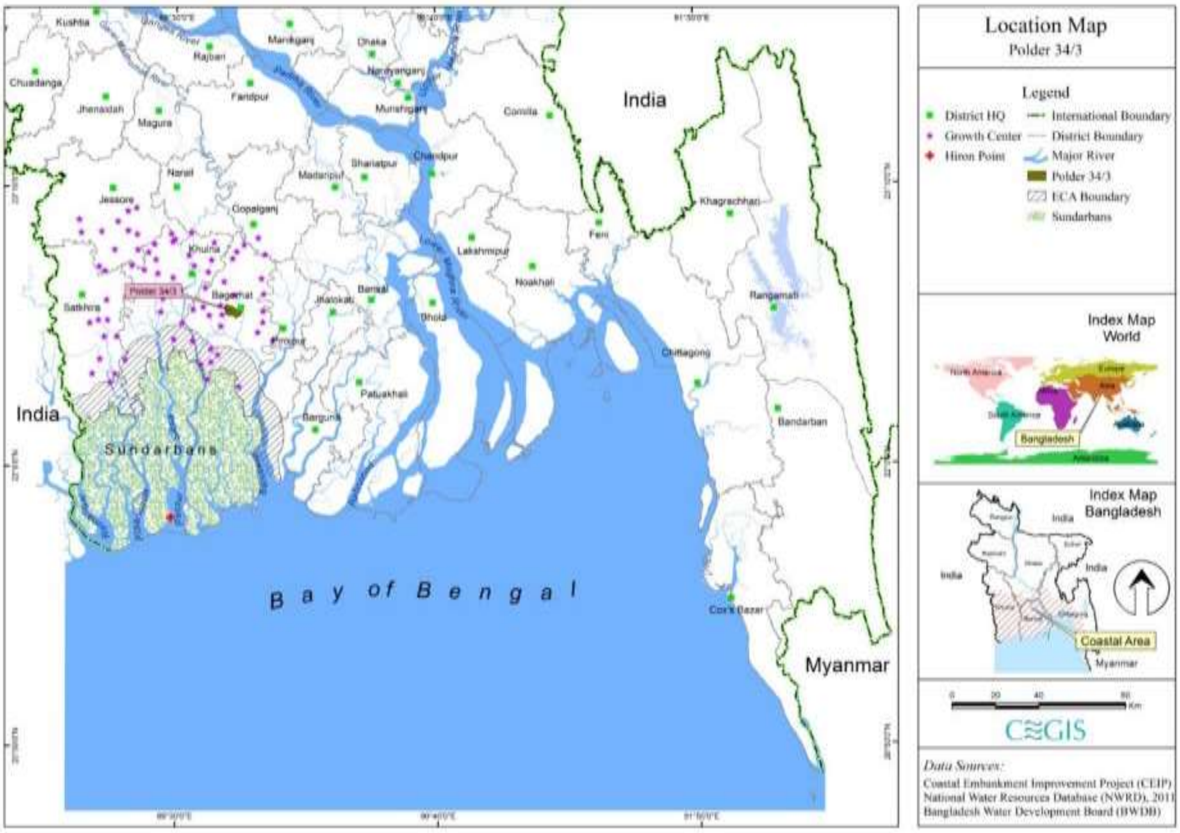
FINAL REPORT

Governmentof the People's Republic of Bangladesh
Ministry of Water Resources
Bangladesh Water Development Board

COASTAL EMBANKMENT IMPROVEMENT PROJECT
PHASE-1



PACKAGE-3

ENVIRONMENTAL IMPACT ASSESSMENT OF
POLDER 34/3

May, 2021

Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 880-2-8821570-72, 58817648-52, Fax: 880-2-8823128, 9855935

EIA Study Team

A multidisciplinary team from Center for Environmental and Geographic Information Services (CEGIS) conducted the EIA study for Rehabiliation of Polder 34/3. The study team comprised of the following professionals:

Sl. No.	Position	Incumbent
1	Water Resources Engineer/Team Leader	Mr. Md. Sarfaraz Wahed
2	River Morphologist	Mr. Pintu Kanungoe
3	Environmental Specialist	Mr. Kazi Kamrull Hassan
4	Socio-economist	Dr. Dilruba Ahmed
5	Soil & Agriculture Specialist	Dr. Anil Chandra Aich
6	Fishery Specialist	Dr. Ashraful Alam
7	Ecologist	Mr. Ashoke Kumar Das
8	GIS/RS Specialist	Ms. Pia Afreena Huq
9	Junior Professional (Water Resources Engineering)	Mr. Fahad Khan Khadim
10	Junior Professional (Morphology)	Mr. Sudipta Kumar Hore
11	Junior Professional (Fishery)	Mr. Md. Ashraful Alom
12	Junior Professional (Ecology)	Mr. Md. Sharif Hossain Sourav
13	Junior Professional (Forestry)	Mr. Md. Mizanur Rahman
14	Junior Professional (Sociology)	Mr. Mobasher Bin Ansari
15	GIS/RS Analyst	Mr. Md Saidur Rahman
16	GIS/RS Analyst	Mr. Hassan Imam Tawfique
17	Enumerator	Mr. Md. Azizur Rahman
18	Enumerator	Mr. Muhammad Shahidur Rahman

Acknowledgement

The Center for Environmental and Geographic Information Services (CEGIS) has been entrusted with the responsibility of conducting the “Environmental Impact Assessment (EIA) and Preparation of Environmental Management Plan” to Aid “Technical Feasibility Studies & Detailed Design for Coastal Embankment Improvement Programme (CEIP)” as a sub-consultant. CEGIS is indebted to the Detailed Design, Construction Supervision and Project Management Support Consultants (DDCS&PMSCs) of CEIP-1engaged by Bangladesh Water Development Board (BWDB) for assigning the task of conducting the environmental impact assessment study of coastal Polders.

The multi-disciplinary team formed by CEGIS for conducting the environmental and social baseline survey of the CEIP-1 remembers with gratitude the guidance and support it received from Mr. Dr. Md. Mizanur Rahman, Project Director and Mr. Md.Delwar Hossain and Mr. Md. Habibur Rahman earlier Project Directors, CEIP-1, BWDB and other officials of his office, while conducting the baseline survey on coastal Polder 34/3. CEGIS is thankful to DevConsultant Ltd.for their co-operation.

CEGIS is grateful to Mr. Harrie Laboyrie, Dr Gerard Pichel and Mr. Derk Jan (Dick) Kevelam Team Leaders and Mr. Habibur Rahman, Deputy Team Leader of CEIP-1 for their direction, guidance and support with necessary data and documents on Polder 34/3 to the EIA study team. CEGIS expresses humble gratitude to the World Bank for providing valuable comments and suggestions during the course of the study. CEGIS also thanks other staffs of CEIP-1 for providing relevant documents during preparation of this report.

CEGIS gratefully acknowledges the support received from the Chief Engineer of Southwestern Zone; Superintending Engineer, Khulna O & M Circle; and Executive Engineer, and other officials of BWDB, Bagerhat for providing necessary information and cooperation to the study team during field visits.

Last but not the least, successful completion of the EIA study of the CEIP-1 has been made possible with active participation of the community of Polder 34/3 during field survey and public consultation meetings.

Table of Content

List of Tables

List of Figures

List of Maps

List of Photographs

Abbreviations and Acronyms

ADB	Asian Development Bank
ASA	Association for Social Advancement
AP	Affected Person
BARC	Bangladesh Agriculture Research Council
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorology Department
BP	Bank Procedures
BRDB	Bangladesh Rural development Board
BRAC	Bangladesh Rural Advancement Centre
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CBD	Convention on Biological Diversity
CCP	Chittagong Coastal Plain
CDS	Coastal Development Strategy
CDP	Coastal Development Partner
CEGIS	Center for Environmental and Geographic Information Services
CEIP	Coastal Embankment Improvement Program
CEIP-1	Coastal Embankment Improvement Project, Phase 1
CERP	Coastal Embankment Rehabilitation Project
CES	Consulting Engineering Services
CAFOD	Catholic Fund for Overseas Development
CLAC	Central Land Allocation Committee
CMG	Canal Management Group
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DDCS&PMSC	Detailed Design Construction, Supervision and ProjectManagement Support Consultant
DCEO	Deputy Chief Extension Officer
DD	Deputy Director
DevCon	Dev Consultants Ltd
DFID	Department for International Development
DoE	Department of Environment
DPHE	Department of Public Health engineering
DPM	Design Planning & Management Consultants
DTW	Deep Tubewell
DWM	Directorate ofWater Management
EA	Environment Assessment
EAP	Environmental Action Plan
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
ECRRP	Emergency 2007 Cyclone Recovery and Restoration project
EDS	Environmental Data Sheet
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan

ES	Environmental Screening
ESBN	Estuarine Set Bag Net
ECSU	Environmental Social and Communication Unit
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FIDIC	International Federation of Consulting Engineers
FRSS	Fisheries Resources Survey System
FWIP	Future-with-Project
FWOP	Future-without-Project
GIS	Geographical Information System
GO	Government Organization
GRC	Grievance Redress Committee
GTPE	Ganges Tidal Plain East
GTPW	Ganges Tidal Plain West
ha	Hectare
HTW	Hand Tubewell
HYV	High Yielding Variety
IDA	International Development Association (World Bank)
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
ILO	International Labour Organization
IPMP	Integrated Pest Management Plan
IS	Institutional Survey
IUCN	International Union for Conservation of Nature
IWM	Institute of Water Modelling
JICA	Japan International Cooperation Agency
KCC	Khulna City Corporation
KII	Key Informant Interview
KJDRP	Khulna-Jessore Drainage Rehabilitation Project
LCB	Local Competitive Bidding
LCS	Landless Contracting Society
LLP	Low Lift Pump
LV	Local Variety
MC	Main Consultant (for CEIP-1 Feasibility study)
MDP	Meghna Deltaic Plain
MSDSDs	Material Safety Data Sheets
MOEF	Ministry of Environment and Forest
MOWR	Ministry of Water Resources
MoL	Ministry of Land
MP	Muriate of Potash
MSL	Mean Sea Level
NCA	Net Cultivated Area
NGO	Non-Governmental Organization
NOC	No Objection Certificate
NWRD	National Water Resources Database
O&M	Operation and Maintenance
OP	Operational Policies
PAP	Project Affected Person
PCM	Public Consultation Meeting
PCD	Project Concept Document
PID	Project Information Document

PIO	Project Implementation Office
PL	Post Larva (fish seed)
PRA	Participatory Rural Appraisal
PWD	Power Works Datum
PRSP	Poverty Reduction Strategy Paper
RCB	Reinforced Concrete Box
RRA	Rapid Rural Appraisal
SEA	Strategic Environmental Assessment
SEO	Secondary Education Office
SLR	Sea Level Rise
SMG	Sluice Management Group
SMRPF	Social Management & Resettlement Policy Framework
SO	Sectional Officer
SRDI	Soils Resources Development Institute
SSO	Social Service Office
STW	Shallow Tubewell
TAO	Thana Agriculture Officer
TDS	Total Dissolved Solids
TOR	Terms of Reference
TPV	Third Party Validation
TSP	Triple Superphosphate
UFO	Upazila Fisheries Office
UNDP	United Nations Development Program
VGD	Vulnerable Group Development
VGF	Vulnerable Group Feeding
WAO	Women Affairs Office
WARPO	Water Resources Planning Organization
WMIP	Water Management Improvement Project
WB	World Bank
WMO	Water Management Organization
WMG	Water Management Group
YDD	Youth Development Department

Glossary

Aila:	Major Cyclone, which hit Bangladesh coast on May 25, 2009
Aman:	Group of rice varieties grown in the monsoon season and harvested in the post-monsoon season. This is generally transplanted at the beginning of monsoon from July-August and harvested in November-Dec. Mostly rain-fed, supplemental irrigation needed in places during dry spell.
Arat:	Generally an office, a store or a warehouse in a market place from which Aratdar conducts his business.
Aratdar:	Main actor acting as a wholesaler or commission agent or covers both functions at the same time; carries out public auctions and is the main provider of credit in the marketing chain.
Aus:	Group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season. These are broadcasted/transplanted during March-April and harvested during -July-August. Generally rain-fed, irrigation needed for HYV T. Aus.
B Aus:	BroadcastAus
Bagda:	Shrimp (*Penaeus monodon),* brackish/slightly saline water species.
Baor:	Baor dead arm of a river in the Moribund Delta as in the case of the Ganges; also called oxbow lake. It appears as a saucer shaped depression. The term baor is synonymous to beel, familiar in the southwestern part of Bangladesh.
Bazaar:	Market
Beel:	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
Boro:	A group of rice varieties sown and transplanted in winter and harvested at the end of the pre-monsoon season. These are mostly HYV and fully irrigated, planted in December-January and harvested before the onset of monsoon in April- May.
Charland:	The chars, otherwise known also as charlands, are riverine lands located in the active river basins of the main rivers of Bangladesh. They are formed on the banks of the river and islands in the mid-stream of the main channel that are created by the continual shifting of these rivers and emerge from the deposition of sand and silt from upstream.
Golda:	Prawn *(Macrobrachium rosenbergii*), non-saline/fresh water species
Gher:	Farm lands converted into ponds with low dykes and used for cultivation of shrimp/prawn/fish.
Haor:	A back swamp or bowl-shaped depression located between the natural levees of rivers and comprises of a number of *beel*s.
Jhupri:	Very small shed for living, made of locally available materials. House used by very poor community members.
Kutcha:	A house made of locally available materials with earthen floor, commonly used in the rural areas.

Khal: A drainage channel usually small, sometimes man-made, through which the water flows. Thismay or may not be perennial.

Kharif: Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into kharif-1 (March-June) and kharif-2 (July-October).

Kutcha Toilet: The earthen simple pitunhygienic latrine consisting of a hole without cover.

Mahajan: Powerful intermediary in the value chain or traditional money lender.

Perennial Khal: Water available in the khal all year round.

Pucca: Well-constructed building using modern masonry materials.

Rabi: Dry agricultural crop growing season; mainly used for the cool winter season between November and February.

Ring Slab: The simple pit latrine consists of a hole in the ground (which may be wholly or partially lined) covered by a squatting slab or seat where the user defecates. The defecation hole may be provided with a cover or plug to prevent the entrance of flies or egress of odor while the pit is not being used.

Seasonal Khal: Water not available in the khal all year round.

Sidr: Major Cyclone, which hit Bangladesh coast on November 15, 2007.

Semi Pucca: A *house* that has fixed walls made up of pucca material

T. *Aman*: Transplanted Aman, generally grown between July and December

Upazila: Upazila is an administrative subdivision of a district.

Water sealed: A water sealed latrine is simply a pit latrine that has a water barrier to prevent odors. These latrines are simple pits dug in the ground in which human waste is deposited. A water sealed latrine has a bowl fixture that has a set amount of water retained in it. It is operated on the pour to flush system. These types of latrines can be connected to a septic tank system.

Units Conversion

1 m^2	= 10.77 ft^2
1 Decimal **(শতাংশ)**	= 435.60 ft^2
1 Decimal **(শতাংশ)**	= 40.47 m^2
1 Katha**(কাঠা)**	= 1.653 Decimal**(শতাংশ)**
1 Bigha**(বিঘা)**	= 33 Decimal**(শতাংশ)**
1 Bigha**(বিঘা)**	= 20 Katha **(কাঠা)**
1 Acre**(একর)**	= 3 Bigha **(বিঘা)**
1 Acre**(একর)**	= 60 Katha **(কাঠা)**
1 Acre**(একর)**	= 100 Decimal**(শতাংশ)**
1 Hectare**(হেক্টর)**	= 247 Decimal**(শতাংশ)**
1 Hectare**(হেক্টর)**	= 7.5 Bigha **(বিঘা)**
1 Hectare**(হেক্টর)**	= 2.47 Acre**(একর)**

Executive Summary

The Government of Bangladesh (GoB) has planned to implement the Coastal Embankment Improvement Project, Phase 1 (CEIP-1), under which 17Polders will be rehabilitated and improved in the coastal area of the country.The GoB has obtained financial assistance from the World Bank (WB) for this Project.In accordance with the national regulatory requirements and WB safeguard policies, the rehabilitation and improvement activities of 17 Polders will be implemented in three Packages. EIA and EMP study for Package-1 (Polders 32, 33, 35/1 and 35/3 and Package-2 (Polders 43/2C, 47/2, 48, 40/2, 41/1 and 39/2C) have already been done. Polders 14/1, 15, 16, 17/1, 17/2, 23 and 34/3 are included in Package-3. In Phase-1 of CEIP Package-3 could not be implemented which are decided to implement in the next phase.In accordance with the national regulatory requirements and WB safeguard policies, EIA and EMP studies of seven Polders under Package-3 have been carried out. This document presents the EIA report of Polder 34/3, which is one of these seven Polders of Package 3.It may be mentioned that preliminarily 17 Polders were selected for rehabilitation in the feasibility study considering physical conditions as well as damages to the Polders. Afterwards, these Polders were selected through screening matrix. Considering environmental point of view, multi-criteria analysis was conducted which has been mentioned in Strategic Environmental Assessment (SEA) report for CEIP-1. The implementation of this EIA of Polder 34/3 would be moved to a potential second phase of the Project together with additional polders under design. The source of financing for the second phase is not yet determined.The EIA will be updated ahead of starting of physical work of potential second phase as per requirement of change of situation with passage of time

Background

The coastal zone in southern Bangladesh adjoining the Bay of Bengal is characterized by a delicately balanced natural morphology of an evolving flat delta subject to very high tides and frequent cyclones coming in from the Bay of Bengal encountering very large sediment inflows from upstream. The coastal zone, in the past, in its natural state, used to face inundation by high tides, salinity intrusion, cyclonic storms and associated tidal surges. In 1960s, Polderization started in the coastal areas to convert this area into permanent agricultural lands. The Polders in this area are enclosed on all sides by dykes or embankments, separating the land from the main river system and offering protection against tidal floods, salinity intrusion and sedimentation. These Polders are equipped with in- and outlet sluice gates to control the water inside the embanked area.

The Polders were originally designed without proper attention to storm surges. However, recent cyclones caused substantial damage to the embankments, which threatened the overall integrity of the coastal Polders. In addition to breaching of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused coastal Polders to suffer from water logging**,** which led to large scale environmental, social and economic degradation.Poor maintenance and inadequate management of the Polders have also contributed to internal drainage congestion and heavy external siltation. As a result, soil fertility and good agriculture production in some areas are declining because of water logging and salinity increase inside the Polders.

The above reasons have led the Government to re-focus its strategy on the coastal area from not only to protect against high tides, but also to provide protection against frequent storm surges. The long-term objective of the Government is to increase the resilience of the entire coastal population to tidal flooding as well as other natural disasters by upgrading the entire embankment system. With an existing network of nearly 5,700 km long embankments in 139

Polders, the magnitude of such an initiative is daunting and requires prudent planning. Hence, a multi-phased approach of embankment improvement and rehabilitation is adopted over a period of 15 to 20 years. The proposed CEIP-1 is the first phase of this long-term programmatic approach. Location and Synopsis of Rehabilitation Work

Location and Synopsis of Rehabilitation Work The proposed Polder-34/3 is located in Bagerhat Sadar Upazila of Bagerhat district of Bangladesh. The administrative and management control lies with BWDB's Bagerhat O&M Division under the southern zone.

The Project aims to enhance protection against natural disasters, increase resilience during and after such disasters and improve agricultural production by reducing saline water intrusion. To meet the objectives of the CEIP-1, the key improvement works to be carried out in Polder 34/3 under CEIP-1are: re-sectioning of embankment (16.75 km); construction (replacing) of 3 number of drainage sluices; construction (replacing) of 1 (one) flushing sluice; repair of 5 flushing sluices and re-excavation of drainage channels (9 km), and afforestation of (12.48 km); other components of the CEIP-1include implementation of a social action plan and an environmental management plan (EMP); supervision, monitoring and evaluation of project impacts; project management, technical assistance, trainings, and technical studies; and contingent emergency response.

The Bangladesh Water Development Board (BWDB) is the implementing agency of this Project. After implementation of the proposed interventions, local stakeholders' participation in the development and maintenance of this Polder will be ensured. A three tier organizational structure comprising of Water Management Groups (WMG) at the lowest level, Water Management Associations (WMA) at the mid and Water Management Federation (WMF) at the apex will be formed. The combination of groups, associations and federations in a particular sub-project is together termed as the Water Management Organization (WMO). Moreover, Community Based Organizationsoften termed as CBOs can also play a vital role in maintenance activities. CBOs include ES (Embankment Settler); EMG (Embankment Maintenance Group); LCS (Landless Contracting Society); and CMG (Canal Maintenance Group).

Regulatory and Policy Framework

The construction, reconstruction, expansion of Polders and flood control embankment is categorized as Red[1] in accordance with the DoE's classification and according to the World Bank safeguard policies, the project has been classified as Category A[2] The Environmental Impact Assessment (EIA) study has been conducted andan Environmental Management Plan (EMP) and Resettlement Action Plan (RAP) have been prepared as per GoB regulations and World Bank Policies.

Proposed Rehabilitation Plan

The proposed interventions in Polder 34/3 under CEIP-1 are listed in the following table.

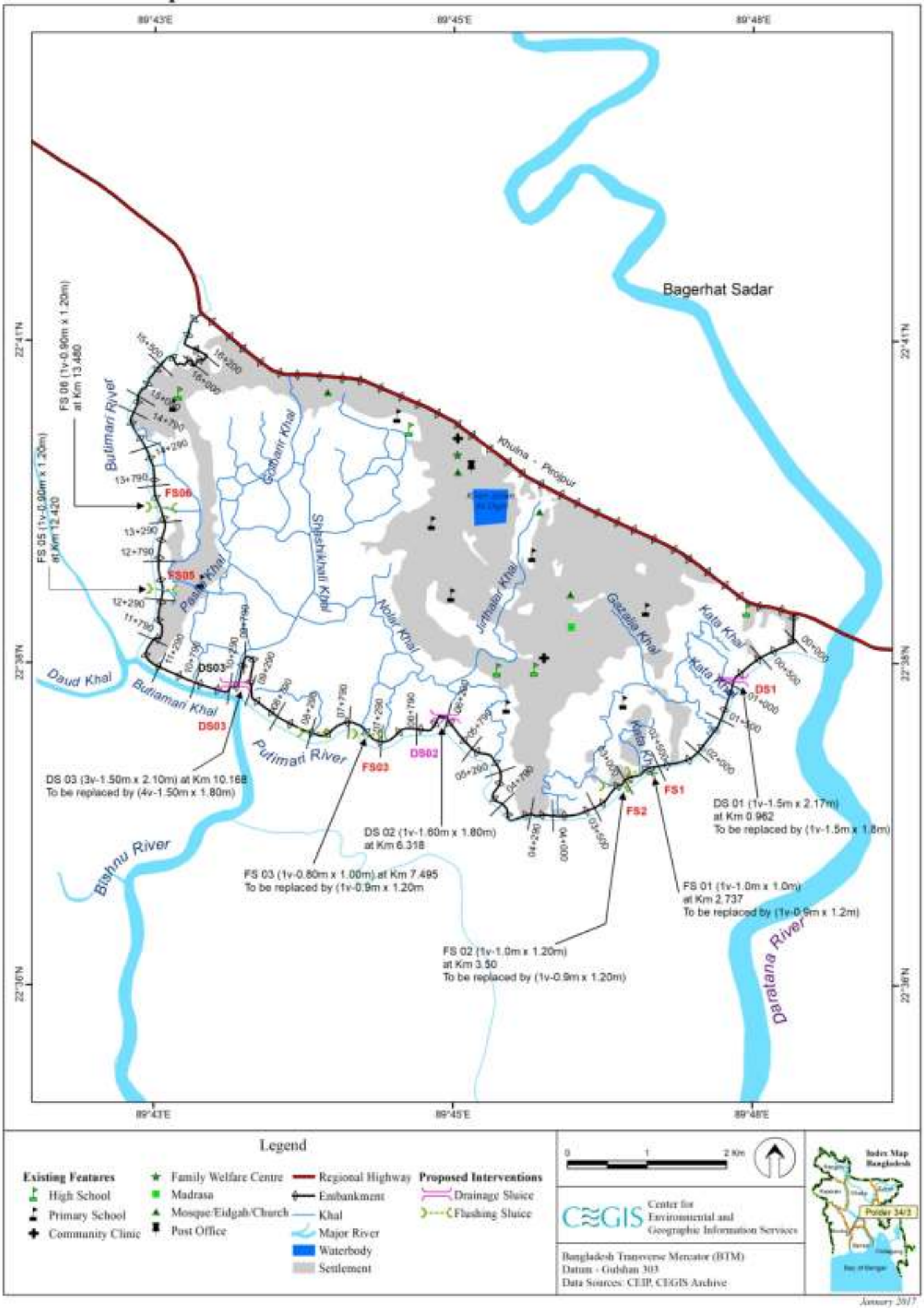
[1]Red category denotes projects (or industries) with severe/irreversible environmental impacts

[2](Projects, those are considered to be high risk, likely to have significant avderse environmental impacts that are sensitive, diverse or unprecedented requiring full EIA).

Type of Work	Length	Description of activities/works
Re-sectioning of embankment	16.75 km	Strengthening, widening and raising of existing embankment. The work will be executed from Ch 0+000 to 16+750
Construction of drainage sluices	03 nos.	Three new drainage sluices will be constructed at different locations to drain out excess rain water under the proposed rehabilitation plan.
Construction of flushing sluices	1 no.	The structure has been fully damaged and approach embankment washed away during AILA. However, one will be constructed with new design specifications.
Re-excavation of drainage channels	9 km	Three (03) drainage channels with a total length of 9 km will be re-excavated to ease water flow and reduce drainage congestion.
Afforestation	7 ha	Afforestation will be implemented within the Polder to ensure the environmental sustainability as well as protection of embankment from erosion and tidal action.

Designed crest level of embankment 4.50m PWD which has been assessd through mathmetical modeling concedering storm surge level and monsoon water level for 25-year return period under climate change scenarios. Side slope of embankment will be R/S 1:3 and C/S 1:2 respectively.

Location of Proposed Interventions: Polder 34/3



Technical and nontechnical manpower will be required for the construction works. Tentively, 294 manpower will be required during construction period of which 78 is skilled and 220 (including local and outside) is non-skilled/labour manpower.The skilled manpower will include senior professionals, Engineers, Technicians, Supervisors, Surveyors, Mechanics, Foremen, Machinery operators, Drivers mainly. A construction camp will be constructed inside the polder. It is mentoined here that labor sheds/camps will be constructed for house workers (skilled labour). There would be no requirement of labour camp for un-skilled labour because they will be recruited from the local area. But temporary labour camp for local labour during preparing of CC block will be established.

Environmental Baseline Conditions

Polder-34/3 lies in the flat agro-ecological zone of the Ganges Tidal Floodplain in the southwestern region of Bangladesh. The soil texture varies from clay to clay loam. Clay contains 90% of the total soil texture. There are two types (high and medium high) of land in the Polder areas. Around 28% and 72% of the net cultivable area falls under high land and medium high land, respectively.

Polder- 34/3 was significantly damaged due to cyclone and storm surges in 2007 (Sidr) and 2009 (Aila), which created water resource related problems like saline intrusion, drainage congestion, sedimentation and shortage of irrigation water and flooding. Many segments of the embankment in different places were damaged during Sidr and to a lesser extent by Aila mostly by overtopping of the embankment, severe wave action and river erosion. The outfalls of the Putimari and Butiamari Rivers has been silted up to a large extent . The internal drainage channels and peripheral rivers have also silted up due to lack of maintenance for a long time. Approximately 70% of the lands are affected by drainage congestion and these drainage problems mostly affect the agricultursector. All the existing drainage sluices and flushing inlets are in a very deplorable conditions, unable to prevent saline water intrusion.

The Polder area coversthree Agro-ecological zones i.e.,Saline Tidal Floodplain, Gopalgonj/ Khulna peat lands and Ganges Floodplain.This area contains different landforms as well as different ecosystems such as agricultural land, settlements, road/ Social forest, ponds, gher, khals, ditches, rivers, etc. .As the Polder is located in the vicinity of theBagerhat town, urban and rural homestead vegetation is found in this area. Most of the rural homestead vegetation consists of fruit yielding plants, timber trees and medicinal plants likeNarikel/Coconut,Kola/Banana,Safeda/ Sapodilla, Payra/Guava but urban homestead vegetation consists of mainly exotic timber trees, as Akashmoni/*Acacia auriculiformis*.Betel leaf gardens in the Polder area are mostly grown besides the homestead premises.A number of saline tolerant aquatic/ mangrove floral species are observed on the torus and along riverside toe of the embankment, khal and rivers.Mammals include Common House Rat (*Rattus rattus),* Field Mouse *(Mus booduga),* Grey Musk Shrew (*Suncus murinus),* Flying Fox (*Pteropus giganteus),* Jungle Cat (*Felis chaus),* Common Mongoose (*Herpestes edwardsii),* Large Indian Civet *(Viverra zibetha).Among them* Common Mongoose and Large Indian Civet are locally uncommon.Unplanned Gher/ shrimp farming activities results in increased salinity and creating continuous pressure to floral (fresh water) and faunal biodiversity as well as total ecosystem of the Polder area.

Fish habitats of the Polder area are mainly classified into capture fisheries and culture fisheries. In this Polder, capture fisheries habitat includes internal khals (canal) and culture fisheries include ponds, ditches and ghers.. The fish habitats in the Polder cover an area of1,373ha of which only 3.13% is open water,considered as capture fisheries habitat. Major Khals are connected with the external river and act as major routes of fish migration into the Polder area for breeding, feeding and nursing. The internal khals also act as breeding/spawning area of the small, indigenous fish species.About 1,199 ha are culture fish habitats, of which commercially cultured ghersare dominant. Carp poly-culture and traditional aquaculture are practiced in homestead ponds while Bagda (Shrimp) culture is mainly practised in ghers. However, fresh water fin fishes (Carp, Tilapia, etc.) are also cultured in the ghers during the monsoon along with fresh water giant prawn (Golda). Brackish water fishes (Tengra, Parshe and Bhetki) are also cultured in the ghers.

Total cropped area is 4,222 ha of which rice area occupies3,073 ha and the rest 1,169 ha is covered by non-rice crops. Among the rice crops Local T. Aus, Local T. Aman, HYV T. Aman and HYV Boro are grown in about 3%, 51%, 37% and 9% respectively of total rice area in the Polder. Total crop production is 16,811 metric tons of which rice production is 7,161 metric tons and non-rice production is 9,650 metric tons. Among the rice crops, the contributions of Local T. Aus, Local T. Aman, HYV T. Aman and HYV Boroare about 2%, 48%, 39% and 11% respectively.

The population of the Polderareais about 26,980 of which 13,691are males and 13,289 females with a population density of 1,022 persons per sq km. The estimated total household number is 6,370 and the average household size is 4.4.The total dependency ratio is about 54 in which child dependency ratio is 45 and age dependency ratio is 9. The average literacy rate is 64%, with males 66% literate and females 62% which is comparatively higher than the national scenario of the country. Health facility of the Polder is moderate because it is situated in Bagerhat Sadar Paurashava. Agriculture is the main occupation in the Polder area followed by fishing and agriculture labor. Out of the total populations only 15% are economically active ofwhich about 39% are employed, around37% engaged in household work and nearly23% people do not work. Standard of living of the area is comparatively high than the other Polders. Historical architectural sites like Shat Gambuj mosque, the mausoleum of Khan Jahan Ali, the mosques of Singair, Bibi Begni, Nine dome mosques and the mausoleum of Zindapir are situated in the Polder area.

The Polder is vulnerable to natural disaster notably with cyclonic storm, storm surges, tidal flooding, heavy rainfall, etc. In some areas, embankments are vulnerable to be eroded within short time. Tidal flood water enters into the Polder as there are no functional gates in any of the drainage and flushing sluices. This water if coincided with heavy rain water, in turn, makes drainage congestion that eventually floods internal road networks, homesteads, playground and educational institutions. Being a coastal area, cyclonic storm is very common in the study area. Substantial aftermath took place with severe cyclonic storm namely Sidr; of which, human and non-human asset loss is mentionable.

Potential Impacts and their Mitigations

Impacts during Pre-construction phase

The potential environmental and social impacts associated with the **pre-construction phase** of the project include deterioration of environmental quality from , land use change, and increased vehicular traffic mobilization as follows: **Important Environmental Components (IECs)**	**Potential Impacts**	**Mitigation Measures**
	Pre-construction Phase	
Environmental Quality (Air and Noise)	Establishment and construction of site facilities in the Polder may potentially cause noise generation. In addition, noise level around the construction sites and in settlement areas will be increased for mobilization of equipment, machineries, construction materials and manpower. Besides, the ambient air quality around the construction site and nearby areas due to exhaust emission from truck/trawler/engine boats containing particulate matter and other ingredients. Fugitive dust emissions from the material stockyards would also deteriorate the ambient air quality of the locality.	• Construction material (sand) should be covered while transporting and stock piled. • The contractors need to be cautious to avoid unnecessary honking of material carrying vehicles, particularly near sensitive areas like schools. • The contractors should be encouraged to move all construction equipment, machineries and materials during day time instead of night, avoiding the rush hours. • Stockyard should be covered during non-working period. • Exhaust emissions from vehicles and equipment should comply with DOE standards. • Vehicles, generators, and equipment should be properly tuned. • Water should be sprinkled where needed to suppress dust emissions. • Speed limits should be enforced for vehicles on earthen tracks. • Vehicles and machinery should have proper mufflers and silencers.
Vegetation	Preparation of construction sites, labor sheds and material stock yards is expected to damage vegetation where the land will be used for these purposes (Details will be illustrated after getting RAP Report).	• Habitat will be restored by planting trees, grasses at the damaged sites after completion of construction works

The potential environmental and social impacts associated with the **pre-construction phase** of the project include deterioration of environmental quality from , land use change, and increased vehicular traffic mobilization as follows: **Important Environmental Components (IECs)**	**Potential Impacts**	**Mitigation Measures**
Land use change	Land would be needed to establish temporary facilities including construction camp i.e labor shed and borrow pit areas. It is estimated that four labor sheds would be constructed to established temporary facilities for the rehabilitation works. Therefore, land use will be changed temporary.	• Establish the construction camps within the area owned by BWDB, wherever available. • Compensation/rent are to be paid if private property is acquired on temporary basis, the instructions should be specified in the tender document. • Construct labor shed/camp at government khas land. • Any areas used for borrow pits in the foreshore should be away from sensitive areas such as mangrove vegetation, known fish spawning ground, habitat for any endangered flora /fauna species.
Increased vehicular traffic during mobilization	During contractor mobilization, equipment, machinery, material, and manpower will be transported to the Polder resulting in additional traffic on roads and waterways. This traffic may potentially cause traffic congestion particularly at roads and jetties. Moreover, most of the schools are located near the embankment and three important *Bazars* are also located besides the embankment. These will face traffic congestion during *Haat* time. Earth work for re-sectioning of embankment and vehicles movement also may create short term disturbances to the polder inhabitants.	• The contractor should prepare a traffic management plan (TMP) and obtain approval from the DDCS&PMS Consultant. • Contractor should also implement mobilization plan considering water vessels and launch movement in the external rivers and avoid the launch movement time. • The TMP should be shared with the communities and should be finalized after obtaining their consent. • Ensure minimal hindrance to local communities and commuters. • The works on embankment should be carefully scheduled to minimize impact on local markets and transportation routes.

The potential environmental and social impacts associated with the **pre-construction phase** of the project include deterioration of environmental quality from , land use change, and increased vehicular traffic mobilization as follows: **Important Environmental Components (IECs)**	**Potential Impacts**	**Mitigation Measures**
		• The embankment works should be carried out in segments and soil will be placed linearly on half of the embankment, leaving the other half to be used as track. • The works of the first half should be completed, and then of the other half should be undertaken. • Work schedule to be finalized in coordination and consultation with local representatives and communities, specifically the Union Parishad members of the Polder. • Local routes will not be blocked as much as possible. If unavoidable, alternative routes will be identified in consultation with local community. • Vehicular traffic should be limited in the Polder area and the embankment during off peak time. To avoid accident, signal man should be appointed during School time (10:00am to 13:00pm) and weekly marketdays (Hatbar) • Keep provision of training on vehicular traffic moving pattern and management system for the local stakeholders using multimedia presentation and showing video at different common population gathering places in the Polder area. a.

Impacts during construction phase

The potential impacts during the construction phase include noise and vibration, air pollution, noise pollution, degradation of landscape, , loss of agriculture, damage to fish and other aquatic fauna, impediments to land traffic and navigation, and safety & health hazards as follows.

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
Noise and Vibration	The construction activities particularly demolition of existing water control structures, excavation, compaction, operation of construction machinery and vehicular traffic will generate noise and vibration which are likely to affect the nearby communities. The sensitive receptors including seven schools which are located close to the embankment (within 500m) are likely to be more severely affected by noise.	• Demolition of the regulators should not be carried out during school time (8 am to 1 pm) particularly near the schools; • Restricting/limiting construction activities during day time; • Noise levels from vehicles, equipment and machinery to comply with the national and WB noise standards; • Vehicles and machinery should have proper mufflers and silencers; • Provision of noise barriers at schools and other sensitive receptors, as needed; • Provision of PPE (ear muffs and plugs) to labor; • The construction crew should be instructed to use proper equipment, to minimize noise levels; • Camps should have to be located at safe distances from communities
Air Quality	Construction machinery and Project vehicles will release exhaust emissions, containing carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM).These emissions can deteriorate the ambient air quality in the immediate vicinity of the Project sites (particularly along the embankment, and around the channel excavation sites and borrow pit areas). Furthermore, construction activities such as excavation, levelling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions.	• Exhaust emissions from vehicles and equipment should comply with standards. • Proper tuning of vehicles, generators and equipment should be carried out, to minimize exhaust emissions. • Construction materials (sand/soil) should be kept covered while transporting and stock piled. • Regular water sprinkling should be carried out as and where needed, particularly on the earthen tracks near communities. • Vehicle speed should be low (15 km per hour) on earthen tracks particularly near communities and school. • Vehicles and other machinery should be turned off when idle • Good quality fuel should be used for minimizing exhaust emissions. • Camps should be located at safe distance from communities and schools.

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
Water Quality	Construction materials, demolition debris, fuel from construction machineries (piling machine, pump etc.) may degrade the water quality. The construction workers will generate domestic solid waste and waste water including sewage. The contractor's workshops will generate oily water, waste oils, oily rags, and other similar wastes. The stores and warehouse will generate solid waste such as empty cement bags, cardboards, and wooden crates. Improper disposal of these waste streams can potentially contaminate the water resources of the area. Water contamination can potentially have negative impacts on the local community, natural vegetation, agriculture, and biological resources of the area including aquatic flora and fauna.	• Prepare and implement pollution control plan; • Workshops should have oil separators/sumps to avoid release of oily water; • Avoid repairing of vehicles and machinery in the field; • Use plastic sheet or gravel in the workshop and equipment yard to prevent soil and water contamination; • Dispose contaminated soil appropriately ensuring that it does not contaminate water bodies or affect drinking water sources; • Contractor should ensure that there is no leakage, spillage or release of fuel, oil or any other affluent/waste on the ground or in the water from its construction machinery, vehicles, boats, launches, and barges. Contractor should regularly monitor the condition of its fleet; • Material borrowed from the river banks should be carried out sufficiently away from the water edge, minimizing the possibility of loosing soil and wash out in the river; • Contractor should locate camps far away from communities and drinking water sources; • Prepare and implement camp waste management plan (septic tanks, proper solid waste disposal); • Release treated wastes on ground or in water; • Recycle spoil and excavated material where possible; • Dispose spoil at designated areas with community consent; and • Construction material, demolished debris and excavated soil/silt should not be allowed to enter the water bodies.
Drainage Congestion	The Project activities particularly on drainage sluices and in water channels may block or clog the drainage channels, potentially causing drainage congestion in the surrounding areas and negatively affecting the cultivation and the associated communities. The project works on the drainage sluices are likely to worsen the situation and exacerbate the drainage congestion problem. In addition, excavation of existing khals in	• Construct diversion channels before replacement of drainage sluices. • Sequence of work on the drainage sluices and on the water channels should be carefully planned to avoid drainage congestion. • Contractor should ensure that drainage channels are not obstructed or clogged by the construction activities which do not causes any drainage congestion situation in the crop fields.

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
	the Polder is likely to disturb the drainage which takes place through these channels.	
Agriculture crop production	Borrow pits will generally be established on private land after agreement between the contractor and the private land owners, typically involving some compensation from the contractor to the land owners. During collection of earth from Borrow pits, agriculture crop production will be lost.	• It should be considered a priority to establish borrow-pits in foreshore areas; • Resettlement Action Plan should be prepared and should also be implemented accordingly • Compensation would be made for any crop damage; • Contractor would avoid cultivable fields during construction; • Contractor would avoid agricultural land for material borrowing, material stockpiling and labor camps; • Contractor would ensure that no vehicular movements take place through the cultivable fields; • Contractor would ensure that no material is dumped on the cultivation fields; • Re-excavated soil of canals should not be dumped in agricultural land and • Contractor would maintain liaison with the local communities; • Contactor will prepare site specific spoil management and disposal plans for each site to be followed upon approval by the DDCS&PMS Consultant and PMU.
Irrigation	Construction activities particularly on construction of drainage sluices (three) repairing of flushing Inlets (five) and re-excavation of drainage channel (9 km) can potentially disrupt the crop irrigation temporarily during both wet and dry season thus negatively affecting cultivation. The works on sluices can cut off the incoming water from the river, while the excavation works in water channels can affect water conveyance through them.	• Contractor should construct diversion channels before construction/replacement of each regulator; • Sequence of work of the regulators and the water channels would be carefully planned to avoid irrigation disruption; • Contractor would ensure having no negative impacts on crop irrigation; • Contractor would maintain liaison with the local communities; and • Contractor would work during dry season.
Fish Feeding and spawning ground	Polder 14/1 is bounded by Kobodak and Arpangasia rivers on the western and Sakbaria River on the eastern part of the Polder. As per consultation with local	• Earth work should be conducted during the dry season (November-May)

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
	fishers during field visit it is learnt that, the bank sides of these rivers have been reported as the feeding, nursery and spawning ground of brackish water fish species like *Chewa, Pairsha, Gulsha Tengra, Bagda, chingri*, etc. It is expected that activities of bank revetment would cause the partial destruction (if in the dry season) and full destruction (if in the rainy season) of the feeding, nursery and even spawning ground of these fish species.	• Sequence of work at the bank sides of Kobodak and Sakbaria rivers will be planned considering local fisheries condition to minimize impacts on spawning and subsequently nursery ground of fish. • Contractor will maintain liaison with experienced local fishermen. ***The contractor will maintain proper sequence of work so that the earth work part of the revetment work could be done within minimum period as far as possible.*** •
Fish Movement and Migration	Most of the brackish and freshwater fish species migrate through the khals at some stages of their life cycle for spawning, nursing and feeding purpose. River resident fishes migrate from adjacent rivers to inside the polder area using the existing khals at pre-monsoon to monsoon. The lateral migratory route for fishes would be obstructed due to construction and repair of three drainage sluice gates, six flushing sluices and re-excavation of nine km connecting khals.	• Duration of construction of structures and other interventions should be shortened as much as possible at least should maintain the contract period. • Dismantle bundhs and other obstructions built to support the construction of structures as soon as work is over. • For manual re-excavation of Khals, compartments could be built in a cascade manner and bailing out of water to take place from one compartment to another to avoid damage to fish. • Sequence of construction of regulators and re-excavation of drainage Khals should be set scientifically so that implementation of project could be completed with minimum hindrance to fish migration. • Contractor will maintain liaison with communities so that they could realize the issue. • Liaison of contractor with community would create scope for setting proper time for the construction work.
Aquatic flora and fauna	All proposed khals are shallow and no aquatic vegetation is observed because of tidal flow and salinity. But this type of wetland to support with success saline tolerant fauna as well as a number of crab, fishes (details fisheries section),	• Keep untouched the deepest points of the khal as much as possible. • Use excavated soil spoils for khal dyke re-sectioning • Implement tree plantation with local species at the khal bank side after re-

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
	mudskippers and shorebirds like Skipper frog, Bullfrog, Kingfisher, Egret, common aquatic snake, etc. The proposed interventions namely khal re-excavation would damage the aquatic flora and fauna.	excavation work where excavated soil dumped khal bank side. • Use minimum land as much as possible for excavator/ labor movement
Vegetation	• Re-sectioning of embankment will damage all undergrowth vegetation both at embankment slopes and the sites from which the soil would be collected. been covered with concrete blocks for slope protection. Embankment toes at Sakbaria, Matiabhanga, Gharilal and Jorshing villages follow strips of dense but small size (not more than 3m height and DBH 4cm) Gewa (Excoecaria agallocha) plants. These strips have been created naturally by germination of floating seeds from nearer mangrove forest. These saplings will be cut down/damaged during embankment re-sectioning. • Collection of soils from foreshore area will also cause vegetation damage of these locations. Most of the foreshore area of this Polder is under plantation program by Climate Resilient Ecosystems and Livelihood (CREL) Project.	• Collect soil from barren land and alternate source like riverbed or nearby burrowpits at countryside as much as possible. • Keep close liaison with CREL Project Authority and Forest Department during implementation of earth works. • Needs approval from the DDCS&PMSC for vegetation clearance, if needed • Create plant strips with same species at the toe of the embankment after completion of earthwork. The community members may be involved for protection of the saplings. • Proper turfing should be made on the embankment slopes with local grasses (i.e., Durba (Cynodon dactylon), Mutha (Cyperus rotundus)) and ensure regular monitoring of turfed grasses till they matured. • The top-soil at the construction and rehabilitation sites should be stored and used for plantation activities. • Choose barren land for CC Block manufacturing and material storing. • Implement plantation with native species along countryside slope of the embankment after finishing of construction works.
Safety and Public Health Hazards	The area is prone to cyclones and storm surges. Although the works will be carried out during the dry season, a certain level of safety hazards still exists for the construction staff. The construction activities will involve operation of heavy construction machinery, vehicular traffic, excavation and filling operations. These activities may pose some safety hazards to the local population as well as for the construction workers. The fuel storage at the camp sites may also pose safety hazards for the construction staff as well as to surrounding population.	• The contractors should prepare site specific Health, Safety and Environment (HSE) Plan and obtain approval from the Construction Supervision Consultants. The Plan should also include awareness building and prevention measures, particularly for communicable diseases such as hepatitis B and C, and HIV/AIDS. • The WBG's EHS Guidelines should be included in the contract documents and that should be followed during construction. • Each contractor should prepare an Emergency Response Plan defining

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
	Inappropriate waste disposal at the camps and construction sites, and air quality deterioration caused by the Project's vehicular traffic and construction activities potentially pose health hazards to the construction staff and nearby population. Unhygienic condition and unavailability of safe drinking water for the construction staff will expose them to health risks. In addition, influx of construction staff can potentially expose the nearby population to communicable diseases.	procedures to be followed during any emergency. This plan should be submitted to the Construction Supervision Consultants for review and approval; • All workers must be provided with and use appropriate Personal Protective Equipment (PPE). First aid must be provided and there would be procedures in place to access appropriate emergency facilities. • Liaison should be established with the Bangladesh Meteorological Department for early warning of storms and cyclones. Radio and television sets should be kept in all the labor camps for obtaining weather information. • The construction sites should have protective fencing to avoid any unauthorized entry, where appropriate and possible • Health screening of employees would be a Contractors obligation prior to laborers working on site and living in the temporary accommodation facilities. The health screening would entail normal review of physical fitness and also include a review of appropriate vaccinations. Workers would be given vaccinations as and where required; • The WBG's EHS Guidelines will be included in the contract documents. Each contractor will prepare an Emergency Response Plan defining procedures to be followed during any emergency. This plan will be submitted to Construction Supervision Consultants for review and approval; • All employees need to provide induction training on health and safety prior to commencement of work. OHS issues would be part of the employee training plan. Training would include the provision of appropriate written or visual materials to reinforce learning. Illiteracy levels where high, the OHS issues should be covered more frequently than normal in toolbox talks; • The labour shed/camps for accommodation of workers should

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
		be constructed according to the IFC/EBRD workers accommodation guidelines. • Public awareness training and workshops on safety and health risks should be conducted for local communities prior to and during construction operations. • Observing statutory requirements relating to minimum age for employment of children and meeting international standards of not employing any persons under the age of 16 for general work and no persons under the age of 18 for work involving hazardous activities. The construction contractor(s) should not hire people under the age of 18 on permanent contracts but would include short training activities for youth to the extent possible; • Ensure the acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work; • Ensure that no workers are charged fees to gain employment on the Project; • Ensure the rigorous standards for occupational health and safety are in place; • Contractor should establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal. • The contractor should adopt a Human Resource Policy appropriate to the size and workforce which indicates the approach for management employees (this could be part requested in the tender process); • Produce job descriptions and provide written contracts and other information that outline the working conditions and terms of employment, including the full range of benefits; • Provide health insurance for employees for the duration of their contracts; • Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts;

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
		• Develop a recruitment process community employees that involves local authorities in clearly understood procedures; • Employ a community liaison officer (which could be full time or part of another post's responsibilities); • Raise awareness prior to recruitment, clarifying the local hire policy and procedures, including identification of opportunities for women to participate in employment and training; • Regularly report the labor force profile, including gender, and location source of workers; • Report regularly the labor and working condition key performance indicators, for instance hours worked (regular and overtime) during period and cumulatively, hours lost, number and type of accidents, near misses, site audits and meetings; trainings, and use of labor grievance mechanism; • Hold toolbox talks on workers' rights and the labor grievance mechanisms during the construction phase; • Organize training program and keep training registers for construction workers; • Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system which provide workers with a safe and healthy work environment taking into account the inherent risks for this type of project. • Availability of safe drinking water should have to be ensured for the construction staff. • First aid boxes should have to be made available at each construction site. Emergency phone numbers (including hospitals, Fire services, and Police) should have to be displayed at key locations within the site. Each site should be occupied with an ambulance. • Firefighting equipment should have to be made available at the camps and worksites. • Waste management plan is to be prepared and implemented in accordance with international best practice.

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
		• Liaison with the community should have to be maintained.
Hindrance for pedestrian and vehicle movement	• Construction activities along the embankments are likely to disrupt the activities of these market because four main markets are located in the Polder near the embankment. These markets play important roles by providing sources of livelihood for the Polder inhabitants as well as meeting the daily needs of the people.. In addition, the tracks (mostly brick soled) on the embankments are the key transportation routes both for pedestrians and vehicles in the Polder connecting the communities and the markets. The construction activities along these embankments will result in removal of these tracks thus causing communication and transportation problems to the local population.	• The works on embankment will be carefully scheduled to minimize the impacts on local markets and transportation routes. • The embankment works will be carried out segment wise and soil will be placed linearly on half of the embankment, leaving the other half to be used as track. When the works of the first half are completed, it will be opened for local traffic and the works of the other half will be undertaken. • Work schedule will be finalized in coordination and consultation with local representatives and communities. • Local routes will not be blocked as far as possible. If unavoidable, alternative routes will be identified in consultation with local community. • No unauthorized entry of the local people/unwanted personnel at the camp site/work site will be allowed. • Work sites and movement routes to be clearly demarcated, with appropriate warning signs (in Bangla and Chinese) at strategic locations. • GRM will be put in place.
Social unrest	• A numbers of skilled and unskilled labors will be required for the construction activities. Most of the labor will be needed for re-sectioning of embankment and constructing retired embankment. It is envisaged that about 60 percent construction workers will be recruited from within the Polder area while the remaining from other areas. The presence of outside laborers in the area may create friction and conflict between the local labor and outside labor., and between	• Proper awareness programs will have to be conducted through public consultation measures such as village scoping sessions, meetings, and placement of bill boards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officials. • Cultural norms of the local community will have to be respected and honored. • GRM will be established to address the grievances of local as well as outside laborers. • Careful use of local natural resources and project resources, fuel, fuel-wood and electricity. • Restrictions to be imposed in consumption of alcohol and drugs. • Safe driving practices.

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
	local community and outside labor. • Presence of number of labors from outside can potentially cause encroachment in the privacy of local population particularly women and hence their mobility can be negatively affected.	• Respect for the local community and its cultural norms in which laborers are working. • Avoid construction activities during prayer time.
Natural hazard	Historically, this area is vulnerable to cyclone, storm and tidal surges. As per construction schedule, the development activities of the proposed new polder will be conducted from October to May while most of the cyclone and storm surges are occurred in this area. According to previous record of occurrence of cyclone and storm surges, October to November and April to May are the pick months of occurrence of cyclone and storm surges. It is suspected that the construction activities during this period may hamper as well as the workers may be injured	• Weather signals should have to be considered by the contractor during construction works. • Radio and television should have to be kept in all labor sheds for getting weather information through these media. • Ensure rigorous standards for occupational health and safety are in place. • Having the Contractor establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal.

Impacts during Post-construction Phase

During operation phase, the project would have positive and negative impacts on environmental and social components. The negative/adverse impacts with mitigation measures are described as follows

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
Embankment Failure	Embankment failure or breaching of embankment is a common threat in the coastal region that is caused due to runoff, wave action, tidal surge and unauthorized activities like entering saline/brackish water through pipies across the embankment by local people making the embankment weak. Lack of regular maintenance has created weak point at the sensitive locations of the embankment where the set back is less than 15m to 25m. Mal-maintenance and increasing intensity and magnitude of	• Regular monitoring and rigorous maintenance of the embankment and existing water control structures especially along the southern and western side of the Polder should be ensured. This monitoring will particularly be carried out before and after monsoon season. • Proper dumping and compaction of soil should be ensured during re-sectioning of the embankment. • Side slope protection works should be maintained with proper design. • Available cyclone and flood shelter should be prepared as a contingency

Important Environmental Components (IECs)	Potential Impacts	Mitigation Measures
	the cyclone and storm surge simultaneously have accelerated the risk of embankment failure.	measure during emergency situation. • WMG should develop fund for such emergency situation. • Structural measures like geo bag and sand bag should be kept in the Upazila office for emergency need.
Salinity intrusion	Mal-operation and leakage of regulators will result in salinity intrusion during dry season, causing severe damage to the soil, water resources, and crops in the Polder. The proposed project has been designed to address such damages which are currently caused by the salinity intrusion. Mishandling and poor maintenance of these control structures will undermine the very objective of the Project.	Regular monitoring and careful maintenance of the water control structures will be ensured. Standard operating procedures will be prepared and implemented for the water control structures. These procedures will be translated in bangle as well. • Capacity building of WMOs will be carried out.
Fish migration time and extent	. The improved drainage sluices would thus hamper the migration behaviour of above mentioned fish species as well as other aquatic fauna. Moreover, the migration of *Pairsa, Vetki, Gulsha, Tengra, Chingri*, etc., would be very much restricted with the replacement of the proposed drainage sluices.	Follow sluice gate operation manual (Appendix-E) for allowing fish migration; Construct fish pass for fish migration Provide training to WMOs for fish friendly operation of sluices; Transferring/stocking juvenile fish from rivers to the Polder.
Agro chemicals	Implementation of the project interventions especially re-excavation of channels would cause expansion of area under irrigated cultivation of Boro (HYV) and T.Aus (Local) varieties of rice. The expansion of irrigated area would increase use of chemical inputs including fertilizers and pesticides. Runoff from such cultivation fields might potentially pollute the water bodies and even drinking water sources thus causing health hazards to the communities.	• Capacity building and awareness raising of the farmers will be carried out to practice Integrated Pest Management (IPM) and Integrated Crop Management (ICM) – in order to minimize usage of chemical inputs. • Farmers group/WMO would have close contact with DAE for adoption of various measures of ICM. • Farmers would be encouraged to use organic manure to increase soil fertility while avoiding water contamination. and • Farmers would be encouraged to cultivate leguminous crops to enhance the soil quality as well as soil productivity.
		•

Risk Assessement

From the study, it is expected that the project interventions would have positive and potential adverse impacts which have been identified and quantified as well as their mitigation measures have also been suggested in this report. Yet, challenges or risk do remain in three sectors, these relate to (a) navigation (b) water management organizations (WMO) and (c) Fish migration and movement as briefed below:

Issue	Risk	Mitigation Measures
Fish Migration and movement	The peak velocity considered in designing of drainage sluices ranges from 3-4 m/s. The sustainable velocities of the indicative fish species are estimated in the range of 0.46 m/s to 1.1 m/s and burst velocities are in the range of 1.75 m/s to 4.2 m/s (Section 6.2.10). The peak velocity of the sluice gate would hamper to fish migration and movement inside the polder. It is noted that burst velocities of fish are applicable for capturing prey as the duration is only for seconds	• The fish pass friendly aspects in the structures to be constructed in the Polder for the proper management of water. • The structure may be done either by constructing drainage sluices by maintaining the velocities passable for the mentioned indicative fish species or by constructing fish pass structure. • In case of sluice gates, based on catchment flow optimum number of vents should be provided with proper opening so that velocity goes down and become passable for fishes. • In constructing fish pass, fish swimming speed or velocity and depth preference should be considered. In case of the indicative fishes velocities are mentioned in Table 6.14 and the depth preferences are as follows: Plotosus canius: 2-10 m; Liza Parsia: 1.5-10 m; Mystus gulio: 1.5-10 m
Function of Water Management Association	At the moment, there are no active WMOs on site, and their activities are almost non-existent. The disrepair and lack of maintenance of the Polder in the past due to financial inadequacies of the WMOs as well as insufficient support from the BWDB had contributed to the general decay of the Polder's structure and utility. In the past, there was usually no fund allocated for the WMOs' functions and needs.	• Ensure the organization/formation of the WMOs before operation of the gates, training them in the operation of structures etc., as well as in records/accounts keeping, and collaboration with NGOs, and CBOs, and most importantly. This would help in developing ownership of the WMA for realization of benefits from the Polder without hampering the hydrological and environmental settings of the Polder • In addition to activation of WMOs, BWDB may recruit sluice khalashi for each of the Drainage Sluices for smooth operation of the gates as per initial practice • provide budgetary allocation in the post-operation phase for the O & M related tasks of the WMOs • Borrow pit, embankment slope, water bodies in the khas land

		may be provided to the WMOs as an income generating sources for their sustainability.
Navigation	Drainage sluices and sluice gates are provided in the Polder, which are being rehabilitated under this project. The gates in those structures are also operated in regular intervals to restrict salinity intrusion. However, such gates or boat passes in the embankment for allowing navigation through the embankment to and from the Polder would allow large volumes of saline water inside the Polder and may damage the soil, water and land – destroying crops.	• In order to maintain navigation scenario, an arrangement may be made for lifting of small size country boat from one side to other side i.e. river side to country side and vise-versa for navigation purposes. • This arrangement will not allow entry of saline water inside the Polder, and thus would not damage soil, water, land and crops.

Cumulative Impacts

The cumulative impact of several existing and ongoing project, as well as the proposed project of CEIP-1 around the proposed rehabilitation Polder, were assessed. Such projects may have impacts on the hydrological network, flooding situation, life and livelihood of people, environmental quality, natural ecosystem, flora-fauna, etc. of Polder 34/3, were considered in this study. Apart from CEIP interventions, there are some other development projects in the region of Polder 34/3, implemented locally or regionally. Impact on hydrology and flooding situation due to construction and implantation of proposed and existing projects were assessed.

The Polder 34/3 area is surrounded by the Putimari River in the south and Butiamari River in the west. The upstream of both the rivers are connected with the Bishnu River having tidal influencehowever, both the rivers flow has reduced.Polder 35/3 is located downstream (south direction) of this polder which has some proposed interventions under CEIP. The protective works i.e. higher crest level, slope protection work of Polder 35/3 may divert flow direction of Putimari River to Polder 34/3.

A small amount of sand and cement can be procured from the local market adjacent to the polder or Khulna during executions of construction works. No significant impact will be caused due to sand procurement of sand and cement from the local market.

The socio-economic condition of Polder 34/3 will be ameliorated due to the overall development of this region, i.e., construction works of surrounding Polders will attract labors from outside as well as local people will also get a working opportunity.

Moreover, Shrimp culture in Polder 34/3 during dry season is a very common practice like other surrounding Polders. In the dry season, a number of places in the embankment were cut down to allow the entry of saline water through Amtoli khal, Ratna Khal, Golbarir khal, etc., which may reduce the strength of the embankment by creating weak points.

Environmental Management Plan (EMP)

The contractor is responsible for implementing the EMP during the construction phase whereas the design and supervision consultant is primarily responsible for monitoring the implementation of the EMP. The environment specialist to be employed by BWDB will conduct field inspections and surveys on a regular basis. The environment specialist will report to the Senior Environment Specialist at Head Quarter. The M&E consultant will be responsible for independent monitoring and implementation of the EMP, and evaluation of the environmental compliance of the project. DoE will have to be consulted if any complicated issue arises during construction and operation stages. BWDB will apply for site clearance/environmental clearance and annual renewal of environmental clearance certificate from DoE. WMOs will be trained to ensure adequate water and environmental management practices during project operation. The Environmental Management Unit of BWDB, strengthened through CEIP-1, will ensure and oversee the environmental management during project operation.The tentative cost for Environmental Management is mentioned as follows:

Tentative Cost Estimates for Environmental Management

Item No.	Description	Cost Million BDT	Cost Million $	Responsible Agency	Timeframe
1	Construction of alternative or bypass channels at each construction sites.	6	0.075	Contrctor	During pre-construction and construction
2	Installation of fugitive particulate matter system and Spraying water on embankment/road	0.5	0.00625	Contrctor	During pre-construction and construction
3	Waste disposal arrangement	0.5	0.006	Contractor	During construction
	Awarense building up campaign(mock drill) may be organized to local community to avoid accidents from vehicular traffic	200,000	2.5		During pre-construction
4	Crop compensation to the indirect loser/ land owner/ share croppers of construction sites /damage to dredge spoils	Budget included in RAP		Contractor	During pre-construction
5	Awareness program on plant and wild life conservation.	0.02	0.00025	BWDB	During post-construction
6	Consultancy services cost for supervision and monitoring of EMP	1	0.01	BWDB	During post-construction
7	Training to the farmers with field demonstration regarding IPM and ICM.	0.4	0.005	BWDB with help of DAE	During post-construction
8	Training to the fisherman/pond owner with field demonstration regarding pond culture.	0.4	0.005	BWDB & WMO with help of UFO	During post-construction
9	Training on improved fish culture	1.5	0.019		
10	Capacity building and training to the WMOs regarding gate operation, post project monitoring	1	0.013	BWDB	During post-construction
11	Updating EMP as per requirement.	1	0.013	BWDB	During post-construction
	Training to the Contractors regarding environmental management	100,000	1.25	BWDB	During pre-construction

Item No.	Description	Cost Million BDT	Cost Million $	Responsible Agency	Timeframe
12	Establishment of Fish Sanctuaries in khals for the Conservation of indigenous Fishes and stocking of Threatened Fish species and Brood Stock of Indigenous Small Fish Species (2 Nos. Sanctuaries-One sanctuary in each khals @ 0.1 million BDT)	0.2	0.036	BWDB with cooperation of DoF	During operation
13	Emergency budget allocation for closing breach points of embankments and repairing the damage of structure	10	0.13	Contractor, BWDB	During construction and post-construction
14	Training to WMA on "Integrated water Management and Operation and Management of Sluice Gates"	1.5	0	BWDB	During operation
15	Social forestry program along both sides of the embankment and other khas areas	Included in afforestation budget	0	BWDB	During operation
	Compensation for trees	Budet Included in Afforestation Plan	0	BWDBwith a consultation of Forest Department	During construction
16	Construction of fish pass friendly structure (one fish pass)	61	0.69	Contractor, BWDB	During construction
	Optimum number of vents should be provided with proper opening so that velocity goes down and become passable for fishes				
	WMOs monitoring cost	150,000	1.88		
Total Cost		**85**	**1.003**		

Extensive monitoring of the environmental concerns of the Polder34/3will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv) overall effectiveness of the project environmental protection measures. The monitoring plans will be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive database of the Polder specific Environmental Impact and Monitoring information will be created, which will help to evaluate the impacts easily.

The monitoring plan during pre-construction, during construction and during operation phases is presented in a tabular form as follows:

Environmental Monitoring Plan during Construction and Operation of Polder System

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Construction					
Sources of Material	Work Site	Possession of official approval or valid operating	Before an agreement for the supply of	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		license of suppliers materials (Cement, soil).	material is finalized.		
Operation of borrow site	Borrow pit/site	Visual inspection of borrow site and ensuring operational health and safety	monthly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Top Soil	Storage area	Top soil of 0.15 m depth will be excavated and stored properly	Beginning of earthwork	Contractor	DDCS&PMSC, BWDB
	do	The stored top soils will be used as cladding material over the filled lands	Immediately after filling and compaction of dredge materials	Contractor	DSCS&PMSC, BWDB
	Work Site	Some of the top soil are placed on top and berm of embankment for turfing and plantation	At the end of filling activity	Contractor	DDCS&PMSC, BWDB
Erosion	Side slopes of the embankments and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	At the end of filling activity	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Monthly	Contractor	DDCS&PMSC, BWDB
Air quality (dust)	Construction site	Visual inspection to ensure good standard equipment is in use and dust	Daily	Contractor	DDCS&PMSC, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		suppression measures (spraying of waters) are in place.			
	Material storage sites	Visual inspection to ensure dust suppression work plan is being implemented	Monthly	Contractor	DDCSPMSC
Air Quality (PM_{10}, $PM_{2.5}$)	Close to School/ Madrasha, Hospital &Villages	Air quality monitoring	Dry season	Contractor through a nationally recognized laboratory	DSCS&PMSC, M&E Consultant, BWDB
Noise	Construction sites	Visual inspection to ensure good standard equipment are in use	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
	Construction sites	Ensure work restriction between 09:00 pm-6:00 am close to School/ Madrasha, Hospital & Villages	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Surface Water Quality (TDS, pH, DO, BOD, COD etc)	Water sample at each of river for each Polder	Sampling and analysis of surface water quality	Dry season	Contractor through a nationally recognized laboratory	DDCS&PMSC, M&E Consultant, BWDB
Drinking Water Quality(TDS, pH, FC, as if groundwater etc)	Sources of drinking water at construction camp/site	Sampling and analysis of water quality	yearly	Contractor through a nationally recognized laboratory	DDCS&PMSC, M&E Consultant, BWDB
Sanitation	Construction camp/site	Visual Inspection	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Waste Management	Construction camp and construction site	Visual inspection of collection, transportation and disposal of solid waste and solid waste is deposited at designated site	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
Top Soil	Storage area	Top soil of 0.15 m depth should be excavated and stored properly	Beginning of earthwork	Contractor	DDCS&PMSC, BWDB
	Storage area	The stored top soils should be used as cladding material over the filled lands	Immediately after filling and compaction of dredge materials	Contractor	DDCS&PMSC, BWDB
	Work Site	Some of the top soil are placed on top and berm of embankment for turfing and plantation	At the end of filling activity	Contractor	DDCS@PMSC, BWDB
Construction of drainage sluice and construction/repair of flushing inlets	Construction site	Physical Observation	Weekly	Contractor	BWDB
Bailing out of water by manual labor or pump	Construction site	Physical Observation	Weekly	Contractor	BWDB
Re-excavation of Khals	Construction site	Physical Observation	Weekly	Contractor	BWDB
Cut off trees	Each of construction sites at embankment	Survey and comparison with baseline environment	Quarterly	Contractor through nationally recognized institute	DDCS&PMSC, M&E Consultant, BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Monthly	Contractor	DDCS&PMSCand BWDB Authority
During Operation and Maintenance					
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, COD etc)	Water sample at each of river for each Polder	Sampling and analysis of surface water quality	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
Air Quality (Dust PM_{10}, $PM_{2.5}$)	At the baseline monitoring site	24 hours Air quality monitoring	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Operation of hydraulic structure	In the project area	Visual inspection and public feedback	Yearly	BWDB	M&E Consultant
Crop production	In the Polder area	Compare the production with the baseline	3 (Three) cropping season	BWDB through a nationally recognized institution	M&E Consultant
Soil quality	In the Polder area	Compare the soil quality with the baseline	Two (2) times of year (dry & wet season)	SRDI	M&E Consultant
Soil salinity	In the Polder area	Compare the soil salinity with the baseline	Once (1) times of year (dry season)	SRDI	M& E Consultant
Fish Species Diversity and Richness	Khals and Sluice Gates adjacent River	Catch Assessment and Physical Observation	Two times per year (dry & wet season)	BWDB/ WMA	BWDB with collaboration of DoF
Habitat Condition	Khals and Sluice Gates adjacent River	Physical Observation and Testing of Water Quality Parameter (i.e. DO, pH, Salinity and Turbidity etc.)	Quarterly four times per year (dry & wet season)	BWDB/ WMA	BWDB with Collaboration of DoF
Monitoring the Status of Fish Sanctuaries and benthic fauna	Deeper part of the khals	Physical Observation and Fish Sampling	Quarterly four times per year	BWDB/ WMA	BWDB with Collaboration of DoF
Monitoring other vertebrates (amphibians, reptiles, birds, mammals) and plants		Physical observation and sampling	Annual, once a year	NGO	BWDB/Forest Department

Environmental Monitoring Plan during Construction and Operation of Afforestation

Parameter	Locations	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During implementation					
Plant species selection	Nursery	Visual inspection. Type and variety of	Before plantation	Contractor	DDCS&PMSC, BWDB, M&E Consultant

Parameter	Locations	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		plant species to be planted for turfing on the top of embankment and foreshore			
Waste Management	Afforestation sites and Nursery	Visual inspection of collection, transportation and disposal of poly bags, debris and disposed at designated site	Weekly	Contractor through nationally recognized institute, NGO	DDCS&PMSC, BWDB, M&E Consultant
During Operation and Maintenance					
Survival and growth of coastal afforested saplings and turfed grasses	Proposed afforestation foreshore area and re-sectioned embankment	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute, NGO	DDCS&PMSC, M&E Consultant, BWDB
Faunal composition	Proposed afforestation foreshore area and along the re-sectioned embankment	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute, NGO	DDCS&PMSC, M&E Consultant, BWDB

BWDB will prepare a Bi-annual Monitoring Report on environmental management and will share this with the World Bank for review during construction phase. The effectiveness of screening, monitoring and implementation of the EMP along with the project component activity monitoring will be carried out by a third party monitoring firm annually.The Annual Environmental Audit Report prepared by the third party monitoring firm will be shared with the safeguards secretariat. The Third Party M&E Consultants will be responsible for independent monitoring of the implementation of EMP. The tentative cost estimates for Environmental monitoring is as follows:

.

Tentative Cost Estimates for Environmental Monitoring

Item No.	Description	BDT	In Thousand $	Responsible Agency	Timeframe
1	Soil quality monitoring including N,P,K, S, Zn, salinity, organic Matter, pH etc. samples in Polder 34/3 = 6 samples x 3 times @ Tk.5,000	300,000	3.75	Contractor	During pre-construction, construction and post construction

					period phases
2	Monitoring of Fish Biodiversity, Fish Migration, Fish Production	700,000	8.75	Contractor with help of UFO	During construction and post-construction
4	Fish swimming speed or velocity and depth preference	150,000	1.875	Contractor with help of UFO	During post-construction
5	Crop Production/Farm Survey for four (4) times of year (dry & wet season).	100,000	1.25	Contractor with help of UFO	During post-construction
6	Air and noise quality monitoring and analysis.	500,000	6.25	Contractor	During construction
7	Surface and ground Water quality monitoring cost (testing for Turbidity, pH, DO, BOD, Salinity etc. + test of As, e etc. for HTWs at workers' camp site) 6 samples in Polder-34/3 during pre-construction, construction and post-construction periods + water quality analysis of HTWs of 10 workers' camp	500,000	6.25	Contractor	During construction and post-construction phases
8	Benthic fauna analysis	200,000	2.5	Contractor & DOF	Before, during and regularly after construction
9	Diversity of Flora and fauna	200,000	2.5	Contractor	During construction and post-construction phases
	Total Cost	**2,650,000**	**33.125**		

Note: US$ 1 = BDT 80

The project activity will be implemented through systematic and effective organizational structure of BWDB headquarters to field level. The Project Management Unit (PMU) will implement the project and the Project Steering Committee (PSC) under the Ministry of Water Resources will oversee and monitor overall activities. The Environmental, Social and Communication Unit (ESCU) to be established for implementation and management of the EMP will be structured to provide co-ordination, technical support and services during the environmental screening and preparation of EA, and implementation of the environmental mitigating measures. At least one of the two environmental specialists must be on board. The specialists will prepare sub-project specific environment screening report with EMP, supervise the implementation of EMP and support capacity building of the field level staff of BWDB and contractor. The ESCU will review the EMP and ensure quality of the environmental screening.

Stakeholder Consultation and Disclosure

Three tiers of consultation process e,g FGD/Informal discussion, PCM (Public Consultation Meeting) and PDM (Public Disclosure Meeting)were conducted under this study. A Focus Group Discussion (FGD) and five (05) informal discussion were carried outat different locations of polder. One PCM at Union level was conducted with the participation of local people, representatives of local government (Union Parishad) and representatives of the BWDB with the objective of disclosing the impacts of the project and the EMP.Local people showed interest in the project and were positive minded for its implementation which is vital for their survival. They also expressed that if the monitoring plan is implemented properly during the pre-construction, construction and post-construction periods then they would support the implementing agency positively.

A Regional level Public Disclosure Meeting (PDM) on the EIA report of Polder 34/3 was held on 27thJuly 2017 in Bagherhat Sadar Upazila, Bagerhat. The participants of the PDM included Upazila Nirbahi Officer (UNO), Upazila Chairman, Upazila Vice Chairman and other concerned government officials, Journalists, NGO representatives, environmentalists, activists, local stakeholders and other representatives. No national level disclosure meeting yet to be done.

Local people showed interest in the project and were positive minded for its implementation which is vital for their survival. They also expressed that if the monitoring plan is implemented properly during the pre-construction, construction and post-construction periods then they would support the implementing agency positively.

1. Introduction

1.1 Background

1. The Government of Bangladesh (GoB) has planned to implement the Coastal Embankment Improvement Project, Phase-1(CEIP-1) (here in after referred as 'project'), under which 17 Polders will be rehabilitated and improved in the coastal area of the country by 3 Packages. Preliminary 17 Polders were selected for rehabilitation in feasibility study considering physical conditions as well as damages of the Polder. Afterwards, these Polders were selected through screening matrix. From environmental point of view, multi-criteria analyses were conducted which has been mentioned in Strategic Environmental Assessment (SEA) report for CEIP-1. It may be mentioned that SEA has been carried out before conducting the EIA study and IEE report was prepared and submitted to Department of Environment (DoE) to obtain site clearance. The rehabilitation and improvement activities of 17 Polders will be implemented in3Packages.EIAs and EMPsfor Package 1 ~~one~~ (Polders 32, 33, 35/1 and 35/3) and Package 2(Polders 43/2C, 47/2, 48, 40/2, 41/1 and 39/2C) are already prepared. Polders 14/1, 15, 16, 17/1, 17/2, 23 and 34/3 are included in Package3. In accordance with the national Environmental regulatory requirements and WB safeguard policies, EIA studies of the 7Polders under Package 3have been carried out. This document presents the EIA report of Polder 34/3.

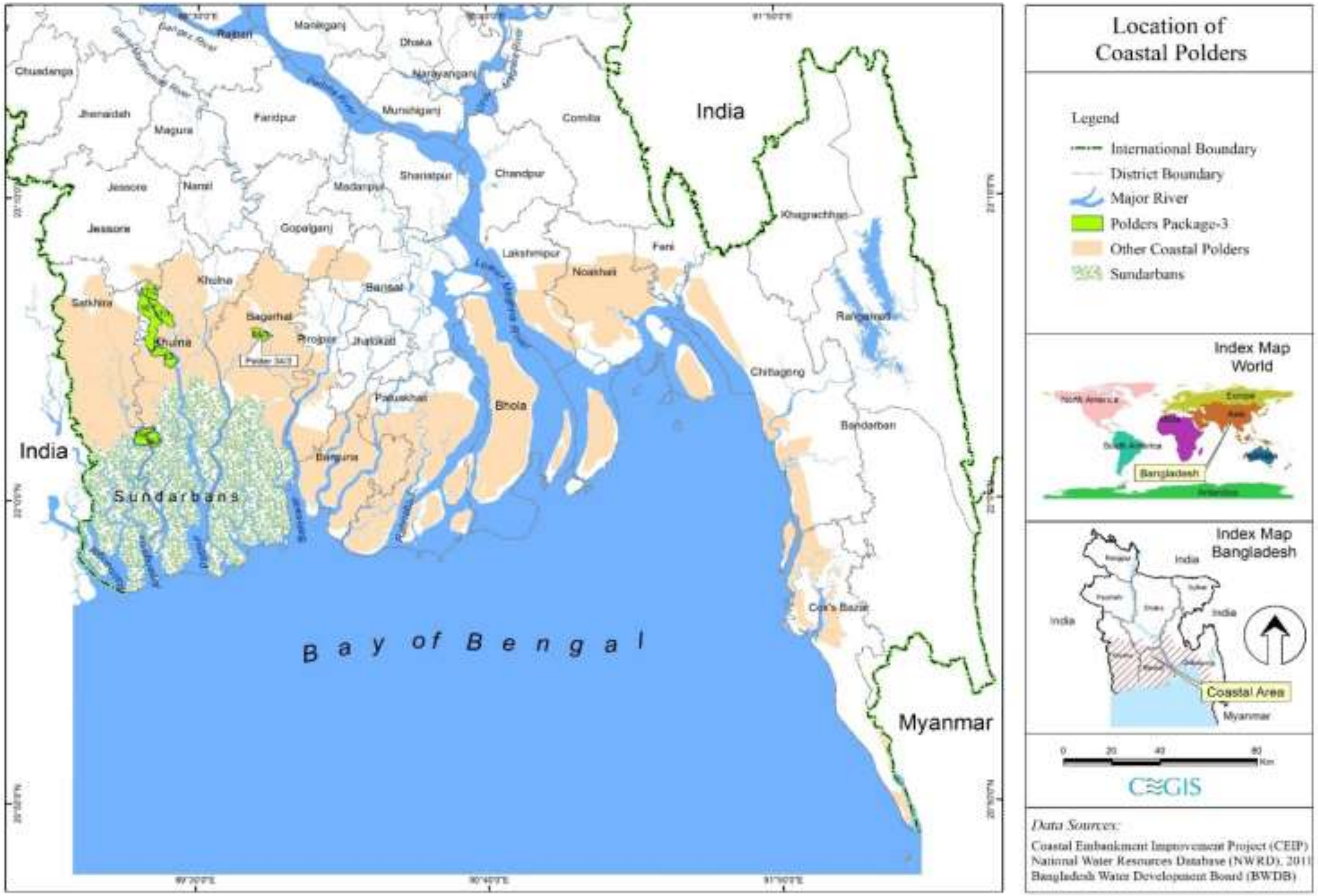
2. The coastal region of Bangladesh consists of 19 districts adjoining the Bay of Bengal. The region is characterized by a delicately modified ecosystem of an evolving flat delta subject to high tides, salinity and frequent cyclones coming from the Bay of Bengal and encountering very large sediment inflows from the upstream.

3. In the 1960s, Polderization started in the coastal zone of the country to convert this area into permanent agricultural lands (refer Map 1.1 for coastal Polders) to increase the agriculture production. The Polders in this area are enclosed on all sides by dykes or embankments, separating the land from the main river system and offering protection against tidal floods, salinity intrusion and sedimentation. Without embankments the coastal communities would be exposed to diurnal tidal flooding. The Poldered lands are slightly higher than sea level. These Polders are equipped with inlet and outlet sluice gates to control the water inside the embanked area.

4. The coastal embankment system of Bangladesh was originally designed in the 1960s without attention to storm surges. Recent cyclones have substantially damaged the embankments and threatened the integrity of the coastal Polders. In addition to breaching due to cyclones, siltation of peripheral rivers surrounding the embankments has caused failures of the drainage systems, creating water logging inside the Polders. This has led to large scale environmental, social and economic degradation. Poor maintenance and inadequate management of the Polders have also contributed to internal drainage congestion and heavy internal siltation which comes from connected river and for top soil erosion. Soil fertility and agriculture production are declining in of water logged areas. Other areas suffer from salinity increase due to incursion of sea water into the Polders.

5. The above reasons have led the Government of Bangladesh (GoB) to readjust its strategy on the coastal area from only ensuring protection against high tides to provide protection against frequent storm surges as well. The long-term objective of the GoB is to

increase the resilience of the entire coastal population to tidal flooding as well as natural disasters by upgrading the whole embankment system. With an existing network of nearly 5,700 km long embankments in 139 Polders, the magnitude of such a project is daunting and requires prudent planning. Hence, a multi-phased approach of embankment improvement and rehabilitation will be adopted over a period of 15 to 20 years. The proposed CEIP-1 is the first phase of this long-term program.



