Cricket frog		D & W	√	√	√	LC		Common
4	<i>Fejervarya sp</i>	Cricket frog		D & W		√	√			
5	<i>Hoplobatrachus tigerinus</i>	Bull frog	Kola bang, Sona bang, Bha wa beng	W	√	√	√	LC		Wide spread
6	<i>Sylvirana leptoglossa</i>	Cope's Assam Frog	Koper Ashami Bang	D & W		√	√	LC		
7	<i>Rana temporalis</i>	Bronzed Frog	Gasobang	D & W		√		LC		
Reptiles										
1	<i>Calotes versicolor</i>	garden lizard	Roktochusha	D & W	√	√	√		TH	
2	<i>Mabuya mabuya</i>	skink	Achil	D & W	√	√	√		TH	
3	<i>Gekko gecko</i>	Tokay Gecko	Tokkhak/Tokhha	D & W	√	√	√		TH	
4	<i>Hemidactylus brooki</i>	house lizard	Tiktiki	D & W	√	√	√	NO		
5	<i>Hemidactylus frenatus</i> Schlegel in Duméril & Bibron, 1836	house lizard	Tiktiki	D & W	√	√	√			

Sl. No.	Species Name	English Name (Local Name)	Habitat	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Status	
6	<i>Melanochelys trijuga</i> (Schweigger, 1812)	Indian Black Turtle	Kalo Kossop	D & W	√	√	√			
7	<i>Geoclemys hamiltonii</i> (Gray, 1830)	Spotted Pond Turtle	Kalo Kasim	D & W	√	√	√	EN	TH	
8	<i>Pangshura tentoria</i> (Gray, 1834)	Median Roofed Turtle	Majhari Kaitta	D & W	√	√	√		TH	
9	<i>Ahaetull prasina</i> (Boie, 1827)	Common Vine snake	Laodoga /Shap/sutanoli Shap	D & W		√				
10	<i>Xenocrophis piscator</i>	Checked keel back	Dhora sap	D & W	√	√	√			
11	<i>Naja kaouthia</i> Lesson, 1831	Monocled Cobra	Jati Sap	D	√	√	√			
12	<i>Naja naja</i>	Bicled Cobra	Gokhra Shap	D	√	√	√		TH	
13	<i>Cerberus rynchops</i> (Schneider, 1799)	Dog faced water snake	Andha sap	W	√					
14	<i>Enhydris sieboldii</i> (Schlegel, 1837)	Siebold's Smooth Water Snake	Sibolder Joloj Shap	W	√	√	√			

(iv) Terrestrial Fauna (Birds)

Table-8.2-12 List of Terrestrial Fauna (Birds)

Sl. No.	Species Name	English Name	Local Name	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Status	
1	<i>Passer domesticus</i>	House Sparrow	Pati Chorui	D & W	√	√	√	-		
2	<i>Dicrurus macrocerus</i>	Black Drongo	Kala Fingey	D & W	√	√	√	-		
3	<i>Sturnus contra</i>	Pied Myna	Pakra Shalik/Gubra Shalik/Gu Shalik	D & W	√	√	√	-		
4	<i>Sturnus malabaricus</i>	Chestnut-tailed Starling	Khoiralej Kathshalik/Deshi Pawei	D & W	√	√	√	-		
5	<i>Acridotheres cinereus</i>	Pale-bellied Myna	Dholatola Shalik	D & W	√	√	√	-		
6	<i>Acridotheres tristis</i>	Common Myna	Bhat Shalik	D & W	√	√	√	-		
7	<i>Acridotheres fuscus</i>	Jungle Myna	Jhuti Sahlik	D & W	√	√	√	-		
8	<i>Gracula religiosa</i>	Common Hill Myna		D		√		-		
9	<i>Copsychus saularis</i>	Oriental Magpie-Robin	Doel/Udoi Doel	D & W	√	√	√	-		

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Sl. No.	Species Name	English Name	Local Name	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Status	
10	<i>Orthotomus sutorius</i>	Common Tailorbird	Pati Tuntuni	D & W	√	√	√	-		
11	<i>Columba livia</i>	Common Pigeon	Gola Paira/Jalali Kabutor	D & W	√	√	√	-		
12	<i>Treron bicintus</i>	Orenge-breasted Green Pigeon	Komlabook Horial/Horikol	D	√	√	√	-		
13	<i>Streptopelia decaocto</i>	Eurasian Collared Dove	Eurashio Konthighughu/Raj Ghughu	D & W	√	√	√	-		
14	<i>Streptopelia chinensis</i>	Spotted Dove	Tila Ghughu	D		√		-		
15	<i>Treron phoenicopterus</i>	Yellow-footed Green Pigeon	Holdepa Horial/Botkol	D & W	√	√	√	-		
16	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Bangla Bulbul/Bulbuli	D & W	√	√	√	-		
17	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	Shipahi Bulbul/Bulbuli	D & W	√		√	-		
18	<i>Corvus splendens</i>	House Crow	Pati Kak	D & W	√	√	√	-		
19	<i>Corvus macrorhynchos</i>	Jungle Crow	Dar Kak/Danr Kak	D & W	√	√	√	-		
20	<i>Oriolus xanthornus</i>	Black-hooded Oriole	Kalamatha Benebou/Holdey Pakhi	D & W	√	√	√	-		
21	<i>Artamus fuscus</i>	Ashy Woodswallow	Metey Bonababil/Latora	D & W	√	√	√	-		
22	<i>Dendrocitta vagabunda</i>	Rufous Treepie	Khoira Harichacha/ Hari Chacha	D & W	√	√	√	-		
23	<i>Dicaeum cruentatum</i>	Scarlet-backet Flowerpecker	Lalpith Fuljhuri	D & W	√	√	√	-		
24	<i>Dicaeum erythrorhynchos</i>	Pale-billed Flowerpecker	Metethot Fuljhuri	D & W	√	√	√	-		
25	<i>Dicaeum trigonostigma</i>	Orenge-bellied Flowerpecker	Komlapet Fuljhuri	D & W	√	√	√	-		
26	<i>Chalcoparia singalensis</i>	Ruby-cheeked Sunbird	Chunimukhi Moutushi	D & W	√	√	√	-		
27	<i>Leptocoma zeylonica</i>	Purple-rumped Sunbird	Begunikomor Moutushi	D & W	√	√	√	-		

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Sl. No.	Species Name	English Name	Local Name	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Status	
28	<i>Cinnyris asiaticus</i>	Purple Sunbird	Beguni Moutushi	D & W	√	√	√	-		
29	<i>Aethopyga siparaja</i>	Crimson Sunbird	Shidure Moutushi	D & W	√	√	√	-		
30	<i>Arachnothera magna</i>	Streaked Spiderhunter		D & W	√	√	√	-		
31	<i>Ploceus philippinus</i>	Baya Weaver	Deshi Babui/Baoi	D & W	√	√	√	-		
32	<i>Lonchura malabarica</i>	Indian Silverbill	Deshi Chandithot	D & W				-		
33	<i>Lonchura malacca</i>	Blkack-headed Munia	Kalamatha Munia	D & W	√	√	√	-		
34	<i>Lonchura punctulata</i>	Scaly-breasted Munia	Tila Munia	D & W	√	√	√	-		
35	<i>Lonchura straiata</i>	White-rumped Munia	Dholakomor Munia	D & W	√	√	√	-		
36	<i>Anthus rufulus</i>	Paddyfield Pipit	Dhani Tulika	D & W	√	√	√	-		
37	<i>Pellorneum ruficeps</i>	Puff-throated Babler	Golafola Satarey	D & W	√	√	√	-		
38	<i>Zosterops palpebrosus</i>	Oriental White-eye	Udoi Dholachokh/Shet Ankhi	D & W	√	√	√	-		
39	<i>Prinia inornata</i>	Plain Prinia	Nirol Prina	D & W	√	√	√	-		
40	<i>Ficedula albicilla</i>	Taiga Flycatcher	Taiga Chutki/Lalbook Chotok	D & W	√	√	√	-		
41	<i>Aegithina tiphia</i>	Common Iora	Fatik Jal	D & W	√		√	-		
42	<i>Hypothymis azurea</i>	Black-naped Monarch	Kalaghar Rajon	D & W	√	√	√	-		
43	<i>Disrurus paradiseus</i>	Greater Racket-tailed Drongo	Boro Racket-Fingey/Bhimraj	D & W	√	√	√	-		
44	<i>Disrurus aeneus</i>	Bronzed Drongo	Fingey	D & W	√	√	√	-		
45	<i>Rhipidura albicollis</i>	White-throated Fantail	Dholagola Chatighurani/Lej Nachuni	D & W	√	√	√	-		
46	<i>Alcedo atthis</i>	Common Kingfisher	Pati Machranga	D & W	√	√	√	-		
47	<i>Alcedo meninting</i>	Blue-eared Kingfisher	Neelkan Machranga	D & W	√	√	√	-		
48	<i>Halcyon smyrnensis</i>	White-throated kingfisher	Dholagoloa Machranga	D & W	√	√	√	-		

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Sl. No.	Species Name	English Name	Local Name	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Status	
49	<i>Ceryle rudis</i>	Pied Kingfisher	Pakra Machranga	D & W	√	√	√	-		
50	<i>Upupa epops</i>	Eurasian Hoopoe	Pati Hoodhood	D & W	√	√	√	-		
51	<i>Dinopium bengalensis</i>	Lesser goldenback	Bangla kaththokra	D & W				-		
52	<i>Merops leschenaulti</i>	Chestnut-headed Bee-eater	Khoiramatha Shuichora	D & W	√	√	√	-		
53	<i>Merops philippinus</i>	Blue-tailed Bee-eater	Neel-lej Shuichora	D & W	√	√	√	-		
54	<i>Psittacula alexandri</i>	Red-breasted Parakeet	Modna Tia	D & W	√	√	√	-		
55	<i>Psittacula krameri</i>	Rose-ringed Parakeet	Shobuj Tia	D & W	√	√	√	-		
56	<i>Cypsiurus balasiensis</i>	Asian Palm Swift	Asio	D & W	√	√	√	-		
			Talbatashi/Nakkati	D & W						
57	<i>Ketupa zeylonensis</i>	Brown Fish Owl	Khoira mechupacha/Bhotoom Pecha	D & W	√	√	√	-		
58	<i>Athene brama</i>	Spotted Owlet	Khuruley Pencha/Konthi Kutipecha	D & W		√		-		
59	<i>Caprimulgus macrurus</i>	Large-tailed Nightjar	Lenja Ratchora	D & W	√		√	-		
60	<i>Ichthyophaga ichthyaetus</i>	Grey-headed Fish Eagle	Metemetha Kura Eagle	D & W				-		
61	<i>Spilornis Cheela</i>	Crested Serpent Eagle	Tila Nag-eegol/Shapkeheko Baj	D & W		√		-		
62	<i>Phalacrocorax niger</i>	Little Cormorant	Choto Pankouri	D & W	√	√	√	-		
63	<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	Deshi Pankouri	D & W		√		-		
64	<i>Egretta garzetta</i>	Little Egret	Choto Boga	D & W	√	√	√	-		
65	<i>Egretta intermedia</i>	Yellow-billed Egret	Majhla Boga/Korche Bok	D & W		√		-		
66	<i>Casmerodius albus</i>	Great Egret	Boro Boga	D & W	√		√	-		
67	<i>Bubulcus ibis</i>	Cattle Egret	Go Boga	D & W	√	√	√	-		
68	<i>Ardeola bucchus</i>	Chinese Pond Heron	China Kanibok	D & W	√	√	√	-		
69	<i>Ardeola grayii</i>	Indian Pond Heron	Deshi Kanibok	D & W	√	√	√	-		

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Species Name	English Name	Local Name	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Status	
70	<i>Sterna aurantia</i>	River Tern	Nodia Panchil	D & W	√		√	-		
71	<i>Glareola lactea</i>	Small Pratincole	Choto Babubatan	D & W			√	-		
72	<i>Ardea cinerea</i>	Grey Heron	Dhupni Bok	D & W	√	√	√	-		
73	<i>Sterna albifrons</i>	Little Tern	Choto Panchil	D & W	√	√	√	-		
74	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron	Kalamatha Nishibok	D & W	√	√	√	-		
	<i>Pandion haliaetus</i>	Osprey	Machmural/Mechubaj	D & W	√	√	√			
76	<i>Tadorna ferruginea</i>	Ruddy Shelduck	Khoira Chokachoki	D & W		√		-		
77	<i>Anas clypeata</i>	Northern Shoveler	Utturey Khuntehash/Panta mukhi	D & W				-		
78	<i>Jynx torquilla</i>	Eurasian Wryneck	Eureshio Gharbetha	D & W			√	-		
79	<i>Halcyon pileata</i>	Black-capped Kingfisher	Kalatupi Machranga	D & W		√		-		
80	<i>Todiramphus chloris</i>	Collared Kingfisher	Dholaghar Machranga	D & W	√	√	√	-		
81	<i>Porzana pusilla</i>	bailon's Crake	Bailoner Gurguri	D & W				--		
82	<i>Gallinago gallinago</i>	Common Snipe	Pati Chega	D & W				-		
83	<i>Gallinago stenura</i>	Pin-tailed Snipe	Lenja Chega	D & W		√		-		
84	<i>Limosa lapponica</i>	Bar-tailed Godwit	Dagilej Jorali	D & W			√	-		
85	<i>Limosa limosa</i>	Black-tailed Godwit	Kalalej jorali	D & W				-		
86	<i>Numenius arquata</i>	Eurasian Curlew	Eureshio Gulinda	D & W	√	√	√	-		
87	<i>Numenius phaeopus</i>	Whimbrel	Choto Gulinda	D & W			√	-		
88	<i>Tringa glareola</i>	Wood Sandpiper	Bon Batan/Balu Batan	D & W	√	√	√	-		
89	<i>Actitis hypoleucos</i>	Common Sandpiper	Pati Batan/Chapakhi	D	√	√	√	-		
90	<i>Tringa stagnatilis</i>	Marsh Sandpiper	Bali Batan	D				-		
91	<i>Tringa guttifer</i>	Nordmann's Greenshank	Nordman Shabujpa	D				EN	TH	
92	<i>Tringa nebularia</i>	Common Greenshank	Pati Shabujpa	D			√	-		

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Species Name	English Name	Local Name	Season (D/W)	Survey Sites			Conservation Status		Remarks
					Sea Area	(KH)	(BDK)	IUCN	Local Status	
93	<i>Tringa totanus</i>	Common Redshank	Pati Lalpa	D			√	-		
94	<i>Xenus cinereus</i>	Terek Sandpiper	Terek Batan	D				-		
95	<i>Arenaria interpres</i>	Ruddy Turnstone	Lal Nuribatan	D		√		-		
96	<i>Limnodromus semipalmatus</i>	Asian Dowitcher	Eshio Daucher	D				-		
97	<i>Calidris alba</i>	Sanderlin	Sanderlin	D		√		-		
98	<i>Calidris ferruginea</i>	Curlew Sandpiper	Gulinda Batan	D				-		
99	<i>Calidris minuta</i>	Little Stint	Choto Chaha	D				-		
100	<i>Calidris ruficollis</i>	Red-necked Stint	Lalghar Chaha	D				-		
101	<i>Calidris temminckii</i>	Timminck's Stint	Timinker Chaha	D		√	√	-		
102	<i>Calidris tenuirostris</i>	Graet Knot	Boro Noth	D				-		
103	<i>Himantopus himantopus</i>	Black-winged Stilt	Kalapakh Thengi/Lal pa Dhenga	D				-		
104	<i>Pluvialis fulva</i>	Pacific Golden Plover	Proshanto Shonajiria	D	√	√		-		
105	<i>Charadrius alexandrinus</i>	Kentish Plover	Kentish Jiria	D	√	√	√	-		
106	<i>Charadrius dubius</i>	Little Ring Plover	Choto Nothjiria	D	√		√	-		
107	<i>Charadrius leschenaultii</i>	Greater Sand Plover	Boro Dhuljiria	D	√	√	√	-		
108	<i>Charadrius mongolus</i>	Little Sand Plover	Choto Dhuljiria	D	√	√	√	-		
109	<i>Eurynorhynchus pygmeus</i>	Spoon-billed Sandpiper	Chamuchthuto Batan	D				CR	TH	
110	<i>Larus brunnicephalus</i>	Brown-headed Gull	Khoiramatha Gangchil	D	√	√	√	-		
111	<i>Larus ichthyaetus</i>	Great Black-headed Gull	Palasi Gangchil/Bara Jal	D	√	√	√	-		
112	<i>Larus heuglini</i>	Heuglin's Gull	Heugliner Gangchil	D				-		
113	<i>Larus ridibundus</i>	Common Black-headed Gull	Kalamatha Gangchil	D				-		
114	<i>Sterna sumatrana</i>	Black-naped Tern	Kalaghar Panchil	D	√	√	√	-		
115	<i>Threskiornis melanocephalus</i>	Black-headed Ibis	Kalamatha Kastechora	D		√		-		

Note: CR - Critically Endangered, EN – Endangered and TH= Threatened

Spoon-billed Sandpiper (*Eurynorhynchus pygmeus*)

It has confirmed from the survey that there is no Spoon-billed sandpiper in and around the proposed port boundary area. It can be confirmed that migration behavior somehow controls the study area to be the wintering ground, that is during winter the Spoon billed Sandpiper come to ashore of the sandy beach of the project front site but it is extremely small compared to nearby coastal offshore, Sonadia Island which is also supported by other's finding in different sites. So, the availability frequency of Spoon billed Sandpiper as a wintering ground to the Matarbari Peninsula is comparatively very poor in comparison with that in the nearby offshore island, Sonadia. According to all those previous survey results point out that Matarbari Peninsula beach is not main migratory habitat for the migratory bird especially for Spoon billed Sandpiper in Bangladesh which was also supported by bird experts and reports (eminent-ornithology-group's views of Bangladesh).

Sea Turtle

The survey results of the power plant in 2013 has mentioned that there were 34 individuals of 4 species of Olive ridley turtle (*Lepidochelys olivacea*), Loggerhead turtle (*Caretta caretta*), Green turtle (*Chelonia mydas*), and Hawksbill turtle (*Eretmochelys imbricate*).

According to their survey results it has confirmed that tidal behavior somehow controls the spawning of both species that is during neap tide the turtles come to ashore to spawn on to the sandy beach is extremely small compared to spring tide which is also supported by other's finding in different sites.

The landing frequency has been decreasing in almost all sites from March to April. These results agreed with the findings of different papers published in MTN (Marine Turtles Network) by Marine Life Alliance survey for Saint Martin's island and Sonadia Island of the sane coast.

In 2011, a study of 2009-2010, 192 individuals per year was confirmed landing in the Sonadia island. Additionally, landing of 19 individuals was confirmed in one day and night in the same investigation (Islam et al 2011) conducted by the Marine Life Alliance survey.

On the other hand, only 34 individuals in 40 days of observation have been confirmed to land in and Matarbari Peninsula. The frequency of nesting is very poor in comparison with their nesting frequency in the nearby offshore island, Sonadia (eminent-reptile-group's views of Bangladesh).

For the sea turtles, available mitigation measures such as controlling levels of lighting, noise and vibrations caused by construction work may be needed as the sandy coast adjacent to the project site appears to be their nesting and egg-laying sites. The detail mitigation measures are mentioned in the EMP of the EIA study.

Spotted Pond Turtle (*Geoclemys hamiltonii*)

It has found that this species observed at the salt pans in the project site, although it did not appear to use these salt pans for its displacement and access to feeding, breeding and reproduction in view of its ecological features, so that there is no need to take special countermeasures to protect it besides capturing and replacing it into its original environment.

Threatened Species that may be treated as rare species by Bangladesh scientist groups in the project areas and effective measures to mitigate the impacts on them:

Eleven rare species which are not yet listed in the IUCN Red List of 2012 as threatened species, but are being evaluated as threatened species by Bangladesh scientist groups have been recorded.

Table 8.2-13 Threatened Species proposed by Bangladesh scientist groups

Taxa	No.	Scientific name	English name
Flora	1	<i>Calamus guruba Buch.-Ham.</i>	Cane
	2	<i>Trichosanthes cordata Roxb.</i>	Snake guard
	3	<i>Lepisanthes rubiginosa</i>	Rusty sapindus
	Total=3nos.		
Reptile	1	<i>Calotes versicolor</i>	Garden lizard

	2	<i>Mabuya mabuya</i>	Skink
	3	<i>Gekko gekko</i>	Tokay Gecko
	4	<i>Pangshura tentoria</i>	Median Roofed Turtle
	5	<i>Naja naja</i>	Bicled Cobra
	Total=5nos.		
Bird	1	<i>Arachnothera magna</i>	Streaked Spiderhunter
	2	<i>Ketupa zeylonensis</i>	Brown Fish Owl
	3	<i>Vanellus duvaucelii</i>	River Lapwing
	Total=3		
Total	(3+5+3)=11nos.		

Other

As said by “Data collection survey on coal power master plan follow-up in the People's Republic of Bangladesh: final report”, there are some endangered species in and around Sonadia Island. Therefore, an investigation of endangered species was conducted.

➤ **Spotted green shanks (*Tringa guttifer*) (EN the IUCN Red List of 2012)**

From the results of the survey on birds which was carried out during the rainy seasons in the port project site none of this species was recorded.