Map 1.1: Location of Coastal Polders of Package-3

1.2 Project Overview

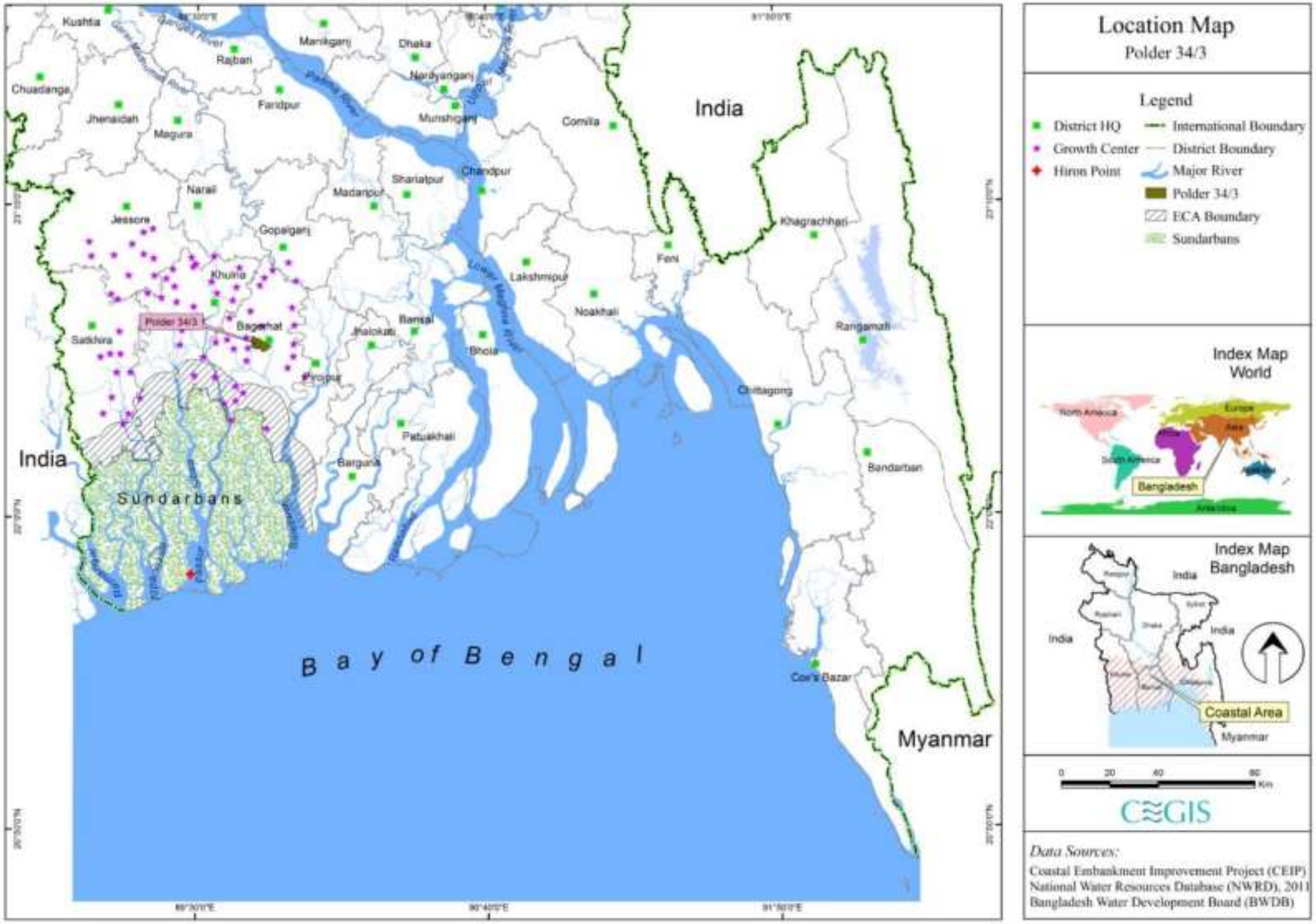
6. The proposed Polder34/3 is located in Bagerhat Sadar Upazila of Bagerhat District of Bangladesh (Map 1.2). The Polder covers a gross area of 3,656 hectare (ha) with net cultivable area of 2,930 ha. The overall cropping intensity is around 149% (which is much below the national average of 191%) giving a total cropped area of 4,366 ha.The major project objective of CEIP-1 is to enhance protection against natural disasters, increase resilience during and after such disasters, and improve agricultural production by reducing drainage congestion. To meet these objectives, the following key improvement and rehabilitation works will be implemented in Polder-34/3 by BWDB under Package-3, CEIP-1:

Re-section of embankment	: 16.75 km
Re-excavation of drainage Channels	: 9:00 km
Slope protection of embankment	: 5.50 km
Replacing of drainage sluice	: 3 Nos.
Replacing of flushing sluice	: 1 Nos.
Repairing of drainage sluices	: 5 Nos.
Afforestation on the foreshore areas	: 12.48ha

7. Other components of the CEIP-1will include implementation of a social action plan and an environmental management plan; supervision, monitoring and evaluation of project impacts; project management, technical assistance, trainings, and technical studies; and contingent emergency response. Detailed information of the Polder is presented in the project description chapter of the report.

1.3 Regulatory and Policy Framework

8. The Bangladesh Environment Conservation Act, 1995 (amended in 2002, 2010), requires that all development and old developed projects shall obtain environmental clearance from the Department of Environment (DoE), Ministry of Environment and Forest (MoEF). Similarly, the World Bank's environmental safeguard policies require an environmental assessment to be carried out for projects being considered for its financing. The present EIA fulfils both of these requirements.



Map 1.2: Location of Polder-34/3

1.4 Objectives of the Study

9. The objective of the EIA study for Polder-34/3 is to identify and assess the potential environmental impacts of the proposed project interventions, evaluate alternatives and design appropriate mitigation and management measures as well as monitoring guidelines to be addressed in the Environmental Management Plan (EMP)[3] in compliance with the national regulatory and WB environmental policies and guidelines (for further details refer Chapter 3).

10. The specific objectives of the EIA study are to:

- Comply with the national regulatory and WB policy frameworks (further discussed later in the document);
- Determine and describe the existing environmental and social settings of the Project area (the Project area is defined as the entire area inside the Polder, project influence area outside the Polder i.e. the embankments, borrow pits and spoil disposal areas if located outside the Polder; earth collection areas if located outside the Polder and access routes to the Polder);
- Identify and assess the potential environmental and social impacts of the Project;
- Identify mitigation measures to minimize the negative impacts and enhancement measure to enhance the positive impacts; and
- Prepare an EMP including a detailed environmental monitoring plan.

1.5 Scope of work

11. The scope of works of the present EIA study for Polder- 34/3 includes the following:

- Carry out detailed field investigation of required parameters of the environmental and social baseline, especially on the critical issues.
- Determine the potential impacts due to the project through identification, analysis and evaluation on sensitive areas (natural habitats; sites of historic, cultural and conservation importance), settlements and villages/agricultural areas or any other identified Important Environmental and Social Components (IESCs).
- Determine the cumulative environmental impacts of the project that may occur inside and outside the project area.
- Distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, and unavoidable or irreversible impacts.
- Identify feasible and cost effective mitigation measures for each impact predicted as above to reduce potentially significant adverse environmental impacts to acceptable levels.
- Determine the capital and recurrent costs of the measures, and institutional, training and monitoring requirements to effectively implement these measures.

[3]WB Operation Policy 4.01. 2011 Revision

The consultant is required to identify all significant changes likely to be generated by the project activities. These would include, but not be limited to, changes in the coastal erosion and accretion due to alteration of tidal currents, changing of fish migration routes, destruction of local habitats, target species conservation and waterlogging.

- Consult with modeling consultants to establish conformity of the impact assessment with existing and ongoing mathematical models due to climate change developed by a number of reputed organizations. The developed models may be available from the main consultant and implementing agency;
- Prepare (a) an estimate of economic costs of the environment damage and economic benefits, where possible, from the direct positive impacts that the project is likely to cause, and (b) an estimate of financial costs on the mitigation and enhancement measures that the project is likely to require, and financial benefits, if any; the damage/ cost and benefits should be estimated in monetary value where possible, otherwise be described in qualitative terms.
- Describe alternatives that were examined in course of developing the proposed project and identify other alternatives that could achieve the same objectives. The concept of alternatives extends to the siting and design, technology selection, rehabilitation/construction techniques and phasing, and operating and maintenance procedures. Compare alternatives in terms of potential environmental impacts, vulnerability, reliability, suitability under local conditions, and institutional, training, and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which may be mitigated. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any mitigating measures. Include the alternative of not constructing the project to demonstrate environmental conditions without it.
- Identify the specific reciprocal impact of climate change on Polder. Check the suggested Polder height with respect to the SLR and high tide. The sub consultant will ensure that the design will minimize the negative impact on the environment due to Polder rehabilitation activities. For example, adequate fish pass should be provided to ensure free movement of fish or adequate drainage facility should be provided to avoid water logging in the surrounding area.
- Prepare a detailed Environmental Management Plans along with respective EIA separately to monitor the implementation of mitigating measures and the impacts of the project of other inputs (such as training and institutional strengthening) needed to conduct it during construction and operation. Include in the plan an estimate of capital and operating costs and a description of other inputs (such as training and institutional strengthening) needed to implement the plan.
- Ensure to address occupational health and safety for the construction workers in the EMP;
- Develop Environmental monitoring format for regular monitoring of the project at the pre-construction, construction and operational stage; and
- Prepare the EIA report

1.6 Structure of the Report

Chapter 1 (Introduction) describes the background of the project, objectives of the study, scope of works with a list of EIA study team.

Chapter 2 (Approach and Methodology) presents the detailed approach and procedure employed to conduct the EIA study. The Chapter also describes data sources and methodology of data collection, processing and impact assessment.

Chapter 3 (Policy, Legislative and Regulatory Framework) reviews the national legislative, regulatory and policy framework relevant to the EIA study. Also given in the Chapter is a discussion on the WB safeguard policies and their applicability for the Project.

Chapter 4 (Climate Change Impact): discusses the climate change aspects from local perspectives and the likely impacts on the project area and its surroundings.

Chapter 5(Description of Proposed Interventions) provides the simplified description of the project and its phases, key activities under three phase, manpower, equipment, and material requirements, implementation arrangements, implementation schedule, and other related aspects.

Chapter 6(Environmental Baseline and Existing Conditions) describes the existing environmental and social settings in respect of Physical Environment, Biological Environment and Socio-cultural environment aspects of the project area.

Chapter 7 (Analysis of Project Alternatives) discusses various alternatives considered during the feasibility and design stage of the project, and their environmental and social considerations.

Chapter 8 (Environmental Impacts and Mitigation Measures) identifies the environmental impacts that may potentially be caused by various project phases, and also proposes appropriate mitigation measures to avoid, offset, reduce, or compensate these impacts.

Chapter 9 (Cumulative and Reciprocal Impacts) presents analysis of cumulative impacts of the proposed Project and other projects in the area In addition, induced impacts are also covered in the chapter.

Chapter 10 (Environmental Management Plan)includes an estimate of the impacts and costs of the mitigation measures, a detailed EMP with proposed work programs, budget estimates, schedules, staffing and training requirements and other necessary support services to implement the mitigation measures, phase wise monitoring etc. Besides, the EMP specifies the implementation arrangements for the mitigation measures identified during the EIA study. The EMP also includesenvironmental monitoring plans.

Chapter 11 (Stakeholder Consultation and Disclosure) provides details of the consultations held with the stakeholders at the project site and framework for consultations to be carried out during construction phase. The disclosure requirements for the EIA are also included in this Chapter.

2. Approach and Methodology

12. This Chapter presents the detailed approach and methodology followed to conduct the EIA study. The Chapter also describes the data sources and methodology of data collection, processing and approach used in the impact assessment.

2.1 Overall Approach

13. The EIA study for the rehabilitation of Polder-34/3 has been carried out following the approved Terms of References (ToR) of DoE dated 05/06/2013 and the Environmental Management Framework (EMF) for CEIP-1. The overall approach of the study is shown in Figure 2.1 below.

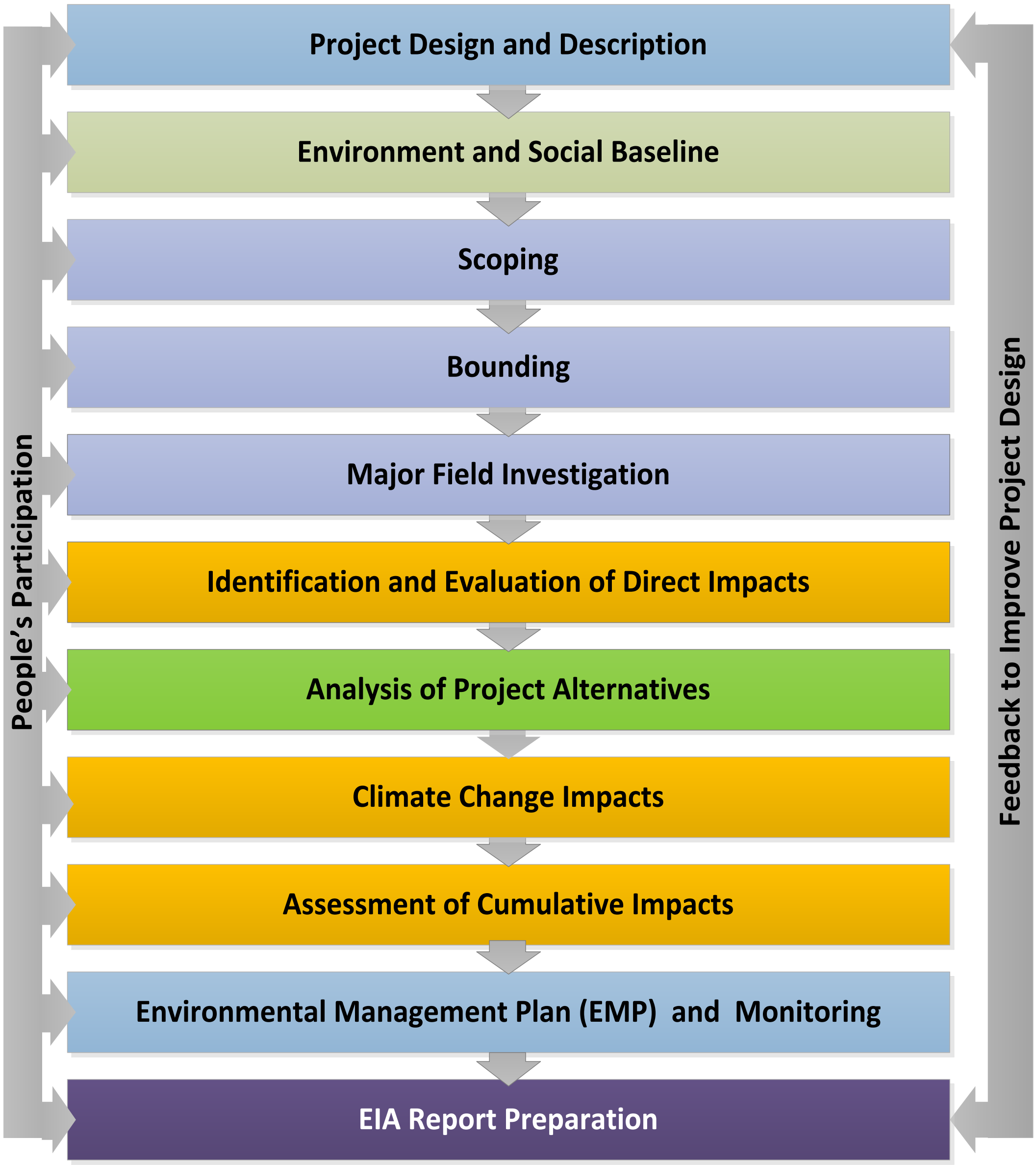


Figure 2.1: Overall approach of the EIA study

2.2 Methodology

14. The detailed methodology followed for the EIA study is described below.

Analysis of the Project Design and Description

15. Detailed information about the Polder34/3 including objective, nature and location of proposed and existing interventions, construction works, and other related aspects were obtained from the Main Consultant of CEIP-1.

16. The Water Resources Engineer of the EIA study team interpreted this information for the multi-disciplinary team members for assessing the potential environmental and social impacts of the proposed interventions.

17. Since the location of most of the project interventions are already fixed, alternative design options of the interventions were analyzed considering environmental, social, and technological criteria to identify suitable alternatives and appropriate mitigation measures for negative environmental impacts. Figure 2.2 shows the different aspects to be addressed in the Project Design and Description step of the EIA studies.

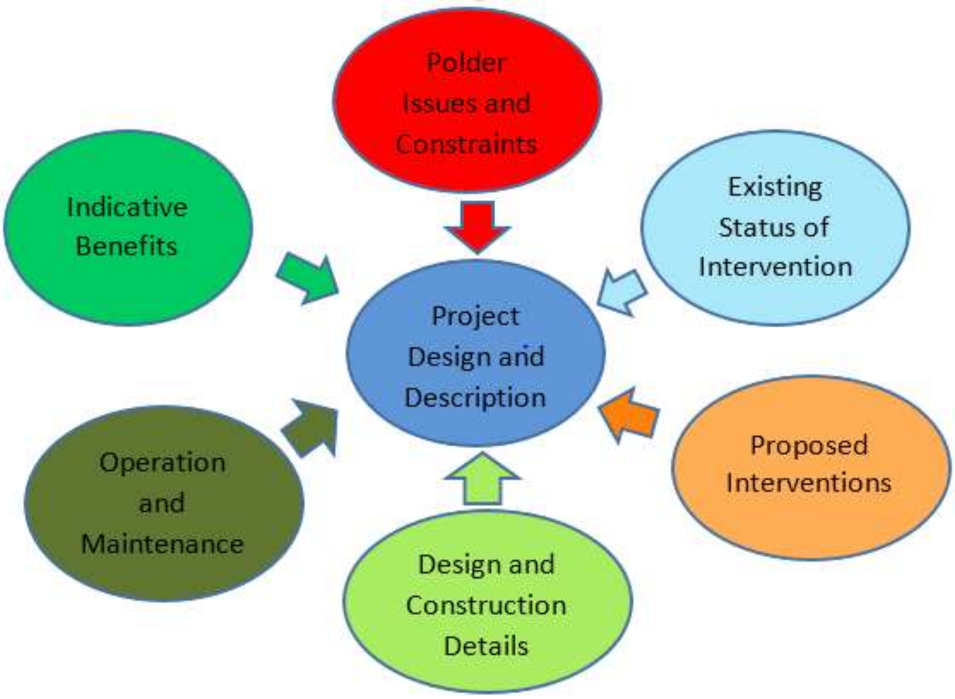


Figure 2.2: Aspects to be addressed in the Project Design and Description

Baseline Data Collection and Analysis

18. A reconnaissance field visit was conducted in the Polder area to identify the existing environmental settings of the Polder area. Subsequent to this, Rapid Rural Appraisals (RRAs), Participatory Rural Appraisals (PRAs), Focused Group Discussions (FGDs) and interviews with key informants were followed to collect data and information on the environmental and social aspects of the Polder area. Local knowledgeable persons including community representatives, traders, teachers, farmers, fishermen and political leaders were interviewed individually to reflect upon the problems regarding the Polder. They were also requested to highlight possible solutions that the project should bring about as per their indigenous knowledge and experiences.

19. The baseline condition of the Polder area was determined according to the information collected from secondary and primary data sources through literature review, field investigations and consultations with different stakeholders. The baseline settings were established with respect to the physical, biological and socio-cultural environment conditions including identification of problems in respect of the proposed project sites and adjoining area. A checklist was developed (see Appendix A) and approved by the Detailed Design Construction, Supervision and Project Management Support Consultant (DDCS&PMSC) and used to register the information obtained from different stakeholders.

Physical Environment

20. Field visits at different stages of the study were arranged to the Polder area and primary data on water resource components were collected. Local knowledgeable persons and community representatives were also interviewed through a developed checklist. During field visits, the multidisciplinary EIA study team members made observations pertaining to their individual areas of expertise.

Water Resources

21. Water resource data related to river hydrology and morphology, surface and ground water availability, drainage pattern, ground and surface water quality and water use were collected from secondary sources.Primary data on ~~air, noise,~~ water resouces were collected and analyzed. Observations by the professionals of the multi-disciplinary team were backed up by feedback from the local people. Major river systems were identified for hydrological and morphological investigation through historical and current image data collection and analysis. Specific areas or points of interest were selected for collecting data on special hydrological and morphological aspects, water availability, drainage pattern, water quality (surface and ground water), tidal flood, risk of erosion and sedimentation.

22. Meteorological data such as temperature, rainfall, evapo-transpiration, wind speed and humidity were collected from the National Water Resources Database (NWRD) of Water Resources Planning Organization (WARPO), and subsequently analysed. The NWRD contains long series of temporal data showing daily values for meteorological stations maintained by the Bangladesh Meteorological Department (BMD).

23. The topographical and geological data were collected from Geological Survey of Bangladesh and NWRD.

Land Resources

24. The agro-ecological region of the project area was identified using secondary sources including Food and Agriculture Organization (FAO) and United Nations Development Program (UNDP) information. The land type and soil texture data was collected from Upazila[4] Land and Soil Resources Utilization Guide of Soils Resources Development Institute (SRDI). The secondary data of these parameters were verified at field level through physical observations as well as consultations with the local people and officials of the Department of Agriculture Extension (DAE) during field visit.

[4]Upazila is an administrative subdivision of a district.

Biological Environment

Agricultural Resources

25. Land use information was prepared from satellite image classification with field verification. Data on agricultural resources which included existing cropping patterns, crop variety, crop calendar, crop yield, crop damage, and agricultural input used were collected from both secondary and primary sources. Agriculture data was collected through extensive field surveys with the help of questionnaires and consultations with local people and concerned agricultural officials. Agricultural resources data were also collected from secondary sources from the DAE. Crop production was determined using the following formula:

Total crop production = damage free area × normal yield + damaged area × damaged yield.

26. The crop damage (production loss) was calculated using the following formula:

Crop production loss = Total cropped area × normal yield - (damaged area × damaged yield + damage free area × normal yield)

27. The crop damage data was collected from the field for the last three years.

Ecological Resources

28. The ecological component of the EIA study focused on terrestrial and riverine ecology including flora, birds (including migratory birds), reptiles, amphibians, and mammals. The field activities included collection of ecosystem and habitat information, sensitive habitat identification, identifying ecological changes and potential ecological impact. The land use information on different ecosystem was generated through analysis of recent satellite imageries.

29. Field investigation methods included physical observation; transect walk, habitat survey and consultations with local people. Public consultation meetings were carried out through FGD and Key Informants Interview (KII) methods. Inventory of common flora and fauna and their status was developed based on field surveys and from the species data base of Bangladesh National Herbarium and the Status of Vertebrates/ Red List of International Union for Conservation of Nature (IUCN)

Fisheries Resources

30. Primary data were collected from the fishermen community, fishermen households and local key informants while secondary data were collected from Upazila Fisheries Offices (UFOs) during field visits.

31. Fish habitat classification was made on the basis of physical existence and was categorized into capture and culture fish habitats. The capture fish habitats included rivers, khals, and tidal floodplains, borrow pits, and beels. The culture fish habitats included homestead culture fish ponds, commercial fish farms, and shrimp ghers.

32. Information on post-harvest activities, forward and backward linkages, fishermen livelihood information, fisheries management issues, potential fish recruitment, fish culture infrastructure and fishermen vulnerability were also collected.

33. Secondary information from UFOs and literature were blended with primary data from individual habitats to estimate fish production

Livestock Resources

34. Data on the present status of livestock (cow/bullock, buffalo, goat and sheep) and poultry (duck and chicken) in the Polder area was collected during field survey in consultation with the local people through Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA). Livestock resources data were also collected from secondary sources from Upazila Livestock Office.

Socio-cultural Environment

35. The steps followed for collecting socio-cultural data are as follows:

- Data was collected from Bangladesh Bureau of Statistics (BBS), 2011. The relevant literatures from BWDB and main consultant were also reviewed;
- Reconnaissance field visit and discussions with BWDB officials and local stakeholders were for primary data collection;
- PRA /RRA, FGDs, KII were carried out for primary data collection;
- Institutional surveys were conducted for primary data collection from district and upazila level.

36. Demographic information, such as population, occupation and employment, literacy rate, drinking water, sanitation, and electricity facilities were collected from secondary sources. Data on income, expenditure, land ownership pattern, self-assessed poverty status, migration, social overhead capitals and quality of life, disasters, conflicts of the study area, information on Non-governmental Organizations (NGOs), cultural and heritage features of the project area were collected mainly from primary sources through PRA and FGDs and public consultations.

Scoping

37. A structured scoping process in two stages was followed for identifying the IESCs, which would potentially be impacted by the proposed Project. In the first stage, a preliminary list of the components, which could be impacted by the Project, was prepared. In the second stage, village scoping sessions were held where opinions of the stakeholders were obtained on their perception about the environmental and social components, which could be impacted by the project interventions. With the help of the professional judgments of the multidisciplinary EIA team as well as the opinions of the stakeholders, the preliminary list of the important environmental and social components was finalized.

Bounding

38. The influence area of the project were defined two broadly categories e.g. direct influence area and indirect influence area. direct influence area is the area where all physical works will take place whereas the indirect influence areas are those ouside direct physical works but within 1 km radius from the direct influence area.

39. The influence area of the project were defined in two broad categories e.g. direct influence area and indirect influence area. The direct influence area includes the area inside

the Polder where most of the Project interventions activities will take place. Theindirect influencearea is located immediately outside the Polder embankments (this area could be used for staging of construction works, material stockpiling, and/or earth borrowing), access routes for the Polder, borrow as well as spoil disposal areas, and labor camps/contractor facilities if located outside the Polder. The Polder is surrounded by river Hari to the East, Upper Salta River to the South West, Taltola River to the West and Geangrail River to the North. It is noted that the indirect area of influence includes peripheral rivers, land surrounding Polders and Sundarban (up to 1 km).

Major Field Investigation

40. The EIA study team members collected intensive data on the possible impact of the project after obtaining the detailed rehabilitation plan from the project authority. The study team carried out a number of comprehensive field investigations in order to collect primary data and solicit feedback from local people. Intensive data on Baseline and IESCs were collected from the field during this stage. Information on the IESCs were collected through a mixed method including RRA, PRA and KII using checklists for water resources, land resources, agriculture, livestock, fisheries, biodiversity, ecosystem and socio-economic components. Intensive consultations with the local people were carried out for their feedback on the key parameters. . This process helped the multidisciplinary EIA study team to qualify their professional observations. In this exercise, attention was given to understand the historical status of the IESCs and the possible condition of the same against the proposed interventions.

Identification and Evaluation of Direct Impacts

41. At this stage, attempts were made to assess the impacts of the proposed interventions of the Polder quantitatively. Alternatively, impacts were assessed qualitatively when quantification was not feasible. The impacts of proposed interventions, considering the climate-change scenario (RCP8.6) for 2050, were estimated on the basis of differences between the future-without-project (FWOP) condition and the Future-with-Project (FWIP) condition. The Future-without-Project (FWOP) conditions were generated through trend analysis and consultations with the local people. This reflected conditions of IESCs in absence of the proposed interventions under the Polder area. Changes expected to be brought about due to proposed interventions under the Project were assessed to generate the Future-with-Project (FWIP) condition. Comparison and projection methods were used for impact prediction.

42. A screening matrix was used specifically for the proposed Project before impact analysis in detail. This matrix was focused on the potential environmental impacts during the design, construction and operation phases. The matrix examined the interaction of project activities with various important components of the environment. The impacts were broadly classified as physical, biological and social impacts, and each of them were further divided into different aspects.

Methodology

43. The assessment of effects and identification of residual impacts takes account of any incorporated mitigation measures adopted due to any potential impact of project activities, and

will be largely dependent on the extent and duration of change, the number of people or size of the resource affected (receptor) and their sensitivity to the change. Potential impacts can be both negative and positive (beneficial), and the methodology defined below was applied to define both beneficial and adverse potential impacts.

44. The criteria to determine significance are generally specific for each environmental and social aspect/receptor. Generally, the magnitude of each potential impact is defined along with the sensitivity of the receptor.

Magnitude

45. The assessment of magnitude has been undertaken in two steps. Firstly, the key issues associated with the Project are categorized as beneficial or adverse. Secondly, potential impacts have been categorized as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the potential impact;
- Spatial extent of the potential impact;
- Reversibility;
- Likelihood; and
- Legal standards and established professional criteria.

46. The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in Table2.1.

Table 2.1: Parameters for Determining Magnitude

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

Parameter	Major	Moderate	Minor	Negligible/Nil
impacts occurring	or construction conditions (Certain)	case (positive impact) operating conditions (Likely)	emergency conditions (occasional)	

Sensitivity

47. The sensitivity of a receptor has been determined based on review of the absorption capacity of the receptor (including proximity / numbers / vulnerability) and presence of features on the site or the surrounding area. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table 2.2.

Table2.2: Criteria for Determining Sensitivity

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

Assessment of Significance

48. Following the assessment of magnitude and sensitivity of the receptor the significance of each potential impact was established using the potential impact significance matrix shown in Table 2.3.

Table 2.3: Assessment of Potential Impact Significance

Magnitude of Potential impact	Sensitivity of Receptors			
	Very High	High	Medium	Low / Negligible
Major	Critical	Major	Moderate	Negligible
Moderate	Major	Major	Moderate	Negligible
Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Mitigation Measures

49. Subsequent to the impact assessment discussed above, appropriate mitigation measures have been proposed to avoid, offset, mitigate/reduce, or compensate for the identified impacts. Generally, impacts having moderate to critical consequence significance as per the Table 2.3 require appropriate avoidance/ mitigation/compensatory measures to reduce the significance. Impacts having low to negligible significance are considered not to need any mitigation measures.

50. Generally, preference is given to the avoidance of the impact with the help of options available for nature, siting, timing, method/procedure, or scale of any Project activity. If avoidance is not possible, appropriate mitigation and control measures are proposed to reduce the consequence significance of the predicted impact, where feasible. Finally, if impact reduction is not possible, compensatory measures are proposed.

Assessment of Residual Impacts

51. The final step in the impact assessment process is to determine the significance of the residual impacts, which would be experienced even after implementing the mitigation/compensatory measures. Ideally, all of the residual impacts should be of negligible to low significance. No residual impacts having major or critical significance are generally acceptable.

Identification of Enhancement Measures

52. Wherever feasible, enhancement interventions, that may increase the positive benefits of the Project should be identified and included in the Project design/implementation. Identification of enhancement measures have been based on experience from implementation of similar projects, applying expert judgment and from consultation with stakeholders.

Analysis of the Project Components and Alternatives

53. Analysis of site alternatives were not considered relevant as the Project mostly entails outright rehabilitation works of infrastructure where their spatial domains are already fixed. However, the possible alternatives of proposed interventions were analyzed on a qualitative basis, considering their environmental, social, technical and economic suitability. This would rationalize the selected interventions, and identify pathways for better design alternatives, if available. Figure 2.3 outlines the approach followed in the alternative analysis.

54. During the suitability assessment process, all design alternates or alternatives in project interventions were compared to the 'without-project' option, which would be generated by projecting the baseline situation for the entire project life, within the Future-Without-Project (FWOP) scenario. Moreover, different possible construction alternatives related to project implementation such as, the materials to be used, workforce procurement sources, locations of stockyards, sources for material procurement, transportation routes, modes of material and manpower mobilization, scheduling etc., were analyzed during the study.

Figure 2.3: Concept of Alternative analysis to be used in the EIA study

Climate Change

55. Climate change is caused by several factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human

activities have also been identified as significant causes of recent climate change, often referred to as global warming. In Bangladesh, climate change is an extremely crucial issue, and according to the Germanwatch Global Climate Risk Index, the country ranks first as the most vulnerable nation, to be highly impacted in the coming decades. In the coastal areas, the consequences of climate change are more staggering. Climate change directly contributes to changes in temperature and precipitation, which eventually is considered to lead to sea level rise and increased tidal flooding. Climate change also affects the frequencies and intensities of cyclonic storm surge events. Increase in salinity intrusion, river erosion, drainage congestion and water logging are other associated impacts of climate change. Consequently, it is important to consider the potential environment and socio-economic impacts in a Climate Change perspective. Figure 2.4 below shows a process diagram of possible climate change impacts in the coastal areas of Bangladesh.

56. Following the development of the Environmental and Social baseline condition, analysis was made to underscore the major climate change issues in the Polders.

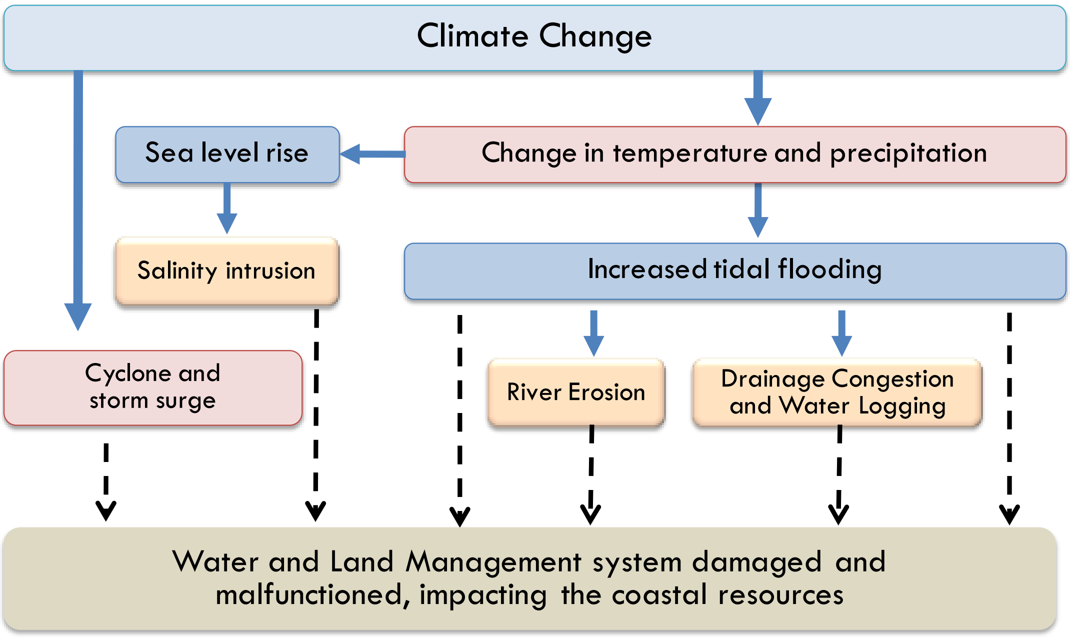


Figure 2.4: Typical process diagram of climate change impacts in coastal areas

57. During field level consultations, the major regional and local issues in connection with climate change and variability were identified. Besides, data on different meteorological parameters such as rainfall, temperature, sunshine hours, humidity and wind speed were collected from the adjacent weather stations of Bangladesh Meteorological Department (BMD). The historical variations of the information were used to develop an understanding of climate science for the Polders. Afterwards, the qualitative field findings were compared with the analyzed historic information on climate science, from which the regional and local climate change vulnerability may be inferred. Moreover, intensive reviews of existing literatures and national reports were made to validate the identified climate change the issues and concerns.

Assessment of Cumulative and Residual Impacts

58. Cumulative impact assessment of a certain Polder is a two-way approach. Initially, the impact due to improvement/development works of Polder has been assessed (e.g. drainage improvement due to re-excavation of khals inside the Polder). In this regard, some parameters

i.e. existing and design crest level of the embankment; hydrological condition, geographical position of Polders, etc., have been considered to quantify the impact assessment. The cumulative impact of existing and ongoing project as well as proposed project of CEIP-1 around the proposed rehabilitation Polder were assessed. During assessing cumulative impacts, rivers/watercourses hydrology, flooding situation, flora and fauna, shrimp farming and livelihood in and around the polder has been considered under this study.

59. Drainage modelling of the coastal Polder has been carried out by IWM to find out the design parameters for drainage canal systems, drainage regulator, river bank, slope protection works. Climate resilient coastal embankment crest levels have been identified based on modelling of the combined effects of cyclone storm surge effects and cyclone wind induced waves, taking into consideration expected Climate Change induced increases in cyclone intensities the impact of proposed interventions on drainage, flooding, river dynamics havebeen analyzed as well through modeling. The model results have been utilized in the EIA study.

Preparation of Environmental Management and Monitoring Plan

60. An environmental management plan (EMP) for the proposed Project was prepared comprising the mitigation/ enhancement measures with institutional responsibilities, environmental monitoring plan, training and capacity building plan, and reporting and documentation protocols (Refer Chapter 10).

EIA Report Preparation

61. At the end of the study, the present report was prepared incorporating all the findings of the EIA.

3. Policy, Legislative and Regulatory Framework

62. This Chapter presents a review of the national policy, legal, and regulatory framework relevant to the environmental and social aspects of the project. Besides, review of the WB environmental and social safeguard policies and guidelines are also incorporated in this chapter.

3.1 Relevant National Policies, Strategies and Plans

63. List of relevant National policies and strategies and plans are given below:

- National Environment Policy, 1992
- National Environment Management Action Plan, 1995
- National Water Policy, 1999
- National Water Management Plan, 2001 (Approved in 2004)
- Coastal Zone Policy, 2005
- Coastal Development Strategy, 2006
- National Land Use Policy (MoL, 2001)
- National Agriculture Policy, 1999
- National Fisheries Policy, 1996
- National Forest Policy, 1994
- Private Forest Policy 1994
- National Livestock Development Policy, 2007
- Guidelines for Participatory Water Management (GPWM), 2014

3.2 National Environmental Laws

- List of relevant national laws and regulation are given below:
- Bangladesh Water Act, 2013
- National River Protection Commission Act, 2013
- Bangladesh Environment Conservation Act (BECA), (Amendments) 2010
- Bangladesh Environment Conservation Rules (BECR), 1997, Amendment 2010
- Bangladesh Environment Court Act, 2010
- The Forest Act, 1927 & Amendment Act 2000
- Private Forest Ordinance (PFO), 1959
- Social Forestry Rules, 2004 and Amendments
- Antiquities Act, 1968
- Bangladesh National Building Code, 2006
- Standing Orders on Disaster, 2010

- The Acquisition and Requisition of Immovable Property Ordinance, 1982
- The East Bengal State Acquisition and Tenancy Act, 1950 (Revised 1994)
- Constitutional Right of the Tribal Peoples Rights
- Ethnic Minority Rights in PRSP, 2005

64. The details of the above policies, plan, strategies and laws are given in Appendix-B

3.3 Other Relevant Acts

65. There is a number of other laws and regulations that are relevant to the project which are presented in Table 3.1.

Table 3.1: Laws and Acts relevant to the project.

Act/Law/Ordinance	Brief Description of Laws and Acts	Responsible Agencies
The Vehicle Act (1927) and the Motor Vehicles Ordinance (1983)	Provides rules for exhaust emission, air and noise pollution and road and traffic safety.	Road Authority
Rules for Removal of Wrecks and Obstructions in Inland Navigable Water Ways (1973)	Rules for removal of wrecks and obstructions.	BIWTA
The Water Supply and Sanitation Act (1996)	Regulates the management and control of water supply and sanitation in urban areas.	MoLG, RD&C
The Ground Water Management Ordinance (1985)	Describes the management of ground water resources and licensing of tube wells.	Upazila Parishad
The Private Forests Ordinance (1959)	Deals with the conservation of private forests and afforestation of wastelands.	MoEF
The Protection and Conservation of Fish Act (1950)	Deals with the protection/conservation offishes in Government owned water bodies.	DoF
The Embankment and Drainage Act (1952)	Describes the protection of embankments and drainage facilities	MoWR
Bangladesh Labor Law (2006)	Deals with occupational rights and safety of factory workers; provision of comfortable work environment and reasonable working conditions.	MoL

3.4 International Treaties Signed by GoB

66. Bangladesh has signed most international treaties, conventions and protocols on environment, pollution control, biodiversity conservation and climate change, such as the Ramsar Convention, the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the Rio de Janeiro Convention on Biological Diversity (CBD) conservation and the Kyoto protocol on climate change, etc. An overview of the relevant international treaties and conventions signed by GoB is provided in Table 3.2 below:

Table 3.2: Treaty or Convention and Responsible Agency

Treaty	Year	Brief Description of Treaty and Convention	Relevant Departments
Protection of Birds(Paris)	1950	Protection of birds in wild state	DoE/DoF
Ramsar Convention	1971	Protection of wetlands	DoE/DoF
Protocol Waterfowl Habitat	1982	Amendment of Ramsar Convention to protect specific habitats for waterfowl	DoE/DoF
World Cultural and Natural Heritage (Paris)	1972	Protection of major cultural and natural monuments	DoA
CITES Washington Convention	1973	Ban and restrictions on international trade in endangered species of wild fauna and flora	DoE/DoF
Bonn Convention	1979	Conservation of migratory species of wild animals	DoE/DoF
Prevention and Control of Occupational hazards	1974	Protect workers against occupational exposure to carcinogenic substances and agents	MoH
Occupational hazards due to air pollution, noise &vibration (Geneva)	1977	Protect workers against occupational hazards in the working environment	MoH
Occupational safety and health in working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	MoH
Occupational Health services	1985	To promote a safe and healthy working environment	MoH
Convention on oil pollution damage (Brussels)	1969	Civil liability on oil pollution damage from ships	DoE/MoS
Civil liability on transport of dangerous goods (Geneva)	1989	Safe methods for transport of dangerous goods by road, railway and inland vessels	MoC
Safety in use of chemicals during work	1990	Occupational safety of use of chemicals in the work place	DoE
Convention on oil pollution	1990	Legal framework and preparedness for control of oil pollution	DoE/MoS
Vienna Convention	1985	Protection of the ozone layer	DoE
London Protocol	1990	Control of global emissions that deplete ozone layer	DoE
UN framework convention on climate change (Rio de Janeiro)	1992	Regulation of greenhouse gases emissions	DoE
Convention on Biological Diversity (Rio de Janeiro)	1992	Conservation of bio-diversity, sustainable use of its components and access to genetic resources	DoE
International Convention on Climate Changes (Kyoto Protocol)	1997	International treaty on climate change and emission of greenhouse gases	DoE
Protocol on biological safety (Cartagena protocol)	2000	Biological safety in transport and use of genetically modified organisms	DoE
MoU on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia	2003	Intergovernmental agreement that aims to protect, conserve, replenish and recover sea turtles and their habitats in the Indian Ocean and South-East Asian region	MOEF/FD

3.5 Implication of GoB Polices, Acts and Rules on CEIP and their Classification

67. The environmental legislative basis for approval of the CEIP-1 project is the Environmental Conservation Act 1995 (ECA'95) and the Environmental Conservation Rules 1997 (ECR'97). DoE). MoEFis the regulatory body responsible for enforcing the ECA'95 and

ECR'97, 2010. According to the Rule 7 (1) of the Environmental Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every project, in consideration of their site and impact on the environment, has been classified into the four categories and they are: Category I (green), Category II (Orange-A), Category III (Orange B) and Category IV (Red). According to the categorization, all construction/reconstruction/expansion of flood control embankment/Polder/dykes, etc., fall under Red Category. Therefore, the CEIP-1 Project intervention in Polder34/3 falls under the 'Red' category.

68. It is the responsibility of the proponent to conduct an EIA of the development proposal.The responsibility to review EIAs for the purpose of issuing an Environmental Clearance Certificate (ECC) rests on DoE. The procedures for "Red" Category include submission of:

- An Initial Environmental Examination (IEE)
- An Environmental Impact Assessment (EIA)
- An Environmental Management Plan (EMP)

69. Environment clearance has to be obtained by the respective implementing agency or project proponent from DoE. The environmental clearance procedure for Red Category projects can be summarized as follows:

Application to DoE →Obtaining Site Clearance →Applying for Environmental Clearance →Obtaining Environmental Clearance → Clearance Subject to annual renewal subject to compliance of EMP/EAP.

3.6 Detailed Steps of In Country Environmental Clearance Procedure

70. Department of Environment (DoE), under the Ministry of Environment and Forest (MoEF), is the regulatory body responsible for enforcing the BECA'95, 2010 and BECR'97, 2010. According to the Bangladesh Environment Conservation Act 1995, no industrial unit or project will be established or undertaken without obtaining, in the manner prescribed by the Environment Conservation Rules 1997, an Environmental Clearance Certificate from the Director General. Therefore, every development projects/industries, which are specified under the Schedule 1 of the Environmental Conservation Rules 1997, require obtaining site clearance and environmental clearance from DoE. For 'Red' category, it is mandatory to carry out an EIA including an EMP and where necessary develop a Resettlement Plan for getting environmental clearance from DoE. The application procedure for obtaining site clearance and environmental clearance for the sub-projects of Red category is shown in **Figure 3.1**.

Application for site clearance
Application should enclose:

1. Prescribed application form
2. Application fee
3. IEE report of the proposed project (including ToR for EIA)
4. Location map/ layout plan, etc.
5. No Objection Certificate (NOC) from local government authority
6. Preliminary Feasibility Study Report/ DPP of the proposed project, if available

Site visit by DOE and applicant agency, if required

Obtaining Site Clearance and approval of ToR for EIA

Applicant agency will conduct EIA study for the proposed project

Application for Environmental Clearance
Application should enclose:

1. Prescribed application form
2. EIA report of the proposed project including EMP
3. Outline of relocation, rehabilitation plan, if applicable
4. Feasibility Study Report of the proposed project, if available

Presentation on the EIA and EMP by the applicant agency to DOE

Obtaining Environmental Clearance

Renewal of the clearance after each one-year period

Figure 3.1: Process of obtaining Clearance Certificate from DoE

3.7 World Bank's Environmental Safeguard Policies

71. Developers seeking financing from the WB are required to comply with the applicable environmental and social safeguards, Operational Policies (OPs) and Bank Procedures (BPs). A list of the relevant safeguards policies considered for the Project is provided below:

- Environmental Assessment (OP 4.01)
- Natural Habitats (OP 4.04)
- Water Resources Management (OP 4.07)
- Physical Cultural Resources (OP 4.11)
- Forestry (OP 4.36)
- Projects on International Waterways (OP 7.50)
- Pest Management (OP 4.09)

- Indigenous Peoples (OP 4.10)
- Involuntary Resettlement (OP 4.12)
- Projects in Disputed Areas (OP 7.60)
- Safety of Dams (OP 4.37)
- Public Disclosure of Information (BP 17.50)
- Environment, Health and Safety Guidelines

72. The highlights of the World Bank's Environmental Safeguard Policies are given in Appendix B.

3.8 Implications of WB Policies on CEIP

73. The project interventions for Polder-34/3 fall under Category A, due to the complexity of environmental issues associated with project activities involving major civil works by reconstruction and rehabilitation of the coastal embankment to protect against tidal flooding and storm surges. Since the coastal area is of high ecological sensitivity and vulnerability, certain negative environmental impacts may occur during the implementation and operational phase on overall Polder system.

74. The environment assessment (OP/BP 4.01), natural habitats (OP/BP 4.04) and forests (OP/BP 4.36) policy have been triggered for the proposed Project. Although no direct impacts on physical cultural resources are expected, screening mechanism incorporated into the EIA process will identify subprojects with archaeological, paleontological, historical, religious, or unique natural values, chance and find procedure will be followed to address physical cultural resources (OP/BP 4.11). The interventions under the proposed Project may result in an increased availability of irrigation water through cleaning and excavation of watercourses in the Polder. This increased water availability can in turn potentially increase the usage of chemical fertilizers and pesticides. During regular environment monitoring during operational phase if water and soil pollution is observed, the proponent will be responsible for preparing a Pest Management Plan with prior approval from Bank. No Project activities are to be carried out in the rivers except some transportation.

75. Projects on International Waterways (OP 7.50): Projects on international waterways may affect the relations between the World Bank and its borrowers, and between riparian states. Therefore, the Bank attaches great importance to the riparian making appropriate agreements or arrangements for the entire waterway, or parts thereof, and stands ready to assist in this regard. A borrower must notify other riparian of planned projects that could affect water quality or quantity, sufficiently far in advance to allow them to review the plans and raise any concerns or objections.

4. Climate Change Impact

4.1 Climate Change Analysis

76. Climate is a critical factor in the lives and livelihoods of the people and socio-economic development as a whole. Climate has shown warming of 0.89 [0.69 to 1.08] °C over the period 1901–2012 which is mainly attributed to anthropogenic activities (IPCC, 2013). Further, it has projected that the global mean surface temperature may increase by 0.4°C to 1.6°C for RCP2.6, 0.9°C to 2.0°C for RCP 4.5, 0.8°C to 1.8°C for RCP6.0 and 1.4°C to 2.6°C for RCP 8.5, respectivelyby 2046-2065 (IPCC, 2013). The newer findings indicate that warming is more pronounced than expected. The impact would be particularly severe in the tropical areas, which mainly consist of developing countries, including Bangladesh. Increasing temperature trends of the order of 0.60°C during last 112 years (IMD, 2012) and increase in heavy rainfall events and decrease in low and medium rainfall events (Goswami *et al*. 2006) over India have been observed. Changes in rainfall and temperatures have also been reported by Dash *et al.* (2009), and others.

77. One of the best ways of understanding how climate may change in future is to examine how it has changed in the past based upon long-term observational records. Polder 34/3 is located in Bagerhat about 40 km away from Khulna. There is no meteorological station in Bagerhat. So meteorological data from the Khulna station are assumed to be representative for Polder 34/3 as well.. Meteorological data for 1981-2012 periods were obtained from Bangladesh Meteorological Department (BMD) for Khulna. Climatologically trends of rainfall and temperature have been analyzed. In addition to mean maximum temperature, mean minimum temperature and rainfall, for each month of the year were also computed. From the monthly values, annual (January-December) and seasonal (winter: December, January, February; pre-monsoon: March-May; Monsoon: June-September; Post monsoon: October-November) time series of mean maximum temperature, mean minimum temperature, and rainfall were also analyzed. Annual total rainfall

78. The temporal plots of the annual total rainfall of Polder 34/3 have been drawn to investigate the nature of inter-annual fluctuations. AA slightly decreasing trend in the annual rainfall at the rate of -0.19 mm/year, is noted from 1981 to 2012, which is not considered statistically significant.

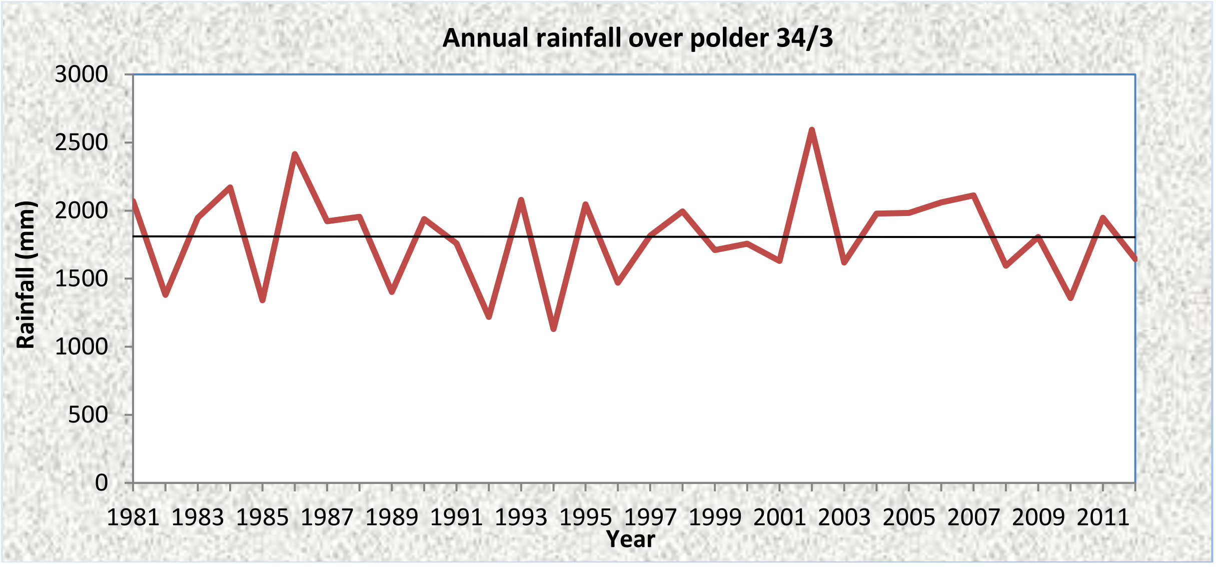


Figure4.1: Temporal variations of annual rainfall over Polder 34/3 during the period 1981-2012

4.2 Climate Change Trends

Annual mean maximum temperature trend

79. The temporal plots of the time series of annual mean maximum temperature of Polder 34/3 is shown in Figure 4.2.

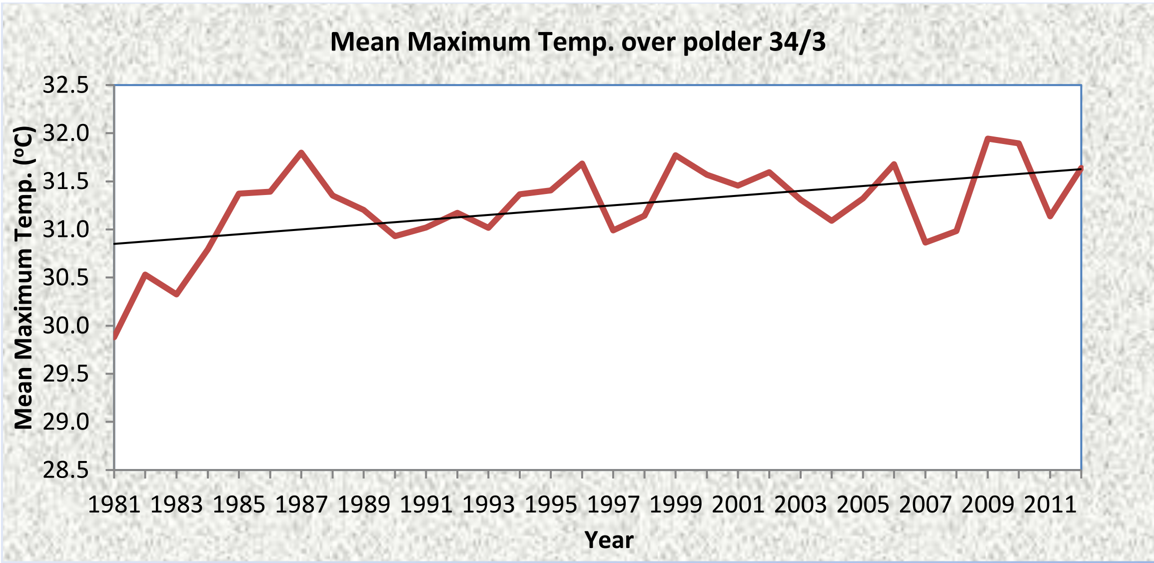


Figure 4.2: Temporal variations of mean maximum temperature over Polder 34/3 during the period 1981-2012

80. The annual mean maximum temperature time series shows an increasing trendat the rate of 0.025ºC/year, which is statistically significant at 5% level.

Annual mean minimum temperature trend

81. The yearly variation of annual mean minimum surface air temperature for Polder 34/3is shown in Figure 4.3 for the period 1981-2012. The trend analysis of annual mean minimum

temperatures shows an increasing trend at the rate of 0.039°C/year which is statistically significant at 1% level.

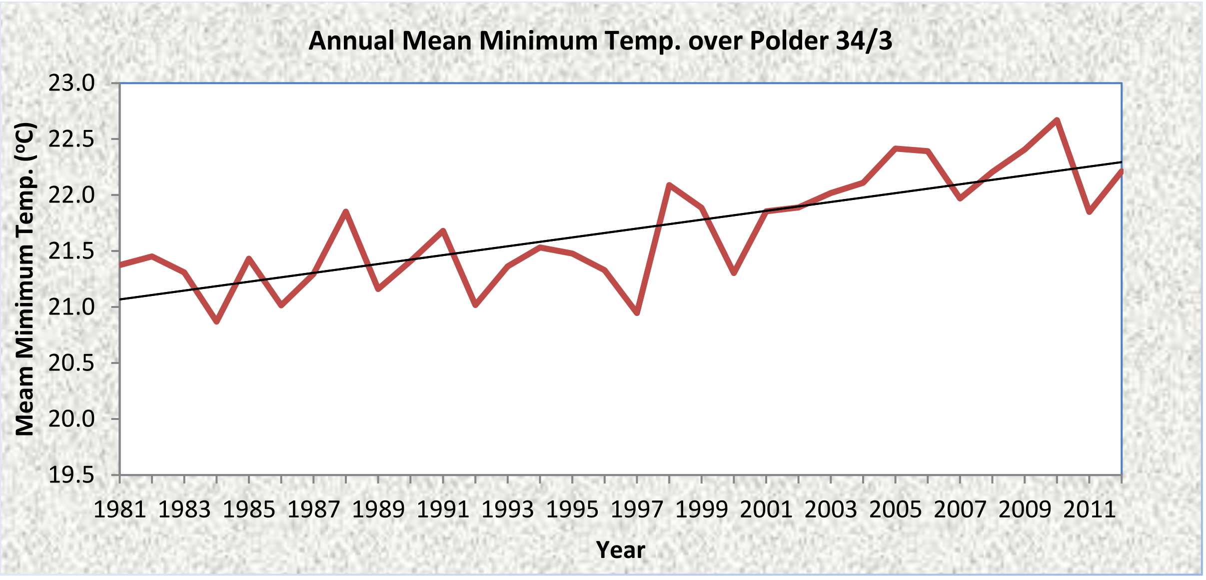


Figure 4.3: Temporal variations of annual mean minimum temperature over Polder 34/3 during the period 1981-2012

4.3 Seasonal climate change trends

82. In this section seasonal climate trend analysis are described below:.

Winter climate change trend

a. Winter season rainfall trend

83. The temporal variations of winter rainfall obtained for 1981-2012 show a slightly decreasing trend in the winter rainfall at the rate of -1.32 mm/year (Figure not shown), which is not statistically significant.

b. Winter mean maximum temperature trend

84. The winter mean maximum surface air temperature shows a slightly increasing trend from 1981 to 2012 (Figure not shownat a rate of 0.0028^{0}C/year, which is not statistically significant.

c. Winter mean minimum temperature trend

85. The winter mean minimum surface air temperature shows an increasing trend over the period of 1981-2012 (Figure not shown of0.057^{0}C/year, which is statistically significant at 1% level for the same period.

Pre-monsoon Climate Change Trends

a. Pre-monsoon total rainfall trend

86. The pre-monsoon total rainfall during the period 1981-2012 (Figure not shown) shows a decreasing trend at a rate of -6.69 mm/year, which is not statistically significant.

b. Pre-monsoon mean maximum temperature trend

87. Pre-monsoon mean maximum temperature shows an increasing trend during the period 1981-2012 (Figure not shown)at a rate of 0.034^{0}C/year, which is statistically significant at 5% level.

c. Pre-monsoon mean minimum temperature trend

88. Pre-monsoon mean minimum temperature shows an increasing trendduring the period 1981-2012 (Figure not shown)at a rate of 0.049^{0}C/year, which is statistically significant at 1% level.

Monsoon Climate Change Trends

a. Monsoon season rainfall trend

89. The temporal plot of the monsoon season rainfall has analyzed to see the nature of inter-annual fluctuations. The linear regression line has also put on the graphs. The temporal variations and the trend of monsoon season rainfall are noticed during the period 1981-2012. It is seen that increasing trend in the monsoon season rainfall are observed over Polder 34/3at the rate of 4.94 mm/year during the same period, which is not statistically significant.

b. Monsoon mean maximum temperature trend

90. The Polder 34/3has shown strong warming trend of mean maximum temperature in the monsoon season during the period 1981-2012. ThePolder 34/3exhibits strong warming trend during the monsoon season at the rate of 0.035^{0}C/year which is statistically significant at 1% level.

c. Monsoon season mean minimum temperature trend

91. It is observed that Polder 34/3 has shown warming trend of mean minimum temperature in the monsoon season during the period 1981-2012. ThePolder 34/3has the warming trend with the value of 0.017^{0}C/year which is statistically significant at 5% level.

Post-monsoon Climate Change Trends

a. Post-monsoon season rainfall trend

92. The temporal variations and the trend of post-monsoon rainfall are obtained during the period 1981-2012. Results show an increasing trend in the post-monsoon season forPolder 34/3 at the rate of 1.87 mm/yearwhich is not statistically significant.

b. Post-monsoon mean maximum temperature trend

93. The mean maximum temperature for Polder 34/3 during the period 1981-2012 shows a warming trend at the rate of 0.025^{0}C/year, which is statistically significant at 5% level.

c. Post-monsoon mean minimum temperature trend

94. Post monsoon mean minimum temperature has shown increasing trend over Polder 34/3 at the rate of 0.041^{0}C/year for the period 1981-2012, which is statistically significant at 1% level.

4.4 Climate change projection

Projection of rainfall over Polder 34/3

95. Global warming is an important issue, with a variety of influences on agriculture, water, health and economy. It is now recognized that climate variability and extreme events affect society more than changes in the mean climate (IPCC, 2001). Human induced changes in the global climate and associated sea-level rise are widely accepted by policy makers and scientists. The IPCC concluded that the balance of evidence suggests a discernible human influence on global climate (IPCC-AR4, 2007). The exact magnitude of the changes in the global climate is still uncertain and subject to worldwide scientific studies. It is broadly recognized that Bangladesh is more vulnerable to these changes. Indeed, it has internationally been argued that Bangladesh, as a country, may suffer the most severe impacts of climate change. Bangladesh is highly vulnerable because it is a low-lying country located in the deltaic plain of the Ganges, the Brahmaputra and the Meghna and it is densely populated. Its national economy strongly depends on agriculture and natural resources that are sensitive to climate change and sea-level rise. The impact of higher temperature and more extreme weather events such as floods; cyclone, severe drought and sea-level rise are already being felt in South Asia and will continue to intensify (Huq et al., 1999; Ali, 1999). In this connection proper planning and sensible management of water resources are essential for this region. Long-term planning is not possible without any idea of the change of climate that may happen in future. Climate models are the main tools available for developing projections of climate change in the future (Houghton et al., 2001). In this context, regional climate model grid data (50 km x 50 km) is used to generate the future scenarios for rainfall and temperature over Bangladesh for RCP4.5. It is assumed that the base period 1990 means averaged during the period 1981-2000 and the year 2030 means averaged precipitation/temperature during the period 2021-2040 and year 2050 means averaged precipitation/temperature for the period of 2041-2060.

Rainfall projections for RCP4.5 scenario

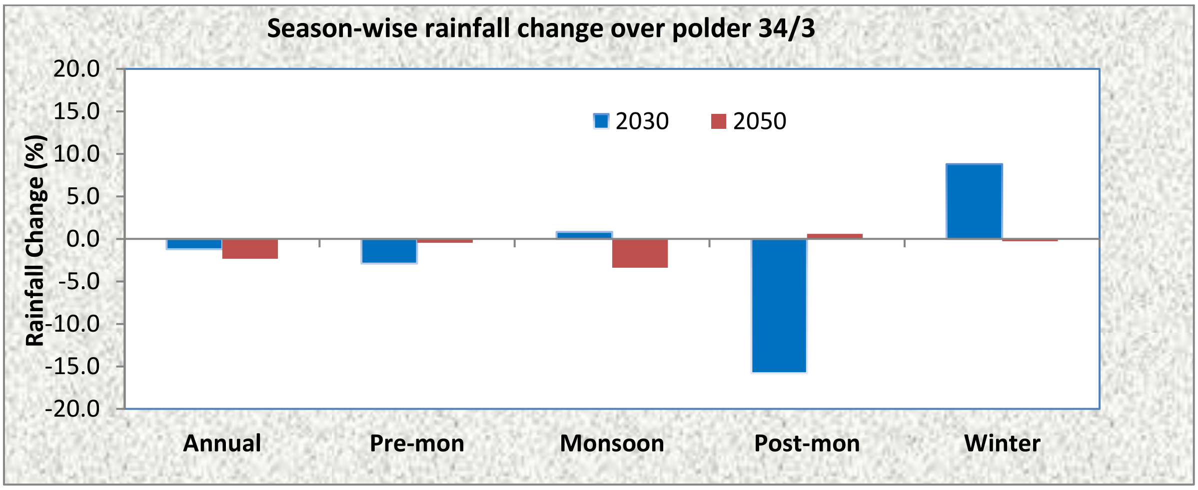


Figure 4.4: Change of seasonal rainfall (%) over Polder 34/3for the year 2030 and 2050, respectively

96. Rainfall change is found to be -2.9, 0.8, -15.8 and 8.8% for pre-monsoon, monsoon, post-monsoon and winter, respectively for 2030 (Figure 4.4). On an average annual rainfall change over Polder 34/3 may be 1.2% for the year 2030. Similarly,the change of rainfall is observed to be -0.5, -3.4, 0.6 and -0.3% for pre-monsoon, monsoon, post-monsoon and

winter, respectively forthe year 2050 (Figure 4.4). On an average annual rainfall change over Polder 34/3may decrease by -2.3% for the year 2050.

Projection of Maximum and Minimum Temperature over Polder 34/3

97. Maximum and Minimum surface air temperature projection is obtained using a new set of scenarios RCP4.5 (Assessment Report, AR5) which is called Representative Concentration Pathway (RCP). The year of 2030 and 2050 of maximum and minimum surface air temperature projections for RCP4.5 is given below:

Maximum temperature projections over Polder 34/3

98. Maximum temperature shows bimodal characteristics. Maximum temperature projection is obtained from the Figure 4.5 for the years 2030 and 2050, respectively. Maximum surface air temperature may change in 2030 by 1.0, 1.0, 0.4, -0.1, -0.3, 0.9, 0.5, 0.7, 0.7, 0.5, 1.1 and 0.8^{0}C for January, February, March, April, May, June, July, August, September, October, November and December, respectively. Maximum surface air temperature in various months may vary by -0.1 to1.1^{0}C over Polder 34/3. On an average, the maximum surface air temperature is estimated to increase by 0.6^{0}C for the year 2030.Similarly, maximum temperature may change in 2050 by 2.0, 1.7, 1.9, 1.6, 0.6, 1.6, 1.4, 1.7, 1.4, 0.8, 1.3 and 1.6^0 C for January, February, April, May, June, July, August, September, October, November and December, respectively. Maximum surface air temperature in various months may vary by 0.6 - 2.0^{0}C over Polder 34/3. On an average the maximum surface air temperature is estimated to be increased by 1.5^{o}C for the year 2050.

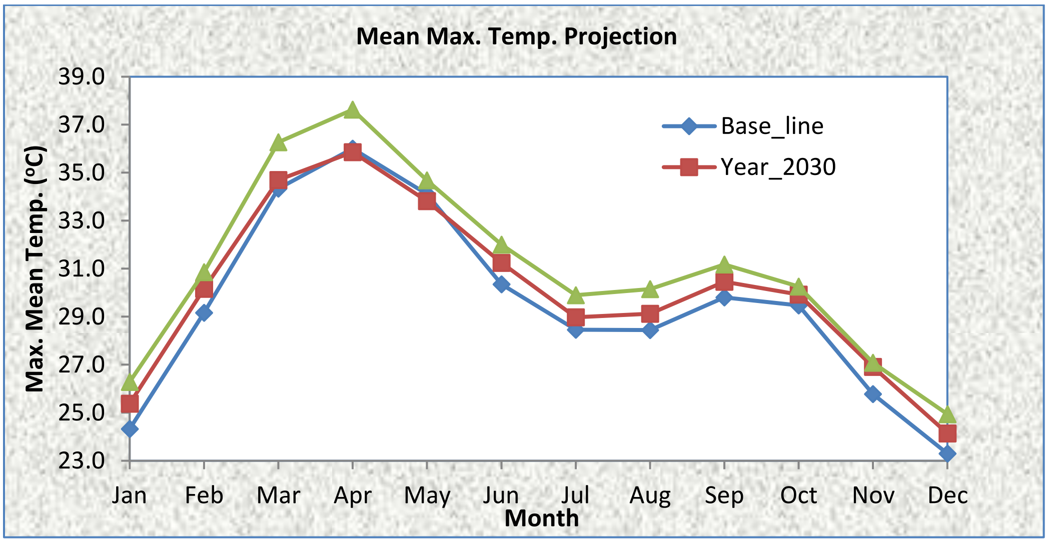


Figure 4.5: Annual cycle of projected maximum temperature with baseline over Polder 34/3in 2030 and 2050, respectively

Minimum temperature projections over Polder 34/3 for RCP4.5 scenario:

99. Minimum temperature projection is obtained from the Figure 4.6 for the years 2030 and 2050, respectively. Minimum surface air temperature may change in 2030 by 1.6, 0.8, 2.0, 0.7, 0.9, 1.0, 0.9, 0.9, 1.0, 1.1, 1.6 and 2.1^{0}C for January, February, March, April, May, June, July, August, September, October, November and December, respectively. It is observed that the change lies between 0.7-2.1^{0}C for the period 2030 and on an average, minimum surface air temperature may increase 1.2^{0}C overPolder 34/3 area in future for the period

2030.Similarly, minimum temperature may change in 2050 by 2.4, 1.9, 2.7, 1.9, 1.5, 1.5, 1.5, 1.4, 1.5, 1.2, 1.2 and 1.8^0 C for January, February, April, May, June, July, August, September, October, November and December, respectively. Minimum surface air temperature in various months may vary by 1.2-2.4^{0}C for the period 2050. On an average the minimum surface air temperature is estimated to be increased by 1.7^0 C for the year 2050.

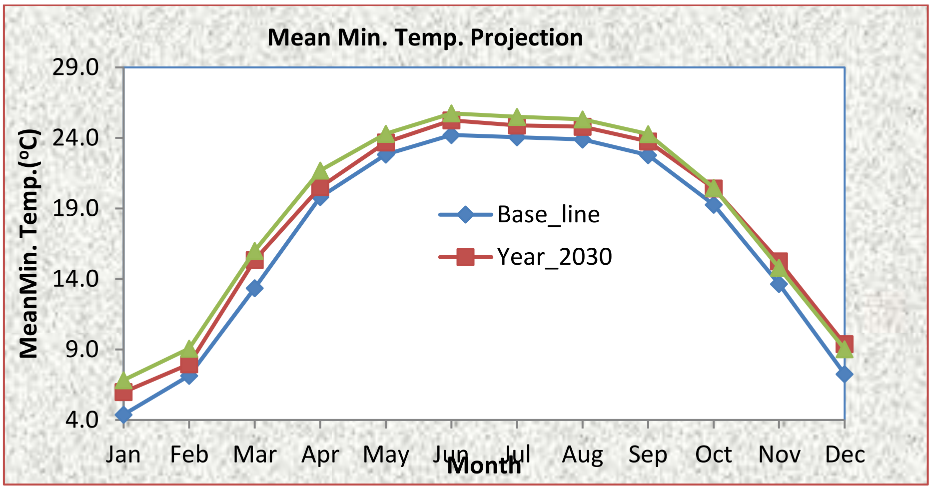


Figure 4.6: Annual cycle of projected minimum temperature with baseline over Polder 34/3 in 2030 and 2050, respectively

4.5 Climate Change Induced Natural Hazard

100. Bangladesh is vulnerable to sea level rise, as it is characterized by a densely populated coastal area with smooth relief comprising broad and narrow ridges and depressions (Brammer, et al., 1993). Sea level rise has various impacts on Bangladesh. The Bay of Bengal is one of the hotspots for the generation of tropical cyclones. In this region, cyclones occur in the pre- and post-monsoon seasons. The coast is also vulnerable to cyclone-induced storm surges. Following are the possible implications of climate change considered in this study for the coastal areas of Bangladesh:

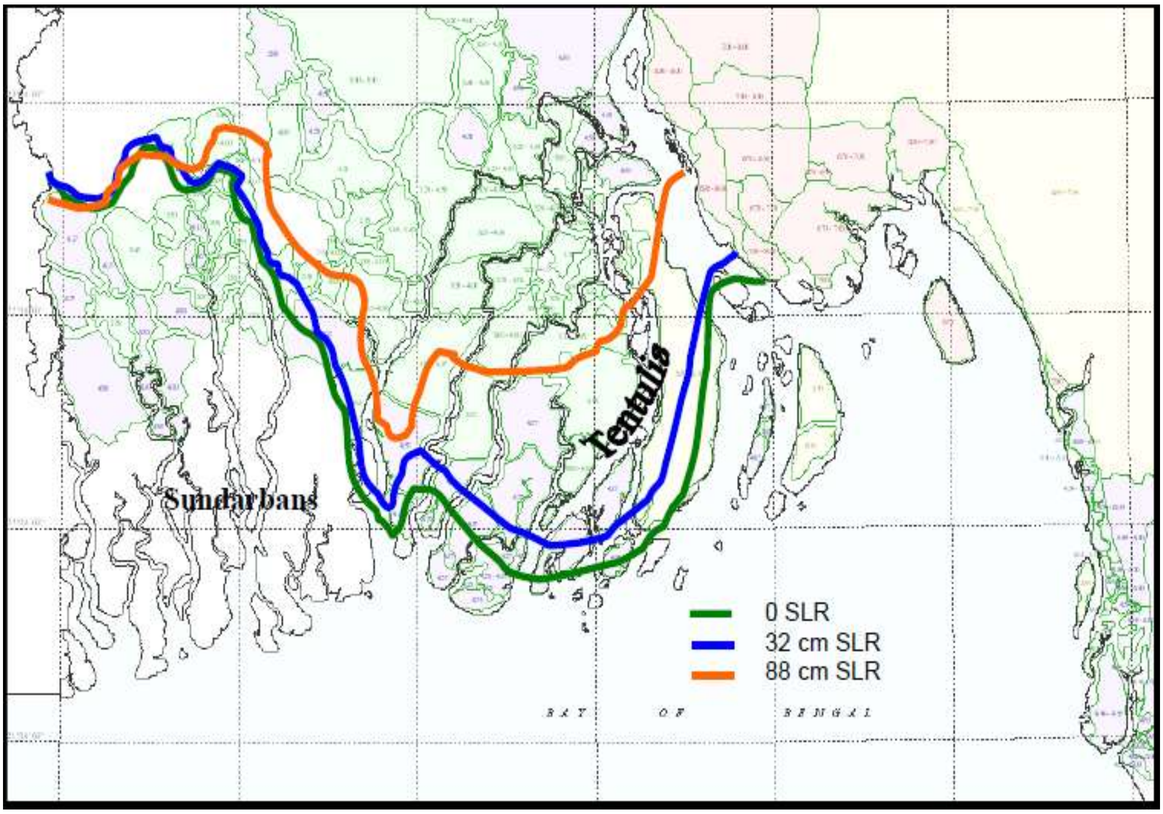
Sea Level Rise and Coastal Inundation

101. Bangladesh is vulnerable to current coastal hazards and anticipated Sea Level Rise (SLR) because of its lower elevation. WARPO (2006) predicted that the Sea Level Rise (SLR) may be increased by 14, 32 and 88 cm in 2030, 2050 and 2100 respectively which may inundate about 8%, 10% and 16% respectively of total land mass of Bangladesh. The 5th IPCC (2013) predicted that the global sea level may be raised by 26 and 47 cm during the period 2046-2064 and 2081-2100 respectively using RCP4.5 scenario. The rate of sea level rise of Bangladesh is higher than that of global sea level rise. SMRC (2000) observing three tidal gauge records for the period 1977-1998 (22 years) and found that tidal level at Hiron Point, Char Changa and Cox's Bazar has been raised by 4.0 mm/year, 6.0 mm/year and 7.8 mm/year respectively;. These three tidal gauge stations are located in western coast (Hiron Point), Central Coast (Char Changa) and Eastern Coast (Cox's Bazar) respectively. The rate of the tidal trend is almost double in the eastern coast than that of the western coast. This difference would be due to subsidence and uplifting of land. However, Sing (2002) mentioned that the difference is mainly due to land subsidence.

Tidal Flooding

102. Tidal flood is a common phenomenon in the coastal belt of Bangladesh. Two tide events (high tide and low tide) occur in a day. During high tide, low lying and un-protected areas are inundated causing damage to agriculture and this extent even gradually increased due to sea level rise.

103. The average elevation of coastal lands in Bangladesh is below 1.5 mPWD. It is predicted in several studies that the sea-level in the Bay of Bengal may rise in the range of 0.3 to 1.5 m by the year 2050 (DOE, 1993). In the coastal front there will be stronger-than-usual backwater effect due to sea level rise induced high oceanic stage, resulting into retardation of discharge flow, particularly around the confluence points of the major rivers. Consequently, the risk of floods of high intensity and duration, similar to that occurred in 1998, will be exacerbated. Under climate change scenario about 18 per cent of current lowly flooded areas will be susceptible to higher levels of flooding while about 12 to 16%of new areas will be at risk of varied degrees of inundation. As per recommendations of NAPA, the SLRs in the coast of Bangladesh are 14 cm, 32 cm and 88 cm for the year 2030, 2050 and 2100 respectively. In a recent study, IWM (2006) predicted that flooding of coastal lands may increase by 21% by the year 2100 and 10.3% by the year 2050 with respect to the ordinary flooding condition when approximately 50% lands go under flood.



Map 4.1: Different sea level rise in dry season (IWM and CEGIS, 2007)

Salinity Intrusion

104. Saline water intrusion is highly seasonal in the coastal area of Bangladesh. Salinity and its seasonal variation are dominant factors for the coastal ecosystem, fisheries and agriculture. Therefore, any change in the present spatial and temporal variation of salinity will affect the biophysical system of the coastal area. IWM and CEGIS (2007) found that the base condition, about 10 percent of the coastal area is under 1 part per thousand (ppt) salinity and 16 percent area is under 5 ppt salinity and this area will be increased to 17.5 percent (1 ppt) from 10 percent and 24 percent (5 ppt) from 16 percent by 2050 considering 88 cm sea level rise. So, there will be an increase of about 8 percent in the area under 5 ppt salinity levels due to sea level rise. The areas of influence of 5 ppt salinity line under different sea level rise are shown in Map 4.1. The intrusion of salinity will increase soil salinity and surface water salinity and might affect agriculture crop production.

Table 4.1: Major Cyclones Hit the Bangladesh Coast

Major Cyclone year and Dates		Maximum Wind Speed (km/hr)	Storm Surge Height (meter)
30 Oct	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 Dec	1965	211	4.6-6.1
1 Nov	1966	146	4.6-9.1
23 Oct	1970	163	3.0-4.9
12 Nov	1970	224	6.1-9.1
25 May	1985	154	3.0-4.9
29 Nov	1988	160	3.0-4.0
29 Apr	1991	225	6.0-7.5
2 May	1994	210	2.0-3.0
25 Nov	1995	140	2.0-3.0
19 May	1997	220	3.1-4.2
15 Nov (Sidr)	2007	240	up to 10
25 May (Aila)	2009	120	3.0

Source: MCSP, 1993; Bangladesh Meteorological Department and field survey, 2010

Cyclones and Storm Surges

105. Bangladesh is especially vulnerable to cyclones because of its location at the triangular shaped head of the Bay of Bengal, the sea-level geography of its coastal area, its high population density and the lack of coastal protection systems. During pre-monsoon (April–May) or post-monsoon (October–November) seasons, cyclones frequently hit the coastal regions of Bangladesh. About 40% of the total global storm surges are recorded in Bangladesh (Murty, 1984).

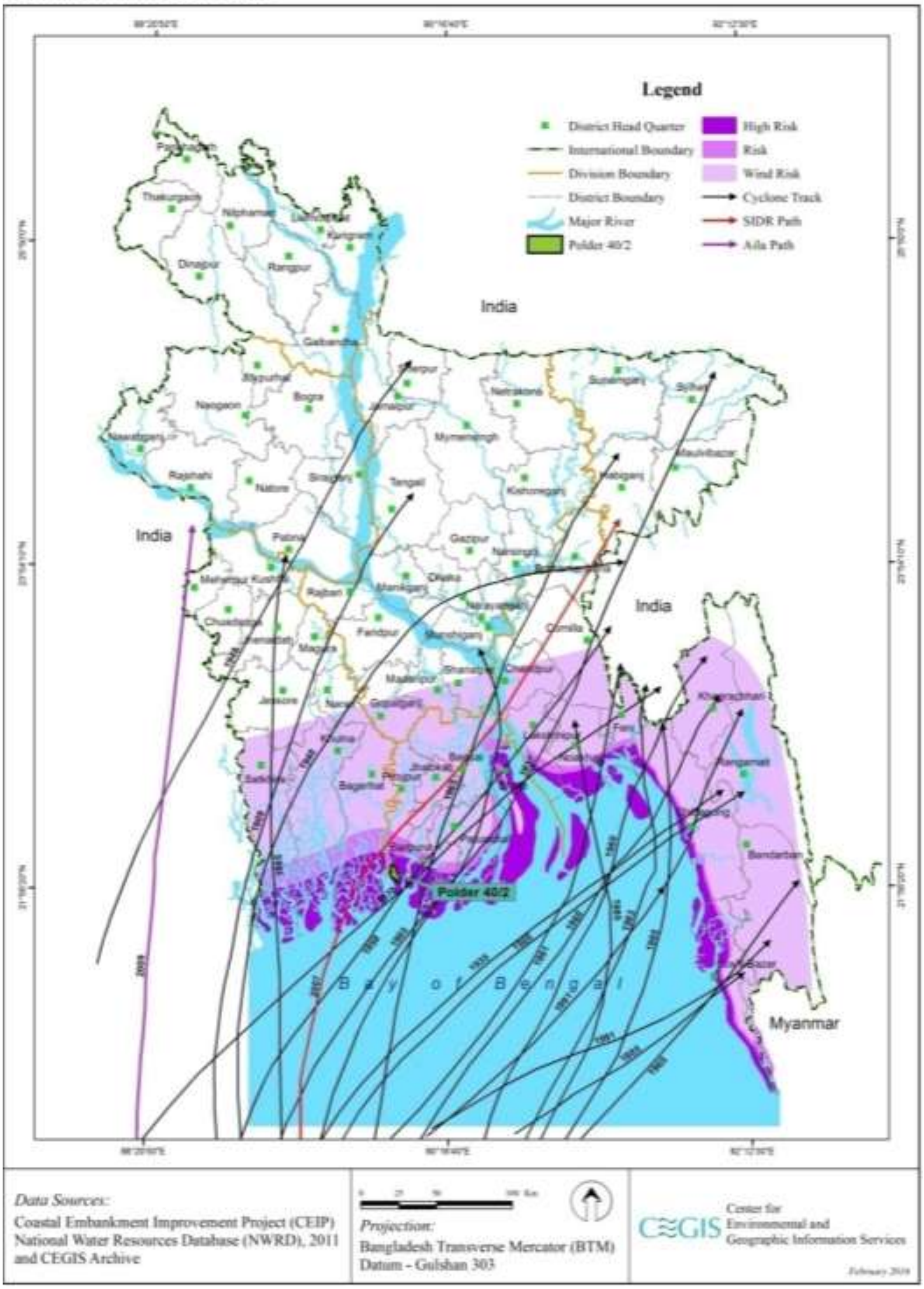
106. Tropical cyclones accompanied by storm surges are among the major disasters that occur in Bangladesh and severely damage lives and standing crops in the study area. Roughly, three to seven severe cyclones hit the coastal area in each decade. There is some evidence that peak intensity may increase by 5 percent to 10 percent, which would contribute to enhance storm surges and coastal flooding. Increase in wind velocity and storm surge height will result in further inland intrusion.

107. Tropical cyclones and surges are the major threats to the coastal areas, causing loss of human lives and livestock and severe damage to crops and properties. During last 125

years, more than 42 cyclones had hit the coastal areas (Map 4.2) and 16 cyclones (Table 4.2) have occurred in the last 25 years. Table 4.2 represents that the occurrence of cyclone is more frequent due to climate change. The strength and number of major cyclones may be increased due to higher sea surface temperatures associated with global warming. Tropical cyclones and storm surges are particularly severe in the Bay of Bengal region. Last devastating cyclone (Aila) hit the study area and project site on 25th May 2009. The project area is located in the wind risk zone of Bangladesh.

108. The area is vulnerable to cyclone and storm surge. During Aila, storm surge water entered the Polder area by overtopping the left bank of the Passur River. As per local community perception, the site has experienced the maximum surge height during cyclone Aila. The local people opined that the area was inundated by the surge height of 4.47m during Aila.

Cyclone StormTracks Map



Map 4.2: Previous Cyclonic Storm Tracks*(Source: MCSP, 1993)*

Rainfall and Temperature, Drainage, and Water logging

109. Global warming is an important issue, with a variety of influences on agriculture, water, health and economy. It is now recognized that climate variability and extreme events affect the society more than changes in the mean climate (IPCC, 2001). Human induced changes in the global climate and associated sea-level rise are widely accepted by the policy makers and scientists. The IPCC concluded that the balance of evidence suggests a discernible human influence on global climate (IPCC-AR4, 2007). The exact magnitude of the changes in the

global climate is still uncertain and subject to worldwide scientific studies. It is broadly recognized that Bangladesh is more vulnerable to these changes. Indeed, it has internationally been argued that Bangladesh, as a country, may suffer the most severe impacts of climate change. Bangladesh is highly vulnerable because it is a low-lying country located in the deltaic plain of the Ganges, the Brahmaputra and the Meghna and densely populated. Its national economy strongly depends on agriculture and natural resources that are sensitive to climate change and sea-level rise. The impact of higher temperature and more extreme weather events such as floods; cyclone, severe drought and sea-level rise are already being felt in South Asia and will continue to intensify (Huq et al., 1999; Ali, 1999). In this connection proper planning and sensible management of water resources are essential for this region. Long-term planning is not possible without any idea of the change of climate that may take place in future. Climate models are the main tools available for developing projections of climate change in the future (Houghton et al., 2001).

110. Regional Climate Downscaling (RCD) has an important role to play by providing projections with much greater detail and more accurate representation of localized extreme events than the GCM. South Asia Coordinated Regional climate Downscaling Experiment (CORDEX) domain data (resolution 50 km) are available at Centre for Climate Change Research (CCCR), IITM, India. The CCCR is recognized by World Climate Research Programme (WCRP) and is responsible to generate downscaling model data over South Asia CORDEX domain. These data have been used to generate the future scenarios for rainfall and temperature at Patuakhali (because patuakhali is the nearest place of the Polder) in Bangladesh using RCP4.5 data set. The RCM model outputs were analyzed to find out seasonal and annual rainfall and temperature over Bangladesh. It is assumed that the year 2030 means averaged precipitation/temperature during the period 2021-2040 and year 2050 means averaged precipitation/temperature for the period of 2041-2060 and base period 1990 means averaged during the period 1981-2000.

5. Description of the Project

5.1 General

111. The Bangladesh low-lying Delta is formed by the interaction of the very large summer discharges of both water and sediment from the Ganges, Brahmaputra (Jamuna) and Meghna Basins with tides in the Bay of Bengal, which can vary in range from 3 m in the west to nearly 6 m in the northeastern corner of the Bay near Sandwip.

112. The Coastal Zone of Bangladesh has been defined as the area within which the rivers flows are influenced by the tide. Given the high tidal range and the very low river gradients, the tide reaches very far landwards, particularly in the dry season. If the upstream freshwater inflows are reduced in the dry season, salinity can also intrude very far upstream within the river system, which comprises a number of very large estuaries.

Coastal Embankment Project

113. The Coastal Embankment Project (CEP) was initiated in the 1960s to reclaim or protect areas in the coastal zone that lay below the highest tide levels for periodic inundation by saline water. These lands could now be used for agriculture by providing drainage structures capable of evacuating excess water during low tide. This system worked well for many years and 1.2 million hectares came under protection the embankment system bringing immense benefits.

114. However, there have been unintended consequences of this project. The very act of preventing the high tides from spreading over the land and confining them within the river channels initially increased the tidal range by about 30 per cent, which might have had an immediate beneficial impact on drainage. However, the reduction of upstream and overbank storage also decreased the tidal cubature (i.e., the volume of water displaced during a tidal cycle).

115. The reduction in cubature induced sedimentation or more correctly a reduction in cross sectional areas of the rivers of all types – the large rivers such as the Passur which have sandy bottoms and clay/silt banks and the smaller rivers which have an excess of silt and clay. The consequent choking of smaller rivers resulted in drainage congestion within some internal Polders, and navigation problems in some.

116. The embankment system was designed originally to keep out the highest tides, without any consideration of possible storm surges. Recent cyclonic storm damages and the anticipation of worse future situations because of climate change, has caused this strategy to be revised. Additional problems have also been identified – the direct impact of sea level rise on salinity intrusion into the coastal zone as well as on Polder drainage.

The CEIP Initiative

117. It is well recognized that infrastructural interventions in the coastal areas by embankments and cyclone shelters have significantly reduced its vulnerability to natural disasters at least partially and thus the poor people have some assurance of safety to their lives and crops. However, some effectiveness of the infrastructures in most cases has been compromised through poor and inadequate maintenance and sometimes by shifting the embankments towards country sides. With the occurrence of the frequent storms in the recent period, the Coastal Embankment Systems (CES) has weakened and calls for systematic restoration and upgrading.

118. After cyclone Sidr struck the coastal area causing severe damage to the infrastructure, lives and properties of the coastal belt, GOB obtained an IDA/credit for Emergency Cyclone Recovery and Restoration Project (ECRRP, 2007) and proceeds from this credit would be used to meet the expenses for preparation of the proposed Coastal Embankment Improvement Project-Phase-1 (CEIP-1).

119. It had been apprehended that undertaking the rehabilitation of coastal embankment system under one or two localized projects would not bring any convincing change in such a vast area. To resolve this multi-dimensional problem a strategic approach in the name of Coastal Embankment Improvement Programme (CEIP) was felt necessary. It incorporates a longer-term perspective in a programme spread over a period of 15-20 years, composed of at least 3-4 sub-phases.

120. Polder 34/3 is one of the Polders to be rehabilitated under the CEIP-1.

5.2 Overview of Polder 34/3

121. Polder 34/3 is located in Bagerhat Sadar Upazila under Bagerhat District. The Polder covers mainly two Union Parishad (U/P) namely Karapara and Shatgombus under Bagerhat Sadar Upazila. The Polder is bounded by Putimari River to the South Butiamari River to the West and Khulna-Bagerhat Highway to the North.

122. The Polder was conceived in the early 1960s. Cyclonesarethe main threat to cause damage of life and properties inthe Polder area. The original concept of construction of this Polder was to protect low lying coastal areas against tidal flooding and salinity intrusion, considering only the tidal effects but ignoring effects of wind, wave and cyclonic storm surges, which in the case of this Polder, are not very significant because the Polder is at a distance of about 50 km from the costline of the Bay of Bengal. Entire Polder is threatened remarkably by drainage congestion which could worsen with changes occurring with on-going human induced land use change activities and climate change. Objective of the Project

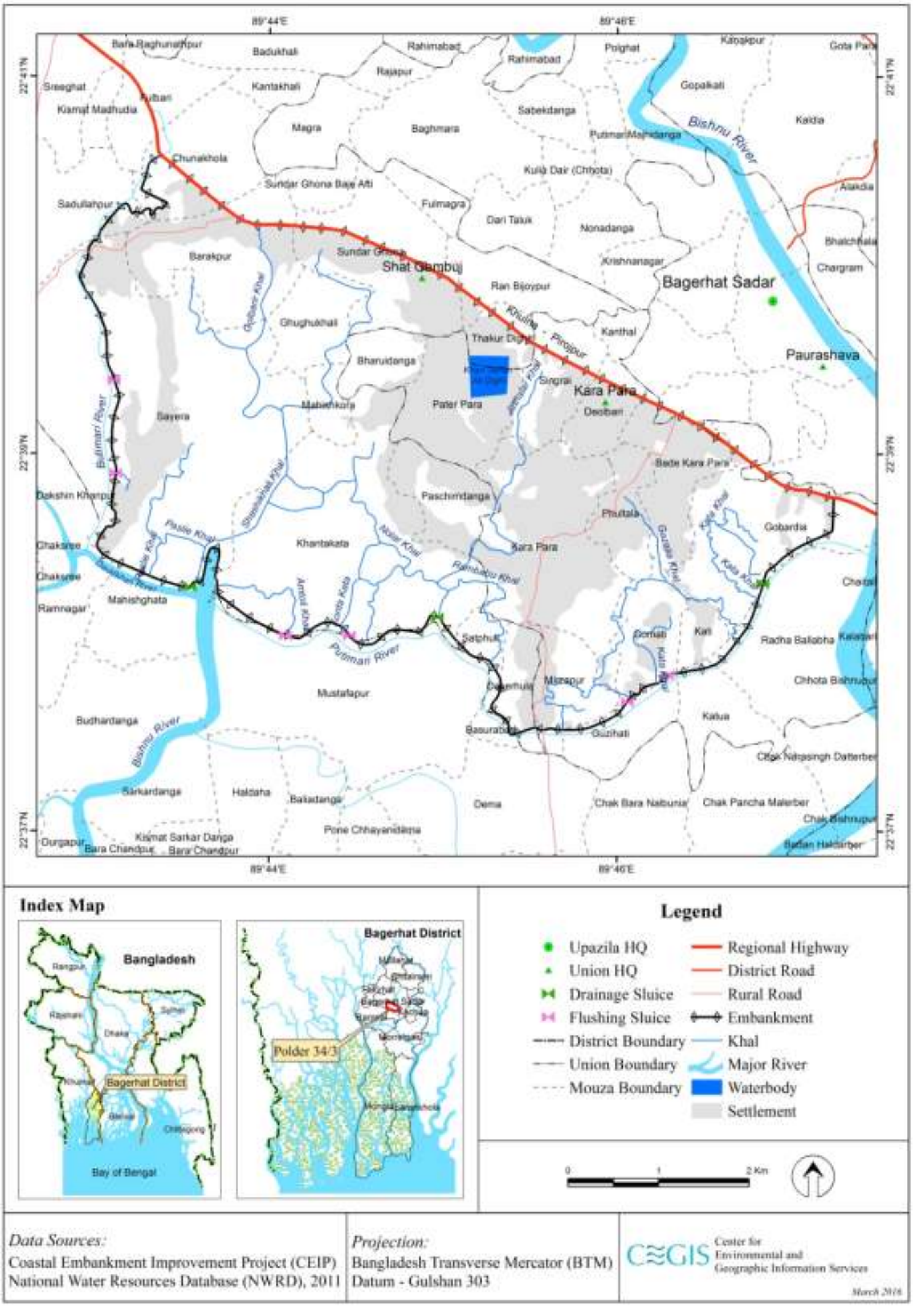
123. The main objective of the Project is to increase the resilience of coastal population from natural disasters and climate change. Specifically, the Project aims at (a) reducing the loss of assets, crops and livestock during natural disasters; (b) reducing the time of recovery after natural disasters such as cyclones; (c) improving agricultural production by reducing saline water intrusion which is anticipated to worsen due to climate change; and (d) improving GoB's capacity to respond promptly and effectively to an eligible crisis or emergency.

5.3 Water Management Problems and Issues in Polder 34/3

124. The condition of the embankment is such that it will be under threat from extreme weather events. Most of the length of the embankment is under-sectioned and in some places the crest level is almost down to ground level. The entire embankment would need to be re-sectioned to comply with the new CEIP design. The existing structures are very dilapidated. The gates are corroded by saline water. The concrete surfaces of the structures are badly deteriorated. The loose apron both C/S and R/S are either damaged or washed away. There is a demand to use these structures both for flushing and drainage purposes. Many of the structures have to be replaced as they are not repairable. There are shrimp cultures Ghers[5] inside the Polder occupying about 50% of the total area of lands as reported by the local

[5]Gher-Farm lands converted into ponds with low dykes and used for cultivation of shrimp/prawn/fish.

people. Conflict exists between Gher owners and farmers in the Polder. For consolidating agricultural activities, the conflict in between the fish pond owner and the farmers have to be resolved.Some flushing inlets have been constructed by the fish pond owners at their own initiative but these are not being used properly rather creating acute internal water management problems. The outfall rivers of the periphery of the embankment namely Putimary River and Butiamary River in between Polder- 35/3 and 34/3 have been silted up causing drainage congestion to the adjacent area. The sustainability of dredging of these peripheral rivers is to be examined under this project to remove drainage congestation as well as to ensure navigation in peripheryof the river and monitored as mentioned in Table 11.2. The internal drainage channels have also silted up due to lack of maintenance for a long time. These also have to be re-excavated for efficient drainage within the Polder. The alignment of the embankment and existing structures is shown below in Map 5.1.



Map 5.1: Existing Structures of Polder- 34/3

125. Based on opinions gathered from the local people, during major field investigation carried out in January 2016, the following key water management problems and issues were identified in Polder 34/3.

- Length of embankment is under-sectioned and in some areas the crest level is almost down to ground level, so tidal water easily inundated the Polder area easily.
- Lack of regular repair and maintenance of water control structures and embankments;
- Deplorable condition of existing drainage/flushing sluices and insufficient number of drainage sluices,
- Community abuse of existing infrastructure for fishing, shrimp/ prawn farming through unauthorized and inappropriate operation of sluices
- High rate of siltation in internal drainage khals and decrease in carrying capacity of khals through illegal encroachment
- Outfall rivers of the periphery of the embankment namely Putimary River and Butiamary River in between Polder- 35/3 and 34/3 have silted up causing drainage congestion to the adjacent area.
- Conflict exists between fish pond owners and farmers in the Polder area during gate operation.
- Absence of functional community organizations for operation and co-management of the Polder system

126. Present Status of Water Management Infrastructures There are some typical water management infrastructures such as peripheral embankments, Drainage/FlushingSluices, drainage khals and others in Polder- 34/3. Based on field investigation carried out in January 2016, coupling with the information received from CEIP Consultant, the study team gathered the following information regarding the status of existing infrastructure.

Table 5.1: Summary of existing water management infrastructures

Type of Infrastructures	Specification
Total length of Embankment	16.75 km (Design crest level: 4.27 mPWD)
Total number of Drainage Sluices	3 nos.
Total number of Flushing Inlets	6 no
Total length of Drainage Khals (Water Channel)	35.00km
Gross protected area	3656 ha
Net Cultivable area	2930 ha

Source: DDCS&PMSC Design Team

127. To ensure sustainable management, optimal use and equitable sharing of water resources through proper management of the infrastructures; adequate physical interventions are required.

Embankment

128. The entire length of the embankment needs to be re-sectioned upto the CEIP design level. There is brick soling and bitumen carpeting on the top at some segments of the embankment constructed by LGED. This needs to be removed to facilitate re-sectioning. Re-building of the roads should be taken up through discussion between BWDB and LGED. Tender has been floated for re-sectioning of embankment from Ch. 1.00 km to Ch. 2.5 km end Ch. 3.5 km to Ch. 5.5 km under Aila (GoB) funding.

Photograph 5.1: Present condition of the embankment of the Polder

Drainage channel

129. Most of the diversion channel and internal drainage channel have silted up. About 30 km of khals are needed to be re-excavated for efficient drainage within the Polder. The river receiving the outfall (Putimarykhal) in between Polder 34/3 and Polder 35/3 has been silted up and about 15 km of outfall channel needs to be re-excavated, if the present drainage pattern is to be restored.

Water Control Structures

130. There are 3 (three) drainage sluices in the Polder. All the sluices are in very bad condition. It was found that the R/S & C/S loose apron are fully or partially damaged and concrete surface of the structures are in a very deplorable condition. The vertical lift gates at C/S and flap gates at R/S are not functioning properly and gate channels are corroded. All these three sluices are not sufficient for draining out the rain water and flushing in of the sweet water within the Polder area. The local farmers suggested the drainage sluices by providing long- lasting to achieve project objective.

131. Some Flushing Inlets are partially damaged due to lack of maintenance. Some additional drainage/flushing inlets are required. The present condition of the structures is shown below in tabular form:

Table 5.2: Operational status and recommendation of structures

Sl.	Location of Structure with Number of Vents	Present Condition of the Structures	Recommendation for remedy
1	DS-1 (1v-1.5 x 1.8) RCB	There are damages to the U/S and D/S loose apron of the structure, concrete surface is in a very deplorable condition. Lift gate channel have been corroded.	The structure is required to be replaced with provision for drainage and flushing.
2	DS-2 (1v-1.5 x 1.8) RCB	Concrete surface is in a very deplorable condition. Loose apron have been damaged. Lift gate channels are corroded.	The structure is required to be replaced with provision for drainage and flushing.
3	DS-3 (3v-1.5 x 1.8) RCB	There is a leakage along the earth face of the barrel wall. Concrete surface is in	The structure is required to be replaced with provision for drainage and flushing.

Sl.	Location of Structure with Number of Vents	Present Condition of the Structures	Recommendation for remedy
		a very deplorable condition. U/S and D/S loose apron have been damaged.	
4	F/S-1 (1v-0.9 x 1.2)	It was found that there is a hole on the top of the barrel slab and crack formed at box wall. Concrete surface was in a very deplorable condition. U/S and D/S loose apron have been damaged.	The structure is required to be replaced with provision for drainage and flushing.
5	F/S-2 (1v -0.9 x 1.2) F/S -3 (1v-0.9 x 1.2) F/S -4 (1v -0.9 X 1.2) F/S –5 (1v -0.9 x 1.2) F/S –6 (1v -0.9 x 1.2)	U/S and D/S loose apron have been damaged in almost all the cases. Minor repairing to the wing-wall is required. In some cases, vertical lift gate with lifting device and flap gates are to be replaced.	Necessary repairing of the structures is needed.

Note: DS = Drainage Sluice; FS = Flushing Sluice

Source: CEIP 2015, and CEGIS Field Investigation, 2016

Intervention Photographs

Photograph 5.2: Gobordia 1 vent Sluice

Photograph 5.3 : Flushing sluice at Gomoti

Photograph 5.4 : Flushing sluice over Amtoli khal

Photograph 5.5 : Sashikhali 3 vent Sluice

Photograph 5.6 : Flushing sluice at Purba sayra

Photograph 5.7 : Flushing sluice at Lashmi khali

5.4 Proposed Rehabilatation Plan

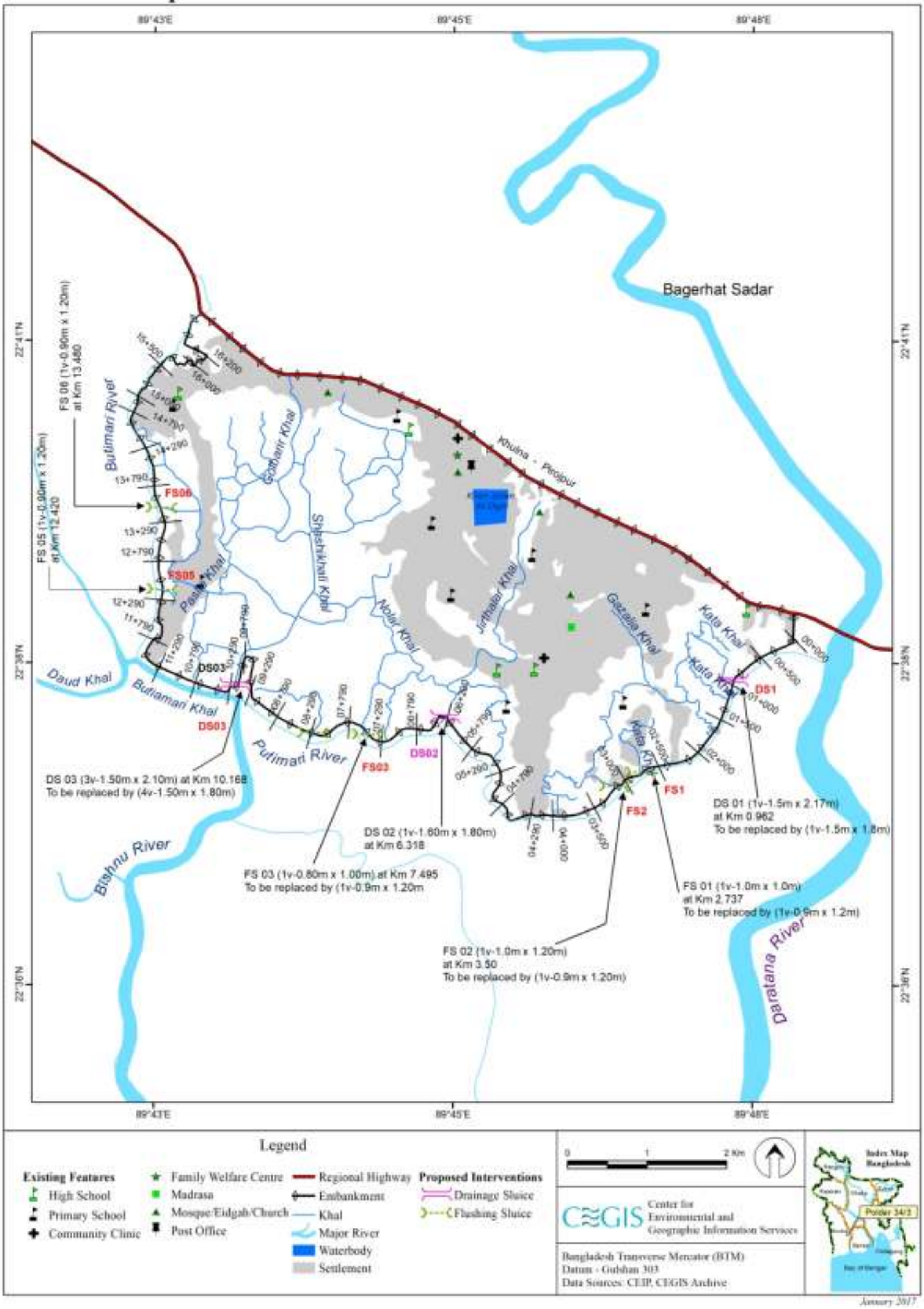
132. The proposed interventions in Polder-34/3 (Map 5,2) under CEIP-1 are listed in Table 5.3. It is mentionable that drainage modelling of the coastal Polder has been carried out by IWM to find out the design parameters for drainage channel systems, drainage regulator, river bank, slope protection works. Climate resilient coastal embankment crest levels have been estimated considering the combined effects of climate change projected cyclone storm surge effects and wave generated by cyclone induced winds. The model has been developed considering climate change condition both with and without Project interventions (IWM, 2016). The Project interventions are further detailed in the following sections.

Table 5.3: List of Proposed Interventions in Polder-34/3

Type of Work	Specification
Re-sectioning of embankment	16.75 km
CEIP design crest level of Embankment	4.50 m PWD
Construction of Drainage sluice under CEIP	3 nos
Construction of Flushing Inlets	1 no.
Repair of flushing inlets	5 nos
Re excavation of drainage channel	9.0 km
Afforestation	7.0 ha

Source: DDCS&PMSC Design Team, 2017

Location of Proposed Interventions: Polder 34/3



Map 5.2: Proposed Interventions of Polder 34/3

133. To implement the afore mentioned interventions, the following phase-wise activities are to be carried out (Table 5.4). The activities under each of the interventions have further been discussed and specified in the following sections:

Table 5.4: List of activities in Polder- 34/3 at different project phases

Pre-construction phase	Construction phase	Post-construction phase
• Preparation of construction site, labor shed, material stock yard etc • Labor, materials and equipment mobilization • Display of billboard at construction site for public awareness	• Re-sectioning of embankment • Placement and compaction of earth • Construction of drainage sluices • Construction/repair of flushinginlets • Re-excavation of Drainage khals • Disposal of canal excavated wastes • Implementation of afforestation	• Checking of the physical condition and function of embankment and water control structures • Checking of the depth of khals • Checking the condition of R/S and C/S slopes • Monitoring the functions of WMOs

Re-sectioning of Embankment

134. Under the proposed interventions in the Polder, a total length of 16.75 km of embankment is to be re-sectioned. The earth will be dumped in layersas specified by the Engineer and compacted upto the recommended crest level. The bitumen carpeting road (paved road) on the crest of the embankment constructed by LGED on some segments needs to be replacedduring re-sectioning of embankment as per CEIP design. The side slopes of the embankment will also be rehabilitated under CEIP program.Table 5.5a and Table 5.5b shows detailed information about the works to be carried out on the embankment.

Table 5.5a: Detail of Works on Embankments

Sl.	Chainage	Length (Km)	Proposed Crest Level	Side slopes
Re-sectioning of Embankment				
1	0+000 to 16+750	16.75	4.50 mPWD	R/S 1:3 and C/S 1:2

Source: Design Study Finding of CEIP-1, 2015

Table 5.5b: Design Parameters for Embankment Crest Level under Climate Change Condition

								Wave Computation								Monsoon Levels				
Point No.	Location	LDL Crest Level (mPWD)	Existing Ave. Crest Level (corrected mPWD)	Modelled Storm Surge level (corrected mPWD)	Standard Deviation (m)	Sidr Simulated surge level (corrected mPWD)	Aila Simulated surge level (corrected mPWD)	Recommended Slope	Free board for Grass or Smooth paved (Roughness coefficient 1.0)	Free board for rough Slope (Roughness coefficient 0.8)	Allowance for Subsidence	Rqd crest Levelw/o roughness + Subsidence & no std	Rqd crest Levelw/o roughness + std + Subsidence	Rqd crest Levelwith roughness + subsidence & no std	Rqd crest Levelwith roughness + Subsidence + std	25 year maximum WL in June-Sept period	Max wind wave height in June Sept period	Free board for Grass or smooth paved(Roughness coefficient 1.0)	Rqd crest Levelw/o roughness with subsidence and freeboard	Crest Level Considering 0.90m freeboard according to Standard Design Manual, Volume 1, standard design
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13 (5+10 +12)*	*14 (13+ 6)*	*15 (5+11 +12)*	*16 (15+ 6)*	*17*	*18*	*19*	*20 (17+19 +12)*	*21 (17+0.9m+ 12)*

Source: Design Team of DDCS&PMSC, 2019

*All values of storm surge level and monsoon water level are for 25-year return period under climate change conditions

Note 1: At Polder No. 34/3, Storm Surge is insignificant, Monsoon Water Level governs the fixation of crest level of embankment.

Note 2: According to the design manual of BWDB (Standard Design Manual, Volume 1, standard design criterion of BWDB), the required minimum freeboard is 0.9m. Accordingly the proposed crest levels are given in column 21.

Description of construction activities

135. The construction of the embankment in re-sectioning work will be carried out with the soil/earth obtained from borrow pits or other sources as approved by the Engineer-in-charge. The earth materials will be well graded, homogenous and free of logs, stumps, roots, rubbish or any other ingredient, organic/ vegetable matter.

136. Labor sheds construction with proper sanitation and other required facilities should be planned before the commencement of construction activities for embankment works. A suitable site shall be selected and prepared by cleaning bushes, weeds, trees, etc. Alignment of the embankments has to be fixed with adequate base width. Base stripping and removal of trees, weeds,etc., will be done as per instruction of the Engineer-in-charge. The tools required for the re-sectioning of embankments will be procured during this period. After validating the final design, excavation of soil/carried earth will be dumped in layers in a selected area. At the same time, each layer (1.5 feet) of dumped soil will have to be compacted mechanically through a compactor machine. The sloping and shaping of embankment will be developed after proper compaction in layers. The required turfing with grass will then be provided on the slope of the embankment. Watering and fertilizers will also be provided as per the instructions in the EMP.

Construction/Repairing of Drainage Sluices/Flushing Inlets

137. The Polder- 34/3 has three numbers of Drainage Sluices and six numbers of flushing inlets. All the existing Drainage Sluices will bereplaced with new design specifications. Amid six (6) existing flushinginlets of the Polder, five of them would be repaired under the proposed interventions. The summary of design information of the proposed works in these drainage sluices/flushing inlets are given in Table 5.6.

138. The EIA study presumes that the invert level of the drainage sluice gate have been fixed in a manner that about 50-60% of water will be retained in the khal to facilitate irrigation, fisheries, other aquatic life, ecological services, environment and other purposes.

Table 5.6: Detail of Works in Drainage Sluices/Flushing Inlets

Sl.	Name of drainage sluices/flushing inlets	Chainage (at km)	Khal Name	Name of outfall river	Length of Khals (Km)	Lowest Tide level (m. PWD)	Lowest elevation of basin (m. PWD)	Existing Sill Level (m. PWD)	Proposed Sill level (m. PWD)	Remarks
1	DS-1 (1v-1.5 x 1.8)	km. 0.95	Gobordia	Putimari river	0.50	- 0.60	0.87	-1.63	-0.75	To be replaced
2	DS-2 (1v-1.5 x 1.8)	km. 6.30	Jirthalar khal	Putimari river	3.50	-0.50	0.89	-1.11	-0.50	To be replaced
3	DS-3 (3v-1.5 x 1.8)	km 10.18	Shashikhali khal	Daudkhali River	5.00	-0.40	0.86	-1.64	-0.50	To be replaced
4	F/S-1 (1v-0.9 x 1.2)	km 2.60	Gomoti	Putimari river	-	-	-	-0.51	0.00	To be replaced
5	F/S-2 (1v -0.9 x 1.2)	km 3.22	Mirzapur	Putimari river	-	-	-	-1.03	0.00	To be repaired
6	F/S -3 (1v-0.9 x 1.2)	km 7.50	Konta kata khal	Putimari river	-	-	-	-0.57	0.00	To be repaired
7	F/S -4 (1v -0.9 X 1.2)	km 8.27	Amtoli khal(1)	Putimari river	-	-	-	-0.71	0.00	To be repaired
8	F/S –5 (1v -0.9 x 1.2)	km 12.42	Amtoli khal(2)	Butiamari khal	-	-	-	-0.76	0.00	To be repaired
9	F/S –6 (1v -0.9 x 1.2)	km 13.59	Ratna khal	Butiamari khal	-	-	-	-0.13	0.00	To be repaired

Source: Design Study Finding of CEIP-1, 2017

Description of construction activities

139. Before starting the construction activities of flushing sluices, a labor shed will be constructed withprovision of sanitation, safe drinking water and other facilities. During this period, required construction materials (sand, cement, wood, shuttering materials, etc.) will be procured by the contractor as per tender schedule. Before starting the construction of drainage sluices, ring bundhs and diversion channels will have to be constructed on the selected and prepared site as per instruction of the Engineer-in-charge. After that, the foundation treatment required for the structure will be carried out. CC and RCC works along with cutting, bending and binding of rods will be performed as per specification. CC blocks will be prepared and placed as and where required as per design and specification. After construction of approach roads/embankment, fitting and fixing of gates and hoisting device will be carried out. Gates will be properly painted. The intake and outfall of the gates will be constructed as per design. The CC blocks will be made for river training works and pitching works will then be conducted.

Re-excavation of Drainage Khals

140. Three (3) drainage channels with a total length of 9 km (see Table 5.7) will be re-excavated to ease water flow and reduce drainage congestion. An estimated volume of 0.0877 million cubic meters of soil/silt will be excavated. If the excavated materials are found suitable, the Contractor can use the materials for construction of embankments upon prior approval by the DDCS&PMSC. Moreover,the excavated soil will be used for strengthening the khal banks. As per consultation, local people are interested to take earth materials, as well. The excavated materialswill be used for raising the plinth level of their earthen kutcha houses as well as individual house yards, school grounds, play ground, low land, prayer grounds, community centers etc. The water channels to be re-excavated under the project are listed in Table 5.7. Figure 5.1 below shows the conceptual layouts of proposed dumping technique. Compartmental dumping spots will be created along the sides of the excavated khals, allowing any runoff from de-watering of the spoils and from precipitation to drain into the excavated khals.

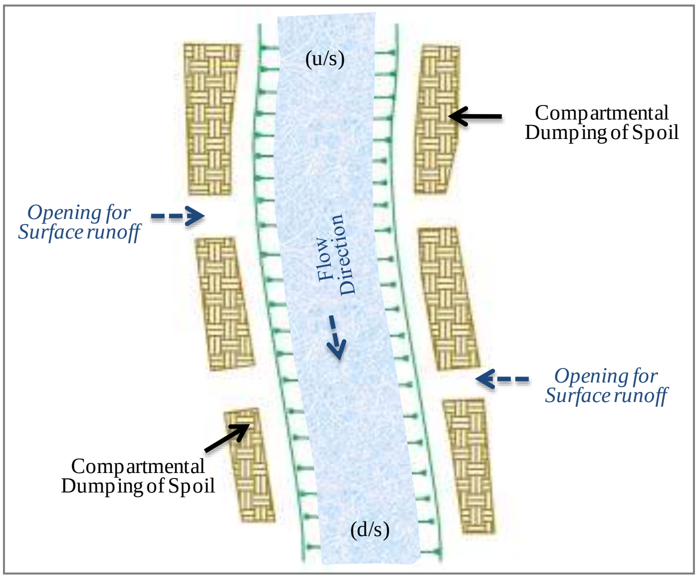


Figure 5.1: Plan form of a typical khal to be re-excavated

Table 5.7: Channels to be Re-excavated

	Name of Khal (Channel)	Length (km)
1	Jirthalar khal	3.50
2	Kata khal-1	0.50
3	Shashi khal	5.00

Source: CEIP-I Design Study Team, 2017

Description of construction activities

141. For re-excavation of the drainage channels, the required tools will have to be procured first. A schematic diagram showing the centerline and layout plan will be made for the re-excavation, the design depth and width of excavation will also be noted as per section of the channel. The channel will then be divided into a number of reaches. The excavation will start from upstream of the channel. Cross dams will be built at both ends of each reach, and soil will be removed from the channels up to the required depth and width. The excavated soil/sludge will be disposed into the approved disposal sites. After completing excavation of one reach, the next reach downstream would be excavated using the same procedures.

Afforestation

142. Afforestation is another intervention for development of the Polder. About 3.28 ha will be brought under plantation from Ch. 4.790 km to Ch. 6.790 km and Ch. 10.00 km to Ch. 15.00 km along the foreshore area of the embankment as a protection measure against tidal surges, wave attack and strong winds in order to reduce toe-erosion and to stabilize the embankment. In addition, afforestation of embankment slope area will be made in 9.2 ha. Thus, the total area under afforestation will be 12.48 ha in Polder 34/3.

5.5 Construction Details

Construction Schedule

143. The construction works in Polder34/3 under the CEIP-1are expected to be completed in four years. The construction schedule is presented in Table 5.8 below:

Table 5.8: Construction Schedule

(Part A)

Sl.	Description	Year One								Year Two			
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Re-sectioning of Embankment (km)												
2	Construction of Drainage Sluices / Flushing Inlets												
3	Re-excavation of Drainage Channels (km)												
4	Other works, including surveys, quality checks, testing,												

Sl.	Description	Year One								Year Two			
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
	inspections, environmental monitoring, etc.												

(Part B)

Sl.	Description	Year Two								Year Three			
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Re-sectioning of Embankment (km)					Turfing							
2	Construction of Drainage Sluices / Flushing Inlets												
3	Re-excavation of Drainage Channels (km)												
4	Other works, including surveys, quality checks, testing, inspections, environmental monitoring, etc.												

(Part C)

Sl No	Description	Year Three								Year Four			
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Re-sectioning of Embankment (km)												
2	Construction of Drainage Sluices/Flushing inlets												
3	Re-excavation of Drainage Channels (km)												
4	Other works, including surveys, quality checks, testing, inspections etc.												
5	Site clearance and clean up												

Design Study Finding of CEIP-1, 2015Construction Manpower Requirement

Construction Manpower Requirement

144. Technical and non-technical manpower will be required for the construction works. The manpower will include senior professionals, Engineers, Technicians, Supervisors, Surveyors, Mechanics, Foremen, Machinery operators, Drivers, and un-skilled laborers. The estimated manpower requirement is presented in Table 5.9. It is mentoined here that labor sheds/camps will be required to house workers (skilled labour). There would be no requirement of labour camp for un-skilled labour because they will be recruited from the local area. But temporary labour camp for local labour during preparation of CC blocks will be established.

Table 5.9: Required manpower for construction

SL	Required Manpower	Number
1	Senior professionals	5
2	Site Engineer	6
3	Technicians	15
4	Admin/support Staff	12
6	Skill labour	40
7	Un-skill labour	220

Source: Main Consultant, 2015

Construction Material

145. The construction materials required for re-sectioning of the embankment and construction/repair of drainage sluices/flushing inlets are soil, cement; steel, stone, sand and vertical gates. Estimated quantities of these materials are presented in Table 5.10.

Table 5.10: Details of Construction materials

Sl	Description	Quantity	Sources
Re-sectioning of embankment			
1	Earth work	477,051 m^3	Private lands specially from river side (low excavated land will be filled up by tidal silts within one or two years), spoils from re-excavation of drainage channels
Construction of drainage sluices/flushing inlets			
2	Cement		To be procured from, cement factory (directly)
3	Sand		To be procured from Khulna, Sylhet
4	Stone		To be procured from Khulna, Sylhet or imported from neaighbour countries
5	Steel		To be procured from Khulna,Dhaka steel mill (directly)

Source: Design Study Finding of CEIP-1, 2017

Construction Machinery

146. A number of construction machinery and equipment would be needed for the construction activities in the Polder. A tentative list of these machinery and equipment is presented in Table 5.11below:

Table 5.11: List of construction equipment and machinery

Sl	Description	Quantity (number)
1	Bulldozer	2
2	Dump- truck	8
3	Pay Loader	2
4	Excavator	15
5	Barge	1
6	Engine Boat	5

Sl	Description	Quantity (number)
7	Vibrator	2
8	Compactor	6
9	Mixture Machine	1
10	Mixing-Plant	1
11	Automated mixture plant	1
12	Truck	6
13	Tractor	5
14	Generator	5
15	Levelling Instrument	3
16	Total Station	3
17	De-watering System	1
18	Low lift pump	10

Source: Engineering / Procurement Team of CEIP-1

147. For rehabilitation of Polder34/3 under CEIP-1 no river protection and no slope protection work will be required. Some CC blocks will be required for rehabilitation/repair of sluices. Since the number of CC blocks required will be less and thus there will be no need of establishing automated CC block manufacturing plant in the Polder area, rather they can be prepared manually.

5.6 Project Implementation Arrangements

Overall Project Management

148. The Government of Bangladesh has the overall responsibility for project management and coordination through its Ministry of Water Resources. A Project Steering Committee (PSC) would provide the forum for overall guidance, policy advice and coordination of the project activities and for addressing inter-agency issues. The BWDB will act as the Project Implementing Agency and implement the project through a Project Management Unit (PMU).

149. **Project Steering Committee (PSC).** The PSC would be chaired by the Secretary of the Ministry of Water Resources and will include the Secretaries of the Ministriesof Finance, Agriculture, Environment& Forest, Public Health Engineering, and the Chief Executive Officersof selected NGOs, and representatives of the local/district administration as its members. The PSC will oversee the project and provide policy-level guidance and inter-agency coordination for the project. The Project Director of the PMU will act as the Secretary of the PSC.

150. **Project Management Unit (PMU).**The BWDB will set up a PMU to oversee the development and management of the Project. It will be led by a Project Director appointed by the BWDB who will be of the rank of Chief Engineer, and will directly report to the Director General (DG). The PMU will have a central project office located at headquarter of the BWDB in Dhaka. The PMU will have 3 subordinate units: (i) Engineering Unit; (ii) Procurement and Finance Unit; and (iii) Social, Environment and Communication Unit. In addition to the central unit in Dhaka, three Field Level Offices will be set up, each headed by an Executive Engineer, recruited by the project. The Field Offices will be located in each of the three main project districts, namely Khulna, Patuakhali/ Barguna and Bagerhat.

151. The **Procurement and Finance Unit** will be responsible for the entire procurement and financial management process of the Project. It will also be responsible for monitoring the progress of the project to liaise with the Bank and to prepare annual programs, implementation reporting, updating of all procurement reporting documents and financial management reporting. The procurement staff would consist of 1Senior Procurement Specialist and

1Procurement Specialist. The finance staff would consist of one Deputy Director, Finance, 2 Accountants and 3 support staffs.

152. **The Engineering Unit** will oversee the work of the consultants on design and construction supervision matters. A Deputy Project Director will head the Engineering Unit and spend about half of his/her time at site to provide coordination between the PMU, the supervising consultant and the three field offices. In addition to the Deputy Project Director, the unit will also include 2Executive Engineers and 2Assistant Engineers.

153. **An Environment, Social and Communication Unit (ESCU)** will supervise the activities/ works related with the Environmental Management Plan and Social Action Program. This unit, together with the Engineering unit will implement the communication strategy. This unit will include a Senior Environmental Specialist, a Senior Social Specialist, a Senior Forestry Specialist, a Revenue Staff and a Communication Specialist. ESCU will supervise programs under all the Packages including Package 3.

154. **Each Field Office** will be staffed with one Project Manager/Executive Engineer (XEN), two Sub-Divisional Engineers (SDEs) and two Assistant Engineers (AEs). In addition, an Environmental Specialist, a Social Specialist and a Revenue Staff will work across all the three field offices.

155. The PMU will be supported by the following consultancy services:

- An experienced NGO will be mobilized by the PMU to implement the social afforestation recommended in the EMP, the Social Action Plan including mobilization of Water Management Organization, the RAP and the EMP.
- A Design and Construction Supervision Consultancy Firm will assist the PMU in preparing the detailed design of the remaining Polders and supervise all construction works. For contracts on civil works, the Project Director will serve as the Employer, and the Project Supervision Consultant will serve as the Engineer for construction supervision. At site, a Resident Engineer, appointed by the consultant, with a team of specialists and inspectors will supervise the activities of the Contractor.
- DDCS&PMSC will supervise/assist in the implementation of safeguard instruments.
- A Monitoring and Evaluation Consultant will provide support in monitoring project impacts and supervise the implementation of the EMP/RAP and report to the PMU.
- A Procurement Panel will be appointed by the BWDB to oversee the procurement process of large value contracts subject to prior review under the Project. The panel will consist of two international/expatriate specialists and one national specialist.
- An Independent Panel of Experts (IPOE) will be appointed by the BWDB to act as an independent “peer reviewer” and undertake quality control functions of various technical outputs. The Panel will consist of 5 renowned experts in the fields of morphology/ river engineering; tidal river management/ sedimentation, geo-technology, sociology and environment.

156. These institutional arrangement are effective and are being followed in Package -1 and Package 2 of CEIP-1.

5.7 Water Management and Operational Plan

157. The National Water Policy (NWPo) through its various provisions emphasizes the participatory water management and underscores the importance of stakeholder participation for sustainable operation of the project. To ensure stakeholder participations, the Ministry of Water Resources, GoB has prepared guidelines namely, The Guidelines for Participatory Water Management (MoWR 2001), known as GPWM. The aims and objectives of the GPWM are as follows:

- Manage, operate and maintain the Project/ Sub-project/ Scheme;
- Maintain liaison with the Implementing Agencies, other relevant Public Sector Agencies, Local Government Institutions, Non-Government Organizations and Community Self-help Groups;
- Plan and coordinate the activities of local stakeholders;
- Mobilize local resources for contribution towards construction, operation and maintenance costs.

158. BWDB managers and field staff in divisions, sub-divisions and section offices do not have adequate expertise and experienced manpower to carry out the O&M of coastal Polders properly. Moreover, in many places, the number of field staff is also insufficient and inadequate compared to the actual requirement. In this case, participation of Water Management Organizations (WMO) and Community Based Organizations (CBOs) are needed to ensure sustainable operation of the project.

159. The GPWM (Guideline for Participatory Water Management) has outlined a three tier organizational structure comprising of Water Management Groups (WMG) at the lowest level, Water Management Associations (WMA) at the mid-tier and Water Management Federation (WMF) at the apex. The combination of groups, associations and federations (in a particular sub-project is together termed as the Water Management Organization (WMO), which has been considered in this project.

(a) Water Management Organizations

(i) Water Management Groups (WMGs)

160. This organization, at the grass-root level will provide the platform for all those who live inside or adjacent (close vicinity) to the Polder and will be treated as the primary society. The entire command area of the Polder will be sub-divided into few hydrological units preferably based on hydrological considerations and each of these units will have one WMG. The size of the units may vary depending on the land topography, actual alignment of the existing roads, canals or embankment and location of structures, turn-outs or even the field channels. Preferably, the size of such hydrological units should vary within the range of 500 ha to 1,500 ha. The areas of the units so demarcated usually comprise of two or three villages and part thereof. One WMG may therefore include several hundreds to a few thousand as its primary members. As per GPWM, the registration of the WMG is a must.

(ii) Water Management Association (WMA)

161. A number of WMGs functioning in the Polder area will form a Water Management Association (WMA) as a coordinating body at the mid-level of the Polder/ sub-project. The WMGs are the grass-root people who would be directly involved in water management while the WMAs will provide necessary coordination at the mid-level. The WMAs are chosen as the

point of formal interface between BWDB and WMGs. This is the level where formal agreements relating to respective duties and obligations of the water sector agency (BWDB) and primary societies, i.e. WMGs are reached and signed. For this reason, this level needs to have a legal status and hence the question of registration arises. Thus, registration of the WMA is essential.

(iii) Water Management Federation (WMF)

162. This is conceived as the supervisory type of organization, functioning at the apex level of the hierarchy and is needed to establish linkages with other higher level organizations for support and mobilization of resources. The requirement of WMF's registration may therefore be kept optional. The WMFs may exist on the basis of the actual functioning strength of WMGs and WMAs. Usually in a district or in a bigger hydrological basin comprising several districts may have one or more federating bodies functioning at the top level of the hierarchy. The office bearers of the WMF, the 5-member federating body will be selected from the MC members of WMAs. Important personalities of the area like a Member of Parliament or local leader may be nominated as the chairperson of the WMF and other members (not exceeding four in number) may come from the WMAs by virtue of their importance in controlling the number of WMGs.

(b) **Participation of Community Based Organizations**

163. Community Based Organizations (CBOs) can also play a vital role in maintenance activities. While engaging CBOs in this Polder, care should be taken to adjust the methodologies slightly as per local situation and project provisions. Under this project, CBOs are conceived to be included in the WMGs as Functional Groups (FGs). The FGs can be engaged in O&M activities of the Polder under the purview of the WMGs. The following CBOs have been recommended to be involved in this Polder under the CEIP:

(i) Embankment Settler (ES)

164. ES are families selected from squatters and project affected persons having no lands or those who have lost their lands during land acquisition for the projects. They can be organized into FGs for taking part in preventive maintenance of the embankments in specified reaches (approximately 0.5 ha) where they are allowed to settle at the toe of the embankments. The maintenance activities include small earthworks, new plantation, re-plantation or enrichment plantationand maintenance of vegetation cover. ESs may be engaged in embankment maintenance activities through a contract agreement for a certain period.

(ii) Embankment Maintenance Group (EMG)

165. EMGs are the groups formed with destitute women (maximum 10 members in each group) selected from landless families. They are responsible for carrying out preventive earthwork maintenance of specified reaches of embankments including grass turf laying works. They are engaged as laborers paid on daily basis.

(iii) Canal Maintenance Group (CMG)

166. CMGs are groups consisting of 10 members selected from landless people and destitute women. Under this concept, they will be responsible for preventive maintenance for improvement and maintaining the capacity of the canals inside the Polder and outfall drains.

Activities of the CMG include removal of floating debris, aquatic weeds and water hyacinths; and to some extent disposal of silt deposits in wet condition. CMGs are paid on daily basis and not on the basis of the volume of actual work done.

(iv) Landless Contracting Society (LCS)

167. LCSs are the groups selected from landless people consisting of nearly 60 or more members per group (as the case may be). They are responsible for carrying out earthworks only up to a limit of Taka 3.00 lacs in a single contract. During formation of CBOs, women participation in the above-mentioned groups will be ensured.

Operation and Maintenance Plan

Introduction

168. Coastal Polders, surrounded by embankments in the coastal region, protect the lives and properties of people and agricultural lands with crops from tidal inundation; saline water intrusion; storms and cyclonic surges thereby releasing a large extent of land for permanent agriculture as well as congenial living condition.

169. The Polders have been playing a vital role in safeguarding the coastal area; ensuring and increasing agricultural production; improving livelihoods of the people; and mitigating environmental damages. But these are vulnerable to storm surges; high tides; annual floods; land erosion and drainage congestion. In many cases the structures as built have not been found adequate to coup with the diversified needs of the local people. Changes in the land use pattern of the area have also created water management conflicts and new dimensional needs asking the structures to allow water to flow in both directions. So maintenance of the Polder system with embankments and structural elements built over there has permanently become important. The Government of Bangladesh either with assistances from international donors and lending agencies or out of its own resources has been spending money almost ona regular basis to keep the Polders in good working condition eventually to save the coastal people. The Coastal Embankment Improvement Program (CEIP) is one of the latest initiatives to address a systematic restoration and upgrading of Polder systems in the coastal region. Under this long term phased program of Polders improvement, Operation and Maintenance issues with special reference to Local Government Institutions (LGIs) as well as local stakeholders participation and need based budgeting will continue to remain at the apex.

Operation Plan

170. The operational plan involves setting out the schedule of activities related to operation of gates of structures by the users' organization to control water levels best suited to water management and agricultural needs. In the coastal Polders, operation of gates mainly focuses on protecting the saline water out of the Polder during high tides and allowing drainage of excess water from inside the Polder during low tides to minimize the depth of flooding but storing enough water on the paddy fields. The trend, however changes in the dry season where the operational plan aims in storing as much water in the canal networks as possible by closing the gates. The water thus stored should have the basis of a balancing mechanism among all categories of user viz., paddy growers; salt producers (if there is any); shrimp producers (also including other fish culture practices); and also domestic users. Operation of structures should therefore be an organizational, low cost activity requiring quick communication with the beneficiaries and with project staffs at the lowest/grass-roots level.

Operational Activities

171. The operational plan provides the framework upon which canal water levels (also referred to as operation target) and day-to-day structure operation will be based. More specifically, the operational plan for the CEIP Polders can be thought of as a hub for the following operational activities:

Operation of drainage regulators;

- Operation of flushing sluices/irrigation inlets; and
- Operation of privately owned Low Lift Pumps (LLPs)

172. Besides, some other activities may also be conceived in the context of varying Polder conditions. The following activities are within the purview of operational plan:

Regulation of gates

173. In the past, BWDB employed the Gate Operators from its own resources; but due to budget cuts this position has been discontinued. Currently the responsibilities of gate operation are given to beneficiaries in the Polders where agricultural activities are of main concern. Standard procedures have been developed under different projects but are hardly followed as common practices.

174. The picture in other Polders where only FCD activities exist is different; institutional set up for the users' organizations is yet to be built and introduced. This particular issue will be discussed in details in the following section to address Beneficiaries' Participation in coastal Polders.

175. The gates of each drainage sluice / regulator must be operated following certain fixed rules regarding timings. The BWDB O&M section in consultation with the beneficiaries' organizations, DWM staffs and DAE field staffs will ensure operation of the gates in conformity with operational timing based on actual water management and agricultural needs.

176. Flap Gates of regulators should remain in place at all times except during maintenance and flushing. During pre-monsoon period, the vertical lift gates of each regulator should remain closed for retention of water for irrigating Aus crops by LLPs. During monsoon (July to September), the vertical lift gates should normally remain closed; but may be opened to regulate the water levels inside the Polder and should not be allowed to exceed the stated maximum permissible level for safety reasons. In order to achieve this, discharges into the river should commence (river levels permitting soon after this level is attained. This type of water management decisions should be taken after due consideration of daily rainfall, river stages, water levels inside the Polder, gate opening schedules. However, the frequency and type of this decision making process will vary with the seasonal conditions.

177. During post monsoon season (October to November), the vertical lift gates will be operated to retain water in the drainage canals without overtopping the canal banks and increasing the soil moisture level for cultivation. In all these cases there should be enough consultation with the beneficiaries' organizations because agricultural practices, crop varieties; and cropping pattern changes over time. A gate operation plan in Banglais provided in Appendix-C.

178. Operation of Flushing Sluices and Pipe Inlets should also have similar practices with maximum involvement of beneficiaries' organizations. The O&M section and DWM staffs of BWDB will assist them in the water management of command areas inside the Polders.

Frequent Watching of Embankments

179. This is a typical monitoring activity to be carried out by the BWDB O&M Staffs It is intended mainly to detect weak sections, gullies, slips, sign of squatter settlements, and cultivation of perennial cash crops, cuts in the embankments to accommodate homesteads, embankment subsidence and erosion and / or settlement of protection works.

Regular Checking of Structures

180. This is also a typical monitoring activity to be carried out by BWDB's O&M field staffs to detect slips at abutments, damage of protective works and wing walls and periodic damage to flap gates and fall boards etc. The functional groups under WMGs in the Polders will assist the O&M Section Office of BWDB to identify and report the damages for rectification.

Condition survey (of embankment & structures) and Engineering survey

181. The survey data obtained by the O&M field staffs of BWDB are used for estimating the required maintenance works. Physical condition of embankments and structures are investigated through field surveys once in a year. This is specially required to prepare the details for carrying out periodic maintenance works.

Supervision of preventive maintenance works

182. Preventive maintenance works are performed by community-based functional groups (e.g. EMGs, SMGs, and CMGs) as and when required round the year. The works are the most simple, cheap and cost effective maintenance works and are implemented more or less continuously. The field staffs of O&M section of BWDB supervise all preventive maintenance works.

Planning of Operation

183. The objective of structures operation is to maintain control over water levels in the Polder channels to ensure integrated water management. This means that the operation of water management structures should be directly linked to agricultural requirements and on-farm water management conditions keeping the eyes open on the requirements of other users like fisher folk community, navigators/boatmen, salt growers (if applicable) and general water users for domestic purpose and natural environment (connectivity for fish). So in the planning of operation, the demands of all categories of beneficiaries should be taken into account for achieving a perfect integrated water management. Participation of beneficiaries at all levels of planning is essential.

184. The decision making process involved in structure operation is shown in Figure 5.2. This illustrates schematically the procedural steps necessary to translate water management needs into actual structure operation. The water management plan drawn over a season provides the framework upon which water levels in the drainage channels i.e., operation targets and day-to-day structure operation needs will be based. However, actual field water levels may diverge from the water management targets due to some unpredictable factors like

rainfall or other causes. During the cropping season, monthly, weekly or daily operational adjustments will be required. Routine monitoring of water management and hydrological conditions will supply data that together with the water management plan, will dictate the need of adjusting the operational measures.

185. Participation of beneficiaries vis-a-vis the farming community is essential in establishing the seasonal or long term water management plan. This however, reduces to a somewhat lesser extent in setting up the weekly operation targets. Although the daily structure operation is largely an activity of the responsible O&M authority like BWDB's Section Office, it can be shifted to the WMG if they are provided with adequate training and management capabilities.

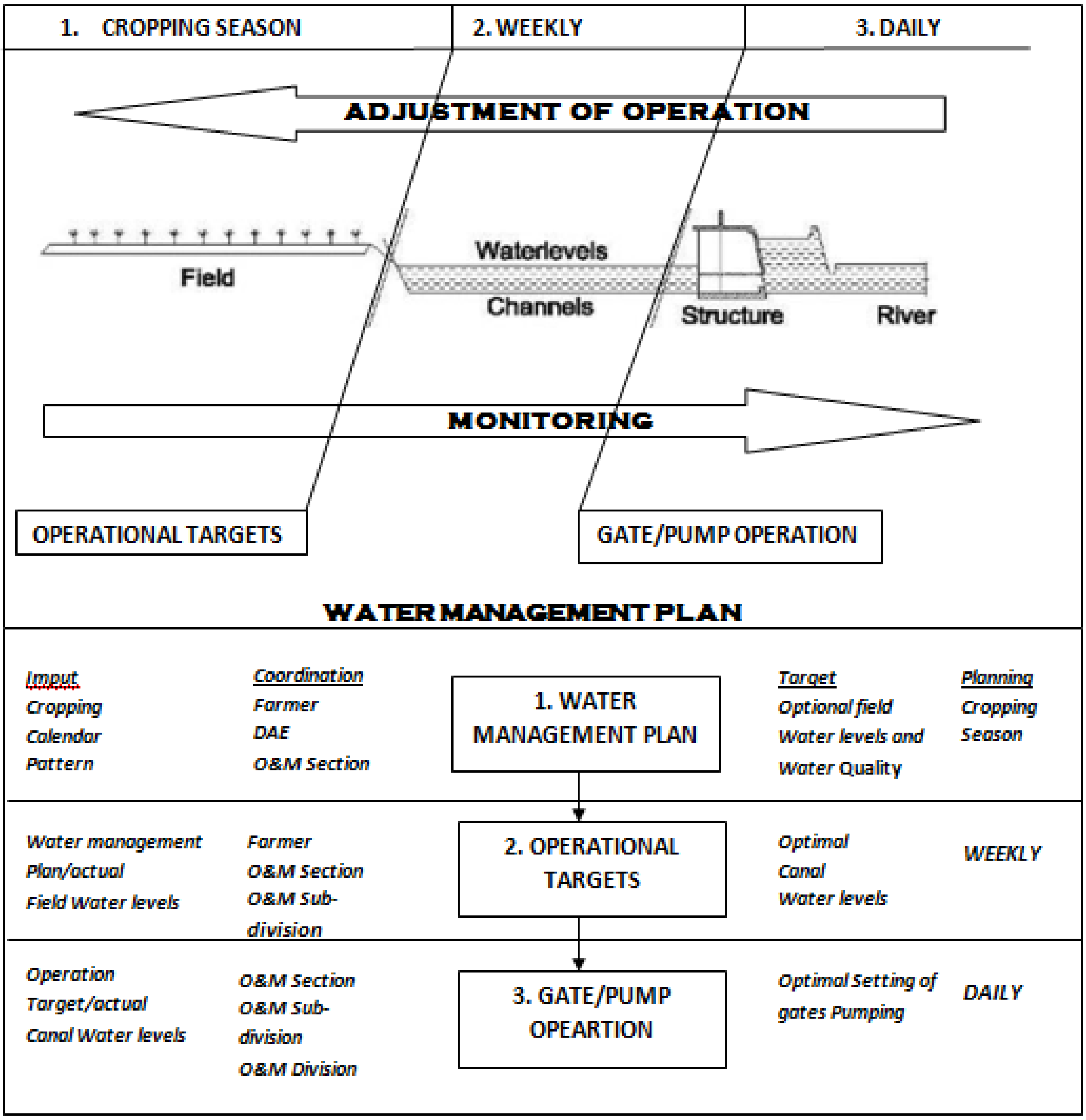


Figure 5.2: Decision making in operation

(a) Seasonal Water Management Plan (WMPlan)

186. In coastal Polders both the drainage and water conservation requirements are equally important; in the wet season drainage will get priority while in the dry season, conservation of sweet water inside the Polder becomes the predominant factor. The seasonal water management plan must therefore emerge covering the Polder as a whole and on the basis of

the requirements of all water users. The plan will have to be prepared jointly by the BWDB's O&M offices, the leaders of WMGs / WMAs, and DWM of BWDB. Draft water management plans will be drawn up to the user level, i.e., WMGs (Figure 5.3, Planning Procedure); these will be combined into water management plans at WMA (Sub-Division level). In large Polders the plans will be compiled by the Executive Engineer (in support and cooperation of the WMF- if exists) and DWM to produce the final WM plan. This needs to be prepared well ahead of the cropping season so that critical farm operation (e.g., seed bed preparation, fish culture, shrimp or salt production requirements) can be carried out in line with the plan.

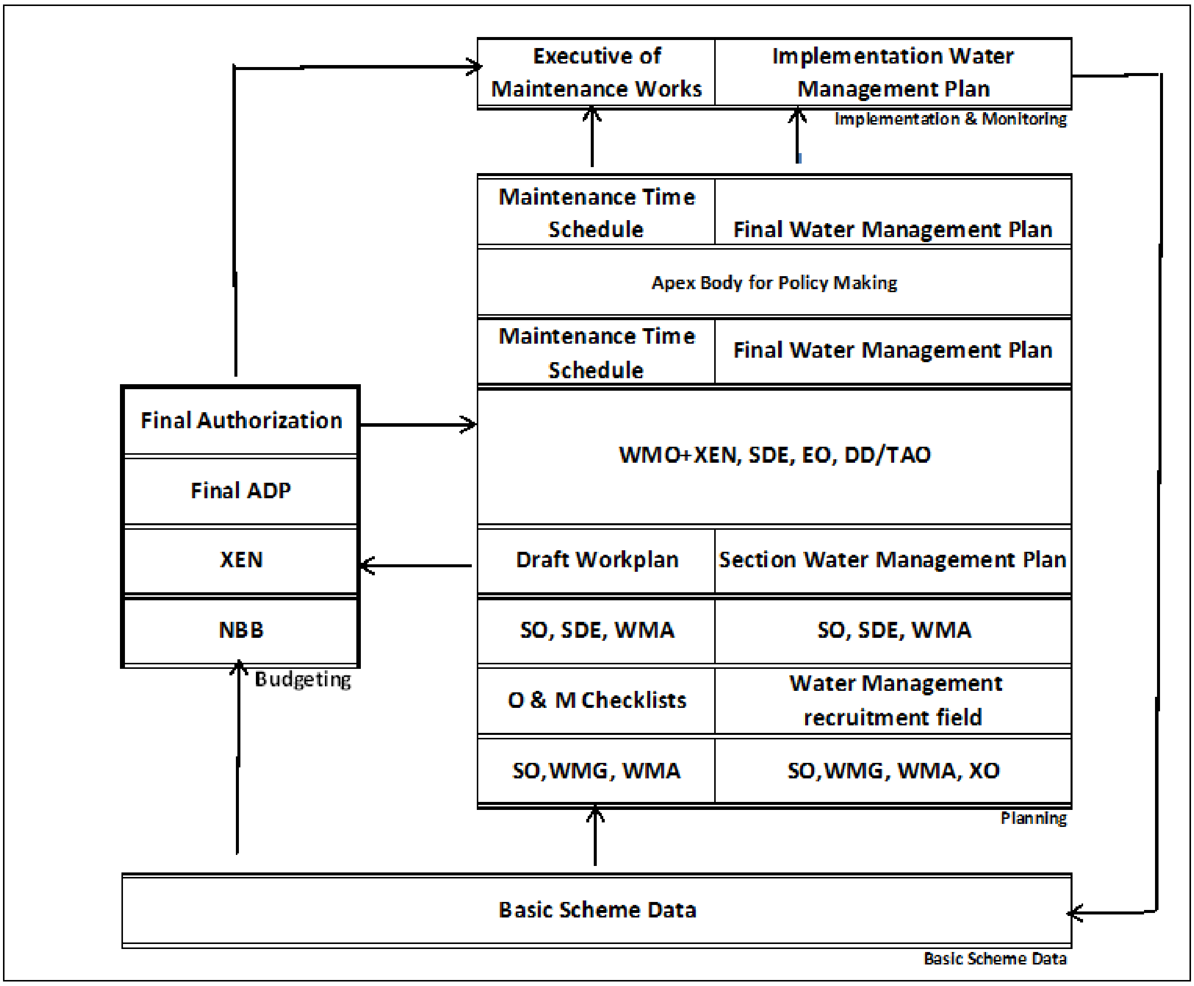


Figure5.3: Standard Planning Procedure

Note:DD -Deputy Director, TAO - Thana Agriculture Officer, BS - Block Supervisor

187. Inputs required for the WM plan includes information on cropping calendars and cropping pattern to be formulated by the farmers in consultation with agricultural and fisheries extension services, DWM and BWDB's O&M staffs. Together with information on the system (Basic Polder data, O&M guidelines, Design details, etc.) and status of the system (Monitoring data, O&M checklists, Maintenance work plans, and Maintenance time schedules) this will enable in drawing up of a detailed water management plan. In large Polders, there will be water management computer model to use as an important tool in the planning process. The models can be used to compute several water management scenarios and the effects of certain measures (e.g. extra regulators, early drainage or flushing, etc.) can be simulated. The model can also be used to develop weekly operation targets and may become a very useful

tool in the day-to-day management of large Polders. Specially trained staff will be required for such advanced calculation.

188. In fact, the WM Plan is a formal agreement between the BWDB's O&M offices and the water users' platforms (WMG or WMA) ensuring the operational services. Once the WM Plan is finalized, information can be passed on to other agencies through the apex body of the beneficiaries so that necessary adjustments can be made to accommodate other national programs, work plans, etc.

Weekly Operation Targets

189. In the coastal Polders water levels in the drainage channels can be manipulated easily because the mode of operation is in line with the FCD system; and the water levels inside a Beel is much more dependent on rainfalls. The parameters in the seasonal WM plan viz., water levels in the channels and discharges will be compared with the actual field conditions, operation targets, etc., on weekly basis to eventually arrive at the weekly operation targets setting. The system users in close contact with O&M staffs of BWDB can set the weekly operation targets to maintain the desired field conditions.

Day-to- Day operation

190. Daily structure operation requirements involve manipulation of gates or pumps to maintain water levels in the channels as laid down in the operation target. Actual structure operation is also implemented and adjusted on a daily basis by the O&M staffs of BWDB. For each Polder the operational practices so developed will have to be documented and kept in proper records for use by the WMGs / WMAs.

Maintenance Works

191. Maintenance of embankments and structures is the most important item of activities in the coastal Polders. It is necessary and cannot be avoided because it helps in preserving the infrastructure in good and functional condition; protects investments; and prevents high rehabilitation costs. Since this is included in the day-to-day task's schedule and needs continuous efforts, maintenance of coastal Polders put emphasis on simple and cost effective community-based interventions.

192. In the coastal Polders, water management work should be maintained regularly. These activities are divided into:

- Preventive or Routine Maintenance;
- Periodic Maintenance;
- Minor Periodic Maintenance
- Major Periodic Maintenance
- Emergency Maintenance;

Preventive or Routine Maintenance

193. The objective of preventive maintenance is to keep the overall Polder system including all its elements in good functional order thereby reducing the need of periodic maintenance eventually avoiding high rehabilitation costs. The works are simple, cheap and cost effective

and can be implemented through community-based functional groups, such as EMGs, CMGs, and SMGs. Preventive maintenance is carried out throughout the year, almost continuously or as and when required. The works are noted below:

- All activities related to vegetative covers on embankment, i.e,new (or re-) plantation; enrichment plantation; and maintenance of vegetation by EMGs and/or EPGs;
- Small earthworks on the embankment by EMGs;
- Cleaning, greasing, and painting of structures by SMGs;
- Cleaning Khals and Outfall Drains from aquatic weeds and floating debris, and removing of silt in wet condition by CMGs.

194. The preventive maintenance interventions have been spelled out precisely in Table 5.12 below.

Periodic Maintenance

195. Periodic Maintenance intends to bring the components of the hydraulic infrastructure back to its design standard. The works are more expensive than preventive maintenance and are implemented by LCBs, LCSs, and PICs (food for works). Periodic maintenance has the character of repair works and is identified during the field assessment at (more or less) regular intervals.

196. The most important distinguishing characteristic of minor periodic maintenance works is that it is more community based and often implemented by LCSs while major periodic maintenance works are generally carried out through competitive bidding (LCBs). However, in case of earth works at least 25% of the works should be allotted to LCSs. Both these types of periodic maintenance are summarized as under:

Minor Periodic Maintenance Works:

- Minor earth works on the embankments by LCSs, i.e.,shaping andminor fillings including repair of access ramps;
- Minor repair of protective works by LCSs, i.e., re-positioning of the displaced blocks;
- Minor repair of structures by LCSs, i.e., small patching of brick works, replacing rubber seals, etc.; and
- Re-excavation of Khals and removal of earthen cross dams by LCSs and / or PICs;

Major Periodic Maintenance Works:

- Major earth works by LCBs / LCSs i.e. re-sectioning of embankments including turfing;
- Major repair of structures by LCBs, i.e., repair or replacement of metal works/hinges, lifting mechanisms, gates, block works, head / wing walls, etc.;
- Re-excavation of Khals by LCSs / PICs.
- The periodic maintenance interventions have been spelled out precisely in Table 512 below:

Emergency Maintenance

197. Emergency works cover unforeseen interventions that require immediate actions to protect the Polder as a whole or a part thereof from the adverse effects of flooding or uncontrolled saline intrusion, etc., associated with damage of lives and properties. This type of work requiring immediate attention includes the closure of an embankment breach, the repair and replacement of flap gates, or the construction of cross dams over canals if structure fails. As the title implies planning of these kinds of works is not possible. Table 5.12indicate each type of emergency maintenance works.

Table 5.12: Types and Classification of Maintenance Works

Sl.	Descriptionof MaintenanceWorks	ImplementationMode									
		Classification byType of Maintenance			Community BasedFunctional Groups under WMOs						LCB
		I	II	III	EMG	ES	CMG	SMG	LCS	PIC	
	Embankment										
1	Incidentalearthworks:Minorfillingsofrills;ghogs;rodentholesat crestand/orslope	√			√	√					
2	Neworadditionalplantingoftreesand/or shrubs on embankment or toe	√			√	√					
3	Maintenanceofembankment vegetation: Patrolling andprotectingyoung plantsagainst browsing, protecting turfs/ grass/ shrubs against overgrazing and indiscriminatetramplingby cattle,upkeep ofpathstofacilitate inspectionof trees, clearing around trees, application of fertilizer,harvestingof producefrom trees, replantingandreplacement ofdiseased/ moribund/dead trees.	√			√	√					
4	Minor earth works: Shaping or minor fillings of crestandslope but not re-sectioning so as tobring it backina shape thatallowsESstosettleandtrees to be planted.		√						√		
5	Majorearthworks: re-sectioningor filling of crest and/ or slope including turfstobringitbacktoitsdesignlevel.		√						√	√	
6	Repair of damaged access ramp, construction ofsmallpartitiondyke		√			√			√		
7	Emergency closingof breached section			√					√		√
	Structure										
8	Cleaningandgreasingofmovingand/or slidingpartsandseal	√						√	√		
9	Removingsiltanddebris(waterhyacinth, aquatic weeds and others) near intake	√							√		
10	Checkingandtighteningnutsandbolts	√						√	√		

Sl.	Descriptionof MaintenanceWorks	ImplementationMode									
		Classification byType of Maintenance			Community BasedFunctional Groups under WMOs						LCB
		I	II	III	EMG	ES	CMG	SMG	LCS	PIC	
11	Brushingcheepedorloosepaintruston metal parts; and painting	√						√	√		
12	Patchingminor damagesorbrick		√								√
13	Replacingrubbersealofgate,positioning		√					√			√
14	Repairing or replacing damaged metal works /hinges,liftingdevicesforflapor Verticalslidinggates		√					√			√
15	Repair defectiveblockworks(aprons)		√								√
16	Replacingstoplogs,flapgateorvertical		√	√							√
17	Repairheadwalls,wingwalls,of structures		√								√
18	**Protective Works** Re-positioning/replacing of incidentally displaced blocks/ boulders /concrete frames,smallrepairtosand/gravel filter.		√								√
19	**Channels** Cleaningkhal andoutfalldrainsand de-siltingoutfalldrains	√					√				
20	Re-excavationofkhal		√						√		
21	Removingcrossdams (usedas access roads, flashing bunds or water retention)		√			√					

***Notes:** Maintenance Class;* *I- Preventive or routine maintenance; II-periodic Maintenance; III- Emergency Maintenance*

Planning of Maintenance

As already stated maintenance activities in BWDB Polders are conceived in three distinct categories,i.e., Preventive Maintenance; Periodic Maintenance; and Emergency Maintenance. Preventive maintenance requires little annual planning because Embankment Maintenance Groups and Canal Maintenance Groups go ahead in a continuous process. Emergency maintenance cannot be planned as this will be dependent on unexpected conditions and can hardly be foreseen. So the maintenance planning centers on periodic maintenance. The selection of items to be maintained and repaired, and the ranking of the works, is the recurrent activities in maintenance planning. This selection depends on the project inventory; the O&M checklists filled in by the farmers under the guidance of the Section Officer; and monitoring data produced by BWDB. A clear dichotomy is apparent here; monitoring focuses on the elements of the infrastructure while the O&M checklists help identify the water management bottlenecks and support the system approach. Another important issue in the maintenance planning is the timing of maintenance, i.e., when certain works need to be carried out without hampering water management, and if it does hamper in any area, all these should be reflected in the seasonal water management plan. This concerns mainly the periodic maintenance works. A third planning activity is a part of the implementation phase and concerns the drawing up of physical work plans prior to the start of the works; this is in fact an activity between the contractor and the O&M Offices. Project Cost

198. The implementation cost of the rehabilitation of Polder 34/3 isTaka 391.3 Million and US Dollar 4.891 Million.

5.8 Need of Resettlement Action Plan (RAP)

199. The interventions proposed in Polder 34/3 do not include any major type of works to be carried out in new alignments. All Drainage Sluices proposed to be replaced will be re-constructed on the existing alignment. Also for the embankment re-sectioning works, the existing alignment is to be used for the additional set back distance is to be used. Moreover, there is no construction of retired embankments. It can therefore be concluded that no major resettlement may occur during project implementation. However, some minor resettlements may be needed as some households still exist over or adjacent to the Polder periphery, which may be displaced during construction works. In this connection, a detail RAP investigation is required, which is being conducted by the Consultants.

5.9 No Objection Certificate

200. Polder 34/3 is located in the Bagerhat Sadar Upazila under Bagerhat District, covering Karapara and Shatgombus Union. Although archaeological sites and cultural heritages exist in the Shatgombus union, these will not beaffected by the proposed interventions for the rehabilitation of the Polder. Furthermore, there will be no problems of land acquisition or displacement of people since rehabilitation will be made on the existing infrastructures. This has been addressed in the No Objection Certificates (NOCs) collected from the Union Chairman.

6. Environmental Baseline and Existing Conditions

201. The baseline condition of Water Resources, Agriculture Resources, Fisheries, Ecology and Socio Economic Resources prevailing in the Polder area has been established by collecting data from primary as well as secondary sources. The secondary sources include Bangladesh Water Development Board (BWDB), National Water Resources Database (NWRD), Department of Public Health Engineering (DPHE), Bangladesh Meteorological Department (BMD), Department of Environment (DoE) and Bangladesh Bureau of Statistics (BBS). Primary data are collected during field visits in the Polder area.

6.1 Physical Environment

202. The physical environment refers to the physical and chemical features of an area. It includes the climate, rainfall, wind, soil, obtainable nutrients and all other natural resources within the area. The following sections provide analyses on different physical environmental features of the Polder 34/3.

Geology

203. Polder 34/3 is situated in a low-lying coastal region and is composed of Tidal Deltaic sediments deposited sub aqueously in a permanent body of water where tidal waves and currents aid in the transportation and deposition. Typically, a low-lying deltaic environment comprises of soft sediments, and these regions are quite dynamic and changes in coastal geomorphology are quite rapid e.g. impacted cyclones.

Seismicity

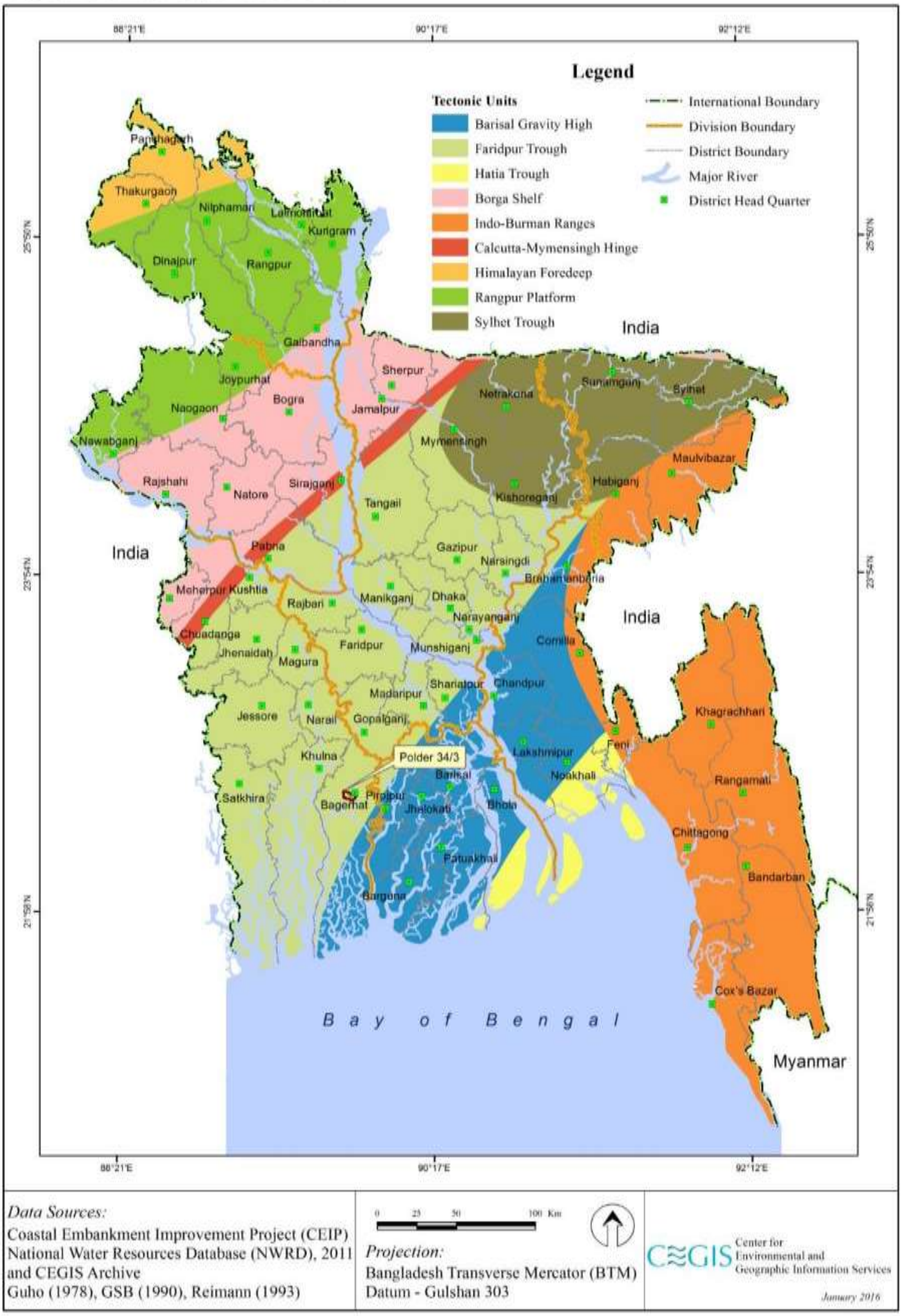
204. Bangladesh is one of the seismically active regions of the world, experiencing numerous earthquakes in the past 200 years. Geological Survey of Bangladesh (GSB) has prepared a seismic zoning map of Bangladesh in 1979 dividing the country into three generalized seismic zones: Zone-I, Zone-II, and Zone-III (Map 6.1) with seismic coefficient of 0.08 g, 0.05 g and 0.04 g respectively. Accordingly, the Polder area falls under Zone-III, which is characterized by Low earthquake prone site and has a basic seismic coefficient of 0.04g (Map 6.1).