➤ **Great knotd (*Calidris tenuirostris*) (VU the IUCN Red List of 2012)**

From the results of the survey on birds which was carried out during the rainy season in the port project site, none of this species was recorded.

➤ **Indo-Pacific Finless Porpoised (*Neophocaena phocaenoides*) (VU the IUCN Red List of 2012)**

From the results of the survey on dolphin which was carried out during the rainy season in the canals, shores and offshore areas of the port site and Sonadia Island, none of this species was recorded.

➤ **Irrawaddy Dolphins (*Orcaella brevirostris*) (VU the IUCN Red List of 2012)**

From the results of the survey on dolphins which was carried out during the rainy season in the canals, shores and offshore areas of the proposed port site and Sonadia Island, none of this species was recorded.

8.3 Baseline Study of the Proposed Dumping Site

8.3.1 Location Details of the Dumping Sites

The dumping site is located in the Dhalghata Mouza of the Dhalghata Union. The area of the dumping site is 44hectares. It is located in the polder 70 of the Matarbari Island. It is just south of the proposed port area. The dumping sites are bounded by the following four coordinates:

- i. Northeast Corner: 21°41'21.05"N & 91°52'0.23"E
- ii. Northwest Corner: 21°41'21.01"N & 91°51'48.05"E
- iii. Southeast Corner: 21°40'39.21"N & 91°52'2.39"E
- iv. Southwest Corner: 21°40'39.05"N & 91°51'51.27"E



Figure-8.3-1 Location of Proposed Dumping Site

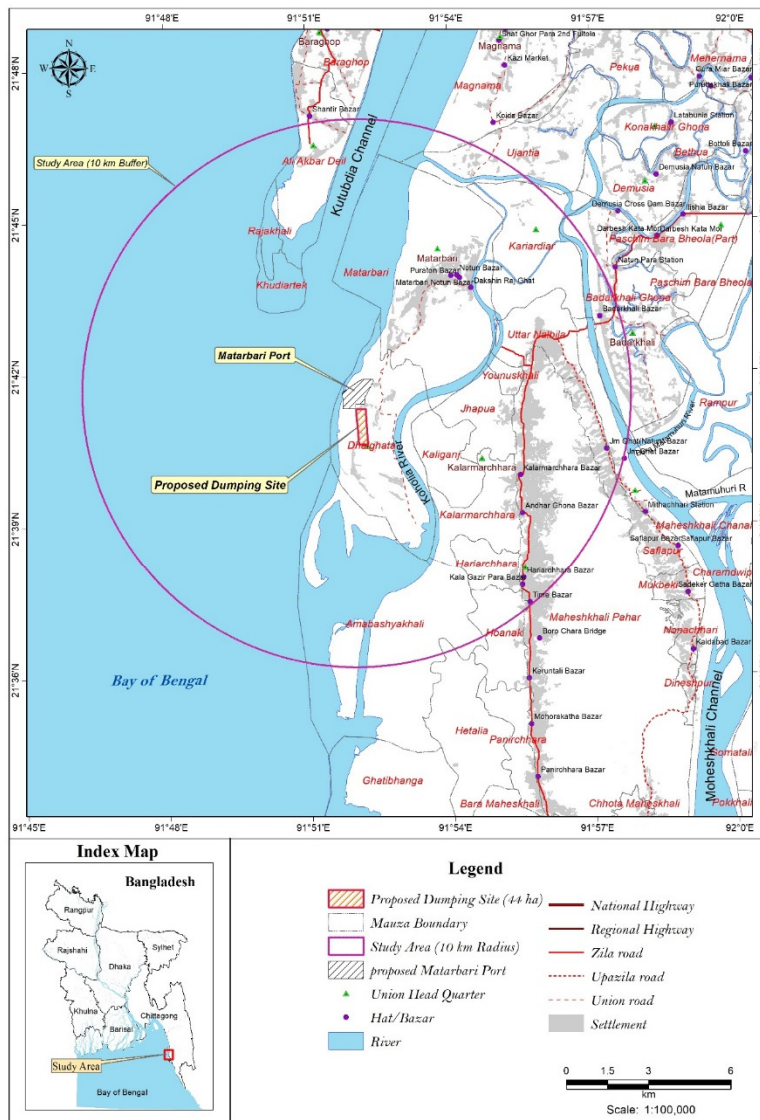


Figure-8.3-2 Base Map of the Proposed Dumping Site

8.3.2 Baseline of the Dumping Area

(i) Water Quality of the Dumping Area

A. Ground Water Quality

The water quality of well water around the Proposed dumping site was surveyed. The location of the sampling point is shown in Satellite Image Figure-8.3-3.

The results of the ground water quality survey are shown in Table-8.3-1. The water quality results satisfied most of the drinking water standards of Bangladesh except Fe, Mn, Barium and Color. In fact, Fe, Manganese and Barium concentrations are within the Guideline value of World Health Organization (WHO) and EPA standard.

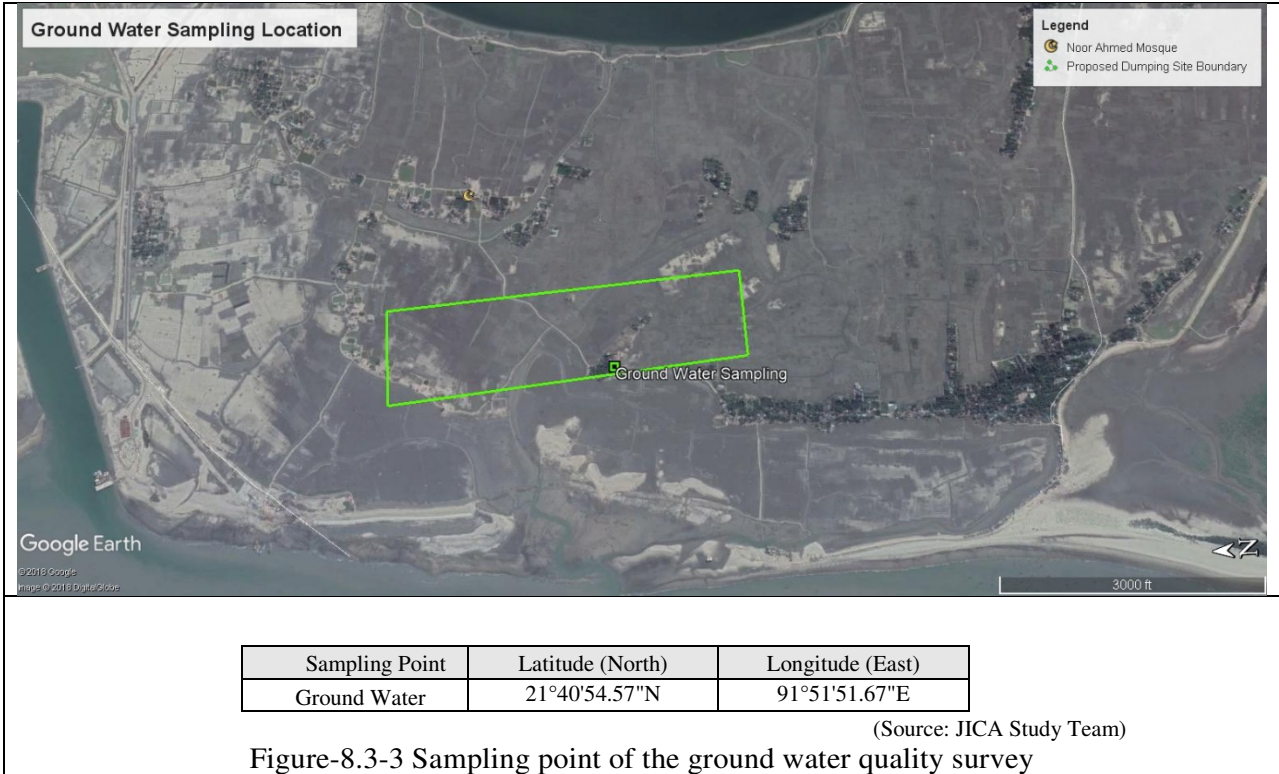


Table-8.3-1 Results of the ground water quality

Parameter	Unit	Concentration	Standards for Drinking Water
Temperature	oC	28	20 – 30
pH	-	6.6	6.5 8.5
Chloride	mg/L	115	150 – 600
Nitrogen (NO ₃)	mg/L	2.2	0.5
Iron (Fe)	mg/L	3	0.3 1.0
Odor	Odorless	0	Odorless
Arsenic (As)	mg/L	0.002	0.05
Total Suspended Solid	mg/L	18	10
Coliform	N/100mL	0	0
Colour	Hazen	44.8	15
Lead (Pb)	mg/L	0.001	0.05

Parameter	Unit	Concentration	Standards for Drinking Water
Manganese (Mn)	mg/L	1.17	0.1
Phosphate	mg/L	0.68	6
Total Dissolved Solid (TDS)	mg/L	270	1000
Barium (Ba)	mg/L	0.048	0.01
Cadmium (Cd)	mg/L	0.00016	0.005

(JICA Study Team)

B. Surface Water Quality

The Surface water quality would be the same as the water Quality of the Port study as because the nature of the surface water system of the dumping area is alike the port area. The surface water system is shown in the figure-8.3-4 of the proposed dumping site as well as the port area.

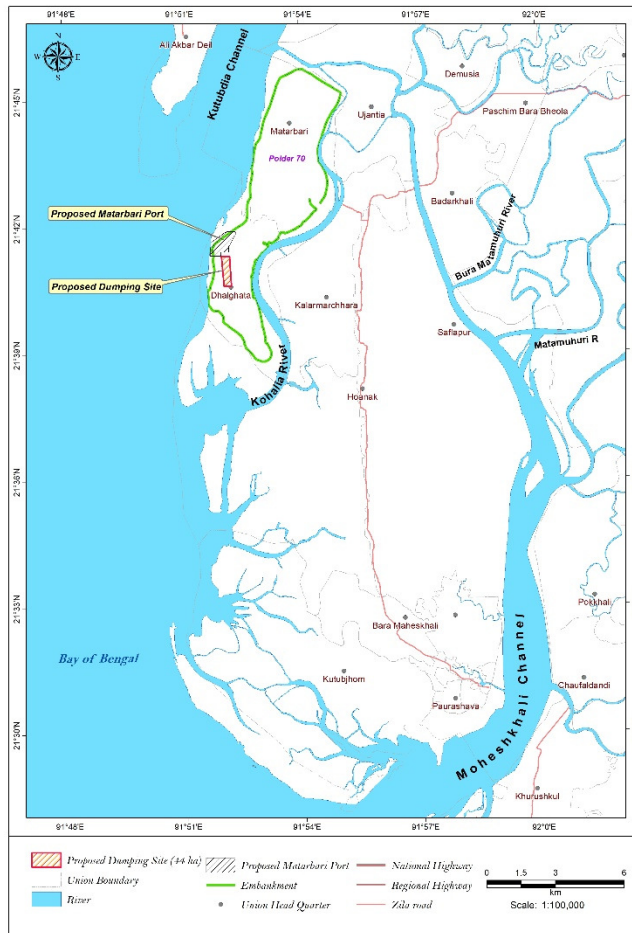


Figure-8.3-4 River Sytem and Sea water of the Proposed Dumping Site

(ii) Air Quality

The Dumping site air shed and the port area Air shed is the same. So, the air quality of the dumping site would be almost same as observed in the port area air measurement. Figure-8.3-5 shows the Air Quality monitoring location of the Port Study.



Figure-8.3-5 Air Quality Monitoring Location of the Port Study

(iii) Soil Quality

The proposed dumping site has fallen in the Chittagong Coastal Plain (AEZ-23) classification of the Agro-ecological Zone of Bangladesh. Figure-8.3-6 Shows the study area Agro-ecological Zone. The soil of the dumping site is non-suitable for agricultural crops, due to moderate and strongly saline soil which is mostly inundated by tidal sea water. This land is commonly used as salt and Shrimp cultivation. The Soil Quality of the Dumping site is listed below in Table-8.3-2.

Table-8.3-2 Soil Quality of the Dumping Site

Sl. No.	Parameter	Concentration/Type
1.	pH	4.4-6.5
2.	Salinity	12-16 dS/m
3.	Fertility	Medium
4.	Organic Matter Content	Low to Medium
5.	Soil Type	Silty Loam to Silty Clay

Source: JICA Study Team & Land Zoning Report: Moheshkhali Upazila, Cox's Bazar District

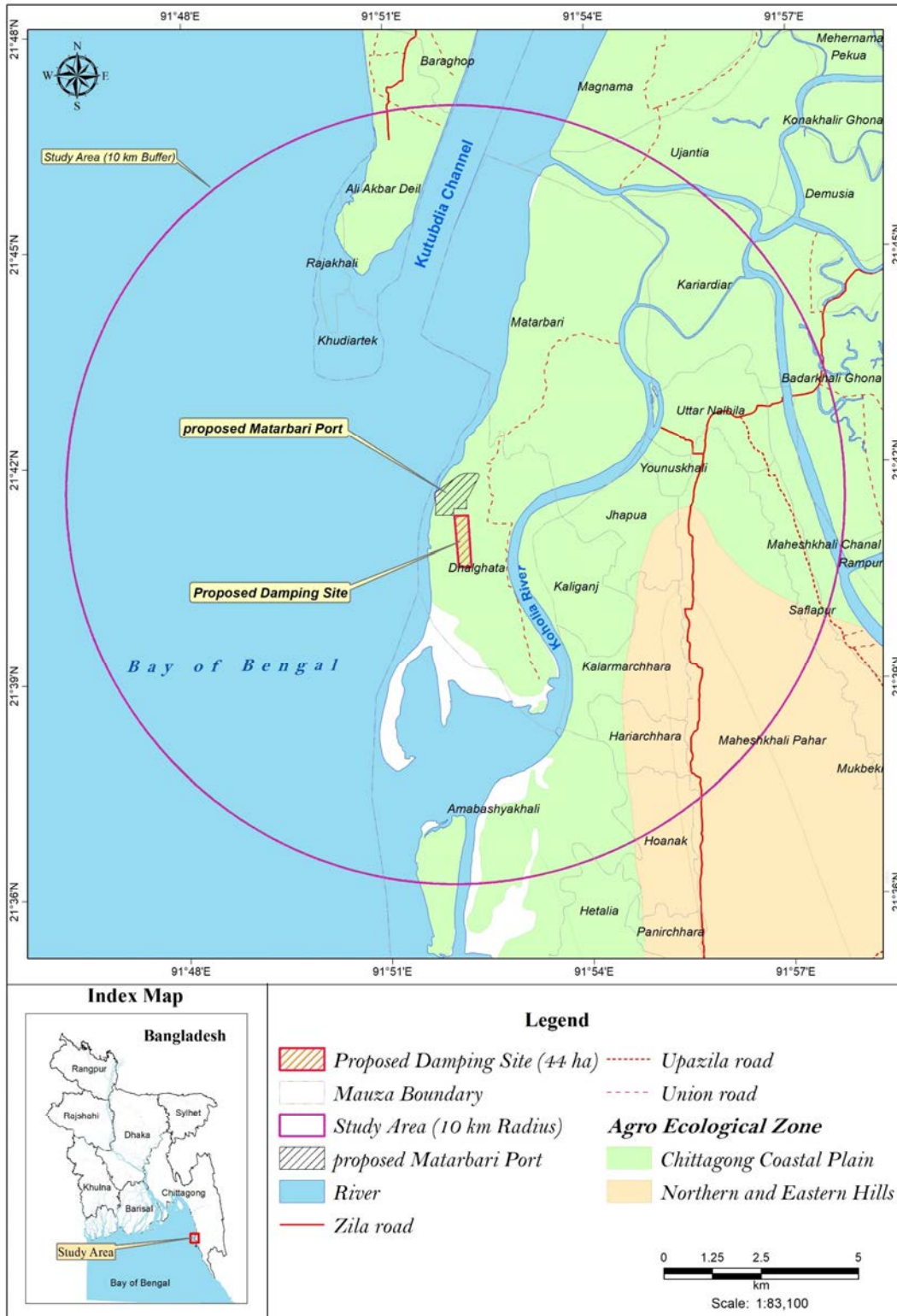


Figure-8.3-6 Agro-ecological Zone of the Study Area

(iv) Topography and land use

The proposed dumping site is located at the Cox’s Bazar coastal area where the land is gently sloped towards the sea. From digital elevation model (DEM) analysis it is found that the Project area is located over a land which is 2.5m to 3.0m PWD (Figure-8.3-7). Land elevation increases towards the hills and

decreases towards the Bay of Bengal. The shrimp farm or salt farms of this area are regularly flooded by tidal water entering through the sluice gates.

The dumping site has rural settlement with Homestead vegetation, pond and salt pan classes of land. Table-8.3-3 shows the detail land use of the dumping site area. Figure-8.3- shows the land use of the dumping site.

Table-8.3-3 Land use details of the Proposed Dumping Site

Sl. No.	Land use	Area (Hectare)	% of Land Use
1	Rural settlement with Homestead vegetation	3.3	7.5
2	Salt Pan	40.55	92.16
3	Pond	0.15	0.34

Like the port area the dumping site is medium highland category of land in type. Figure-8.3-9 shows the land type of the dumping site. Figure-8.3-10 shows the land use of the dumping site.