205. Moreover, the Polder 34/3 is located inside the Faridpur Trough, which is situated adjacent to the Hinge Zone, and is characterized by a general gravity-low with the development of Neogene sequence. Map 6.2 below represents the tectonic units available in Bangladesh and the location of the Polder area.

206. It can therefore be inferred that in consideration of seismicity and stratigraphy, Polder34/3 falls on a relatively safer (seismically quiet and tectonically stable) site.

Map 6.1: Earthquake Zones of Bangladesh and location of Polder 34/3

Tectonic Units Map: Polder 34/3



Map 6.2: Tectonic Units of Bangladesh and location of Polder 34/3

Land use

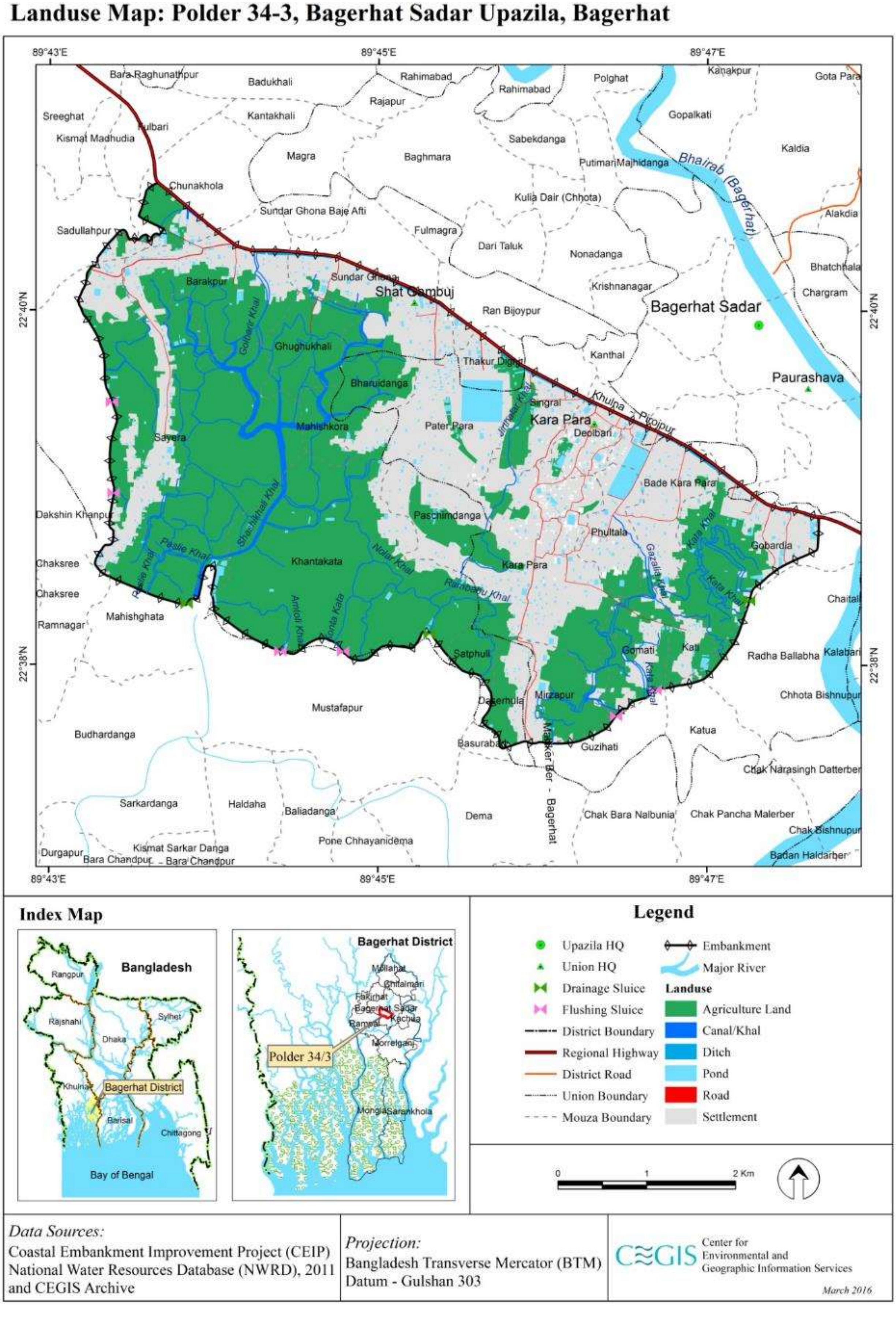
207. The total area of the proposed integrated water management project of Polder 34/3 is 2,865 ha of which 1,553 ha is Net Cultivable Area (NCA). The net cultivable area is 54% of the gross area. The remaining 37% and 9%are covered by settlements with homestead vegetation and Canals, Ditches, Ponds, Embankments and Roads, respectively. About 312 ha (20% of the NCA) is under rice cum gher. Detailed land use is presented in Table 6.1 and Map 6.3.

Table 6.1: Present Land Use of the Polder Area

Land Use	Area (ha)	% of the Gross area
Agriculture Land	1553	54
Betel Vine	13	0
Canal	90	3
Ditch	17	1
Embankment	11	0
Pond	115	4
Road	19	1
Settlement with Homestead Vegetation	1047	37
Total	**2,865**	**100**

Sources: CEGIS Assessment based on SOLARIS –SRDI; 2006

Photograph 6.1: Discussion with Gher owner as well as farmer



Map 6.3: Land use map of the Polder area

Soil Properties

Agro-ecological Zones (AEZ)

208. The Land Resources Appraisal of Bangladesh for agricultural development divides Bangladesh into 30 agro-ecological zones and 88 sub zones. The zonation relates to physiographic characteristics (land forms and parent materials), soil properties, soil salinity, depth and duration of seasonal flooding, agro-climatology(length of kharif and Rabi growing seasons, length of pre-kharif transition period, number of days below certain winter critical temperatures (<15^{0}C) and number of days with extremely high summer temperature (>40^{0}C), which are relevant for land use and for the assessment of present and future agricultural potential (FAO/UNDP,1988, BARC,2012).). The Polder 34/3 comprises of two Agro-ecological zones, namely: Ganges Tidal Floodplain and High Ganges River Floodplain, characteristics of which is briefly discussed. The location of the Polder area is shown in Map 6.4 below:

High Ganges River Floodplain (AEZ-11)

209. This region includes the western part of the Ganges River Floodplain, which is predominately high land and medium high land. Most areas have a complex relief of broad and narrow ridges and inter-ridge depressions, separated by areas with smooth broad ridges and basins.

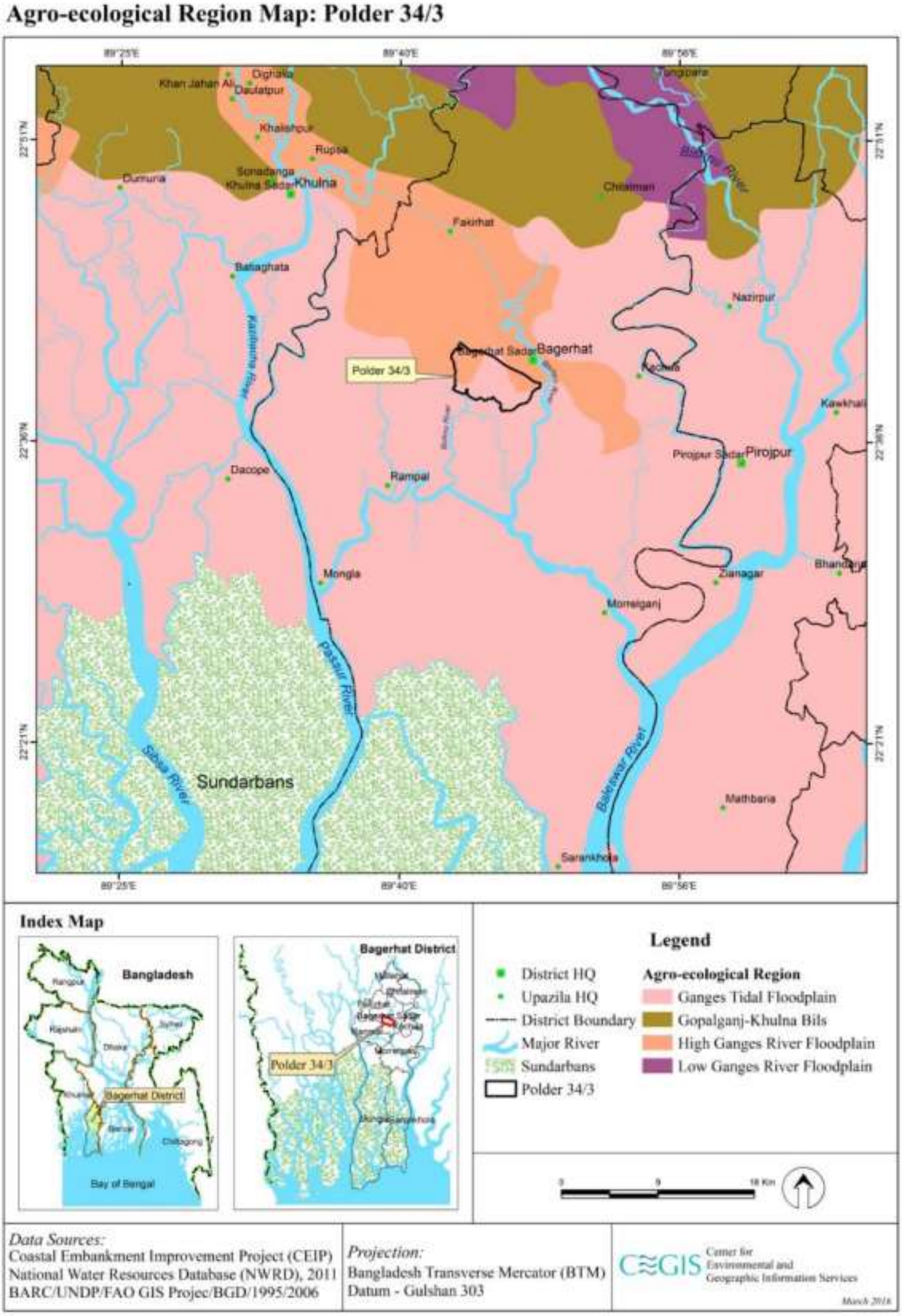
210. There is an overall pattern of olive-brown silt loams and silty clay loams on the upper parts of the floodplain ridges and dark grey mottled brown, mainly clay soils on ridge sites and in basins. Most ridge soils are calcareous throughout the profile. General Soil Types predominately include Calcareous Dark Grey Floodplain soils and Calcareous Brown Floodplain soils. Organic matter content in brown ridge soils is low, but higher in dark grey soils.

211. In general, top soils are slightly acidic to slightly alkaline in reaction, but there is a significant lowering of soil pH in high land in the recent years and in some places top soils become strongly acidic. Sub-soils are slightly alkaline in reaction. General fertility level is low including N, P, S and B although CEC is medium. The K- bearing minerals are medium to high, but the Zn status is low to medium.

Ganges Tidal Floodplain (AEZ-13)

212. This region occupies an extensive area of tidal floodplain land in the south-west of the country. The entire Polder 34/3 area is covered by this agro-ecological zone. This region occupies an extensive area of tidal floodplain land in the south-west part of the country. The greater part of this region has smooth relief having large area of salinity. There is general pattern of grey, slightly calcareous, heavy soils on river banks and grey to dark grey, non calcareous, heavy silty clays in the extensive basins. The entire zone is vulnerable to tropical cyclones.

213. Non-calcareous Grey Floodplain soil is the major component of General Soil Types. Acid Sulphate soils also occupy a significant part of the area where it is very strongly acidic during dry season. In general, most of the top soils are acidic and sub-soils are neutral to slightly alkaline. General fertility level is high with low to medium organic matter content and very high CEC and K status. There are limitations of high exchangeable Na and low Ca/Mg ratio. The Zn status is low to medium while the B and S status are mediumto optimum.



Map 6.4: AEZ of the Polder area

Land type

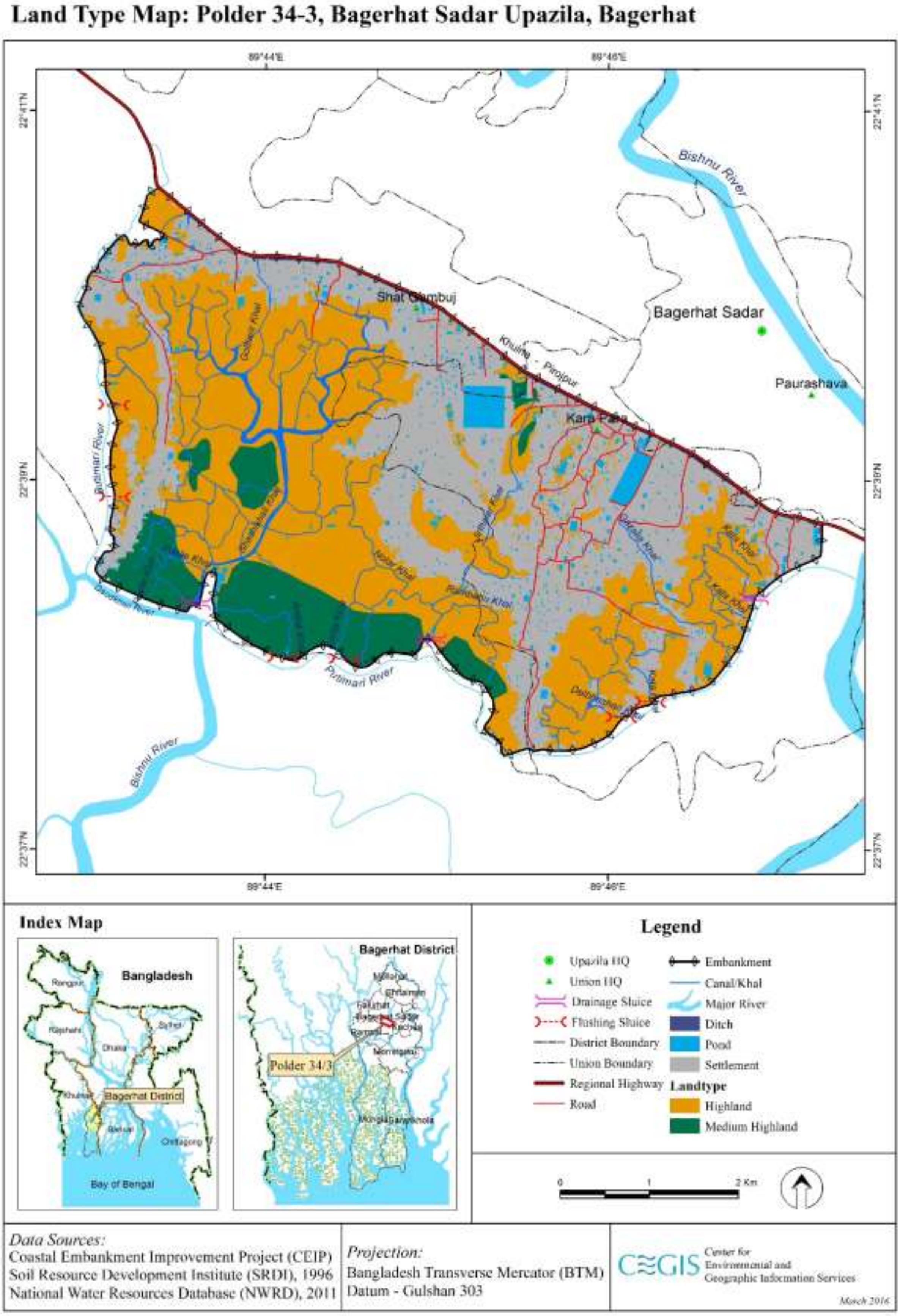
214. Land types are classified based on the depth of inundation during the monsoon season. The land type is very important for utilization of lands for crop production.

215. Around 73% and 27% of the NCA of the Polder area (Polder 34/3) fall under high land and medium high land, respectively. Details of the land classification and distribution of land types in Polder 34/3are presented in Table 6.2.

Table 6.2: Detailed land type of Polder area

Land Type	Description	Flooding depth	Flooding characteristics	Polder area	
				Area (ha)	% of NCA
F0	High land	Above flood level	Non-flooded to intermittent	1134	73
F1	Medium Highland	0-90cm	Seasonal	419	27
			Total	**1,553**	**100**

Sources: IWM, 2016



Map 6.5: Land Types of Polder34/3

Soil Texture

216. Soil texture relates to the relative proportions of sand, silt and clay. Soil texture is an important soil characteristic that guides crop selection, crop production and also field management. The soil texture in the project area varies from clay to clay loam, see Table 6.3.

Table 6.3: Soil Texture of the Polder area

Soil Texture	Area (ha)	% of Gross Area
Clay	1,398	90
Clay Loam	155	10
Total	1,553	100

Sources: CEGIS Assessment based on SOLARIS –SRDI; 2006

Drainage Characteristics

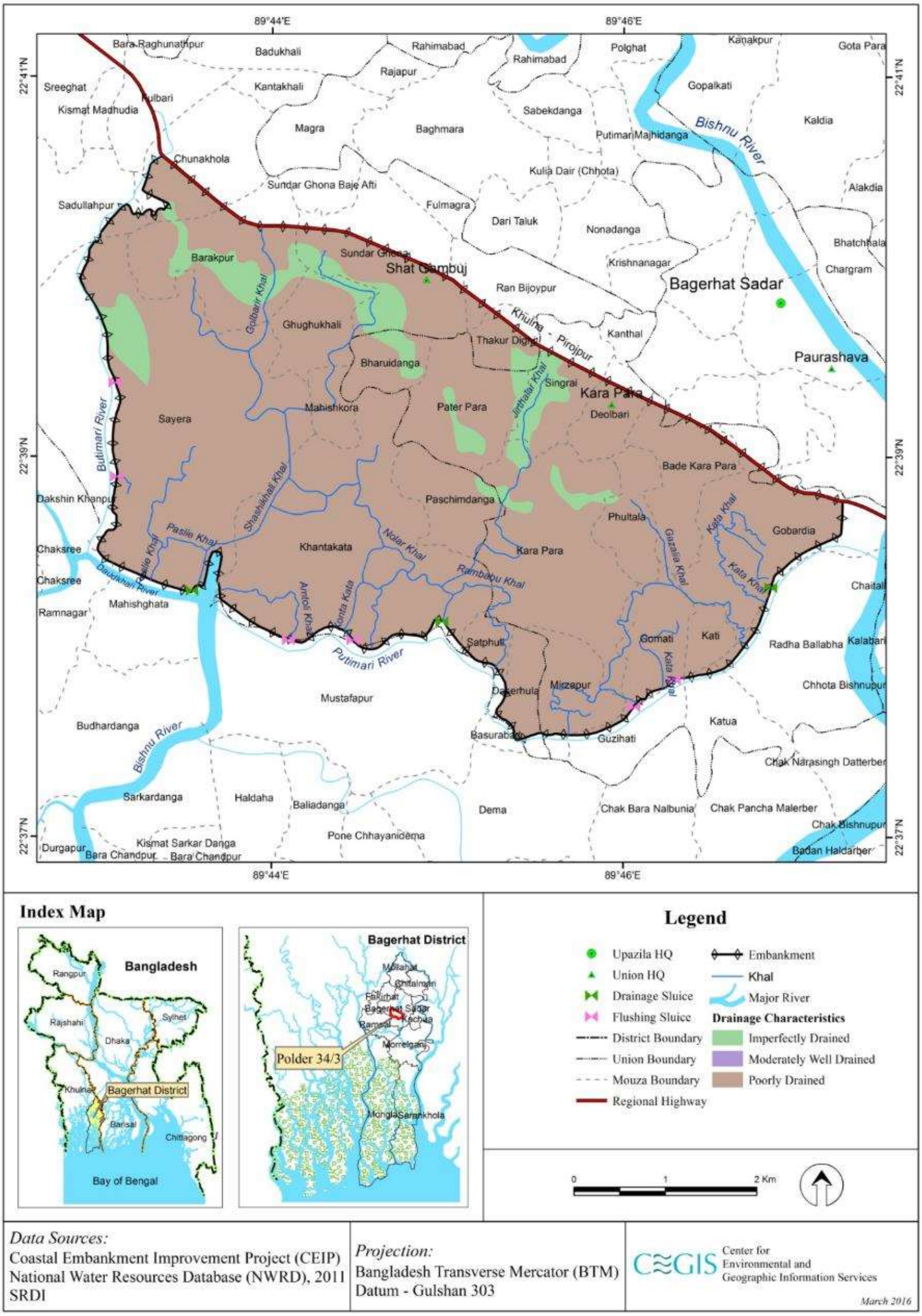
217. For the agricultural crop production drainage characteristics play an important role. The drainage characteristics have been divided into six classes from the agriculture point of view, e.g., Excessively Drained, Well Drained, Moderately Well Drained, Imperfectly Drained, Poorly Drained and Very Poorly Drained (SRDI; 1988). In Polder 34/3, 93% of the agricultural land is poorly drained while 7% is imperfectly drained (CEGIS Assessment based on SOLARIS–SRDI; 2006). Details are presented in Table 6.4 and Map 6.6.

Table 6.4: Present Drainage Characteristics of the Polder area

Drainage	Characteristics	Area(ha)	% of Area
Imperfectly Drained	Water is drained from soil badly or slowly. This soil often remains wet in rainy season due to rainfall. In normal situation, water does not stand on land for more than 15 days at a stretch. In rainy season, groundwater stands within 1 meter at least for some time.	110	7
Poorly Drained	The soil remains under water from 15 days to 7/8 months. Water is drained from the soil slowly. In most cases, the land remains wet/ water logged for a considerable period of time after the rainy season.	1,443	93
	Total	**1,553**	**100**

Sources: CEGIS Assessment based on SOLARIS –SRDI; 2006

Drainage Characteristics Map: Polder 34-3, Bagerhat Sadar Upazila, Bagerhat



Map 6.6: Drainage Characteristics of the Polder area

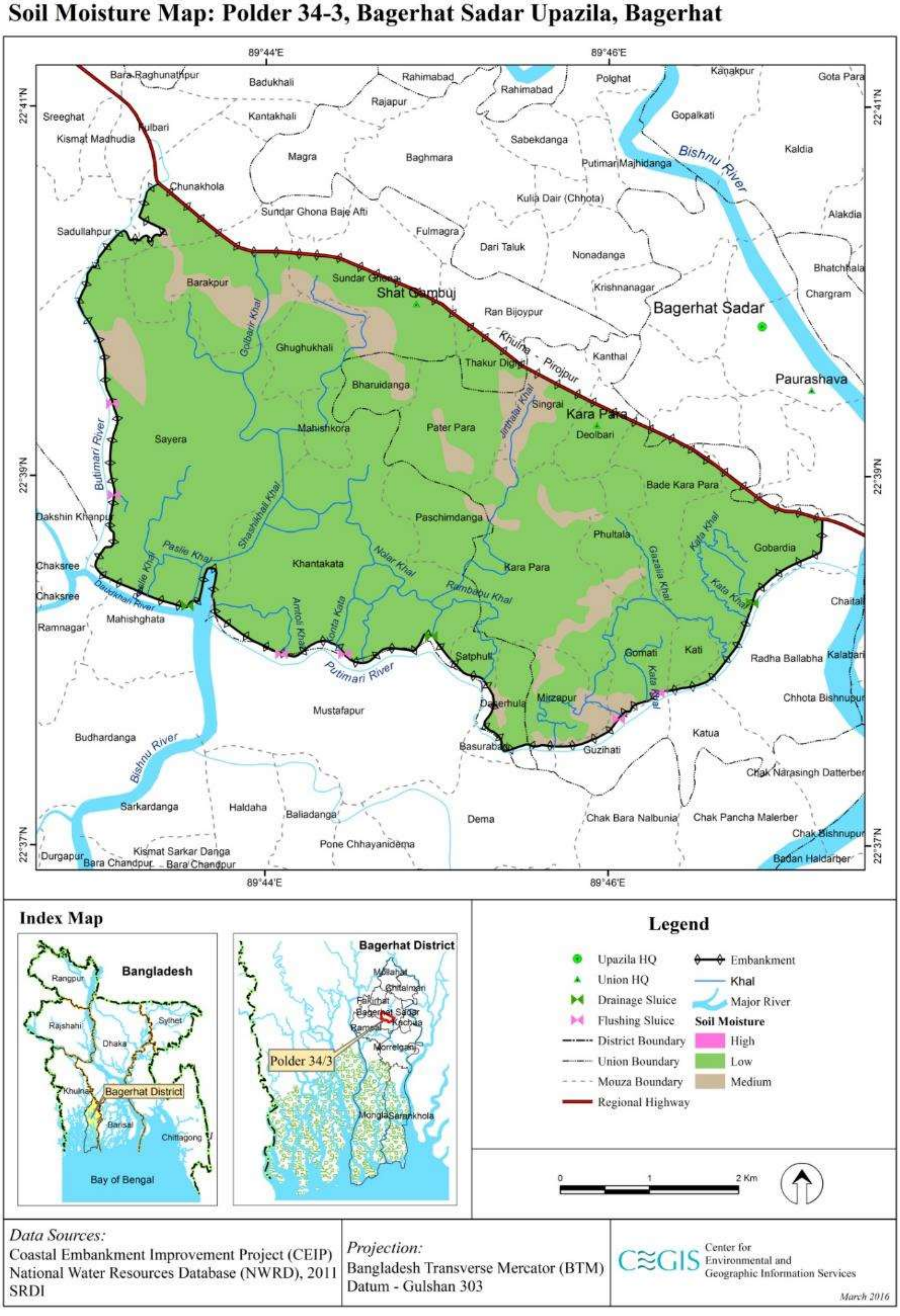
Available Soil Moisture

218. Soil moisture varies depending on the soil characteristics. Growth of plantsand crop production depend on the soil moisture from which plants uptake essential nutrients and water. In Polder 34/3 thesoil moisture is generally low(CEGIS Assessment based on SOLARIS–SRDI; 2006).Details of the soil moisture ispresentedin Table 6.5 and Map 6.7.

Table 6.5: Present Available Soil Moisture of the Polder area

Classification of soil based on available soil moisture	Characteristics	Area(ha)	% of NCA
Low	Plant extractable soil moisture remained in the field level less than one month.	1,398	90
Medium	Plant extractable soil moisture remained in the field level for one to two months.	155	10
Total		1,553	100

Sources: CEGIS Assessment based on SOLARIS –SRDI; 2006



Map 6.7: Soil moisture of the Polder area

Soil Quality (Soil fertility analytical data of analytical samples)

219. Soil samples were collected from three locations namely Mirzapur, Khantakata and Ghughukhali under Bagerhat Sadar Upazila of Bagerhat District on depth 0-15 cm (top soil) inside the Polder area on 21st and 22nd January, 2016 (Photograph-2). Collected soil samples were analyzed by the Soil Resource Development Institute (SRDI), Dhaka and Entomology Division of Bangladesh Agriculture Research Institute (BARI), Joydebpur, and Gazipur. Results indicate that EC level is little higher in Mirzapur village which is not harmful for crop production. N P K level are indicating thatthey are suitable for crop production, with application of fertilizers/manure.Detail results of the analysis are presented in the Table 6.6.

Table 6.6: Chemical properties of soil on agriculture land

Farmers Name/ (Mouza / Village)	GPS reading	Land use	Depth (cm)	EC (ds/m)	pH	OM	N	K	P	S	Zn	Pesticide residue
						%			µg/g			
Mr. Anser Ali Village-Mirzapur	22 37 28.9 89 46 00.5	Fallow-HYV.Aman-HYV Boro	0-15	22.50	8.3	2.32	0.13	0.57	7.94	526.40	0.63	0
Amina Begum Village:-Khantakata	22 39 22.5 89 43 35.9	Fallow-HYVAman-Fallow	0-15	9.39	7.7	2.19	0.12	0.61	19.13	788.90	1.52	0
Md. Bazlur SK Village Ghughukhali	22 41 28.4 89 29 3.5	Fallow-Lt.Aman-Fallow	0-15	8.96	8.3	2.24	0.13	0.53	17.05	469.60	0.79	0

Sources:SRDI and BARI Laboratory analysis;2016

Photograph 6.2: Soil sample collection from Village Kontakata

Soil Salinity

220. CEGIS estimates from SOLARIS-SRDI, 2006, show that soil salinity inside Polder 34/3 increases gradually over the year. Local farmers reported that most of the water control structures are not functioning properly. As a result, they cannot prevent intrusion of saline water into the Polder. Twenty eight farmers and four SAAOsof DAE, named Mr. Bokteruddin, Mr. Shee Ronjon Sarker, Mr. Mohadeb Chandra Shil and Mrs. Gonza Moni Pal reported that

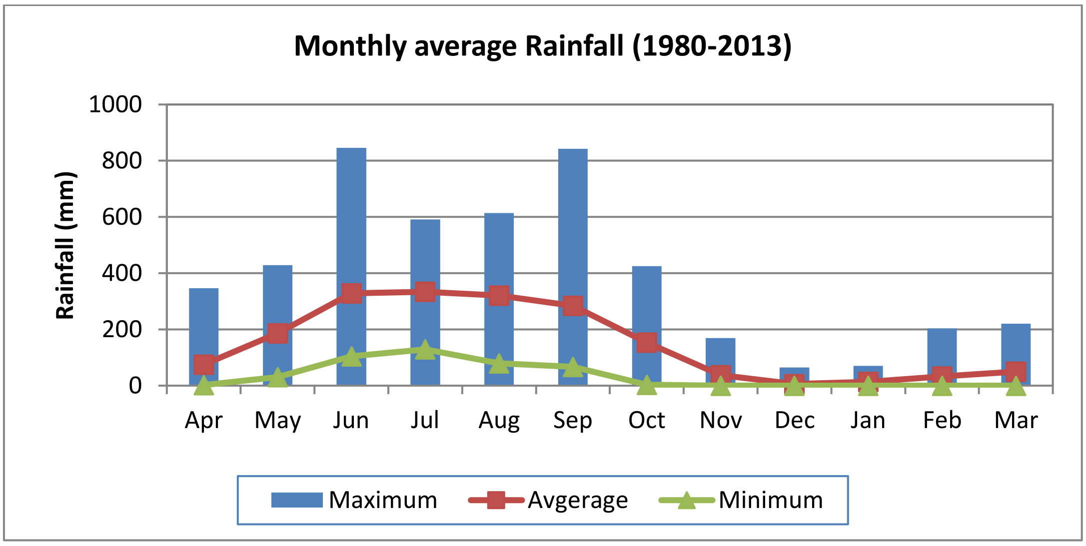
the soil and water salinity gradually increases with dryness from late December and reaches maximum level in the month of March and then decreases due to onset of monsoon rainfall.

Climate

221. Ambient mean temperature of Polder34/3 is about 18^{0}C-19^{0}C in winter and 28^{0}C-29^{0}C in summer and the annual average rainfall is around 2000 mm.Monsoon occurs from June to September when there is heavy to very heavy rainfall Tropical cyclones and storms do occur during summer in the month from April to June and then from September till November.Although the occurrence of cyclones and stormsisnot frequent but they causeserious devastation for the people of the Polder area.

Rainfall

222. The rainy season is very significant in the Polder area in comparison to the other regions of the country. November to February is the driest months of the year with negligible rainfall, while June to September is the wettest months with highest rainfall. The record of last 34 years (1980-2013) shows that, the study area received monthly maximum rainfall of 846 mm which was recorded in June 2002. Values of monthly maximum, average and minimum cumulative rainfalls are collected from the BMD station of Khulna (1980-2013). The collected data are shown in Figure 6.1 below. The figure shows that significant rainfall occurred during the months of May to October while very insignificant during the months of December to February. The hyetograph shows the highest and lowest values of maximum rainfall are observed during the months of June (846 mm) and January (70 mm), respectively while the line graph illustrates that the highest and lowest values of average rainfall are observed during the months of July (334 mm) and January (13.2 mm) respectively.

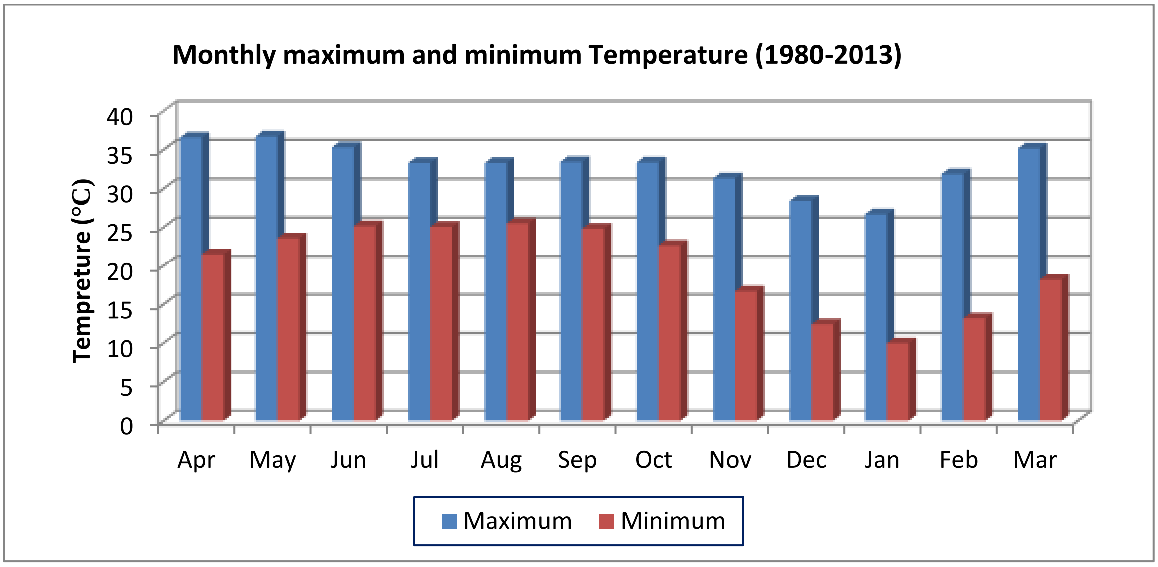


Source: Bangladesh Metrological Department (BMD), 2013

Figure6.1: Monthly maximum, average and minimum rainfallat Khulna BMD station

Temperature

223. Temperature data of the last 34 years (1980-2013) from the BMD station in Khulna shows that the monthly maximum average temperature varies from 26.7°C (January) to 36.7 °C (May), whereas the monthly minimum temperature varies between10.0°C (January) to 25.5°C (August) The highest maximum temperature recorded in the last 34 years is 36.71°C, which occurred in the month of May, 2012 while the lowest minimum temperature of10.0°C was recorded in the month of January, 1989. The monthly maximum and minimum temperature of last 34 years (1980-2013) are shown in Figure 6.2below:



Source: Bangladesh Metrological Department (BMD), 2013

Figure 6.2: Monthly maximum and minimum Temperatureat Khulna BMD station

Humidity

224. Themonthly average relative humidity at the BMD station at Khulna for the last 34 years varies seasonally from 73.1% (March) to 88.1% (July).The most humid months are June, July, August, September and October with a relative humidity 1980-2013higher than 80%, while from January to March it remains a range from 73 to 79 %. The monthly average relative humidity data are collected from BMD station of Khulna for the last 34 years (1980-2013).

Evaporation

225. Water is transformed from the surface to the atmosphere through a process of evaporation. Therefore, evaporation is another important component of the hydrological cycle which influences the overall water balance on the earth surface. Historical data on evaporation available for the last 19 years (1992-2010) has been collected from the BMD station at Khulna which reveals that the average evaporation rate varies from 1.78 mm/day (January) to 3.92 mm/day (April).

Wind Speed

226. Historical data on wind speed for the last 34 years (1980-2013) has been collected from the BMD station at Khulna. The monthly average wind speed in Khulna region varies from 1.74 to 6.88 km/hr. The Average speed of wind is highest in April (6.88 km/hr) and lowest in November (1.74 km/hr).

Sunshine Hour

227. The data for sunshine hours for the last 34 years (1980-2013) has been collected from the BMD station at Khulna. The monthly average values of sunshine hours in Khulna vary from 4.25 to 8.88 hour/day. The average value of sunshine hours is highest in April (8.54 hr/day) and lowest in July (3.78 hr/day). From October to May, the daily average sunshine hours are higher than 7 hours, but due to increased extent of cloud cover in monsoon (June to September) the values dropped below 5 hr/day.

Water Resources System

228. The water resource system is the source of water supply, and plays an indispensable role in assimilating and diluting waste, attenuating and regulating flood, drainage, recharge into the aquifer and maintaining the environment for aquatic habitats.

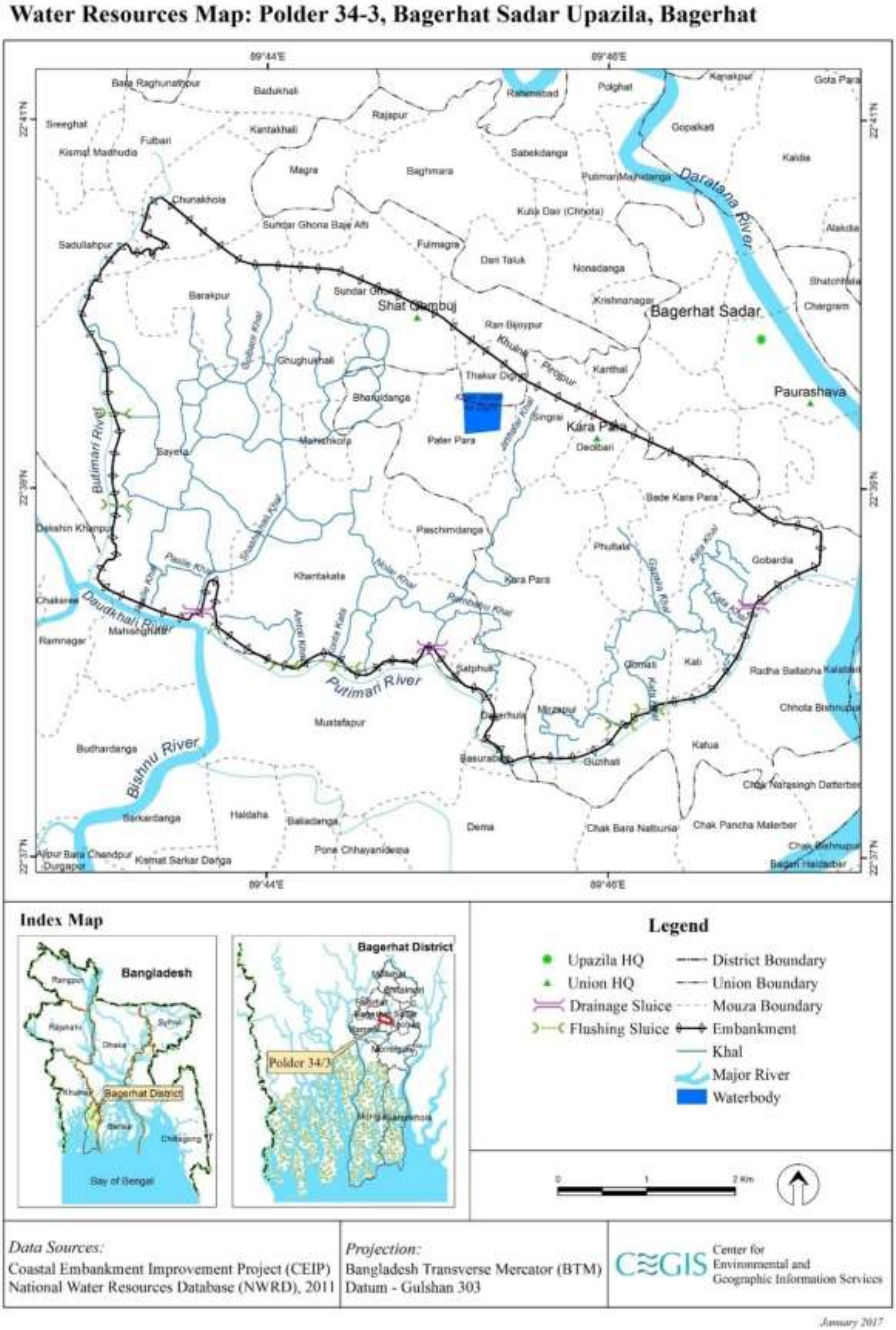
Major Rivers and Khals

229. The Polder 34/3 area is hydrologically linked with the Putimari River in the south and Butiamari River in the west. The upstream of both the rivers are connected with the Bishnu River having tidal influence (Map 6.8). There are numerous internal khals in the Polder area namely Kata khal, Delbhashani khal, Dashkhali khal, Jirthalar khal, Shashikhali khal, Konta kata khal, Amtoli khal, Ratna Khal, Golbarir khaland others which control the drainage system.

230. The water resources system of the Polder area is mainly governed by the Putimari River. The river originates from Bishnu-Kumarkhali River at Bagerhat sadarupazila of Bagerhat District and travels through Bagerhat sadar and Rampal before falling into the Doratana-Poilahara River in same district. The river is seasonal in nature with tidal effect. The PutimariRiver has a length of 15 km, an average width of about 50 m and it is meandering in nature. Approximately 3 cubic meters per second of water flows through the river during the dry season and approximately 400 cubic meters per second of water flows during monsoon.

Photograph 6.3: Butiamari river

Photograph 6.4: Putimari river



Map 6.8: Water Resources System of the Polder

Hydrological Settings

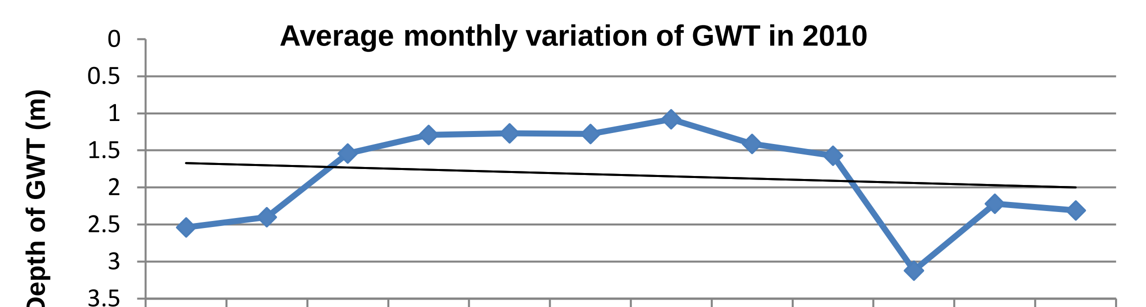
Surface Water Levels

231. There is no water level and discharge measuring gauge station at the peripheral rivers of Polder 34/3to assess the surface water levels. During field visits, it was observed that the maximum water level at Putimari River was 2.0 m (during high tide) and minimum water level was 0.2 m (during low tide). Amid all the existing khals the maximum water depth was found at Sashikhali khal approximately 1.3 m (during high tide) and minimum water flow was 0.00 m at Amtola khal (during low tide).

Groundwater Level

232. Monthly variations in ground water levels in 2010have been plotted in Figure 6.6 for the ground water observation well named as BAH 002 (at Bagerhat sadar). GWT values are fairly low in the dry season; where increased dependency of the local people on ground water lowers the GWT due to abstraction. During the monsoon, the groundwater is recharged.

233.



	April	May	June	July	August	September	October	November	December	January	February	March
Depth	2.54	2.4	1.54	1.29	1.27	1.28	1.08	1.41	1.57	3.12	2.22	2.31

Figure 6.3: Average monthly variations of GWT in 2010

234. Analyses have also been made to understand the annual variations of the GWT at BAH 002 station for April and September (from 1980-2010). The values show a decreasing trend in both cases (Figure 6.4 and 6.5).

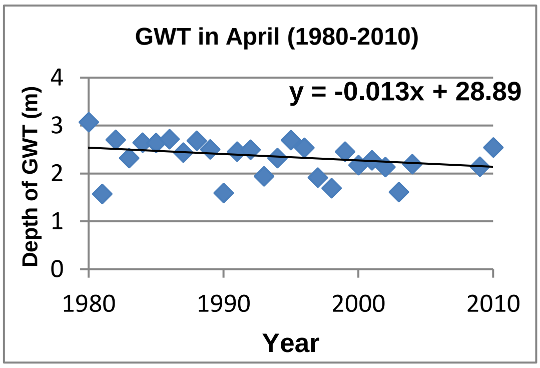


Figure 6.4: Variation of GWT at BAH 002 in April (1980 – 2010)

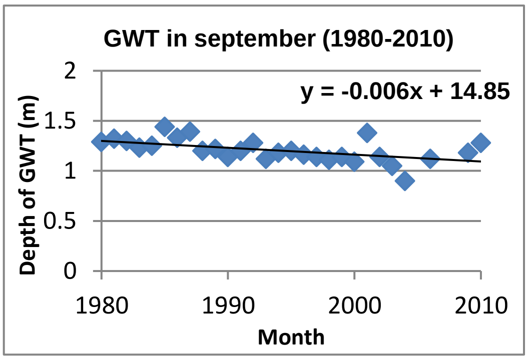


Figure 6.5: Variation of GWT at BAH 002 in September (1980 – 2010)

Water Resources State

(a) Tidal/Storm Surge Flooding

235. The tropical cyclone Sidr (2007) and Aila (2009) directly affected about 40% of the Polder area. At that time, the peripheral embankment along the rivers was severely damaged and the water control structures were also badly deteriorated. Surge water entered the Polder area and damaged crops and shrimp Ghers. At present, the total length of embankment is under-sectioned especially at Gobordia;Gomoti and Mirzapur area where most of the segments of the crest level are almost down to ground level. During monsoon the river water enters through those areas by overtopping the embankment. About 30% of the Polder area is under threat from any extreme cyclone and high tidal effect.

(b) Drainage Congestion and Water Logging

236. Drainage congestion has been identified as the major problem inside the Polder. Almost all the khals inside the Polder, which are directly connected to the peripheral rivers, suffer from tremendous drainage congestion. Some of the severely affected khals are Kata khal, Delbhashari khal, Dashkhali khal, Jirthalar khal, Konta kata khal, Amtoli khal, Shashikhali khal, Ratna Khal and Golbarir khal. During monsoon and post-monsoon periods, these khals cannot cope with the increased rainfall occurrences, leading to moderate to severe drainage congestion problems. Local people opined that, around 70% of the Polder area suffers from severe drainage congestion problem. The mostly affected areas are Gomoti, Gobordia, Mirzapur, Karapara, Khantakata, Sayera, Paschimpara, Paturpara, Mostafapur, Shashikhali, and Shingrimari. Such drainage congestion problems mostly affect the agriculture and production sector. Due to the reduced drainage capacity of khals, rainwater inundates agricultural fields for a period of 3~4 months during monsoon, and affects crop cultivation. Water depth in the agricultural fields during that time was about 3-4 ft.

237. The main reason for the drainage congestion problem is silting up of khals,especially Sashikhali khal and Jirthalar khal through which the maximum portion of congested water drains out. During field visit it was observed that all the drainage sluices and most of the flushing inlets are completely damaged. During high tide (monsoon), water enters into the Polder through the malfunctioning structures and causes inundation.

238. Putimari and Butiamari Riversare silted up considerably andhave lost their conveyance capacity. Therefore, during monsoon, water cannot be drained out properly. However, local people opined that, no prolonged water logging situation exists inside the Polder.

(c) Surface Water Salinity

239. During monsoon the salinity levels are very low. According to local people the level of salinity starts increasing from January due to the reduction of upland discharge and reaches the peak in the month of March-April and then starts decreasing again. Along the Butiamari river area, people endorsed that most of salinity intrusion and agricultural practices are less than the eastern and south eastern areas. Saline water intrudes frequently in the Polder through the damaged structures to internal khals. There areshrimp culture ponds inside the Polder area occupying about 50% of total area. Intake of saline water increases the salinity levels inside the Polder and hinders agricultural activities. Conflict exists in the Polder between fishpond owners and farmers with respect to salinity and water levels. Some intakes have been constructed by the fishpondowners for letting in saline water to the fishponds.(d) Siltation

240. Siltation is a major problem in the Polder area. The peripheral rivers Putimari and Butiamari are heavily silted up. Daudkhali River also faces siltation problems and high amounts of silt have deposited in recent years. At the confluence of Daudkhali and Putimari Rivers near Paschim Para sedimentsare deposited due to reverse tidal flow. During field visit it was observed that the Putimari River in between Polder 34/3 and Polder 35/3 (at a length of about 9 km) has silted up, significantly over the last 4-5 years according to local people.One of the main reasons for sediment deposition is thereducing tidal volume where silt is brought in at high tide with a reduced out-going flow at low tide. People are cultivating crops at the silted up sections.

241. The internal drainage channels in Polder 34/3 have silted up due to lack of maintenance/ excavation for a long time. The silting up of the peripheral rivers is a contributing factor for the deposition of the internal khals. Local people reported that on an average, the sedimentation rate is roughly 6 to 8 inches each year on the rivers and internal khals of the Polder.

Environmental Quality

242. This section provides a baseline scenario on the environmental indicators, i.e., water quality and noise level of the Polder area. The values of these environmental parameters were collected during field visit in the Polder area.

a. Air Quality

243. The national standards for air quality are given in Table 6.7.

Table 6.7: Standards of ambient air quality

Organization	Unit	Concentration of micrograms per cubic meter				
		PM_{10}	$PM_{2.5}$	BC in $PM_{2.5}$	SO_2	NO_2
BNAAQS	24h average (µg/m3)	150	65	-	365	-
	Annual (µg/m3)	50	15	-	-	100
WHO	24h average (µg/m3)	50	25	-	-	200 (1h average)
	Annual (µg/m3)	20	10	-	-	40

Source: Bangladesh National Ambient Air Quality Standard

244. The air particulates matter (APM) concentrations of the Polder area were measured by collecting PM samples on Teflon filters using an Air Metrics portable sampler and subsequent gravimetric analysis using microbalance. The concentration of black carbon (BC) in the fine fraction ($PM_{2.5}$) of the samples was determined by reflectance measurement using an EEL-type Smoke Stain Reflectometer. The NO_2 and SO_2 concentrations were determined using GENT sampler. The air sampling has been carried out for 1 day (24 hr) in the Polder at Sonatola in Bagerhat Sadar Upazila.The results are presented in Table 6.8.The values suggest that the concentrations of the measured air quality parameters ($PM_{2.5}$, PM_{10}, BC in $PM_{2.5}$, SO_2, NO_2) lie within the range of standard values of Bangladesh National Ambient Air Quality Standard (BNAAQS). However, there are numerous vehiclespowered by diesel engines moving in the Polder area,especially along the Bagerhat-Khulna road,which are considered toaffect the ambient air, especially to the relatively high measured value of Particulate Matter ($PM_{2.5}$).

Table 6.8: Values of ambient air quality parameters in the project area

Area	Air particulates matter concentration µg/m³ (24h average)				(mg/m³) (1h average)
	PM_{10}	$PM_{2.5}$	BC in $PM_{2.5}$	SO_2	NO_2
Bagerhat, Khulna	86.6	45.6	10.7	88.1	0.073

Source: Air quality measured by Bangladesh Atomic Energy Commission, April, 2016

b. Surface Water Quality

245. Six major water quality parameters (pH, TDS, DO, EC, Temperature and salinity) have been measured from different locations of the Polder area during the major field investigation in January, 2016. Surface water quality of the Polder area is found satisfactory related to DoE standards except for EC, indicating slight saline conditions. Table 6.9presents the values of the surface water quality parameters with reference to the DoE standard of the Polder area.

Table 6.9: Surface water quality of the Polder area

River/khal	Location	GPS point	Water quality parameter					
			TDS (ppm)	Salinity (ppt)	EC (ms/cm)	DO (mg/L)	Temperature (°C)	p^H
Putimari River	Mirzapur	22°37'24.2"N 89°46'00.3"E	380	6	2.9	6.5	24.5	6.9
Butiamari khal	Sayera	22°39'30.0"N 89°43'05.0"E	510	5	2.8	7.2	24.7	6.6
Kata khal	Gobordia	22°37'43.2"N 89°46'37.9"E	320	5	2.7	6.8	24.2	6.3
Delvashani khal	Gomoti	22°37'35.3"N 89°46'24.1"E	340	6	2.8	7.3	24.0	6.8
Jirthalar khal	Paturpara	22°38'04.4"N 89°45'10.8"E	680	7	3.5	7.0	24.5	6.4
Shashikhali khal	Shashikhali	22°38'04.4"N 89°45'10.8"E	400	6	3.9	6.9	25.3	6.4
DoE Standard Value (Bangladesh)			**2100**	**-**	**0.2-0.7**	**4.5-8.0**	**20-30**	**6.0-9.0**

Source: CEGIS field survey, January, 2016

Photograph6.5: CEGIS professional measuring water quality at field

Dissolved Oxygen (DO):

246. Dissolved Oxygen (DO) is an essential parameter for sustainingaquatic flora and fauna. Decrease in DO values below the critical level of 3 mg/l causes death of most fish species and other aerobic aquatic organisms. The values of DO measured inside the Polder varies from 6.5 to 7.3 mg/L which complies with the DoE standards for irrigation(5 to 6 mg/l) and fisheries (5 mg/l).

pH:

247. The hydrogen ion concentration of water is expressed by its pH value (pH is the measurement of negative logarithm of hydrogen ion concentration). A pH value of 7 indicates the neutral condition, neither alkaline nor acidic. The pH values found during field investigation are lower than the neutral zone (pH=7) which indicates that water in these locations are acidic in nature. All the pH values found in the surface water sources during field investigation is satisfactory compared with the DoE standard (pH=6 to 9).

Temperature:

248. The temperature of water bodies affects the fish habitats and their oxygen holding capacity. The temperature of the water bodies inside the Polder area was found to vary from 24.0°C to 25.3°C, which complies with DoE standard (20°C-30°C) for both irrigation and fish habitats.

Total Dissolved Solids (TDS):

249. The values of TDS found inside the Polder area ranged between 320-680 mg/l (Table 6.8). TDS values during field visit which is within the limit and complies with DoE standard.

Electric Conductivity (EC):

250. Conductivity(orspecific conductance) is a measure of the ability toconduct electricity in a (water) solution.Conductivity measurements are used routinely as a fast, inexpensive and reliable way of measuring the ionic content, especially salinity contents in a solution. The DoE standard of Electric Conductivity (EC) for drinking water is 1.2 mS/cm and for irrigation water is 0.20 to 0.7 mS/cm. The measured EC values ranges between 2.7 and 3.9 mS/cm, which exceeds the standard value specified by DoE and indicates a significant salinity concentration in the water.

Salinity:

251. Salinity is the saltiness or dissolved salt content of a body of water and an important factor in determining many aspects and assessing the effects on soil structure, crop growth/yield, animals and corrosion rates. Salinity also is an ecological factor of considerable importance, influencing the types of organisms that live in a body of water. As well, salinity influences the kinds ofplants that will grow either in a water body, or on land fed by water. When salts reach high levels in freshwater it can causesignificant problems for aquatic ecosystems, crop yield and human uses. The measured salinity levels in the month of January ranges between 5 to 7ppt, which will reach the peak in month of April. The salinity levels renders the water unfit for drinking water and irrigation purposes, as also reflected in the EC values referred to above.

c. Soil quality of Borrowpit and Khals

252. Soil samples were collected from two locations (borrow pit and internal khal) of Bagerhat Sadar (Polder 34/3) in the month of July, 2017. Collected soil samples were analyzed by Bangladesh Agricultural Research Institute (BARI) (Table 6.10). Result of the analyzed data reveals that all the parameters are within the average limit except Manganease (Mn) which may be due to the tidal submergence of those areas. The sampling location of

borrow pit was situated in riverside of the Polder which is submerged in regular high tide. Salt water frequently infiltrate at internal khal during high tide. In both of the cases salt water carry sediments. As no industry were found within or around the project area, this sediment may be the only source of excess Mn.

Table 6.10: Soil Quality of Borrow pit and Sediment quality of Internal Khal of Polder 34/3

Sl. No	Parameters	Sampling location		Standard in soil (ppm)
		Borrow pit	Internal khal	
1	Fe (ppm)	26,040	17,760	32,000
2	Mn (ppm)	1,641	999	761
3	Pb (ppm)	9.29	4.53	10
4	Cd (ppm)	0.014	0.045	0.06
5	Cr (ppm)	52.74	41.09	100
6	EC	1.84	3.24	

d. Noise Quality

253. A number of suitable sites were selected within the Polder area for sound level measurements, considering some criterion in connection with sound generation (project interventions and other secondary activities) and places which are to be affected by any anomalies in sound level (settlements, schools). The Environmental Conservation Rules 1997, of Department of Environment (DoE), Bangladesh has defined standard noise levels as 50 dB during day time for residential zones. During field inspection, sound levels were collected near the proposed construction sites. The Polder area has fallen under residential zone category and average noise value was found within the standard limit.

254. The noise level has been collected during daytime. The values of noise level (location wise) are shown in Table 6.11.

Table 6.11: Daytime noise levels of the Polder area

Sl.	Location	GPS Reading	Average Noise Values (dB)
1	Gobordia	22°38'47.00"N 89°47'45.08"E	40.6
2	Gomoti	22°37'35.01"N 89°46'24.06"E	42.6
3	Mirzapur	22°37'24.02"N 89°46'00.03"E	40.3
4	Mostafapur	22°37'47.07"N 89°45'31.03"E	43.2
5	Paturpara	22°38'04.4"N 89°45'10.8"E	41.5
6	Paschimpara	22°37'57.3"N 89°44'36.2"E	42.8
7	Konta kata	22°37'57.9"N 89°44'12.3"E	44.8
8	Shashikhali	22°38'13.7"N 89°43'37.3"E	46.1
9	Purba Sayera	22°39'30.0"N 89°43'05.0"E	48.4
10	Lashmikhali	22°38'56.8"N 89°43'05.4"E	47.6

Source: CEGIS field survey, January, 2016

6.2 Biological Environment

The Bio-ecological Zones

255. The World Conservation Union (IUCN) has identified 25 bio-ecological zones (2002) in Bangladesh. Polder34/3 falls under three of these bio-ecological zones, namely the Saline tidal Floodplain, Gopalganj/Khulna peat lands and the Ganges Floodplain. Table 6.12 represents major ecological features and present conditions in the Polder area.

Table 6.12: Major Ecological features and present condition inside the Polder area

Major Ecological features[1]	Present condition according to BEZ zone[2]
Ganges Floodplain (1524 ha/ 53.27%)	
• Presence of a lot of stagnant water bodies and channels, rivers and tributaries in this zone support a habitat of rich biodiversity to some extent. • Homestead forests, on the other hand, include both cultivated and wild plant species. • Different species of freshwater tortoises and turtles are also found in the rivers and ponds	• Wetlands (Beels, Ditches, Floodplains area) have been converted to shrimp farming. • Most of the local farmers are converting their agricultural land to shrimp farming. • Habitat loss of fresh water tortoise and turtles in the existing rivers and ponds.
Gopalgonj/ Khulna peat lands (1314 ha/ 45.93%)	
• The Gopalganj/Khulna peat land occupies a number of low-lying areas between the Ganges River floodplains and the Ganges Tidal Floodplains in south of Faridpur region and the adjoining part of Khulna and Jessore districts. • The faunal species and their population size in this zone are low due to lack of diversity in vegetation	• The population of wildlife species in the Gher areas' is less in comparison to homestead land species. • The Polder is bounded by Putimary River to the South Butiamari river to the West and Khulna-Bagerhat Highway to the North
Saline tidal floodplain (23 ha/ 0.80%)	
The Mango (*Mangifera indica*) and Jackfruit (*Artocarpus heterophyllus*) supply the commonest timber and are used for making doors, windows, boxes, etc. (Bari, 1978).	Jackfruit tree etc. are also deteriorating due to salinity intrusion as well as increasing of soil salinity

**Source: 1=IUCN, 2002, 2= CEGIS Field survey, 2016*

Ecosystem

256. According to the field survey, the Polder area can be divided into two types of ecosystem: i) Terrestrial ecosystem, and ii) Aquatic ecosystem.

The terrestrial ecosystem

257. The terrestrial ecosystem denotes the ecosystem of homestead garden and settlements include adjoining fallow area as well as agricultural cropland.

258. Homestead vegetation resources play an important role for the livelihoods of people. Most of the rural homestead vegetation consists of fruit yielding, timber and medicinal plants. The urban homesteads havemainly exotic timber species. The homestead vegetation is an important habitat for wildlife specifically local birds, small mammals and amphibians. In the rural area, undergrowth is composed of many species of wild herbs, shrubs, and creepers

occasionally also found in the urban areas. A typical picture of a homestead in Polder 34/3 is seen in the Photograph 6.6.

Photograph 6.6: Homestead garden inside the Polder (Shashikhali village) area

259. Crop land is used mainly for shrimp, paddy and vegetables cultivation. Betel leaves are planted in the homestead yards or and backyards. In croplands, some flora have been observed within the crop varieties which are not cultivated formally known as weeds (**Appendix D**). The weeds have importantrole as source of organic matter to be added in the crop field.

260. The seasonal fallow (Figure 6.6) lands found in this Polder area play important roles to the functioning of the terrestrial ecosystem providing grazing for cattle andfeedingandbreeding habitats for wildlife.

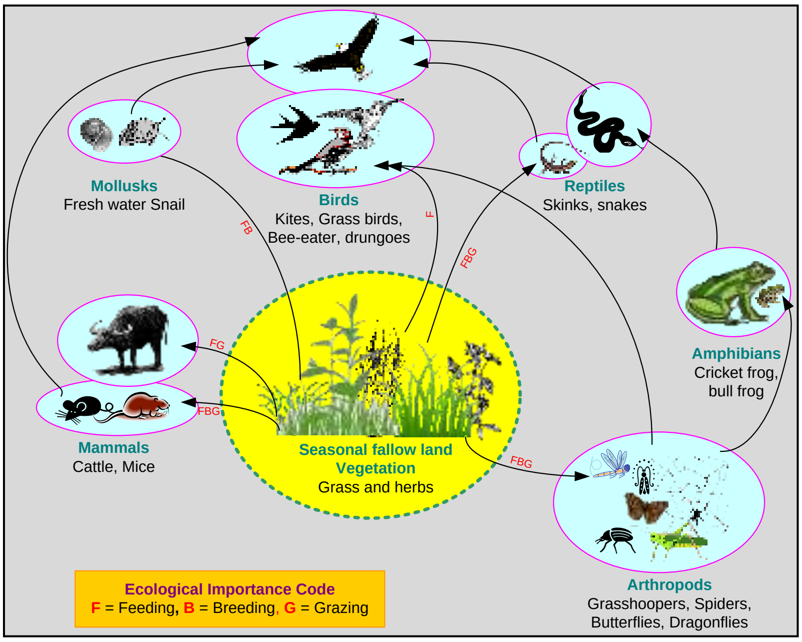


Figure 6.6: Seasonal fallow land's vegetation for different faunal communities along with partial food web

261. The embankments encirclingPolder 34/3are occupied by different types of vegetation mainly timber species, e.g. Babla, Sirish and Akashmoni. Undergrowth combined of herbs and shrubs are seen beneath tall trees and at the embankment slopes. An embankment view is provided in Photograph 6.7 and a list of thevegetation found is given in the **Appendix C.**

Photograph 6.7: The view of embankment of the Polder 34/3

The aquatic ecosystem

262. The aquatic ecosystem of the Polder area consists offresh, brackish and saline water ecosystems. Khal, ditches and homestead ponds are habitats for many aquatic flora and fauna species.

263. A good number of saline tolerant aquatic/mangrove vegetationare present along the river banks, lower portions of the embankments, in khalsand rivers and adaptedto these intertidal zones. Similarly, fresh water dependent aquatic vegetation is also found insidethePolder area. Photograph 6.8 shows an example of free floating aquatic vegetation, *Lemna* sp., in a ditch inside the Polder.

Photograph 6.8: Aquatic vegetation inside the Polderarea

Fauna (wildlife) of the Polder 34/3

264. The wildlife species in this Polder area is lessdiversified.. The large mammals and snakes are noted as less frequent due to habitat disturbance and habitat conversion into cultivable lands. The homesteads provide roosting and nesting support for avifauna but the habitats are declining day by day. A list of wild fauna has presented in the **Appendix E.**

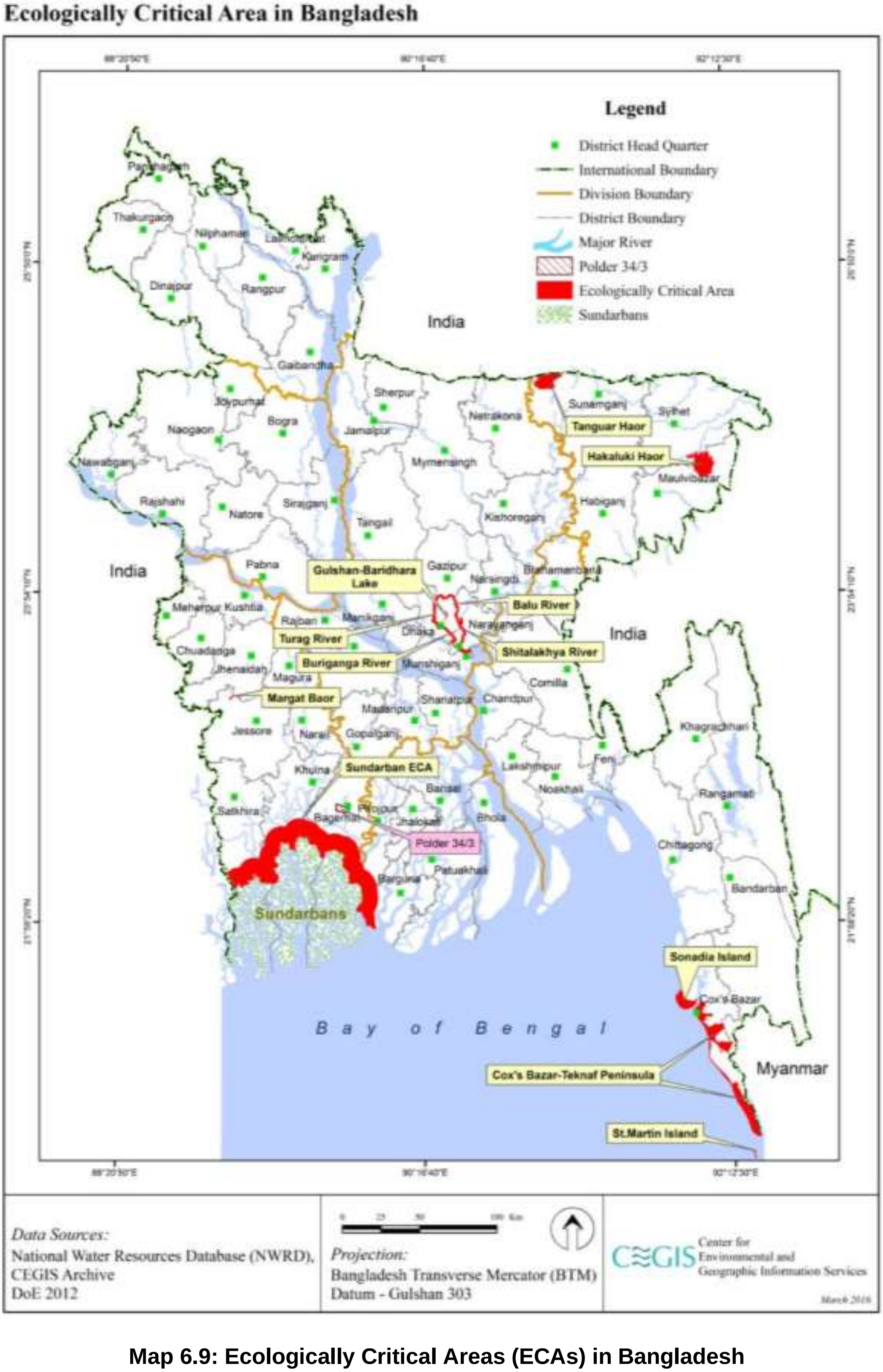
Photograph 6.9: A roosting site of Little Egrets at Sayera village

Indicative species

265. Presence of Golpata (*Nypa fruticans),* Keora (*Sonneratia apetala),* Choila/Ora (*Sonneratia caseolaris),*Hargoza (*Acanthus ilicifolius)* indicate brackish and saline water exists in this Polder environment. On the other hand, some locations of this Polder area also show sign of desalinization by emerging many freshwater species, e.g., Kochuripana (*Eichhornia crassipes)*, Kutipana (*Azolla pinnata)*, Khudipana (*Lemna perpusilla)*, and Hijol (*Barringtonia acutangula)*. However, the Polder environment appears to gain saline free environment as observed due to reduction of saline water species and emergence of fresh water species.

Protected areas

266. The Department of Environment (DoE) in 1999 circulated that no development project is to be implemented within 10 Km of any Environmental Critical Areas (ECAs). Polder34/3 is not within 10 km of any ECA, see Map 6.9.



Map 6.9: Ecologically Critical Areas (ECAs) in Bangladesh

Fish Habitats

267. Fish habitats of the Polder area are classified into capture fisheries habitats and culture fisheries habitats. In Polder 34/3 capture fisheries habitatsare mainly related to the internal khals (canal) and culture fisheries related to ponds, ditches and ghers. Khals are the major routes of fishes into the Polder area. Major khals such as Butiamari khal, Kata khal, Delbhashari khal, Dashkhali Khal, Jirthalar khal, Konta Kata Khal, Amtoli-1 and Amtoli-2 khal, Shashikhali khal, Ratna khal, Golbarir khal are connected to the outsides river such as the Gangrail River, Putimari River, Bishnu River and Daudkhali River. These rivers are tidally influenced and play a major role as habitats and longitudinal migration route for saline and brackish water fish species. The Polder area has diversified fisheries resources for fresh and brackish water fish habitats.

268. Most of the khals are silted and dried during dry season but fishes of different species use these khals to accomplish their biological and physiological needs such as grazing, spawning and nursing, etc., during monsoon.

269. The culture fisheries of the Polder area are dominated by ponds and ghers. At present, local people mostly concentrate on both bagda (Shrimp) and golda (Giant Fresh Water Prawn) farming in this area. Usually, saline water is taken from the river through khals during January and February and exchange of water is continued throughout the shrimp culture period. Golda (Giant Fresh Water Prawn) along with white fish culture are also practiced in some ghers where saline water is not available. Rice-cum fish culture (simultaneous fish culture with rice or alternative rice cum fish culture) is also practiced in some parts of the study area. Pond culture practices are mainly semi-intensive methodsadopting poly-culture or mixed culture and mono culture system with major carp, exotic carp and other fast growing fish species.

Capture Fisheries

270. Of the 534 ha fish habitats in Polder 34/3 only 17% are considered as capture fisheries habitats, mainly khals**(Table 6.13).** Local villagers inform, there were some beels in the Polder area before. However, these have beenconverted to ghers for combined aquaculture and rice culture. Most of the khals have little water during the dry season and seasonally un-suitable as fish habitats. Local people reported that the siltation rate in the internal khals of the Polder area is gradually increasing **andthe**maximum water depth of some internal khals as observedwas 1.5 m, see**Picture 6.10**. However, in some khals the conditions remain suitable as fish habitats, see **Photograph 6.11.**

Table 6.13: Fish Habitat Status of the Study Area

Sl	Category	Habitat Types	Area (hectare)	% of Habitat
1.	Capture	Canal	90	17
		Sub-total	**90**	**17**
		Pond	115	22
3.	Culture	Ditches	17	3
4.		Gher	312	58
		Sub-total	**444**	**83**
		Total	**534**	**100**

Source: CEGIS estimation based on GIS and Field visit data 2016

Photograph6.10: Silted and Dried Capture Fisheries Habitat (Konta Kata Khal) inside the Polder Area

Photograph 6.11: Good condition of Capture Fisheries Habitat (Shashikhali Khal) within the Polder Area

Culture Fisheries

271. Culture fish habitats of the Polder area are classified as closed water fish ponds and commercial shrimp and prawn ghers. The estimated culture fish habitat within the Polder is nearly 444ha of which are about 115ha is homestead pond and 329ha is commercially culture gher. As per views of the local fish farmers and physical observation, about 60% of these ponds are practicing commercial and modern aquaculture. At present, modern aquaculture practice is expanding rapidly in Polder 34/3. Different types of aquaculture technologies are adopted by the local fish farmers- mainly carp poly-culture or mixed culture are practicing in homestead pond **(Photograph 6.12)**, althougha few farmers havealso started mono culture of Thai Pungas and mono-sex Tilapia.

272. Besides, different kinds of aquaculture technology are also practiced in the gher **(Photograph 6.13)** depending on water quality, especially salinity of water. Bagda (Shrimp) culture (improved extensive) in the gher is usually started from January and mostly continues until July/August depending on the salinity level of water.

273. Afterwards, farmers started the carp poly-culture or mixed culture along with golda (Prawn) and continue until November. Farmers mostly stocked Catla, Rui, Mrigel, Grass carp, Tilapia etc. in mixed fish culture system. They also culture some of the brackish water fishes such as Tengra, Parshe and Khorshola etc. in the gher as well. Not only that, if salinity of water drops, then some of the gher owner also started to cultivate rice in the gher along with fish and golda **(Photograph 6.14).** On the other hand, after the completion of rice harvest, some of the farmers start to culture fish/prawn in the deeper part of the rice field **(Photograph 6.15).**

Photograph 6.12: Culture Fishery Habitat (Pond) at Gomoti Village in the Polder

Photograph 6.13: Culture Fishery Habitat (Big Ghers) inside the Polder at Sayeravillage

Photograph 6.14: Culture Fishery Habitat (Paddy cum Fish Culture) inside the Polder Area at Sayera Village

Photograph 6.15: Culture Fishery Habitat (Fish culture after paddy harvest) inside the Polder at Gobardia village

Water Quality of Fish Habitat

274. Water quality is very important for the life of fish and effects on all physiological function such as feeding, digestion, assimilation, growth, reproduction etc. The surface water quality parameters of major khals and nearby rivers have been measured and compared with the fish habitat suitability standards and are presented in **Table 6.14.** It is observed that pH, Dissolve Oxygen (DO) and other water quality parameters are within the permissible limit for fisheries resources. It is noted that temperature of the surface water is below the standard range forfish culture due to winter but this is not harmful for fishes for their survival.

Table 6.14: Summarized Water Quality Parameters of Different Water Bodies in the Polder Area (values in range)

Water Bodies	Temperature (°C)	p^H	DO (mg/l)	TDS (ppm)	Salinity (ppt)
River (Outside Polder)	24.5	6.9	6.5	380	6
Internal Khals (Canal)	24.0-25.3	6.3-6.8	6.8-7.3	320-680	4-6
Standard Values for Fish	(28-34)**	(6.5-8.5)*	(4.0-6.0)*	1000*	0-4 for prawn 5-35 for shrimp**
DoE Standards Values (Bangladesh)	20-30	6.0-9.0	4.5-8.0	2100	-

*Source: *M A Mazid 2002 **Jack M et al. 2002; Source: CEGIS field survey, January, 2016.*

Loss of Open Water Fish Habitat

275. The open water fish habitat in the Polder area, such as internal khals habitat is gradually decreasing in the Polder area. As per information of local peoples and field observation, at present most of the internal khals become seasonal where little water is seen in the dry season. Even some of the khals are fully silted looks like agriculture land. The main causes of reducing such fish habitat are siltation, topsoil erosion, decomposition of excessive organic materials from the agricultural land (remaining part of straw of paddy field), and encroachment of part of the khals by the local power holders for agriculture land and modified for aquaculture. Due to these reasons, spawning and grazing habitats are declining and thus capture fisheries is declining in the Polder area.

Role of Aquatic Vegetation for Fisheries

276. Aquatic vegetation play an important role in the aquatic ecosystem. Different types of hydrophytes like emergent, submerged and floating with leafs arehabitats and spawning ground for fish, and for insects and crustaceans. So, a low abundance of hydrophytes in open waters may hamper fish breeding and production.

Fish Migration and Movement

277. Fish generally migrate from one habitat to another to obtain a favourable environment for spawning, nursing and feeding purposes.The rivers and khals have collective purposes of breeding, feeding and shelter of fishes. The rivers situated outside the Polders act as longitudinal migration route through the internal khals in the Polder area. The riverine fish species migrate through khals in the Polder to some extent during the period of May to August. The internal khals situated in the Polder area are used as feeding and nursing ground of the fishes. Fish species such as Tengra, Parshe, Chingiri, Nuna Baila, Khorsola, Bhetki, Punti, Taki, Baim, etc.,migrate from the river through the sluice gates to the internal open water bodies as parts of their life cycle. Fish migration status in the Polder area is found to be poor due to the present condition of the rivers and khals as they are silted up-which reduce the length of successive migration routes. In addition, as per local peoples' opinions, migration of fishes in Polder area is poor due to mal-functioning of water control structures and inactivity of the Water Management Organizations (WMO) for operating the sluice gates and regulators. The improper management of regulators hinders the migration of fish hatchling/fry. Overall,

the fish migration status is partially obstructed during the early migration period (April-May) in Polder 34/3.

Fish Biodiversity

278. According to field investigation and consultationwith fishers, PL (Post-larvae) collector, elderly people and local DoF officials, about 45-50 fishes species are known in the regular catch of fishermen in Polder 34/3. Both brackish water fish species **(Photograph 6.16)** and fresh water fish species **(Photograph 6.17)**are present**.**Overall, the fish biodiversity is considered to be moderate with a declining trend over the years. The causes of gradual declining of fish abundance and biodiversity are the morphological changes in outside rivers, internal khals, siltation of fish habitats, squeezing of the size of spawning and feeding grounds and illegal fishing etc.

279. Common crustaceanspecies are Bagda and Golda chingri, Horina chingri, Kathali chingri, and fish species include Tengra, Baila, Parshe, Bhetki, Punti, Shol, Taki, Shing, Tara baim, Phesa, Gutum, Koi, etc. in open water and Rui, Catla, Mrigel, Carpio, Tilapia, Grass carp etc. in closed water. A list of available fish species in the Polder are presented in **Appendix F**:

Photograph 6.16: Major Brackish Water Fish/Shrimp comprisingthe Catch Composition of Study Area

Photograph 6.17: Major Fresh Water Culture Fish/Prawn Species in Polder Area

Indicative Fish Species

280. Among the fish species found in the study area mentioned above, the major indicative and migratory fish species are Kaine Magur (*Plotosus canius*), considered near threatenedby IUCN, Bangladesh; Bhetki (*Lates calcarifer*), not evaluated; Parshe (*Liza parsia*), not evaluated and Guli Tengra (*Mystus gulio*), near threatened. These species generally live in the brackish to saline water but for spawning they enter to brackish to freshwater environments. The spawning season of *Lates calcarifer, Plotosus canius* and *Mystus gulio* range from March to August whereas *Liza parsia* breeds from November to February (**Figure 6.7**). Usually these fishes enter into the Polder areas with the tide in drifting mode of migration during the life stages of hatchling to fry.

281.

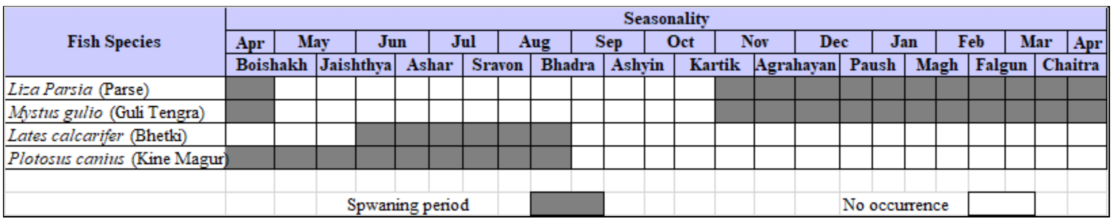


Figure 6.7: Seasonality of fish spawning

Threatened Fish Species

282. Threatened fish species are those, which are locally rare or unavailable for the long time (10-15 years) as reported by the local fishers and concerned elderly people. Threatened fish species, as reported by local fishers and elderly peoples' are noted in **Table 6.15**. The decline in presence ofthreatened fish species are due to changes of habitats, declining water depth and deteriorating water quality resulting from decomposition of aquatic weed and residual harmful chemicals coming from access uses of illegal agrochemical and pesticides in the paddy field, obstruction of fish migration, indiscriminate fishing by sluice net, illegal fishing and destroying the spawning and breeding ground, etc.

Table 6.15: List of Threatened Fish Species

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
Notopterus chitala	*Chital*	√	
Notopterus notopterus	*Foli*	√	
Nandus nandus	*Bheda/Mini*	√	
Clarias batrachus	*Magur*	√	
Ompokpabda	*Pabda*	√	
Wallagoattu	*Boal*	√	
Channa marulius	*Gojar*		√

Source: CEGIS Field Survey 2016 and Consultation with local fishers and elderly people in the study area

6.3 Human and Economic Development

Fish Productivity and Production

283. There are two types of fish culture systems in the Polder area- one is pond/ditch aquaculture and another is gher aquaculture. Gher owners mostly concentrate on bagda (shrimp) farming starting from January and continue until July depending on the suitable saline water. Bagda farming follows improved extensive to semi intensive systems along with other brackish water fishes (Tengra, Parshe, Khoshola, etc). If salinity drops in the gher during the monsoon, culture of fresh water fish (Catla, Rui, Mirgel, Grass carp, Tilapia, etc.) along with golda (prawn) is started. Sometimes rice cultivation is donein the gherswith continuedgolda and fresh water fish culture.

284. Pond owners culture fresh water fishes (Catla, Rui, Mirgel, Grass carp, Tilapia, etc.) in their pond over the year following poly-culture or mixed culture.

285. The fish productivity of the Polder area is presented in **Table 6.16.** The fish productivity of khalsis 130 kg/ha, which is comparatively lower than the national productivity rate (196 kg/ha). The main reasons for low productivity in open water capture fisheries in Polder 34/3 are: reduction of water depth due to siltation, illegal fishing by nets close to the sluice gates, obstruction of fish hatchling movement during pre-monsoon and monsoon due to improper management of sluice gate and lack of the enforcement of Fish Conservation and Protection Acts. Fish productivity of cultured pond and ghers is also low. The low production of culture fisheries in the Polder area are due to tidal flooding risk for mal-functioning of sluices and regulator, lack of quality fish and shrimp seed and feed, lack of training of modern fish culture and specially low stocking density of fishes due to the mixed culture with golda. However, intensification of aquaculture practice in gher is improving significantly in the Polder area.

Table 6.16: Fish Productivity and Production in the Study area

Sl	Fisheries Category	Habitat Types	Productivity (MT/ha)	Production (MT)	Remarks
1.	Capture	Canal	0.120	10.8	-
			Sub-total	***10.8***	
2	Culture	Pond/	2.200	253	
3		Ditches	1.200	20.4	
4.		Gher	1.000	312	Production includes Bagda, Golda and other fresh water and brackish water fishes.
			Sub-total	***585.4***	**-**
			Total	**596.2**	

Source: CEGIS estimation based on field survey data 2016 andFishery Resources Survey System (RSS) 2015

286. The estimated total fish production of the Polder area is about 596 metric ton (MT). Most of the fish production (about 98%) is from culture fisheries and very less (2%) from capture fisheries (Table 6.16). Capture fisheries is gradually declining in the Polder area due to the degradation of the canals habitats as per opinion of local fishers and villagers.

Fishermen and Fishing Effort

Fishermen

287. During field investigation and consultations with local people and the fishers at the different villages of Polder, the respondents informed that, the fisher's households in the Polder area can be grouped as commercial, subsistence and part time fishers. As per their opinion about 7-8% fishers' households are engaged in commercial fishing, while about 60-65% fishers' households are involved in subsistence level fishing and 20-25% fishers households are involved in part time fishing in an around the habitats of the Polder area. Among the fisher households, commercial fishers are spending around 6-7 hours a day in fishing activities throughout the year. Fishermen mostly come from the Muslim (90%) and rest (10%) from Hindu community. There is no specific area or fisher's villages in the Polder area. They usually catch fish in the nearby rivers, canals of Polders and also harvest fishes in private ghers and ponds as wages basis. They also catch the post larvae of Bagda/Golda from the rivers. The socio-economic condition of the commercial fishers is poor. As per opinion of local fishers, the seasonal vulnerability of the fishers' starts from December andcontinues until March. The fish catch from open water during this period is hardly recorded. Due to low amount of fish catch during this period, most of the fishers maintain their livelihoods through daily labour in or outside the Polder. Some fishers are also involved in agricultural activities or fish farming in their own land.

Fishing Season

288. Fishing in canals in the Polder area and in peripheral rivers starts in April and continues up to February. Rest of the time the fishersare mainly engaged in other fishing. Most of the fish caughtfrom open water capture fisheries is by using different gears from late June to Mid-November. Monofilament Gill net (Current Jal) fishing is the major fishing gear in the study area, followed by push net, cast net, lift net, seine net etc. Moreover, shrimp trap (Atol) is also used in the gher to harvest shrimp and prawn while fish trapsare used in the open water. It is important to note that Berjal and Bendijal are used in the peripheral river round the yearto catch more fish. The seasonality of major fishing gear is presented in the **Table 6.17.**

Table 6.17: Fishing Seasonality of the Polder Area

Type of Gear	Apr	May	June	July	August	Sept	Oct	Nov	Dec	Jan	Feb	March	April
	Baishakh	Jaishthya	Ashar	Sraban	Bhadra	Ashyin	Kartik	Agrahayan	Poush	Magh	Falgun	Chaitray	
Seine net (BerJal)													
Gill net (Current Jal)													
Drag net (Net Jal)													
Push net (DhelaJal)													
Cast net (JhakiJal)													
Sluice net (Dip net)													
Pull net (TanaJal)													
Lift net (VesalJal)													
Fish Trap (Chau)													
Shrimp Trap (Atol)													
Lining (Borshi)													
	High		Moderate		Low		No Occurrence						

Source: CEGIS Field Survey, 2016

Fishing Crafts

289. Different kinds of fishing gears and traps are used to catch specific fish in the area depending on fish species as well as season. The commercial fishers of the Polder area catch fish in the peripheral rivers and internal khals by using both small mechanized and traditional boats including Nouka and Kusha, Dingi, medium and small sized non- mechanized fishing boats. Fishing boat in the Polder area is shown in the **Photograph 6.18.**

Photograph6.18: Traditional Fishing Boat with Seine Net in Dashkhali Khal during Low Tide in the Polder Area

Fishing Gear

290. Among the fishing gears, (a) Seine net (Ber jal/Bendi jal) is used to catch all types of small and big fishes; (b) Mono filament net (locally known as Current jal) is used to catch poa, chingri, tengra, gulsha, koi and also other kinds of fishes; (c) Cast net, locally known as Jhaki jal **(Photograph6.19),** is used to catch puti, chingri, tengra, khorshola, rui, mrigel etc. (d) Push net, locally known as Thela jal, is used to catch puti, tengra, chingri etc. (e) Sluice/Dipnet locally known as Sluice net or jal is found to be used at the mouth of sluice gate to catch all types of fishes. (f) Drag net, locally known as Net jal is mainly used to catch PL (Post larvae) of shrimp and prawn; (g) Lift net (Vesal Jal) is a common traditional fishing gear and widely used in the Polder area in all capture fisheries. Besides, Katha is found in the deep pool area of khals inside the Polder to aggregate the fishes. As per opinion of local fishermen, the Katha isconstructed in the internal canal by putting the branches of trees from late October to January to aggregate the fish in a certain area and then catch all type fishes by using the seine net by a group of fishermen. In addition, shrimp farmers mainly harvest their shrimp/prawn from the ghers by using the bamboo made trap locally called *Atol.* About 10% fishers ownfishing boats and almost 90% fishers have fishing gears/nets.

Fish Marketing and Post-Harvest Facilities

291. There is no big fish market and no structured fish-landing centers in the rural area within the Polder. But there is a small daily market named Mirzapur bazaar within the Polder area, where fishermen and fish farmers can sell the fish of their daily catch or harvest. However, there is a very big wholesale fish market in peri-urban area named *Barakpur*, where fishermen and fish farmers can sell the fish to the Arats (whole seller) every day through open bidding. This fish market is started at afternoon usually from 12:30pm to 17:30pm. Usually, most of the fish farmers' (Pond and Gher owner) are used to sell their bulk of fish/shrimp directly to the Barakpur fish market. There is an ice factory in Barakpur from where ice is supplied to the others part of the Polder for short term storage of fishes/shrimp. Iced fish/shrimp are sent from the Barakpur market to fish processing plants in different parts of the country.

Photograph 6.19: Fishing Gear (Cast net) is using for Fishing in the Polder Area at Amtoli Khal

Photograph 6.20: Fishers caught the Shol-Snake head fish(*Channa* sp.) by Cast net from Amtoli Khal

292. Transportation facilities at the root level is well developed. There is no fish/shrimp hatchery inside the Polder area. Availability of fish feed and fish fry for culture ponds is insufficient. Fish seeds for culture fisheries are collected from the nearby hatcheries and

nurseries situated outside the Polder. In addition, fish feeds are also collected from the local market or from mobile traders who come from Khulna, Satkhira and Jessore districts.


Photograph 6.21: Open bidding fishes and ice blocks in Barakpur fish market in the Polder

Fisheries Management

293. There is no community based fishers association in the Polder area. The fishers have full fishing rights and access to existing fish habitats of the Polder area. There is no leased water body in the Polder. Department of Fisheries (DoF) has limited initiatives for fisheries resource conservation and management (enforcement of Fish Conservation and Protection Acts, training on aquaculture etc.) in the Polder. Some NGOs are also working here, but their programs are very much limited to micro credit rather than extension services and aquaculture training.

Agriculture farming practices

294. Farming practices in the Polder area are largely controlled by physical, biological, climatologically and socioeconomic factors. There are two distinct cropping seasons in a year. The Kharif season is from March to October while the Rabi season is from November to February. Based on crop adaptability and crop culture, the Kharif season is further sub-divided into the Kharif-1 (March-June) and the Kharif-II (July-October) seasons.

295. The Kharif-I season is characterized by high temperatures, low humidity, high evaporation, high solar radiation and uncertainty of rainfall with low alternating dry and wet spells. Local Transplanting Aus (Lt. Aus), Chilli, B Leaf and Summer Vegetables are grown in the Kharif-I season.

296. The Kharif-II season is characterized by high rainfalls,comparatively 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. Local Transplanting Aman (Lt. Aman), High Yielding Varieties of Transplanting Aman (HYV Aman), B. Leaf and Summer Vegetables are grown in the Kharif-II season.

297. In the Rabi/Boro season, Local T. Aman & HYVT. Amanoccasionally overlaps the Kharif-II season.In this season, High Yielding Varieties of Boro (HYV Boro) rice, Chili, Potato, Pulses, Oilseeds, Spices and Winter Vegetables is grown.

Present Cropping Pattern and Intensity

298. The present cropping pattern of the Polder area is Fallow-T Aman (Local)-Gher, which is practiced in 20% of the Net Cultivable Area (NCA) (Photograph 6.22). B. Leaf + B. Leaf + B. Leaf, covers 5 percent of NCA and S. Vegetables + HYV T. Aman + Fallow , covers 13 parcent and Fallow + HYV T Aman + Fallow 16.% of the NCA (Photograph 6.23 and 6.24). Farmers are also growing HYV Boro and day by day the practice is increasing (Photograph 6.24). The cropping intensity of the Polder area is 167%. Detailed cropping patterns by land type and cropping intensity are presented in Table 6.18.

PhotographPhotographPhotographTable 6.18: Present Cropping Pattern and Cropping intensity by Land Type

Land Type	Cropping Pattern			Area (ha)	% of NCA
	Kharif - I	Kharif - II	Rabi		
Fo	Fallow	HYV T Aman	Pulses	169	11
	B. Leaf	cont	cont	75	5
	T. Aus (LV)	T. Aman (LV)	Oilseeds	58	4
	S. Vegetables	T. Aman (HYV)	Fallow	209	13
	S. Vegetables	S. Vegetables	W. Vegetables	40	3
	Fallow	T Aman (LV)	Potato	118	8
	Chilli	T. Aman (LV)	Spices	30	2
	Fallow	HYV T. Aman	Chilli	60	4
	Fallow	T. Aman (LV)	Pulses	50	3
	Fallow	T. Aman (LV)	HYV Boro	183	12
	Fallow	HYV T. Aman	Fallow	142	9
			Sub Total =	**1134**	**73**
	Fallow	T. Aman (LV)	Gher	312	20
	Fallow	HYV T. Aman	Fallow	107	7
			Sub Total =	**419**	**27**
			Grand Total =	**1,553**	**100**
			Cropping Intensity % 167		

Source: Field investigation, Local farmers and SAAO of DAE, 2016

Photograph 6.22: Gher + Local Aman field

Photograph 6.23: View of vegetable grown on the bank of the Gher

Photograph 6.24: View of Betel Leaf plantationat Mahishkora

Photograph 6.25: View of HYV Boro platation at Khantakata

Cropped Area and Production

299. Detailed cropped area, yield rate and crop production is presented in Table 6.19.

Cropped Area

300. Total cropped area is 2,860 ha of which rice occupies1,911 ha and the rest 949 ha is covered by non-rice crops. The rice and non-rice cropped area are 67% and 33% of the total cropped area respectively. Among the rice crops Local T. Aus, Local T. Aman, HYV T. Aman and HYV Boro are grown.

Crop Production

301. Total crop production is 11,021 metric tons of which rice production is 4,508(42%)metric tons and non-rice production is 6,514(58%) metric tons. Detailed informationis on cropped area, yied and production are presented in Table 6.19.

Table 6.19: Present Cropped Area, Yield and Production of the Polder Area

Present crop grown	Present crop area, yield & production			
	Cropped area (ha)	Yield/ha (mt)	Production (mt)	% of contribution
Local T. Aus	54	1.9	103	1
Local T. Aman	711	2.2	1,564	14
HYV T. Aman	963	2.4	2,311	21
HYV Boro	183	2.9	530	5
Total rice	**1,911**	**0**	**4,508**	**41**
S. Vegetables	249	10	2,490	23
Chili	60	2.8	168	2
Potato	118	8	944	9
W. Vegetables	40	14	560	5
Oil Seeds	58	1	58	1
Pulses	169	1.5	254	2
Spices	30	8	240	2
B. Leaf	225	8	1,800	16
Total non-rice	**949**	**0**	**6,514**	**59**
Total	**2,860**		**11,021**	**100**

Crop Damage

302. The scenarios of crop damage during 2009-2014 and 2015 are presented in Table 6.20, which shows that crops were damaged by Ailain 2009, Tidal affect in 2012 and Flooding due to heavy rainfall in 2013. In 2009, 80% Vegetables, 85% oilseeds and 75% B. leaf were damaged due to Aila. Farmers reported that 25% HYV T. Aman crops were damaged by water logging in the year 2011 and in this year total 20% of Vegetable crops were damaged by pest and disease infestation. In the 2013, Local T. Aman was damaged 30% by Flooding as cause by heavy rainfall (Field visit; January 2016).

Table 6.20: Crop area Damaged by Different Means and % Losses during 2007-2011 and in 2013

Sl. No.	Crops	Damage (%)	Year	Caused by
1	Local T. Aman	65%	2009	Aila
	HYV T. Aman	75%	2009	Aila
	Vegetables	80%	2009	Aila
	Oilseeds	85%	2009	Aila
	B. Leaf	75%	2009	Aila
2	HYV T. Aman	20%	2010	Heavy rainfall (water logging)
	Vegetables	15%	2010	Pests
3	HYV T. Aman	25%	2011	Water logging
	Vegetables	20%	2011	Pests
4	Local T. Aman	25%	2012	Tidal affect
5	Local T. Aman	30%	2013	Flooding due to heavy rainfall
6	HYV T. Aman	30%	2014	Water logging
	Vegetables	12%	2014	Pests
7	HYV T. Aman	20%	2015	Tidal affect

Sources: Information of Field Survey; January 2016.

Agriculture Input Use

Fertilizer and pesticides application

303. According to SAAO's indiscriminate use of chemicals and pesticides raise issues of safe production of produce causing concerns of health hazards to human, livestock and fisheries. Integrated Crop Management (ICM) practices though have been initiated but limited knowledge and availability of the inputs are limiting widespread application. However, the rate of use of fertilizer per hectare varies considerably from farmer to farmer depending on soil fertility, cropping pattern and financial ability (Table 6.21). The major fertilizers used in this area are Urea, TSP and MP. The quantities of fertilizer are used generally lower than the recommended doses and the proportions of Urea, TSP and MP by the majority of farmer. The use of nitrogenous fertilizer (Urea) is higher than other chemical fertilizers. Annually about 1,524 metric tons of chemical fertilizers are being used in the Polder area of which 38% urea, 31% TSP, 19% MP, 11% Gypsum and 1% Zinc. Generally farmers did not use manure or compost in their fields. Unbalanced use of chemical fertilizers would affect the soil health which would be ultimately reflected on crop yields.

Table 6.21: Fertilizer and Pesticides use in the Polder Area

Crop Name	Fertilizer (Kg/ha)					Pesticides (Tk/ha)
	Urea	TSP	MP	Gypsum	Zinc	
Local T. Aus	90	70	50	30	5	500
Local T. Aman	100	120	65	40	5	580
HYV T. Aman	150	130	70	60	5	1500
HYV Boro	270	135	120	70	10	800
S. Vegetables	125	90	75	0	0	1000
Chili	90	50	40	0	0	800

Crop Name	Fertilizer (Kg/ha)					Pesticides (Tk/ha)
	Urea	TSP	MP	Gypsum	Zinc	
Potato	105	60	35	0	0	1400
W. Vegetables	50	0	20	0	0	700
Oil Seeds	130	80	80	0	0	-
Pulses	20	30	25	0	0	300
Spices	100	80	40	10	5	600
B. Leaf	150	60	55	15	10	1000

Source: Farmers interview, January, 2016

304. The use of pesticides depends on the degree of pest infestation. The majority of the farmers applied pesticides in Local T. Aus, Local T. Aman, HYV T. Aman,HYV Boro, Chili, Potato, Pulses, Spices, B. Leaf and Vegetable crops. Annually about 26 metric tons pesticides are being used as a liquid or granular form in Polder 34/3 for pest control. The major insects as reported by the farmers are Yellow Stem borer, Ear cutting caterpillar, Brinjal fruit and shoot borer, Fruit weevil, etc. Local farmer reported that they are using different types of pesticides such as Volian Flexi, Amestartop, Virtako, Aktara, Fighter, and Fanfan etc. to prevent pest infestation in rice, vegetables and other croplands. Granular Liquid and powder pesticides are used for crop protection from the infestation. Farmers of the Polder area applied pesticides once or twice in a season (Field visit; January, 2016).

Seeds

305. Most of the farmers in the Polder area use their own seeds in case of local variety, such as T. Aus and T. Aman. Medium and small farmers meet their requirement from neighboring farmers or local markets. Various improved crop seeds (HYV/Hybrid) are provided by BADC and private seed dealers. Market price of the private dealer seeds is higher than BADC seeds. The salt tolerant cultivars are not available in the market and farmers are also not aware of them.

Integrated Crop Management (ICM)

306. In the project area farmers are practicing ICM in about 30% of the crop cultivated area in the field. ICM activities are implemented by the Department of Agricultural Extension (DAE). Objective of the infrastructure project for agricultural crop production has been addressed. DAE isthe main agency responsible for agricultural crop production through reduced dependence on agro-chemicals.

Irrigation

307. Irrigation coverage of the Polder area is about 30% (868 ha) of the total NCA during the dry season(see Table 6.22). Of these, 425 ha is partially irrigated. For irrigation both surface and ground water are useddrawn by Low Lift Pumps (LLP) and Shallow Tube Wells (STW) respectively. For surface water, farmers are using Khals water like Butiamari khal, Kata khal, Delbhashari khal, Jirthalar khal and Amtoli khal where there is little water in the dry season. Farmers provide irrigation with surface water for raising seedlings, land preparation and transplantation up to February. For Boro and other Rabi crops they use thestorage water for irrigation purpose by Low Lift Pumps (LLPs). Aus (HYV), Aus (Local), T. Aman (HYV) and T. Aman (Local) crops are grown in the Polder area under fully rain-fed condition. Farmers reported that in some cases, HYV Aman and S. Vegetables are grown with supplementary irrigation (Field visit; January, 2016).Supplementary irrigation to high land and medium high

lands crops is practiced and potato and different winter & summer vegetable receive sometimes one or two or three irrigation during growing season. Supplementary irrigation cost is 1500-2000 Taka/hadepending on crops and number of application. After implementation of the project about 300 ha of land will come under irrigation.Access to water will be provided during the dry season with proper re-excavation of khals and water management. Rabi Season (November-February) crops cultivated in the Polder area are primarily pulses, potato, winter vegetables spices, oilseeds, etc. Generally, major irrigated crops will incude the HYV types

Table 6.22: Cultivation Cost in the Polder Area

Crop Name	Seed (Kg/ha)	Irrigation cost (Tk)/ha	Equipment used for cultivation		Power tiller cost
			Power tiller (%)	Bullock	
Local T. Aus	45	-	90-95	5-10	4,500-5,000
Local T. Aman	45	-	90-95	5-10	4,500
HYV T. Aman	40	-	90	10	5,000
HYV Boro	40	6,500	100	-	6,500
S. Vegetables	4-5	1200	85-90	15-10	4,500
Chilli	2	-	85-95	15-10	4,500
Potato	22,000 (Tuber)	3,000	85-90	15-10	5,000
W. Vegetables	4-5	1,500	80	20	4,500
Oil seeds	5-6	-	90	10	4,500
Pulses	8-15	-	80	20	3500
Spices	3-8	2000	90	10	5000
B. Leaf	18000 (Vine)	8000	100	-	4500

Sources: Field visit, January, 2016

Labor for Agriculture

308. In the Polder area, mostly manual labor is used for cultivation. Thereby, agricultural labor is considered as one of the essential inputs for crop production. At the time of winnowing and threshing local women and men are working (Photograph 6.26 and 6.27). The labor requirement is not uniform throughout the year. The number of labor requirement varies from crop to crop. Annually a total 0.808 million man-days labour is used for crop cultivation. The average labor used in the study area is presented in **Table 6.23**.

Table 6.23: Agricultural Labor used by crop in the Polder Area

Crop name	Labor (No/ha)	Crop name	Labor(No/ha)
Local T. Aus	140	Potatoes	210
Local T. Aman	160	W. Vegetables	190
HYV T. Aman	165	Oilseeds	110
HYV Boro	175	Pulses	80
S. Vegetables	180	Spices	140
Chili	170	B. Leaf	290

Source: CEGIS Assessment; 2016

Photograph 6.26: Paddy threshing

Photograph 6.27: Women are winnowing their paddy

Livestock and Poultry

309. Livestock and poultry, being essential elements of an integrated farming system, play an important role in the economy of Polder 34/3. Livestock provide significant draft power for cultivation and 30% cases of rice threshing.Cow dung as a source of manure and fuel (Photograph 6.28) and a ready source of funds and meat, milk and eggs for human consumption. Most of the households raise poultry and livestock, a practice that significantly reduce poverty through generating income and employment. The numbers of livestock and poultry in the Polder area are presented in Table 6.24.

Table 6.24: Number of Livestock and Poultry of the Polder Area

Name of Livestock and Poultry	% of HH having Livestock/Poultry in the Polder Area	Number of Livestock/poultry in the Polder Area
Cow/Bullock	20	1271
Buffalo	3	191
Goat	5	318
Sheep	30	1907
Duck	65	4131
Chicken	75	4767

Sources: CEGIS Assessment based on field information and DLS, January; 2016

Photograph 6.28: Cow dung used for fuel

Fodder

310. The owners of the livestock population are facing problems in respect of non-availability of fodder and feeds during the months of July to January due to unavailability of grazing land. Rice straw is the only fodder in this Polder area. Cattles graze in the field and they eat rice straw which was left after T aman season (Photograph 6.29and 6.30). The 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 and ducksgoing hither and thither.

Photograph 6.29: Cattles are grazing but there is severe scarcity of grass in the Polder area

Photograph 6.30: Cattle grazing but severe scarcity ofgrass in the Polder area

Disease

311. Productions of livestock and poultry are mainly constrained due to diseases and death of the population. Outbreak of disease is causing a considerable economic loss in livestock farming. Every year the livestock population is affected by different diseases. Major livestock diseases are Foot and Mouth Disease (FMD), Gola fula, Mastitis, Diarrhoea and Goat Peste Des Petits of Ruminants (PPR). Major poultry diseases are Ranikhet (New castle), Cholera, Fowl pox and Duck plague. However, some diseases are spreading round the year. During monsoon season, the soggy condition of the animal shelter promotes various kinds of diseases to the bullocks and cows.

6.4 Socio-cultural environment

Introduction

312. The socio-economic condition of the people living in Polder 34/3 is describedin this chapter. Primary data were collected using a range of RRA techniques including Key Informant Interview (KII), Focus Group Discussion (FGD), observation and unstructured interview. Moreover, relevant secondary information was compiled from the community series of the Population Census 2011 published by Bangladesh Bureau of Statistics (BBS) and from different reliable sources.

Area and Location

313. The Polder 34/3 is situated in Bagerhat Sadarand Rampal upazila under BagerhatDistrict. The Polder area encloses five unions namely Dema, Bagerhat Paurashava,

Kara Para and Shat Gambuj of Bagerhat Sadar Upazila and Baintala Union of Rampal. Percentages of unionboundariesare shown in **Table 6.25**

Table 6.25: Upazila and unions in Polder34/3

Name of district	Name of upazila	Name of unions	Percentage of union within Polder
Bagerhat	Bagerhat Sadar	Shat Gambuj	46
		Kara Para	46
		Dema	.05
		Bagerhat Paurashava	1
	Rampal	Baintala	1

Source: Spatial GIS Analysis, CEGIS, 2016

Demography

314. The 6,370 households living in the Polder area have a total population of 26,980 of which 13,691 are male and 13,289 are female. The male population isslightly higher than the female population. The demographic data of this Polder is presented in **Table 6.26**.

Table 6.26: The present Demographic Data of the Polder-34/3

Households	Population			Sex ratio	Population density/sq.km
	Total	Male	Female		
6,370	26,980	13,691	13,289	100	1,022
	100 (%)	50.74(%)	49.25(%)		

Source: Population Census 2011, BBS

315. The average density of the population in Polder 34/3 is1,022 persons per sq. km close to the national average population density of 1,015 persons per sq. km. The studied area's sex ratio is 100 which same as the national sex ratio. According to BBS report of 2011, among the total population 85% belong to Muslim, 14% are Hindu and 1% is Christian.

Demography for the year 2016

316. According to the BBS 2016, the population growth rate of Bangladesh is 1.37. Considering as linear growth rate it is also distributed into 5 year (2011-2015). This calculator attempts to show the power of human numbers to grow exponentially, like the proverbial penny in a savings account that yields millions in interest after a thousand years. Culture, infant mortality, quality of health care, life expectancy, availability of birth control, illiteracy, education, war and pestilence all effect growth, but for the sake of simplicity this calculator[6] assumes consistent growth. Study area population has been calculated with the number of baseline population. Applying this method, in the year 2016 the estimated population is28,126 in which 14,276 are male and 13,849 are female and 6,622 total households. The demographic data of this Polder for the year 2016 is presented in **Table 6.27**.

[6]The formula to calculate a growth rate given a beginning and ending (Estimated Population) population is:$Pop_{Future} = Pop_{Present}(1+r)^n$

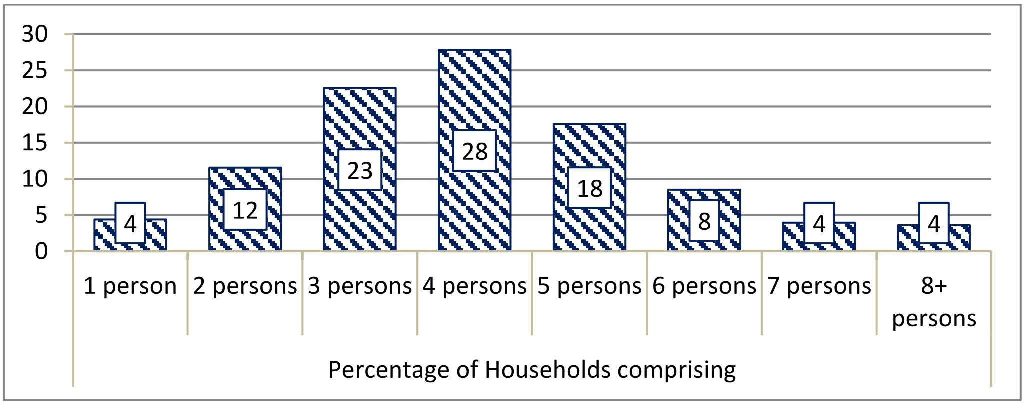
Where: Pop_{Future} = Future Population, $Pop_{Present}$ = Present Population, r = Growth Rate and n = Number of Years

Table 6.27: The 2016 Demographic Data of the Polder- 34/3

Households	Population			Sex ratio	Population density/sq.km
	Total	Male	Female		
6,622	28,126	14,276	13,849	107	1094
	100 (%)	50.75(%)	49.24(%)		

Source: Population Census 2011, BBS and Population estimation for the year 2016, CEGIS

317. The size of households in Bangladesh continues its long term decline, with an average of 4.4persons per household in 2011, compared to 4.8 in 2001 and 5.5 in 1991. Household distribution by number of persons in Polder 34/3 is almost the same as the national scenario of 4.1 where the highest percentage (27.8%) of household comprises of 4 persons in each. In **Figure 6.8**, it is presented the distribution of household members;

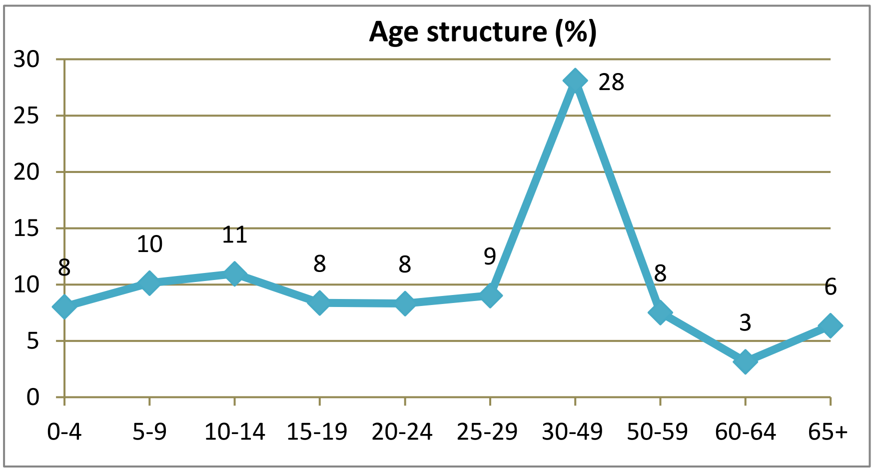


Sources: Housing and Population Census, BBS, 2011

Figure 6.8: Distribution of Households comprising member in each

Age Structure

318. With respect to age structure in Polder 34/3 about 28% belongs to age category of 30 to 49 years old. About 3% and 6% people are in 60-64 and 65+ year's category respectively which is presented, according to Housing and Population Census, BBS 2011, in below **Figure 6.9.**



Sources: Housing and Population Census, BBS, 2011

Figure 6.9: Age Structure of the studied people

319. 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, CIA[7]). This classification is important as the size of the young population (under age 15) would need more investment in schools, while the size of older populations (ages 65 and over) would call for more investment in the health sector.

320. The percentage of the (potentially) active working population in the age group of 15-64 is 65%. , where the national level is 57%. Unfortunately, the high active working population suffers under a severe unemployment problem, which renders about one-seventh of them living under the poverty line.

321. There is a small percentage (6%) of 65 years and above. The categorization is made on the basis of ILO reference for opting out potential labor force and dependent population. Population of 15 to 64 years category is considered as labor force whereas, populations below 14 years and above 65 years are considered as dependent. Thus, the total dependency ratio[8] is about 54 in which child dependency ratio[9] is 45 and aged dependency ratio[10] is 9. It illustrates that a total of 54 persons are dependent on 100 labor forces in which 45 are children and 9 are elderly people.

Education

322. The literacy rate, based on a definition “ability to write a letter in any language”, is 64%, where for male it accounts to 66% and female 62%. Out of the population of 7 years and above~~.~~Compared to the national literacy ratesPhotograph (Male 54.1% and Female 49.4%), the literacy rate in Polder 34/3 is relatively high, with a male populationmore educated than the female counterpart. It is found that the Polder’s education facilities are better than other Polders’ facilities.

323. Field findings shows there are 19 primary schools, 7 high schools and a college namely the B.M. College situated at Barakpur(**Photograph 6.31**). Among the schools, there are 3girls’ schools. As a place of Saint Khan Jahan Ali and his companions, people of the Polder are comparatively more involved in religious activities than elsewhere. Therefore, there are many religious institutions in the Polder, including 4 4 ebtedaye madrasahs, 2 dakhil madrasahs and 2 fazil madrasahs (*Source: CEGIS field work, 2016).*

---

[7] Retrieved on 30/06/2015 from https://www.cia.gov/library/publications/the-world-factbook/docs/notesanddefs.html

[8] Total dependency ratio= $\frac{number\ of\ people\ aged\ 0-14\ \&\ those\ 65\ and\ above}{number\ of\ people\ aged\ 15-64} \times 100$

[9] Child dependency ratio= $\frac{number\ of\ people\ aged\ 0-14}{number\ of\ people\ aged\ 15-64} \times 100$

[10] Aged dependency ratio= $\frac{number\ of\ people\ aged\ 65\ and\ above}{number\ of\ people\ aged\ 15-64} \times 100$

Source: Field data, CEGIS, 2016

Photograph 6.31: Local educational institutions at the Polder area

324. Different NGOs and government also work for expansion of education. BRAC plays an important role for acceleration of education. Even government initiated pre-primary education based on mosque/temple plays an important role in the area.

Source: Field data, CEGIS, 2016

Photograph 6.32: Pre-primary education based on mosque/temple.

325. Most people of the area are satisfied with their education facilities. But people of village Sayera and its surrounding villages are not satisfied with their education facilities due to lack of adequate educational institutions in the nearby locations.

Access to health service

326. Access to health services and facilities refer to availability and adequacy of supply, affordability, physical accessibility and socio-cultural acceptability. Field data shows that there are 4 community clinics, 2 union family welfare centers and more than 32 pharmacies.

327. Most of the people of the area also receive treatment from nearby Sadar Upazila (Bagerhat Sadar Upazila) Health complex and Khulna Medical College Hospital at the time of serious health problems but the economically wellbeing people receive treatment from nearby private clinics like Doctor's Clinic, Dristydan Eye Hospital, Konica Clinic, Mukti Clinic and Poly clinic, Boira Clinic, Rashida Clinic, Shibsa Clinic, Surgical Clinic, Ideal Clinic and Al-Noor Eye Hospital at Khulna.

Photograph 6.33:Health facilities in the Polder area. Source: Field data, CEGIS, 2016

328. Field data shows that almost 93% of the people have access tovarious treatment facilitiesand only 7% have no such access.. Out of the 93% having access to treatment facilities nearly 17% people receive health services from quack doctors and informal treatment systems, 52% from paramedic/diploma physicians and 24% from trained doctor. The remaining7% have no access to treatment facility due to their impoverishment.

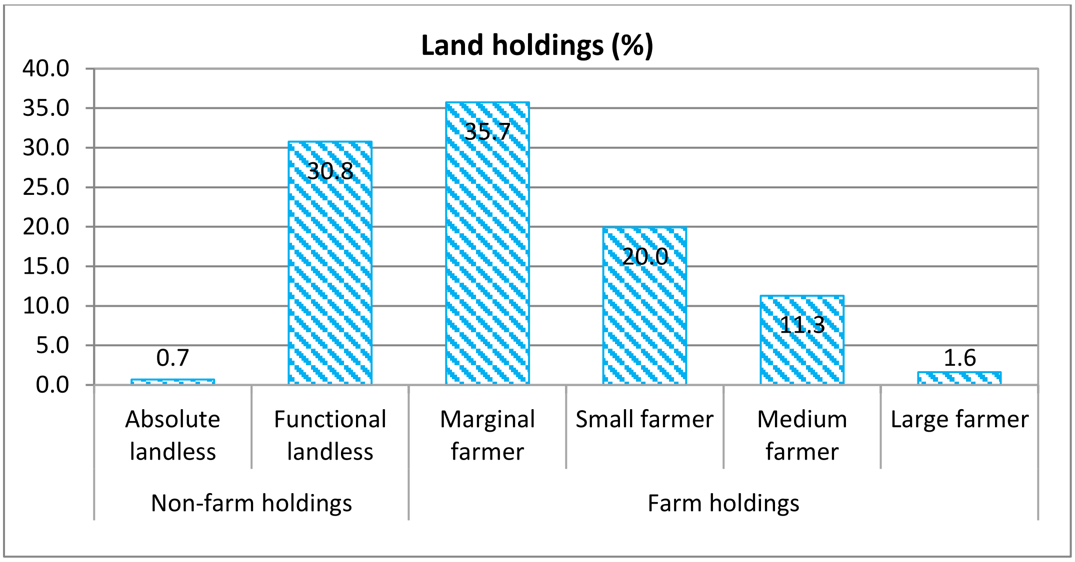
329. The Population Census, 2011 identified almost six types of disabilities and their proportionate distribution in the respective area. It is found that the study area comprises only 1.46% of all types of disabilities, people reported that physically challenged is comparatively most common disability problem in the area.

330. Local people opined that the incidence of diarrhoea is the most prevalent ailment in the area. Dysentery, skin diseases, cough, flu, worms, tumor, hypertension and common fevers are also common in the Polder.

Ownership and utilization of land

331. The Census of Agriculture, 2008 by BBS classified land holdings into two broad categories- one is farm-holdings and another is non-farm holdings. A farm holding is defined as being an agricultural production unit having cultivated land equal to or more than 0.05 acre. Conversely, non-farm holding includes landless households and households having lands up to 0.04 acre. In Polder 34/368.57% are farm and the rest 31.43% are non-farm holdings.

332. 0.7% of the households are absolute landless, i.e., they have no lands either homesteads or cultivated. 30.8% of the households belong to the functional landless category that comprises households who have only homestead lands and 9.3% who have homesteads with 0.01 to 0.04 acre cultivated lands. Here, cultivated lands include mainly kitchen gardening produced predominantly by housewives mainly for household consumption.



Source: The Census of Agriculture, 2008, BBS

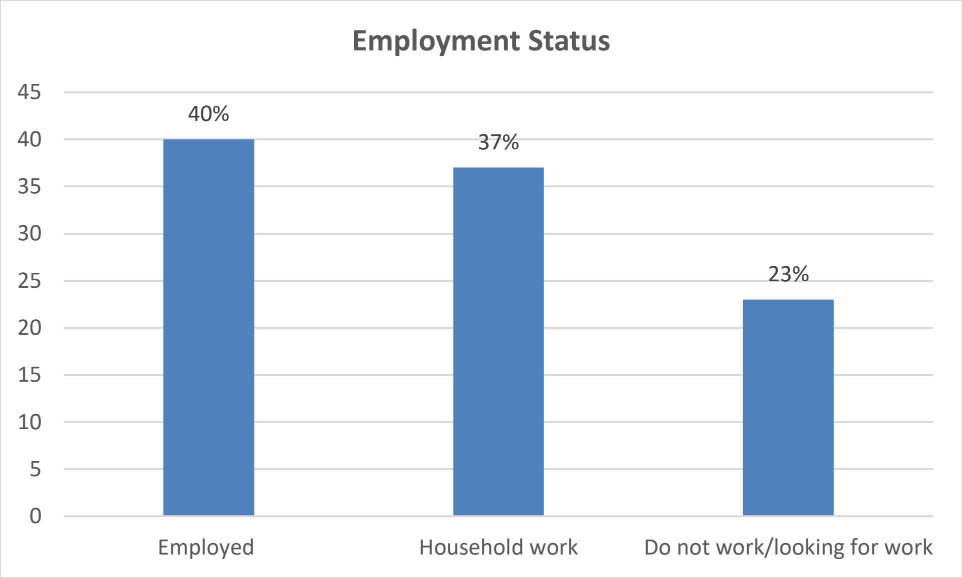
Figure 6.10: Households by land holdings

333. The farm holding distribution further shows that 35.7% households belong to marginal farmer (owning 0.05 to 0.99 acre), 20% belong to small farmer (owning 1.00 to 2.49 acre), 11.3% belong to medium farmer (owning 2.5 to 7.49 acre) and 1.6% belong to large farmer (owning 7.5+ acre) categories. It is evident that land fragmentation decreases the holding size therefore; large and medium farmers are gradually being converted to small and marginal farmers.

334. Generally, the small land owners are unable to prevent land acquisition by the shrimp cultivators/Gher owners in spite of minimum year-round payment which pressurize them to out migration for income generation. Field data showthat large numbers of landless populations, as a result of land acquisition, usually adopt alternative livelihood options, for instances; farm and non-farm laboring, driving, earth work, working for shrimp farm and other manual works.

Occupations and Livelihood

335. Out of the total 26,980 population in the Polder area, about 40% are employed and about 37% are engaged in household work, while about 23% people either do not work or looking for work (Fig. 6.11).

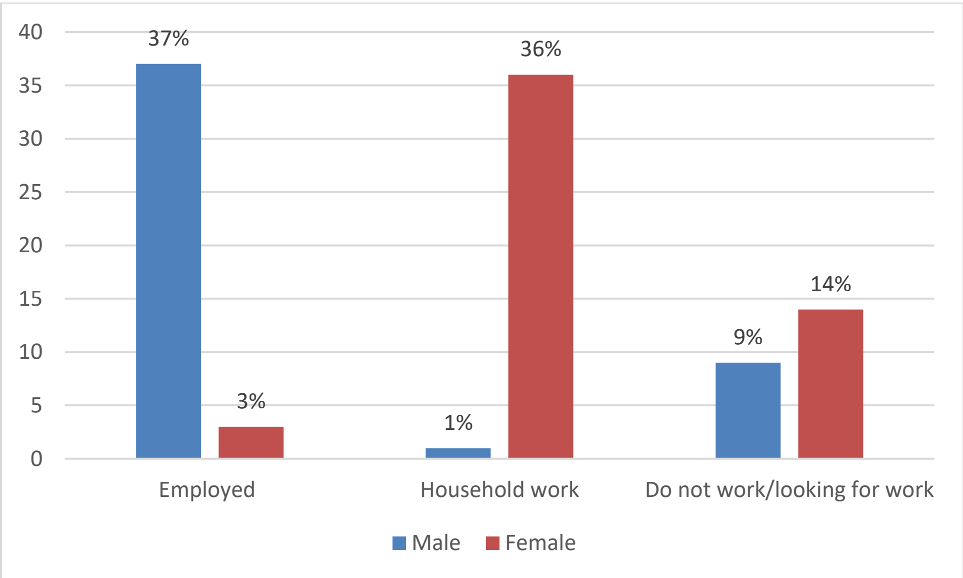


Source: Housing and Population Census, BBS, 2011

Figure 6.11: Employment status of the Polder

336. Although the Polder is situated in the Bagerhat Sadar Paurashava which encompasses a large portion of urban area, a considerable percentage of the population do not work. Comparatively the Polder has more employment opportunities; nonetheless 925 (23%) people still do not work in the study area yet.

337. Women participation in direct income generating activities (employed category) are mainly involved in household activities as shown in figure 6.12. The other women employment activities in the area are agricultural farming, earthworks and brickfield works, etc.



Source: Housing and Population Census, BBS, 2011

Figure 6.12: Sex-wise employment status

Source: Field data, CEGIS, 2016

Photograph 6.34 : Different modes of livelihood activites at Polder 34/3

338. Scope of employment in the agricultural sector is gradually decreasing due to the lack of availability of sweet water and intrusion of saline water in the area for shrimp cultivation. The gher cultural practice in the area is shown in the**Photograph 6.35**

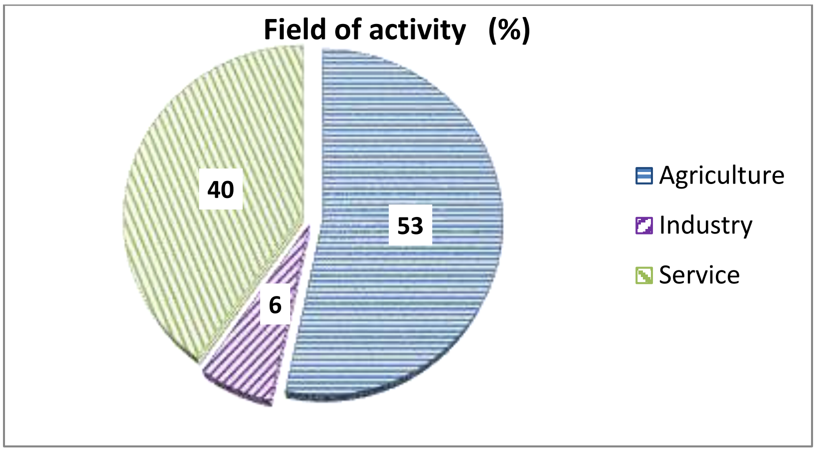
Source: CEGIS fieldwork, 2016

Photograph 6.35: Shrimp cultivation practices in agricultural land (dry season).

339. People stated that before people from nearer regions would come for employment in their area, but as a result of the decreasing agricultural land availability and reduced farming activities as a consequence of the increase in cultivating shrimp,employment opportunities are decreasing.Therefore, there is out migration from the Polder for employment elsewhere, at present.

Labor market

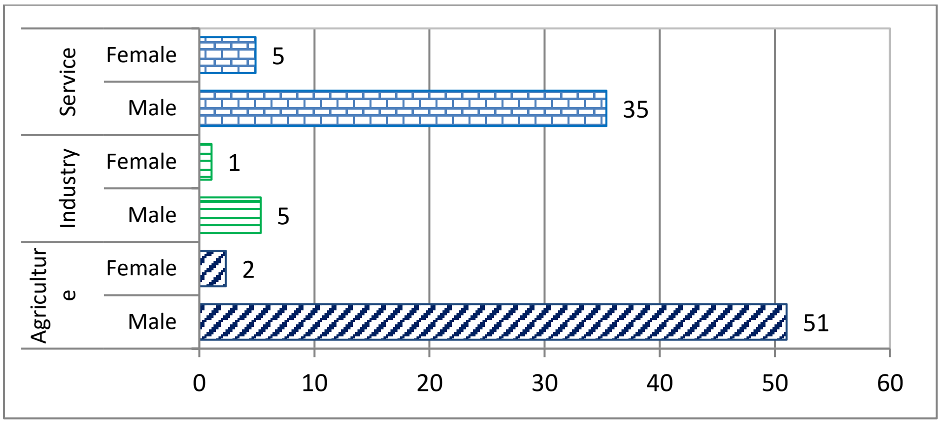
340. Data confirms that agriculture, industry and service are the sole sectors to generate employment in Polder 34/3. Field findings documented that peoples who are not permanently employed tend to engage themselves in those sectors in the forms of agricultural laborers, fishers, brick field workers and earth workers.



Source: Housing and Population Census, BBS, 2011

Figure 6.13: Employment generating sectors

341. Agriculture generates employment for about 53% of people. Most of the agricultural laborers arefrom the local villageswhile some labors are hired from nearby districts during the harvesting time, when the demand for labors are the highest.As the area encompasses a large portion of urban areas, there are also the employment opportunitiesfor industrial workers.



Source: Housing and Population Census, BBS, 2011

Figure 6.14: Distribution of population by field of activity

342. The above figure implies that male participation in agriculture sectors is higher than that of industry and service. But most of the industry and service employed people are out migrated to nearby urban area and the capital city as well. Field findings documented that during the harvesting period, a number of women take part in associating with men in same agricultural field. Some of the women are alsoinvolved in catching fish from river, earthwork etc. The wage rate varies between Tk. 200 to Tk. 250 /day for female whereas men wage rate is Tk. 300 to Tk. 400.

343. During the field visit, people stated that out migration of laborers of the Polder is about 25%, which is comparatively lower than for other Polders of the coastal area. Additionally, fewskilled workers (4%)are also out migratingto the Middle East for the betterment of life and searching for improved livelihood options.It is stated by the local people that during the last 5

years almost 32 households have migrated permanently to Dhaka; with most of them working in the garment sector.

Standard of living

344. Standard of living indicates the level of wealth, comfort, material goods and necessities availability to the studied population which includes people's access to issues like electricity, sanitation facilities, safe drinking water availability, fuel consumption and housing condition.

345. According to the BBS Report, 2011, 56% people of the Polder 34/3 are under electricity connection. But field data shows a better scenario, it states that almost94% of households are now getting electricity facilities with 68% from grid connection and 26% from solar connection, leaving only 6% of the population without electricity facilities. *(Source: CEGIS fieldwork, 2016).*

346. According to the Housing and Population Census, BBS, 2011; the overall housing condition[11]is not satisfactory.The census shows the predominance of kutcha houses (used by 65% households) following semi-pucca houses (16%), pucca (13%) and jhupri houses (6%). However, field findings show an improved housing condition in the study area compared to the 2011 census. Due to an improved and more sustainable economy, a number of jhupri and kutcha houses have been converted to semi pucca and pucca houses over the last five year since the census in 2011.However, thepredominanceof kutcha houses are still higher (42%) compared to -semi-pucca (36%) and pucca (18%) houses (Field survey, 2016).

347. With respect to sanitation[12], the BBS, 2011 states that about 30% households used sanitary (water sealed) latrines and 47% used non water-sealed sanitary latrines and 22% used non-sanitary. Field findings in 2016 shows that people living in semi-pucca, kutcha and jhupri housesused unhygienic sanitary latrines, i.e. nonwater-sealed sanitary latrines, non-sanitary latrines and open defecations (**Photograph 6.36**). However, the households who have pucca houses mostly used water-sealed sanitary latrines.With the improved housing standards since 2011, the sanitary conditions have improved as well (Field survey, 2016).

---

[11]BBS distinguishes housing structures into four classes such as- i) **Jhupri**: House which consist mud walls of 1.5 to 3.0 ft thickness, which carry the roof load. Earthen floor, thatch or CI sheets are used as roofing materials. . There is no monolithic joint between the wall and the roof. ii) **Kutcha**: Walls: Organic materials like jute stick, catkin grass, straw, and bamboo mats. Split are bamboo framing. In some areas wall are made by earth. Foundation: Earthen plinth with bamboo or timber posts. Roof: Thatch-rice or wheat or maize straw, and catkin grass, with split bamboo framing; iii) **Semi-pucca**: Walls: Bamboo mats, CI sheet, Timber or bamboo framing. In some areas wall are made by earth, sometimes part or full brick. Foundation: Earthen plinth; Brick perimeter wall with earth infill; Brick and concrete also use. Roof: CI sheet with timber or bamboo framing; and iv) **Pucca**: House which is made by fully concrete, cement, and iron.

[12]BBS defined four types sanitation in Bangladesh such as (i) Sanitary (water-sealed): A water sealed latrine is simply a pit latrine that has a water barrier to prevent odors. These latrines are simply pits dug in the ground in which human waste is deposited. (ii) Sanitary (not water-sealed/ring slab), latrine with a slab or other secure cover over the drop hole, or a polyethylene flap preventing in-sects from flying into or coming out of the pit; and (iii) Non-sanitary (Kucha): latrine is a frame or platform extending over earth or water; an "open pit latrine" does not have a squat platform or slab on the pit and (iv) No facilities: Defecation in bushes or fields or other outdoor locations.

Photograph 6.36: Sanitation facilities at the area

348. According to the BBS report 2011, almost 74% people collect drinking water from tube-wells, 20% from taps and 6% from other sources. During the field survey, it was found that about 15% of the tube wells are arsenic contaminated. Therefore, many government and non-government purified water installations are now available in the Polder (**Photograph 6.37**).

Photograph 6.37: People collect safe drinking water from different sources

Poverty Situation

349. During the field survey in 2016 a poverty profile was prepared based on RRAs through a self-assessment exercise. The assessmentwas based on the year-round income along with the food consumption of the inhabitants within three different categories (**Figure 6.15).** It is observed that about 5%of the households are in the ‘deficit’ category. Considering the standard consumption of food (three meals in a day), the deficit group was usually taking two meals in a day in the lean period since they could not afford three full meals. Only 16% of the households are in the surplus category and remaining (79%) are in the balance category.

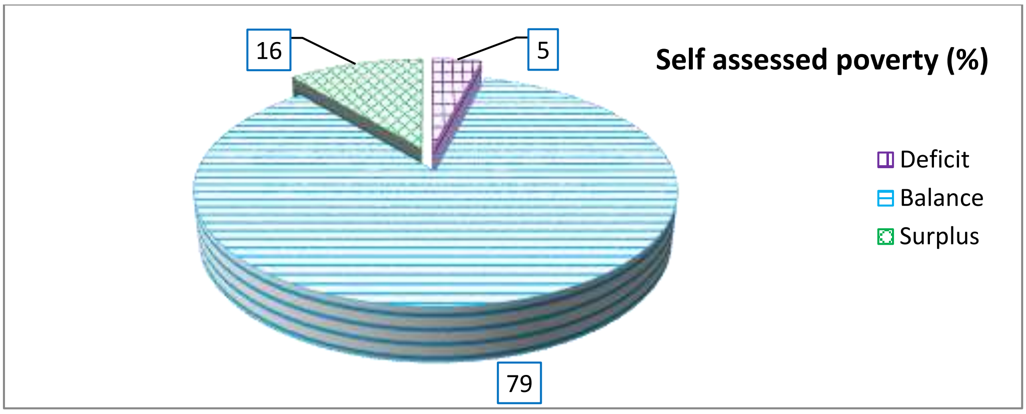


Figure 6.15: Self assessment of poverty status

Social Capital

350. The provision of different types of safety net programs are initiated by the government and NGOs in Polder 34/3. The major social safety nets and poverty reduction programs are initiated by government in the Polder area, and include the Vulnerable Group Development (VGD), Food/Taka for Work (F/TFW), Food for Education/Cash for Education, Rural Maintenance Program (RMP), Old Age Allowance, Freedom Fighter Allowance and the Integrated Poverty Reduction Program. According to local people, these programs have created food security as well as social safety nets among the targeted poor households and vulnerable communities to some extent. But some poor people stated that, in reality, they get only a minimum advantage from the government programs, which is basically given on the basis of political consideration.

351. A number of local, national and international NGOs are working in the Project area. The main activities of these NGOs are operating micro credit programs among the rural poor and landless women/men. The major NGOs working in the area includeHYSAWA, SMKK, Muslim Aid, BRAC (Bangladesh Rural Advancement Centre), ASA (Association for Social Advancement), Grameen Bank, Bureau Bangladesh, Diganto, Polli Unnayan, Uttaran, Rupantor, Sushilon and different local associations.

352. Alongwith micro credit programs, many NGOs also carry out many social development activities without charge. For example BRAC is working for non-formal education, health, human rights, water and sanitation, gender and children development programs; Uttaran gives them free capital for business, cow, goat different types of medicine and vaccine. Along with micro credits, SMKK gives them adequate information about agricultural cultivation, money for domestic animal rearing, training on fish cultivation and free treatment facilities. Table 6.28 provides an overview of the NGO activities in Polder 34/3.

Table 6.28: NGOs and their Programs in the Project Area

Name of the NGOs	Type of Programs							
	Credit	Education	Water and Sanitation	Health	Disaster	Gender	Food security	Others
SMKK	-	✓	✓	✓	-	-	✓	✓
BRAC	✓	✓	✓	✓	-	✓	✓	✓
Uttaran	✓	-	-	✓	-	-	✓	✓
ASA	✓	-	-	-	-	-	-	-
Muslim Aid	-	✓	-	-	-	-	✓	✓
Grameen Bank	-	-	-	-	✓	-	✓	-
Bureau Bangladesh	✓	✓	-	-	-	-	-	✓
Diganto	✓	✓	-	-	-	-	-	-
Polli Unnayan	✓	-	-	-	-	-	-	-
Rupantor	✓	-	-	-	-	-	-	-
Sushilon	✓	-	-	-	-	-	-	✓
RIC	-	-	-	-	-	-	-	✓

Source: Field data, CEGIS, December, 2015

Photograph 6.38: NGOs activities in the area

Roads

353. There are various types of roads which provide means of communication mostly within Polder 34/3. The Polder is bounded by the Putimary River to the south Butiamari River to the west and Khulna-Bagerhat highway to the north. The Khulna-Bagerhat highway provides easy road access to 34/3 from north. within the Polder road communication facilities arecomparatively better than in other Polders.

354. According to the NWRD database, Polder 34/3 has about 54 km of roads of which 33 km roads are paved/brick soled and 21 km roads are earthen.Some portion of the Polder’s communication is well developed and people of the area are satisfied with their communication system in Barakpur, Sundar Ghona, Singrai and Badekarapara villages.However, communication for other villages especially Sayera village and Konta Kata village are poor.

As a result, people of this area are dissatisfied with their communication system which deprives them from advantages of easy communication.**Table6.29**presents data on road networks in the Polder area; **Photograph 6.39**presents some photographs of the roads of the Polders.

Photograph 6.39: Roads of the studyarea

Table 6.29: Different roads of the study area

Name of the Unions	Types of the Roads	Description	Length (KM)	Total
Shat Gambuj		Shaitgambuj UP-Karapara Bazar via patorpara west danga	3.6	33
		Bagerhat - Kashimpur Gc-gilatala Gc-rampal	3.8	
		Barakpur - Polerhat-chulkathi R&h Road.(start At Saera Modhudia School)	1.7	
		Khankasharif-Mashzidbari road.	1.3	
Kara Para		Zindapir mazar-Khanjahan Ali mazar with link of nine gambuj mosque.	2.5	
	Paved/Brick Soling	Ranbejopur-K.Ali, Paglapir-Thandapir mazar road-Sundarghona Kazibari road.	3.4	
Bagerhat Paurashava		Karapara UP office to Karapara bazar via Magnitala bazar via Kathigomti Rd-Sonatala	4.7	
		Bagerhat Circuit House - Kara Para	7	
		Zindapir mazar- Bagerhat bus stand-Sobaki sluice gate road	2.3	
Dema		Badekarapara-Sonatala -Karapara S.C High school via Pt. Mda.	2.7	

Name of the Unions	Types of the Roads	Description	Length (KM)	Total
Baintala	Earthen Road	Badekarapara-Kathigomti road-Fultala-Dewanbati village roadBakultala-sreeghat	8	21
		Singra Mollick bari road.	0.9	
		Gobordia village road.	1.4	
		Patorpara Pry. School-Karapara S.C High school via Pt. Mda.	1.6	
		Dema bridge-Putimari BWDB road.	2.9	
		Shaitgambuj UP-Karapara Bazar via patorpara west danga	6.2	

Sources: LGED Website and Field data, CEGIS, 2016

Market/growth centre

355. There are7markets in the Polder area (Table 6.30). Among these, Barakpur Bazar is significant and different types of commodities are available here. Although the areahas many local markets people have to go to Bagerhat Sadar upazila for important marketing. The village markets only serve their daily marketingand people's first priority is Barakpur Bazar for thispurpose. Still, small markets of the area play important roles for the inhabitants.

Table 6.30: Markets and growth centres in project area

Unions	Number of markets/ bazaar	Name of the Markets/bazaar
Shat Gambuj Kara Para Bagerhat Paurashava Dema Baintal	7	➢ Barakpur Bazar ➢ Darga Gat Bazar ➢ Vhutiyamari Bazar ➢ Kara Para Bazar ➢ Jugida Pukur Bazar ➢ East Sayera Bazar ➢ Dosani Bazar

Source: Field data, CEGIS, 2016

Photograph 6.40: Markets in the study area

Gender and Women

356. Field observation suggests that Polder 34/3 is a highly male dominated area. Roles of women in both decision making at household level and economic contribution to household income are inconsequential. Traditional beliefsare very strong here.Generally males make all major household decisions and at the same time they contribute to household income more than females. A very few women participate in agricultural activities in the field while others work as day labors.PhotographWage discrimination is very common where male labor get Tk. 300 to Tk. 350 and women labor get Tk. 200 to Tk. 250 per day.

357. Over time the government's strong policy towards women education hasled to an increase in women's education rate and dropping school due to early marriage has been reduced. NGOs have changed the rural society to a significant extent in terms of awareness rising. Different NGOs along with community health clinics work for women's health reducing women's maternal mortality rate. People stated that some union health workers play important roles for women health improvement.

358. Women mobility in the area is mostly localized except when going for medical treatment, fetching water, farming activities, and visiting relatives. The growing consciousness among the local people as well as the health services provided by the public and other health centers including the programs of NGOs have contributed to the decrease of the overall women's mortality rate.

Social Structure

359. Social stratification is also present where different types of capital, e.g. social capital, cultural capital, physical capital, financial capital, etc.,determine people's positions. Gher owners belong to the highest strata and landless to the lowest. Although the power structure was centered around the land ownership in earlier time, this has now changedThe Gher owners are now dominatingthe rural power structure. Even land owners subdued to the Gher owner because they (the gher owners) are linked with external power sources and are politically powerful. Here, marginal land owners are in worse condition.

Social conflict

360. Gher owner are few in numbers but dominate water management in Polder 34/3. Every year, gher owners let saline water inside the Polder for shrimp cultivation, however affecting agricultural land and capture fisheries.As a result, the few number of gher owners benefit from it but agricultural production and sustenance fishing that should benefit a major part of the population is hampered by the saline water.While having a dominating control over management of existing embankments, sluices and flushing gates, gher owners also set up their own gates by which they enter saline water to the agricultural lands. Further, they even closesluice-gates for keeping water inside the Polder. As a result, every year, the people in Polder 34/3facedrainage congestion. Consequently,a high number of people lose their agricultural production.Even the betel-leaf cultivation is threateneddue to drainage congestion. As a result, there exists a conflict between gher owners, fishermen and agricultural land owners.

Rituals and festivities

361. Anniversaries, Fairs and Festivals form a vital part in the social life of ordinary people of the Polder 34/3. The biggest religious festivals are Durga Puja for the Hindus,Eid-ul-Fitr and Eid-ul- Azha for the Muslim community and Christmas for the Christians. There is no religious discrimination in the Polder area. Different types of religious groups are performing their religious festivals with cheerfulness. Even other religious communities participate in the festivals with eagerness. Like Muslims participate in different types of Pujas whereas Hindus and Christians also participate in Eids and many Muslims festivals. All religious communities also participate in the ethnic community's festivals.

362. Among the non-religious festivals, Bengali New Year (Pahela Baishakh, on 14 April), Language Martyrs' Day (on 21 February, now also called International Mother Language Day), Independence and National Day (26 March), and Victory Day (16 December) are celebrated nation-wide. Mostly these festivals are performed by the students of schools and colleges of the area.

Cultural heritage and tourism

363. The Mosque City of Bagerhat was founded in the 15th century by the Turkish warrior saint General Ulugh Khan Jahan. The historic city, listed by Forbes as one of the 15 lost cities of the world, has more than 50 Islamic monuments which have been found after removing the vegetation that had obscured them from view for many centuries.

364. Most of the establishments of his old township have disappeared with the passage of time. Only a few survive, most of which are religious buildings like mosques and mausoleums. The traceable evidences of Bagerhat the surviving monuments and structural ruins buried in the earth. The first group comprises the Shat Gombuj Masjid (Sixty Dome Mosque), Singara Mosque, Bibi Begni's Mosque, the Chunakhola Mosque, Noy Gombuj Masjid (Nine dome Mosque), Ronvijoypur Mosque, Rezakodha Masjid (Six-Domed Mosque), Zindapir Masjid, Sabekdanga Monument and Khan Jahan's Tomb. In the latter group there are many structural ruins scattered in and around Bagerhat town. A few of them are in the form of low mounds while some others are almost levelled down to the surrounding land surface. Some of them are Khan Jahaner Vasatbati, Bara Azina Masjid, Jahajghata, Kotwali Chawtara.

365. The Shat Gombuj Masjid has been recognized as a UNESCO World Heritage Site in 1983 under criteria (iv), "as an outstanding example of an architectural ensemble which illustrates a significant stage in human history", of which the Sixty Pillar Mosque (Shat Gombuj Masjid inBangla), constructed with 60 pillars and 77 domes, is the most well-known. Apart from these monuments, UNESCO also includes the mausoleum of Khan Jahan, the mosques of Singar, Bibi Begni, Reza Khoda, and Zindapir among the unique monuments.

366. The mausoleum of Khan Jahan Ali, the mosques of Singair, Bibi Begni, Nine domesmosque and the mausoleum of Zindapir are situated within the Polder area. But Shat Gombuj Masjid, Bibi Begni's Mosque, The Chunakhola Mosque, Kare Dighi and Bagerhat Museum are outside the Polder area.

367. Every day, thousands of people and tourist come to visit the sites. The inhabitants of the area get different types of advantages from these cultural sites. These sites become a source of employment. A large part of the populationalready make their existencefrom the tourism industry. But if all the sites were taken under adequate care thiswould increase the source of earnings.

Shat Gombuj Masjid

The mausoleum of Khan Jahan Ali

The mausoleum of Zindapir

The mosque of Singair

Photograph 6.41: Cultural Heritages in the Polder

Common Property Resources

368. The common property resources and community facilities in the area are different social amenities, e.g. mosques, graveyards, temples, cremation grounds, playgrounds, open water bodies and Eidgahs (place for offering Eid prayers). These are used by the local people for the purposes of religious, social and cultural gathering.

369. Besides these, the BWDB embankment is also used very commonly for different livelihood purposes, i.e. living or takingshelter by the local inhabitants. Even some poor people are living besides the fallow land of embankment where they not only live but also collect wood and fruits from embankment's trees.

370. There are 2 club houses in the Polder area where people come for recreation. Besides, there are 7 local Bazars, 12 playgrounds, a cultural center, 3 Eidgahs and more than 30 mosques. Many families have their own temple and graveyard. Nonetheless there are 3 public graveyards and 3 public temples.

Photograph 6.42: Common Property Resources in the Area

7. Analysis of Project Alternatives

7.1 Overview

This Chapter presents an analysis of various alternatives considered during the Project feasibility and design stage including the 'no project' alternative. To the extent possible, environmental and social considerations of these alternatives have been considered.

7.2 'No Project' Alternative

371. The 'No-Project' option analysis provides a clear view of the existing situation of the Polder and helps understand the need of the proposed interventions under CEIP-I. At present the people in Polder is extremely vulnerable to cyclones, storm surges, wave action, and climate change effects, as described in Chapter 4. Furthermore, the Polder is not in a state to provide required services, i.e. protection against tidal inundation, efficient drainage, and minimizing the impact of cyclonic surges. About 40 percent of the Polder area is vulnerable to salinity intrusion and water logging. The silted water channels are resulting into limited navigation in these waterways, declining fisheries, and increasing environmental pollution.

372. The interventions proposed in Polder 34/3 under CEIP-1 are planned to eliminate the major problems described above. To highlight the present state of various aspects in the Polder and to help understand the importance of the proposed interventions under the Project, the 'No Project' and 'with project' scenarios are compared in Table 7.1 below.

373. Section 7.6 provides a detailed assessment of the high positive impacts of the Project that is considered to improve the security and socio-economic conditions for all strata in Polder 34/3

Table 7.1: Comparison of 'No Project' and 'With Project' Scenarios

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
Construction of new embankments (34.00 km)	No protection in almost all parts of the Polder. As a result, cyclones, rise in surge heights due to global warming, and tidal actions will inundate the Polder, causing severe damage to the lives and properties of local people.	New embankments will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, will reduce the loss of lives and assets caused from natural disasters.
	During monsoon, the transportation system would be heavily impacted inside the Polder, and sufferings of local people would further increase.	New embankments will provide enhanced protection to Polder, facilitating transportation within the Polder even during monsoon.
Re-sectioning of embankments (16.75 km)	The embankments will further deteriorate at a number of locations, and will drop below design level. Therefore, cyclones, rise in surge heights due to global warming, and tidal actions will inundate the Polder, causing severe damage to the lives and property of local people.	Re-sectioned embankments would be more effective and resilient, and will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, will reduce the loss of lives and assets from natural disasters.

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
	Because of submergence of the embankments during monsoon, transportation system would be further deteriorated inside the Polder, and sufferings of local people would further increase.	Re-sectioned embankments will provide enhanced protection to Polder, facilitating transportation within the Polder even during monsoon.
	Reduction of agricultural area, crisis situation to farmers from January to April (salinity intrusion) and May to August (flooding).	Re-sectioned embankments will provide enhanced protection to the Polder, facilitating enhanced agriculture activities and increased area for cultivation, thus increasing agriculture output.
	Continued silt deposition inside the Polder due to cyclonic surges and floods would be increased causing water logging, drainage congestion and other associated problems.	Decrease in silt deposition in the Polder will result in improved drainage and navigation in internal lakes/khals, increase usage of surface water for irrigation, and reduce water logging problem.
	Local farmers and labor will remain financially stressed. Livelihood opportunities will remain limited, and local people will migrate outside the Polder for employment.	Enhance agricultural activity will increase the demand of farm workers. Local people can engage themselves in the construction works inside the Polder. Improve earnings of local people during the construction phase of the project.
Slope protection (5.5 km)	Continue the weakening of embankments; continuous subsidence of embankments due to traffic load and wave action; land resources would continue to be damaged/ lost.	Slope protection works will strengthen the embankments and protect them against subsidence, wave action, and wear and tear.
Replacing of 3 drainage sluices	Cultivable lands and irrigable lands will further decrease in future.	New drainage sluices will alleviate drainage congestion and facilitate the availability of surface water, better control on irrigation during periods of low rainfall and will increased agricultural production.
Repairing of 5 drainage sluices	Cultivable lands and irrigable lands will further decrease in future.	Repaired drainage sluices will alleviate drainage congestion and facilitate the availability of surface water, better control on irrigation during periods of low rainfall and will increased agricultural production.
Replacing of 1flushing sluice	Cultivable lands and irrigable lands will further decrease in future.	New flushing sluices will alleviate drainage congestion and facilitate the availability of surface water, better control on irrigation during periods of low rainfall and will increased agricultural production.
Afforestation of the foreshore areas, 12.48 ha.	Wind and wave action during cyclones would cause severe damage.	Effects of cyclone surge, wave action and wind could be mitigated to some extent, reducing loss of lives and assets.

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
Re excavation of Drainage Channels (57.23 km)	Depth of water bodies would further decrease, and drainage congestion and water logging will further increase.	Depth of water bodies will increase, water logging and drainage congestion will decrease and fish habitats will increase.

7.3 'With project'Alternatives:

374. 'With Project' Alternative explicates the interventions proposed under CEIP-1 to alter the Polder 34/3 condition addressedthe problems summarized in 'No Project Alternative'.

Site selection alternative:

375. Since CEIP-I is a rehabilitation project, no site alternatives were available to be considered. However, a comprehensive multi-criteria analysis was carried out to prioritize the Polder rehabilitation under CEIP-1. The analysis results are presented in Table 7.2.

Table 7.2: Results of Multi-criteria Analysis to Prioritize Polder Rehabilitation

Criteria		Mark Obtained
Polder No	34/3	
Type of Dyke	ID	
Location of the Polder	Bagerhat	
Gross Area of the Polder (Hectare)	3656	
Embankment Length (Km)	17	
Breach of Embankment (Km)	17	6
Erosion (Km)	-	0
Requirement of BPW (Km)	-	0
Location in the Risk Zone	LRZ	5
Drainage Congestion (HA)	0	0
Opinion of Stakeholder (marks, MV=15, MDV=10, LV=5)	MDV	10
Rehabilitation Cost (Crore BDT)	55	15
Special Criterion		0
Total Marks		36

Notes:

a) Rate of marks = Full marks allotted for the criterion against highest quantity of the criterion except "Rehabilitation Cost".
b) Negative marks has been allotted in case of "Rehabilitation Cost" exceeding $30 Million (210 Crore BDT).
c) HRZ = High Risk Zone, MRZ = Medium Risk Zone, LRZ = Low Risk Zone.
d) MV = Most Vulnerable, MDV = Medium Vulnerable, LV = Less Vulnerable.
e) SD = Sea Dyke; ID = Interior Dyke; MD = Marginal Dyke.
f) BPW = Bank Protective Work.
g) Rehabilitation Cost to consider embankment section with one meter extra height over the existing designed level.
h) Special Criterion indicates territory loss due to erosion of Polders located in border area.

376. Technical, Financial, Economic, Environmental, and Social Considerations of Selected Options

377. Following Table 7.3 reviews the technical, financial, economic, environmental, and social considerations as probable consequences of the intervention.

Table 7.3: Technical, Economic, Environmental and Social Considerations

Intervention	Considerations			
	Technical	**Financial/Economic**	**Environmental**	**Social**
Re-sectioning, embankment with new design heights	Better protection against cyclone surges and water level rise	Financial savings from reduced damages caused by the floods	Improved surface water quality; improved natural vegetation	Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people.
	Prevention of salinity intrusion in the Polder	Improved cropping pattern and boosting the local economy	Improved surface water quality	Improved cropping particularly for small farmers thus alleviating poverty.
Bank revetment, slope protection	Enhanced embankment protection against tidal wave action of rivers, provide erosion protection Protection to river bank erosion	Financial savings from reduced damages caused by the floods; increased life span for the infrastructure and associated water control structures; improved earnings of local people through employment during bank revetment works and slope protection works. Financial savings as the embankments will provide good road transportation routes.	Improved embankment stability; reduced soil erosion; and provide good means of transportation Reduced traffic congestion inside the Polder because of improved embankments, which will facilitate vehicular traffic	Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people.
Replacement of existing drainage sluice with drainage-cum-flushing sluice and construction of new flushing sluices where needed	Better functional performance in both flushing and drainage; achieving the objectives of Polder and CEIP-I	Financial savings against damages due to water logging, drainage congestion, and salinity intrusion.	Removal of inactive sluices would improve the drainage characteristics	Better agriculture practice could be achieved which would improve cropping pattern, enhance local earnings, and reduce poverty.
		Agricultural production will be boosted as dry season rice cropping would increase	Water logging, drainage congestion would be reduced.	
Channel re-excavation	Reduce water logging and drainage congestion	Enhanced agriculture output; the dredged soil can later be used in construction works and will save construction cost	Increase navigability of water ways and fish habitats would improve, the ecosystem will be enhanced	Increase in cultivable area, increased availability of irrigation water thus increased farm income for local community; increased farm labor opportunities.

Alternatives during Construction

378. The key alternatives available during the construction phase include location of material stockpiling, material sourcing, manpower sourcing, and transportation of materials, equipment, and manpower. These are discussed below.

Material Storage

379. For project works in Polder34/3, two options are available for material storage: within the Polder at suitable location(s); and outside the Polder at suitable locations. The first option would entail easy transportation of bulk materials from the sources outside the Polder; however, it would involve regular transportation of materials from the storage site to the work sites.

380. The required materials would be collected and transported from their respective sources to the Polder area and then would be stored in the stock yard to be used during construction phase.

Material Sources

381. The study on sources of construction materials are selected at this point of study. The outcomes of analyses are given sequentially below:

Soil for Embankments

382. For re-sectioning of embankments, about 1,949 million cubic meters of soil will be required. The following options are available for sourcing this material:

- Soil can be obtained from borrow pits along the river bank just outside the embankments, provided the soil quality is appropriate for this purpose. This is a feasible options with some benefits since it will minimize soil transportation needs, minimize related to material transportation and having minimum environmental and social impacts related to excavation and transportation. However, as BWDB does not own any land sites for borrow pits, these have to be obtained from the owners and compensation provided.
- Part of the required material can be obtained from the re-excavation of the water channels within the Polder, provided the quality of this material is technically acceptable. About 0.295 million cubic meters of earth will be obtained from re-excavation of channels during implementation of rehabilitation works inside the Polder. This option minimize the cost of excavation for the borrow material, though the cost of transportation to work site will be slightly more than the first option, in addition to some environmental and social impacts such as traffic congestion and air pollution within the Polder.
- Some quantity of soil can be sourced from borrow pits inside the Polder. For this purpose consent of the land owners will have to be obtained and mutually agreed compensation will have to be paid them. This option will entail cost of excavation similar to the first option but more than the second option discussed above. Other considerations including cost of transportation and environmental and social impacts are likely to be similar the ones for the second option, though land degradation may take place in addition to the air quality and traffic congestion.

- If the river bed material is suitable having the required material quality, dredged material can be used for embankment construction. From an environmental point of view this is the preferred option, as there will be no terrestrial impact, while the aquatic impact will be very temporary and localised to the river bed. Any dredged material will rapidly be replaced due to the high sediment transport capacity in the rivers in the Polder region. Transport of the dredged material can take place directly at the embankment construction site, requiring minimal land transport. However, sites for de-watering the dredged material will be required. The use of dredged material is considered the preferred option from an environmental point of view.

383. As per the Project design, the final decision regarding the material source will depend on the material quality, either dredged from rivers, from re-excavations of khals or from borrow pits, as well as the availability of the latter two. The Contractor will carry out tests of the material quality from various sources, provide a plan for obtaining the required amounts of suitable quality and obtain approval from the DDCS&PMS Consultant before starting obtaining the material.

Sand

384. Sand would be needed for embankment improvement works, concrete works, and for manufacturing concrete blocks for slope protection. Two broad options are available to source this material:

- Sand will be procured from markets. This would entail consistent quality and assured supply; however it would also entail increased transportation with associated environmental and social impacts including traffic congestion, noise and air pollution.
- The second option is to obtain sand from the river beds. This would reduce the transportation needs along with the associated costs and environmental as well as social impacts. However, the quality of the sand readily available may not be as required.

385. As per the Project design, the final decision regarding the sand source will depend on the material quality, either acquired on the market or dredged from rivers. The Contractor will carry out tests of the material quality from various sources, provide a plan for obtaining the required amounts of suitable quality and obtain approval from the DDCS&PMS Consultant before starting work with sand. The DDCS&PMS engineers will decide on the source of the soil/sand.. Alternatives for Workforce Procurement

386. Two broad options are available for sourcing the manpower for the construction works. These are discussed below:

- Employing the bulk of the manpower from outside the Polder. This will entail requirement of larger labor camps, need for labor transportation causing traffic congestion and air pollution, and possible resistance and resentment from the local community.
- Employing manpower from within or in the vicinity of the Polder and only bringing more skilled and technical manpower from outside. This option will entail reduced labor camp sizes, decreased transportation needs and reduced environmental and social problems related to outside workers. This option will also offer employment opportunities for the local community thus increasing their economic condition and

also increasing the local ownership and acceptance of the project. In view of these advantages, this is the preferred option for manpower sourcing.

Alternatives for Mode of Transportation

387. Khulna Bagherhat main road is aligned beside the Polder 34/3. Trucks are mostly used along with pick–up vans to transfer construction materials to main stock yard. Roadsare mainly used for conveying materials. The condition of the roads is good enough for transporting larger vehicles, i.e. dump truck, trolley, excavator, etc.

388. River way is not preferable for transporting construction materials. Rampal River partially flows at the periphery of the Polder 34/3 but is very narrow. The depth is on average 3-5 meter range. To transport of construction materials and equipment waterway is not suitable.

8. Environmental Impact and Mitigation Measures

8.1 Preamble

389. This Chapter identifies the impacts of the project interventions on environment that may potentially be caused during different phases of project implementation along with appropriate mitigation measures to avoid, offset, reduce, or compensate these impacts. Proposed Interventions which may cause potential environmental impacts during pre-construction, construction, and post-construction phases have been identified in **Chapter 5**. The following detailed investigations have been carried out to assess the magnitude of these impacts:

- Environmental quality baseline monitoring of air, noise, surface water, groundwater and soil;
- Ecological surveys comprising vegetation, wildlife and fisheries covering both mainland and offshore area; includes also monitoring of river bed and khal bed benthos;
- Offshore surveys comprising socio-economic status and environmental settings,
- Experts' consultations focus group discussions, and public consultations.
- Census survey to assess the extent of resettlement (as required) loss of vegetation, occupation, income and poverty status of the affected households.

8.2 Impact Screening

390. As a part of the environmental impact assessment process, a screening matrix was used specifically for the proposed Project, focusing on the potential environmental impacts during the design, construction and operation phases. Key potential impact sites are shown in Map 5.1. The matrix examined the interaction of project activities with various important components of the environment. The impacts were broadly classified as physical, biological and social impacts, and each of them were further divided into different aspects. The potential impacts thus predicted are characterized as follows:

- Highly negative (adverse) impact;
- Moderately negative impact;
- Insignificant impact;
- Highly positive (beneficial) impact;
- Moderately positive impact.

391. The matrix of Polder 34/3 is provided in Table 8.1.The negative impacts predicted in this manner are the 'unmitigated' impacts. Appropriate mitigation measures are recommended as part of this EIA study, for reducing the occurrence possibility and severity of the potentially adverse impacts. The potentially negative impacts identified through this process are discussed in the subsequent sections. The assessment of the impacts follows the methodology and approach described in Chapter 2.