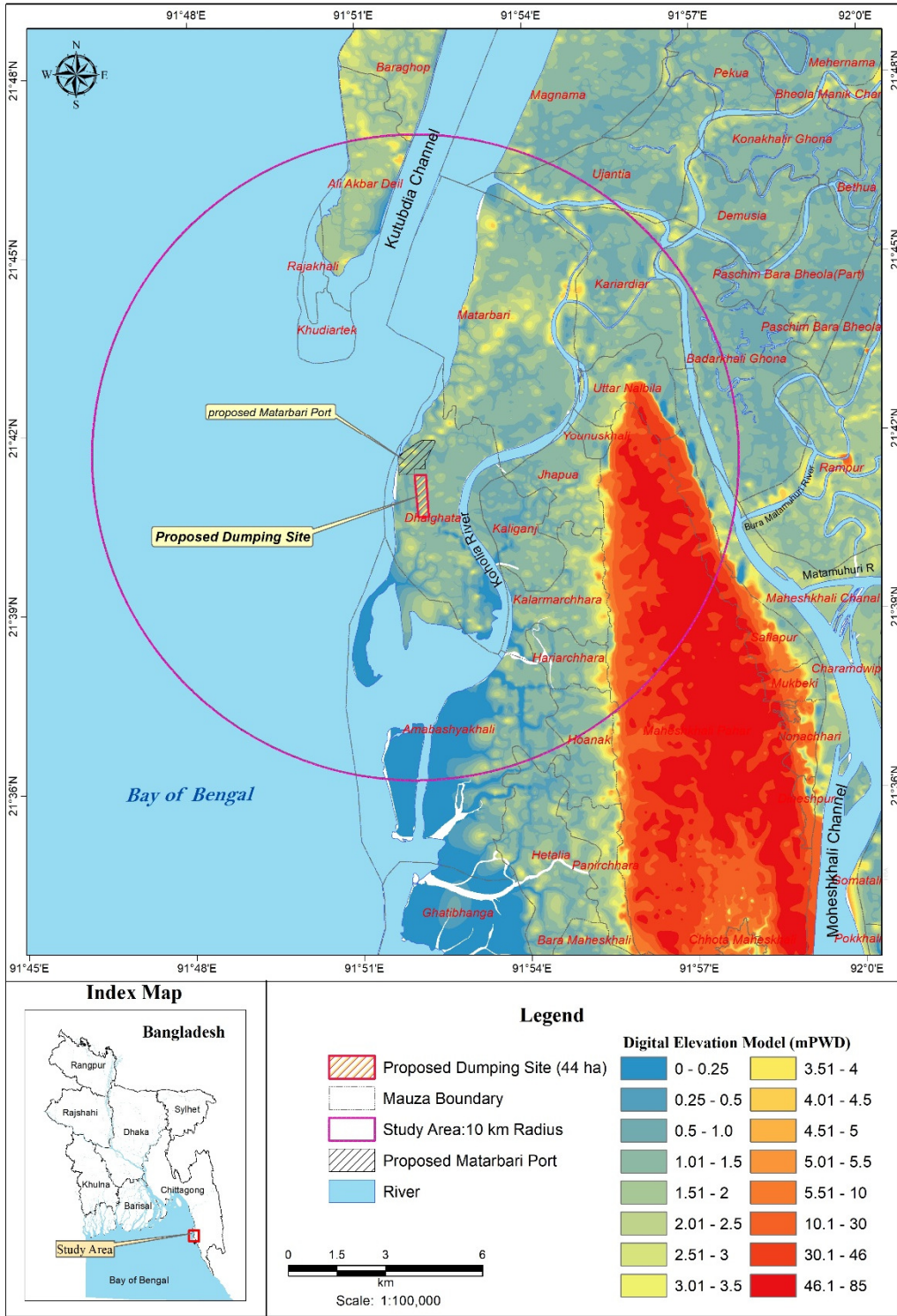


Figure-8.3-7 Digital Elevation map of the Dumping Area

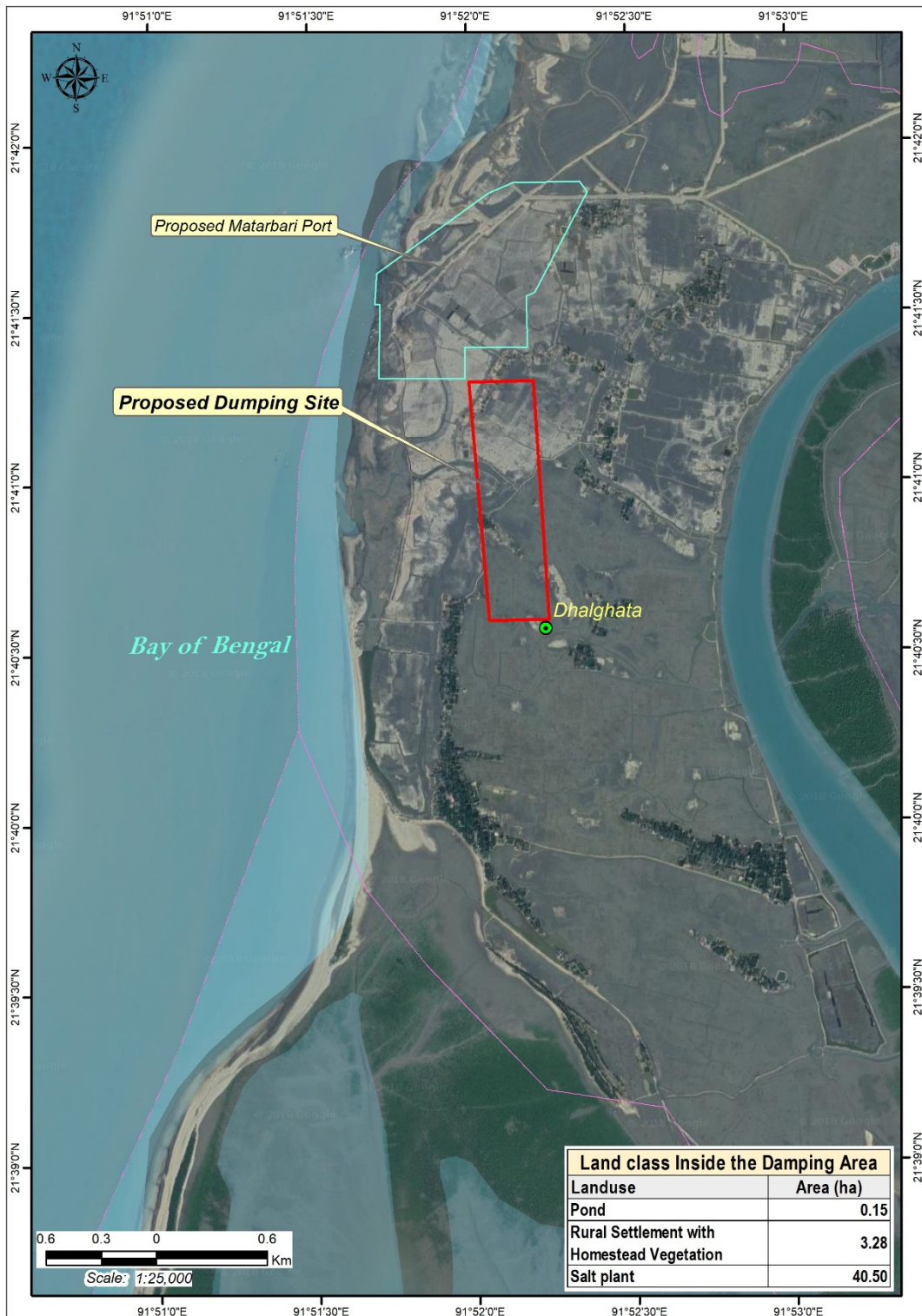


Figure-8.3-8 Landuse Map of the Dumping Site in Google Satellite Image

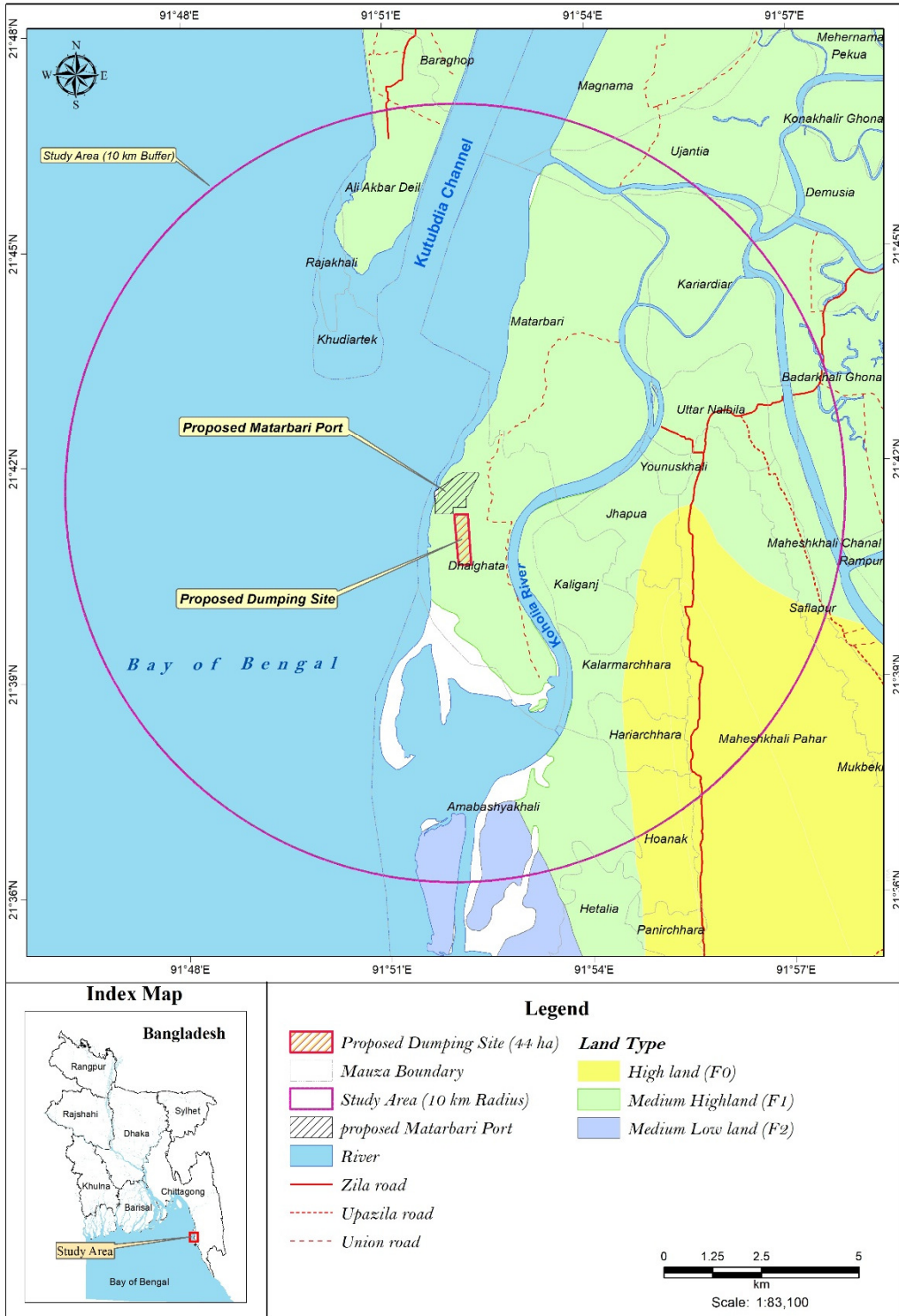


Figure-8.3-9 Land Tyoe of the Dumping Site

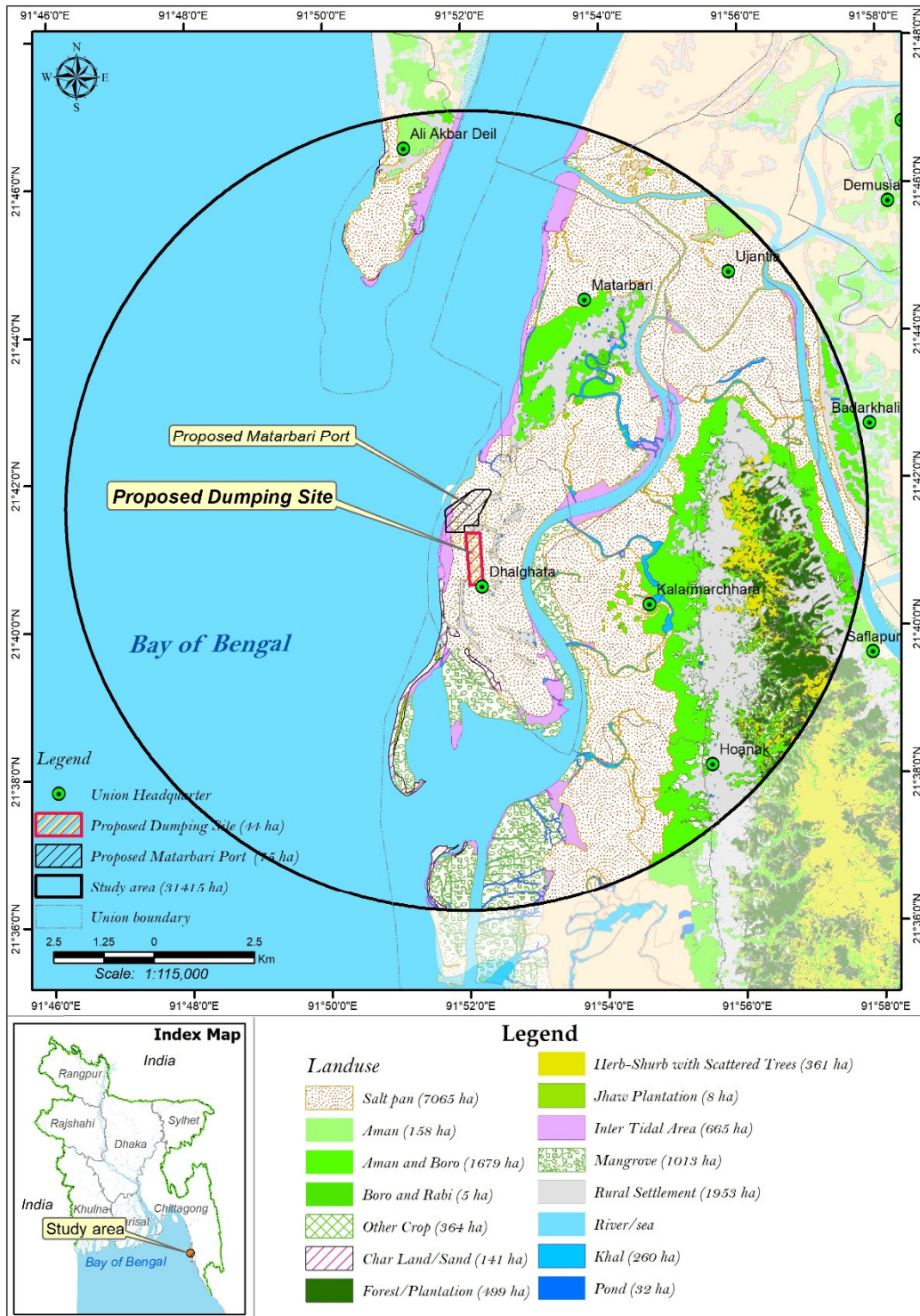


Figure-8.3-10 Landuse Map of the Dumping Site Study Area

(v) Flora and Fauna of the Study Area

The dumping site lies within the Bio-ecological zone 8a: coastal plains (IUCN, 2002) and unique in nature. Figure-8.3-11 Shows the Bio-ecological map of the dumping site. Roadside and embankment vegetation's are generally planted and develop an ecosystem which is dominated by hard wood tree

species. These species are Raintree, Babla, Mahogoni, Acacia, Koroi, Neem, etc. Some plants also grow naturally in-between the planted plants and remain at the bottom levels on either sides of the road function as barrier of soil weathering. The small-sized herbs are also available and Bhat, Croton, Bondhona, Daton are found commonly everywhere in the area. In the homestead area the common plants are Betel Nut, Coconut, Mango, Jackfruit, Palmyra Palm, Jamun, Date Palm, Rain tree, Mehagani, Rose, Bamboo, Banana, Dholkalmi etc.

The homestead and roadside vegetation are considered as secondary habitats for the terrestrial fauna. The cropland vegetation also supports insects, amphibians and some reptiles. Some small to medium-sized mammals are reported to be available in this area: Field Rat, House Rat and Indian Flying Fox etc. The commonly available terrestrial birds of the area include Black Drongo, Common Myna, Asian Pied Starling, Oriental Magpie Robin, Jungle Myna, Spotted Dove, Red-vented Bulbul, House Sparrow, Common Tailorbird, etc. The population of birds is richer than all other faunal communities. Of the terrestrial reptiles, the Indian Rat snake, Common Garden Lizard, House Gecko, Spotted House Lizard, Little Skink, Striped Keel back are reported to be found in the area. The amphibians are naturally small-sized, inhabit in various habitats from human settlement to agricultural lands and even in ditches. Though the amphibians are smaller in size but they have great contribution in the food chain and recognized as indicator species of the environment. The frog species those are commonly observed in the area are Green Frog, Common Toad, Indian Bullfrog, Common Tree Frog and Cricket Frog.

Wetlands are among the most fertile and productive ecosystem that supports the life cycle of different fauna and flora resources of an area. The prime uses of the wetland of the wetlands are fisheries, vegetation and navigation. The dumping site area is enriching with open water fisheries. The salt pan area of the dumping site is generally under the shrimp cultivation in the rainy season. The shrimp Species are *Penaeus monodon*, *p. japonicas* (*Bagda Chingri*), *P. indicus* (*chaga Chingri*) etc.

Diversity and density of floral species are varied according to wetland types as well as water depth and velocity. Kochuripana (*Eicchorniacrassipes*) is the most common free floating hydrophyte that covers maximum portion of water area of the ponds and ditches. Topapana (*Pistiastratotes*) are found in most of the ditches as well as ponds mixed with hyacinth. Shapla (*Nymphaeastellata*), Chandmala (*Nymphoides* sp.) are dominating the floodplain vegetation. Sedges are quite common during monsoon inside all types of wetlands. Hydrilla, valesnaria, Helencha (*Enhydrafluctuans*), Ludwgjia, Echinocola, Hygrorhyza, Ficus heterophylla are the main components of the floral composition of aquatic vegetation.

Population of aquatic faunal species is varied according to wetlands characteristics and surface area of water inside the water bodies. Fishes are holding the major populations among aquatic faunal species those are describe in fisheries section of this report. Among the amphibians, the green frog, skipper frog, etc. are common all over the year. They have been the most successful fauna in adapting to the all kinds of wetlands. Abundance of Bullfrogs (*Hoplobatrachustigerinus*) is generally increased in rainy season at paddy fields, ditches and other marshy places. Common aquatic snakes include the checkered keel back (*Xenocrophiscator*) and smooth water snake (*Enhydrisenhydris*) are observed in the area.

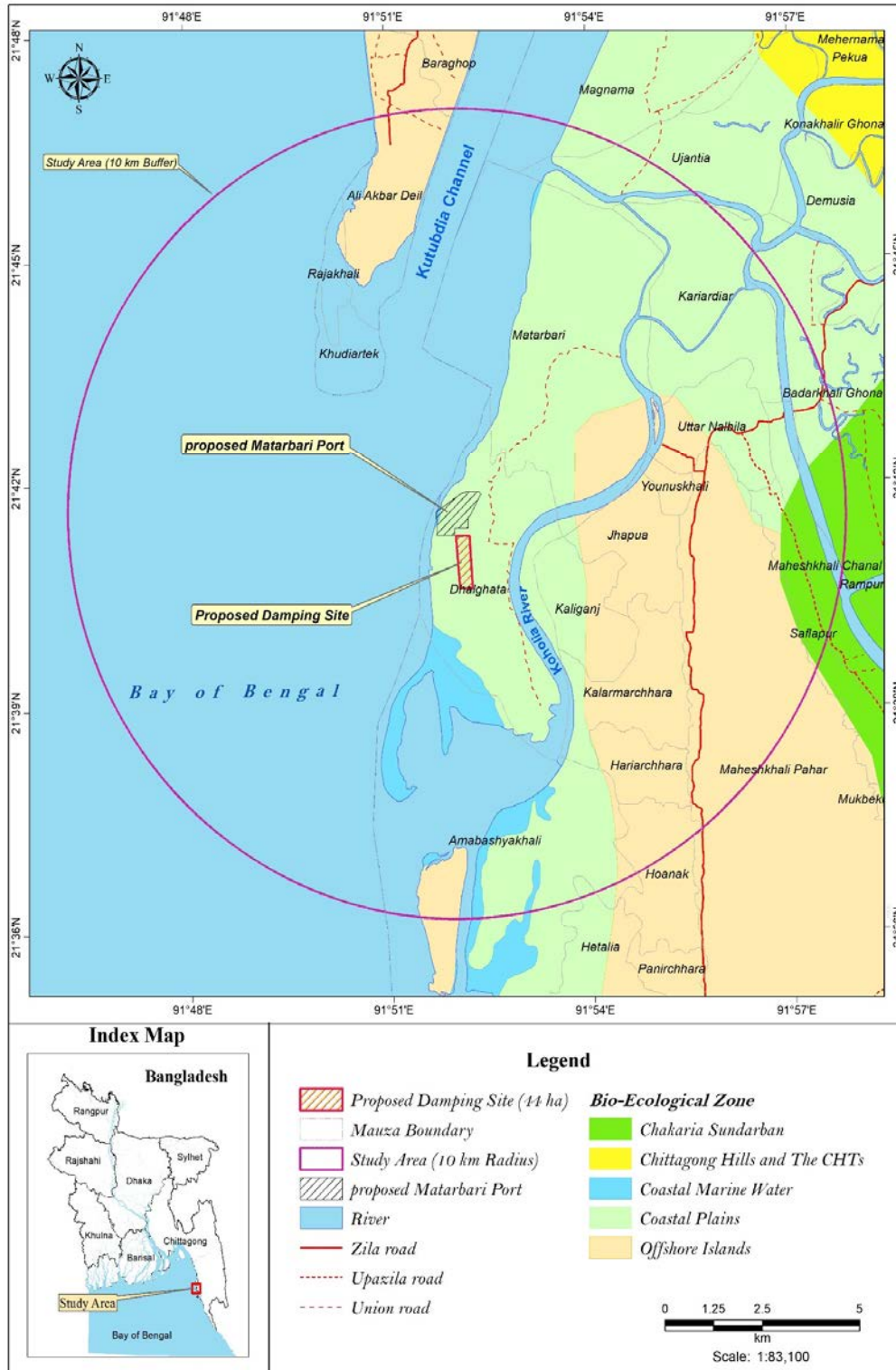


Figure-8.3-11 Bio-ecological Map of the Dumping Site

Different species of local birds roam on the salt field and shrimp farm within the study area during winter. The wetland dependent birds of the area are: Common Kingfisher, Little Heron, Lesser Whistling Duck, Indian Pond Heron, Little Egret, Yellow Bittern, Great Egret, Pheasant-tailed Jacana etc. Common and uncommon bird species found in the study area are India Pond Heron, Little Egret, Cinnamon Bittern, Cotton Pigmy Goose, Little Cormorant, White breasted Water Hen, Common Kingfisher, Lesser Whistling Duck, Bronzed-winged Jacana, Brhaminy Kite, Pied Kingfisher etc.

Existence of Fishing Cat has been found within the area. The commonly observed snake population in water bodies are Checkered Keelback (*Xenochrophis piscator*), Common Wolf Snake (*Lycodon aulicus*) in the area. Skipper Frog is available in water body like hill stream. Among amphibians, the Skipper Frog (*Euphylyctis cyanophlyctis*) is common and found in all wetland habitats and has been the most successful in adapting to the altered habitat.

(vi) Protected Area/Wildlife Sanctuary/Forest

Based on the significance and ecological sensitivity, Ministry of Environment & Forest (MOEF) has declared a number of areas as "ECAs" and "Protected Areas", but there is not much information or study on the Ecologically Sensitive Area (ESA's) of different coastal and marine Ecosystem and its habitat.

Ecologically Sensitive Areas are:

- ✓ Mangroves
- ✓ Mudflats
- ✓ Salt Marshes
- ✓ Sea grass Bed
- ✓ Coral Reefs
- ✓ Marine Wildlife Protected Areas
- ✓ Turtle Nesting Grounds
- ✓ Seaweed bed
- ✓ Sandy Beaches and Sand Dunes
- ✓ Coastal freshwater bodies
- ✓ Horseshoe crab Habitats
- ✓ Nesting Ground of Bird

The proposed dumping site area is out of the Ecologically Critical Area (ECA).

Table 8.3-4: Protected area in the Coastal zone of Bangladesh

Type	Name	Area (ha)	Location	Effects of 1-m Sea Level Rise (SLR)
Reserved Forest	-	885,043	Khulna, Satkhira, Bagerhat, Bhola, Patuakhali, Noakhali, Chittagong, Cox's bazaar	Yes
National Park	Himchari	1,729	Cox's bazaar	No
Wild life Sanctuaries	Nijhum Deep	4,232	Hatiya, Noakhali	Yes
	Sundarban south	36,970	Khulna	Yes
	Sundarban west	71,502	Satkhira	Yes
	Char Kukri-Mukari	2,017	Bhola	Yes
	Chunati	7,761	Chittagong	No
Ramsar Site	Sunderbans	601,700	Khulna, Satkhira, Bagerhat	Yes
Environmental Critical Areas	Sonodia	4,916	Cox's Bazar	Yes
	Teknaf	10,465	Cox's Bazar	Yes
	St. Martin's Island	590	Cox's Bazar	Yes
World Heritage Site	Wild life sanctuaries of the Sunderbans		Khulna, Satkhira, Bagerhat	Yes
Marine Reserve		69,800	Bay of Bengal	Yes

(Source: Islam 2004; (in Hussain & Haq (eds.), 2010)

The Sonadia Island (Figure-12) is an identified ECA of the Cox's Bazar. Its outer boundary is almost 9 Km away from the Proposed dumping site area. So the project activities will not intervene the ECA.

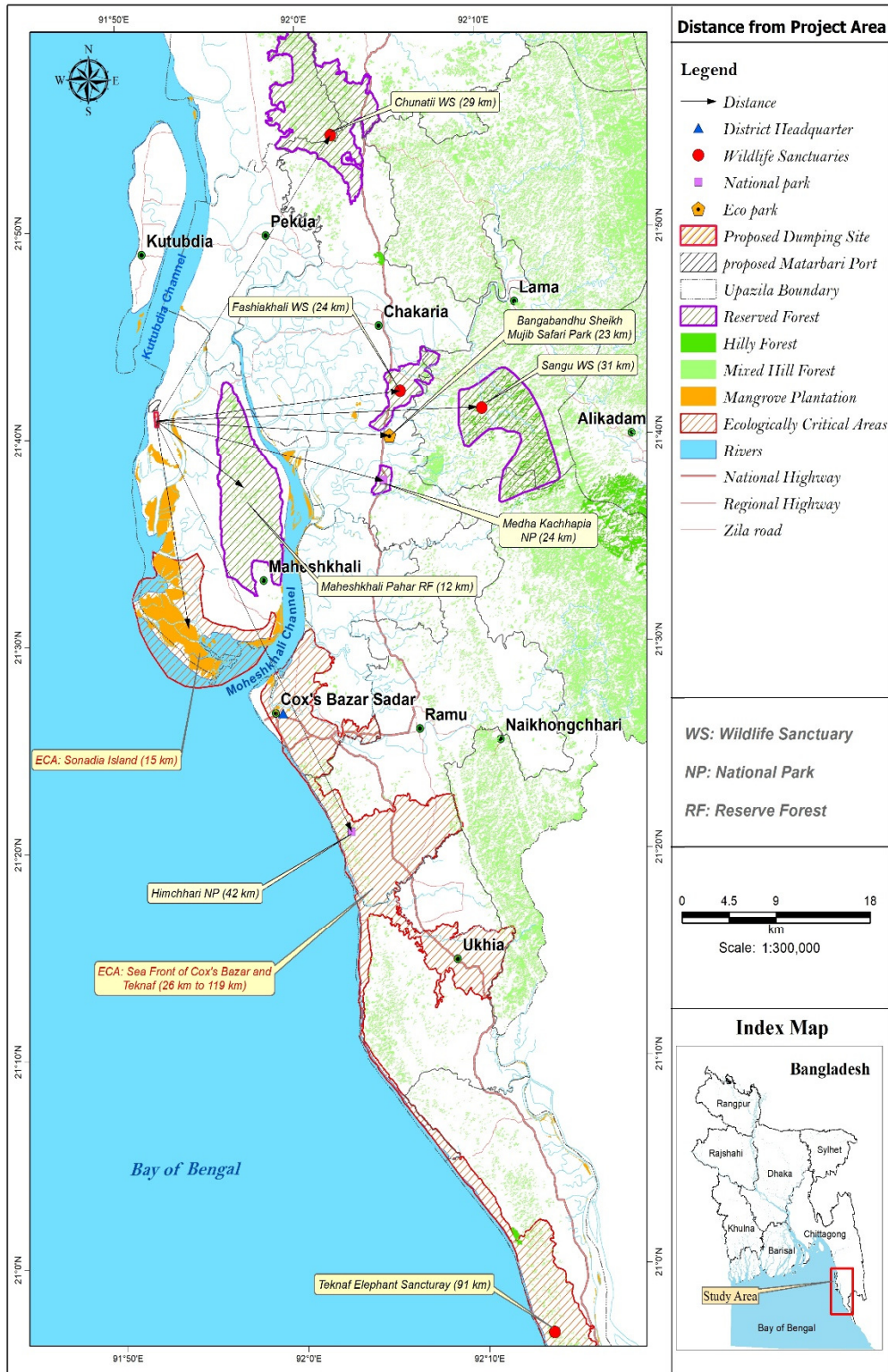


Figure-8.3-12 Comparative Position of ECA and WS

8.4 CO2 Emissions from the Port Project

i) Vessel Details:

The number of entrance vessels was calculated using a representative ship type.

- Container ship: 52,900 GT (60,000 DWT),

- Load capacity: 4,400 TEU, captain: 294 m,
- Loading and unloading amount at one calling: 3,520 TEU

The general cargo ship would be 30,000 DWT, as a standard ship type used for steel transportation, and the bulk ship is assumed to be 70,000 DWT, assuming grain transportation.

The average loading capacity would be 27,000 tons for the steel transport ship and 35,000 tons for the grain transportation, assuming two loadings in one trip.

Container: 210,000TEU per annum

ii) Prediction of Vessel Type and Size

Table-8.4-1 Marginal Laden TEUs Required for an Extra Calling by Size

TEU Capacity →	2,500	3,800	5,400	8,200	10,000
Laden TEUs required for an extra call (SIN/CHG/SIN)	2,022	2,756	3,528	5,135	6,344
Laden TEUs required for an extra call (CMB/CHG/CMB)	1,771	2,410	3,092	4,513	5,580

Table-8.4-2 Laden Throughputs Assumed to Receive an Extra Calling by Size

(’000 TEUs)

TEU Capacity →	1,610	2,500	3,800	5,400	8,200	10,000
Intra-Asia or North America Trades	1,745	2,568	3,501	4,480	6,521	8,057
Europe Trade	1,745	2,249	3,061	3,927	5,732	7,086

iii) Shipping Details

Table-8.4-3 Estimated number and average size of Ships

Sl. No.	Types	No. of ships per Annum	Average mileage traveled to reach (origin of trip by %)	Average size (DWT)
1	Container ships	230	10Km	60,000
2	Cargo ships (Steel)	50	10Km	30,000
3	Bulk ships (Grain)	210	10Km	70,000

iv) CO₂ Calculation

The CO₂ Emissions has been calculated for the port project by using the Cargo Shipping emissions calculator. Total cargo tonnages were calculated as per the nos. of ships annually travelling multiplying with its average sizes. In this case three types of vessels/ships are assuming to be travelled all over the year. The vessels would be container ships, cargo ships (steel) and Bulk ships (grain). The frame of Cargo Shipping emissions calculator is shown in Figure-8.4-1. The estimated total CO₂ emission per annum of the proposed port would be 3,741.00 Tones. Table-8.4-4 detailed out the estimated emissions of the proposed port project.

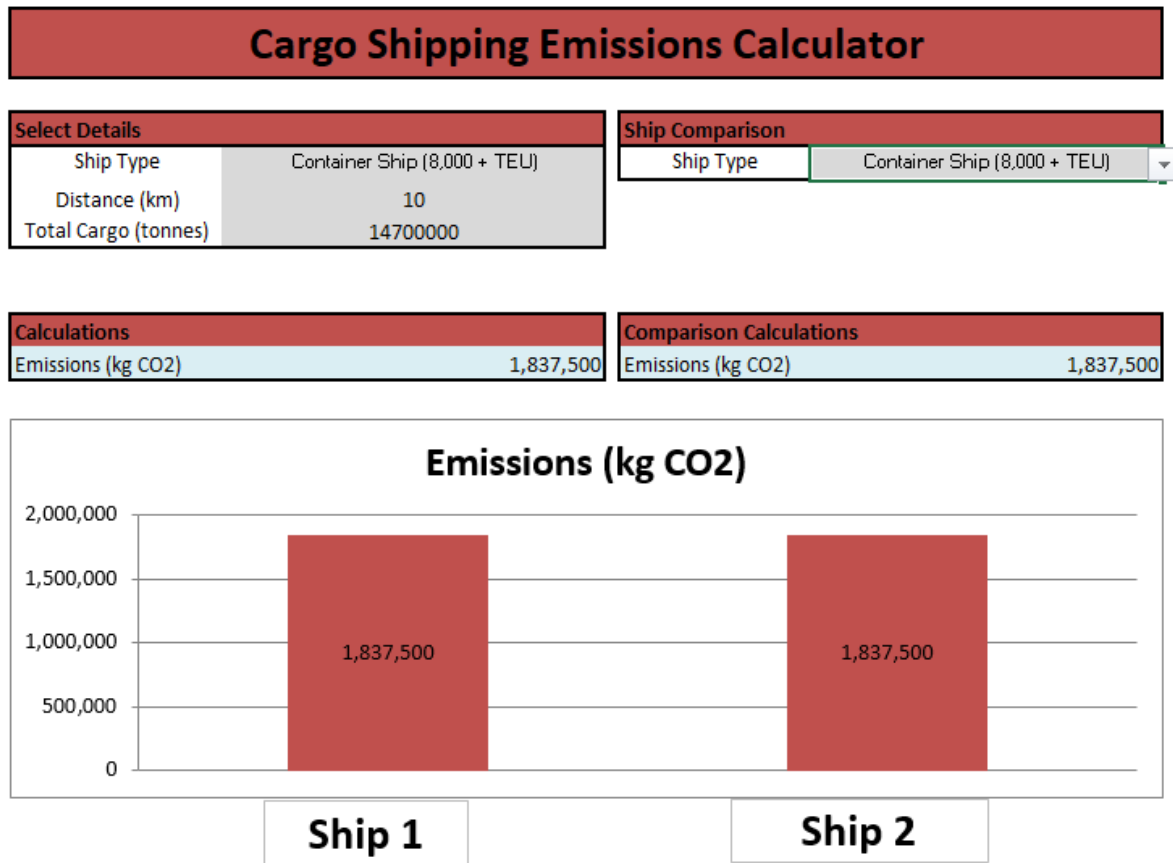


Figure-8.4-1 Frame of Cargo Shipping Emissions Calculator

Table-8.4-4 Estimated CO₂ emissions of the proposed port project

Sl. No.	Type of Ship	No. of ships Per annum	Average mileage traveled to reach (origin of trip by %)	Average size (DWT)	Total Cargo (Tones)	Emissions (KgCO2)	Emissions (TonesCO2)
1	Container ships	230	10km	60,000	13,800,000.00	1,725,000.00	1,725.00
2	Cargo ships (Steel)	50	10km	30,000	1,500,000.00	178,500.00	178.50
3	Bulk ships (Grain)	210	10km	70,000	14,700,000.00	1,837,500.00	1,837.50
4	Total Emissions					3,741,000.00	3,741.00

CHAPTER-9 ENVIRONMENTAL AND SOCIAL IMPACT EVALUATION

9.1 General

This chapter identifies and evaluates the potential impacts associated with the port Project facilities. With the help of survey results the impacts were identified and therefore examination of interactions between Important Environmental Components (IECs) and Project activities were assessed through the scoping matrix and the results of scoping matrix is listed in the next section of this chapter.

9.2 SCOPING RESULT

The scoping matrix of the proposed Port project has been narrated in Chapter-7. Based on detail survey result analysis the scoping results are tabulated in Table-9.2-1.

Table-9.2-1 Scoping Results of the Proposed Port Project

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air Quality	B-	B-	B-	B-	Construction phase: - dust dispersion occurs. - machinery will exhaust polluted gas emissions. Operation phase: Air pollution caused by exhaust gas generated from the vessels using the port is predicted. - Cumulative impacts are expected with the surrounding areas.
	2	Water Quality	B-	B-	B-	B-	Construction phase: - diffusion of turbidity expected when excavating the land area, - Turbid water from the land will be expected. Operation phase: - Dredging cause turbidity. - The ballast water pollution is expected.
	3	Waste	B-	B-	B-	B-	Construction phase: -Sand and silt from dredging work of the navigation channel and the port will be re-used for land preparation of the port and others are disposed by sea and land dumping. -there emerge both general and hazardous waste Operation phase: - Dredged materials are generated by maintenance of the port.
	4	Soil Contamination	B-	B-	B-	B-	Construction phase: Generation of the construction waste and waste materials is assumed. Operation phase: Some pollutants are assumed to be generated from vessels entering and leaving ports such as oil and chemical material spills.
	5	Noise and Vibration	B-	B-	B-	B-	Construction phase: - Noises and vibrations from construction machinery and vehicles will be caused regularly. Operation phase: - Construction machinery and vehicles will cause noises regularly.

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
	6	Subsidence	C	C	D	D	Construction/Operation phase: There is no groundwater use during construction/operation phase:
	7	Odor	D	D	D	D	Construction/Operation phase: There is no material creating odors during construction/operation phase:
	8	Sediment	D	D	B-	B-	Construction phase: Both in ocean dumping place of the dredged sediment and the route areas of dredging, there are some negative impacts on benthos. Operation phase : Because of the maintenance dredging, benthos are affected.
Natural Environment	9	Protected Areas	B-	B-	B-	B-	Construction/Operation phase: There is no protected area in the planned site, but there could be some negative environmental impact in the peripheral changes due to the project site.
	10	Ecosystem	B-	B-	B-	B-	Construction phase: The sandy beach of the intertidal zone disappears for the construction of the harbor facility. Impacts on surrounding ecosystems (birds, sea turtles, dolphins) due to overseas line change and construction activities are assumed. Operation phase: There were no threatened species such as birds, sea turtles, and dolphins. However, maintenance dredging and the influence on the coastline of the drilling waves due to the navigation of large vessels gradually progresses, and adaptation of these changed is expected.
	11	Hydrology	B-	B-	B-	B-	Construction/Operation phase: It is assumed that changes in the hydrology will occur due to the addition of port facility.
	12	Topography and Geology	B-	B-	B-	B-	Construction/Operation phase: It is assumed that changes in the topography and Geology will occur due to the addition of port facility.
Social Environment	13	Resettlement and Land Acquisition	A-	D	A-	D	Pre-Construction: Approximately 56ha of private land including residential area and salt farm need to be acquired. 45 HHs will be resettled. Construction: No impact is expected, as relocation will be completed before construction begins. Operation: No impact is expected, as relocation will be completed before construction begins.
	14	Poor Classes	B-/B+	B-/B+	B-/B+	B-/B+	Pre-Construction: There are poor households among those to be resettled and/or lose their livelihood means. Construction: They will have job opportunities at the construction site. Operation: Resettled people may experience the deterioration of their household economies and loss of livelihood following relocation. Positive impact will be expected due to job opportunity at port facilities, improvement of local economy facilitated by livelihood of port workers.
	15	Ethnic Minorities and Indigenous Peoples	C	D	D	D	Pre-Construction: Neither ethnic minorities nor indigenous peoples live in the project affected area. Construction: Neither ethnic minorities nor indigenous peoples live in the project affected area. Operation: Neither ethnic minorities nor indigenous peoples live in the project affected area.

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
	16	Local Economy such as Employment and Livelihood, etc.	B-/B+	B-/B+	A-/B+	B-/B+	<p>Pre-Construction: Employers/ employees of salt farms, shrimp farms, fishermen, farmers and some ferry boat workers may lose their means of livelihood or their jobs.</p> <p>Construction: Local people will be employed for construction work. The sandy beach will not additionally disappear due to the dredging activities for the port's construction and maintenance. Cumulative impact from the adjacent project on salt and shrimp farm will be expected.</p> <p>Operation: Means of livelihood in salt farming and shrimp farming could be lost. Cumulative impact from the adjacent project will be expected. The construction of port will benefit the lives of local people through job opportunity and improvement of local economy due to livelihood of port works.</p>
	17	Land Use and the Utilization of Local Resources	A-	A-	A-	A-	<p>Pre-Construction/ Construction: The implementation of this project will change the traditional land use pattern. Local resources can get stringent.</p> <p>Operation: Influx of port workers may change the traditional land use pattern and utilization of local resources.</p>
	18	Water Usage and Water Rights	A-	B-	B-	B-	<p>Pre-construction: No activities are expected to give any impact on water usage.</p> <p>Construction phase: Local economy may be affected by the turbid water discharged from the construction site. Outflows of street dust and oil while it rains, may also cause certain effects.</p> <p>Operation phase: Local economy may be affected by the discharged water into the sea which requires management plan for water quality.</p>
	19	Existing Social Infrastructure and Services	B-	B-	B-	B-	<p>Pre-construction: Some social infrastructure may subject to relocation. Access to social infrastructure and social service may be affected due to resettlement of project affected persons.</p> <p>Construction: Construction work will not disturb access to existing social infrastructure and social services.</p> <p>Operation: Increased marine traffic may disturb the existing marine traffic (traffic of fishing boats).</p>
	20	Local Communities and Decision-making Institutions	B-	D	B-	D	<p>Pre-construction: Displacement may affect the existing network of local communities and decision-making institutions. For mitigating this, relocation site needs to be secured near the current residence.</p> <p>Construction: No impact is expected as relocation will be completed before construction begins.</p> <p>Operation: No impact is expected as relocation will be completed before construction begins.</p>
	21	Unequal Distribution of Benefits and Damages	B-	B-/C	B-	B-	<p>Pre-Construction: There may be feelings of resentment, because people living around the project site will benefit through the improvement of social infrastructure and services. People to be resettled and those who lose their means of livelihoods will receive certain damages.</p> <p>Construction: Local resident may not receive benefits if external workers are employed at construction site.</p>

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							Operation: Local resident may not receive benefits if external workers are employed at port facility.
	22	Local Conflicts of Interest	B-	B-	B-	B-	Pre-Construction: Local conflicts of interest may occur between residents, and between local administration bodies and local political leaders. Construction: Conflicts between local residence and external workers may occur because of changes in local customs if the external workers cannot understand local customs. Operation: Conflicts between local residence and external port workers may occur because of changes in local customs if the external port workers cannot understand local customs.
	23	Cultural Heritage	C	C	D	D	Pre-Construction/ Construction: There is no historical/ cultural/archaeological properties nor heritage sites at the project site. Operation: There is no historical/ cultural/archaeological properties nor heritage sites at the project site.
	24	Landscape	B-	D	D	D	Pre-construction: No activities are expected to give any impact on landscape. Construction: No significant impact will be expected as there is no scenic spot near the site. Operation: No significant impact will be expected as there is no scenic spot near the site.
	25	Gender	B-	B+/B-	B-	B+/B-	Pre-construction: Unequal distribution of compensation can be occurred within households. Construction: Unequal employment opportunity can be provided at construction site. Operation: Improvement of local economy will give positive impact. Unequal employment opportunity can be provided at port facility.
	26	Children's Rights	B-	B+/B-	B-	B+/B-	Pre-construction phase: There are children among households to be resettled and/or lose their livelihood means. Children from households losing their land or jobs may suffer from adverse impact on their household economy, such as dropping-out of school. Construction phase: Access way to their schools will not be physically blocked by the construction site. Child labour can be provoked at the construction site because of the huge demand for unskilled workers. Operation phase: Improvement of local economy will give positive impact. Child labour can be provoked at the port facility.
	27	Infectious Disease such as HIV/AIDS	B-	B-	B-	B-	Pre-construction: No impact is expected as no influx of migrant labor is expected at this phase. Construction: A temporary influx of migrant labor during the construction period may increase the risk of infectious diseases. Operation: Influx of migrant port worker may increase the risk of infectious diseases. For mitigating this risk, measure for prevention of infection shall be taken.
	28	Work Environment (Including Work Safety)	B-	B-	B-	B-	Pre-construction: No activities are expected to give any impact on work environment. Construction phase: Accidents may be caused by construction work.

Item	Sl. No.	Impact	Assessment based Scoping		Assessment based survey results		Results
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							Operation phase: Accidents may be caused by the entry and departure of vessels and loading-unloading of cargo.
Others	29	Accidents	B-	B-	B-	B-	Pre-construction: No activities are expected to cause accidents. Construction phase: Accidents may be caused by construction work. Operation phase: Accidents may be caused by increased marine traffic.
	30	Cross-boundary Impact and Climate Change	C	C	D	B-	Construction phase: CO2 emissions due to construction activities is a temporary impact on climate change. Operation phase: CO2 emissions due to the operation of vessels entering and leaving port affects climate change in the long term, and adaptation measures are necessary.

Note:

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

9.3 IMPACT EVALUATION

A simple semi-quantitative descriptive checklist method has been applied to evaluate the potential environmental impacts. Firstly, the activities during construction and operation were identified and listed in the impact table. Then the corresponding impacts on the specific ecological components (terrestrial and flora), socio-economic parameters and physico-chemical environment attributes were evaluated based on the baseline scenario and an assessment of the typical interactions with project activities. Assessments were made as to whether the impacts were positive (beneficial) or negative (harmful), short-term (short recovery time) or long-term (extended recovery time); and of high or low/moderate intensity. The results of the assessment are summarized in Tables 9.3-1, 9.3-2 & 9.3-3.