Table 8.1: Environmental Screening Matrix

	Physical								**Biological**						**Social and Socioeconomic**												
Project Phases and Activities	**Air and Noise Quality**	**Salinity**	**Surface Water Quality**	**Drainage congestion**	**Irrigation**	**Vehicular Traffic**	**Sedimentation**	**Land use**	**River/foreshore side vegetation**	**Herbs and Shrubs**	**Fish habitat**	**Fish movement & migration**	**Aquatic Flora & Fauna**	**Timber Fruit tree**	**Land and Infrastructure**	**Noise and Vibration**	**Impacts on crop production**	**Impacts on fish production**	**Flooding**	**Communication**	**Disaster Incidence**	**Social water use**	**Public Health**	**Seasonal Out-migration**	**Gender promotion**	**Employment Opportunities**	**Livelihood development**
Design Phase and Pre-Construction Phase																											
Land Acquisition/Resettlement????																											
Contractor Mobilization	MN	0	0	0	0	MN	0	MN	0	0	0	0	0	0	0	MN	0	0	0	HN	MN	MN	0	0	0	MP	MP
Construction Camp Establishment	0	0	0	0	0	MN	0	MN	MN	0	0	0	0	0	MN	0MN	MN	0	0	MN	MN	MN	MN	0	MN	MP	MP
Construction Phase																											
Equipment / Material Transportation	MN	0	0	0	0	MN	0	MN	0	0	0	0	0	0	0	MN	MN	MN	0	HN	MN	MN	HN	0	MN	MP	MP
Operation of Construction Camp	0	0	0	0	0	0	MN	MN	0	0	0	0	0	0	0	0	0	0	0	MN	MN	MN	0	0	MN	MP	MP
Site Clearance	0	0	0	0	0	0	0	MN	MN	0	0	0	0	MN	0	MN	MN	MN	0	MN	MN	MN	MN	0	MN	HP	MP
Borrow and disposal area management	0	0	0	0	0	0	0	MN	MN	0	0	0	0	0	0	MN	HN	MN	0	MN	MN	MN	HN	0	MN	HP	MP
Excavations of water channels	0	0	HN	0	MN	0	0	MN	HN	0	MN	MN	HN	0	0	MN	0	HN	MN	0	MN	0	0	0	MN	HP	HP
Re-sectioning of Embankments	MN	0	0	0	0	HN	0	MN	0	MN	0	0	0	HN	0	MN	MN	0	MN	HN	MN	MN	MN	0	MN	HP	HP
Replacement/repairing of Regulators	0	0	MN	0	0	MN	0	0	MN	0	0	0	MN	0	0	MN	0	MN	HN	MN	MN	MN	MN	0	MN	HP	
Operation Phase																											**HP**
Operation of Regulators	0	MN	HP	HP	HP	0	HP	MP	MP	0	0	0	MP	0	0	0	0	HP	HP	HP	0	0	MP	HP	0	HP	HP
Repair and Maintenance	0	MN	MN	HP	HP	0	0	0	MN	0	0	0	MP	0	0	MN	MN	MN	MN	HP	MN	0	MP	HP	0	MP	MP

Key:-HN: High negative impact; MN: moderate negative impact; 0: insignificant/negligible impact; HP: high positive impact; MP: moderate positive impact.

8.3 Impacts during Pre-construction phase

392. Site development involves the following activities:

- Planning and design of the proposed infrastructures
- Land acquisition and resettlement
- Preparation of construction site, labor shed, material stock yard, etc.
- Labor, materials and equipment mobilization

Land acquisition and Resettlement

393. A total estimated 9.66 ha of land will be required for the implementation of the project in Polder 34/3[13] resulting in displacement of 230 households. The details of the land is:4.05ha occupied by households, 10.93 ha used as crop land, ponds 0.40 ha, highland 0.41 ha and1.22 ha orchard.

Deterioration of Environmental Quality (Air and Noise)

Impact

394. Establishment and construction of site facilities in the Polder may potentially cause noise generation. Additional traffic on roads is expected to intense the noise level of the locality. Therefore, settlements, educational institutions, bazar areas and surroundings of the construction site will be affected by the increased noise level.

395. Besides, exhaust emission from heavy vehicles containing particulate matter and other ingredients would deteriorate the ambient air quality around the construction site and nearby areas. Fugitive dust emissions from the material stockyards would also deteriorate the ambient air quality of the locality. Moreover, the air and noise pollution are temporal and are reversible and will naturally return back to their baseline condition.

396. The significance of this potential unmitigated impact has been assessed as Medium on the basis of impact magnitude and receptor sensitivity.

Mitigation

397. The following mitigation measures should be taken to address the above concerns:

- Construction material (sand) should be covered while transporting and stock piled.
- The contractors need to be cautious to avoid unnecessary honking of material carrying vehicles, particularly near sensitive areas like schools/Madrashas and the local community, if any
- The contractors should be encouraged to move all construction equipment, machineries and materials during day time instead of night, avoiding the rush hours.
- Stockyard should be covered during non-working period.

[13] Land survey carried out by KMC.

- Exhaust emissions from vehicles and equipment should comply with DoE standards.
- Vehicles, generators, and equipment should be properly tuned.
- Water should be sprinkled where needed to suppress dust emissions.
- Speed limits should be enforced for vehicles on earthen tracks.
- Vehicles and machinery should have proper mufflers and silencers.

Residual Impacts

398. The impacts associated with establishing the site facilities are likely to be adequately addressed with the help of above mitigation measures. The significance of residual impacts will be Low.

Change of land use

Impact

399. Land would be needed to establish temporary facilities including construction camp (labor shed) and borrow areas. It is estimated that about four labor sheds would be constructed to established temporary facilities for the rehabilitation works. As per consultation with the main consultant all four labor sheds should be constructed in Khas land and acquiredland.

400. For the re-excavation of canals materials and equipment mobilization requires land at the side of the canals, which is commonly used for crop production.

401. Borrow pits for extraction of construction material are expected to be both from inside the Polder and in the foreshore land[14]. Borrow pits will generally be established on private land after agreement between the contractor and the private land owner, typically involving some compensation from the contractor to the land owner.The use of the borrow pit areas inside the Polder will typically be converted from agriculture to pond based aquaculture. In the foreshore areas,commonly fallow land will be used. Excavation will take place during the dry season. In wet season, these borrow pits areas are likely to be filled up gradually due to sedimentation.The fallow land is scatteredly used for seedbed or grazing of livestock by the dwellers of the Polder.

402. The significance of this potential unmitigated impact has been assessedas Moderateon the basis of impact magnitude and receptor sensitivity.

Mitigation

403. The following mitigation measures should be taken to address the above concerns:

- Establish all the construction camps within the area owned by BWDB.
- Pay compensation/rent if private property is acquired on temporary basis, which instructions should be specified in the tender document.
- Labor shed/camp should be constructedongovernment khas land.
- Avoid impacts on local stakeholders.

[14] Lessons learnt from implementation of CEIP Package-I. PDSC observations.

- Any areas used for borrow pits in the foreshore should be away from sensitive areas such as mangrove vegetation, known fish spawning ground, habitat for any endangered flora /fauna species.

Residual Impacts

404. The impacts associated with changes in land use are likely to be adequately addressed with the help of above mitigation and significance of residual impact will be **Low.**

Impacts on undergrowth herbs and shrubs

Impact

405. The embankment slopes are vegetated with a number of trees and undergrowth local herbs shrubs, grass (Poaceae and Cyperaceae are the dominant family). Existing undergrowth local herbs shrubs, grasses like Durba grass (Cynodon dactylon), would be damaged due to preparation of construction sites, labor shed and material stock yards Providing a detailed estimate by counting the numbers of small plants/bushy existing at the proposed sites is not feasible.

Mitigation:

406. The following mitigation measures should be taken to address the above concerns:

- Use barren land or possible low vegetated land for placing of materials stock yards
- Fuel wood should be collected from local market.
- The work should be completed within contracted scheduled time (4 month)
- Labor should be made aware about the importance of local floral and faunal species.

Residual Impacts

407. The impacts associated with establishing the site facilities are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

Increased Vehicular Traffic during mobilization

Impact

408. During contractor mobilization, equipment, machinery, material, and manpower will have to be transported to the Polder by road, resulting in additional traffic on roads. In comparison to many other Polders, no navigable waterways existsaround Polder 34/3, providing an alternative means of transport to road transport. This traffic may potentially cause traffic congestion particularly at roads. The embankment is the main road for communication for a large portion of the local people. However, during haat and marketing time, all the stakeholders use this embankment as road for carrying their goods for buying and selling and other purposes. Mobilization of Contractor, equipment, machinery, construction materials and manpower will be transported to the Polder resulting in additional traffic on roads,which may

potentially cause traffic congestion. Earth work for re-sectioning of embankment and vehicles movement also may create short term disturbances to the Polder inhabitants.

Mitigation

409. The following mitigation measures should be taken to address the above concerns:

- The contractor should prepare a traffic management plan (TMP) and obtain approval from the Detailed Design, Construction Supervision & Project Management Support Consultants (DSCs).
- Contractor also implement mobilization plan considering water vessels and launch movement in the external rivers and, avoid the launch movement time.
- The TMP should be shared with the communities and should be finalized after obtaining their consent.
- Ensure minimal hindrance to local communities and commuters.
- The works on embankment should be carefully scheduled to minimize impact on local markets and transportation routes.
- The embankment works should be carried out in segments and soil should be placed linearly on half of the embankment, leaving the other half to be used as track.
- The works of the first half when completed, and then of the other half should be undertaken.
- Work schedule should be finalized in coordination and consultation with local representatives and communities, specifically union parishad members of the Polder.
- Local routes should not be blocked as much as possible. If unavoidable, alternative routes should be identified in consultation with local community.
- Vehicular traffic should be moved in the Polder area and also on embankment during off peak time. School time (10:00 am to 14:00 pm) and day of marketing time (Hat-bar) should be considered during vehicular traffic movement.
- Keep provision of training on vehicular traffic moving pattern and management system for the local stakeholders using multimedia presentation and showing video at different common population gathering places in the Polder area.

Residual Impacts

410. Thetemporary impacts on Hindrance for Pedestrian and Vehicle Movement are likely to be addressed with the help of above mitigation measures and the significance of residual impact is consideredto be **Moderate**.[15]

8.4 Impacts during construction phase

411. Implementation of the interventions involves the following activities:

[15]Because there is no means for river transport in Polder 34/3, only road transport is possible, creating more impacts than in other polders, where impacts are low. Source: Lessons learned from CEIP Package-I implementation. Observations by PDSC.

- Re-sectioning of embankment
- Placement and compaction of earth
- Construction of drainage sluices
- Construction/repair of flushing inlets
- Re-excavation of drainage khals
- Disposal of canal excavated wastes
- Implementation of afforestation at selected/affected sites

Generate Noise and Vibration

Impact

412. The construction activities particularly demolition of existing water control structures, excavation, compaction, operation of construction machinery and vehicular traffic will generate noise and vibration which are likely to affect the nearby communities. Noise levels may cause disturbance, nuisance and even health hazards for the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will be exposed to noise and vibration generated by the project activities. Therefore, sensitive receptors such as primary school, high school, madrasa, family welfare centre, community clinic, etc., which are located close to the interventions (within 500 m from the embankment) are likely to be affected by noise during movement of vehicle and construction activities of water control structures (Figure 8.1). Table 8.2 shows the noise level to be expected from the equipment. According to ECR'97 and IFC- EHS guideline 2007, noise level ob 60 dBA is applicable for mixed area and 50 dBA for residential area respectively (Table 8.3).

Table 8.2: Noise level expected from the equipment

Sl.	Equipment	Noise Level (7m away (dB)
1	Bull-dozer	85
2	Excavator	80
3	Compactor	85
4	Concrete Mixer	85
5	Generator	81
6	Scraper	86

Source: CEIP report, 2013

Table 8.3: Bangladesh and IFC Standards for Noise

Area Category	Standard Values (all values in dBA)			
	Bangladesh		IFC	
	Day	Night	Day	Night
Silent Zone	45	35		
Residential area; Institutional; Educational	50	40	55	45
Mixed area (basically residential and together used for commercial and industrial purposes)	60	50		
Commercial area	70	60	70	70
Industrial area	75	70	70	70

Source: Schedule 4, Rule-12, Environment Conservation Rules, 1997 (Page 3127, Bangladesh Gazette, 28 August 1997) (Translation from original Bangla) and Environmental, Health, and Safety (EHS) GuidelinesGENERAL EHS GUIDELINES, World Bank Group, April, 2007

Note:

1. Day time is reckoned as the time between 6 a.m. to 9 p.m.
2. Night time is reckoned as the time between 9 pm to 6 am
3. Silent zones are areas up to a radius of 100 meter around hospitals, educational institutes or special establishments declared or to be declared as such by the Government. Use of vehicular horn, other signals and loudspeakers is prohibited in silent zones.

413. The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity.

Mitigation

414. The following mitigation measures should be taken to address the above concerns:

- Restricting/limiting construction activities during the day time;
- Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards;
- Vehicles and machinery should have proper mufflers and silencers;
- Provision of noise barriers at schools and other sensitive receptors, as needed;
- Provision of PPE (ear muffs and plugs) to labor;
- The construction crew should be instructed to use the proper equipment, to minimize noise levels;
- Camps should be located at a safe distance from communities

Residual Impacts

415. The impacts associated with noise and vibrations are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low.**

Figure 8.1: Sensitive receptors near the embankment of Polder 34/3

Deterioration of Air Quality

Impact

416. Construction machinery and Project vehicles will release exhaust emissions, containing carbon monoxide (CO), Sulphur dioxide (SO_2), Oxides of nitrogen (NO_X), and particulate matter (PM). These emissions can deteriorate the ambient air quality in the immediate vicinity of the Project sites (particularly along the embankment, and around the channel excavation sites and borrow pit areas). Furthermore, construction activities such as excavation, levelling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions. These emissions pose health hazards for the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will be exposed to air contamination caused by the project activities.

417. The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity.

Mitigation

418. The following mitigation measures should be taken to address the above concerns:

- Exhaust emissions from vehicles and equipment should comply with standards.
- Proper tuning of vehicles, generators, and equipment should be carried out to minimize exhaust emissions.
- Construction material (sand/soil) should be kept covered while transporting and stock piled.
- Regular water sprinkling should be carried out where needed, particularly on the earthen tracks near communities.
- Vehicle speed should be on low (15 km per hour) on earthen tracks particularly near communities and school.
- Vehicles and other machinery should be turned off when idle
- Good quality fuel should be used, minimizing exhaust emissions.
- Camps should be located at a safe distance from communities and schools.

Residual Impacts

419. The impacts associated with noise and vibrations are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low.**

Degradation of Water Quality

420. Construction materials, demolition debris, fuel from construction machineries (piling machine, pump etc.) may degrade the water quality. The construction workers will generate domestic solid waste and waste water including sewage. The contractor’s workshops will generate oily water, waste oils, oily rags, and other similar wastes. The stores and warehouse will generate solid waste such as empty cement bags, cardboards, and wooden crates. Improper disposal of these waste streams can potentially contaminate the water resources of the area. Water contamination can potentially have negative impacts on the local community, natural vegetation, agriculture, and biological resources of the area including aquatic flora and

fauna. Borrowing material from the river banks may potentially cause increased turbidity in the rivers. Further, release of effluents, soil, and/or sand in water bodies may increase water turbidity, which would prevent sunlight to enter into the water that is necessary for promoting photosynthesis of aquatic plants.

421. The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity.

Mitigation

422. The following mitigation measures should be taken to address the above concerns:

- Contractor should prepare and implement a pollution control plan.
- Contractor workshops should have oil separators/sumps to avoid release of oily water;
- Contractor should use plastic sheet or gravel in the workshop and equipment yard to prevent water contamination.
- Material borrowing from the river banks should be carried out sufficiently away from the water line, minimizing the possibility of loose soil to wash away in the river.
- Contractor should locate labor sheds/camps including their sanitary installations away from water bodies.
- Contractor should locate the fuel container above the ground level for monitoring pollution due to leakage of fuels and lubricants.
- Contractor should prepare and implement camp waste management plan (septic tanks, proper solid waste disposal).
- Contractor should not release untreated wastes in water.
- Contractor should re-use spoil and excavated material where possible.
- Contractor should dispose spoil at designated areas with community consent.
- Construction material, demolition debris, and excavated soil/silt should not be allowed to enter water bodies.

Residual Impacts

423. The impacts associated with water quality are likely to be addressed with the help of the above mitigating measures appropriately and the significance of residual impact will be **Low**.

Increase of Drainage Congestion

Impact

424. The Project activities particularly on drainage sluices and in water channels may block or clog water drainage channels, potentially causing drainage congestion in the surrounding areas and negatively affecting the cultivation and the associated communities. In particular, areas along Mirzapur, Khantakata, Gobardia, Gomoti, Shashikhali and East Sayera water channels are already facing drainage congestion problems. The project works on the drainage sluices are likely to make the situation worsen and exacerbate the drainage congestion

problem. In addition, excavation of existing khals in the Polder is likely to disturb the drainage which takes place through these channels.

425. The significance of this potential unmitigated impact has been assessed as Moderate on the basis of impact magnitude and receptor sensitivity.

Mitigation

426. The following mitigation measures should be taken to address the above concerns:

- Construct bypass canal before replacement of drainage sluices.
- Sequence of work at the drainage sluices and in the water channels should be carefully planned to avoid drainage congestion.
- Contractor should ensure that drainage channels are not obstructed or clogged by the construction activities which do not cause any drainage congestion situation in crop fields.

Residual Impacts

427. The impacts associated with drainage congestion are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

Increase of Sedimentation

Impact

428. Borrowing material from the river banks may potentially cause increased sediments in the rivers. Similarly, excavation of water channels if carried out in water can potentially increase their sediment load. Excavated material from the channels if left along their banks may again enter the water thus increasing their sediment load. In addition, construction material, loose earth/soil, demolition debris, and other materials may enter the river or other water bodies causing increased sediments in them. Run off from construction sites, camps, and other temporary facilities may enter water bodies increasing their sediment load.

429. The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity.

Mitigation

430. The following mitigation measures should be taken to address the above concerns:

- Contractor should excavate channels after dewatering them;
- Contractor should not leave excavated earth and silt on channel banks;
- Contractor should implement measures to protect channels from run-off from work areas and camps; and
- Contractor should obtain borrow material from foreshore areas in a manner not to increase siltation in rivers, and should not leave loose soil after excavation.

Residual Impacts

431. The impacts associated with drainage congestion are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

Effects on crop production

Impact

432. Borrow pits for extraction of construction material are expected to be both from inside the Polder and in the foreshore land[16]. Borrow pits will generally be established on private land after agreement between the contractor and the private land owner, typically involving some compensation from the contractor to the land owner. The use of the borrow pit areas inside the Polder will typically be converted from agriculture to pond based aquaculture. In the foreshore areas, commonly fallow land will be used. Excavation will take place during the dry season. In wet season, these borrow pits areas are likely to fill up gradually due to sedimentation. The fallow land is used scattered for seedbed or grazing of livestock by the dwellers of the Polder.

433. In addition, construction activities, movement of construction machinery, project related vehicular traffic, material borrowing, material stockpiling, re-excavated soil of canals, waste disposal or camp establishment might damage crops or affect the cultivated land.

434. The significance of this potential unmitigated impact has been assessed as **Moderate** based on impact magnitude and receptor sensitivity.

Mitigation

435. The following mitigation measures should be taken to address the above concerns:

- It should be considered a priority to establish borrow-pits in foreshore areas
- Resettlement Action Plan should be prepared and should also be implemented accordingly
- Compensation would be paid for any crop damage;
- Contractor would avoid cultivation fields during construction;
- Contractor would avoid agricultural land for material borrowing, material stockpiling and labor camps construction;
- Contractor would ensure that no vehicular movements take place inside cultivation fields;
- Contractor would ensure that no material is dumped inside cultivation fields;
- Re-excavation soil of canals should not be dumped in agricultural land and
- Contractor would maintain liaison with communities.

[16] Lessons learnt from implementation of CEIP Package-I..

- Contactor will prepare site specific spoil management and disposal plans for each site to be followed upon approval by the DDCS&PMS Consultants and PMU.

Residual Impacts

436. The impacts associated with loss of agriculture are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact would be **Low**.

Effects on irrigation

Impact

437. Construction activities particularly on construction of drainage sluices (three) repairing of flushing Inlets (five) and re-excavation of drainage channel (9 km) can potentially disrupt the crop irrigation temporarily during both wet and dry season thus negatively affecting cultivation. The works on sluices can cut off the incoming water from the river, while the excavation works in water channels can affect water conveyance through them.

438. The significance of this potential unmitigated impact has been assessed as **Moderate**[17] based on impact magnitude and receptor sensitivity.

Mitigation

439. The following mitigation measures should be taken to address the above concerns:

- Contractor would construct bypass canal before construction of drainage sluices;
- Sequence of work at the drainage sluices, inlets and water channels would be carefully planned to avoid irrigation disruption;
- Contractor would ensure no negative impacts on crop irrigation;
- Contractor would maintain liaison with communities; and
- Contractor would work during the dry season.

Residual Impacts

440. The impacts associated with disruption of irrigation are likely to be adequately addressed with the help of above mitigation measures and the significance of the residual impact would be **Low**.

Feeding and Spawning Ground of Fish Habitat

Impact

441. The Polder 34/3 area is surrounded by the Putimari River in the south and Butiamari River in the west. The upstream of both the rivers are connected with the Bishnu River having tidal influencehowever, both the rivers flow has reduced. Polder 35/3 is located downstream (south direction) of this polder which has some proposed interventions under CEIP. As per consultation with local fishers during field visit it is learnt that, the bank sides of these rivers

17

have been reported as the feeding, nursery and spawning ground of brackish water fish species like *Chewa, Pairsha, Gulsha Tengra, Bagda, chingri*, etc. It is expected that activities of bank revetment cause the partial destruction (if in the dry season) and full destruction (if in the rainy season) the feeding, nursery and even spawning ground of these fish species.

442. The significance of this potential unmitigated impact has been assessed as Major on the basis of impact magnitude and receptor sensitivity.

Mitigation

443. The following mitigation measures are being suggested to address the above concerns:

444. Earth work should be conducted during the dry season (November-May)

445. Sequence of work at the bank sides of Putimari River and Butiamari River will be planned considering local fisheries condtion to minimize impacts on spawning and subsequently nursery ground of fish.

446. Contractor will maintain liason with experienced local fishermen.

Residual Impacts)

The impacts on spawning and nursery ground are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be Low.

Degradation of the Fish Habitat Condition

Impact

447. Construction and repair of drainage sluicegates, flushing sluices and bailing out of water from the project area and re-excavation of khals would temporarily degrade the present habitats condition of khals. Removal of bottom soil of khals would disturb the habitat of bottom dwellers such as guchi, baim, gutum, kuchia fish, mud crab and benthic organisms of those habitats. Therefore, the significance of this impact has been assessed as **Moderate** on the basis of impact magnitude and sensitivity.

Mitigation

448. The following mitigation measures should be taken to address the above concerns:

- Contractor should construct bypass canal before construction and repair of each drainage sluice gates and flush sluices.
- Re-excavation work should be done in winter and early dry season, i.e., November to February to minimize the hamper of Bagda culture along with fish culture.
- Re-excavation of drainage khals will follow the construction of regulators by spanning a shortest possible time. Re-excavation of Khals should be implemented by maintaining the alignment of side so that fish can utilize the space on the other side for its migration. As a result, construction activities will have minimum hindrnace to fish migration
- Re-exacation should be done section-wise with cross dam to protect the benthic organisms.

- Excavated soil should be dumped on high land at safe distance from the bank of re-excavated khals.
- By-pass canals should be dismantled just after the completion of the repairing of the sluice gates and excavation work.

Residual Impacts

449. Implementing the above mitigation measures, the impacts on fish habitat condition are likely to be reduced to some extent. Therefore, the significance of residual impact will be **Low**.

Obstruction of Fish Movement and Migration

Impact

450. Most of the brackish and freshwater fish species migrate through the khals at some stages of their life cycle for spawning, nursing and feeding purpose. River resident fishes migrate from adjacent rivers to inside the Polder area using the existing khals at pre-monsoon to monsoon. The lateral migratory route for fishes would be obstructed due to construction and repair of three drainage sluice gates, six flushing sluices and re-excavation of nine km connecting khals. This would directly impede lateral migration of mild to moderate saline tolerant fish species. Obstruction to fish migration would result in decline of fish production of the project area and ultimately would affect the dependents livelihoods.

451. Hence, the significance of this impact has been assessed as **Major**on the basis of impact magnitude and receptor sensitivity.

Mitigation

452. The following mitigation measures should be taken to address the above concerns:

- Duration of construction of structures and other interventions should be shortened as much as possible at least should maintain the contract period.
- Dismantle bundhs and other obstructions built to support the construction of structures as soon as work is over.
- For manual re-excavation of Khals, compartments could be built in a cascade manner and bailing out of water to take place from one compartment to another to avoid damage to fish.
- Sequence of construction of regulators and re-excavation of drainage Khals should be set scientifically so that implementation of project could be completed with minimum hindrance to fish migration.
    - Contractor will maintain liaison with communities so that they could realize the issue. It is more important in case of timing of entering water into the Polder for shrimp culture along with paddy cultivation and exiting water from the same.
- Liaison of contractor with community would create scope for setting proper time for the construction work so that no or insignificant impact to the shrimp farming and paddy cultivation is caused.

Residual Impacts

453. Implementing the above mitigation measure, the impacts on the lateral fish migration are likely to be adequately addressed and reduced to some extent. Thus the significance of residual impact will be **Low**.

Impact on undergrowth herbs and shrubs

Impacts:

454. All the existing undergrowth herbs, shrubs like bhant *(Clerodendron viscossum)*, akand(Calotropis *procera)*, and durbaghas (*Cynodon dactylon)*would be damaged both at embankment slopes and the sites from where soil would be collected during embankment re-sectioning. Most of the plant species (Herbs, Shrubs) at the proposed sites are seasonally grown and life span is not more than one year. Existing big trees at the embankment slopes will not be cut in most of the cases. For this reason, this negative impact is temporary and recoverable.

Mitigation

455. The following mitigation measures should be taken to address the above concerns:

- Collect soil from barren land as much as possible
- Proper turfing should be implemented at embankment slopes with local and ensure regular monitoring of turf grasses till they matured
- Avoid construction activities during favourable time of wildlife movement (early morning and night)

Residual Impacts

456. With the help of above mitigation measures, the impacts associated with establishing the site facilities are likely to be adequately addressed and the significance of residual impact will be **Low**.

Impact on timber/ fruit tree

Impact:

457. The embankment slopes are vegetated with number of trees herbs and shrubs. A large portion of the embankment is occupied by woody trees like Babla (*Acacia nilotica)*, Akashmoni *(Acacia auriculiformis),* Khejur (*Phoneix sylvestirs)*, etc. About 23 (twenty three) number of trees with different sizes and heights will be damaged/cut for construction of water control structure (replacement). Wildlife should relocate by damaging their habitat loss for vegetation damage. Following Table 8.4 presents a total number of trees to be cut for construction of water control (replacement) Structures.

Table 8.4: List of trees to be cut for construction of new structures

Structure ID	Tree to be cut	
	Species Name	No. of trees
DS1	Khejur*(Phoneix sylvestirs)*	1
	Babla*(Acacia nilotica)*	3
	Hijol*(Barringtonia acutangula)*	1

Structure ID	Tree to be cut	
	Species Name	**No. of trees**
DS2	Arjun(*Terminalia arjuna*)	1
	Babla*(Acacia nilotica)*	1
	Geowa*(Excoecaria agallocha)*	3
DS3	Babla*(Acacia nilotica)*	1
	Sada Koroi /Sil Koroi(*Albizia procera*)	3
	Akashmoni*(Acacia auriculiformis)*	2
	Hargoza(*Acanthus ilicifolius*)	Medium
FS1	Mahogoni (*Swietenia macrophylla*)	2
	Sada Koroi /Sil Koroi(*Albizia procera*)	5
Total=23		

Mitigation:

458. The following mitigation measures should be taken to address the above concerns:

- Give proper compensation to the tree owners against tree felling.It is mentioned here that a detail Resettlement Action Plan (RAP) is being prepared for Package-3 under CEIP-1. According to plan, payment to owners against tree felling will be established.The tree owner will be compensated according to the RAP.
- Implement plantation with native species (i.e. Sirish(*Albizia lebbeck*), Narikel (*Cocos nucifera*), Tal (*Borassus flabelifer*), Khejur (*Phoneix sylvestris*), etc., at the damaged sites (sluice ground and nearer foreshore mudflats) after construction works.
- Avoid construction activities during favourable time of wildlife movement (early morning and night)

Residual Impacts

459. The impacts associated with Construction of drainage sluice will be **low** with the help of above mitigation measures.

Impact on aquatic flora and fauna

Impact:

460. All proposed khals are shallow and little aquatic vegetation is observed. This type of water bodies support both freshwater and saline tolerant flora -and fauna like Water Hyacinth,Water Velvet and Minute Duckweed, Water Primrose, and Holy-leaved Acanthus/Hargoza;crabs, fishes (details in the fisheries section), mudskippers, shorebirds, Skipper frog, Bullfrog, Kingfisher, Egret, etc. The proposed interventions namely khal re-excavation would greatly affectthe density and composition of aquatic flora and fauna.

Thus, the significance of this impact has been assessed as Moderateon the basis of impact magnitude and receptor sensitivity.

Mitigation

461. The following mitigation measures should be taken to address the above concerns:

- Deeper sections of the khals not to be disturbed/excavated.

- Use excavated soil spoils for khal dyke re-sectioning
- Implement tree plantation with local species (fruit and timber tree) at the khal bank side after re- excavation work preferably where excavated soil is dumped along the khal bank side.
- Use minimum land as much as possible for excavator/ labor movement

Residual Impacts

462. With the help of above mitigation measures, the impacts associated with re-excavation of khal will **Low** residual impact.

Impacts on river/ foreshore side vegetation

463. In the Polder area, most of the river/ foreshore areas have already been implemented under afforestation. However, further afforestation program may damage existing undergrowth vegetation due to labor movement. Incautious disposal of sapling's poly bags may cause deterioration of soil quality during plantation at foreshore area. There may be a risk to outbreak of plant diseases to the other existing plants from the disease affected saplings. Inadequate distance between two saplings may hinder proper growth and cause disease outbreak.

Mitigation:

464. The following mitigation measures should be taken to address the above concerns:

- Aware labors about plant conservation who are engaged for afforestation activities
- Collect saplings from near natural source as much as possible.
- All kinds of polyethylene bags and plastic ropes should be piled up in a pit for dumpingor burned in a proper way
- Care should be taken for physical and biological control of plant disease while raising nursery and sapling plantation (i.e., using of disease free seeds, proper treatment of nursery soils, using appropriate doses of pesticides and fertilizers)
- Pre-consultation with Forest Department and other related non-government organizations for selecting of suitable species for plantation and spacing of the saplings
- Develop a pest management plan for the holistic afforestation

Residual Impacts

465. With the help of above mitigation measures, the impacts associated with foreshore afforestation will be **Low**.

Safety and Public Health Hazards

Impact

466. The area is prone to cyclones and storm surges. Although the works will be carried out during the dry season, a certain level of safety hazards still exists for the construction staff.

467. The construction activities will involve operation of heavy construction machinery, vehicular traffic, excavation and filling operations. These activities may pose some safety hazards to the local population as well as for the construction workers. The fuel storage at the camp sites may also pose safety hazards for the construction staff as well as to surrounding population.

468. Inappropriate waste disposal at the camps and construction sites, and air quality deterioration caused by the Project's vehicular traffic and construction activities potentially pose health hazards to the construction staff and nearby population. Unhygienic condition and unavailability of safe drinking water for the construction staff will expose them to health risks. In addition, influx of construction staff can potentially expose the nearby population to communicable diseases.

469. The significance of the potential impacts is assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

470. The following mitigation measures are to be implemented to address the above concerns:

- Liaison will be established with the Bangladesh Meteorological Department for early warning of storms and cyclones. Radio and television sets will be kept in all the labor camps for obtaining weather information.
- The contractors will prepare site specific Camp management plans, an Occupational health and safety plan including training programs as well as an Emergency response plan with early warning system and training programmes to be approved by the DDCS&PMS Consultants and PMU. The Plan will also include awareness raising and prevention measures, particularly against communicable diseases such as hepatitis B and C, and HIV/AIDS. Besides:
- The WB's EHS Guidelines will be included in the contract documents The WBG's EHS Guidelines are to be included in the contract documents and that should be followed during construction.
- Each contractor will prepare an Emergency Response Plan defining procedures to be followed during any emergency. This plan will be submitted to Construction Supervision Consultants for review and approval;[18]
- All temporary facilities including labor camps will meet minimum safety, hygiene and sanitation requirements (safe drinking water, proper sewage disposal, solid waste management, general cleanliness, protection against disease vectors, and protection against weather elements, firefighting, and other similar essential services).

[18] http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines

- The labour shed/camps foraccommodation of workersshould be constructed according to the IFC/EBRD workers accommodationguidelines.[19]
- All workers must be provided with and use appropriate Personal Protective Equipment (PPE). First aid must be provided and there would be procedures in place to access appropriate emergency facilities.
- The construction sites will have protective fencing to avoid any unauthorized entry, where appropriate and possible.
- Health screening of employees would be a Contractor obligation prior to labourers working on site and living in the temporary accommodation facilities. The health screening would entail normal review of physical fitness and also include a review of appropriate vaccinations. Workers would be given vaccinations as and when required.
- All site staff will undergo screening against communicable diseases. Communicable disease careers will not be employed at the working site.
- All employees need to carry out induction health and safety training prior to commencement of work. Training would include the provision of appropriate written or visual materials to reinforce learning. Where illiteracy levels are high, OHS issues need to be covered more frequently than normal in toolbox talks.
- Public awareness training and workshops on safety and health risks will be conducted for local communities prior to and during construction operations.
- Observing statutory requirements relating to minimum age for employment of children and meeting international standards of not employing any persons under the age of 16 for general work and no persons under the age of 18 for work involving hazardous activities. The construction contractor(s) would not hire people under the age of 18 on permanent contracts but would include short training activities for youth to the extent possible.
- Ensure the acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work;
- Ensure that no workers are charged fees to gain employment on the Project.
- Ensure rigorous standards for occupational health and safety are in place.
- Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal.
- The contractor will adopt a Human Resource Policy appropriate to the size and workforce which indicates the approach for management employees (this could be part requested in the tender process).

[19] http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/learning+and+adapting/knowledge+products/publications/publications_gpn_workersaccommodation

- Produce job descriptions and provide written contracts and other information that outline the working conditions and terms of employment, including the full range of benefits;
- Provide health insurance for employees for the duration of their contracts;
- Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts;
- Employ a community liaison officer (this could be full time or part of another post's responsibilities);
- Raise awareness prior to recruitment, clarifying the local hire policy and procedures, including identification of opportunities for women to participate in employment and training;
- Report regularly on the labor force profile, including gender, and location source of workers;
- Hold toolbox talks on workers' rights and the labor grievance mechanisms during the construction phase;
- Organize a training program and keep training registers for construction workers;
- Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system, which provide workers with a safe and healthy working environment taking into account the inherent risks for this type of project.
- Availability of safe drinking water will be ensured for the construction staff.
- First aid boxes will be made available at each construction site. Emergency phone numbers (including hospitals, Fire Department, and Police) will be displayed at key locations within the site. Each site will have an ambulance facility.
- Firefighting equipment will be made available at the camps and worksites.
- The camp staff will be trained for safety against firefighting.
- All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel.
- Waste management plan to be prepared and implemented in accordance with international best practice.
- Liaison with the community will be maintained.

Residual Impacts

471. The impacts associated with safety and health hazards are likely to be mostly addressed with the help of above mitigation measures and the significance of residual impact will be **Moderate.**

Hindrance for Pedestrian and Vehicle Movement

Impact

472. The markets in Polder 34/3 play a very important role in the livelihood of the Polder inhabitants as well as meeting the daily needs of the people. Construction activities along the

embankments are likely to disrupt the markets as these will be displaced during construction of the embankment. The construction activities along the embankment will also cause temporary disturbance in the movement of local people. The internal roadways are not sufficient enough to provide alternate means of transportation. Local people will suffer due to their limited roadway movements during construction works along the embankment. This will affect their economy and earning options as well.

473. The significance of those unmitigated impacts is assessed as Moderate on the basis of impact magnitude and receptor sensitivity.

Mitigation

474. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will prepare site specific traffic management plans as well as Spoil management and disposal plans to be implemented upon approval by the DDCS&PMS Consultant and PMU, for:
- The works on embankment will be carefully scheduled to minimize impact on local markets and transportation routes.
- The embankment works will be carried out segment wise and soil will be placed linearly on half of the embankment, leaving the other half to be used as track. The works of the first half when completed, it will be opened for local traffic while the works of the other half will be undertaken.
- Work schedule will be finalized in coordination and consultation with local representatives and communities.
- Local routes will not be blocked as far as possible. If unavoidable, alternative routes will be identified in consultation with local community.
- A GRM will be put in place.

Residual Impacts

The impacts on the floral resources are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be Low.

Labor force related impacts

Impact

475. Around 100 skilled workers/technical staff/operators/drivers and about 100common labour are considered required for construction activities. The common labours are considered to be recruited among the local people in the Polder. No need for any worker's camp is considered needed.

476. Contractor's staff may not be accustomed to local conditions and people's culture, causing incidents of tension with the local population.

477. The significance of this potential unmitigated impact has been assessed as Moderateon the basis of impact magnitude and receptor sensitivity.

Mitigation

478. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will provide proper housing for his staffs at a site with adequate facilities securing neighbours arenot disturbed.
- The Contractor will prepare and implement a Code-of-Conduct for his staff showing respect to comply with and not offend local customs and cultural norms.

Residual Impacts

479. The impacts associated with labor force related impactsare likely to be adequately addressed with the help of above mitigation measures, and the significance of residual impact will be Low.

Disturbance of construction activities due to natural hazards

Impact

480. Historically, this area is vulnerable to cyclone, storm and tidal surges. As per construction schedule, the development activities of proposed new Polder will be conducted from October to May while most of the cyclone and storm surges have occurred in this area. In the event of a cyclone the works will be in danger.

481. The significance of this potential unmitigated impact has been assessed as Major on the basis of impact magnitude and receptor sensitivity.

Mitigation

482. The following mitigation measures are to be implemented to address the above concerns:

- The contractors will prepare site specific Emergency response plan with early warning system and training programmes to be approved by the DDCS&PMS Consultant and PMU, incorporating:
- Weather signals will be considered by the contractor during construction works.
- Radio and television will be kept in all the labour sheds for getting weather information through these media.
- Ensure rigorous standards for occupational health and safety are in place.

Residual Impacts

483. The impacts associated with natural hazards are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be Moderate.

Social and Gender Issues

Impact

484. It is envisaged that about 60 percent construction workers will be recruited from within the Polder while the remaining will come from other areas. The presence of outside laborers in the area may create friction and conflict between the local labor and outside labor, and between local community and outside labor.

485. Presence of a large number of outside labor can potentially cause encroachment in the privacy of local population particularly women and their mobility can be negatively affected.

Mitigation

486. The following measures will be implemented to address the above concerns:

- Proper awareness programs will be conducted through public consultation measures such as village scoping sessions, meetings, and placement of bill boards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officers.
- Liaison with the communities will be maintained.
- Cultural norms of the local community will be respected and honored.
- GRM will be established to address the grievances of local as well as outside laborers.
- Careful use of local natural resources and project resources, fuel, fuel-wood and electricity;
- Restrictions related to consumption of alcohol and drugs for foreign workers;
- Safe driving practices;
- Respect for the local community and its cultural norms in which laborers are working.
- Avoiding construction activities during Prayer time and allowing the workers to offer prayer during working time

Residual Impacts

487. With the help of above mitigation measures, the impacts associated with social unrest are likely to be adequately addressed and the significance of residual impact will be **Low**.

8.5 Impacts during Post-construction Phase

Increase of sedimentation in water channels and rivers

Impact

488. Sediment may be deposited at the intake of regulator which may create further drainage problem inside the Polder if a sediment management plan is not adequately implemented in future..

489. The significance of this potential unmitigated impact has been assessed as **Major**on the basis of impact magnitude and receptor sensitivity.

Mitigation

490. The following mitigation measures should be taken to address the above concerns:

- An ongoing program of de-silting of water channels should be considered with full community involvement and participation.
- Provide silt management plan
- The local government (union parishad) should be authorized to monitor the development activities.
- Prepare Bangla manual for sluice gate operation and provide training to WMOs; and
- Include farmers and fishermen in WMOs for conflict resolution.

Residual Impacts

491. The impacts associated with drainage congestion are likely to be mostly addressed with the help of above mitigation measures and the significance of residual impact will be **Moderate**.

Increased use of agro-chemicals

Impact

492. At present, about 183ha and 983ha of lands are under Boro (HYV) rice cultivation, respectively. 345tons of chemical fertilizers and 4.5 tons (Both granular and liquid) pesticides are used for cultivation of Boro and T. Aman crops. Implementation of the project interventions will expandthe area under irrigated cultivation of Boro(HYV) and T.Aman (HYV). It is expected that additionallyabout 147ha of Boro (HYV) and 369ha of T.Aman(HYV) will come under cultivation. The increase in areas for Boro and T.Aman cultivation is expected to increase which will increase the use of chemical inputs including fertilizers and pesticides.. It is estimated that additional 170,325 kg or 17 tons of chemical fertilizers and1,524 kgor0.15 tons pesticideswould be required for future (Table 8.5). Runoff from such cultivation fields might potentially pollute the water bodies and even drinking water sources thus causing health hazards to the communities.

493. The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity.

Mitigation

494. The following mitigation measures should be taken to address the above concerns:

495. Capacity building and awareness raising of the farmers will be carried out by the Project Authority (BWDB) to practice Integrated Pest Management (IPM) and Integrated Crop Management (ICM) with assistance of the competent authority– in order to minimize usage of chemical inputs.

- Farmers group would have close contact with DAE for adoption of various measures of ICM.
- Farmers would be encouraged to use organic manure to increase soil fertility while avoiding water contamination,and
- Farmers would be encouraged to cultivate leguminous crops to enhance the soil quality as well as soil productivity.

Residual Impact

496. With the help of above mitigation measures, the impacts associated with usage of increased level of chemical inputs are likely to be somewhat addressed and the significance of the residual impact will be **Minor.**

Table 8.5: Impact on Area (ha), Fertilizers (kg) and Pesticides (kg/ml) required in Present and Future Situation

Crop name	Present cultivate area (ha)	Fertilizer required (kg/ha)	Granular pesticides required kg/ha	Liquid pesticide required ml/ha	Total Fertilizer required (kg)	Total granular pesticides required (kg)	Total liquid pesticides required (ml)	Future cultivated area (ha)	Increased area (Ha)	Total future fertilizer required (kg)	Future granular Pesticides (kg)	Future liquid pesticides required (ml)	Impact		
													Fertilizers (kg)	Pesticides (kg)	Pesticides (ml)
HYV T. Aman	963	245	4	700	235,935	3852	674,100	1110	147	271,950	4440	777,000	36,015	12	2,100
HYV Boro	183	610	8	800	110,715	1464	146,400	405	222	245,025	3240	324,000	134,310	1,512	151,200
Total	**1146**	**850**	**12**	**1,500**	**346,650**	5316	**820,500**	**1515**	**369**	**516,975**	**7,680**	**1,101,000**	**170,325**	**1,524**	**153,300**

Sources: Feasibility report (Agriculture), CEIP and field information; 2016

Fish Habitat Condition

Impact

497. Rivers habitat and khals in the both sides of the adjacent sluice gates would be deteriorated due to gradual deposition of silt. But due to regular checking of the physical condition and function of embankment and water control structure will overcome the problem. Hence, the significance of this impact has been assessed as very **Low** on the basis of impact magnitude.

Mitigation

498. The following mitigation measures should be taken to address the above concerns:

- Maintenance activities (rivers dredging and khals re-excavation) should be executed after certain interval for removing the silt from the rivers and khals bed.
- Monitoring the functions of WMOs.

Residual Impacts

499. Implementing the above mitigation measure, the impacts associated with the rivers habitats adjacent to drainage sluice gate & khals habitats in the Polder area and habitats quality are likely to be alleviate and the significance of residual impact will be negligible.

Risk of Embankment Failure

Impact

500. Rain cuts, wave action, tidal surge and public cuts are the major causes of embankment breaching of the coastal region. Lack of regular maintenance has created weak point at the sensitive locations of the embankment. Mal-maintenance and increasing intensity and magnitude of the cyclone and storm surge simultaneously have accelerated the risk of embankment failure. Unplanned settlement of new gates in embankment by gher owner for entering saline water for shrimp cultivation may cause of embankment failure. On the other hand, lack of proper management of embankment accelerates the risk of embankment failure.

501. The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

502. The following mitigation measures should be taken to address the above concerns:

- Regular monitoring and careful maintenance of the embankment and existing water control structures especially along the eastern side of the Poldershould be ensured. This monitoring should particularly be carried out before and after the monsoon season.
- Available cyclone and flood shelter should be prepared as a contingency measure during emergency situation.

- WMG should develop a fund for this kind of emergency situation.
- Structural measures like geo bag and sand bag should be kept in stock yard of local BWBD colony.

Residual Impacts

503. The impacts associated with risk of embankment failure are likely to be adequately addressed with the help of above mitigation measures, and the significance of residual impact will be **Moderate**.

Impact of major periodic maintenance works

Impact

504. The major periodic maintenance works during project operation phase include (i) re-sectioning of embankments including turfing; (ii) repair or replacement of metal works/hinges, lifting mechanisms, gates, block works, head / wing walls etc.; and re-excavation of khals by LCSs / PICs. It is expected that these periodic maintenance works would have minor negative and positive environmental and social impacts. However, re-sectioning of embankment along with turfing may hamper movement of local people temporarily. Besides, temporary damages of herbs, shrubs, various species of grass and bushes would take place due to soil dumping for re-sectioning work. The repairing works of structure would obstruct movement and migration of fish species like Chingri, Baila, Pairsa and fresh water fish like puti, tengra, bele, etc. Fish hatchling movement will also be hampered due to repairing works during hatchling period (May-July). On the other hand, a significant number of local labour will be recruited for earth work, repairing of embankment and afforestation, soil dumping and compaction of earth. Most of the maintenance works will be done by the LCS/WMO involving 60% male and 40% female from the local area. Thus, employment access to both male and females of locality during operation /maintenance phase will be promoted significantly and they can also take part in different decision making processes.

Mitigation/Enhancement Measures

- Re-sectioning of embankment along with turfing would be conducted segment by segment so that the movement of local people would not be hampered
- Re-excavation activity should be done segment wise
- Construction activities should be avoided during fish migration period, e.g. month of May to July
- Excavated earth should be dumped at a safe distance from the khal banks to avoid return back in the khals
- Implement plantation along the slopes of embankment after completing the earth works;
- Construction activities should not be carried out at early morning and night to avoid disturbance to wild fauna

8.6 Positive Impacts of the Project

Improved drainage system

505. After implementation of the proposed re-excavation of internal drainage khals and construction of drainage sluices as per design and specification by CEIP, the drainage system and situation of the Polder area would be improved significantly. The conveyance capacity of the khals will be increased resulting in proper drainage inside the Polder area. Consequently, the cropping pattern and crop cultivation will be increased while presently about 50% of the Polder net area is covered by shrimp culture ghers. Drainage congestion in the internal khalsduring the monsoon will be minimized and drainage pattern will be smoother than in the present condition.

506. The significance of this potential positive impact has been assessed as **Major** on the basis of impact magnitude.

Protect salinity intrusion

507. According to the proposed intervention, re-sectioning of embankments and construction of drainage sluices as per design would protect against saline water intrusion in the Polder area. Proper construction and operation of the sluices will protect saline water intrusion in the Polder during dry season considering about 50% of the net area of the Polder is occupied by shrimp culture ghers. Since operation of sluices play a very crucial role, WMOs should be formed and take over the responsibility of the sluices (maintenance and operation) to protect saline water intrusion.

508. This would decrease soil salinity thereby increasing crop production as well as create increased opportunities for employment generation.

509. The significance of this potential positive impact has been assessed as **Major** on the basis of impact magnitude.

Increased Crop Production

510. Presently, the cropping intensity of the Polder area is 167%. According to the proposed intervention, the Polder would be protected from tidal & monsoon flooding and will arrest salinity intrusion. It would remove drainage congestion in the Polder area. Besides, drainage congestion will be significantly reduced due to re-excavation of internal khals of the Polder area as per proposed plan. Due to the improved situation, cropping patterns would be change; farmers of the respective areas would encourage cultivate more crops in their lands. Thus, it is expected that the cropping intensity would be increased to181% in the Polder area in future **(Table8.6).** with an expected increase of14% from the base situation, refer 6.17.

Table 8.6: Future cropping pattern of the Polder area

Land Type	Cropping Pattern			Area (ha)	% of NCA
	Kharif - I	Kharif - II	Rabi		
F_o	Fallow	T. Aman (HYV)	Pulsed	69	4
	B. Leaf	cont	cont	25	2
	T. Aus (LV)	T. Aman (LV)	Oilseeds	78	5
	S. Vegetables	T. Aman (HYV)	Fallow	160	10
	S. Vegetables	S. Vegetables	W. Vegetables	60	4
	Fallow	T aman (LV)	Potato	150	10
	Chilli	T. Aman (LV)	Spices	86	6

Land Type	Cropping Pattern			Area (ha)	% of NCA
	Kharif - I	Kharif - II	Rabi		
	Fallow	T. Aman (HYV)	Chilli	61	4
	Fallow	T. Aman (LV)	Pulses	108	7
	Fallow	T. Aman (HYV)	HYV Boro	298	19
	Fallow	T aman (LV)	Oilseed	39	3
Sub Total				**1134**	**73**
F1	Fallow	T. Aman (LV)	Gher	219	14
	Fallow	T aman (HYV)	Gher	93	6
	Fallow	T. Aman (LV)	Boro(HYV)	62	4
	Fallow	T. Aman (HYV)	Boro (HYV)	45	3
Sub Total				**419**	27
Grand Total				**1,553**	**100**
Cropping Intensity % 181					

Source: Field information; 2015

511. Presently, total cropped area is about 2,900ha (NCA 1,553ha) of which rice croppingarea is 1,951 ha and non-rice cropped area is 949 ha (see Table 6.19). The total crop production is13,156 tons of which rice is5,424 tons (43%) and non rice 1,214 tons (57%). Adverse impact might occur due to siltation of river and drainage channels.

Table 8.7: Impact on crop production and land use in the Polderarea

Name of crops	Baseline/FWOP			FWIP			Impact	% of change
	Cropped area (ha)	Yield (ton/ha)	Production (metric ton)	Cropped area (ha)	Yield (ton/ha)	Production (metric ton)	(FWIP-FWOP)	
Local T. Aus	54	1.9	103	40	1.9	76	-27	-1.2
Local T. Aman	711	2.2	1564	397	2.2	873	-691	-32.4
HYV T. Aman	963	2.4	2311	1110	2.9	3219	908	42.5
HYV Boro	183	2.9	530	405	3.1	1256	726	34.0
Total rice	**1951**	**0**	**4508**	**1952**	**0**	**5424**	**916**	**42.9**
S. Vegetables	249	10	2490	220	12.0	2640	150	7.0
Chili	60	2.8	168	147	2.8	412	244	11.4
Potato	118	8	944	150	8.0	1200	256	12.0
W. Vegetables	40	14	560	60	14.0	840	280	13.1
Oil Seeds	58	1	58	117	1.5	176	118	5.5
Pulses	169	1.5	254	177	1.8	319	65	3.1
Spices	30	8	240	86	11.0	946	706	33.1
B. Leaf	225	8	1800	75	16.0	1200	-600	-28.1
Total non- rice	**949**		**6514**	**1032**		**7732**	**1,218**	**57.1**
Total	**2,900**		**11,021**	**2984**		**13156**	**2,134**	**100**

Sources: CEGIS Assessment from field information and DAE, January; 2016;

512. The cropped area would be changed if the project is implemented. The estimated cropped area would be 2,984ha of which rice cropped area would be 1,952ha and non-rice cropped area would be 1,032ha. The total crop production would be 13,165 tons of which rice would be 5,424 tons and non-rice would be 7,732 tons. The rice and non-rice production would be about 42.9% and 57% higher in compared to the baseline. Production would be increased mainly due to re-excavation of khals;a construction of drainage sluices and repair/replaced of Inlet with adoption of modern technology in crop production, change in cropping pattern etc. Crop production would be increased due to expansion of Local T. Aus, HYV T. Aman, HYV Boro, Chilli, Potato, Oil seeds and summer vegetables cultivation area.

513. Overall the increase in crop production is considered to provide a **Major** positive impact of the Project.

Increase in Fisheries

514. During the re-excavation soil will be removed from the bottom of khals (benthos removed will revive within few months) which will improved the khals habitat and shallow khals converted to deeper one which would act as fish shelter for certain fish species and crustaceans like *Guchi, Baim, Kuchia, Mud crab*, etc., during the lean period. Besides, some of the brood fish of small indigenous fish species (SIS) can stay in the deeper area which will spawn in the following year.Moreover, proper management of drainage sluice gates and flushing sluices will potentially increase the capture fish habitat areas. With respect to aquaculture, the improved embankments and sluice gates will protect and reduce the risk of over flowing the ghers and ponds during the wet season.

515. Mending of drainage sluices, flushing sluices and re-excavation of khals would facilitate the fish and other aquatic fauna movement and migration. Moreover, increased water depth of khals due to re-excavation would also facilitate the internal fish movement and migration significantly enhancing aquatic biodiversity.

516. It is expected that sufficient freshwater will be available throughout the year in the khals due to the re-excavation of khals and construction/repair of drainage sluice gates and flushing sluices. Besides, through proper management of the sluice and flushing gates, regular migration of indigenous fish species would be appeared again. Therefore, numbers of fish species are expected to increase.

517. Culture of fish in ghersand ponds within the Polder area would be more secured and protected from unwantedsaline water intrusion and tidal surge due to protection work and re-sectioning of embankment.This in turn is expected to encourage local fish farmers to cultivate fish and shrimp/prawn. Re-excavation of nine km internal major khals would restorelarge water body area that will increase capture fisheries and facilitate the culture fisheries to promote aquaculture. Capture fisheries productivity would be increased 40-50 kg/ha due to the intervention and improved management. Besides this, culture fisheries may also increase significantly by 500-600 kg/ha and 400-500 kg/h in the ponds and gher, respectively by applying modern technology.

Afforestation

518. Implementation of the afforestation programme will partly mitigate negative impacts associated with tree cutting necessary for the construction activities. Foreshore afforestation will enhance mangrove vegetation coverage surrounding the Polder and is expected to protect embankment from tidal surge, reduce erosion of foreshore land and provide habitats especially for various avifauna (i.e., Egrets, Herons, Bee eaters, Sandpipers, Owls/owlets, Kingfishers, Sparrows, Wagtails, Sunbirds, Babblers, Starlings), reptiles (i.e. Garden Lizard, monitors, pit viper), mammals (i.e., Bats, flying fox and pipistrelle, jackal) and fishes.

519. Overall the Project is considered to provide a **Moderate** positive impact on afforestation and providing habitats for fauna.

520. Overall the positive impact of afforestation is considered a Moderate.

Employment Generation

521. The construction work will generate a significant amount of employment over its construction period for local people and other associated professionals. People are also

expected to be involved in carrying operation and maintenance related jobs to operate the hydraulic structures. It is expected the agriculture production will be increased; water logging will be decreased due to the project which will create jobs indirectly from agriculture, business and commercial services.

522. On the other hand, during construction period, earthwork of embankment and constructing structure will create temporary employment opportunities for laborers of the Polder. The employment generation represents the different way of livelihood by which people can generate their income and improve their living standard.

523. Overall the increase in employment generation is considered to provide a **Major** positive impact of the Project.

Gender Promotion

524. Construction work requires various types of skilled and unskilled labors. To some extent women are hired for certain work activities, such as clearing of borrow pit material[20].The female workers are often distressed or, and do not have any other source of income. Therefore, the substantial increased job opportunities for women in the construction works and especially in the agricultural sector during the operation phase is significantly positive.

525. Overall the Project is considered to provide a Moderate to **Major** positive impact on the gender situation.

Livelihood Development and Out-migration

526. The project is expected to increase resilience of people within Polder 34/3. The project will increase agriculture production, reduce drainage congestion; generate income which improves the livelihood of the people.

527. The seasonal out migration of day labourers from this Polder area to other areas is expected to decline due to creation of local employment opportunities in the agriculture and other sectors, respectively.

528. Overall the Project is considered to provide a **Major** positive impact by improving livelihood and reducing out-migration

Social Use of Water

529. Main social uses of water is for taking shower, washing chores and other social uses. During the summer, most of the open water bodies, i.e.,khals, ponds getdriedup. However, the re-excavation of khals will increase the storage capacity of water from the monsoon season to the dry season and increase access to water for social uses.

530. Overall the Project is considered to provide a **Moderate** positive impact on the access to social use of water.

[20] Lesson earnt from CEIP Package-I implementation. .

Disaster Risk Reduction

531. The Project will improve people's safety by providing protection against storm and cyclone related flooding as well as river related flooding. Considering the high vulnerability of the population, and the high risk of flooding, the Project is expected to increase the safety of the population and improve the socio-economic conditions.

532. Overall the Project is considered to provide a **Major** positive impact by reducing the risk of disasters.

8.7 Summary of Assessed Impacts

533. A summary of impacts and their significance are tabulated and provided in **Appendix-G.**

8.8 Reduction of Fish Migration Time and Extent

Impact

534. The mal-functioning of the drainage sluices in the Polder area are still facilitating the migration of Pairsa, Vetki and Gulsha, Tengra, Chingri fishes from river to internal khal and vice-versa. However, drainage sluice gates are designed to control water for improvement of drainage system of the Polder area. Sluice gates are mainly operated in order to meet the irrigation purpose. The improved drainage sluices would thus hamper the migration behavior of above mentioned fish species as well as other aquatic fauna. Moreover, the migration of Pairsa, Vetki, Gulsha, Tengra, Chingri, etc., would be very much restricted with the replacement of the proposed drainage sluices.

535. The significance of the combined impacts has been assessed as Major on the basis of impact magnitude and sensitivity to receptors.

- Mitigation
-

536. The following mitigation measures are being suggested to address the above concerns:

Follow sluice gate operation ***manual (Appendix-E) for*** allowing fish migration***;***

537. Provide training to WMOs for fish friendly operation of sluices;

538. Collection and stocking of juvenile fish from rivers to the Polder will be done once in a year during the period of April to May by the fish farmers.

Residual Impacts

539. The impacts on migration status are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be minimized.

(b) Summary of Assessed Impacts
A summary of these impacts and their significance is presented in a Table (Appendix G).

9. Cumulative Impacts

9.1 Cumulative Impacts

540. Definition: Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

541. Cumulative impacts on the environment of individual effect can be minor but it can be significant when in combination with others taking over a period of time. The multiple impacts of different activities may have an additive, synergistic or antagonistic effect on one another and with the natural processes.

542. Methodology: Cumulative impacts entail the total of all impacts to a particular resource that have occurred, or occurring, or may occur as a result of any action or influence in the surrounding area. To Assess Cumulative Impact (CIA) of the proposed polder under CEIP, a number of other projects exist apart from the CEIP Polders (at the vicinity of the polder) as well as future plan has been considered. Before assessing the impacts, Valued Environmental Component (VEC) has been selected. VECs for which an impact was deemed insignificant in the EIA are not included in the CIA. The combined impacts of the project, other projects and activities, and natural environmental drivers surrounding the polder that will influence the VEC's condition e.g. life and livelihood of people, water resources/hydrology, environmental quality, natural ecosystem and flora-fauna etc.in a specific Polder have been assessed as cumulative impact. The cumulative impact has been estimated qualitatively based on the consensus estimate of a panel of experts. Furthermore, necessary additional mitigation measures have been suggested for reducing an estimated unacceptable cumulative impact on a VEC to an acceptable level.

543. Several existing, on-going and planned projects also exist in this region. Such projects may have impact on the hydrological network, life and livelihood of people, environmental quality, natural ecosystem, flora-fauna, etc. of Polder 34/3 This Chapter attempts to analyze several indirect effects regarding several existing and ongoing project, as well as the implementation of different interventions proposed in Polder 34/3 under Coastal Embankment Improvement Project-1 (CEIP-1).Besides, necessary mitigation measures based on analysis of cumulative impacts are proposed.

9.2 Proposed CEIP interventions on Polder 34/3

544. CEIP is a multi-phased effort laid down by the GoB to refocus its strategy on the coastal area by providing extra emphasis on frequent storm surges. The long term objective of the project is to increase the resilience of the entire coastal population to tidal flooding as well as natural disasters by upgrading the whole embankment system. The embankment improvement and rehabilitation approach will be adopted over a period of 15 to 20 years and in this regard a total number of 17 Polders have been selected through a participatory screening process. Among these 17 Polders (shown in Map 9.1), four Polders (Polders 32, 33, 35/1, 35/3) and six Polders (Polders 39/2C, 40/2, 41/1, 43/2C, 47/2 and 48) were selected for rehabilitation works under the first phase of CEIP (CEIP-1) which are being implemented. The other 7 Polders have undergone feasibility studies and would be implemented gradually

in later phases.It is assumed that Implementation of CEIP interventions may cause the following impacts of Polder 34/3 and its surrounding.

545. .

546. Apart from CEIP interventions, there are some other development projects nearby Polder 34/3, implemented locally or regionally.**Table 9.1** below shows a list of various projects in relevance with Polder 34/3, undertaken by different line agencies in Khulna, Bagerhat and Satkhira districts.

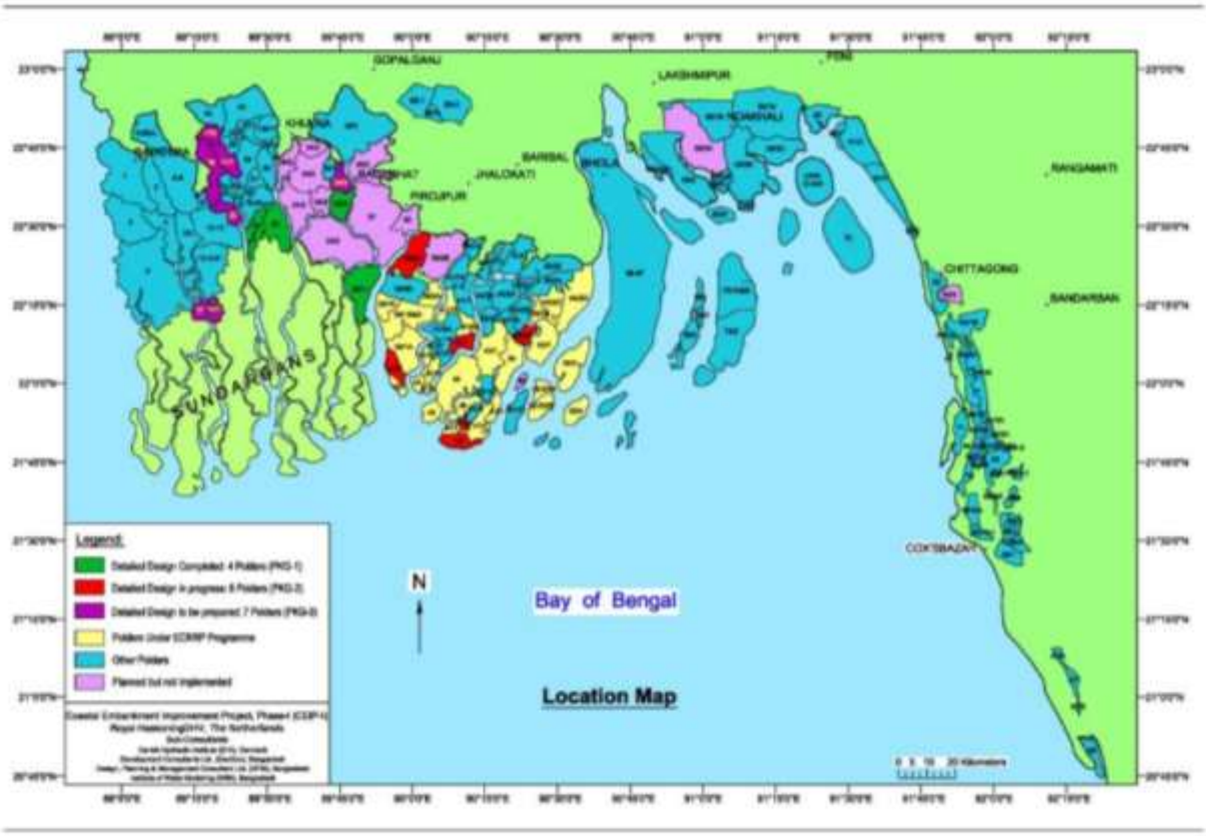


Figure 9.1: Locations of Polders under CEIP-I

Table 9.1: List of water management projects

Agency	Project Name	Duration	Location	Sensitivity
	National			
MoDMR	Comprehensive Disaster Management Program (CDMP), Phase II	2010- ongoing	Entire country	Negligible
BWDB	Projects under Climate Change Trust Fund	2013-ongoing	Entire country	Low
	Water Management Improvement Project (WMIP)	2010-ongoing	Entire country	Low
	Regional			
BWDB	Blue Gold Program	2013- ongoing	Coastal zone	Negligible
	Coastal Embankment Rehabilitation Project (CERP)	1995-2004	Coastal zone	Negligible
BFD	Marine Shrimp culture technology	1998-2004	Coastal zone	Moderate

9.3 Cummulative Impacts of proposed and existing projects

Impact on hydrology and flooding situation

547. The Polder 34/3 area is surrounded by the Putimari River in the south and Butiamari River in the west. The upstream of both the rivers are connected with the Bishnu River having tidal influencehowever, both the rivers flow has reduced.Polder 35/3 is located downstream (south direction) of this polder which has some proposed interventions under CEIP. The protective works i.e. higher crest level, slope protection work of Polder 35/3 may divert flow direction of Putimari River to Polder 34/3.

Impact of construction materials on local markets

548. The construction materials to be required for re-sectioning of the embankment, rehabilitation/ construction of water regulatory sluices, flushing sluices, and bank protection works will include soil, cement, and steel, stone and sand. The constructions materials especially sand and stone for construction of sluice gate and preparation of CC-block to be procured mainly from Sylhet directly. Coarse sand available from Sylhet and stone chips (good quality) may be imported from neighbor countries. Cement and Steel will be procured from company sale market of Khulna or will be procured from cement factory and steel factory directly which would not cause any impact on market price. A small amount of sand and cement can be procured from the local market at adjacent to the polder or from Khulna during executions of construction works. No significant impact will be caused due to procurement of sand and cement from local market.

Impact on Livelihood

549. The socio-economic condition of Polder 34/3 will be ameliorated due to the overall development of this region, i.e., construction works of Polder 34/3 will attract labors from outside as well as local people will also get working opportunity.

Impacts of Marine Shrimp Culture Technology

550. In 1998, Bangladesh FisheryDepartment (BFD) extended the culture technology of marine shrimp on a macro scale in Khulna, Bagerhat, Sathkhira and Cox's Bazaar. Following, the popularity of shrimp culture spread in local level. Shrimp culture during dry season is now a very common practice in Polder 34/3 like in other surrounding Polders. Shrimp culture is less labor intensive compared to agriculture. Therefore, the change of land-use from agriculture to aquaculture reduces the employment opportunities in Polder 34/3. One notable positive impact of shrimp culture in Polder 34/3 is that it initiated a financial revolution of the Polder area.However; it has become a monopoly business with serious impacts on remaining agriculture due to the intrusion of saline water for shrimp culture.

Mitigation Measures

- Peripheral rivers should be dredged or capital dredging need to be carried out;
- Crest level 4.5m PWD need to be justified through discussions with local people;
- Protection work can be initiated where scouring occurs;

- Existing regulators need to be checked. If problems found then need to be rehabilitatede or rebuilt based on need;
- Wave breaker should be constructed along the embankment for reducing wave action;
- Social awareness have to be developed on a larger scale through discussing with local people.

Reciprocal Impact

551. Reciprocal impacts of Polder 34/3have been assessed based on the model results conducted by Institute of Water Modelling (IWM). IWM used a rainfall-runoff model, hydrodynamic models and a storm surge model to analyze the existing hydrological situation of the Polder area. IWM evaluated the physical changes in the Polder, which may occur due to climate change. All data used in the model setup and calibration (including topography, soil maps, land use maps, and weather data, river network and cross-section, water level, discharge and salinity) were obtained from national/international sources, published reports and surveys by IWM.

552. The assessment of effectiveness of existing drainage system is performed under climate change scenario RCP 8.5. Climate change condition is added to the model by considering sea level rise of 50 cm at downstream boundary, increase of flow of Ganges with 16% to 28%, Brahmaputra with 8.5 % to 18.5% and Upper Meghna with 8% to 11%. Five days rainfall event is considered with 10 year return period with an increase in rainfall of 178% considering climate change for the simulation for the existing drainage system.

553. From the simulation, flood free (FF) areas and F0 (0~0.3m) areas cover about 33% and 40% of the Polder area, respectively, without considering climate change. The fulfilment of the overall drainage criteria requires about 85% to 90% areFF and F0 land, whereas only 73% of FF and F0 land was found from the simulation without climate change.

554. Considering the climate change scenario FF and F0 land cover are reduced to 17.58% and 19.92% respectively. However, F1 land class (water depth .03m to 0.9m) increases from 27.41% to 62.13%. It indicates that the drainage channels have no proper storing capacity to resist the future climate condition and needs further attention to obtain a climate resilient Polder management.

555. The newly developed, calibrated and validated Bay of Bengal Model has been applied for the study of storm surge modeling. It is a combination of Cyclone and Hydrodynamic (MIKE21FM) models. Three open boundaries are defined in the model, two in the North in the Upper Meghna River at Bhairab and in the Padma River at Baruria. Another one is in the South in the Southern Bay of Bengal up to 16° latitude. The coastal Polders are included in this model as dike. The surge water levels in different return period are presented in **Table 9.2**. It is observed that due to climate change, surge level increases up to 0.17 m.

Table 9.2: Storm Surge level for different return periods with and without climate change condition

Events and Return period	Surge level (m+PWD) without climate change.	Surge level (m+PWD) with climate change.	Change in surge level
10	2.19	2.36	0.17
25	2.59	2.67	0.08

Events and Return period	Surge level (m+PWD) without climate change.	Surge level (m+PWD) with climate change.	Change in surge level
50	2.89	2.89	0.00
100	3.18	3.12	-0.06
Sidr	3.67	-	-
Aila	3.28	-	-

556. Statistical analysis of significant wave height is carried out using extreme value analysis in MIKE Zero. Cyclonic wind field for 19 severe cyclones have been generated using MIKE21 Cyclone model for the entire costal region of Bangladesh. The cyclonic wind speed corresponding to 10, 25, 50, 100 years return periods at Polder 34/3 are 24.33, 34.36, 41.40 and 48.26 m/s whereas during Sidr and Aila the wind speeds were 34.27 and 18.79 m/s respectively.

557. Wind speed for 25 years return period is used for determining the wave height considering climate change. The wave height simulated for Polder 34/3 is 0.32 m.

558. The South West Regional Model (SWRM) has been calibrated and validated using annual maximum monsoon water level of 27 years (1982-2011) for monsoon water level analysis. Water levels corresponding to log-normal return period of 10, 25, 50 and 100 are 2.71, 2.78, 2.84 and 2.88 m + PWD without considering climate change. Water levels considering climate change are 3.19, 3.29, 3.36 and 3.43 m+PWD, respectively.

559. The overall summary of climate change for storm surge is insignificant whereas the monsoon water level governs the overall impact of the Polder. Considering 25 years return period of monsoon water level and maximum wind wave height, the crest level of the Polder should be above 3.56 m + PWD. The present crest levels of the Polder varies from 2.83 to 3.17 m+PWD. So the present crest level is not sufficient to address future climate change and will be increased to 4.60 m providing additional safety for higher return periods land subsidence as part of the re-sectioning of all embankments in Polder 34/3.

10. Environmental Management Plan

560. This Chapter presents the Environmental Management Plan (EMP) for the rehabilitation activities in the Polder 34/3. The EMP essentially provides the implementation mechanism for the Environmental and Social mitigation measures discussed in **Chapter9.**

10.1 Objectives of EMP

561. The basic objective of the EMP is to manage, prevent, and mitigate potentially adverse impacts of Project interventions. The specific objectives of the EMP are to:

- Facilitate the implementation of the environmental and social mitigation measures identified during the present EIA and discussed in Chapter 6.
- Indicate the responsibilities for project proponent, contractors, consultants, and other members of the Project team for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters to ensure effective implementation of the mitigation measures; and
- Assess environmental training requirements for different stakeholders at various levels. Describe communication and documentation requirements.

10.2 EMP Components

562. The EMP components are listed below:

- Institutional Arrangement
- Mitigation Measures and Plan
- Monitoring Plan
- Documentation and reporting
- Contractual arrangements for EMP implementation
- EMP implementation cost
- Capacity building
- Grievance redress mechanism

563. These components are discussed in the following Sections.

10.3 Institutional Arrangement

564. Clearly defined and functional institutional arrangements are essential for ensuring effective and sustainable implementation of the EMP, particularly the mitigation measures identified in the EIA. An Organogram showing the institutional set up of CEIP-1including organization for implementation and monitoring of the EMP is shown in Figure 10.1.

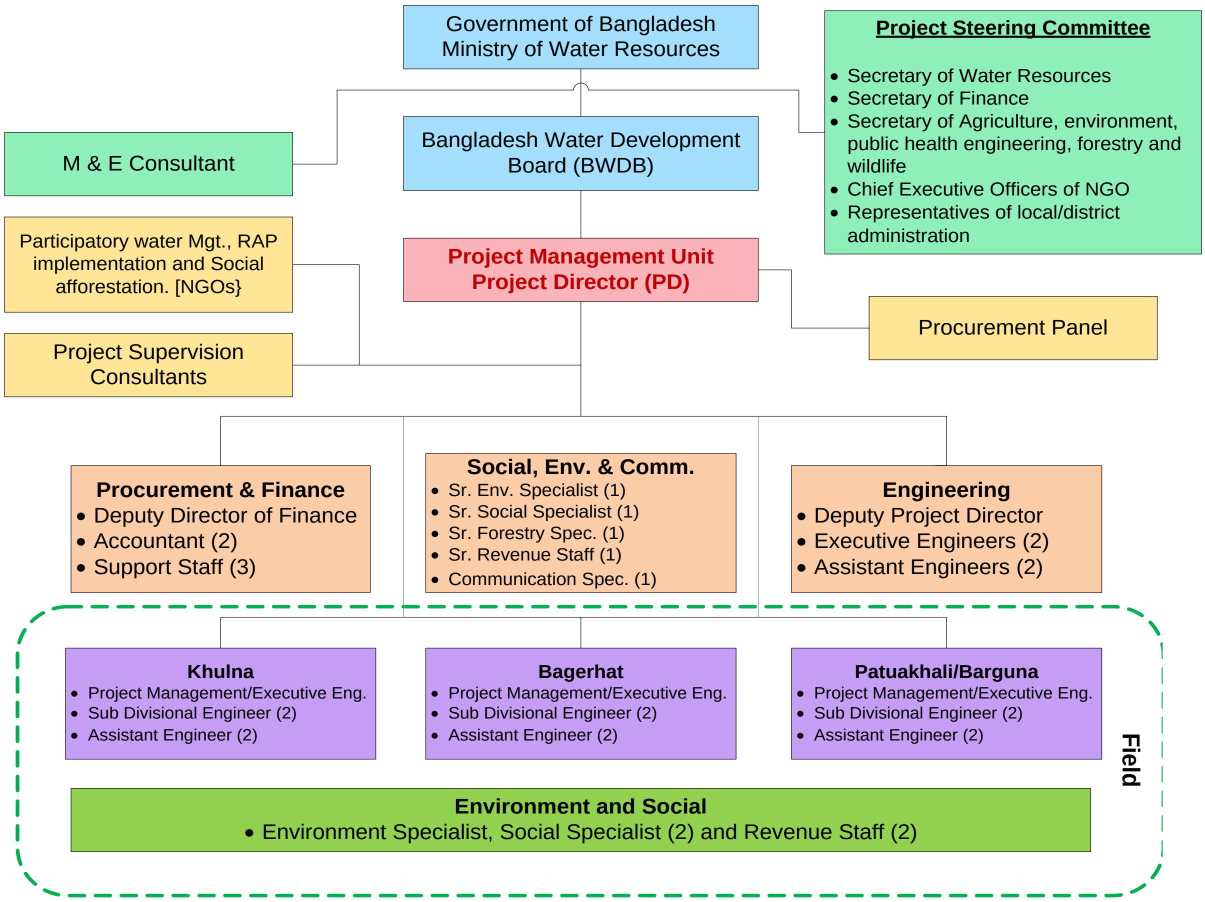


Figure 10.1: Organogram showing the institutional setup for CEIP-1

565. The institutional arrangements proposed to implement the EMP of Polder 34/3 are described in detail below:

Overall Responsibility

566. The overall responsibility of EMP implementation and fulfilling other environmental obligations during the Project rests with the Project Director (PD). For this purpose, the PD will be supported by environmental and social staff of the PMU, Detailed, Design, Construction Supervision and Project Management Support Consultants (DDCS&PMSCs), and Contractors.

Construction Phase

Environment and Social Staff in PMU

567. As described in **Section 5.8**, the BWDB will set up the PMU to manage the Project implementation. The PMU will be led by the Project Director (PD). To manage and oversee the environmental and social aspects of the Project, the PMU will have an Environment, Social, and Communication Unit (ESCU). The Unit will supervise compliance with and implementation of the EMP. The Unit will include a Senior Environmental Specialist. One environment specialist will be posted at the field level to support all three divisions. The ESCUwill maintain liaison with the WB safeguards team, regulatory agencies, and other

stakeholders during the Project implementation. The ESCU will also coordinate with the environmental staff of the DDCS&PMSC. In order to manage the EA process and EMP implementation effectively, the ESCU will be established and made operational before awarding the contract to contractor. The ESCU will be responsible for updating the EIA after receiving the pending information.

568. IPoE will review the updated report and will guide to ESCU for further improvement of the monitoring report, if felt necessary.

Environment and Social Staff with Detailed Design Construction Supervision and Project Management Supervision (DDCS&PMS) Consultants

569. The DDCS&PMSCswill be responsible for overall supervision of Polder rehabilitation related activities. The DDCS&PMSCswill ensure quality control and report to the PD. The DDCS&PMSCs will also assist the ESCU for ensuring environmental compliance and monitoring of progress including EMP and/or ECP implementation. The DDCS&PMSC will supervise the contractors, ensuring design compliance and quality of works. For supervising the EMP implementation, DDCS&PMSC will have dedicated and adequately qualified and experienced environmental staff including field-based environmental monitors (Ems). The DDCS&PMSC will supervise and monitor contractors to ensure compliance with the EMP. The DDCS&PMSC environmental staff will maintain coordination with the ESCU for the effective implementation of EMP and other environmental commitments and obligations of the Project.

Contractor's Environment Supervisors

570. The construction contractors will have an adequate number of dedicated, properly qualified and experienced, site-based Environmental Supervisors (ESs) at the construction sites. The ESs will be responsible to implement various aspects of the EMP particularly the mitigation measures to ensure that the environmental impacts of the construction works remain within acceptable limits. The ESs will maintain coordination with the DDCS&PMSC at the site. The ESs will also be responsible to conduct environmental trainings for the construction crew.

Post-Construction Phase

571. BWDB core unit has post of 4 Assistant Chiefs and 2 Deputy Chiefs to oversee the overall environmental compliance of BWDB implemented projects. Under CEIP, the ESCU will provide training to the BWDB personnelresponsible for monitoring of environmental compliance. Thus, a smooth transition to BWDB will happen to ensure environmental compliance during the O&M after the project completion. These staff will be responsible to manage the environmental aspects of the operation and maintenance of Polder, its water control structures, and other relevant issues such as protection of key environmental resources of the Polder and maintain fish migration. Water Management organizations (WMO) will be formed under the Bangladesh Guidelines for Participatory Water Management (Nov 2000) and involved the beneficiary communities. WMOs will be trained by BWDB to ensure environmental management during project operation. The Environmental Management Unit of BWDB will ensure and oversee the environmental management during project implementation

and operation. The Water Management Organization will also be trained and involved in EMP implementation during the operation phase.

10.4 Mitigation Measures and Plan

572. Mitigation is an integral part of impact evaluation. Where mitigation is deemed appropriate, a proponent should strive to act upon effects, in the following order of priority, to:

- Eliminate or avoid adverse impacts, where reasonably achievable.
- Reduce adverse impacts to the lowest reasonably achievable level.
- Regulate adverse impacts to an acceptable level, or to an acceptable time period.
- Create other beneficial impacts to partially or fully substitute for, or counter-balance, adverse effects.

573. Mitigation measures should be considered starting with the Environmental Assessment process. It is therefore important, that there should be a good integration between the EIA team and project design engineers. Project specific environmental construction guidelines should be developed. These guidelines should specify precautions and mitigation measures for construction activities, and to be included with the EMP. An Environmental Construction guideline has been compiled in Appendix 10 of Environmental Management Framework.

574. Impacts identified severe in consequence category and or likelihood category will be further analyzed to identify additional mitigation measures that are potentially available to eliminate or reduce the predicted level of impact. Potential mitigation measures will include:

- habitat compensation program
- species specific management program
- engineering design solutions
- alternative approaches and methods to achieving an activity's objective
- stakeholders participation in finalizing mitigation measures
- Construction practice, including labor safety and welfare measures.
- operational control procedures
- management systems

575. Mitigation measures during pre-construction, construction and post-construction operation phases have been presented in a tabular form in Table 10.1 which will be used in Polder specific mitigation measure stated in Chapter8. Moreover, cost related EMP has been presented in a different Table 10.6.

Tabel 10.1: Mitigation plan during during pre-construction, construction and operation phases

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
A. Pre-construction Phase			
Deterioration of Environmental Quality (Air and Noise)	• Construction material (sand) should be covered while transporting and stock piled. • The contractors need to be cautious to avoid unnecessary honking of material carrying vehicles, particularly near sensitive areas like schools. • The contractors should be encouraged to move all construction equipment, machineries and materials during day time instead of night, avoiding the rush hours. • Stockyard should be covered during non-working period. • Exhaust emissions from vehicles and equipment should comply with DOE standards. • Vehicles, generators, and equipment should be properly tuned. • Water should be sprinkled where needed to suppress dust emissions. • Speed limits should be enforced for vehicles on earthen tracks. • Vehicles and machinery should have proper mufflers and silencers.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Changes in land use (preparation of construction facilities, borrow areas, others)	• Established all the construction camps within the area owned by BWDB. • Pay compensation/rent if private property is acquired on temporary basis, which instructions should be specified in the tender document. • Labor shed/camp should be constructed on government khas land. • Avoid impacts on local stakeholders. • Any areas used for borrow pits in the foreshore should be away from sensitive areas such as mangrove vegetation.	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
Clearances of vegetation	• Use barren land or possible low vegetated land for placing of materials stock yards • Fuel wood should be collected from local market. • The work should be completed within contracted scheduled time (4 month) • Labor should be made aware about the importance of local floral and faunal species.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Increased Vehicular Traffic during mobilization	• The contractor should prepare a traffic management plan (TMP) and obtain approval from the Design Consultant (DC) and Construction Supervision (CS) consultant. • Contractor also implement mobilization plan considering water vessels and launch movement in the external rivers and, avoid the launch movement time. • The TMP should be shared with the communities and should be finalized after obtaining their consent. • The TMP should address the existing traffic congestion. • Ensure minimal hindrance to local communities and commuters. • The works on embankment should be carefully scheduled to minimize impact on local markets and transportation routes. • The embankment works should be carried out in segments and soil should be placed linearly on half of the embankment, leaving the other half to be used as track. • The works of the first half when completed, and then of the other half should be undertaken. • Work schedule should be finalized in coordination and consultation with local representatives and communities. Specifically union parishad members of the Polder.	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	• Local routes should not be blocked as much as possible. If unavoidable, alternative routes should be identified in consultation with local community. • Vehicular traffic should be moved in the Polder area and also on embankment during off peak time. No school time (10:00 Am to 14:00Pm) and day of marketing time (Hat bar) should be considered during vehicular traffic movement. • Keep provision of training on vehicular traffic moving pattern and management system for the local stakeholders using multimedia presentation and showing Video at different common population gathering places in the Polder area.		
Preparation of Facilities for Contractor and Labor force	• Contractor should prepare site establishment plan and obtain approval from the Construction Supervision Consultants (DDCS&PMSC) • Approval from DDCS&PMSC should be obtained for the location of temporary facilities. • Tree felling and vegetation clearing should be minimized to establish site facilities. • Photographic record should be maintained to record pre-construction condition of the area. • Site facilities should be established at a safe distance from communities. • Contractor should prepare and implement pollution control and waste management plans. • No untreated wastes should be released on ground or in water. • Exhaust emissions from vehicles and equipment should comply with standards. • Vehicles, generators, and equipment should be properly tuned. • Water should be sprinkled where needed to suppress dust emissions.	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	• Speed limits should be enforced for vehicles on earthen tracks. • Vehicles and machinery should have proper mufflers and silencers. • Liaison should be maintained with the communities.		
A. Construction Phase			
Generate Noise and Vibration	• Restricting/limiting construction activities during the day time; • Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards; • Recording noise level of work sites and nearby communities if applicable • Vehicles and machinery should have proper mufflers and silencers; • Provision of noise barriers at schools and other sensitive receptors, as needed; • Provision of PPE (ear muffs and plugs) to labor; • The construction crew should be instructed to use the proper equipment, to minimize noise levels; • Camps should be located at a safe distance from communities	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Deterioration of Air Quality	• Exhaust emissions from vehicles and equipment should comply with standards. • Proper tuning of vehicles, generators, and equipment should be carried out, to minimize exhaust emissions. • Construction material (sand/soil) should be kept covered while transporting and stock piled. • Regular water sprinkling should be carried out where needed, particularly on the earthen tracks near communities. • Vehicle speed should be on low (15 km per hour) on earthen tracks particularly near communities and school. • Vehicles and other machinery should be turned off when idle	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	• Good quality fuel should be used, minimizing exhaust emissions. • Camps should be located at a safe distance from communities and schools.		
Impact of manually C. C. block preparing site	• Ensuring proper quality of eduipment/vehicle to reduce noise level • Proepr management of waste and waste water	Contractor	DDCS&PMSC, M&E Consultnts and BWDB
Degradation of Water Quality	• Contractor should prepare and implement pollution control plan. • Contractor workshops should have oil separators/sumps to avoid release of oily water; • Contractor should use plastic sheet or gravel in the workshop and equipment yard to prevent water contamination. • Material borrowing from the river banks should be carried out sufficiently away from the water line, minimizing the possibility of loose soil to wash away in the river. • Contractor should locate labor sheds/camps including their sanitary installations away from water bodies. • . • Contractor should prepare and implement camp waste management plan (septic tanks, proper solid waste disposal). • Contractor should not release untreated wastes in water. • Contractor should re-use spoil and excavated material where possible. • Contractor should dispose spoil at designated areas with community consent. • Construction material, demolition debris, and excavated soil/silt should not be allowed to enter water bodies.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Increase of Drainage Congestion	• Construct bypass canal before replacement of drainage sluices. • Sequence of work at the drainage sluices and in the water channels should be	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	carefully planned to avoid drainage congestion. • Contractor should ensure that drainage channels are not obstructed or clogged by the construction activities which do not causes any drainage congestion situation in crop fields.		
Increasing of Sedimentation	• Contractor should excavate channels after dewatering them; • Contractor should not leave excavated earth and silt on channel banks; • Contractor should implement measures to protect channels from run-off from work areas and camps; and • Contractor should obtain borrow material from river banks in a manner not to increase siltation in rivers, and should not leave loose soil after excavation.	Contractor	DDS&PMSC, M&E Consultant, BWDB
Affects on agriculture crop production	• Resettlement Action Plan should be prepared and should also be implemented accordingly • Compensation should be paid for any crop damage. • Contractor should avoid cultivation fields during construction. • Contractor should avoid agricultural land for material borrowing, material stockpiling and labor camps construction. • Contractor should ensure that no vehicular movements take place inside cultivation fields. • Contractor should ensure that no material is dumped inside cultivation fields. • Re-excavated soil of canals should not be damp in agricultural land. • Contractor should maintain liaison with communities.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Affects on irrigation	• Contractor should construct bypass channel before construction/repair of each sluices and Inlets. • Sequence of work at the sluices and in the water channels	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	should be carefully planned to avoid irrigation disruption. • Contractor should ensure no negative impacts on crop irrigation. • Contractor should maintain liaison with communities. • Contractor should work during dry season.		
Impacts on Fish Habitat and Habitat Quality	• Contractor should construct bypass canal before construction and repair of each drainage sluice gates and flush sluices. • Re-excavation work should be done in dry season , i.e. during November to May to minimize the hamper of Bagda culture along with fish culture. • Sequence of work at drainage sluice gate, flush sluices and in khals should be carefully planned to minimize impacts on fish migration and fish culture in open water area. • Re-exacation should be done section-wise with cross dam to protect the benthic organisms. • Excavated soil should be dumped on high land at safe distance from the bank of re-excavated khals. • By-pass canals should be dismantled just after the completion of the repairing of the sluice gates and excavation work.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Impacts on Feeding and Spawning Ground of Fish Habitat	• Earth work should be conducted during the dry season (November-May). • Sequence of work at the bank sides of Putimari River in the south and Butiamari River in the west will be planned considering local fisheries condtion to minimize impacts on spawning and subsequently nursery ground of fish. • Earth work should be conducted during the dry season (November-February)	Contractor	DDSCS&PMSC, M&E Consultant and , BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	• Sequence of work at the bank side of Putimari River in the south and Butiamari River in the west will be carefully planned to minimize impacts on spawning and subsequently nursery ground of fish. • Contractor will maintain liason with experienced fishermen.		
Impacts on Fish Movement and Migration	• Duration of construction of structures and other interventions should be shortened as much as possible at least should maintain the contract period. • Dismantle bundhs and other obstructions built to support the construction of structures as soon as work is over. • For manual re-excavation of Khals, compartments could be built in a cascade manner and bailing out of water to take place from one compartment to another to avoid damage to fish. • Sequence of construction of regulators and re-excavation of drainage Khals should be set scientifically so that implementation of project could be completed with minimum hindrance to fish migration. • Contractor will maintain liaison with communities so that they could realize the issue. It is more important in case of timing of entering water into the Polder for shrimp culture along with paddy cultivation and exiting water from the same. • Liaison of contractor with community would create scope for setting proper time for the construction work so that no or insignificant impact to the shrimp farming and paddy cultivation is caused.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Clearance of vegetation	• Collect soil from barren land as much as possible • Proper turfing should be implement at embankment slopes with local grasses and	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	ensure regular monitoring of turf grasses till they matured • Avoid construction activities during favourable time of wild life movement (early morning and night) • Give proper compensation to the tree owners against tree felling. • Implement plantation with native species (i.e Sirish (*Albizia lebbeck*), Narikel (Cocos nucifera), Tal(*Boassus flabelifer*), Khejur(*Phoneix sylvestirs*), etc) at the damaged sites (sluice ground and nearer foreshore mudflats) after construction works. • Avoid construction activities during favorable time of wild life movement (early morning and night) • Keep untouched the deepest points of the khal as much as possible. • Use excavated soil spoils for khal dyke re-sectioning • Implement tree plantation with local species (Fruit and timber tree) at the khal bank side after re- excavation work where excavated soil dumped khal bank side. • Use minimum land as much as possible for excavator/ labor movement		
Outbreak of plant diseases	• Aware labors about plant conservation who are engaged for afforestation activities • Collect saplings from nearer natural source as much as possible. • All kinds of polyethylene bags and plastic ropes should be piled up in a pit for dumped or burned in a proper way • Care should be taken for physical and biological control of plant disease while raising nursery and sapling plantation (i.e.: using of disease free seeds, proper treatment of nursery soils, using appropriate	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	doses of pesticides and fertilizers) • Pre-consultation with Forest Department and other related non-government organizations for selecting of suitable species for plantation and spacing of the saplings • Develop a pest management plan for the holistic afforestation		
Safety and Public Health Hazards	• Liaison will be established with the Bangladesh Meteorological Department for early warning of storms and cyclones. Radio and television sets will be kept in all the labor camps for obtaining weather information. • The contractors will prepare site specific Camp management plans, an Occupational health and safety plan including training programs as well as an Emergency response plan with early warning system and training programmes to be approved by the DDCS&PMS Consultants and PMU. The Plan will also include awareness raising and prevention measures, particularly against communicable diseases such as hepatitis B and C, and HIV/AIDS. Besides: • The WB's EHS Guidelines will be included in the contract documents The WBG's EHS Guidelines are to be included in the contract documents and that should be followed during construction. • Each contractor will prepare an Emergency Response Plan defining procedures to be followed during any emergency. This plan will be submitted to Construction Supervision Consultants for review and approval; • All temporary facilities including labor camps will meet minimum safety, hygiene and sanitation requirements (safe drinking water, proper sewage disposal, solid waste management, general cleanliness, protection	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	against disease vectors, and protection against weather elements, firefighting, and other similar essential services). • The labour shed/camps for accommodation of workers should be constructed according to the IFC/EBRD workers accommodation guidelines. • All workers must be provided with and use appropriate Personal Protective Equipment (PPE). First aid must be provided and there would be procedures in place to access appropriate emergency facilities. • The construction sites will have protective fencing to avoid any unauthorized entry, where appropriate and possible. • Health screening of employees would be a Contractor obligation prior to labourers working on site and living in the temporary accommodation facilities. The health screening would entail normal review of physical fitness and also include a review of appropriate vaccinations. Workers would be given vaccinations as and when required. • All site staff will undergo screening against communicable diseases. Communicable disease careers will not be employed at the working site. • All employees need to carry out induction health and safety training prior to commencement of work. Training would include the provision of appropriate written or visual materials to reinforce learning. Where illiteracy levels are high, OHS issues need to be covered more frequently than normal in toolbox talks. • Public awareness training and workshops on safety and health risks will be conducted for local		

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	communities prior to and during construction operations. • Observing statutory requirements relating to minimum age for employment of children and meeting international standards of not employing any persons under the age of 16 for general work and no persons under the age of 18 for work involving hazardous activities. The construction contractor(s) would not hire people under the age of 18 on permanent contracts but would include short training activities for youth to the extent possible. • Ensure the acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work; • Ensure that no workers are charged fees to gain employment on the Project. • Ensure rigorous standards for occupational health and safety are in place. • Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal. • The contractor will adopt a Human Resource Policy appropriate to the size and workforce which indicates the approach for management employees (this could be part requested in the tender process). • Produce job descriptions and provide written contracts and other information that outline the working conditions and terms of employment, including the full range of benefits; • Provide health insurance for employees for the duration of their contracts; • Provide insurance for accidents resulting in disabilities or death		

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	of employees for the duration of their contracts; • Employ a community liaison officer (this could be full time or part of another post's responsibilities); • Raise awareness prior to recruitment, clarifying the local hire policy and procedures, including identification of opportunities for women to participate in employment and training; • Report regularly on the labor force profile, including gender, and location source of workers; • Hold toolbox talks on workers' rights and the labor grievance mechanisms during the construction phase; • Organize a training program and keep training registers for construction workers; • Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system, which provide workers with a safe and healthy working environment taking into account the inherent risks for this type of project. • Availability of safe drinking water will be ensured for the construction staff. • First aid boxes will be made available at each construction site. Emergency phone numbers (including hospitals, Fire Department, and Police) will be displayed at key locations within the site. Each site will have an ambulance facility. • Firefighting equipment will be made available at the camps and worksites. • The camp staff will be trained for safety against firefighting. • All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel. • Waste management plan to be prepared and implemented in accordance with international best practice.		

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	• Liaison with the community will be maintainedLiaison with the community should be maintained.		
Hindrance for Pedestrian and Vehicle Movement	• The works on embankment should be carefully scheduled to minimize impact on local markets and transportation routes. • The embankment works should be carried out in segments and soil should be placed linearly on half of the embankment, leaving the other half to be used as track. When the works are completed on the first half, it should be opened for local traffic while works should be undertaken on the other half of the embankment. • Work schedule should be finalized in coordination and consultation with local representatives and communities. • Local routes should not be blocked as much as possible. If unavoidable, alternative routes should be identified in consultation with local community.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Social unrest between Local worker and outside worker	• Proper awareness programs should be conducted through public consultation measures such as village scoping sessions, meetings, and placement of bill boards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officers. • Liaison with the communities should be maintained. • Cultural norms of the local community should be respected and honored. • GRM should be established to address the grievances of local as well as outside laborers. • Careful use of local natural resources and project resources, fuel, fuel-wood and electricity.	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	• Restrictions related to consumption of alcohol and drugs. • Safe driving practices. • Respect for the local community and its cultural norms in which laborers are working. • Avoiding construction activities during Prayer time.		
Social and Gender Issues	• Proper awareness programs will be conducted through public consultation measures such as village scoping sessions, meetings, and placement of bill boards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officers. • Liaison with the communities will be maintained. • Cultural norms of the local community will be respected and honored. • GRM will be established to address the grievances of local as well as outside laborers. • Careful use of local natural resources and project resources, fuel, fuel-wood and electricity; • Restrictions related to consumption of alcohol and drugs for foreign workers; • Safe driving practices; • Respect for the local community and its cultural norms in which laborers are working. • Avoiding construction activities during Prayer time.	Contractor	DDS&PMSC, M&E Consultant, BWDB
Increased inland and waterway traffic	• Contractor to prepare and implement traffic management plan. • Contractor to establish new, temporary jetties where needed. • River crossing for material transportation during nighttime where possible and appropriate • Material transportation through rivers during high tide where needed. • Liaison to be maintained with community and BIWTA.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Seasonal Impacts (Natural Hazards)	• The contractors will prepare site specific Emergency response	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
	plan with early warning system and training programmes to be approved by the DDCS&PMS Consultant and PMU, incorporating: • Weather signals should be considered by the contractor during construction works. • Radio and television should be provided in all the labor sheds for receiving weather information through these media. • Ensuring rigorous standards for occupational health and safety are in place.		
Labor force related impacts	• The Contractor will provide proper housing for his staffs at a site with adequate facilities securing neighbours are not disturbed. • The Contractor will prepare and implement a Code-of-Conduct for his staff showing respect to comply with and not offend local customs and cultural norms.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Damage to Local Infrastructure	• The condition of the infrastructure being used for the construction and transportation activities should be regularly monitored. • All damaged infrastructure should be restored to original or better condition. • To take preventive measures for protection of local infrastructure.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
B. Post-construction phase			
Increase Salinity Intrusion due to leakage of drainage sluices	• Formation of WMOs in concern with the structures and embankment • Regular monitoring and careful maintenance of the water control structures should be ensured. • Standard operating procedures should be prepared and implemented for the water control structures. These procedures should be translated in bangle as well. • Capacity building of WMOs should be carried out.	BWDB	BWDB
Increase of sedimentation in	• An ongoing program of de-silting of water channels should	BWDB	BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
water channels and rivers	be considered with full community involvement and participation. • Provide silt management plan • The local government (union parishad) should be authorized to monitor the development activities. • Prepare Bangla manual for sluice gate operation and provide training to WMOs; and • Include farmers and fishermen in WMOs for conflict resolution		
Hampered fish migration	• Proper sluice gate operation allowing fish migration. • For Sluice gate operation a manual will be prepared for facilitation of fish migration • WMO will be provided training to follow the manual to facilitate fish migration • provide training to WMOs; • Transferring juvenile fish from rivers to Polder.	BWDB with the help of DoF	BWDB
Risk of embankment failure	• Regular monitoring and careful maintenance of the embankment and existing water control structures especially along the eastern side of the Polder will be ensured. This monitoring will particularly be carried out before and after monsoon season. • Prevention of establishing hand tube-wells at the crest of the embankment. • Available cyclone and flood shelter will be prepared as a contingency measure during emergency situation. • WMG will develop a fund for this kind of emergency situation. • Structural measures like geo bag and sand bag will be kept in stock yard of local BWBD colony.	BWDB	BWDB
Soil and water contamination	• Capacity building and awareness raising of the	BWDB with the help of DAE	BWDB

Potential Impacts	Mitigation Measures	Responsible Agency for implementation of mitigation	Monitoring/Supervision Agency
(Increased use of agro-chemicals)	farmers will be carried out by the Project Authority (BWDB) to practice Integrated Pest Management (IPM) and Integrated Crop Management (ICM) – in order to minimize usage of chemical inputs. • Farmers group would have close contact with DAE for adoption of various measures of ICM. • Farmers would be encouraged to use organic manure to increase soil fertility while avoiding water contamination, and • Farmers would be encouraged to cultivate leguminous crops to enhance the soil quality as well as soil productivity.		

576. Based on the experience, a generic Mitigation Measures for EMP has been presented in Table 10.2 for reference. This can be used as a reference material for comprehending the scope of the EMP.

Table 10.2: Generic Mitigation/Compensation Measures/Guideline
(ECoP: Environmental Code of Practice)

Parameter/Activities	Mitigation/Compensation Measure/Guideline
ECoP 1: Soil/ Land Management	
Sources of Material for Earthwork	• During design the segment wise soil requirement and location of the sources of soil for earthwork for each Polder construction/rehabilitation will be identified. • Selection of Borrow areas for earthen material collection. • No objection from land owner/Revenue authorities as applicable • Contractor shall ensure good qualityof borrow materials to be used for embankment filling • Disposal of excess soil will be done at site with no objection from DoE and local authority
Borrowing of Earth	**Borrow Area Selection** Borrowing close to the toe line on any part of the embankment is prohibited. Earth available from dredging may be used as embankment material (if necessary and applicable), subject to approval of the Engineer, with respect to acceptability of material. Borrowing to be avoided on the following areas: • Lands close to toe line and within 500m from toe line. • Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles although borrowing of agricultural land need to be avoided. • Grazing land. • Lands within 1km of settlements. • Environmentally sensitive areas such as reserve forests, protected forests, sanctuary, wetlands. Also, a distance of 500 m will be maintained from such areas. • Unstable side. • Water-bodies (only if permitted by the local authority, and with specific pre-approved redevelopment plans by the concerned authority and engineer-in-charge) • Streams and seepage areas. • Areas supporting rare plant/ animal species. **Documentation of Borrow Pit** The contractor must ensure that following data base must be documented for each identified borrow areas before commencing the borrowing activity that provide the basis of the redevelopment plan. • Chainage along with offset distance; • Area (Sq.m); • Photograph and plan of the borrow area from all sides; • Type of access/width/kutcha/pucca etc. from the roadway; • Soil type, Slope/drainage characteristics; • Water table of the area or identify from the nearest well, etc; • Existing land use, for example barren / agricultural /grazing land; • Location/name/population of the nearest settlement from borrow area; • Quantity excavated (likely and actual) and its use; • Copy of agreement with owner/government; and • Community facility in the vicinity of borrow pit. • Rehabilitation certificate from the land owner along with at least four photograph of the rehabilitated site from different angles.
Re-excavation operation and Management of Excavated Material	To minimize the adverse impact during re-excavation of material following measures are need to be undertaken: • Adequate drainage system shall be provided to the excavated area • At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff. The followings precautions shall be undertaken during quarry operations.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Overburdened labours shall be removed. • During excavation slopes shall be flatter than 20 degrees to prevent their sliding. • In case of blasting, the procedure and safety measures shall be taken as per DOE guidelines. • The Contractor shall ensure that all workers' related safety measures shall be taken. • The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation. • During transportation of the material, measures shall be taken to minimize the generation of dust and to prevent accidents.
Handling Dredged Material from khals re-excavation	• Deposition of dredged material will be away from the channel edge to limit damage to streamside habitats. This also allows a degree of flooding to occur on the floodplain, thereby creating opportunities for wet grassland, scrub/wet woodland, wetlands and seasonally grazed rough grass. • Where possible biotechnical engineering, for example geo textiles, may be used to help stabilize the material and aid re-colonization. • Other possibilities include: drying and spreading the spoil over adjacent land, which can improve soil fertility in some cases, but may also smother important flora and habitats; excavating a trench and infilling it with spoil, thus minimizing disturbance to agriculture and the local environment; dumping off-site is possible but expensive, using spoil to create artificial wetlands • Dredged material to be tested for any pollutants and treated if contaminated, prior to any beneficial use.
ECoP 2: Water Resource & Hydrology Management	
Hazardous Waste Management	The contractor will minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes).
Ponding of water/water logging	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all the storage containers that are capable of storing of water, after use or store them in inverted position • Reinstate relief and landscape • Monitor drainage pattern after high down pouring and recession flood • Connect water pockets to the nearest drainage structures/canals
Top Soil management	• The Contractor shall water the material stockpiles, access roads and bare soils as and required to minimize dust emissions. Increase the watering frequency during periods of high risk (e.g. high winds) • All working sites (except permanently occupied by the road and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover). • Ensure that roads used by construction vehicles are swept regularly to remove sediment
Construction activities in water bodies	• Protect water bodies from sediment loads by silt screen or bubble curtains or other barrier. • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets • Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary
ECoP 3: Air Management	
Construction vehicular traffic	The Contractor will • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel efficient manner • Cover haul vehicles carrying dusty materials (cement, borrow and quarry) moving outside the construction site

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Materials will be transported to site in off peak hours.
Construction activities	• Water the material stockpiles, access roads and bare soils when needed to minimize the potential for environmental nuisance due to dust. • Increase the watering frequency during periods of high risk (e.g. high winds). • Stored materials such as excavated earth, dredged soil, gravel and sand shall be covered and confined to avoid their being wind-drifted • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site • Restore disturbed areas/side of the embankment as soon as practicable by plantation/vegetation/grass-turfing • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems
Odor from Construction labor Camps	• Construction worker‘s camp shall be located at least 500 m away from the nearest habitation. • The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odor is generated.
ECoP 4: Noise Management	
Construction vehicular traffic	• Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise at the work site.
Construction machinery	• Appropriately site all noise generating activities to avoid noise pollution to local residents • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures.
Construction activity	• Notify adjacent landholders/Schools prior any typical noise events outside of daylight hours • Employ best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Plan activities on site and deliveries to and from site to minimize impact • Monitor and analyze noise and vibration results and adjust construction practices as required • Avoid working during 09:00pm to 06:00 am within 500m from residences.
ECoP 5: Agriculture Management	
Loss of Top Soil	• Soil from fallow lands/ non-agricultural lands will be used in earthwork in embankments • Collect/strip top soil before earth filling and store and reuse it for final surfacing of embankment top and tree plantation/a forestation. • Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m • Remove unwanted materials from top soil like grass, roots of trees and similar others • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Locate topsoil stockpiles in areas outside drainage lines and protect from erosion • Spread the topsoil to maintain the physic-chemical and biological activity of the soil. • The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites • Topsoil stockpiles will be monitored and will any adverse conditions be identified corrective actions will include: o Anaerobic conditions-turning the stockpile or creating ventilation holes through the stockpile; o Erosion – temporary protective silt fencing will be erected;
Soil salinity	• Use of aquatic plants like duckweed will remove soil salinity.Flushing with pre-monsoon rain water will reduce soil salinity. • Saline tolerant crops need to be cultivated. • Environmentally and socially responsive shrimp farming e.g. shrimp-rice farming system is encouraged. • Increasing upland discharge of fresh water will push back ingress of saline water from the sea • Green manure application is promoted • Ground water abstraction for shrimp farming will be avoided.
ECoP 6: Fisheries Management	
Earth work for constructing by pass canal	• Earth work for by pass should be done in dry season. • By-pass canal should be dismantled just after completing the construction and repairing of drainage sluice gates, flushing sluices and re-excavation of khals.
Bailing out of water by manual labor or pump	• Bailing out of water should be done by constructing the compartments in the khals. • Entire khals should not be closed during construction work.
Construction works for drainage sluice gate, construction/repair of flushing inlets and re-excavation of khals	• Construction and re-excavation should be avoided during spawning of the fishes and peak time of fish and shrimp culture in gher. • Construction work should be done in winter and early dry season (November to February). • Critical breeding area of small indigenous fish species (SIS) will be identified and declared as sanctuaries. • Creation of some deeper part in the khals and declared as sanctuaries where brood fish and juveniles may stay during dry season and can breed in the following year. • Soil removed from the bottom of khals should be placed in safe distance from the bank of khals and compact to avoid the flash out during rainy season. • Open the sluice gates just after completion of construction and repair work to flow the water.
ECoP 7: Ecology Management	
Clearances of vegetation	• Use barren land or possible low vegetated land for placing of materials stock yards • Fuel wood should be collected from local market. • The work should be completed within contacted scheduled time (4 month) • Labor should be made aware about local faunal species • Collect soil from barren land as much as possible • Proper turfing should be implement at embankment slopes with local grasses and ensure regular monitoring of turf grasses till they matured • Avoid construction activities during favorable time of wild life movement (early morning and night) • Give proper compensation to the tree owners against tree felling. • Implement plantation with native species (i.e. Sirish (*Albizia lebbeck*), Narikel (*Cocos nucifera*), Tal(*Borassus flabelifer*), Khejur(*Phoneix*

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	sylvesris), etc) at the damaged sites (sluice ground and nearer foreshore mudflats) after construction works. • Avoid construction activities during favorable time of wildlife movement (early morning and night) • Keep untouched the deepest points of the khal as much as possible. • Use excavated soil spoils for khal dyke re-sectioning • Implement tree plantation with local species at the khal bank side after re-excavation work where excavated soil dumped khal bank side. • Use minimum land as much as possible for excavator/ labor movement
Outbreak plant diseases	• The contractor shall hoist signboard at work site mentioning the details of activities to be done along with cost, work tenure, name and address of firm. It shall also contain the address of supervision organization, who may be informed of any grievances of the activities. • Aware labors about plant conservation who are engaged for afforestation activities • Collect saplings from nearer natural source as much as possible. • All kinds of polyethylene bags and plastic ropes should be piled up in a pit for dumped or burned in a proper way • Care should be taken for physical and biological control of plant disease while raising nursery and sapling plantation (i.e.: using of disease free seeds, proper treatment of nursery soils, using appropriate doses of pesticides and fertilizers) • Pre-consultation with Forest Department and other related non-government organizations for selecting of suitable species for plantation and spacing of the saplings • Develop a pest management plan for the holistic afforestation.
ECoP 8: Socio-Economic Management	
Construction Camp Management	
Construction Camp Facilities	The following facilities will have to be provided by the Contractor • Adequate housing for all workers • Safe and reliable water supply • Hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities • Provide in-house community/common entertainment facilities, dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Solid Waste Management	• Ensure proper collection and disposal of solid wastes within the construction camps • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. • Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Not to establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved disposal sites
Health and Hygiene	• Provide adequate health care facilities within construction sites • Provide first aid facility round the clock. Maintain adequate stock of medicines in the facility • Provide ambulance facility for the laborers during emergency for transferring to nearest hospitals. • Initial health screening of the laborers coming from outside areas • Train all construction workers on basic sanitation and health care issues and safety matters, and on the specific hazards of their work • Provide HIV awareness programming, including STI (sexually transmitted infections) • HIV information, education and communication for all workers on regular basis

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during monsoon. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. • Place display boards at strategic locations within the camps containing messages on best hygienic practices
Payment of Wages	• The payment of wages will be as per the Minimum Wages Act, Department of Labor, and Government of Bangladesh for both male and female workers. • Display of the minimum wages board at camps and major construction sites will be made in local languages at the construction and labor camp sites. • Wages will be paid to the laborers only in the presence of BWDB staff; • Contractor is required to maintain register for payment of labor wages with entry of every labor working for him. Also, he has to produce it for verification if and when asked by the DDCS&PMSC, PMUand/or the concerned BWDB staff/DDCS&PMSC‘s representative. • Contractor to follow the guidelines of prevalent by law 5 of Bangladesh Labour Act, 2006.
Damage and Loss of Cultural Properties	
Conservation of Religious Structures and Shrines	• All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including temples, mosques, churches and shrines, etc., graveyards, monuments and any other important structures as identified during design and all properties / sites / remains notified. No work shall spillover to these properties and premises. The design options for cultural property relocation and enhancement need to be prepared. • All conservation and protection measures will be taken up as per design. Access to such properties from the road shall be maintained clear and clean.
	• During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from the PD. The Archaeological Department shall be intimated of the chance find and the DDCS&PMSC shall carry out a join inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work. • All fossils, coins, articles of value of antiquity, and structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation.
Worker’s Accident Risk	
Risk from Operations	• The Contractor is required to comply with all precautions as required for the safety of the workmen as per the International Labor Organization (ILO) convention. The contractor shall supply all necessary safety appliances such as aprons, safety goggles, helmets, masks, boots, etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and outlet.
Risk from Electrical Equipment	• Adequate precautions will be taken to prevent danger from electrical equipment. No materials on any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant Bangladesh Standards (BS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	maintained as per BS provisions and to the satisfaction of the DDCS&PMSC.
Risk from Hazardous Activity	• All workers employed on mixing material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Stone-breakers will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals.
Disruption to Users	
Loss of Access	• At all times, the Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock. Work that affects the use of existing accesses shall not be undertaken without providing adequate provisions to the prior satisfaction of the DDCS&PMSC. • The works shall not interfere unnecessarily or improperly with the convenience of public or the access to, use and occupation of public or private roads, and any other access footpaths to or of properties whether public or private.
Traffic Management	• Special consideration shall be given in preparation of the traffic control plan for the safety of pedestrians and workers at night • The temporary traffic detours in settlement areas shall be kept free from dust by frequent application of water
Traffic Control and Safety	• The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain barricades, including signs, markings, flags, lights and flagmen as may be required by the DDCS&PMSC for the information and protection of traffic approaching or passing through the cross section.

10.5 Chance-Find Procedures for Physical Cultural Property

577. The Contractor will be responsible for familiarizing themselves with the following “Chance Finds Procedures” in case culturally valuable materials are uncovered during excavation or any project activities as per Antiquities Act, 1968, including:

- Stop work immediately following the discovery of any materials with possible archaeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;
- Protect artefacts as well as possible using plastic covers, and implement measures to stabilize the area, if necessary, to properly protect artefacts;
- Prevent and penalize any unauthorized access to the artefacts; and
- Restart construction works only upon the authorization of the relevant authorities (e.g. Upazila Nirbahi Officer, Deputy Commissioner and Department of Archaeology).

10.6 Monitoring Plan

578. Extensive monitoring of the environmental concerns of the CEIP-1 will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv)overall effectiveness of the project environmental protection measures. The monitoring plans should be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive database of the Polder specific

Environmental Impact and Monitoring information should be created, which will help to evaluate the impacts easily.

579. The Monitoring activities during design/preconstruction period are:

i. (i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and

ii. (ii) Checking that the contract documents' (Construction Environmental Action Plan) references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out in good time.

580. Construction environmental monitoring is a function of supervision, and the essential purpose is to ensure adherence to the EMP. The monitoring is a daily process, which ensures that departures from the EMP are avoided or quickly rectified, or that any unforeseen impacts are quickly discovered and remedied.

581. Post project monitoring evaluation will be carried to evaluate the impacts of the Project during first three (3) years of operation of the Project. Regular monitoring of the condition of the embankment, drainage structures and slope protection structures and afforestation are important from an environmental management point of view. In addition to this activity, information on the locations, type and consequences of flooding, erosion, flora and fauna mortality, availability of fish, occupational shift, migration is required. Recommended air, noise and water quality monitoring, greening and landscaping and community feedback are also included in the Monitoring Plan. The monitoring plan and details of monitoring locations for environmental condition indicators of the project during the construction and operation stage are presented in Table 10.3 and Table 10.4.

Table 10.3: Environmental Monitoring Plan during Construction and Operation of PolderSystem

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Construction					
Sources of Material	Work Site	Possession of official approval or valid operating license of suppliers materials (Cement, soil).	Before an agreement for the supply of material is finalized.	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Operation of borrow site	Borrow pit/site	Visual inspection of borrow site and ensuring operational health and safety	monthly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Top Soil	Storage area	Top soil of 0.15 m depth will be excavated	Beginning of earthwork	Contractor	DDCS&PMSC, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		and stored properly			
	do	The stored top soils will be used as cladding material over the filled lands	Immediatel y after filling and compaction of dredge materials	Contractor	DDCS&PMSC, BWDB
	Work Site	Some of the top soil are placed on top and berm of embankment for turfing and plantation	At the end of filling activity	Contractor	DDCS&PMSC, BWDB
Erosion	Side slopes of the embankments and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	At the end of filling activity	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Monthly	Contractor	DDCS&PMSC, BWDB
Air quality (dust)	Construction site	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Daily	Contractor	DDCS&PMSC, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
	Material storage sites	Visual inspection to ensure dust suppression work plan is being implemented	Monthly	Contractor	DDCS&PMSC
Air Quality (PM_{10}, $PM_{2.5}$)	Close to School/ Madrasha, Hospital &Villages	Air quality monitoring	Dry season	Contractor through a nationally recognized laboratory	DDCS&PMSC, M&E Consultant, BWDB
Noise	Construction sites	Visual inspection to ensure good standard equipment are in use	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
	Construction sites	Ensure work restriction between 09:00 pm-6:00 am close to School/ Madrasha, Hospital & Villages	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Surface Water Quality (TDS, pH, DO, BOD, COD etc)	Water sample at each of river for each Polder	Sampling and analysis of surface water quality	Dry season	Contractor through a nationally recognized laboratory	DDCS&PMSC, M&E Consultant, BWDB
Drinking Water Quality(TDS, pH, FC, as if groundwater etc)	Sources of drinking water at construction camp/site	Sampling and analysis of water quality	yearly	Contractor through a nationally recognized laboratory	DDCS&PMSC, M&E Consultant, BWDB
Sanitation	Construction camp/site	Visual Inspection	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB
Waste Management	Construction camp and construction site	Visual inspection of collection, transportation and disposal of solid waste and solid waste is deposited at designated site	Weekly	Contractor	DDCS&PMSC, M&E Consultant, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
Top Soil	Storage area	Top soil of 0.15 m depth should be excavated and stored properly	Beginning of earthwork	Contractor	DDCS&PMSC, BWDB
	Storage area	The stored top soils should be used as cladding material over the filled lands	Immediatel y after filling and compaction of dredge materials	Contractor	DDCS&PMSC, BWDB
	Work Site	Some of the top soil are placed on top and berm of embankment for turfing and plantation	At the end of filling activity	Contractor	DDCS&PMSC, BWDB
Construction of drainage sluice and construction/repair of flushing inlets	Construction site	Physical Observation	Weekly	Contractor	BWDB
Bailing out of water by manual labor or pump	Construction site	Physical Observation	Weekly	Contractor	BWDB
Re-excavation of Khals	Construction site	Physical Observation	Weekly	Contractor	BWDB
Cut off trees	Each of construction sites at embankment	Survey and comparison with baseline environment	Quarterly	Contractor through nationally recognized institute	DDCS&PMSC, M&E Consultant, BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Monthly	Contractor	DDCS&PMSCand BWDB Authority
During Operation and Maintenance					
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, COD etc)	Water sample at each of river for each Polder	Sampling and analysis of surface water quality	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
Air Quality (Dust PM_{10}, $PM_{2.5}$)	At the baseline monitoring site	24 hours Air quality monitoring	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Operation of hydraulic structure	In the project area	Visual inspection and public feedback	Yearly	BWDB	M&E Consultant
Crop production	In the Polder area	Compare the production with the baseline	3 (Three) cropping season	BWDB through a nationally recognized institution	M&E Consultant
Soil quality	In the Polder area	Compare the soil quality with the baseline	Two (2) times of year (dry & wet season)	SRDI	M&E Consultant
Soil salinity	In the Polder area	Compare the soil salinity with the baseline	Once (1) times of year (dry season)	SRDI	M& E Consultant
Fish Species Diversity and Richness	Khals and Sluice Gates adjacent River	Catch Assessment and Physical Observation	Two times per year (dry & wet season)	BWDB/ WMA	BWDB with collaboration of DoF
Habitat Condition	Khals and Sluice Gates adjacent River	Physical Observation and Testing of Water Quality Parameter (i.e. DO, pH, Salinity and Turbidity etc.)	Quarterly four times per year (dry & wet season)	BWDB/ WMA	BWDB with Collaboration of DoF
Monitoring the Status of Fish Sanctuaries and benthic fauna	Deeper part of the khals	Physical Observation and Fish Sampling	Quarterly four times per year	BWDB/ WMA	BWDB with Collaboration of DoF
Monitoring other vertebrates (amphibians, reptiles, birds, mammals) and plants		Physical observation and sampling	Annual, once a year	NGO	BWDB/Forest Department

Table 10.4: Environmental Monitoring Plan during Construction and Operation of Afforestation

Parameter	Locations	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During implementation					
Plant species selection	Nursery	Visual inspection. Type and variety of plant species to be planted for turfing on the top of embankment and foreshore	Before plantation	Contractor	DDCS&PMSC, BWDB, M&E Consultant
Waste Management	Afforestation sites and Nursery	Visual inspection of collection, transportation and disposal of poly bags, debris and disposed at designated site	Weekly	Contractor through nationally recognized institute, NGO	DDCS&PMSC, BWDB, M&E Consultant
During Operation and Maintenance					
Survival and growth of coastal afforested saplings and turfed grasses	Proposed afforestation foreshore area and re-sectioned embankment	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute, NGO	DDCS&PMSC, M&E Consultant, BWDB
Faunal composition	Proposed afforestation foreshore area and along the re-sectioned embankment	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute, NGO	DDCS&PMSC, M&E Consultant, BWDB

<u>Qualitative Spot Checking Indicators</u>

582. Moreover, a rapid environmental monitoring will be carried out as per the following checklist in terms of visual judgment during field visit as a control of the implementation of the Environmental Mitigation plan. Table 10.5 can be followed during the construction phase.

Table 10.5: Spot Checking Indicator

Parameter	Visual Judgment			
	Poor	Moderate	Satisfactory	Comments
Workers Safety (use of PPE, provision of safe driniking water, sanitation facility and first aid facilities, training for worker's awareness etc.)				
Camp Site Management				
Plant Site Management				
Borrow Area Management				
Top Soil Prevention				
Waste Management				

Parameter	Visual Judgment			
	Poor	Moderate	Satisfactory	Comments
Occupational Health and Safety				
Stockpiling of construction materials				
Reporting and Documentation				

10.7 Third Party (M&E Consultants) Validation

583. BWDB will engage independent consultants to conduct a third party validation (TPV) of the EMP implementation on yearly basis during the construction phase. During the TPV, the consultants will review the implementation and effectiveness of various EMP activities including mitigation measures, environmental monitoring, trainings, and documentation. The consultants will also identify gaps and non-compliances in EMP implementation and propose actions for their remedy.

10.8 Documentation, Record keeping and Reporting

Record Keeping

584. Proper arrangements are necessary for recording, disseminating and responding to information which emerges from the various environmental monitoring and management programs. They are also necessary for rendering the environmental management system "auditable". However, the primary focus must remain on the pragmatic control of pollution, not the creation of complex bureaucratic procedures. BWDB will maintain database of the Polder specific Environmental Impact and Monitoring information for keeping all type of monitoring record. The ESCU will assist BWDB for keeping those records initially. The trained BWDB staff will take the responsibility of record keeping and monitoring during operation phase.

Monitoring Records

<u>Quantitative Physical Monitoring</u>

585. The objective of quantitative physical monitoring is to ensure that the mitigation measures designed to prevent, reduce and where possible offset any significant adverse impacts on the environment are being implemented throughout the Project lifecycle. DDCS&PMSC will regularly monitor and provide information to ESCU for updating the database. DDCS&PMSC will provide the following information bi-weekly to ESCU, if not urgent.

- Sampling points;
- Dates and times of sample collection;
- Test results;
- Control limits;
- "Action limits" (circa 80 percent of the control limits) at which steps must be taken to prevent the impending breach of the control limit; and
- Any breaches of the control limits, including explanations if available.

586. The monitoring data would be continually processed as it is received, so as to avoid a build-up of unprocessed data.

General Site Inspections and Monitoring

587. A Site Inspection Checklist for recording the findings of the general site condition surveys would be developed by the respective contractors, on the basis of the Environmental Mitigation Plan described in Chapter 6, during the construction phase. The Site Inspection Checklist would be supported by sketches, as necessary.

Information Sources

588. A complete and up-to-date file of all relevant sources of information should be maintained by the ESCU of PMU. This file would be readily accessible and include, as a minimum, copies of the following documents:

- Current environmental permits and consents;
- Action to fulfill the requirement of annual site clearance for Polder area
- All relevant national regulations, international guidelines and codes of practice;
- Manufacturers' MSDSs for all hazardous substances used on the plant;
- Manufacturers' operating manuals for all the environmental monitoring equipment;
- Current calibration certificates for all the equipment that requires calibration by an external organization; and
- The latest version of this Environmental Management and Monitoring Plan.

Non-Compliance Report

589. Any breaches of the acceptable standards specified, would be reported to the PMU using a standard form, i.e. a Non-Compliance Report (NCR).

590. A copy of each completed NCR would be held on file by DDCS&PMSC, to be replaced by the reply copy when it is received. A record of corrective actions would also be made and tracked to their completion.

Monthly Internal Reports by DDCS&PMSC

591. The DDCS&PMSC will prepare a monthly report for issue to the ESCU of PMU. These reports will summarize the following:

- Progress in implementing this EMP;
- Findings of the monitoring programs, with emphasis on any breaches of the control standards, action levels or standards of general site management;
- Any emerging issues where information or data collected is substantially different from the baseline data reported in the Environmental Assessment;
- Outstanding NCRs;
- Summary of any complaints by external bodies and actions taken / to be taken; and
- Relevant changes or possible changes in legislation, regulations and international practices.

Bi-annual Environmental Monitoring Report by BWDB

592. ESCU of BWDB will prepare the Bi-annual Environmental monitoring report during construction phase and will submit to the World Bank for review during construction phase. The monitoring report will include the status of environmental monitoring and the plan for the next six months. The report will summarize the information presented in Table 10.2, 10.3 and 10.4.

Environmental Audit Report & Third Party Monitoring Report

593. It is expected that BWDB will conduct annual environmental audits. In addition, the environmental audit will be carried out before the mid-term evaluation and before project closing. All Environmental Audit Report will be shared with Bank. Environmental monitoring will be conducted during the project.

Third Party Monitoring

594. The Third Party Monitoring consultants will monitor the quality of environmental compliance and will share their findings with the World Bank.

Donor Agency/WB Monitoring

595. The Donor Agency/WB will also monitor from time to time the quality of environmental compliance as part of their regular implementation support missions

10.9 Contractual arrangements for EMP implementation

596. A fixed Budget will be assigned for EMP implementation. The contractors may need orientation on the requirement of the EMP in the pre-bidding meeting. The contractor needs to submit a Construction Environmental Social Management Action Plan (C-ESMAP) based on the EIA including the EMP in line with the construction schedule and guideline. The C-ESMAP needs to be reviewed by the supervision consultant and cleared by BWDB and World Bank.

597. Guideline to Incorporate Environmental Management in Bid Document & Preparation of ESMAP

- Prepare cost estimates, to be incorporated in Bid Documents.
- The EMP along with the good environmental construction guidelines to be incorporated in the bid document‘s work requirements.
- Preparation of work requirement (addendum/corrigendum to Polder & hydraulic structure construction/afforestation) and
- Corrigendum / Addendum to Polder/embankment specification, if any, as special provisions to be incorporated in bid document.
- Penalty clauses for not complying with EMP requirements to be incorporated. Indicative penalty clauses proposed in the CEIP are presented below (Addendum to Clause 17.2 Contractor‘s Care of the Works of FIDIC).
- The contractor has to follow all traffic safety measures as defined in the technical specification. Damage shall be levied at the rate Tk. 3000/- per day per location for non – conformity of traffic safety measures as per the decision of the engineer.

- The contractor has to follow all environmental mitigation measures as defined in the technical specification read along with the Environmental Management Plan for the specific CEIP activities. Damage shall be levied at the rate Tk. 3000/- per day per location for nonconformity of Environmental Management Plan measures as per the decision of the BWDB Engineer.
- The contractor has to ensure that prior to every monsoon season, during the construction period; all the temporary and permanent cross drainage structures are free from debris as defined in the Technical Specifications read along with the Environmental Management Plan. Damage shall be levied at the rate of Tk.3000/- per day per location for non-conformity as per the decision of the Engineer.

598. The contractor has to ensure that sufficient numbers and good quality Personnel Protective Equipment (PPE), should be provide to staff and labor all time as defined in the labor codes read along with the EMP. Damage shall be levied at the rate of Tk. 1000/- per day for non-conformity as per the decision of the Engineer.

Guideline for Compensation and Contingency Plan during Project Period

599. Compensation becomes necessary when project impacts cannot be mitigated satisfactorily. This can be paid in cash or kind and the emphasis should be on ensuring fairness and causing minimum inconvenience to the affected party. The most common cause of compensation payment is displacement of people and loss of productive land due to land acquisition, tree cutting, or property damage. Such impacts can rarely be fully compensated. The compensation should be given as per provision of the Resettlement Action Framework. Any disputes over the compensation should be handles by the Grievance Redress Committee.

600. In addition to the compensation, water management projects should also have a contingency plan to deal with emergencies and accidents. Such incidences encompass a whole range of situations from personal injury during operation of a machine to breaching of an embankment. Therefore, BWDB would prepare for the following emergency situations:

- Embankment failure during a flood – keep sufficient number of sand bags in reserve.
- Bank caving/erosion – keep sufficient number of concrete blocks and sand bags in reserve.
- Have an emergency evacuation plan for the people in the line of danger.

10.10 EMP Implementation Cost

601. The estimated costs for the environmental management and monitoring activities are set in **Table10.6.**

Table 10.6: Tentative Cost Estimates for Environmental Management

Item No.	Description	BDT	In Thousand $	Responsible Agency	Timeframe
1	Crop compensation to the indirect loser/ land	300,000	3.75	Contractor	During pre-construction

Item No.	Description	BDT	In Thousand $	Responsible Agency	Timeframe
	owner/ share croppers of construction sites /damage to dredge spoils				
2	Awareness program on plant and wild life conservation.	96,000	1.2	BWDB	During post-construction
3	Construct a new sluice near the Patakhali closure which is linked with Jorshing Khal, Hajerali Khal and Sadderfer Khal for efficient drainage within the Polder area.				During construction
4	Awareness building up campaign(mock drill) may be organized to local community to avoid accidents from vehicular traffic	200,000	2.5		During pre-construction
5	Consultancy services cost for supervision and monitoring of EMP	280,000	3.5	BWDB	During post-construction
6	Training to the farmers with field demonstration regarding IPM and ICM.	200,000	2.5	BWDB with help of DAE	During post-construction
7	Awareness building up to local community for conservation of threatened fish species.	50,000	0.625	BWDB & WMO with help of UFO	During post-construction

Item No.	Description	BDT	In Thousand $	Responsible Agency	Timeframe
8	Training to the fisherman/pond owner with field demonstration regarding pond culture.	40,000	0.5	BWDB & WMO with help of UFO	During post-construction
9	Solid and liquid waste disposal arrangement.	100,000	1.25	BWDB	
10	Capacity building and training to the WMOs regarding gate operation, post project monitoring	1,000,000	12.5	BWDB	During post-construction
11	Consultancy services cost for river bank erosion monitoring	1,200,000	15	BWDB	During construction
12	Training to the Contractors regarding environmental management	100,000	1.25	BWDB	During pre-construction
13	Training of Environmental awareness of local population	80,000	1	Contractor	During pre-construction and construction phases
14	Updating EMP as per requirement.	1,000,000	12.5	BWDB	During post-construction
15	Construction of alternative or bypass channels at each construction sites.	1,061,053	13.26	Contrctor	During pre-construction and construction
16	Conservation and stocking of threatened fish species (at least 3 spots).	120,000	1.5	BWDB with help of UFO	During pre-construction and construction phase

Item No.	Description	BDT	In Thousand $	Responsible Agency	Timeframe
17	Campaigning and providing training on improved culture practices as well as the rice cum golda farming.	200,000	2.5	BWDB with help of UFO	During post-construction
18	Emergency budget allocation for closing breach points of embankments and repairing the damage of structure	1,200,000	15	Contractor, BWDB	During construction and post-construction
19	Additional Tree Plantation at HH and other grounds to compensate the tree cutting (planting 3 trees for cutting 1tree) @ Tk.50 each tree including the cost of sapling, gabion and nursing etc. (19,834 nos. of trees)	991,700	12.4	BWDB in association of Department of Forest	During post-construction
20	Water sprinkling at re-sectioned/newly constructed embankments (@ Tk.3,000 per km (of embankment 30.50 km)	91,500	1.14	Contractor	During pre-construction and construction phases
21	WMOs monitoring cost	150,000	1.88		

Item No.	Description	BDT	In Thousand $	Responsible Agency	Timeframe
22	Construction of fish pass friendly structure (one fish pass) Optimum number of vents should be provided with proper opening so that velocity goes down and become passable for fishes	61,420,026	767.75	Contractor, BWDB	During construction
	Total Cost	**69,880,279**	**873.50**		

Here, 1 USS $ = 80 Taka

Table 10.7: Tentative Cost Estimates for Environmental Monitoring **Item No.**	**Description**	**BDT**	**In Thousand $**	**Responsible Agency**	**Timeframe**
1	Soil quality monitoring including N,P,K, S, Zn, salinity, organic Matter, pH etc. samples in Polder 14/1 = 6 samples x 3 times @ Tk.5,000	200,000	2.5	Contractor	During pre-construction, construction and post construction period phases
2	Fish Habitat Observation for four (4) times of year (dry & wet season).	100,000	1.25	Contractor with help of UFO	During construction and post-construction
3	Fish Catch Assessment Survey for two (2) times of a year (dry & wet season).	200,000	2.5	Contractor with help of UFO	During post-construction
4	Fish swimming speed or velocity and depth preference	150,000	1.8	Contractor with help of UFO	During post-construction

Table 10.7: Tentative Cost Estimates for Environmental Monitoring **Item No.**	**Description**	**BDT**	**In Thousand $**	**Responsible Agency**	**Timeframe**
5	Crop Production/Farm Survey for four (4) times of year (dry & wet season).	60,000	0.75	Contractor with help of UFO	During post-construction
6	Air and noise quality monitoring and analysis.	200,000	2.5	Contractor	During construction
7	Surface and ground Water quality monitoring cost (testing for Turbidity, pH, DO, BOD, Salinity etc. + test of As, e etc. for HTWs at workers' camp site) 6 samples in Polder-14/1 during pre-construction, construction and post-construction periods + water quality analysis of HTWs of 10 workers' camp	500,000	6.25	Contractor	During construction and post-construction phases
8	Diversity of Flora and fauna	200,000	2.5	Contractor	During construction and post-construction phases
	Total Cost	**1,460,000**	**18.25**		

Here, 1 USS $ = 80 Taka

Afforestation Plan

602. The Senior Forestry Specialist, Employed in PMU will finalize the afforestation plan in consultation with the Forestry Department for afforestation in slope and foreshore areas which

will be implemented by the selected NGO (to be hired) .who will also be responsible for maintenance of the saplings under social forestry guidelines.

603. The afforestation regulations (policy) enunciated by the BWDB on June 01, 1998 will be followed. Afforestation plan have been finalized after reviewing previous studies on foreshore afforestation, consultation with Forest Department and field verification for suitable species selection.

604. For the Slope Plantation, the lower one third of the slope may be planted with deep rooted tree species, the mid one third may be planted with shallow rooted medium size tree species and the upper one third may be planted with species that have very small root system (Fig. 10.2). Keeping this in view, the lower and middle row along the slope can be planted with *Tamarindus indica* (Tamarind/Tentul),*Acacia nilotica* (Gum Arabic/Babla), *Borassus flabellifer* (Palmyra Palm/Tal), *Cocos nucifera* (Coconut/Narikel) and *Phoenix sylvestris* (Date Palm/Khajur) at a spacing of 2M (6.5 ft) apart. The upper row can be at a distance of 6 to 9 feet, i.e., 2 to 3M from the lower row. The upper row will be planted with shallow rooted bushy plants which are available in local area. The *Tamarindus indica* (Tentul) and *Acacia nilotica* (Babla) seedlings have to be raised in 10” X 6” poly bags. Before plantation, a temporary nursery will be established in the Polder area to ensure the availability of seedlings. Nursery costing has been shown separately in Feasibility Report. The *Borassus flabellifer* (Tal), *Cocos nucifera* (Coconut/Narikel) and *Phoenix sylvestris* (Date Palm/Khajur) seedlings may be purchased from local nurseries. Planting of 2,500 seedlings will make one ha slope plantation. As per that estimation, a total of 23,000 nos of saplings can be planted along the 9.2 ha area of embankment slope.

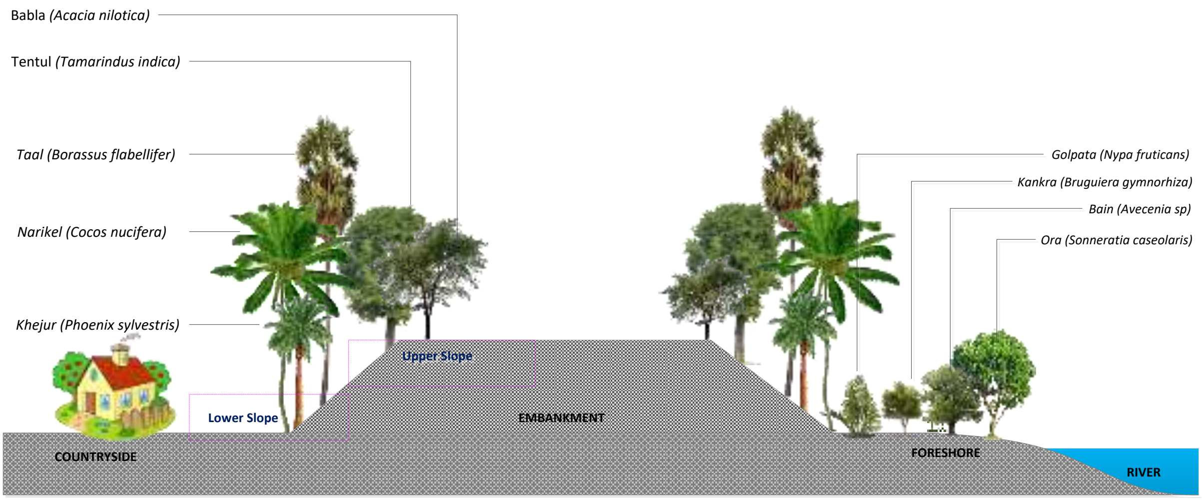


Figure 10.2: Typical cross section of Embankment slopeand Fore shore Afforestation

605. The available foreshore area of the Polder can be planted with suitable mangrove species. *Sonneratia apetala* (Mangrove Apple/Keora), *Avicennia officinalis* (Indian Mangrove/Baen), *Sonneratia caseolaris(*Crabapple Mangrove/ Ora), *Bruguiera gymnorhiza* (Black Mangrove/Kankra), *Excoecaria agallocha* (Blinding Tree /Gewa), *Hibiscus tiliaceus* (Coastal Hibiscus/Bola) and *Nypa fruticans* (Nipa Palm/Golpata) can be selected as the suitable species for this Polder. Average distance between two saplings will be 1.5 m. accordingly; more than 14,500 mangrove saplings can be planted in 3.28 ha of available foreshore area of this Polder.

606. Detailed Plantation establishment Matrix is presented in following Table:

Table 10.7: Detail information on Plantation Program

Item of works		Timescheduleforthegiventype			
		Golpata (Nypa) Plantation	**Chailla, Kankra, Gewa Plantation**	**Keora Baen Plantation**	**Embankment Slope Plantation.**
Selection of site, survey the site and prepare plantation site map.		March	January	February and March	February
Cleaning of unwanted growths by cutting them off.		May 3rd week.	April 4th week immediately before planting.	One week before the planting day. May be in the 1st week of May.	April 1st week.
Pit making		n.a.	March 2nd week.	n. a.	April 1st week.
Application of Compost		n.a.	March 4th week.	n. a.	April 3rd week.
Stacking		May 3rd week.	April 1st week.	n. a.	April 3rd week.
Bring seedlings from the nursery to plantation site.		June 1st week.	April 3rd week.	On the day of planting during 1st or 2nd week of May.	April 4th week.
Planting of seedlings.		June 1st week. Immediately after bringing seedlings from the nursery.	April 4th week.	May be 1st or 2nd week of May.	Immediately after bringing the seedlings.
Fixing of red flags indicating planting sites to avoid fishing.		May 4th week.	n. a.	n. a.	n. a.
Application of fertilizers.		n. a.	After of week of planting the seedling.	n. a.	After the week of planting.
First weeding		August 1st week	May 4th week	May 4th week. 1st year.	May 2nd week, 1st year, to be done by the watcher free of charges.
Second weeding		November 1st week	June 3rd week	June 1st week. 1st year.	July 1st week, 1st year, to be done by the watcher free of

Item of works		Timescheduleforthegiventype			
		Golpata (Nypa) Plantation	Chailla, Kankra, Gewa Plantation	Keora Baen Plantation	Embankment Slope Plantation.
					charges.
Third weeding		May 1st week next year	July 2nd week	June 4th week. 1st year.	May 1st week, 2nd year, to be done by the watcher free of charges.
Fourth weeding		n.a.	August 4th week.	May 1st week. 2nd year.	August 1st week, 2nd year, to be done by the watcher free of charges.
Fifth weeding with light pruning if necessary.		n. a.	April 1st week next year.	October 1st week. 2nd year.	n. a.
Sixth weeding (Climber cutting)		n. a.	June 1st week next year.	n. a.	n. a.
Seventh weeding (Climber cutting)		n. a.	August 1st week. Next year.	n. a.	n. a.
Pruning.		n. a.	n. a.	n. a.	n. a.
Watching		For 30 months by involving the participants on wages @ Taka 8000 per month. Each will get Taka 2000 per month.	For 30 months by involving the participants on wages @ Taka 8000 per month. Each will get Taka 2000 per month.	For 30 months by involving the participants on wages @ Taka 8000 per month. Each will get Taka 2000 per month.	For 30 months by involving the participants on wages @ Taka 8000 per month. Each will get Taka 2000 per month.

Source: Feasibility Report of CEIP, Volume III: Afforestation Report, September 2013

607. According CEIP services, NGO will be engaged as Consultancy Services to Implement (a) Social afforestation and (b Mobilization with Social Action plan.

10.11 EMP Updating

608. The study infers that the EMP has been developed assessing the impacts of interventions on the basis of baseline and prediction information. However, monitoring has to be carried out to collect information on the impacts that actuality have occurreddue to construction of interventions. Furthermore, actual information due to implementation of the EMP measures need to be collected for updating the EMP to make the development more environmental friendly as because EMP is not an one time plan rather it is a plan which needs updating continuously.

10.12 Grievance Redress Mechanism

609. BWDB will establish a Grievance Redress Mechanism (GRM) as a means to ensure social accountability and to answer to queries and address complaints and grievances about any irregularities in application of the guidelines adopted in this EIA for assessment and mitigation of social and environmental impacts. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal action. The procedure will however not pre-empt a person's right to go to the courts of law.

Grievance Redress Focal Points

610. A Grievance Redress Committee (GRC) at local level will be formed for each Union with union level representation to ensure easy accessibility by the project affected persons and communities. This local GRC will be the local focal points of the project GRM. The GRM sets out the information and communications strategy to ensure that PAPs and communities are fully informed about their rights to offer suggestions and make complaints. All grievances received through the GRM process will primarily be forwarded to the GRCs. The Secretariat for each GRC will be at the office of the Executive Engineer. If any grievance is not resolved at GRC, the aggrieved person may request the convener of GRC to forward the case to the Project Director at PMU. The GRC will officially forward the cases with their comments to the Project Director. Hearing of petitions with GRCs will be held at the Convener's office or at Union Parishad/Ward Councillor's office as agreed by the committee members. The membership of the GRCs will ensure proper presentation of complaints and grievances as well as impartial hearings and investigations, and transparent resolutions.

Membership of GRC

1. Executive Engineer (BWDB Division Office) : Convener
2. Representative of the RP Implementing NGO : Member-Secretary
3. Local UP Chairman /Ward Councillor : Member
4. Teacher from Local Educational Institution (nominated by
5. Upazila Administration) :Member
6. Representative from Local Women's Group :Member
7. Representative from the PAP Group :Member

611. Members of the GRCs will be nominated by the Executive Engineer at division level and approved by the Project Director, PMU, BWDB, Dhaka.

Grievance Resolution Process

612. All complaints will be received at the GRCs facilitated by the implementing agency. The aggrieved persons may opt to make complaints directly to the Project Director or Secretary of the MoWR or even to the court of law for resolution. The Member Secretary will review and sort the cases in terms of nature of grievance, urgency of resolution, and schedule

hearings in consultation with the Convener. All cases will be heard within four weeks from the date of receiving the complaints.

613. If the resolution attempt at the local level fails, the GRC will refer the complaint with the minutes of the hearings to the Project Director at PMU for further review. The Project Director will assign the ESC at PMU for review the grievance cases and assist Project Director in making decision. The ESC will review the case records and pay field visits for cross-examining and consult the GRC members and aggrieved persons, if required. If a decision at this level is again found unacceptable by the aggrieved person(s), BWDB can refer the case to the MoWR with the minutes of the hearings at local and headquarters levels. At the ministry level, decisions on unresolved cases, if any, will be made in no more than four weeks by an official designated by the Secretary, MoWR. A decision agreed with the aggrieved person(s) at any level of hearing will be binding upon BWDB.

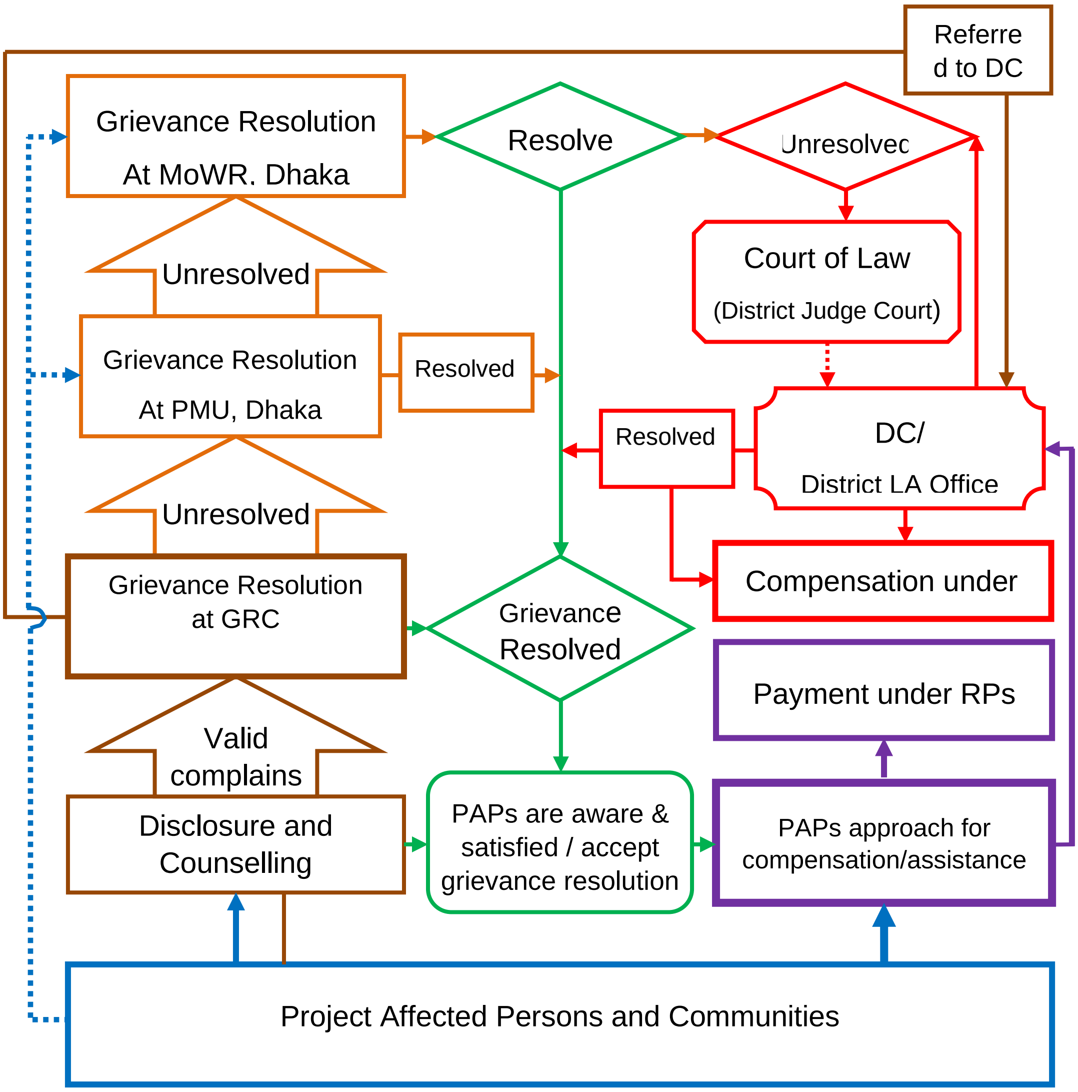


Figure 10.3: GRM Process flow Chart

614. To ensure that grievance redress decisions are made in formal hearings and in a transparent manner, the Convener will apply the following guidelines:

- Reject a grievance redress application with any recommendations written on it by a GRC member or others such as politicians and other influential persons.

- Remove a recommendation by any person that may separately accompany the grievance redress application.
- Disqualify a GRC member who has made a recommendation on the application separately before the formal hearing:

615. A GRC member when is removed, appoint another person is to be appointed in consultation with the Project Director.

616. The Convener will also ensure strict adherence to the impact mitigation policies and guidelines adopted in this SMRPF and the mitigation standards, such as compensation rates established through market price surveys.

GRM Disclosure, Documentation and Monitoring

617. The affected persons and their communities will be informed of the project's grievance redress mechanism in open meetings at important locations and in PAP group meetings. Bangla translations of the EMF and the GRM in the form of information brochures will be distributed among the project- affected persons. The PAPs will also be briefed about the scope of the GRC, the procedure for lodging grievances cases and the procedure of grievance resolution at the project level.

618. To ensure impartiality and transparency, hearings on complaints will remain open to the public. The GRCs will record the details of the complaints and their resolution in a register, including intake details, resolution process and the closing procedures. BWDB will maintain the following three Grievance Registers:

619. **Intake Register:** (1) Case number, (2) Date of receipt, (3) Name of complainant, (4) Gender, (5) Father or husband, (6) Complete address, (7) Main grievance regarding social (loss of land/property or entitlements) or environmental, (8) Complainants' story and expectation with evidence, and (8) Previous records of similar grievances.

620. **Resolution Register:** (1) Serial no., (2) Case no.,(3) Name of complainant, (4) Complainant's story and expectation, (5) Date of hearing, (6) Date of field investigation (if any), (7) Results of hearing and field investigation, (8) Decision of GRC, (9) Progress (pending, solved), and (10) Agreements or commitments.

621. **Closing Register:** (1) Serial no., (2) Case no., (3) Name of complainant, (4) Decisions and response to complainants, (5) Mode and medium of communication, (6) Date of closing, (7) Confirmation of complainants' satisfaction, and (8) Management actions to avoid recurrence.

622. Grievance resolution will be a continuous process in RP implementation. The PMU and SMOs will keep records of all resolved and unresolved complaints and grievances (one file for each case record) and make them available for review as and when asked for by WB and any other interested persons/entities. The PMU will also prepare periodic reports on the grievance resolution process and publish these on the BWDB website. The format of SMF may be used for periodic grievance reporting.

10.13 Capacity Building

623. Since the effectiveness of the Environmental Assessment & implementation depends considerably on the understanding and preparedness of their Engineers and in particular their Environmental Team (Consisting of Contractor's Environmental specialist, Consultant environmental specialist, and ESCU of BWDB). It is important that the project authority makes effort to sensitize the Engineers and Environmental Team on management of environmental issues, provides guidance, and encourages them to build requisite capacities. Table 10.6 provides a summary of various aspects of the environmental and social trainings to be conducted at the construction site (Table 10.8). PMU may revise the plan during the Project implementation as required.

624. During the O&M phase of the Project, these trainings will continue to be conducted by BWDB staff for all relevant O&M personnel and community.

Table 10.8: Environmental Training

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project area; Key findings of the EIA; Mitigation measures; EMP; Social and cultural values of the area.	Selected BWDB; PMU; DDCS&PMSC	DDCS&PMSC,ESCU	Prior to the start of the Project activities. (To be repeated as needed.)
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project area; Mitigation measures; Community issues; Awareness of transmissible diseases Social and cultural values.	PMU; DSC; selected contractors' crew	ESCU	Prior to the start of the field activities. (To be repeated as needed.)
EMP; Waste disposal; HSE	Construction crew	Contractors	Prior to the start of the construction activities. (To be repeated as needed.)
Road/waterway safety; Defensive driving/sailing; Waste disposal; Cultural values and social sensitivity.	Drivers; boat/launch crew	Contractors	Before and during the field operations. (To be repeated as needed.)
Camp operation; Waste disposal; HSE Natural resource conservation; Housekeeping.	Camp staff	Contractors	Before and during the field operations. (To be repeated as needed.)
Restoration requirements; Waste disposal.	BWDB core unit, Restoration teams	Contractors	Before the start of the restoration activities.
Strengthening of water management organizations(i.e. WMGs, WMAs and WMF) and beneficiaries organizations	Member of water management organizations(i.e. WMGs, WMAs and WMF) and beneficiaries organizations	BWDB, ESCU, Contractor	Before and during construction activities

625. Capacity building training programs should be undertaken in the following area:

- Training of the management level officials of BWDB, BWDB environmental compliance personnel on the overall environmental concerns and responsibilities for implementing EMP;
- Recruitment of new professionals with background on environment, if required and provide necessary training ;

- Organizing workshop, seminar, with stakeholders on the environmental concerns of CEIP ;
- Special training program for the contractors and workers on the EMP and their responsibilities, who will actually be involved in the construction of the project interventions. The Contractors will be provided guideline for preparation of Environmental Action Plan in line with the construction work plan;
- Training of the WMOs on successful operation of hydraulic structures; and
- Training on structured format in reporting for all stages of implementation and those of relevant agencies who are involved in EMP implementation.
- The training programs should be arranged before implementation of the interventions in the Polder area. A detailed plan can be made by the proposed ESCU of BWDB.

10.14 Risk Assessment and Mitigation Measures

626. Risk assessment in a development project involves the identification or recognition of weaknesses and gaps in the project and evaluation of their potential threats to the sustainability of the project. The rehabilitation works in Polder 34/3 have the dual purpose of prevention of saline water intrusion into the Polder area and agricultural improvement within that area. The expected positive impacts from the project interventions have been summarized in the impact chapter, while the potential adverse impacts have been identified and quantified above as well as their mitigation measures have also been suggested in this report. Yet, challenges or threats do remain in tree sectors, which are addressed in this section. These relate to (a) navigation and (b) water management organizations (WMO) and (3) fish migration.

Navigation

627. Navigation in the inland waterways is an important aspect of the coastal economy - facilitating the movement of people and commodities. Hence, Poldering areas are likely to obstruct normal navigational operations between the rivers in the periphery and the khals, and this issue could be a matter of concern in Polder 34/3. However, since the early construction of Polders in the 1960s, the problem was recognized and analyzed to reach the conclusion that, in most cases, the benefits obtained from the construction of Polders far outweigh the navigational losses. Field visits to Polder 34/3 also revealed that water bodies and internal khals in the project area are used for transportation of goods and persons, but there is not much marked demand for water traffic to and from the Poldered area and the neighboring sites outside the Polder. Drainage sluices and sluice gates are provided in the Polder, which are being rehabilitated under this project. The gates in those structures are also operated in regular intervals to restrict salinity intrusion. However, such gates or boat passes in the embankment for allowing navigation through the embankment to and from the Polder would allow large volumes of saline water inside the Polder and may damage the soil, water and land – destroying crops.

628. However, in order to maintainnavigation, an arrangement may be made for lifting (or lifting on rail of smallsize country boat from one side to other side i.e. river side to country side and visa-versa for navigation purposes. This arrangement will not allow entry of saline water inside the Polderthus would not damage soil, water, land and crops.

Function of Water Management Association

629. This project has aimed at rejuvenating the Water Management Organizations (WMO) in the Polder, which consists of a three-tier organizational structure with Water Management Groups (WMG) at the bottom of the hierarchy, Water Management Association (WMA) at the mid-level and Water Management Federation (WMF) at the top. The main functions of the WMOs are supposed to be assisting and participating in the operation and maintenance of the Polder. However, at the moment, there are no active WMOs on site, and their activities are almost non-existent. The disrepair and lack of maintenance of the Polder in the past due to financial inadequacies of the WMOs as well as insufficient support from the BWDB had contributed to the general decay of the Polder's structure and utility. In the past, there was usually no fund allocated for the WMOs' functions and needs. In Table 5.15 above, a long list of duties and responsibilities of different tiers of WMOs has been provided, which – if successfully performed and implemented – would greatly contribute to the sustainability of the project. It is, therefore, recommended that the project should (i) ensure the organization/formation of the WMOs before operation of the gates, training them in the operation of structures etc., as well as in records/accounts keeping, and collaboration with NGOs, and CBOs, and most importantly. This would help in developing ownership of the WMA for realization of benefits from the Polder without hampering the hydrological and environmental settings of the Polder(ii) In addition to activation of WMOs, BWDB may recruit sluice khalashi for each of the Drainage Sluices for smooth operation of the gates as per initial practice (iii) provide budgetary allocation in the post-operation phase for the O &M related tasks of the WMOs (iv) In addition, borrow pit, embankment slope, water bodies in the khas land may be provided to the WMOs as an income generating sources for their sustainability.

Fish Migration and Movement

630. The peak velocity considered in designing of drainage sluices ranges from 3-4 m/s. The sustainable velocities of the indicative fish species are estimated in the range of 0.46 m/s to 1.1 m/s and burst velocities are in the range of 1.75 m/s to 4.2 m/s (Section 6.2.10). It is noted that burst velocities of fish are applicable for capturing prey as the duration is only for seconds. Considering designed peak velocities of drainage sluices and the estimated sustainable velocities of the indicative fishes, it is observed that no fish will be able to pass through the gates. Gradual decrement of the discharge and corresponding velocity at some stages the fish can move against the current and eventually can pass through the gates if these attain the velocities congenial for such species.

631. On the other hand, during the spawning season, fish hatchlings and fries will be able to pass through the gates, however with relatively high mortality. Moreover, there is a conflict of interest between the Gher owners and agriculture farmers regarding the issue of water usage.

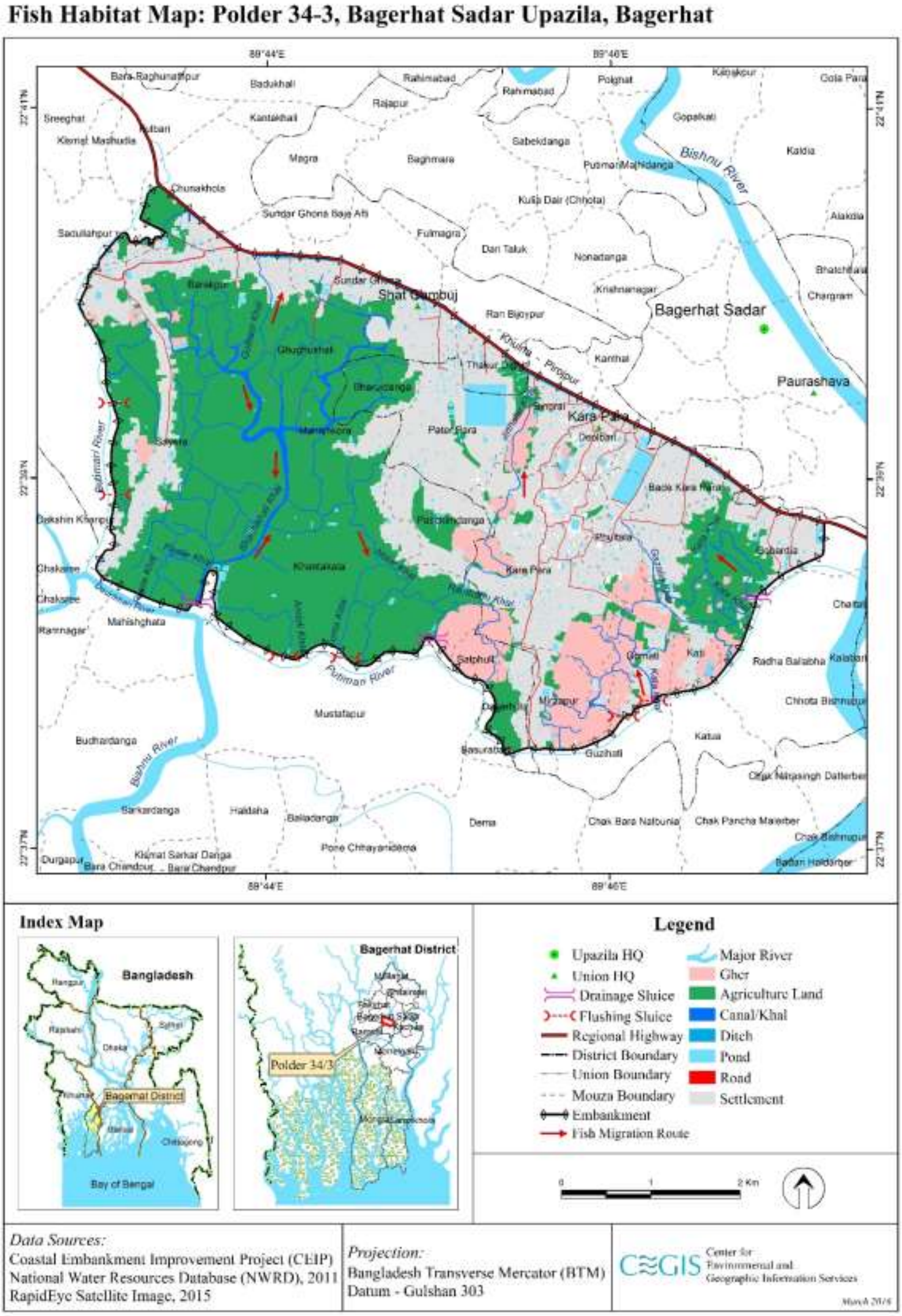
632. For mitigating the fish passing issues through the gates, it is recommended to consider the fish pass friendly aspects in the structures to be constructed in the Polder for the proper management of water. These may be done either by constructing drainage sluices by maintaining the velocities passable for the mentioned indicative fish species or by constructing fish pass structures. In case of sluice gates, based on catchment flow optimum, a suitable number of vents should be provided with proper opening so that the flow velocity remains below the threshold passable for fishes. Whendesigning the fish pass, fish swimming speed or velocity and depth preference should be considered. In case of the indicative fishes

velocities are mentioned in Table 6.14 and the depth preferences are as follows: *Plotosus canius*: 2-10 m; *Liza parsia*: 1.5-10 m; *Mystus gulio*: 1.5-10 m and *Lates calcarifer*: 2-20 m.