Table 9.3-1 Evaluation of ecological impacts ensuing from different project activities

Sources of Potential Impacts	Ecological Issues										
	Flora		Fish	Fauna							
	AQ	TR		Amphibian		Reptile		Bird		Mammal	
			AQ	TR	AQ	TR	AQ	TR	AQ	TR	
A. Construction Phase											
Camp Setting	0	-1S	0	0	-1S	0	-1S	0	-1S	0	-1S
Land Clearing	0	-1S	0	0	-1S	0	-1S	0	-1S	0	-1S
Soil Excavation	0	-1S	-2S	0	-1S	0	-1S	0	-1S	0	-1S
Generation of Noise	0	0	-2S	0	-1S	0	-1S	0	-1S	0	-1S
Deterioration of Water Quality	-1S	0	-2S	0	-1S	0	0	0	0	0	0
Sewage Discharge on Soil/Water	-1S	0	-1S	0	-1S	0	0	0	0	0	0
B. Operation Phase											
Treated Waste Water Disposal	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S

Ship Traffic	-1S	-1S	-2S	-1S	0	0	0	0	-1S	-1S	-1S
Cargo Operations and Waterfront Industry	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S	-1S

[Legend :AQ = Aquatic; TR = Terrestrial; 0 = No impact (negligible impact), 3 = High impact, 2 = moderate impact, 1 = Low impact, S = Short term impact, L = Long term impact, +/- = positive/negative impact]

Table 9.3-2: Socio-economic impacts from activities associated with the Construction and Operation

Project Activities		Socio-economic Impacts				
		Loss of Land and income	Traffic (road and Rail)	Impact on indigenous/tribal people	Public Health and safety	Employment and commercial activities
A. Preconstruction Phase	Resettlement and Land Acquisition	-2S	0	0	0	-2S
B. Construction Phase	Construction noise	0	0	0	-1S	0
	Labor camp setting	0	0	0	0	+2S
	Land clearing	0	0	0	0	+2S
	Soil excavation	0	0	0	0	+2S
	Piling work	0	0	0	-1S	+2S
	Concreting work	0	0	0	-1S	+2S
	Local road use	0	-1S	0	-1S	+1S
	Provision for safe water and sanitation facilities for workers	0	0	0	+2S	0
C. Operation Phase	Ship Traffic	-1S	-1S	-1S	-1S	+3L
	Cargo Operations and Waterfront Industry	0	-1S	0	-1S	+3L

[+3 = High Positive Impact, +2 = Moderate positive impact, +1 = Low Positive Impact, 0 = No impact, -1 =Low Negative Impact, -2 = Moderate Negative Impact, -3 = High Negative Impact S = Short term impact, L= Long term impact]

Table 9.3-3: Physico-chemical impacts from activities associated with the construction and operation

Project Activities		Physico-chemical Impacts						
		Drainage congestion	Noise level	Air quality	Surface Water	Groundwater quality	Physical cultural	Soil quality
A. Construction Phase	Labor camp setting and its operation	0	0	0	-1S	0	0	0
	Land clearing	-1S	0	0	0	0	0	0
	Soil excavation	-2S	-2S	-2S	-1S	0	-1S	-1S
	Piling work	0	-2S	-1S	-1S	-1S	-1S	0
	Concreting work	0	-2S	-1S	0	0	0	0
	Provision for safe water and sanitation facilities for workers	0	0	0	0	0	0	0
B. Operation Phase	Ship Traffic	0	-1S	-1S	-1S	-1S	0	0
	Cargo Operations and Waterfront Industry	0	-2S	-2S	-1S	-1S	0	-1S

[+3 = High Positive Impact, +2 = Moderate positive impact, +1 = Low Positive Impact, 0 = No impact, -1 =Low Negative Impact, -2 = Moderate Negative Impact, -3 = High Negative Impact S = Short term impact, L= Long term impact]

9.2 NO PROJECT SCENARIO

The “no action alternative” would have no negative impacts on the existing environmental and social resources but the positive socio-economic and beneficial commercial impacts would also not be realized

as well. All these impacts are likely to contribute to improve the quality of life of the local community, in addition to contributing to national economic growth.

CHAPTER-10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 INTRODUCTION

This chapter summarizes the mitigation and abatement measures in order to minimize or eliminate the assessed impacts as well as presents an environment management plan (EMP), including the resources and institutional setup for implementation of the EMP. Since loss of land and associated income, effects on a few social structures etc. are anticipated in this project, a comprehensive Land Acquisition and Resettlement Action Plan (LARAP) study will be applicable and JICA is preparing parallel to this EIA study.

10.2 SCOPE OF EMP

The primary objective of the environmental management plan is to record environmental impacts resulting from the project activities and to ensure implementation of the “mitigation measures” identified earlier in order to reduce adverse impacts and enhance positive impacts from specific project activities. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operation phases of the project. The EMP should clearly layout:

- b) the measures to be taken during both construction and operation phases of the project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels; and
- c) the actions needed to implement these measures.

Activities of the Environmental Management Plan for the proposed port project would be of two phases:

- i. During construction phase, and
- ii. During operation phase

10.3 IMPLEMENTATION WORK PLAN

10.3.1 Construction Phase

The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected.

At this phase, the Project Implementation Unit (PIU) of CPA shall carefully consider all construction activities with the supervision consultant, and encourage the contractor to fully understand the necessary mitigation measures and to implement them.

For this purpose, an environmental management unit (EMU) shall be organized prior to construction activity. An expert of environmental management administrator in the EMU shall be deployed. The unit will discuss and prepare mitigation measures with the supervision consultant and the contractor prior to the start of construction.

It is anticipated that a large inflow of workers and vehicles will be in the project activities once construction work begins. The EMU shall also be responsible for functioning as a grievance organization to understand and address any grievances from local people during the construction phase, and conduct appropriate mitigation measures.

The EMU shall improve the understanding of the surrounding community regarding construction details, the schedule and mitigation measures, and shall obtain local input from people and change the mitigation measures as appropriate.

In order to confirm the implementation of environmental management and to consider further mitigation measures, the contractor would be responsible for submitting the regular reports to the supervisory consultant and the EMU on the implementation status of the management plan.

The administrator of the EMU shall regularly hold explanation sessions with the local community, continuously listen to their grievances, submit reports to the Department of Environment, JICA and other relevant organizations regarding those grievances, as well as the implementation status of environmental management and environmental monitoring (described hereinafter).

If any environmental problems occur due to construction work, the EMU shall confirm the cause with the contractor as soon as possible. In order to resolve these problems, the administrator of the EMU shall instruct the contractor and consultant regarding necessary measures. If the problem is serious, the PIU may order the contractor to halt construction work until the problem is resolved.

Also, because it is planned to merge coal port with some port facilities, this project is similar in many points to the supplement points, CPGCBL (Coal Power Generation Company Bangladesh Limited), because it is necessary to manage, it shows a cooperative system because it is negotiating a joint management system.

Figure 10.3-1 outlines the environmental management and monitoring implementation structure in accordance with the reporting flow diagram during the construction phase.

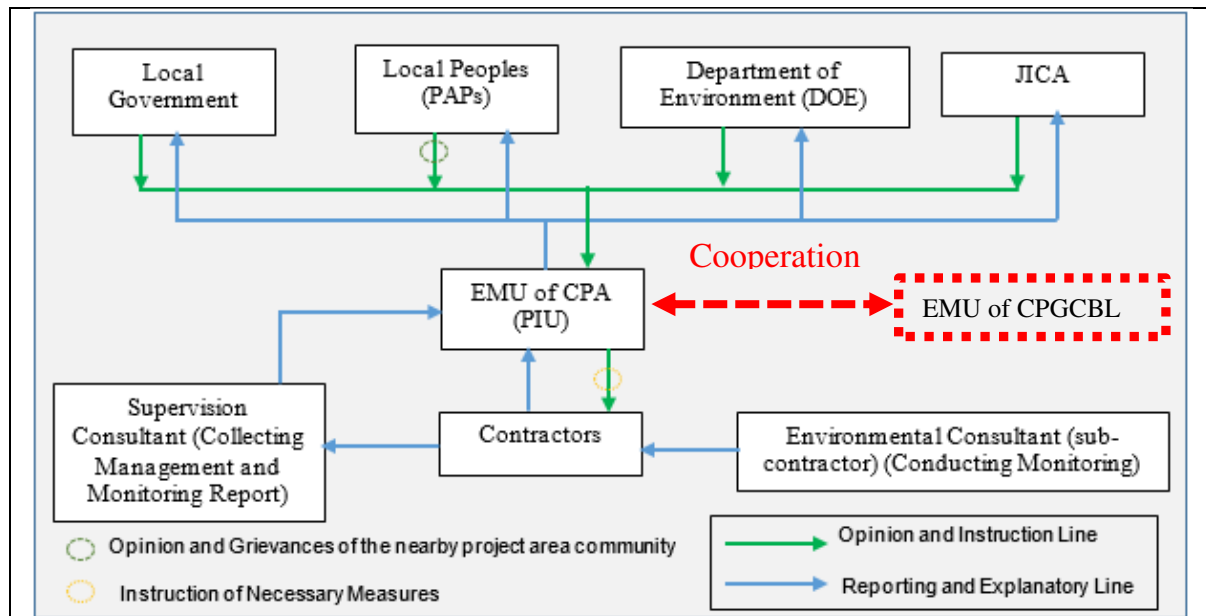


Figure 10.3-1 EMP Implementation Structure in the Construction Phase

10.3.2 Operation phase

CPA is responsible for organizing the EMU in a manner that allows it to develop and implement an environmental management plan that includes mitigation measures. An expert of environmental management administrator shall be employed at the EMU to make sure the appropriate implementation of the proposed environmental management plan. The administrator shall encourage the project staff to familiarize themselves with the environmental management plan prior to the start of port operation, and shall regular educate those regarding ongoing matters

during the operation phase of the port. The EMU shall also function as a grievance organization and will strive to understand and address any grievances from the local people during the operation phase, and undertake appropriate mitigation measures.

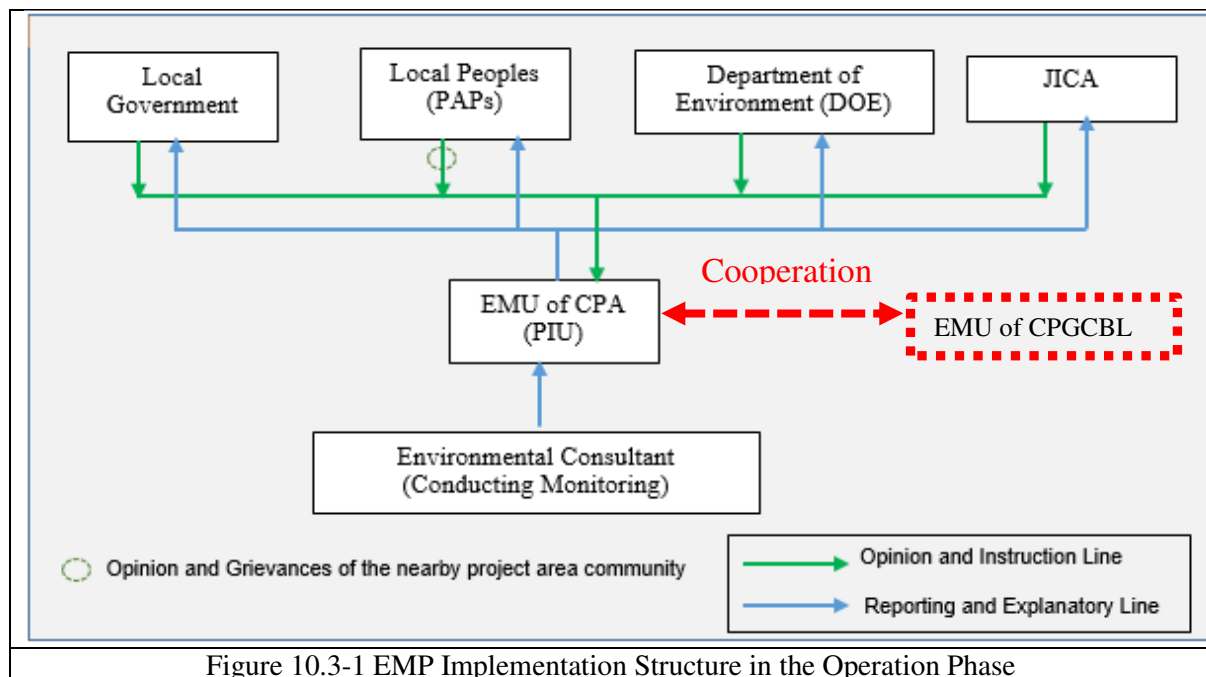
The basic function of the environmental management plan is to lease with the local community and to provide them with sufficient explanations based on positive mitigation measures, which is very important.

The administrator shall report on the contents and implementation status of the environmental management plan and environmental monitoring plan described below to the director of the port, with the director taking final responsibility.

The administrator of the EMU shall regularly hold explanation sessions with the local community, continuously listen to their grievances, submit reports to the Department of Environment, JICA and other relevant organizations regarding those grievances, as well as on the implementation status of environmental management and environmental monitoring activities (described hereinafter).

Also, because it is planned to merge coal port with some port facilities, this project is similar in many points to the supplement points, CPGCBL (Coal Power Generation Company Bangladesh Limited), because it is necessary to manage, it shows a cooperative system because it is negotiating a joint management system.

Figure 10.3-2 describes the environmental management and monitoring implementation structure with the reporting flow during the operation phase



10.4 MITIGATION MEASURES

Key environmental impacts, mitigation measures, responsible organizations, and expenses for each environmental item during the construction and operation phases for the port project is listed in Table-10.4-1.

Table 10.4-1 Environmental Management Plan

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
D. Preconstruction Phase									
1	Land acquisition	i) Loss of private land ii) Loss of salt fields, shrimp farms and fishing ground for push net iii) Loss of residential /commercial structures iv) Loss of trees, home gardens, fish ponds and fruit	i), ii), iii) & iv) - The Acquisition and Requisition of Immovable Property Act of 2017 - JICA Guideline (2010)	iii) Consideration for land owners iv) Consideration for persons losing their livelihoods iii), iv) Consideration for persons losing their property	i), ii), iii) & iv) - Developing an appropriate LARAP - Land acquisition should be conducted in compliance with the relevant laws and regulations - The cost related to relocation will be given to relocated residents - Employ local residents, especially loss of salt fields, shrimp farms, and fishing ground for push net as much as possible	i), ii), iii) & iv) - At the site	i), ii), iii) & iv) During land acquisition process	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
2	Disturbance to poor classes	- Poor households among those who are to be resettled.	- JICA Guideline (2010)	- Consideration for burden on vulnerable groups	- Developing “livelihood restoration program”, including job training programs to persons who want the training.	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
3	Deterioration of Local Economy	- Loss of existing livelihood, employment and	- Income level	- Maintaining or Improvement of living standards of	- Developing an appropriate LARAP - Compliance with	- At the site	- During land acquisition process	- Office of the Deputy Commissioner	CPA Cost is included in

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
	such as Losses of Employment and Means of Livelihood	business opportunities		local residents	relevant law for land acquisition - Appropriate implementation of compensation			- CPA	LARAP budget.
4	Land Use and Utilization of Local Resources	- Changing the traditional land use patterns and utilization of local resources	- Land Use Pattern - Use of Local Resources	- Mitigation of land use change and Prevention of local resource depletion	- Ditto	- near the site	- During land acquisition process	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
5	Disturbance to Existing Social Infrastructure and Services	- Loss of access to social infrastructure	- Accessibility to Social Infrastructure and social services -GRM cases	- Ensuring access to social infrastructure and social services	- Ditto	- near the site	- During land acquisition process	- Office of the Deputy Commissioner - CPA	CPA Cost is included in LARAP budget.
6	Disturbance to Local Communities and Decision making Institutions	- Loss of access to social infrastructure - community severance due to resettlement	- Accessibility within community -Perception of local residents	- Ensuring accessibility within community and maintaining Local Decision making Institutions	- Ditto	- near the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
7	Unequal Distribution of Benefits and Compensation	- It can occur among residents, workers, government officers and local politicians	- Perception of local residents	- Consideration for unequal distribution of benefits and losses	- Implement the same mitigation measures as those outlined in “Social infrastructure”	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
8	Local Conflicts of Interest	- It can occur among residents, workers, government	-Perception of local residents	- Consideration to affected peoples’ emotions	- Implement the same mitigation measures as those outlined in “Social	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		officers and local politicians			infrastructure”				
9	Gender	- Inappropriate distribution of compensation within HHs	- distribution of compensation within HHs	- Appropriate distribution of compensation within HHs	- Awareness and monitoring for appropriate distribution of compensation within HHs	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
10	Children’s Rights	- Deterioration of livelihood due to resettlement and land acquisition	- enrollment rate	- ensuring education opportunity	- Ditto	- At the site	- Prior to start construction	- Office of the Deputy Commissioner - CPA	Expenses to be paid by CPA
E. Construction Phase									
1	Air Quality	i) Dust resulting from construction work ii) Exhaust gas from construction machinery and vehicles used for mobilization of equipment iii) Air pollution arising from incineration of construction materials and waste	i) ii) & iii) - Ambient Air Quality Standard - IFC guideline values for ambient air quality (General/ 2007)	i) ii) & iii) - Prevention of air pollution in the surrounding area	i) Dust prevention ii) Watering access road and construction site, especially in the dry season iii) Using cover sheets on trucks for the transportation of soil Gas emission prevention - Periodic maintenance and management of all the construction machinery and vehicles Waste management - Prohibit open	i) ii) & iii) - Construction area	i) ii) & iii) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					burning and illegal dumping				
2	Water Quality	i) Dredging Landfill for land preparation ii) Raising for leveling iii) Runoff water from construction area iv) Domestic wastewater of workers v) Inappropriate disposal of waste vi) Leakage oil and chemical materials from construction activity	i) dredging laws ii)-vi) Wastewater standards for industrial activity	i) - vi) - Prevention of water pollution in the surrounding coastal area	vi) Dredging Conducting dredging at sea area with pump dredger or grab dredger and setting film preventing the diffusion of contamination When dredging terrestrial area, firstly driving steel sheet pile at the sea side vii) Levelling Managing the rainwater by collection and draining wastewater to port iii) Runoff water - Excavate channels, ditches and temporary settling pond around construction area - Install oil separator for treatment of oily wastewater - Construct silt basin	ii) i) Dredging area iii)-vi) Port site	iii) During the dredging activities iv) -vi) During landfill activities	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					<ul style="list-style-type: none"> - Domestic wastewater - Install wastewater treatment facility for workers such as septic tanks viii) Wastewater management - Prohibit illegal dumping ix) Oil and chemical materials leakage - Storage of oil and chemical materials in an appropriate storage site and appropriate method to prevent permeation into ground and dredging with pump or grab after sea water penetrates the land x) Landfill - Treating turbid water from land, such as rainwater runoff, with precipitation process and discharging the remaining water into the excavated part of the port 				
		vii) Sediment caused by the embankment	vii) Water quality environmental standard	vii) Minimize pollution from stagnant water	vii) Installation of pipe type seawater introduction	vii) Embankment	vii) During construction phase	vii) Implementation: Contractor/	vii) Expenses included in contract cost

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					workers and seawater introduction works with submerged breakwater			Environmental Consultant - Supervisor: CPA/ Supervision Consultant	by Contractor
3	Waste	- Dredging material for the channel	- Waste Management Rules	- Prevention of inappropriate waste disposal	Dredging material - Sand: Use for leveling the site	iii) Dredging area iv) Port site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
4	Noise and Vibration	iii) Noise and vibration caused by construction machinery iv) Noise caused by vehicles used or mobilization of equipment and workers	Noise level standards IFC guideline values for noise (General/ 2007)	- Reduction of noise levels from construction activities	i) Optimizing construction schedule - Perform construction work during daytime, especially piling work - Using low-noise/ low vibration equipment as much as possible ii) Mobilization - Transportation of material and equipment for construction by shipping - Determine a traffic control plan including route-	i) & ii) Construction area	i) & ii) During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					setting - Limit truck speed especially around residential areas				
5	Odor	- Domestic wastewater of workers	- Wastewater standards	- Prevention of generating odor	- Taking appropriate measures for handling general waste - Prohibit illegal waste disposal	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor.
6	Soil	ii) Leakages of oil and chemical materials from construction activity ii) Inappropriate disposal of waste	i), ii) - Drinking water quality standards	i), ii) - Prevention of water and soil pollution in the surrounding area	ii) Leakages of oil and chemical materials - Storage of oil and chemical materials in an appropriate storage site and method to prevent permeation into the ground ii) Waste management - Prohibit illegal dumping	i), ii) - Construction Area	i), ii) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
7	Sediment	vi) Runoff water from construction area vii) Domestic wastewater of workers viii) Inappropriate disposal of waste ix) Leakages of oil	i) ii) iii) & iv) - Wastewater standards	i) ii) iii) & iv) - Prevention of water pollution in the surrounding area	i) ii) iii) & iv) - Implement the same mitigation measures as those addressed in “Water quality”	i) ii) iii) & iv) - Construction area	i) ii) iii) & iv) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
		and chemical materials from construction activity							
8	Ecosystem	ii) Existence of endangered species x) Spawning of sea turtles	i) & ii) - Bangladesh Wild Life Preservation (Amendment) Act, 1974 JICA Guideline	i) & ii) - Protection of endangered species	iii) Existence of endangered species - Prohibit disturbance, harassment, and hunting, especially the Spoon billed Sandpiper, by workers - Replace to nearby sites if needed. iv) Spawning of sea turtles - Turning off unnecessary lights during the nesting season - Using a smaller number or lower wattage of lights - Using red and yellow lights (as sea turtles are less affected by these colors) - Using low noise machinery Planning construction activities to minimize adverse	ii) Construction area Construction site adjoining sand beach	i) & ii) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					effects during the nesting season				
9	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Loss of existing livelihood, employment and business opportunities	- Income level, Number of employment opportunities for local residents and number of businesses around the construction area	- Maintaining or Improvement of the local economy - Maintaining or Improvement of living standards of local residents - Consideration to local residents' feelings	- Employ local residents as much as possible - Use the services (i.e., laundry and catering services, etc.) and products offered by the local community. - Developing "livelihood restoration program", including job training programs to persons who want the training.	- Villages near the site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expense is included in contract cost by Contractor - Hire local residence: 1,000Tk./person-day
10	Land Use and Utilization of Local Resources	- Changing the traditional land use patterns and utilization of local resources	- Land Use Pattern - Use of Local Resources	- Mitigation of land use change and Prevention of local resource depletion	- Implement the same mitigation measures as those addressed in the "Local economy"	- Villages near the site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
11	Disturbance to Water Usage, Water Rights, etc.	iii) Adverse impact due to water pollution iv) Usage of underground water	i) Water pollution - Same as those addressed in "Water quality" ii) Ground water - Drinking water quality standards	i) Water pollution - Same as those addressed in "Water quality" ii) Ground water - Consideration to local residents' living	i) Water pollution - Implement the same mitigation measures as those addressed in "Water quality" ii) Ground water - Monitoring of	i), ii) - Construction area	i), ii) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					water levels and water quality at wells in residential areas				
12	Unequal Distribution of Benefits and Damages	- Unequal distribution of benefits and damages between local residents and external workers	- Consciousness of local residents	- Consideration of the attitudes of local residents to the project	- Employ local residents as much as possible - Promote communication between external workers and local people (e.g., join in local events)	- Villages near the site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
13	Local Conflicts of Interest	- Conflicts between local residents and external workers	- Change in local customs	- Consideration of the attitudes of local residents to the project	- Employ local residents as much as possible - Promote communication between external workers and local people (e.g., join in local events)	- Villages near the site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
14	Gender	- Unequal opportunity of employment	- Opportunity of employment	- Equal opportunity of employment	- Opportunity of employment shall be properly provided both for male and female	- Construction Site	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
15	Children's Rights	- Child labor	- Child labor	- Banning child labor	- Prohibit labor contracts between subcontractor and children - Patrolling periodically to	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					check for any child labor			Supervision Consultant	
16	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during construction may increase risk of infection	- sanitation for local residents	- Consideration for sanitation for local residents	- Implementation of periodic medical check-ups by temporary medical team - Education and training on health care of workers	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor - Medical checkups: 45,000Tk./ person (Full Medical Checkup) - Safety education and training: 150,000Tk./ 20 person
17	Work environment (including work safety)	iii) Labor accidents iv) Diseases caused by air pollutants, water pollutants, and noise by construction work	iii) Labor accidents - Handling heavy loads - Working at heights - Electric shocks iv) Environment pollution Ambient Air Quality Standards - Noise level standards - Waste management rule - IFC guideline values for ambient	i) & ii) - Prevention of labor accidents, traffic accidents, and health problems	iii) Labor accidents - Prepare a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices, such as cranes, are appropriate for	i) & ii) - Construction area	i) & ii) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
			air quality and noise (General/ 2007)		expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate during the period of construction - Use equipment that protects against electric shock iv) Environm ent pollution - Observe related standards and provide workers with appropriate facilities				
18	Accidents	- Traffic accidents	i) Marine traffic accidents ii) Land traffic	i), ii) - Prevention of traffic accidents	i) Marine Traffic: Setting marking buoys around the construction area for marine safety - Informing vessel schedules to local fishermen, etc. ii) Land traffic: - Informing bus schedules to the surrounding villages - Determini	i) Sea area around the construction site for port facility ii) Area around the construction site for port facility	i), ii) - During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					<ul style="list-style-type: none"> Implementing a traffic control plan - Training safe operation of vehicles 				
19	Cross-boundary impact and climate change	- CO ₂ will be produced by construction work	-	- Reduce CO ₂ emissions as much as possible	- Periodic maintenance and management of all construction machinery and vehicles	- Construction area	- During construction phase	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
F. Operation Phase									
1	Air Quality	-Exhaust gas from vessels	-MARPOL 73/78 treaty	- Prevention of air pollution caused by vessels	Gas emission from vessels - Hire vessels compliant to MARPOL 73/78 treaty - Stop engines in the port	- Port facility	- During unloading activity	CPA/ Environmental Consultant	Expenses by CPA/ Vessel owners
2	Water Quality	- Dredging material for the maintenance of the navigation channel	- Regulations relating to dredging	- Minimization of water pollution by dredging	- To choose dredging method and equipment that will minimize turbidity	- Dredging area	- During the dredging activities	CPA/ Environmental Consultant	Expenses by CPA
		<ul style="list-style-type: none"> iii) Leakages of oil from oil tankers iv) Wastewater from vessels will cause water pollution 	<ul style="list-style-type: none"> i) & ii) - MARPOL 73/78 treaty (Annex I- V) ii) Wastewater from vessels - International Convention for the control and 	i) & ii) Prevention of water pollution caused by vessels	<ul style="list-style-type: none"> iii) Leakages of oil from oil tankers - Installation of oil fence iv) Wastewater from vessels - Prohibition of dumping any 	<ul style="list-style-type: none"> i) & ii) - Port facility 	<ul style="list-style-type: none"> i) & ii) - During unloading activity 		Expenses by CPA/ Vessel owners

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
			management of Ships' Ballast Water and Sediments (BWM), 2004		contaminated materials - Hire vessels compliant to MARPOL 73/78 treaty and BWM - Any waste will be treated by the port facility				
3	Waste	- Dredging material for the maintenance of the channel	- Waste management rules	- Prevention of inappropriate waste disposal	- Sand: To use for construction material	- Dredging area	- During the dredging activities.	CPA	Expenses by CPA
		- Waste from vessels	- Waste management rules - MARPOL 73/78 treaty	- Appropriate waste management	- Prohibition of dumping any contaminated materials - Hire vessels compliant to MARPOL 73/78 treaty - Any waste will be treated by the port facility	- Port facility	- During unloading activity		Expenses by CPA / Vessel owners
		-Sewage and garbage from workers	- Waste management rules	- Management of waste, especially hazardous waste - Prevention of inappropriate waste disposal	Waste management - Waste management program consisting of reduction, reuse, and recycling of materials - Systematic collection and protected storage - Waste disposal at appropriate	Ditto	During operation of the Port	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					location - Hazardous waste shall be treated under the related regulations - Prohibition of dumping any contaminating materials				
4	Noise and Vibration	- Noise from Cargo handling activity at the port - Noise caused by vehicles used for mobilization of equipment and workers	- Noise standards - IFC guideline values for noise (General/2007)	- Mitigation of noise generated by the unloading activity	- Maintenance of equipment. - Installation of low noise type equipment - Optimizing unloading schedule	- Port facility	- During unloading activity	CPA	Expenses by CPA
5	Odor	- Domestic wastewater of workers	- Wastewater standards	- Prevention of generating odors	- Taking appropriate measures for handling general waste - Prohibit illegal waste disposal	- Port Area	- During the operation of power plant	CPA	Expenses by CPA
6	Soil	-Leakages of oil and chemical materials	- Ground water (Drinking water quality standards)	- Prevention of soil and water pollution in the surrounding area	Oil and chemical materials leakage - Storage of oil and chemical materials in an appropriate tank with retaining wall and method to prevent permeation into ground	Port Area	- During cargo unloading activity Movement of vehicles	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
7	Ecosystem	iii) Existence of endangered species iv) Spawning of sea turtles	i) & ii) - Bangladesh Wild Life Preservation (Amendment) Act, 1974 - JICA Guideline (2010)	i) & ii) - Protection of endangered species	iii) Existence of endangered species - Prohibit disturbance, harassment, and hunting, especially of the Spoon billed Sandpiper, by workers iv) Spawning of sea turtles - Turning off unnecessary lights during the nesting season - Using a smaller number or lower wattage of lights - Using red and yellow lights (as sea turtles are less affected by these colors) - Using low noise machinery	- Around the port facility	- During the operation of the Port	CPA	Expenses by CPA
8		i) Leakage oil from oil tanker ii) Wastewater from vessels will cause water pollution	i), ii) MARPOL 73/78 treaty ii) Wastewater from vessels International Convention for the control and management of Ships' Ballast Water and Sediments (BWM),	i), ii) Prevention of water pollution caused by vessels	i) Leakages of oil from oil tankers - Installation of oil fence ii) Wastewater from vessels - Prohibition of dumping any contaminated materials	i) & ii) - Port facility	i) & ii) - During unloading activity - During oil storage activity	CPA	Expenses by CPA/ Vessel owners

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
			2004		- Hire vessels compliant to MARPOL 73/78 treaty and BWM Any waste will be treated by the port facility				
9	Hydrology	- Potential impact to tidal currents caused by construction of the port facility	- Tidal currents	- Minimization of change of tidal currents	- Conducting tidal current simulation to assess any changes in tidal currents	- Sea area port facility	- During operation of the port facility	CPA	Expenses by CPA
10	Topography and Geology	- Potential impact on coastal line caused by changing tidal currents	- Coastal line	- Minimization of change of coastal line	- Conducting tidal current simulation to assess the change of drift sand movement	- Sea area around construction area for port facility	- During operation of the port facility	CPA	Expenses by CPA
10	Disturbance to poor classes	- Poor households among those who are to be resettled.	- JICA Guideline (2010)	- Consideration for burden on vulnerable groups	- Implementing “livelihood restoration program”, including job training programs to persons who want the training.	- At the site	- During operation	CPA and Environmental Consultant	Expenses by CPA
11	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Loss of existing livelihood, employment and business opportunities	- Income level, Number of employment opportunities for local residents and number of businesses around the construction area	- Maintaining or Improvement of the local economy - Maintaining or Improvement of living standards of local residents - Consideration to local residents’ feelings	- Employ local residents as much as possible - Use the services (i.e., laundry and catering services, etc.) and products offered by the local community. - Developing	- Villages near the site	- During operation	CPA and Environmental Consultant	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					“livelihood restoration program”, including job training programs to persons who want the training.				
12	Land Use and Utilization of Local Resources	- Changing traditional land use patterns and utilization of local resources	- Land Use Pattern - Use of Local Resources	- Mitigation of land use change and Prevention of local resource depletion	- Settlement of port workers shall be made in the organized manner.	- Villages near the site	- During the operation of port	CPA	Expenses by CPA
13	Disturbance to Water Usage, Water Rights, etc.	- Adverse impact due to water pollution	- Same as those addressed in “Water quality”	- Same as those addressed in “Water quality”	- Implement the same mitigation measures as those addressed in “Water quality”	- Port Area	- During the operation of port	CPA	Expenses by CPA
14	Disturbance to the Existing Social Infrastructure and Social Services	iii) Increase in the number of vessels iv) Traffic jams caused by increased vehicles	i) ii) - Interference to other tankers or barges -Interference with local transport	i) ii) - Minimize disturbance to the local peoples - Minimize increase of traffic volume	i) vessels - Setting water routes after consultation with related authorities. ii) Traffic volume - Minimizing traffic volume by using buses for employees	Sea area around port facility	- During unloading activity	CPA	Expenses by CPA
15	Unequal distribution of Benefits and Compensation	- It can occur among residents, workers, government officers and local politicians	- Perception of local residents	- Consideration to affected peoples’ emotions	- Developing an employment plan that is fair to every affected person	- Villages near the site	- During the operation of port	CPA	Expenses by CPA
16	Local	- Conflict between	- Change in local	- Consideration of	- Employ local	- Villages near	- During the	CPA	Expenses by

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
	Conflicts of Interest	local residents and workers	customs	the attitudes of local residents to the project	residents as much as possible - Promote communication between workers and local people (e.g., join in local events)	the site	operation of port		CPA - Hire local residence: 1,000Tk./person-day
17	Gender	- Unequal opportunity of employment	- Opportunity of employment	- Equal opportunity of employment	- Opportunity of employment shall be properly provided both for male and female	- Port Area	- During the operation of port	CPA	Expenses by CPA
18	Children's Rights	iii) Child labor iv) Improved access to education	i) Child labor ii) Access to education	iii) Banning child labor iv) Improved access to education	i) Child labor - Prohibit labor contracts between subcontractor and children - Patrolling periodically to check for any child labor ii) Improved access to education - Livelihood restoration program in LARAP shall be properly conducted	i), ii) - Port Area	i), ii) - During the operation of Port	CPA	Expenses by CPA
19	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during operation may increase risk of infection	- sanitation for local residents	- Consideration for sanitation for local residents	- Education and training on health care of workers	- Port Area	- During operation phase	CPA	Expenses by CPA
20	Work	iii) Labor	i) Labor accidents	i), ii)	i) Labor accidents	i), ii)	i), ii)	CPA	Expenses by

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
	Environment (Including Work Safety)	accidents iv) Diseases caused by air pollutants and noise by unloading activity	- Handling heavy loads - Working at heights ii) Environmental pollution - Ambient air quality standards - Noise standards - Waste management rules - IFC guideline values for ambient air quality and noise (General/ 2007)	Prevention of labor accidents and health problems	- Prepare a manual for labor accident prevention including safety education and training - Provide workers with appropriate protective equipment - Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads - Keep lifting devices well maintained and perform maintenance checks as appropriate ii) Environment pollution - Observe related standards and provide workers with appropriate equipment	Port facility	- During unloading activity		CPA
21	Accidents	- Traffic accidents	- Marine traffic	- Prevention of traffic accidents	- Consulting with related authorities on vessel schedules - Determining water routes after	- Sea area around port facility	- During unloading activity	CPA	Expenses by CPA

Sl. No.	Potential Impact to be Managed	Sources of Potential Impact	Standard of Impact	Objectives	Management Effort	Management Location	Period of Management	Responsible Authority	Cost
					consultation with related authorities - Setting course buoys around navigation channel area for marine safety - Informing operation schedule to local fishermen etc.				

CHAPTER-11 MONITORING PLAN

11.1 INTRODUCTION

Environmental management is a sustainable way of planning, arranging, supervising, organizing, and developing the environment for the maintenance of the preservation of natural resources and the prevention or reduction of damage to the environment. For this port development project an Environmental Monitoring Plan would be prepared to provide guidelines for environmental management plan during its construction and operation phases. The environmental aspects which are positively or negatively affected, or expected to be affected, by construction activity would be monitored in a prescribed monitoring format.

11.2 ENVIRONMENTAL MONITORING PLAN

Key environmental impacts, monitoring methods, responsible organizations, and expenses for each environmental item in the preconstruction, construction and operation phases for the power plant are listed in Table 11.2-1.

Table-11.2-1 Environmental Monitoring Plan of the Project

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
D. Preconstruction Phase									
6.	Land acquisition	v) Loss of private land vi) Loss of salt fields, shrimp farms and fishing sites vii) Loss of residential structures viii) Loss of trees and pond	i), ii), iii) & iv) - The Acquisition and Requisition of Immovable Property Ordinance of 2017 - JICA Guideline (2010)	i), ii), iii) & iv) - Confirmation of compensation process	i), ii), iii) & iv) - Attendance at compensation payment - Record of compensation agreements	i), ii), iii) & iv) - Areas eligible for compensation	i), ii), iii) & iv) - During land acquisition process	- Office of the Deputy Commissioner - CPA	Expenses by CPA - Witness: 8,500Tk./person/day
7.	Disturbance to poor people	iii) Poor households among those who are to be resettled iv) Loss of salt fields, shrimp farms and fishing sites	i), ii) - JICA Guideline (2010)	i), ii) - Same as those addressed in "Land acquisition"	i), ii) - Interviewing affected people	i), ii) - Affected people	i), ii) - Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses by CPA - Interviewer: 7,500Tk./ Person/day
8.	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	- Changing peoples` thinking through interacting with local government officers, local residents and others in the land acquisition procedure	-	- Confirmation of affected peoples` feelings	- Interviewing affected people	- Affected people	- Once a year	Implementation: Contractor/ Environmental Consultant Supervisor: CPA/Supervision Consultant	Expenses by CPA
9.	Misdistribution of Benefits and Compensation	- It can occur among residents, workers, government officers and local politicians	-	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Implementation: Contractor/Envir onmental Consultant - Supervisor: CPA/ Supervision consultant	Expenses by CPA

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
10.	Local Conflicts of Interest	- It can occur among residents, workers, government officers and local politicians	-	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	- Same as those addressed in "Land acquisition"	-Implementation: Contractor/ Environmental Consultant -Supervisor: CPA/ Supervision Consultant	Expenses by CPA
E. Construction Phase									
1.	Air Quality	iv) Dust resulting from construction work v) Exhaust gas from construction machinery and vehicles used for mobilization of equipment vi) Air pollution arising from incineration of construction materials and waste	i), ii) & iii) -PM₁₀ - Ambient Air Quality Standard - IFC guideline values for ambient air quality (General/ 2007) - Meteorological Condition (Temperature, Moisture, Wind)	i), ii) & iii) - Evaluation of effect of the mitigation measures towards air pollution	i), ii) & iii) - Collecting samples and analyzing at a lab - Measuring meteorological data	i), ii) & iii) - 2 points Residential area around the Port	i), ii) & iii) - Once every three months	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor Sampling: 50,000Tk./ sample Analyzing: 45,000Tk./ sample
2.	Water Quality (Soil) (Sediment)	v) Runoff water from construction area vi) Domestic wastewater of workers vii) Inappropriate disposal of waste viii) Leakages of oil and chemical materials from construction activity	i), ii) iii) & iv) pH, BOD, TSS, Oil, Coliforms, etc. - Wastewater standards - Ambient water quality standards (inland surface water) - Ground water (Drinking water quality standards)	i), ii) iii) & iv) - Evaluation of effect of the mitigation measures towards water pollution	i), ii) iii) & iv) - Collecting samples and analyzing at a lab	i), ii) iii) & iv) - 1 point: Foreside of the drain outlet - 1 point: Surface water near the construction area - 1 point: Ground water from existing wells - 4 points:	i), ii) iii) & iv) - Once every three months	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor Sampling: 50,000Tk./ sampling - Analyzing: 100,000Tk./ all sample

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
						Sea water near the construction area			
3.	Wastes (Odor) (Sediment)	iv) Construction waste from construction work v) Domestic waste from workers vi) Hazardous waste such as dry batteries, etc.	i), ii) & iii) - Waste Management Rules	i), ii) & iii) - Evaluation of effect of the mitigation measures for waste	i), ii) & iii) - Record of kinds and quantity of waste, and the disposal method	i), ii) & iii) - Construction area	1) - 4) - Continuous records	-Implementation: Contractor/ Environmental Consultant -Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
4.	Noise and Vibration	iii) Noise and vibration caused by construction machinery iv) Noise caused by vehicles used for mobilization of equipment and workers	i), ii) Noise level - Noise level standards - IFC guideline values for noise (General/ 2007)	i), ii) - Evaluation of effect of the mitigation measures towards noise levels	i), ii) - Measurement using noise level meter	i), ii) - 3 points: On the border of the site near the residential areas	i), ii) - Once every three months	-Implementation: Contractor/ Environmental Consultant -Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor - Measurement: 50,000Tk./ session
5.	Ecosystem (Endangered Species)	iii) Existence of endangered species iv) Spawning of sea turtles	i), ii) Species, Number - Bangladesh Wild Life Preservation (Amendment) Act, 1974 - JICA Guideline (2010)	iii) Evaluation of existence of endangered species iv) Evaluation of spawning of sea turtles	i), ii) - Observation	i) Endangered species - 1 point: Construction area ii) Sea turtle - 2 lines: Beach in front of the site and the sandbar	i) Endangered species - Bird: Once a week in migration season - Others: Twice a year in dry and rainy seasons ii) Every 3 days in spawning season	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor -Observation: 400,000Tk./ Researcher/year

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
	Ecosystem (Marine Biota)	iv) Potential impact due to the degradation of water quality caused by civil engineering work v) Domestic wastewater of workers vi) Inappropriate disposal of solid waste	i), ii) & iii) Species, Number - Phyto and Zoo Plankton - Benthos (Sea bottom)	i), ii) & iii) - Evaluation of effect of the mitigation measures towards water pollution - Confirming the population and change in types of marine organisms	i), ii) & iii) - Collecting samples at the site, analyzing at a lab	i), ii) & iii) - 4 points: Sea area in front of construction area	i), ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expenses included in contract cost by Contractor - Sampling & analyzing: 200,000Tk./season (Same as “water quality”)
	Ecosystem (Mud Flat, Fish & Nekton)	i), ii) & iii) Ditto	i), ii) & iii) Species, Number, Weight - Benthos (Mud flat) - Fish and Nekton	i), ii) & iii) Ditto	i), ii) & iii) - Collecting samples at the site, analyzing at a lab	i), ii) & iii) - 1 point: In front of the site	i), ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expense is included in contract cost by Contractor - Sampling & analyzing: 200,000Tk./season
6.	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Increase in employment and business opportunities	- Number of employment opportunities for local residents and number of businesses around the construction area	- Improvement of the local economy - Improvement of living standards of local residents - Consideration to local residents’ feelings	- Information from related institutions - Interviewing residents	- Related institutions - Villages near the site	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor - Interviewer: 5,500Tk./ researcher (Same as “Poor people”)

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
7.	Land Use and Utilization of Local Resources	- Changing the traditional land use patterns and utilization of local resources	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	- Same as those addressed in "Local Economy"	Implementation: Contractor/ Environmental Consultant -Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
8.	Disturbance to Existing Social Infrastructure and Services	iii) Increase in the number of vessels iv) Increase in the number of cars	i), ii) - Traffic volume by construction	i), ii) - Evaluation of effect of construction schedule	i), ii) - Record of numbers of vessels and cars being used	i), ii) - Project site	i), ii) - Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
9.	Local Conflicts of Interest	- Conflict between local residents and external workers	- Change in local customs	- Confirmation of the attitudes of local residents to the project	- Interviewing residents	- Villages near the site	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor - Interviewer: 7,500Tk./researcher (Same as "Poor People")
10.	Gender	iii) Gender among those who are to be resettled iv) Loss of salt fields, shrimp farms and fishing sites	i), ii)	i), ii) - Same as those outlined in "Poor people"	i), ii) - Same as those outlined in "Poor people"	i), ii) - Same as those outlined in "Poor people"	i), ii) - Same as those outlined in "Poor people"	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
11.	Children's Right	- Child labor	-	- Evaluation of effect of banning child labor	- Checking the labor contracts between subcontractor and workers - Patrolling construction area for child labor	- Construction area	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
12.	Infectious Diseases such as HIV/AIDS	- Temporary influx of migrant labor during construction may increase risk of infection	-	- Evaluation of sanitation for labor	- Labor health records	- Related institutions	- Once a year	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
13.	Work Environment (Including Work Safety)	- Labor accidents	- Handling heavy loads - Working at heights - Electric shock	- Evaluation of effect of the work safety plan	- Record of accidents	- Contractor's office	- Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor
14.	Accidents	- Traffic accidents	-Marine traffic -Land traffic	- Evaluation of effect of traffic schedules	- Record of accidents	- Contractor's office	- Continuous records	- Implementation: Contractor/Environmental Consultant - Supervisor: CPA/ Supervision Consultant	Expenses included in contract cost by Contractor

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
15.	Cross-boundary Impact and Climate Change	- CO ₂ will be produced by construction work	-	- Efforts to reduce CO ₂	- Record of machinery maintenance	- Contractor's office	- Continuous records	- Implementation: Contractor/ Environmental Consultant - Supervisor: CPA/Supervision Consultant	Expenses included in contract cost by Contractor
F. Operation Phase									
1.	Air Quality	iv) Exhaust gas from vehicles used for mobilization of equipment and workers v) Dust from cargo handling activity at jetty and yard vi) Exhaust gas from vessels	i), ii) & iii) SO₂, NO₂, PM₁₀ - Emission gas standards - Ambient air quality standards - IFC guideline values for gas emission and ambient air quality (General/ 2007) i), ii) & iii) Meteorological Condition (Temperature, Moisture, Wind) - MALPOL 73/78 treaty	i), ii) & iii) - Evaluation of effect of the mitigation measures towards air pollution	Set up CEMS (Continuous Emission Monitoring System) i), ii) & iii) - Collecting samples at the site, analyzing at a lab - Measuring the meteorological	Installation of CEMS at the gate of the Port. -2 points measurements: Residential area around the port	-Continuous measurement -two points measurements shall be once in every 3 months	- CPA/ Environmental Consultant	- CEMS (Expenses included in contract cost by Contractor) Expenses by CPA - Sampling: 50,000Tk./ staff - Analyzing: 45,000Tk./ sample
2.	Water Quality (Soil) (Sediment)	v) Dredging material for the maintenance of the navigation channel vi) Wastewater from port area vii) Leakages of oil and chemical materials viii) Wastewater from vessels will cause water pollution	i), ii) iii) & iv) Water temperature, TSS, pH, DO, SS, oil, BOD, COD, Heavy metals - Wastewater standards - IFC guideline values for wastewater - Ground water (Drinking water quality standards) iii) & iv)	i), ii) iii) & iv) - Evaluation of effect of the mitigation measure towards water pollution	i) Collecting samples at the site, analyzing at a lab temperature profile with CTD meter ii), iii) & iv) - Collecting samples at the site, analyzing at a lab - Continuous measurement using a sensor	- 4 points: Sea area around Dredging area and disposal of wastewater from the Port to the sea. - 2 points: One Ground water from existing well	- Once every 3 months for the sea water testing - Sampling and analyzing: SS, Oil, BOD, Heavy metal etc.(as necessary) - Continuous measurement:	- CPA/ Environmental Consultant	- Continuous sensor (Expenses included in contract cost by Contractor) and Expenses by CPA Sampling: 100,000Tk./ staff - Analyzing: 200,000Tk./sample

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
			- MALPOL 73/78 treaty iv) International Convention for the control and management of Ships' Ballast Water and Sediments (BWM), 2004 -Ground water (Drinking water quality standards)		- Record of vessels log - Record of oil leakages	inside the port and another ground water of the deep tube-well from the nearby residential area	pH - Drinking water quality measurement for the Ground water		
3.	Waste (Odor) (Sediment)	iii) Sewage and garbage from workers iv) Waste from vessels	i) & ii) - Waste management rules - MALPOL 73/78 treaty	i) & ii) - Evaluation of effect of the waste handling	i) Record of the amount garbage ii) Record of the amount of waste from vessels	- Port office	- Continuous record	- CPA/ Environmental Consultant	Expenses by CPA
4.	Noise and Vibration	iv) Noise and vibration from port generators, and pumps, etc. v) Noise caused by vehicles used for mobilization of equipment and workers vi) Noise from cargo handling activity at jetty and the port area	i), ii) & iii) Noise level -Noise standards -IFC guideline values for noise	i), ii) & iii) - Evaluation of effect of the mitigation measures towards noise levels	i), ii) & iii) - Measurement using noise level meter	i), ii) & iii) 3 points: On the border of the site near the residential area	i), ii) & iii) - Once every 3 months	- CPA/ Environmental Consultant	Expenses by CPA - Measurement: 100,000Tk./ season
5.	Ecosystem (Endangered Species)	iii) Existence of endangered species (migration bird) iv) Spawning of sea turtles	i) & ii) Species, Number - Bangladesh Wild Life Preservation (Amendment) Act, 1974 - JICA Guideline (2010)	iii) Evaluation of existence of endangered species (migration bird) iv) Evaluation of spawning of	i) & ii) - Observation	i) Endangered species (migration bird) - 1 point: Port Area ii) Sea turtles - 2 lines:	iii) Once a week in migration season iv) Every 3 days in spawning season	CPA/ Environmental Consultant	Expenses by CPA -Observation: 250,000Tk// researcher

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
				sea turtles		Beach in front of the port site and the sandbar			
	Ecosystem (Marine Biota)	iv) Potential impact due to the degradation of water quality caused by civil engineering works v) Domestic wastewater of workers vi) Inappropriate disposal of solid waste	i), ii) & iii) Species, Number - Phyto and Zoo Plankton - Benthos (sea bottom)	i), ii) & iii) -Evaluation of effect of the mitigation measure towards water pollution -Confirming the population and change in types of the marine organisms	i), ii) & iii) - Collecting samples at the site, analyzing at a lab	i), ii) & iii) - 4 points: Sea area in front of the site	i), ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expenses by CPA - Sampling & Analyzing: 400,000Tk./ all sample
	Ecosystem (Mud Flat, Fish & Nekton)	Ditto	i), ii) & iii) Species, Number, Weight -Benthos (mud flat) -Fish and nekton	i), ii) & iii) Ditto	i), ii) & iii) - Collecting samples at the site, analyzing at a lab	i), ii) & iii) -2 point: In front of the port site	i), ii) & iii) - Twice a year in dry and rainy seasons	Ditto	Expenses by CPA - Sampling & Analyzing: 350,000Tk./ all sample
6.	Disturbance to Poor People	- Improved road along with the power plant	-	- Evaluation of access to social services	- Information from related institutions - Interviewing residents	- Related institutions - Villages near the site	Once a year	- CPA/ Environmental Consultant	Expenses by CPGCBL - Interviewer: 7,500Tk./researcher

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
7.	Deterioration of Local Economy such as Losses of Employment and Means of Livelihood	- Increase in employment and business opportunities	-	- Evaluation of increase in employment and business opportunities	Ditto	Ditto	Ditto	- CPA/ Environmental Consultant	Expenses by CPA
8.	Land Use and Utilization of Local Resources	- Changing traditional land use patterns and utilization of local resources	-	- Confirmation of local residents' feelings	- Interviewing residents	- Villages near the site	- Once a year	- CPA/ Environmental Consultant	Expenses by CPA - Interviewer: 7,500Tk./researcher (Same as "Poor people")
9.	Disturbance to the Existing Social Infrastructure and Services	iii) Increase in the number of vessels iv) Increase in the number of cars	i), ii) - Traffic volume	i) & ii) - Evaluation of effect of traffic schedules	i), ii) - Record of numbers of vessels and vehicles being used	i) & ii) - Project site	i) & ii) Continuous records	- CPA/ Environmental Consultant	Expenses by CPA
10.	Misdistribution of Benefits and Compensation	- It can occur among residents, workers, government officers, and local politicians	-	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- CPA/ Environmental Consultant	Expenses by CPA
11.	Local Conflicts of Interest	- Conflict between local residents and workers	-	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- Same as those addressed in "Land use"	- CPA/ Environmental Consultant	Expenses by CPA

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Sl. No.	Significant Impact to be Monitored	Source of Significant Impact	Monitored Parameter	Purpose of the Monitoring	Monitoring Method			Responsible Authority	Monitoring Cost
					Method of Collecting and Analysing Data	Location	Duration and Frequency		
12.	Gender	iii) Loss of salt fields, shrimp farms and fishing sites iv) Improved road along with the power plant	-	i), ii) - Same as those addressed in "Poor people"	i), ii) - Same as those addressed in "Poor people"	i), ii) - Same as those addressed in "Poor people"	i), ii) - Same as those addressed in "Poor people"	- CPA/ Environmental Consultant	Expenses by CPA
13.	Children's Rights	iii) Child labor iv) Improved road along with the power plant	i) Child labor ii) -	iii) Evaluation of effect of banning child labor iv) Same as those addressed in "Poor people"	i) Child labor - Checking labor contracts between subcontractor and workers - Patrolling construction area for child labor ii) Same as those addressed in "Poor people"	iii) Working area iv) Same as those addressed in "Poor people"	ii) & ii) Once a year	- CPA/ Environmental Consultant	Expenses by CPA
14.	Work Environment (Including Work Safety)	- Labor accidents	- Labor accidents - Handling heavy loads - Working at heights - Electric shocks	- Evaluation of effect of the work safety plan	- Record of accidents	- Port area	- Continuous records	- CPA/ Environmental Consultant	Expenses by CPA
15.	Accidents	iii) Traffic accidents iv) Fire	i) Traffic accidents - Land traffic - Marine traffic ii) Fire - Record	i), ii) - Evaluation of effect of the work safety plan	i), ii) - Record of accidents and fire	i), ii) - Power plant	- Continuous records	- CPA/ Environmental Consultant	Expenses by CPA
16.	Cross-boundary Impact and Climate Change	- CO ₂ emissions	- Amount of CO ₂ emissions	- Efforts to reduce CO ₂	- Calculate the CO ₂ emissions from fuel consumption	- Port area and the vessels	- Once a year	- CPA/ Environmental Consultant	Expenses by CPA

CHAPTER-12 OCCUPATIONAL HEALTH AND SAFETY PLAN

12.1 OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational health and safety means preventing accidents and work related ill health. Improved health and safety management can bring significant benefits to the business. It reduces individual and human costs of accidents and ill health, direct and indirect cost to the business, improves customer perception and company profile and workers' morale. Under occupational health hazards, one can group several categories of working conditions impairing the health conditions of workers, though this impairment is slow. Safety relates more to health hazards that results from accidents and can cause instantaneous impairment of the workers' health.

12.1.1 General Requirements

In Bangladesh the main law related to occupational health and safety is Labor Law 2006. The law has provisions on occupational hygiene, occupational diseases, industrial accidents, protection of women and young persons in dangerous occupation. The salient features of the general requirements for the workers' health and safety stated in this law is presented in Table 12.1-1.

12.1.2 Workplace Environmental Quality

The proposed project has several phases' the construction of infrastructure and operation.

Health Hazards

The construction phase includes site preparation and port construction, access road construction etc. The health hazards associated with these activities are mainly due to dust and noise pollution. Excessive noise contributes to loss of hearing and triggers physiological and psychological body changes. Dust pollution can cause eye and respiratory irritation and in some cases allergic reactions. The inhalation of exhaust gases from vehicles and machinery are also harmful for health. Stress can be caused by working in shifts, high work load, poor living condition of workers etc.

Table 12.1-1 General requirement for workers' health and safety

Issue	Requirements
Health and Hygiene	<ul style="list-style-type: none"> - Cleanliness - Ventilation and temperature - Dust and fumes - Disposal of wastes and effluents - Overcrowding - Illumination - Latrines and urinals - Spittoons and dustbins
Safety	<ul style="list-style-type: none"> - Safety for building and equipment - Precautions in case of fire - Fencing of machinery - Floor, stair and passage way - Work on or near machinery in motion - Carrying of excessive weights
Compensation for accidents at work	<ul style="list-style-type: none"> - Owner's responsibility for compensation - Amount of compensation - Report on fatal accident and treatment - Compensation on contract and contract registration - Appeal
Dust and Fumes	<ul style="list-style-type: none"> - Any dust or fumes or other impurities likely to be injurious to the workers, effective measures shall be taken to prevent its accumulation and its inhalation by workers

Issue	Requirements
Overcrowding	<ul style="list-style-type: none"> - No work room in any factory shall be overcrowded - At least five hundred cubic feet of space shall be provided for every worker employed in a work room
Latrines and urinals	<ul style="list-style-type: none"> - Sufficient latrines and urinals shall be provided - Shall be maintained in clean and sanitary condition - Shall be adequately lighted and ventilated
Precautions in case of fire	<ul style="list-style-type: none"> - Shall be provided with means of escape in case of fire - Effective measures shall be taken to ensure that all the workers are familiar with the means of escape - Firefighting apparatus should be provide and maintained
First aid	<ul style="list-style-type: none"> - Provided and maintained first aid facility - One for every one hundred and fifty workers - Shall be kept with a responsible trained person who shall be available during the working hours - In every facility where five hundred or more workers are employed, a dispensary shall be provided and maintained
Disposal of wastes and effluents	<ul style="list-style-type: none"> - Provide with proper disposal system for solid waste and effluents. - In case of a factory where no public sewerage system exists, prior approval of the arrangements should be made for the disposal of wastes and effluents
Occupational and poisoning diseases	<p>16 occupational diseases notifiable to the Chief Inspector of Factories:</p> <p>1. lead poisoning 2. lead tetraethyl poisoning 3.phosphorous poisoning 4.mercury poisoning 5. manganese poisoning 6. Arsenicpoisoning7. poisoning by nitrous fume 8. carbon di sulfide poisoning9. benzene poisoning 10. chrome ulceration 11. Anthrax12.silicosis13. poisoning by halogens 14. Primary epitheliomatous cancer of the skin15. toxic anemia 16. Pathological manifestation due to radium or x-rays</p>
Compensation	<ul style="list-style-type: none"> - If personal injury is caused to workmen by accident arising in the course of employment, employer shall be liable to pay compensation - 36 occupational diseases for compensation payable - Monthly payment as compensation for temporary disablement are <ol style="list-style-type: none"> 1. Compensation should be paid for the period of disable mentor for one year whichever period is shorter 2. Such compensation shall be paid at the rate of full monthly wages for the first two months 3. Two thirds of the monthly wages for the next two months and at the rate of the half of the monthly wages for the subsequent months 4. In case of chronic occupational diseases , half of the monthly wages during the period of disablement for a maximum period of two years shall be paid

A quantification of the measure of severity in health hazards is not well defined. They are slow acting and cumulative, their effects may not be visible for years. During the project construction and operation phase, use of chemicals (paints, solvents, thinners etc.) batteries, welding materials, lubricants etc. may contribute to health hazards to the workers. These substances may be carcinogenic or detrimental in other ways. Use of industrial solvents can cause anemia, liver and kidney damage, cardiovascular diseases and neurological disorder.

Remedial Measures

To minimize the hazards arising from the activities at different phases of port project construction and operation, the following measures should be taken:

- employees should be informed of the potential health impacts they are facing;

- the employer should inform his employees of these potential hazards, arrange proper medical examination prior to and during employment, as well as tests and analyses necessary for the detection of diseases;
- works with volatile toxic chemicals should be undertaken in a well-ventilated place;
- laborers handling offensive toxic chemicals should be provided with and forced to use protective clothing;
- workers exposed to an excessive amount of noise should be provided with protective gear and be relieved frequently from their post;
- workers exposed to large amounts of dust should be provided with adequate protective gear;
- frequent spraying of water should be undertaken to minimize dust pollution;
- persons undertaking construction and installation works should have access to amenities for their welfare and personal hygiene needs such as sanitary toilets, potable drinking water, washing facilities, shelter sheds etc.;
- proper disposal of waste and sullage should be arranged;
- health education and information on hygiene should be provided to the workers;
- regular checks on food quality should be arranged within the work site.

Safety

Safety implies the reduction of risk of accidents at the work site. Accident prevention is more valuable than any mitigatory or compensatory measures. This may be achieved through strict rules and procedures for the execution of specific tasks, enforcement of the rules, and discipline amongst workers, maintenance of machineries used and by providing all necessary gear or equipment that may enhance the safety of the workers.

The following guidelines should be followed to maintain the safety of the workers:

- workers have to be informed about the possible damage or hazards related to their respective jobs
- if pedestrian, traffic or plant movements at or near the site are affected by construction works, the person with control of the construction project must ensure that these movements are safely managed so as to eliminate or otherwise to control any associated health and safety risks
- must ensure sufficient lighting in the area where a person performs construction work or may be required to pass through, including access ways and emergency exit or passage without risk to health and safety
- construction site needs to provide safe access to and egress from all places where they may be required to work or pass through. This includes the provision of emergency access and egress route that must be free from obstructions
- adequate perimeter fencing should be installed on the site before construction work commences and that should be maintained during the construction work and signs should be placed which is clearly visible from outside the site including emergency telephone numbers.
- must ensure that electrical installations materials, equipment and apparatus are designed, installed, used, maintained and tested to eliminate the risk of electrical shock, burns, fire or explosion.
- construction site should be kept orderly and tidy. Access ways should be kept clear of materials and debris and maintained in a non-slippery condition. Materials should be stored in an orderly manner so that it does not pose any risk to the health or safety of any person
- arrangements of first aid facility should be made accessible when construction work is being undertaken.

12.1.3 Hazardous Material Handling and Storage

During construction of the project, commercially available chemicals (paints, thinners, etc.) will be used and stored in the construction area. Hence small amount of unused or spent chemicals (used paints, motor oils) will be generated. Operation and maintenance of the project also may generate some hazardous wastes. However this is not often the case and the following set of storage guidelines should be adopted:

- the storage place must be sheltered from rain and other water sources and if possible , away from heat sources;
- the storage place must have a ground cover;
- the storage place must have an exhaust ventilation system in order to avoid gas accumulation;
- the storage place must have a restricted access and be identified as a hazardous material storing place;
- any other lead materials which may eventually arise, such as plumbing, should be conveniently packaged and stored in accordance with its characteristics.

12.1.4 Training

Training is an integral part of a preventive strategy. The target groups requiring training should be managers, supervisors, and technicians and related staff who may be exposed to risk at work. The following issues should be addressed in training of the managers, staff and workers:

- Workers should be trained to use the engineering controls where installed
- Arrange workplace consultation on noise control
- Workers should participate in training and contribute to the noise management strategy
- Employee representatives should represent the views of workers to management about occupational health and safety and report to workers about management policy
- Persons likely to be exposed to risks should be provided with information and instruction in safety procedures associated with the factory at the work place.
- Relevant health and safety information should be provided to persons involved in construction and operation of the factory.
- Information on emergency procedures relating to the factory should be displayed in a manner that can be readily observed by persons who may be affected.
- Training should be provided to use firefighting equipment when necessary.
- Facility staff needs to be trained in the safety procedures that are to be implemented during unloading, transfer and storage of hazardous materials.

12.1.5 Record Keeping and Reporting

Record keeping and reporting is one of the requirements of any QA/QC system and essentially of a good management tool. Properly maintained records of construction, installation, training, equipment maintenance, operation, fault detection and remedy can help in reducing risks of accidents, legal costs and thereby overall cost of operation of the project. Records also help in identifying causes of any accident and elimination of the same accident in future. Records may be maintained for the proposed port project as follows.

Port Construction

A person with control of a construction project or control of construction work should retain records for a reasonable period after the completion of the construction project of the occupational health and safety induction training and any other training given to persons directly engaged or trained by them to undertake construction work on the project.

Port Operation

During operation of the port, arrangements should be made to keep records on any relevant tests, maintenance, inspection and alteration of the factory, and make those records available to any employee or relevant health and safety representative.

Noise

Audiometric test records of employees should be kept during the employee's period of employment and longer as necessary, as they may provide a useful reference for workers' compensation. The records should be kept in a safe, secure place and held as confidential documents.

Hazardous Substances

Assessment reports which indicate a need for monitoring and/or health surveillance together with the results of monitoring and/or health surveillance shall be kept as records in a suitable form for at least 30 years from the date of the last entry made. Retention for a period of at least 30 years is necessary because some health effects, such as cancers, may take a long time to become evident. The information kept will be valuable in epidemiological studies and for developing effective control strategies.

All other records, including assessment reports not indicating a need for monitoring and/or health surveillance and records of induction and training, shall be maintained for at least five years in a suitable form.

12.2 CONTRACTOR REQUIREMENT

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

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

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

Occupational Health and Safety:

The Contractor shall-

- observe and maintain standards of Health and Safety towards all of his employees not less than those laid down by the national standards or statutory regulations.
- provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, the contractor shall provide belts, harnesses and lines. The “safety directives for work equipment” and “safety directives for protective gears”, as specified in the Occupational Health and Safety Guidelines shall be followed.
- provide and maintain in prominent and well-marked positions all necessary first-aid equipment, medical supplies and other related facilities. A sufficient number of trained personnel will be required to be available at all times to render first aid.
- provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced.

- report to the Engineer promptly and in writing particulars of any accident or unusual or unforeseen occurrences on the site, whether these are likely to affect progress of the work or not.

Disposal and Pollution:

The Contractor shall-

- not dispose any waste, rubbish or offensive matter in any place not approved by the Engineer or Statutory Authority having jurisdiction. The Contractor shall not discharge into any watercourse oil, solids, noxious or floating materials.
- take all reasonable precautions to keep public or private roads clean of any spillage or droppings from his vehicles or equipment. Any spillage or droppings, which accrue, shall be cleaned without delay to the satisfaction of the Engineer.
- provide waste bins/ cans for collection of solid waste at appropriate locations (as directed by the Engineer), and ensure proper transfer/disposal of solid waste.

12.3 CONCLUDING REMARKS

Apart from the services mentioned above, the Environmental Management Unit (EMU) must ensure that all staffs working within the port are care oriented, through orientation programs, about the do's and don'ts during emergencies as well as overall environmental aspects and issues related to port operations. It is however, to be emphasized that the emergency response plan (ERP) outlined in the Chapter-13 is to be used as guide only and that the Environmental Management Unit and the Emergency Response Cell shall develop their own environmental management system (EMS) following other international guidelines and standards.

CHAPTER-13 EMERGENCY RESPONSE/MANAGEMENT PLAN

13.1 INTRODUCTION

Emergency response plans are developed to address a range of plausible risk scenarios and emphasize the tasks required to respond to a physical event. The emergency response plan (ERP) for the proposed Port has been developed listing various actions to be performed in a very short period of time in a predetermined sequence if it is to deal effectively and efficiently with any emergency, major accident or natural disaster. The primary objective of the plan is to keep the loss of life, material, machinery/equipment damage, and impacts on the environment to minimum.

13.2 EMERGENCY RESPONSE CELL

It is highly recommended that an Emergency Response Cell (ERC) adequately equipped with highly trained manpower and appropriate gears is established within the factory complex in order to effectively implement the emergency response plan.

The main functions of the emergency response cell should include the following:

- Identification of various types of emergencies;
- Identification of groups, communities, and areas those are vulnerable to different kinds of emergencies;
- Preparing service teams for various operations within the organization through extensive training;
- Establishment of early detection system for emergencies;
- Developing reliable, instant information communication system;
- Mobilizing all units in the complex within a very short time to address any emergency.

13.3 EMERGENCY PREPAREDNESS

The ERC headed by a trained Manager should establish an Emergency Control Room with links to all building control rooms and all other services. The ERC shall work as a team of the following officials:

- Emergency Manager (Team Leader),
- Security and Safety Officer,
- Chief Medical Officer, and
- Public Relations Officer

The AGM, Planning and Implementation of the proposed Environmental Management Unit for the port with adequate skills of facing emergency situation can act as the Emergency Manager of ERC. The Emergency Manager (EM) shall have the privilege of shutting down of building or any other unit, which are affected or may further deteriorate damages, in case of an emergency.

The EM however, shall have to report to the GM (HSE) of such an event without any delay.

The team will be responsible for preparing and executing a specific emergency response plan for the port area. The team should meet at regular intervals to update the plan, based on port emergency data and changes in support agencies.

The team should undertake some trial runs, e.g. fire drill, in order to be fully prepared and to improve upon the communication links, response time, availability and workability of emergency gears and other critical factors.

Upon receiving information about an accident, the ERC team will assemble in the Emergency Control Room within the shortest possible time and formulate emergency control procedure.

13.4 FIRE FIGHTING SERVICES

- The Security and Safety officer will be the commanding officer of the firefighting services. The Security and Safety officer will head a fire fighting team of trained officers and workers. The size of the team should be determined by the port considering requirement of all Cargo Operations and Waterfront Industry within the port.
- Adequate firefighting equipment e.g. fire extinguishers of different types appropriate for different strategic locations must be planned according to requirements of Cargo Operations and Waterfront Industry.
- Depending on the scale of emergency, the firefighting team will work in close association with security and maintenance personnel of the port. Additional assistance may also be sought from outside fire stations when required.
- Preparedness is extremely important for efficient and effective firefighting services at the time of emergency. This can be better achieved by organizing fire drills at regular intervals, e.g. once every two weeks during dry summer months and once every two months during wet months involving all team members, all other service groups, all staff of the port, and utilizing all firefighting gears.

13.5 EMERGENCY MEDICAL SERVICES

- The Medical Officer will be responsible for providing medical services within the Port Area at the time of any emergency. The services should also be rendered to people living in the close vicinity of the complex and affected by any accident within the Port.
- The existing Medical Center of the Port must be equipped with adequate medical personnel and equipment for providing emergency services in addition to normal Medicare services to population of the complex.
- A team of well-trained Medical Officers specializing in burn injury, orthopedics, electrocution, chemical toxicity or poisoning, and shock treatment must be available at the port Medical Center. The number of officers may be determined considering the total number of staff and their family members in the complex. Special attention must be given to child injury treatment.

The following services must be on alert at all times in the factory complex.

- First aid services for attending patients on the spot. The Medical Center should provide training on first aid services to some designated staffs of important areas of operation, for immediate attention to the injured.
- Ambulance services for transport of casualties from spot to Medical Center of the factory, and from Medical Center to outside hospital, as necessary. Facilities for transportation of fatalities to appropriate hospital or to relatives or to the police following prescribed procedure should be available.
- All potential areas for emergency/accidents in the factory complex must have an information chart including contact phone numbers of relevant services.

13.6 RESCUE SERVICES

Without going for additional manpower, the rescue team can be formed with potential staffs of the port, e.g. from medical services, security services and firefighting services, for conducting rescue operations following an emergency. The Security and Safety Officer will be responsible for formulating rescue plan and guiding the team as well. Important functions include:

- Cut-off electricity, fuel or water supply to accident spots;
- Rescue people from debris of collapsed structures;
- Demolish damaged structures that may endanger human lives;
- Rescue people from fire areas with adequate protection;
- Assist other services promptly to save human lives;
- Salvage equipment from debris;
- Isolate damaged equipment or machineries that may endanger human lives; and
- Provide repair services as appropriate to restore operations.

13.7 SECURITY SERVICES

The port authority will have a strong independent security team headed by the Security and Safety Officer and will be responsible for the overall security of the factory complex, its equipment, machineries, buildings, utilities, and the community living within the complex. The security office shall maintain liaison with other emergency services at the time of emergency and during normal hours.

The Security and Safety Officer shall communicate with local police and other law enforcing agencies and seek assistance as may be needed during an emergency. In particular they will ensure that all roads are unobstructed during emergencies.

13.8 PUBLIC RELATIONS SERVICES

The Public Relations Officer (PRO) of the port authority will be responsible for communicating emergency related information to concerned officials within the factory complex. The PRO however, will consult the Emergency Manager before communication with outside agencies. The PRO will be responsible for warning people in and around the factory complex against potential fire hazards, or possible chemical contamination of water. The PRO will keep close contact with outside local community and provide direction, and participate along with management team in the welfare services for the affected communities.

CHAPTER 14 GRIEVANCE REDRESS MECHANISM

14.1 INTRODUCTION

Experience from past projects shows that project implementation is a complex process involving numerous interested and aggrieved parties giving rise to likely instances of conflict, allegations, etc. Most of the conflicts and allegations appear not to be of a serious nature but may snowball into a bigger issue if not given adequate attention from the beginning itself.

Some of the potential points that could give rise to grievances could be related to compensation payment, improper estimation of affected assets, failure to fulfil commitments, poor management of construction activities, inappropriate planning of vehicle movement, and cultural conflicts between migrant workers and local communities etc.

Therefore, it is imperative to have an internal mechanism in place where the aggrieved party/s can lodge their complaints and get it amicably settled prior to approaching the formal mode of solution available to them i.e. access to legal system through courts. In order to provide a formal forum to the aggrieved parties to deal with issues arising out of project, it is proposed that a joint grievance redress mechanism be instituted for both environmental and social related issues.

The proposed Grievance Redress mechanism (GRM) will be developed for the Project in order to settle as many disputes as possible through consultations. Such a mechanism is important as it is expected that most cases, if not all, would be resolved amicably; and the process, as a whole, will promote dispute settlement through mediation to reduce litigation. However, the options of legal recourse will not be restricted in any way by the project proponent.

14.2 OBJECTIVES OF GRIEVANCE REDRESS MECHANISM

The basic objective of the GRM shall be to provide an accessible mechanism to the affected people, community and any stakeholder(s) having stake in the project to raise their issues and grievances as well as concerns. The Grievance Redress Cell (GRC) shall be officially recognized “non-judicial” body that will seek to resolve non-judicial disputes arising out of various matters related to the implementation of the EMP, as well as other aspects of the project, as may deemed fit to be raised before the GRC.

The fundamental objective of GRM is to resolve any resettlement and environmental related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of the EMP. Another important objective is to democratize the development process at the local level and to establish accountability towards the stakeholders.

14.3 COMPOSITION OF GRC AND ULC

It is suggested to have two levels of grievance redress mechanism for the project, viz. Grievance redress Cell (GRC) at the project level and another at Union level committee (ULC). The aim of having two levels of grievance redress mechanism is to provide a higher forum to the aggrieved party, if the same is not satisfied with the decision of GRC.

GRC will be driven internally by Matarbari Port Authority and shall have the following representation to ensure fair and timely solution to the grievances:

- Community officer serving as grievance officer;
- Port Authority Environment and social officer
- Project management representative;
- CPA EHS representative;

The composition of ULC will have the following members:

- Dhalghata Union Parishad Chairman or his representative
- Project Manager of the Matarbari Port
- Environment and social officer of Matarbari Port
- Local elected Ward Member (s)
- Representative of affected people and women

The normal route to be followed for any grievance shall be GRC, and in case not satisfied then to ULC; however, the grievances can be directly taken to ULC too. The ULC shall be empowered to take a decision which is binding on CPA and considered final. However, the decision of ULC is not binding on aggrieved person; he or she can take the legal course if not satisfied with the outcome of GRC decision.

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.

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 social or 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.

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 concerned.

A grievance form is presented below and hard copies of both English and Bangla will be made available at the Port Authority project office.

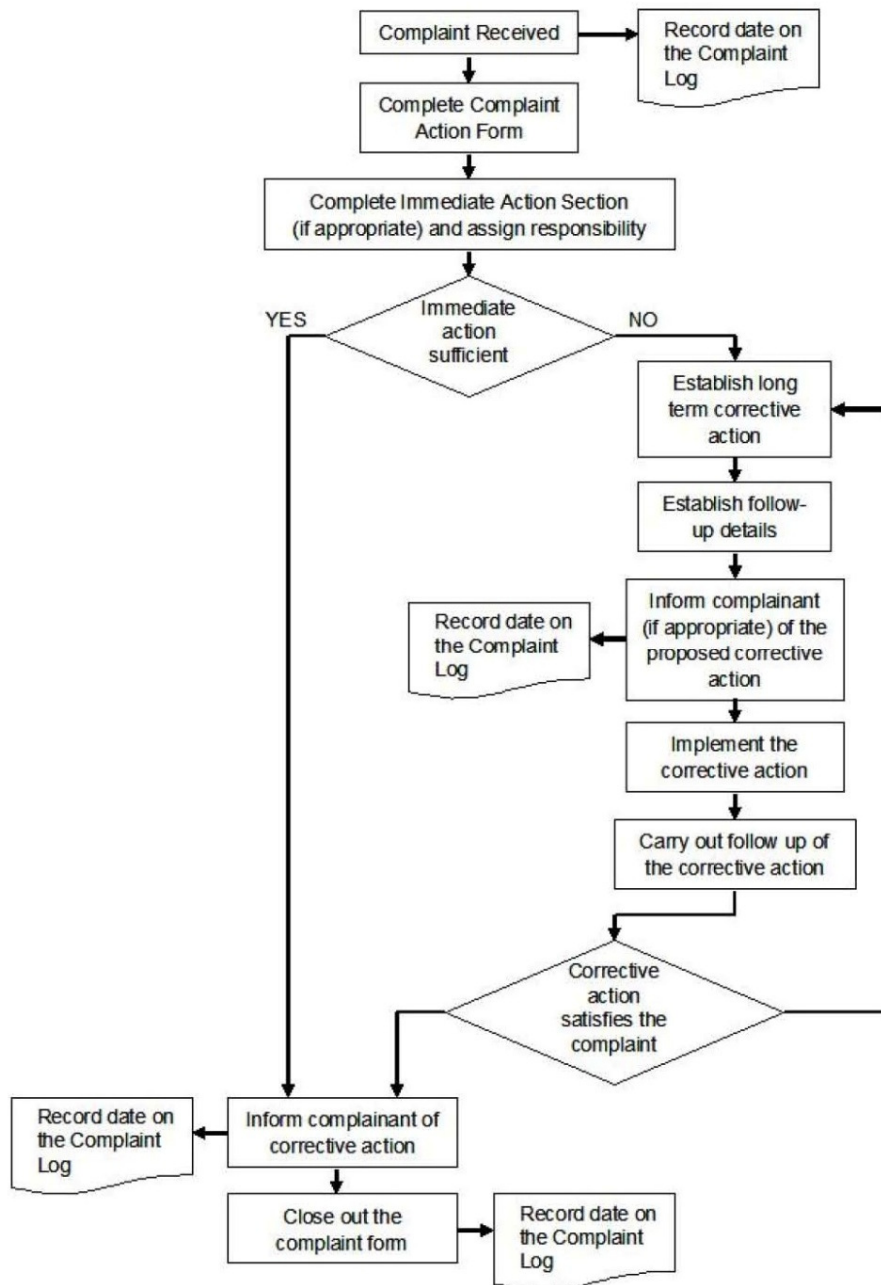


Figure 14.3-1 Flow Chart of Grievance Procedure

Table 14.3-1: Sample Grievance Reporting Form

Reference No.	Date:
Contact Details	Name
	Address
	Telephone Number/Cell Number:
	Email:
How would you prefer to be contacted? (please tick box)	<input type="checkbox"/> By Phone <input type="checkbox"/> By Email

Environmental Impact Assessment (EIA) (Port) for JICA Data Collection Survey on the Matarbari Port Development

Details of your Grievance: (Please describe the problems, how it happened, when , where, and how many times, as relevant)	
What is your suggested resolution for the grievance?	
Signature of complainant/ Thumb impression of complainant	Signature of person filling the form (CPA Representative)

CHAPTER-15 CONCLUSION AND RECOMMENDATION

15.1 CONCLUSION

The demand of international trade with Bangladesh is increasing every year. To satisfy the future international trade demand through enhancement of cargo handling capacity as well as to ease the congestion of Chittagong Port, the development of a deep sea port in the Chittagong region is a must. The deep sea port is really important to correspond to trend of increasing size of vessels and to facilitate trade with neighboring countries through securing ship water depth of 16m where big container vessel with 8,000TEU can navigate. In this connection, the “Data Collection Survey on the Matarbari Port Development in the People’s Republic of Bangladesh” has identified the suitable location for development of a deep sea port in the in the Matarbari Island. This EIA study for this port project is to understand the environmental aspects due to the project activities as well as to prescribe suitable EMP for its sustainability.

The EIA study has covered the construction and operational phases of the project. The detailed EIA of the proposed port was conducted following the guideline (GoB, 1997) of the Department of Environment (DoE) of GoB and the JICA guidelines.

In this study, the effects of the project activities on physico-chemical, ecological and socio-economic (i.e., human interest related) parameters during preconstruction, construction and operation phases have been assessed. The impacts have been identified, predicted and evaluated, and mitigation measures suggested for preconstruction, construction and operation phases of the proposed project. The important physico-chemical environmental parameters that are likely to be affected by the project activities include air quality and noise level.

The study suggests that most of the adverse impacts on the physico-chemical environment could be offset or minimized if the mitigation measures are adequately implemented. Noise level has been identified as a significant potential impact of the proposed port project during both the construction and operation phases. The project workers should not be exposed to the noise produced by the construction equipment for a prolonged period to prevent permanent hearing loss. A rotational work plan is advised for the workers and operators of this equipment.

The proposed project will be constructed within the acquired land. So a comprehensive land acquisition and resettlement action plan (LARAP) shall be prepared. Additionally, this area is an income generating area considering Salt/Shrimp cultivation. Therefore, people will be displaced and for them resettlement will be required for the construction of the port, and loss of income is associated with the proposed project.

During operation phase, no significant negative impact is anticipated on socioeconomic environmental parameters. Significant positive impacts are expected due to huge no of employment generation associated with the port activities. During public consultations carried out as a part of the EIA study, people welcomed the proposed project at their locality.

15.2 RECOMMENDATION

The environmental assessment carried out for the proposed port project suggests medium to minor scale of adverse impacts, which can be reduced to acceptable level through recommended mitigation measures as mentioned in the EMP. It is therefore recommended that the proposed port provided the suggested mitigation measures are adequately implemented. It is also recommended that the environmental monitoring plan be effectively implemented in order to identify any changes in the predicted impacts and take appropriate measures to offset any unexpected adverse effects.

Apart from risks associated with noise generation, solid waste, hazardous waste and wastewater disposal as a result of construction activities, the CPA may have certain degree of risk of accident and sometime loss of life. An emergency response plan (ERP) for the proposed project has been developed listing various

actions to be performed in a very short period of time in a predetermined sequence if it is to deal effectively and efficiently with any emergency, major accident or natural disaster.

It will be the obligation of the contractor to submit their Environmental Management Action Plan (EMAP) before commencement of work. The EMAP should specify all affected environmental values, all potential impacts on environmental values, mitigation strategies, relevant monitoring together with appropriate indicators and performance criteria, reporting requirements and, if an undesirable impact or unforeseen level of impact occurs, the appropriate corrective actions available.

REFERENCES

1. “Assessment of Environmental Impact of Port Development” United Nation, New York, 1992.
2. “Environmental Impact Assessment of Construction of Matarbari 600X2 MW Coal Fired Power Plant and Associated Facilities” report of CPGCBL Voulme1/2 year 2013.
3. Banglapedia (2003), ‘Banglapedia: National Encyclopedia of Bangladesh (Volume 1 to 10)’, Asiatic Society of Bangladesh, Dhaka, Bangladesh
4. BBS (2011), ‘Bangladesh Population Census 2011’, Bangladesh Bureau of Statistics, Dhaka, Bangladesh.
5. “Wildlife Management Plan of Sonadia Island (2016-17 to 2026-27)” Bangladesh Forest Department.
6. GoB (1997), Environmental Conservation Rules 1997, Department of Environment, Ministry of Environment and Forest, Government of the People’s Republic of Bangladesh, June 1997.
7. GoB (1997a), EA Guidelines for Industries, Department of Environment, Ministry of Environment and Forest, Government of the People’s Republic of Bangladesh, June 1997.
8. Bangladesh Meteorological Department (BMD), Dhaka.
9. BARC, Report 2005.
10. GoB (2005), SRO No. 220-Rule/2005, Revision of the Environment Conservation Rules 1997, Ministry of Environment and Forest, Government of the People’s Republic of Bangladesh, Dhaka.
11. IUCN Bangladesh (2002), Bio-ecological Zones of Bangladesh. The World Conservation Union, Bangladesh Country Office, Dhaka, Bangladesh. pp.139.
12. World Bank Group and IFC (2007), Environmental Health and Safety Guidelines, International Finance Corporation and the World Bank.
13. World Bank (1999a), Operational Manual–OP 4.01, The World Bank operation manual for environmental assessment, Washington.
14. Flood Action Plan (FAP)-3 of North Central Regional Study Report.
15. https://www.researchgate.net/profile/Md_Islam291/publication/320255051_Seaweed_Hypnea_sp_culture_in_Cox%27s_Bazar_coast_Bangladesh/links/59d79c5145851567c03b9d07/Seaweed-Hypnea-sp-culture-in-Coxs-Bazar-coast-Bangladesh.pdf

APPENDIX-A: DOE APPROVED TOR OF THE EIA STUDY

APPENDIX-B: AIR QUALITY MONITORING RESULT

APPENDIX-C: NOISE MONITORING RESULT OF THE PROJECT AREA

APPENDIX-D: TEST REPORT OF SEA BOTTOM SEDIMENT (HEAVY METALS)