633. In other areas where ghers are less intensive and crops are dominant, there should be a mechanism of water distribution in an equitable manner. Generally, surface water irrigation for the Boro crops is done during January to March when drifting migration of hatchling and fry with the tide of *Liza parsia* and *Mystus gulio* may be obstructed as the farmers will use the deposited water of the canal and inhibit the entry of saline water. The fishes at all their life stages from hatchling to adult of *Plotosus canius, Lates calcarifer, Liza parsia* and *Mystus gulio* will enter the Polder area with the tide when water will be allowed during the T. Aman season in the July-August.

Confict Resolution between Gher Owners and Farmers

634. The density of shrimp ghers is more in the following mouzas like Mirzapur, Gomati, Satphuli, Kara Para and Singral (**Map 10.1**) of this Polder. Reasonably, conflicts between gher owners and the crop farmers are also more though these mouzas are relatively less crop intensive. The major drainage canals, such as Kata Khal, Mirzapur Khal, Rambabu Khal and Jirthalar Khal pass through the mentioned mouzas and Ghers. Entry of saline water through these drainage canals in this cluster may not harm significantly to the crops if water can be managed in the canals in such a way that water does not spill over the crop fields. This will also resolve the drainage congestion issue. The Gher owners close many gates for holding water at the time when crop farmers need dry field for crop cultivation. This is hampering the crop production. For mitigating such conflict, re-xcavation of the above mentioned drainage canals would be done for creating more room for water so that Gher owners could use water as per their requirements and the crop fields are not inundated. In that case, the proper operation of the sluice gates and their distributary canals should be ensured. For proper operation of the gates a 'Gate Operation Manual' in Bangla version has been appended in Appendix C so that WMAs can follow in the field condition.



Map 10.1:Fish habitatin the Polder area

11. Stakeholder Consultation and Disclosure

11.1 Introduction

635. This section provides particulars of the consultations held with the stakeholders at the Project site and structure for consultations to be carried out during construction phase.

11.2 Overview

636. The GoB as well as international donors (e.g. the World Bank) place great importance on involving primary and secondary stakeholders for determining the environmental and social impacts associated with project implementation. In order to assemble local information for baseline conditions, understand perceptions of the community regarding impact significance, and propose meaningful mitigation measures, participation of stakeholders is an integral part of the EIA process. During the present EIA, an attempt has been made to consult with a full range of stakeholders to obtain their views on Project interventions.

637. Consistent with the EIA Guidelines of the DoE, community contribution is obligatory for the EIAs of the Red Category projects. Public participation through consultations in the water sector project is also mandated according to the Guidelines for the Participatory Water Management (GPWM) of the BWDB. Similarly, the World Bank's OP 4.01 requires that stakeholder consultations are carried out at least twice for the Category A projects, once shortly after environmental screening and before the terms of reference for the EA are finalized, and then once a draft EIA report is prepared.

638. The present EIA has been conducted after consulting with local communities, Non-Governmental Organizations (NGOs) and concerned government departments/ organizations dealing particularly with related fields, thus ensuring that their views and concerns are taken into account in the study.

11.3 Objectives of Stakeholder Consultations

639. The overall objective of the Stakeholder Consultation Meeting (PCM)was to explore the viewpoint of rehabilitation of Polder 34/3 to the local people and collect their suggestions for strengthening or sustaining the project. Environmental and socio-economic benefits would be flashed out by the implementation of proposed interventions.

640. The following were the objectives of stakeholder consultation:

- To provide key project information and create responsiveness among various stakeholders about project intervention;
- To have interaction for primary and secondary data collection with project beneficiaries, affectees, and other stakeholders;
- To identify environmental and social issues such as displacement, safety hazards, employment, and vulnerable persons;
- To begin establishing communication and an evolving mechanism for the resolution of social and environmental problems at local and Project level;
- To involve Project stakeholders in an inclusive manner; and
- To receive feedback from primary stakeholders on mitigation and enhancement measures to address the environmental and social impacts of the project.

11.4 Identification of Stakeholders

641. Stakeholders include all those who affect and are being affected by the proposed interventions of the project. Stakeholders can be groups of people, organizations, institutions and sometimes even individuals. Stakeholders can be divided into primary and secondary stakeholder categories.

Primary Stakeholders

642. Primary stakeholders are people who would be directly benefited or impacted by a certain scheme intervention. In case of the proposed project in Polder 34/3, the primary stakeholders included the people living within the project (Polder) area particularly those who reside within and in the immediate vicinity of the Polder. The primary stakeholders of the Polder included the farmers, day labor, fishermen, local business community as well as the households to be displaced, women groups, and caretakers of community properties.

Secondary Stakeholders

643. This group of stakeholders include those who might not be directly affected but have interests that could contribute to the study, play a role in implementation at some stage, or affect decision making on project aspects.

644. Secondary stakeholders for the project included Local Government Institutions (LGI), Bangladesh Water Development Board (BWDB), the Ministry of Water Resources, Department of Forest, and other government agencies, academia, NGOs, the World Bank and general public at large.

11.5 Approaches and methodology

Approach

645. A participatory approach was applied for identifying the problem and solution across the intervention in public consultation meeting. At first, the consultants discussed with the BWDB authority of the respective areas in order to obtain their views and suggestions on the project. Key stakeholders were identified through consultation with local people and local government officials. The venue, date and time of those meetings were fixed in consultation with the key persons. The EIA team used convenient and necessary checklists for facilitating the public consultation meetings, which helped to reflect uniformity and relevancy of the opinions and views of participants.

Methodology

646. The vital issues like overall briefing of the project including problem of the area with the possible solutions, proposed interventions, probable impacts of selected interventions etc. were incorporated in the checklist. During SCM, all relevant issues within socio-economic, agricultural, hydrological, fisheries, ecological aspects were discussed in detail. A Socio-economist along with the multi-disciplinary consultant team (Water, Agriculture, Fisheries resources and Ecology) facilitated the consultation meeting. The consultants displayed maps of the Polder area and explained the initial baseline condition and proposed interventions. The facilitators explained all relevant points and issues in order to enable the participants to

comprehend the proposed interventions/activities properly and to respond, accordingly. The stakeholders' perceived views over the impacts on Important Environmental and Social Components (IESCs) along with perceived benefits, risks, threats and demand from the project were identified. The consultants took utmost care in recording opinions and views of the participants relevant to the EIA Report. The EIA team also conducted the informal meetings with stakeholders as per the quires of the consultants. In the informal meeting, the meeting place were not fixed prior to the meeting.

11.6 Stakeholder consultation and Community Meetings

647. The stakeholders' meetings and community level discussions were conducted in the Polder 34/3 areas using different ways of surveys and consultations techniques. Using different techniques, necessaryresponses were obtained from the stakeholders/communities and they were brought under a good communication and participation process. This consultation process was initiated by CEGIS in January, 2016. In this regard, two (02) SCMs and three (03) FGDs were conducted in the Polder areas. It is to be noted that, the consultation, discussion and peoples' participation process will be continued further during the disclosure stage after having the entitlement policies and implementation. In the SCMs, 92 numbers of participants from public representatives, community leaders, teachers, service holders, farmers, day laborers, fishers, traders, women etc. attended. The SCMs were held at Karapara and Shat Gumbuj Union Parishads hall room while FGDs were held at different locations of the Polder area.

11.7 Location of stakeholder consultation meetings

648. During field visit, the EIA study team formally and informally discussed with the local stakeholders in different parts of the Polder area. The details of the stakeholders consultation is given in the following table:

Table 11.1: Location of formal and informal stakeholder's consultation

District	Upazila	Union	Type of consultation	Meeting place	Date	Time
Bagerhat	Bagerhat Sadar	Karapara	SCM	Karapara UP Bhaban	21.01.2016	10:00
			Informal	Karapara	22.01.2016	09:30
		Shat Gumbuj	SCM	Shat Gumbuj UP Bhaban	21.01.2016	02:30
			Informal	Doshani Bazar	22.01.2016	11:30
			Informal	Barakpur Bazar	22.01.2016	03:00

649. The local persons who could potentially be affected by the project along with local community leaders and other stakeholders were consulted through group meetings and personal contacts. The opinion of different stakeholders regarding the project was sought and considered in preparation of the EIA. A total of two formal stakeholder meetings were held with different communities in the Polder 34/3. Different types of stakeholders including concerned UP chairmen/members, teachers, *imams* (prayer leaders), local community leaders, political leaders, farmers, shopkeepers, and other people to be affected by the project attended these sessions. Some photographs of these meetings are presented in **Photograph 11.1** and **Photograph 11.2**

Photograph 11.1: View of Informal Discussion with local stakeholders

Photograph 11.2: View of formal stakeholder consultation meeting with local stakeholders at Karapara Union Parishad Bhaban, Bagerhat Sadar, Bagerhat

Photograph 11.3: View of formal stakeholder consultation meeting with local stakeholders at Shat Gumbuj Union Parishad Bhaban, Bagerhat Sadar, Bagerhat

Photograph 11.4: View of meeting with BWDB officials at Bagerhat.

11.8 Environmental Aspects from Consultations

650. During these meetings, the key features of the proposed interventions in Polder 34/3 under CEIP-I, its key benefits, its potential impacts particularly relating to resettlement and displacement were discussed. Views of the stakeholders were obtained on the project and its potential impacts. Consultations were also conducted with women and other vulnerable groups and their views obtained on their livelihood aspects, and projects impacts.

651. The communities including the persons to be affected by the project expressed their views in favor of the project and wanted early implementation to protect them from the tidal surges and disasters such as Aila and Sidr.

11.9 Participants list

652. A list of participants who attended in different meetings is featured in the following Table 11.2 with their ages, occupations and addresses including cell phone numbers (if any).

Table 11.2: Name of the participants in discussions

S.I	Name	Age	Occupation	Address	Mobile number
1	Md. Al-kas Miah	60	Farmer	Jirthala	01712902385
2	Rasel Mondol	28	Labor	,,	01813078920
3	Elius Mollah	38	Business	,,	01723028299
4	Anwara Begum	55	Housewife	,,	-
5	Mst. Rashida Bibi	50	Housewife	Jirthala	-
6	Mst. Ayesha Khatun	40	Housewife	Jirthala	-
7	Md. Habibul Basar	32	Service Holder	,,	01754528768
8	Md. Alomgir Hawladar	43	Business	,,	01736477595
9	Md. Rafiqul Hawldar	28	Business	,,	01795154048
10	Md. Litin Hosssain	34	Business	,,	01552553889
11	Md. Rejaul Islam	37	Business	,,	01739320290
12	Md. Akkas Ali	45	Business	Doshani Bazar	-
13	Md. Hazi Nazrul Islam	62	Business	,,	01715526381
14	Md. Sheikh Selim	40	Up Member	,,	01918875922
15	Kishor Kumar	50	Service Holder	,,	01715857054
16	Gongamoni Paul	45	Service Holder	,,	01734685844

S.I	Name	Age	Occupation	Address	Mobile number
17	Mullah Abdul Latif	60	Service Holder	,,	01714480845
18	Mizanur Rahman	54	Advocate	,,	01711460098
19	Babu	20	Labor	,,	01947716516
20	Sheikh Abu Jafor	55	Service Holder	,,	01950130595
21	Md. Abu Taher	40	Up Member	,,	017172690475
22	Anwar Ali	50	Business	,,	01721046968
23	Hanif Howlader	40	Business	,,	01934716943
24	Monir Uddin	25	Labor	,,	01961617401
25	Sheikh Hasan Ali	22	Farmer	,,	01950617701
26	Robindronath Adhikhari	50	Farmer	East Sayera	-
27	Shankar Kumar paul	35	Business	,,	01724353142
28	Md. Abu Bokkar	45	Day Labor	,,	-
29	Md. Abid Kamal	34	Van puller	,,	-
30	Md. Rofiqul	41	Farmer	,,	01733233128

11.10 Issues discussed in SCMs

653. At the outset of the meetings, an overview of the proposed project including the ongoing activities of the implementing agencies and the EIA process was shared with the participants. Subsequently, the key environmental, social, and socioeconomic aspects listed below were discussed.

- Water resources:
- Surface water (tidal flooding, drainage, salinity, siltation)
- Effact of climate change in the Polder area (heavy rainfall, drought, high flooding, tidal surge)
- Water management (flood control, drainage, irrigation)
- Land resources:
- Cropping practice,
- Crop production and yield,
- Water logging and drainage congestion
- Crop damage.
- Socio-economic aspects:
- Occupation and Employment (unemployment/joblessness)
- Migration (temporary/permanent out-migration)
- Poverty (food and income poverty)
- Education (poor literacy rate, non-schooling, less female education, drop out etc)
- Health and nutrition (illness, diseases, poor nutrition)
- Quality of life (poor housing and sanitation facilities, scarcity of drinking water, fuel and fodder)
- Disasters:
- Cyclones
- Associated damages
- The sustainable and integrated solutions of the main problems being faced in the Polder:
- Water resource management
- Agriculture and fisheries management
- Land resource management

- Disaster management.

11.11 Issues discussed, problems and suggested measures

654. Issue problems and suggested measures of five different disciplines of EIA study are given in the following table (Table 11.3).

Table 11.3: Issues, problems and suggested measures

Sl	Issues	Problems	Suggested measures
1	Water Resource	- Tidal flooding, salinity intrusion, drainage congestion, sedimentation	- Re-sectioning of the embankment and maintaining design slope of the embankment firmly - Construction and repair of drainage sluices/flushing inlets to regulate the water flow - Re-excavation of drainage khals - Dredging of Putimari river and Butiamari river - Proper maintenance and management of the water control structures - Afforestation along the embankment
2	Agriculture Resource	• Every year (Feb. to April) farmers can not cultivate Boro, other cereals and vegetable crops due to soil salinity. • Drainage congestion during transplanting period in Aman season. • Severe scarcity of irrigation water during dry season especially for rabi crops cultivation. • Most of the water control structures (regulators) are not functioning properly. • The siltation caused raise of different internal drainage khals.	• Re-excavation of proposed khals • Replacement of sluice gates. • Training for WMAs.
3	Fisheries Resource	• Depth of internal canals are gradually reducing due to siltation and leads to degradation of habitats • Inundation of ponds and ghers due to drainage congestion • Fish and hatchling improper operation of water control structures. • Illegal fishing in the canals and at the site of Drainage Structure • Illegally closing the sluice gate during monsoon by muscle men to create artificial flood to over flow the ponds and ghers and then they harvest escaped cultured fish from the canals and nearby sluice gate • Damage the fresh water fishes of ponds and ghers through sudden	• Re-excavation of khal will improve the habitat condition and also help to increase the richness of fish species in the Polder area • Enforcement of Fish Conservation and Protection Acts by Government • Strengthening of local water management committee or the activities of WMA/WMO • Re-sectioning of embankment with reasonable height

Sl	Issues	Problems	Suggested measures
		entrance of saline water by storm surges associated tidal flooding	
4	Ecology	• Soil salinity and internal khal siltation are the main threats on ecosystems of this Polder. • Mal-functioning of water control structures like regulators, causes insufficient drainage and flashing capacity of the Polder area that damages vegetation.	• Removing siltation and drainage congestion by re-excavation of khal. • Re-sectioning of embankment and repairing of water control structures will protect the settlement, road side; inter tidal area and crop field's vegetations.
5	Socio-economic	• During high tidal, water inters into the Polder area, but is not drained out. • Siltation at both side of all structures • Scarcity of fresh water is one of the main problems in the Polder area especially during dry season. • The typical conflict among different type of users, e.g. *Bagda Gher* owner, open water fisher (fishing at sluice gates) and farmers are observed in maximum part of project area. • Communication system is a vital issue of this Polder; • Drainage congestion, tidal flooding, salinity intrusion and cyclone are the main community concerns in the Polder 34/3 area. • Lack of adequate expertise and experienced manpower to carry out the O&M of the Polder and the numbers of field staffs are also insufficient and inadequate in some places of the Polder with respect to the actual requirement. • Local powerful persons, including the political leaders illegally interfere on the water control/ management infrastructure.	• All Socio-economic issues will follow "Resettlement Action Plan (RAP)". • All *khals* should be kept free from illegal occupier (e.g. *Butiamari, Jirthalar, Konta Kata and Petnerami khals*); • Re-excavate the inlet and outlet of the structures • Replacement by two vent regulator at *Jirthalar khal instead of one vent;* • Construction of one vent regulator at *Dashkhali khal* along with re-excavation; • Shashikhali sluice gate need to be kept open round the year; • Three sluice gates located at Badukhali beel (Barakpur, Fullbari and Sreeghat gate) should be repaired immediately; • Construct new sluice gate at Gazalia *khal* (Godardia and Kati mouza) to remove drainage congestion; • Comprehensive rehabilitation of the Polder should be taken up at the earliest with the active involvement of the local community especially UP chairman, all members and elite society; • The embankment cum road should be repaired immediately in places; • The embankment needs to be strengthened and re-sectioned for prevention of tidal water intrusion; • Excavating and dredging of the major river (*Putimari, Daudkhali and Bishnu River*) and *khals* for well connectivity of water flow; • Existing embankment's height need to be increased; • Shingrimari flushing gate should be repaired;

Sl	Issues	Problems	Suggested measures
			• Need awareness building among the communities about water management; • All structures and flushing inlets and outlets should be managed properly; • It is necessary to ensure sustainable operation of the project, participation of Water Management Organization (WMO) and Community Based Organizations (CBOs) and also manage properly water control structures i.e. embankment, sluice gate, regulator, inlets, culverts etc and growing of consciousness among the community in the Polder.

11.12 Findings

655. The proposed rehabilitation works in Polder 34/3 is the foremost demand of the local people to mitigate the existing irrigation and drainage problems. Local people also demanded that dredging at Putimari River, Daudkhali and Bishnu River should be conducted first, which could mitigate the irrigation and drainage problems in the Polder area significantly. The proposed interventions for this Polder should be implemented properly. Otherwise, existing drainage congestion problems might increase further. They also opined that drainage channels near the inlet and outlet of the proposed structures should be re-excavated (e.g. *Butiamari khal, Kata khal, Delbhashari khal, Dashkhali khal, Jirthalar khal, Konta kata khal, Amtoli khal, Shashikhali khal, Ratna Khal, Golbarir khal*) to continue the water flow. However, local peoples expected that if the proposed interventions are implemented properly considering above mentioned issues, the loss of assets will be reduced and the income level of the local peoples will be increased.

11.13 EIA Disclosure

656. The draft EIA report and its executive summary was disclosed to the public on 27thJuly (from 11:00am to 13:00pm), 2017 in Bagherhat Sadar Upazila, Khulna. The main aim of the meetings was to present the findings of the final draft report on EIA and to receive feedback from the local stakeholders. The report was also finalized through incorporation of comments and suggestions received from the meetings.

657. The participants of the PDM includes, Upazila Nirbahi Officer (UNO),Upazila Chairman, Vice Chairman and other concerned government officials, Journalists, NGO representatives, environmentalists and activists, local stakeholders and other representatives of CEGIS. A total of 54 participants attended the public disclosure meetings. The findings of the Public Disclosure Meeting (PDM) are given below.Some photographs of the PDM are also given below Photo 11.5.

Photograph 11.5: View of PDM at Upazila Auditorium, Bagerhat Sadar, Khulna

11.14 Findings of the PDM:

658. The communities including the persons to be affected of Polder 34/3 by the Project expressed their views in favour of the Project and wanted early implementation to protect them from natural disasters. They demanded following actions for immediate implementation. These are:

- The design consultant should organize a consultation meeting with the local people in the Polder area before selection of interventions
- Water management committee should be formed by consultation with local UP representatives and handed over to the local administrations for smoothly operation of the gates
- All internal khals should be re-excavated
- Peripheral rivers should be re-excavated under this project, otherwise, internal khal re-excavation would not remove the drainage congestion in the Polder area
- Before starting of construction activities, the project authority should arrange a meeting with local administration
- Proper compensation should be made to the project affected people before starting the construction activities
- Land use based gate operation system should be introduced in some places of the Polder for elimination of conflicting between gher owners and agriculture farmers
- Effective coordination should be conducted between and local administration for better functioning of the Polder

- Issues like climate change, sustainable development etc should be taken into consideration while implementing the project.
- Effective monitoring should be ensured during the construction of the project activities.
- Ensure engagement of local government for canal excavation
- Tree plantation need to be increased.
- Adequate compensation for slum area people who may be affected by the project activities has to be ensured.
- Awareness building among the communities should be conducted for improved water management;
- Proper O & M for embankments and sluice gates should be ensured in the Polder area
- Water Management Organizations (WMOs) should be formed to manage water control structures properly

References

BARC, 2012. Fertilizer Recommendation Guide, Bangladesh Agricultural Research Council, Farmgate, Dhaka-1215.

BBS, 2011. Population Census 2011, Bangladesh Bureau of Statistics (BBS), Statistical Division, Ministry of Finance and Planning,

BBS, 2008. Preliminary Report of Agriculture Census 2008, Bangladesh Bureau of Statistics (BBS), Government of the People's Republic of Bangladesh

DoE, 1997. EIA Guidelines for Industries. Department of Environment (DoE), Dhaka, Bangladesh.

CEIP,2012. Feasibility Report, Coastal Embankment and Improvement Project (CEIP), Bangladesh Water Development Board (BWDB), Dhaka, Bangladesh.

MoEF, 1997. The Environment Conservation Rules, Ministry of Environment and Forest (MoEF) Government of the People's Republic of Bangladesh, Dhaka, Bangladesh

FAO/UNDP, 1988. Land Resources Appraisal of Bangladesh for Agricultural Development (Report-2), "Agro-ecological Regions of Bangladesh", Prepared by Food and Agricultural Organization (FAO), United Nations.

Feasibility Report of CEIP, Volume lll: Afforestation Report, September 2013.

IMD, 2012. "Annual Climate Summary 2012". National Climate Centre, Pune.

IPCC, 2001, Climate Change 2001: The scientific Basis, Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Houghton, J.T., Ding. Y., Griggs, D.J., Noguer, M., van der Linden, P.J., Dai, X., Maskell, K., Johnson, C.A. (Eds), IPCC, Cambridge University Press, Cambridge, p. 881.

IPCC, 2013. Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Dash, S.K., Kulkarni, M.A., Mohanty, U.C. and Prasad, K., 2009. “Changes in the characteristics of rain events in India”. J. Geophys. Res., 114, D10109, doi:10.1029/2008JD010572

IUCN, 2000. Red list of threatened animals of Bangladesh. The World Conservation Union (IUCN), Dhaka, Bangladesh. 54 pp.

Jack M. Whetstone, Gravil D. Treece, Craig L. Browdy, and Alvin D. Stokes, 2002. Opportunities and Constraints in Marine Shrimp Farming, SRAC Publication No. 2600, July 2002

Mazid. M.A, 2002. Development of Fisheries in Bangladesh, Plans for Strategies for Income Generation and Poverty Alleviation, Momin Offset Press, Dhaka1205

SOLARIS-SRDI (Soil and Land Resources Information System-Soil Resource and Development Institute), 2006. SOLARIS Model developed by Center for Environmental and Geographic Information Services (CEGIS) for Soil Resource and Development Institute (SRDI), Farmgate, Dhaka-1215.

WARPO, 2005. Guidelines for Environmental Assessment of Water Management (flood control, Drainage and Irrigation) projects. National Water Management Project. Water Resources Planning Organization (WARPO), Dhaka

Appendix A: Checklist

EIA of Coastal Polders under CEIP

Checklist for Water Resources Information Collection

Center for Environmental and Geographic Information Services (CEGIS)

A. Administrative Information

Name of Polder:	**BWDB Zone:**	**Hydrological Zone:**
BWDB Circle name:	BWDB O & M Division:	
District (s):	Upazila (s):	
Union (s):	Mouza (s):	

B. Project Description

General Information	
a. Type of project:	b. Area of Polder (Ha):
c. Objectives of the scheme:	
d. New problems (if any) created by the project activities:	
e. Year of Starting:	f. Year of completion:
g. Name of surrounding Polder	
h. Name of the projects hydro-morphologically dependent on the Polder	
i. Cumulative hydraulic and morphological impacts as anticipated by local people	
Data Collected by:	Date:

Present Status/condition of Embankment	
Embankment length (……………….Km)	Embankment Type: Submergible / Full flood protection
Breaching: 1. Yes 2. No Breaching spot (If yes): (Please specify the spot names, length, GPS reading)	

Location of Breaching Points (Name of Place)	Reasons of breach	Good		Moderately affected		Badly affected/ Vulnerable		Completely damaged	
		GPS ID	Length	GPS ID	Length	GPS ID	Length	GPS ID	Length

Public Cuts: 1. Yes 2. No Public Cuts (If yes): (Please specify the spot names, length, GPS reading)

Location of Public Cuts	Reasons	Moderately affected		Badly affected/ Vulnerable		Completely damaged	
		GPS ID	Length	GPS ID	Length	GPS ID	Length

Re-sectioning: 1. Yes 2. No Re-sectioning (If yes): (Please specify the spot names, length)

From	**To**	**Length**	**Height**	**Actual reasons**

Regulators

Location of Structure	GPS ID	Type	Vent Size	No of Vent	Service Condition (VG/G/M/B/VB)21	Present Condition (Partial/full damage/good)	Present Problems	Reasons for problem	Year of problem	Rehabilitable (Y/N)	Replaceable (Y/N)

Fish pass Structures

Cross Drainage Structures (Syphon/Aqueduct)

21 VG – Very Good, G – Good, M – Moderate, B – Bad, VB – Very Bad

Barrage										

Pipe Sluices										
Irrigation Inlets										
Bridge/Culverts										
Others										

Drainage Channels

Name	Length	Flow Direction	Flow (%)	Present Service Condition \Problems	Reasons of Problem	Re-excavation Need (Y/N)	Proposed Re-excavation Mode (Manual/ Mechanical)	From – To (Approx. length)	GPS ID (Structure)

Irrigation Canals					
Name	Length	Problems	Reasons	Re-sectioning (Y/N)	From – To (Approx. length)

Protective Works							
Location Name	Type (Temporary/Permanent)	Length	Present Condition (G/ MD/ CD)22	Problems	Reasons	From – To (Approx. length)	GPS ID (Protection Work)

Do you think that local people/Stakeholders were involved or could be involved in future for the maintenance work of the above mentioned works? If 'Yes' mention the source of generating funds?	
Persons engaged in operating gates of the structures:	BWDB/Local people or Stakeholders/Beneficiaries
Problems facing in operating the gates of the structures:	
Your suggestions regarding the people to be engaged in operating these gates:	BWDB/Local people or Stakeholders/Beneficiaries

D. Water Resources			
1.River system (inside and outside the Polder)			
Inside	Outside	Main river	Flow direction

2. Name of beels:			
Union	Beels	Union	Beels
3. Topography:		4. Drainage pattern:	
5. Drainage congestion extent (ha):		Causes: Natural / Man made/Through project activities	
Problems:		Reasons:	
6. Water logging (% of extent) in the month of February			

22 G – Good, MD – Moderately Damaged, CD – Completely Damaged

Union	Area (%)	Causes

7. Flooding (depth, % of extent, onset, peak and recession)

Flood/Inundation Condition	Area (%)	Reasons of Flooding	Onset:
F0 (< 30 cm)			
F1 (30-90 cm)			Peak:
F2 (90 – 180 cm)			
F3 (180 – 360 cm)			Recession:
F4 (> 360 cm)			

E. River Erosion

River/Khal name	Area (ha)	Length (m)	Reasons

F. Accretion

River/Khal name	Area (ha)	Reasons

G. Water Quality (Peoples perception)

1. Ground water (Presence of pollutant)

Arsenic (Yes/No)	Location:
Iron (Yes/No)	Location:

2. Surface water

River/Khal name	Quality of water (Good/Bad/Avg.)	Type of Pollutant	Sources of pollutant

H. Historical severe flood:

Recent flood	**Extent (Days)**	**Flood level (cm)**	**Damage of resources**	
1988				
1994				
1998				
2004				
2007				
Last five years	Flood year			Flooding areas:
	Non flood year			

I. Participatory Social Mapping by stakeholders (Name of regulators, name of public cuts points, Name of breaching points, location of water logged area, identification of encroached canal with name and their location on map)

J. Peoples opinion of the project

Pre-project condition:
Period of project benefits:
Present condition and Present problems:
Causes of problems:
Probable Solution/Improvement:

EIA of Coastal Polders under CEIP

Checklist for Land Resources, Agriculture and Livesock Information Collection

Center for Environmental and Geographic Information Services (CEGIS)

Land Resources:

Land degradation

Factors	Year from starting LD	Result of LD
Soil erosion		
Sand carpeting		
Salinisation		
Acidification		
Nutrient deficiency		
Farming practices		
Water logging		
Others		

Agriculture Resources: (For small project information collection from filed. For large project both primary and secondary information collection from field and DAE office)

Cropping Pattern by land type

Land Type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-February)	% of area

Crop calendar

Crop name	Seedling		Transplanting/Sowing		Harvesting	
	Start	End	Start	End	Start	End

Crop yield

Crop Name	Damage free Yield (ton/ha)	Damage area (%)	Damage Yield (ton/ha)

*Damage area and yield loss calculation: Last 3 years average value

Crop damage

Name of hazard	Ranked	Timing	Causes
Flood			
Drought			
Pest infestation*			
Others:			
*List name of pest and pesticide by crop			

Fertilizer and pesticide application

Crop Name	Seed (Kg/ha)	Fertilizer (Kg/ha)				Pesticide		
		Urea	TSP	MP	Other	No of Appli.	Liq. (ml/ha)	Gran. (Kg/ha

Irrigation, Land preparation and Labour

Crop Name	Irrigation			Land preparation			Labour	
	Mode	% of Area	Charge (Tk/ha)	Power (%of Area)	Animal (% of Area)	Tk/ha	Nos./ha	Tk/ labour

Note: Support Services of the project areas

Livestock Resources: Primary and Secondary Information collection from field and DLS offices

Livestock and poultry production

Name of Livestock/poultry	% of HH having Livestock/Poultry	No. of Livestock/poultry per HH
Cow/Bullock		
Buffalo		
Goat		
Sheep		
Duck		
Chicken		

Feed and Fodder

Name of Livestock/poultry	Feed/Fodder Scarcity (Timing)	Causes	Remarks
Cow/Bullock			
Buffalo			
Goat			
Sheep			
Duck			
Chicken			

Diseases

Name of Livestock/poultry	Name of Disease	Disease (Timing)	Causes	Remarks
Cow/Bullock				
Buffalo				
Goat				
Sheep				
Duck				
Chicken				
Note: Support Services-				

Where, when, how much and causes of Crop Damage.

Fisheries Baseline Checklist

EIA of Coastal Polders under CEIP

Village: Mouza: Union: Upazila: District: BWDB Circle: BWDB Division:

Background Water bodies: Name: Alphabetic, Area: in Ha/% of area/Ana, Length: in km, Depth/Inundation depth: in Meter, Flood Duration: in Months, Production: metric ton

Problem/Issue	Fishing Effort	Habitat Type	Water Quality	Avg. Production	Production Trend (+/-) and Reason	List of Gears	% of gears	List of Habitat Name	Present					Past (15-20 yrs back)				
									Area	Length	Width	Depth	Duration	Area	Length	Width	Depth	Duration
Capture Fisheries:	a. Total No. of fisher HHs: b. %/No. of CFHHs:	River																
Culture Fisheries:	c. %/No. of SFHHS:	Beel (Leased/ non leased)																
Indiscriminate Fishing Activities:	d. No. of Days spend annually in fishing by CFHHs: SFHHs:	Khal																

Problem/Issue	Fishing Effort	Habitat Type	Water Quality	Avg. Production	Production Trend (+/-) and Reason	List of Gears	% of gears	List of Habitat Name	Present: Area	Present: Length	Present: Width	Present: Depth	Present: Duration	Past (15-20 yrs back): Area	Past (15-20 yrs back): Length	Past (15-20 yrs back): Width	Past (15-20 yrs back): Depth	Past (15-20 yrs back): Duration
		Floodplain																
	e. Hrs/Day spend in fishing by CFHHs:	Swamp Forest																
		Fish pond																
		Baor																
	SFHHs:	Other																

Fish Migration				Fish Biodiversity		Species List: River	Species List: Khal	Species List: Beel	Species List: Pond	Species List: Other	Species Composition: Group	Species Composition: River	Species Composition: Khal	Species Composition: Beel	Species Composition: Pond
Previous Migration Status				Fish diversity status (Poor/Moderate/Rich)/%							Major carp				
											Exotic carp				
											Other carp				
											Catfish				
											Snakehead				
Present Obstacle to fish migration:	1.			Reasons of increase or decrease	1.						Live fish				
											Other fish				
	2.				2.						Prawn				
											Hilsa				
	3.				3.										
Important breeding, feeding and over wintering ground															
					4.										
					5.						Rui				
											Catla				
Horizontal Migration pattern	Species:	Season (Months):	Routes:	Significant areas	1.						Mrigel				
	1.										Koi				
	2.				2.						Sarpunti				

Fish Migration				**Fish Biodiversity**		**Species List**					**Species Composition**				
						River	**Khal**	**Beel**	**Pond**	**Other**	**Group**	**River**	**Khal**	**Beel**	**Pond**
	3. 4. 5.				3.						Large prawn				
											Small Pprawn				
Vertical Migration Pattern	Species: 1. 2. 3. 4. 5.	Season (Months):	Habitats:	Species of Conservation Significance	Rare:						Silver carp				
											Carpu				
											Grass carp				
											Tengra				
					Unavailable:						Chapila				
											Others				

Post Harvest Activities		**Fishermen Lifestyle**	
Fish edible quality:		Socio-economic Status of subsistence level fishermen:	
Source of pollution in each habitat:		Socio-economic Status of Commercial fishermen:	
Seasonal vulnerability:		Other conflict (with muscle men/ agriculture/ other sector/laws):	
Ice factory (Number, location and name):		Fishermen community structure (Traditional/Caste/Religion)	
Landing center, whole sale market, other district markets, etc.:		Traditional fishermen vulnerability (Occupation change/others):	
Storage facility (number, location and name):		Existing Fisheries Management	
Fish market (Number, location and name):		Fishermen Community Based Organizations (FCBOs):	
Marketing problems:		WMOs activity:	

Post Harvest Activities		**Fishermen Lifestyle**	
Fish diseases (Name, Host species, Season, Syndrome, Reason, etc.):		Fishing right on existing fish habitats (Deprived/Ltd. access/Full access):	
Other backward and forward linkages (Number, location and name):		Leasing system:	
Transport facility (Mode of fish transportation, cost, other involvements)		Enforcement of fisheries regulation (Weak/strong):	
Dry fish industries		Department of Fisheries (DoF) activity:	
Others information:		NGOs activities:	

Note: 1. Major Carp - Rui, Catla, Mrigal, 2. Exotic Carp - Silver Carp, Common Carp, Mirror Carp, Grass Carp, 3. Other Carp - Ghania, Kalbasu, Kalia, 4. Cat Fish - Rita, Boal, Pangas, Silon, Aor, Bacha, 5. Snake Head - Shol, Gazar, Taki, 6. Live Fish - Koi, Singhi, Magur, 7. Other Fish - Includes all other fishes except those mentioned above.

Beels: Rui (Labeo rohita), Catla (Catla catla), Mrigal (Cirrhinus mrigala), Kalbasu (Labeo calbasu), Gonia (Labeo gonius), Boal (Wallago attu), Air (Mystus aor / Mystus seenghala), Shol/Gazar (Channa spp.), Chital/Phali (Notopterus chitala / N. notopterus), Koi (Anabas testudineus), Singi/Magur (Heteropneustes fossilis /Clarias batrachus), Sarpunti (Puntius sarana), Large Shrimp (Macrobrachium rosenbergii /M. malcomsonii), Small Shrimp, Silver Carp (Hypophthalmichthys molitrix), Carpio (Cyprinus carpio), Grass Crap (Ctenopharyngodon idellus), Pabda (Ompok pabda), Punti (Puntius spp.), Tengra (Mystus spp.), Baim (Mastacembelus spp.), Chapila (Gudusia chapra), Others.

Pond: Rui (Labeo rohita), Catla (Catla catla), Mrigal (Cirrhinus mrigala), Kalbasu (Labeo calbasu), Mixed Carp, Silver Carp (Hypophthalmichthys molotrix), Grass Carp(Ctenopharyngodon idellus), Mirror Carp (Cyprinus carpio var. specularis), Tilapia (Oreochromis mossambicus / O. niloticus), Shrimp, Aor (Mystus aor / Mystus seenghala), Boal (Wallago attu), Shol/Gazar & Taki (Channa spp.), Chital/Phali (Notopterus chitala / N. notopterus), Koi (Anabas testudineus), Singi/Magur (Heteropneustes fossilis / Clarias batrachus), Sarpunti (Puntius sarana), Thai Sarpunti (Puntius gonionotus), Punti (Puntius spp.), Others.

EIA of Coastal Polders under CEIP

Checklist for Ecological Information Collection

Center for Environmental and Geographic Information Services (CEGIS)

Basic Information

Date		**Prepared by**	
Name of the Polder			
BWDB Circle Name			
District/s		Upazila/s	
Location of the FGD			

Habitat Information/Ecosystem Types (Please put tick where is applicable)

Agriculture land		Forest patches including social forestry	
Settlement/Homesteads		Canal and ponds	
Orchard		Grasslands	
Fallow		Reserve forest	
Ridges		Others	

Terrestrial Vegetation Checklist (List of Major Plant Species)

Species Name	**Status**	**Utilization**
Homestead Vegetation		
Mangrove Vegetation		
Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others		

Terrestrial Wildlife Check List

Species Name	**Habitat**	**Status**	**Migration Status**
Mammals			

Species Name	**Habitat**	**Status**	**Migration Status**
Amphibians			
Reptiles			
Birds			
Habitat: 1= Homestead forest, 2= Floodplains, 3= Wetlands, 4= River, 5= Pond, 6=Forest Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare Migration Status: 1= Local, 2= Local Migratory, 3= Migratory			

Aquatic Wildlife Checklist

Species Name	**Habitat**	**Status**	**Migration Status**
Mammals			
Amphibians			
Reptiles			
Birds			
Habitat: 1= Homestead forest, 2= Floodplains, 3= Wetlands, 4= River, 5= Pond, 6=Forest Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare Migration Status: 1= Local, 2= Local Migratory, 3= Migratory			

Foreshore vegetation/Mangrove vegetation

Name of the forest patches location (s)	Species Name	Abundance	Utilization
Abundance1= High,2=Moderate,3=Low Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others			

Major Wetland information

Name of wetland	Type of Wetland	Area in Acre	Connectivity		Impor tance
			Khal	River	
Type 1= Beels, 2= Rivers, 3= Open water wetlands, 4= Floodplains, 5= Closed water wetlands, 6= Ponds, 7= Baors (oxbow lake). 1=Fish; 2= migratory bird; 3= other wildlife; 4=aquatic flora					

Wetland vegetation Checklist

Species Name	Habit	Status	Utilization
Habit 1=Submerged, 2=Free floating, 3=Rooted floating, 4=Sedges, 5=Marginal Status 1= High, 2= Moderate, 3= Low Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others			

Forest Information (Surrounding/nearer the Polder)

Forest Name with Range/Beet office	**Type**	**Location**	**Area in Acre**	**Major Plant Species**
Type 1=Swamp Forest, 2=Reserve Forest, 3=Vested Forest, 4=Reed forest, 5=Other (specify)				

(9)Anticipated Impacts due to proposed interventions on particular Ecosystems

(Impact from changed land use, noise, human presence etc.)

Name of Intervention	Impacts
Embankment Re-sectioning	
Breach Closing	
Construction of Water control Structures	

(10) Comments (If any):

EIA of Coastal Polders under CEIP

RRA/FGD Data Collection Format for Socio-economic Survey

Date of Survey:.................................. Name of Polder:

1. Place of Interview:

Name of Mouza(s)...
...

Union(s)/Ward(s)...

Municipality(s).if any
....
Upazila(s)/Thana(s)...
District(s)/.....................................

2. Characteristics of Population:

2.1 Total Households, Population (male, female, rural and urban) in Project area

Total Households	Population		
	Male	Female	Total

Source: BBS

2.2 Age distribution

Age range													
0-4 Years		**5-9 Years**		**10-14 Years**		**15-17Years**		**18-34 Years**		**35-59 Years**		**60+Years**	
M	F	M	F	M	F	M	F	M	F	M	F	M	F

Source: BBS

2.3 Literacy rate

% of Literacy (Over 7 years)		
Total	Male	Female

Source: BBS

2.4 Occupation and employment

Main occupation by population	**% of population**
Not working	
Looking for work	
Household work	
Agriculture	
Industry	
Water, Electricity & Gas	
Construction	
Transport	
Hotel & Restaurant	
Business	
Service	
Others…..	

Source: BBS

Main occupation by households:

Main occupation by households	**% of households**
Agriculture/Forestry/Livestock	
Fishery	
Agriculture Laborer	
Non-agriculture Laborer	
Handloom	
Industry	
Business	
Hawker	
Construction	
Transport	
Religious	
Service	
Rent	
Remittance	
Others…..	

Source: BBS

2.5 Labor availability and wage

a. Labor (Male) for farming (High/Medium/Low), Av. Wage/Day (Tk.) Max:............Min: ....

b. Labor (M) for non-farming (High/ Medium/ Low), Av. Wage/Day (Tk.) Max:............Min: ....

c. Labor (Female) for farming (High/Medium/Low), Av. Wage/Day (Tk.) Max:............Min: ....

d. Labor (F) for non-farming (High/ Medium/ Low), Av. Wage/Day (Tk.) Max:............Min: ....

2.6 Migration (seasonal/permanent)

a. Seasonal out migration from study area (% per year with location):

b. Seasonal in migration to study area (% per year with location):

c. Permanent out migration from study area (Number per 1/2 years with location):

d. Permanent in migration to study area (Number per 1/2 years with location):

2.7 Annual Expenditure and Income by range

a. Expenditure

Expenditure group (in taka)	Percentage of households
<=12,000	
12,000-24,000	
24,000-60,000	
60,000-1,08,000	
1,08,000-2,40,000	
>=2,40,000	

Sources: RRA

b. Income

Expenditure group (in taka)	Percentage of households
<=12,000	
12,000-24,000	
24,000-60,000	
60,000-1,08,000	
1,08,000-2,40,000	
>=2,40,000	

Sources: RRA

Self assessed poverty for year round

Sl. No.	Poverty status	Percentage of households
1	Deficit	
2	Balance/Breakeven	
3	Surplus	

Sources: RRA

Housing (photographs)

Sl. No.	Housing status	% of hhs having
1	Jhupri	
2	Kutcha	
3	Semi Pucca	
4	Pucca	

Source: RRA

Drinking water (photographs)

Sl. No.	Drinking water sources	Percentage of households use
1	Tap	
2	Tube well	
3	Well	
4	Pond	
5	Other.........................	

Source: BBS

Sanitation (photographs)

Sl. No.	Toilet types	Percentage of households under each type
1	Water Sealed	
2	Ring Slub	
3	Kancha	
4	No facilities	

Source: RRA

2.12 Diseases in Polder area

a. Diseases in area

Sl. No.	Disease	Ranking by incidence	Sl. No.	Disease	Ranking by incidence
1	Influenza/ Common fever		9	Chicken pox	
2	Cough/cold		10	Skin disease	
3	Diarrhoea		11	Diabetes	
4	Dysentery		12	Hypertension	
5	Hepatitis		13	Asthma	
6	Malaria		14	T B	
7	Dengue fever		15	Gastric	
8	Typhoid		16	Arsenicosis	

Sources: RRA

b. Health facilities in study area (photographs)

Sl. No.	Type of facility	Number of facilities with name
1	Number of District level Hospitals	
2	Number of Upazila Health Complex	
3	Union Health Center	
4	Private Health Clinic/ Hospitals	

Sources: RRA

b.1 Status of peripheral health facilities used by the study area people:

____
____
____
____
____

Source of treatment facilities in study area

Sl. No.	Source of treatment facilities	% of hhs received
1	Trained Physician	
2	Paramedic/ Diploma Physician	
3	Quack Doctor and Informal Treatments	
4	No treatment facilities at all	

Sources: RRA

2.13 Electricity

Percentage of household having electricity facility: ....BBS

Percentage of household having electricity facility: ....(During Survey)

3. Social overhead capital (photographs)

3.1 Existing road networks in study area and it's level of benefit

a. National Road (km.) ....(GIS) Beneficial: Highly /Moderately / Poorly

b. Regional Road (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

c. Local Road Pucca (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

d. Local Road Kancha (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

3.1.1 Status of peripheral road networks (with name) used by the study area people:

3.2 Existing railway network in study area and it's level of benefit

a. Railway (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

3.2.1 Status of peripheral railway service used by the study area people:

3.3 Existing waterways in study area and it's level of benefit

a. National Route (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

b. Local Route (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

3.3.1 Status of peripheral water ways (with name) used by the study area people:

3.4 Status of the navigation route by season

a. National Route: Served Seasonally/Through out the year

b. Local Route: Served Seasonally/ Through out the year

3.5 Major waterways handicapped

a. by structures.................................... location

b. by siltation................................. location

3.6 Nos. of major ghats/ports and name:

3.7 Academic Institution (school, colleges) (photographs)

Sl. No.	Type of facility	Nos. of Institution	Type of facility	Nos. of Institution
1	Primary School		Ebtedayee Madrasha	
2	High School		Dakhil Madrasha	
3	College		Alim/ Fazil Madrasha	

Sources: RRA

3.6.1 Status of peripheral academic institutions (with name) used by people of the study area:

____
____
____
____

____
____

____
____

3.8 Markets and GC (photographs)

Sl. No.	Type of facility	Nos. of markets	Comments with name
1	Major markets		
2	Minor markets		
3	Growth Centers		

Sources: RRA

3.8.1 Status of peripheral markets used by people of the study area:

____
____
____
____
____

4. Land holding categories

4.1 Percentage of HH who have owned agricultural land: ....(BBS)

Percentage of households with different land ownership category in the area:

Land ownership classes	Percentage of household
Land less/ No land (0 decimal)	

Land less (up to 49 decimal)	
Marginal (50-100 decimal)	
Small (101-249 decimal)	
Medium (250-749 decimal)	
Large (750 + decimal)	

Sources: RRA

5. Conflict between different land owner group and professional group

Reasons of Conflicts	Present status of problem	Solution they want with location
Water control infrastructures		
Land elevation		
Cross-interest		

6. Disaster related information: (photographs)

6.1 Type of major disaster and damage occurred in the area after completion of the Project

Sl. No.	Major Disaster	Severely affected year	% of area affected	% of hhs affected	% of crop damage	Major crop damaged
1	Flood					
2	Drought					
3	Tidal flood					
4	Storm					
5	Cyclone					
6	Hail storm					
7	Salinity intrusion					
8	Water logging					
9	Erosion					

Sources: RRA

7. Safety Nets and Poverty Reduction Measures in the area:

7.1 Name and activity of GO/ NGOs working in this area

Name	**Activity (Credit, Education, Health, Forestry, Fishery, Livestock Rearing, Women Empowerment, Human Rights, VGF, Boyosko bhata, etc.)**	**% of HHs coverage**

8. Information on Water Management Organizations (WMOs) (photographs of office building, committee members, resolution etc)

8.1 Do you know about the CEIP project? Y/N

8.2 Existence of WMOs: Yes/No

8.2.1 If WMO exists:

Sl	**Issue/Question**	**Response/Suggestion**		
a)	Year of formation (date if possible)			
b)	Registered by whom?			
c)	Number of members (male-female)	Male	Female	Comments
	Farmer			
	Trader			
	Labor			
	Landless			
	Fisher			
	Service holder			
	Others			
d)	No. of villages covered			
e)	Existence of fund			
f)	AGM			
g)	Election			
h)	EC meetings			
i)	Present water resources management activities			

8.2.2 Name of EC members with address/phone number:

Sl. No.	**Name**	**Address**	**Phone Number**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

If WMO does not exist, please state the reasons for

____
____
____

____

____

8.3 Are people willing to form WMO? Y/N

(If yes, give demonstrative proof of their capacity if any)

8.4 Is WMO willing to take up management responsibilities? Y/N

8.4.1 If yes, please give some idea about what to do on management

9. Some other Issues

9.1 Any land acquisition to be needed for the rehabilitation of the Polder ? Yes/No

9.1.1 If yes, size of the area? __________________________________(acre)

9.1.2 If yes, are they willing to provide land for acquisition? Yes/No

9.2 Any replacement of people to be needed for the rehabilitation of the scheme? Yes/No

9.2.1 If yes, how many? _____________________________ (number of household)

9.3 Have any cultural heritage /archeological sites in the Polder? Yes/No

Give some description

9.4 Have any vulnerable communities (e.g. landless, fishermen, boatmen, destitute women without food and/or shelter) in the scheme area? Yes/No

a. Give some description

9.5 Have any common property resources (e.g. irrigation systems, fishing grounds (wetlands), pastures, forests, graveyard, cremation ground, mosque, temple, etc.) in the scheme area? Yes/No

a. Give some description

10. Comments of Facilitator:

Name of the RRA/FGD Participants:

Name	Age	Occupation	Address/Phone No.

Appendix B: Details of Relevant Policies and Laws

Legislation

(i) Environment Conservation Act, 1995

The national environmental legislation is known as Environmental Conservation Act (ECA), 1995 (subsequent amendments) is currently the main legislative document relevant to environmental protection in Bangladesh. It was promulgated in 1995 and has repealed the earlier environment pollution control ordinance of 1977. The main objectives of ECA 1995 are:

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

The main strategies of the Act can be summarized as:

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

Bangladesh Environmental Conservation Act (Amendment 2000) focuses on: (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

Bangladesh Environmental Conservation Act (Amendment 2002) elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

Bangladesh Environmental Conservation Act (Amendment 2010) elaborates on (1) demarcation of wetlands and water bodies, (2) Hazardous waste import, transportation, storage etc., (3) Cutting of hills, mountains (4) Ecologically Critical Areas.

Failure to comply with any part of the Environment Conservation Act 1995 may result in punishment to a maximum of 5 years imprisonment or a maximum fine of Tk. 100,000, or both.

(ii) Environment Conservation Rules, 1997 (amendments in 2002 and 2003)

A set of the relevant rules promulgated to implement the ECA 1995. There have been three amendments to the Rules until now in February and August 2002 and April 2003 respectively. The Rules mainly consist of:

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

- Categorization of industries, development projects and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities.
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities;
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

The proposed projectbelongs to the Red Category according to the classification of industrial units or projects described in the Schedule-1 in the Rules. The procedure for issuing Environmental Clearance Certificate is elaborated in the Rules that must have to follow by the BWDB.

Another rule of the ECR is to determine environmental standards. The standards for air, water, sound, odor and other components of the environment shall be determined in accordance with the standards specified in Schedules - 2, 3, 4, 5, 6, 7 and 8. The proposed project must comply these standards during carrying out the activities.

(iii) The Environment Court Act, 2000

The Environment Court Act, 2000 has been enacted in order to establish environmental courts in each administrative division of Bangladesh. Under this Act, the court has concurrent jurisdiction i.e. to try both civil and criminal cases. The basis for instituting a case is a violation of the “environmental law”, meaning the Bangladesh Environment Conservation Act, 1995 and Rules made there under. In particular the environment court is empowered to:

- Impose penalties for violating court orders;
- Confiscate any article, equipment and transport used for the commission of the offence2;
- Pass any order or decree for compensation;
- Issue directions to the offender or any person (a) not to repeat or continue the offence; (b) to take preventive or remedial measures with relation to any injury, specifying the time limit and reporting to the DOE regarding the implementation of the directions.

(iv) Bangladesh Water Act, 2013

The Water Act 2013 exists for integrated development, management, extraction, distribution, usage, protection and conservation of water resources in Bangladesh.

As per this Act, all forms of water (e.g., surface water, ground water, sea water, rain water and atmospheric water) within the territory of Bangladesh belong to the government on behalf of the people. Without prior permission issued by the Executive Committee, no individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor they will be allowed to build any structure that impede the natural flow of rivers and creeks. Issuance of clearance certificate must be obtained by all organizations or appropriate authorities that are involved in undertaking, making or implementing a Water Resource Development Project before initiating the project, according to section 16.

(v) The Embankment and Drainage Act, 1952

This is an Act to consolidate the laws relating to embankment and drainage and make better provisions for the construction, maintenance, management, removal and control of embankments and watercourses or the better drainage of lands and for their protection from floods, erosion or other damage by water. The major provisions are:

According to the Section 4 (1) every embankment, watercourse and embanked tow-path maintained by the Government or the Authority, and all land, earth, pathways, gates, berms and hedges belonging to or forming part of, or standing on, any such embankment or water-course shall vest in the Government or the Authority.

Section 25 describes the restoration of land etc. that any person who shall have sustained damage by the execution of such works shall receive compensation from the Government or the Authority. Any alteration if appear unnecessary shall be restored as nearly as possible to the state in which they were before the activity at the expense of the Government or the Authority.

Section 28 outlines the provisions of compensation of damages of any land or any right of fishery, right of drainage, right to the use of water or other right of property shall be compensated.

Section 55 to 59 outline penalties for following cases: unauthorized interference and abetment, injuring embankments, diverting rivers or grazing cattle on embankments, removal of obstruction and repair of damage, and obstructing persons in exercise of powers under this Act.

(vi) Wildlife (Conservation and Security) Act, 2012

The Bangladesh Wildlife (Conservation and Security) Act of 2012 has been formulated by repealing previous laws i.e. Wildlife (Preservation) Act of 1973 and it aims at conservation and safety of biodiversity, forest and wildlife of the country. The Department of Forest (DoF) has the primary responsibility for implementing this Act. The key issues in the Act are:

- Prohibition made related to wild animals and plants that no person can hunt any wild animal without a license or willfully pick, uproot, destroy or collect any plant
- Determination of vulnerable, endangered and critically endangered species of wild animals and plants
- Declaration of sanctuary for the conservation of forest and habitat of wildlife and prohibitions made on such sanctuary.
- Requirement of license to cultivate, extract, manufacture, rear, export or import any wild animal or part of its body, meat, trophy, uncured trophy or any plant.
- Restriction on import, export and re-export of wild animals and plants.

The regulation of the Wildlife Act prohibits establishing or operating any industrial factory within 2 (two) kilometers from the boundary of a sanctuary. This applies to the Polders improvement activity near the Sundarbans Reserve Forest area. Capturing, killing, shooting or trapping of wildlife is prohibited in sanctuary and conservation of all natural resources such as vegetation, soil and water are managed mainly for undisturbed breeding of wildlife.Clause 14 articulates the activities prohibited in a sanctuary listed below:

- cultivate any land;
- establish or undertake any industrial operation;
- harvest, destroy or collect any plant;
- set any kind of fire;
- enter into a sanctuary with any weapon without the permission of the Chief Warden or the officer authorised by him in this behalf;
- disturb or threat any wildlife, or use chemicals, explosives or any other weapon or substances which may destroy wildlife habitat;
- introduce any exotic animal or plant;

- introduce any domestic animal or allow any domestic animal to stray;
- dump any materials detrimental to wildlife;
- explore or dig for extraction of minerals;
- fell any plant or part thereof except silvicultural operations required for natural regeneration of plants;
- divert, stop or pollute watercourse; or
- Introduce any alien and invasive plant species.

This Act is particularly relevant to this study because “biodiversity “is dealt under the Act and according to the Act, “biodiversity” means genetic and species diversity of all species or sub-species of flora and fauna living in aquatic, terrestrial and marine ecosystems or diversity of their ecosystems. It is to be ensured that sufficient mitigation measures are taken for ensuring the safety of biodiversity and protection of flora and fauna. The EIA provides mitigation measures for biodiversity conservation including ecology and fisheries in chapter 8.

(vii) The Protection and Conservation of Fish Act, 1950 and Rules, 1985

The Act aims for the protection and conservation of fish in Bangladesh which has amendment in 1995. This Act provides power to the government to:

- Make and apply rules in any water or waters for the purposes of protection of fisheries.
- Prohibit or regulate the erection and use of fixed engines; and the construction, temporary or permanent, of weirs, dams, bunds, embankments and other structures.
- Prohibit the destruction of fish by explosives, guns, and bows in inland or coastal areas.
- Prohibit the destruction of fish by means of poisoning, pollution and effluents.
- Prescribe the seasons during which fishing is allowed.
- Prohibit fishing in all waters during spawning periods.
- Specify the officials with authority to detect breaches.

The Government made Rules in 1985 which contains 11 sections about various measures of protection and conservation and 2 Schedules specifying waters in which the catching of certain fish species is prohibited without a valid license, specifying fish species of which the catching or sale in certain periods is prohibited, and containing a form of a license for catching of carps in Prohibited Waters. Regulation 3 prohibits the erection of fixed engines in rivers and canals. No fish shall be destroyed by making use of poison or explosives (regulations 4 and 5). Licenses issued under regulation 8 only for purposes of pisciculture. Regulations prohibit the catching, carrying, transporting, offering for sale or possessing of frogs.

(viii) The Forest Act, 1927

The Forest Act was passed in 1927 in order to consolidatethe lawrelating to forests,The forest Act was enacted to preserve and safeguardforest in general, both public and private.The Forest Act of 1927 was amended in 1989 to provide deterrent penalties for certain forest offences and latest amendment came 2000 to add provision for social forestry. To elaborate the social forestry procedure Social Forestry Rules were framed in 2004 under the Forest Act, 1927 and Forest Transit Rules were framed in 2011.

This Act bears some important provisions suchas constitution of reserved forest, formation of any forestlandor wasteland or any land suitable for afforestation willbe the property of Government. This Act covers all procedural matters in implementationin all aspects related to forest conservation and developmentin Bangladesh. The key issues in the Act are:

- Section 3: The Government may declare any forest land which is property of the Government to be reserved forest land.

- Section 4: The Government shall issue a notice to that effect in the Official Gazette.
- Section 5: No rights shall be acquired in reserved forest land other than those acquired by succession or by government grant or contract and no clearing of cultivation shall be carried out other than in accordance with rules made by the Government for the reserved area.
- Section 28 provides for settlement of claims in the reserved area, prohibited activities, and powers of the Forest Officer in respect of such area. The Government may assign to any village community reserved forests and such forest land shall be called Village Forest.
- Section 32: Other public forest or waste land may be declared protected forests and the Government may make rules in respect of all matters listed in the section for such areas.
- Section 76 defines additional regulation making powers of the Government.

(ix) Acquisition and Requisition of Immovable Property Ordinance 1982

The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance, 1982 and subsequent amendments during 1993 - 1994. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, and houses) and (ii) any other damages caused by such acquisition. The Ordinance provides certain safeguards for the owners and has provision for payment of “fair value” for the property acquired.

659. Deputy Commissioners (DC) will pay compensation for the land to be acquired based on Land Acquisition Proposals to be submitted by the requiring body. DCs, in all the cases, determine market value of acquired assets on the date of notice of acquisition (notice under section 3 of the Ordinance). The DCs then adds 50% premium on the assessed value for cash compensation under law (CCL) of all acquired assets except standing crops due to compulsory acquisition. The CCL paid for land is generally less than the “current market price” as owners customarily report undervalued land transaction prices in order to pay lower stamp duty and registration fees. If the land acquired has standing crops cultivated by tenant (bargadar) under a legally constituted agreement, the law requires that part of the compensation money be paid in cash to the tenants as per the agreement. Places of worship, graveyard and cremation grounds are not to be acquired for any purpose. The law requires that the salvaged materials upon payment of compensation will be auctioned out by the government. Under the 1982 Ordinance, the Government is obliged to pay compensation only for the assets acquired.

However, the provisions under this law are not adequate to cope with the adverse effects related to land acquisition and involuntary resettlement, nor do they do fully match the requirements of the WB’s Operational Polices (OP 4.12) or international standards. Some of such gaps in existing land acquisition law of the country are:

- Existing GOB laws recognize title owners only; informal settlers are not covered
- Consultation with affected community not legally required
- No support or program for income and livelihood restoration.

In light of addressing these shortcomings, the Government of Bangladesh is working on preparation of a **national policy on involuntary resettlement**, which is consistent with the general policy of the Government that the rights of those displaced by development projects shall be fully respected, and persons being displaced shall be treated with dignity and assisted in such a way that safeguards their welfare and livelihoods irrespective of title, gender, and ethnicity. The Government will undertake further work towards legislative changes to safeguard resettlement rights by law once the draft policy is approved in the Cabinet.

660. This proposed project requires land acquisition in each Polder area, which should be done following the procedure mentioned in this Act.

(x) Noise Pollution (Control) Rules, 2006

According to Environment Protection Act 1995, the government formulated the noise pollution Rules & Regulation in 2006. This regulation recommends to keep the sound level 50 dB at the quieter area from 6am until 9pm and at night 40 dB, similarly, at residential area on the day of 55 dB and at night 45 dB, a mixed area, 60 dB at day time and at night 50 dB, a commercial area on the day of 70 dB and at night 60 dB and the industrial areas of the day 75 dB and at night 70 dB.

(xi) Disaster Management Act, 2012

The Disaster Management Act 2012 aims at coordinating the activities of disaster management and making these object oriented and strengthened to build up infrastructure of effective disaster management to fight all types of disaster. Disastermeans any such incidents created by nature or human.

This Act is particularly relevant to avoiding accidental hazard both in construction and post-construction phase. The relevance of this act for this proposed project arises as following:

- To make a disaster management plan for rehabilitation to bring back any infrastructure, life, livelihood and working environment damaged by disaster to previous condition or better condition.
- To create effective disaster management infrastructure to fight disaster and to make the public concerned and strengthened to face the disasters.
- To ensure that obstacle is created in plying fire brigade and rescue vehicles during fire, earthquake, building slide or other disaster.

Disaster (to certain degree) may occur in present project if any harmful situation occurs during the normal work or construction activity. Therefore, appropriate management plan should have to be taken by the project proponent to prevent any unwanted disaster in the location.

(xii) Antiquities Act, 1968

b. The Antiquities Act 1968 (amended in 1976) establishes the legal framework for the preservation and protection of antiquities.According to the Act, any ancient monument (minimum 100 years old) illustrative of architecture, warfare, politics or culture can be regarded as an article of antiquity.The law terms the archeological sites and monuments as antiquities. The Act has defined the procedure in dealing with antiquities in following matters, i.e. custody, preservation of ownerless antiquity, prohibition of movement of antiquity, right of access to protected immovable antiquities etc.

c. If the proposed project finds any archaeological sites or national antics during carrying out the activity, then it will be dealt under this Act. Discovery or existence of an antiquity will immediately be notified to the Advisory committee formed under this law for the protection of national antiquities. Mitigation measures are outlined for the potential damage and loss of cultural propertiesin chapter 10.

(xiii) Bangladesh Labour Act, 2006 and Rules, 2015

Bangladesh Labour Act was promulgated in 2006. The legislation pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions. The amendment in 2013 has introduced a good number of important items like workers' welfare, rights and safety and industrial safety and expansion of the industry are particularly relevant for this proposed study.

In 2015, Bangladesh government has introduced the Bangladesh Labour Rules. Some of the relevant points of this Rules are health and fire safety, prescribe from for filling case in Labour Court, and approval of factory plan and any extension among others.

The Bangladesh Labour Act 2006 consolidated and repealed 25 previous labour related laws including the Dock Labourers Act, 1934, the Factories Act, 1965 among others.

The proposed project is required to obey occupation health and safety of the workers covered under this Act while carrying out the activities.

Relevant National Policies, Plans and Strategies

(i) National Environment Policy, 1992

The National Environment Policy (NEP) is one of the key policy documents of the Government. The policy addresses 15 sectors in all, in addition to providing directives on the legal framework and institutional arrangements. Coastal and marine environment is one of the key sectors covered in this policy. The policy declarations that have particular bearing on the Integrated Coastal Zone Management (ICZM) are listed below.

- Sustainable use of coastal and marine resources and preservation of coastal ecosystem
- Prevention of national and international activities causing pollution in coastal and marine environment
- Strengthening research in protection and development of coastal and marine resources and environment
- Exploration of coastal and marine fisheries to a maximum sustainable limit

Regarding water resource development, flood control and irrigation sector, the policy seeks to:

- ensure environmentally-sound utilization of all water resources;
- ensure that water development activities and irrigation networks do not create adverse environmental impact;
- ensure that all steps are taken for flood control, including construction of embankments, dredging of rivers, digging of canals, etc, be environmentally sound at local, zonal and national levels;
- ensure mitigation measures of adverse environmental impact of completed water resources development and flood control projects;

- keep the rivers, canals, ponds, lakes, haors, baors and all other water bodies and water resources free from pollution;
- ensure sustainable, long-term, environmentally sound and scientific exploitation and management of the underground and surface water resources; and
- conduct environmental impact assessment before undertaking projects for water resources development and management.

The Policy is applicable to the Package 3 under CEIP-1and the proposed interventions are required to comply with all the policy directives emphasizing particularly on reducing adverse environmental impacts. The EIA studies of the coastal Polders are required to clearly address the potential impacts and propose mitigation measures.

(ii) National Water Policy, 1999

The National Water Policy (NWP) was adopted in 1999 with the objectives of improved water resources management and protection of the environment.

The policy has several clauses related to water resource development projects for ensuring environmental protection. Some of the relevant clauses are:

- Clause 4.5b: Planning and feasibility studies of all projects will follow the Guidelines for Project Assessment, the Guidelines for People's Participation (GPP), the Guidelines for Environmental Impact Assessment, and all other instructions that may be issued from time to time by the Government.
- Clause 4.9b: Measures will be taken to minimize disruption to the natural aquatic environment in streams and water channels.
- Clause 4.9e: Water development plans will not interrupt fish movement and will make adequate provisions in control structures for allowing fish migration and breeding.
- Clause 4.10a: Water development projects should cause minimal disruption to navigation and, where necessary, adequate mitigation measures should be taken.
- Clause 4.12a: Give full consideration to environmental protection, restoration and enhancement measures consistent with National Environmental Management Action Plan (NEMAP) and the National Water Management Plan (NWMP).
- Clause 4.12b: Adhere to a formal environment impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects, in each water resources development project or rehabilitation program of size and scope specified by the Government from time to time.
- Clause 4.12c: Ensure adequate upland flow in water channels to preserve the coastal estuary ecosystem threatened by intrusion of salinity from the sea.
- Clause 4.13b: Only those water related projects will be taken up for execution that will not interfere with aquatic characteristics of those water bodies.

Most of the above clauses will be applicable to the Package 3 under CEIP-1. The Project design and present EIA study will be required to comply with these requirements.

(iii) Guidelines for Participatory Water Management, 2014

The Guidelines for Participatory Water Management,2014 have been prepared under “Bangladesh Water Development Board Act 2000”. The Rules relate to formation and functions of water management organizations (WMOs) in water resources projects.

The Guidelines for Participatory Water Management (GPWM) in Bangladesh provides the following:
• Participation is an important voluntary process in which local stakeholders influence policy formulation, alternative plans/designs, investment choices and management decisions affecting their communities and establish the sense of ownership.
• Give the local stakeholders a decisive voice at all stages of water management.
• Participation of local stakeholders to prepare production plans on agriculture, fishery, forestry and livestock development and environmental management plan based on the feasibility study by the implementing agencies.
• According to this rule, every water management group will form cluster groups including landless men and women of the project area for infrastructure development or maintenance related activities of which 30 percent will be women.

(iv) National Water Management Plan, 2004

The National Water Management Plan (NWMP) has been prepared with three central objectives consistent with Water Policy aims and national goals. These objectives are:

- Rational management and wise-use of Bangladesh's water resources
- People's quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
- Clean water in sufficient and timely quantities for multi-purpose use and preservation of the aquatic and water dependent eco-systems.

The Plan is structured in a manner that the objectives of 84 different programmes planned for the next 25 years contribute individually and collectively to attainment of both the overall objectives as well as to intermediate sub-sectoral goals. The major programs in the Plan have been organized under eight sub-sectoral clusters: (i) Institutional Development, ii) Enabling Environment, (iii) Main River, (iv) Towns and Rural Areas, v) Major Cities; (vi) Disaster Management; (vii) Agriculture and Water Management, and (viii) Environment and Aquatic Resources.

The CEIP-1 is itself a project designed under this Plan and addresses its key objectives for the water resource management in the coastal areas.

(v) Coastal Zone Policy, 2005

The Government has formulated the Coastal Zone Policy that provides a general guidance to all concerned for the management and development of the coastal zone in a manner so that the coastal people are able to pursue their life and livelihoods within secure and conducive environment.

The Policy has relevance in proposed project in following matters:

- Reduction of *vulnerabilities:* Safety measures will be enhanced by combining cyclone shelters, multi-purpose embankments, killas, road system and disaster warning system. It should include special measures for children, women, the disabled and the old;
- Sustainable management of natural resources:Small water reservoirs shall be built to capture tidal water in order to enhance minor irrigation in coastal areas. Appropriate water management system within the Polder utilizing existinginfrastructures will be established for freshwater storage and other water utilization.

(vi) National Land-use Policy 2001

The Government of Bangladesh has adopted national Land use Policy, 2001. The salient features of the policy objectives are:

- To prevent the current tendency of gradual and consistent decrease of cultivable land for the production of food to meet the demand of expanding population;
- To promote sustainable and planned utilization ofland through 'zoning system' of land for commercial and other purposes;
- To ensure the best utilization of char lands by land accretion for rehabilitation of landless people,
- To protect state-owned land which can be used to meet the needs of development projects;
- To ensure that land use is in harmony with natural environment;
- To use land resources in the best possible way and to play supplementary role in controlling the consistent increase in the number of land less people towards the elimination of poverty and the increase of employment;
- To protect natural forest areas, prevent river erosion and destruction of hills;
- To prevent land pollution; and
- To ensure the minimal use of land for construction of both government and nongovernment buildings.

The land-use policy has specific section for the coastal region, where strengthening the protection against cyclone through implementing various activities has been guided. The extent of activities that will affect the land will ensure that the existing national land use policy is adhered.

(vii) National Agriculture Policy, 1999

The overall objective of the National Agriculture Policy is 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. The policy has some specific guidelines related to coastal areas ensuring to the development of coastal zone agriculture.

- To increase production of potential crops suitable for the coastal areas.
- To build water reservoir to capture tidal water and thereby expanding mechanized irrigation facilities in the coastal areas.
- To research the development of improved crop varieties and technologies suitable for cultivation in coastal, hilly, water logged and salinity affected areas.

The above policies are not directly relevant to the responsibility of the project proponent; however, the proposed CEIP-1is expected to contribute to achieving the objectives of the agriculture policy.

(viii) Guidelines for Environmental Assessment of Water Management (Flood Control, Drainage and Irrigation- FCD/I) Projects

The Guidelines for Environmental Assessmentof Water Management (Flood Control, Drainage and Irrigation- FCD/I) Projects is prepared by the Water Resources Planning

Organization (WARPO) on 2001 and approved on 2003 by the Ministry ofEnvironment and Forestwith assistancefrom National Water Management Plan Project (NWMPP).

The Guidelines are intended to be a mandatory part of planning FCD/I projects of all sizes.The aim of this document is to provide the framework for EA of FCD/I projects in Bangladesh. The steps for EA include project appreciation, data collection and environmental baseline description, fieldinvestigations, people's participation, scoping and bounding, impact assessment, analysis ofalternatives and the environmental management plan, which are within the national framework of environmental and social planning.

However,these EA Guidelines for FCD/I projects do not contain details of all the necessary environmentalissues and procedures. EA practitioners must follow the relevant instructions in other nationalregulations and guidelines, as well as those of bilateral or international funding agencies whenapplicable. Therefore, ECR 1997 has been followed primarily along with this for the procedures for obtaining ECC from DoE along with these Guidelines. There is no major deviation in the process.

Implication of legal aspects on this project

(i) Administrative Procedures for Obtaining Location/Environmental Clearance

The legislative bases for environmental assessment for the proposed project intervention are the Environmental Conservation Act 1995 and the Environmental Conservation Rules 1997. According to the ECA 1995, the proponent must need to obtain an Environmental ClearanceCertificate from the Department of Environment (DoE) in the manner prescribed by the Rules.

Environmental clearance has to be obtained in two steps: first location clearance and thereafter environmental clearance. Environmental Clearance Certificate is issued to all existing and proposed industrial units and projects falling in the Green category, but it is required to obtain a Location Clearance Certificate for industrial units and projects falling in the Orange – A, Orange – B and Red categories, and then the Environmental Clearance Certificate will be issued. According to the categorization, construction/reconstruction/expansion of flood control embankments, Polders, and dykes related activities fall into the Red category. **Therefore, the proposed water supply project falls under the 'Red' category and hence necessitates a full-scale EIA**.

Like all other projects, this project also needs to meet the requirement of the DOE. An environmental assessment (EA) study needs to be undertaken for obtaining the environmental clearance. The procedure to obtain an Environmental Clearance Certificate for this "Red" category project requires submission of following documents along with the application:

- Feasibility Report for the Project (where applicable)
- Environmental Impact Assessment (EIA) Report
- Environmental Management Plan (EMP)
- No Objection Certificate from relevant Local Authority (where applicable)
- Other necessary information, (where applicable)

Public participation or consultation is not a condition in the ECR 1997 and/or EIA Guidelines, however, DoE prefers the proponent to do public consultation during the assessment and puts condition for it while providing site clearance or during the approval of the EIA TOR.

Steps to be followed for obtaining Environmental Clearance Certificate (ECC) in connection with the Red Category from DOE are outlined in **Figure 3.1**.

Application for site clearance
Application should enclose:

7. Prescribed application form
8. Application fee
9. IEE report of the proposed project (including ToR for EIA)
10. Location map/ layout plan, etc.
11. No Objection Certificate (NOC) from local government authority
12. Preliminary Feasibility Study Report/ DPP of the proposed project, if available

Site visit by DOE and applicant agency, if required

Obtaining Site Clearance and approval of ToR for EIA

Applicant agency will conduct EIA study for the proposed project

Application for Environmental Clearance
Application should enclose:

5. Prescribed application form
6. EIA report of the proposed project including EMP
7. Outline of relocation, rehabilitation plan, if applicable
8. Feasibility Study Report of the proposed project, if available

Presentation on the EIA and EMP by the applicant agency to DOE

Obtaining Environmental Clearance

Renewal of the clearance after each one-year period

Figure 11.1: Process of obtaining Clearance certificate from DoE

(ii) Organization related to Enforcement of Environmental Standards

The **Department of Environment (DoE),** the technical arm of the Ministry of Environment and Forest (MoEF) is the regulatory body and the enforcement agency of all environmental related activities. It is the responsible body for reviewing and approving the EIA reports in Bangladesh.

The DOE is headed by a Director General (DG). The DG has complete control over the DoE. The power of the DG, as given in the Act, may be outlined as follows:

- The DG has the power to close down the activities considered harmful to human life or the environment. The operator has the right to appeal and procedures are in place for this. However, if the incident is considered an emergency, there is no opportunity for appeal.
- The DG has the power to declare an area affected by pollution as an ecologically critical area. The DoE governs the type of work or process, which can take place in such an area.

- Before undertaking any new development project, the project proponent must take an Environmental Clearance from the DoE. The procedures to take such clearance are in place.

Failure to comply with any part of ECA 1995 may result in punishment by a maximum of 10 years imprisonment or a maximum fine of Tk. 1000,000 or both.

World Bank's Environmental Safeguard Policies

(i) Environmental Assessment (OP 4.01)

EA requirement. The World Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision making. The Bank Policy OP 4.01 considers that EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout the project implementation period. EA takes into account the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples and physical cultural resources); and trans-boundary and global environmental aspects. The Bank Policy also envisages that the borrower Government is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements.

The present EIA has been carried out in compliance with this Operational Policy(OP).

EA classification. The World Bank classifies the proposed project into oneof the four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. These categories are defined below.

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

Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category F: A proposed project is classified as Category F if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

The proposed CEIP-1has been classified as Category A, since some of the potential impacts are likely to be significant and diverse.

(ii) Natural Habitats (OP 4.04)

The Policy describes the conservation of natural habitats, like other measures that protect and enhance the environment, to be essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank also supports, and expects borrowers to apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank-promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

The WBOP 4.04 is triggered for the proposed Project. However, the proposed activities will be undertaken in an area where natural habitat has already been modified to farm lands and built-up area. Furthermore, appropriate control measures have been incorporated in the environmental management plan (provided later in the document) to prevent any potential impacts of the Project on the nearby foreshore area.

(iii) Water Resources Management (OP 4.07)

Through this Policy, the Bank seeks to support operations that provide potable water, sanitation facilities, flood control, and water for productive activities in a manner that is economically viable, environmentally sustainable, and socially equitable. The Bank assists borrowers in many priority areas, among which developing a comprehensive framework for designing water resource investments, policies, and institutions is very important. Within this framework, when the borrower develops and allocates water resources, it considers cross-sectoral impacts in a regional setting (e.g., a river basin). Restoring and preserving aquatic ecosystems and guarding against overexploitation of groundwater resources are also given priority to the provision of adequate water and sanitation services for the poor. Furthermore, special attentions are needed by the borrowers to avoid the water logging and salinity problems associated with irrigation investments by (i) monitoring water tables and implementing drainage networks where necessary, and (ii) adopting best management practices to control water pollution.

The proposed Project seeks to address several of the Policy objectives particularly those relating to flood control and water resource management for productive activities.

(iv) Physical Cultural Resources (OP 4.11)

The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. The specific aspects of the Policy are given below. [23]

- The Bank normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage.
- The Bank will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. In some cases, the project is best relocated in order that sites and structures can be

[23]Excerpts from the OPN 11.03. WB Operational Manual. September 1986.

preserved, studied, and restored intact in situ. In other cases, structures can be relocated, preserved, studied, and restored on alternate sites. Often, scientific study, selective salvage, and museum preservation before destruction is all that is necessary. Most such projects should include the training and strengthening of institutions entrusted with safeguarding a nation’s cultural patrimony. Such activities should be directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are to be internalized in computing overall project costs.

- Deviations from this policy may be justified only where expected project benefits are great, and the loss of or damage to cultural property is judged by competent authorities to be unavoidable, minor, or otherwise acceptable. Specific details of the justification should be discussed in project documents.
- This policy pertains to any project in which the Bank is involved, irrespective of whether the Bank is itself financing the part of the project that may affect cultural property.

This OP is not triggered since no cultural or archaeological resources are known to exist in the vicinity of the Project nor have any such resources been identified during field investigations. However, ‘chance find’ procedures will be implemented in the EMP.

(v) Forestry (OP 4.36)

This Policy recognizes the need to reduce deforestation and promote sustainable forest conservation and management in reducing poverty. The Bank believes that forests are very much essential for poverty reduction and sustainable development irrespective of their location in the world. The Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank also assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats. Furthermore, the Bank does not finance projects that contravene applicable international environmental agreements.

Though this OP is triggered during the concept development stage, the proposed Project is not located in any forested area and will therefore not have any direct impact on forests.

(vi) Projects on International Waterways (OP 7.50)

Projects on international waterways may affect the relations between the WB and its borrowers, and between riparian states. Therefore, the Bank attaches great importance to the riparian making appropriate agreements or arrangements for the entire waterway, or parts thereof, and stands ready to assist in this regard. A borrower must notify other riparian of planned projects that could affect water quality or quantity, sufficiently far in advance to allow them to review the plans and raise any concerns or objections.

(vii) Pest Management (OP 4.09)

Through this OP, the WB supports a strategy that promotes use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. Rural development and health sector projects have to avoid using harmful pesticides. Other pesticides can be used, but only as an element of an Integrated Pest Management Plan (IPMP) that emphasizes environmental and biological controls.

(viii) Indigenous Peoples (OP 4.10)

For purposes of this Policy, the term 'Indigenous Peoples' is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees:[24]

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

The OP defines the process to be followed if the project affects the indigenous people.

No indigenous people - with a social and cultural identity distinct from the dominant society that makes them vulnerable to being disadvantaged in the development process – are known to exist in the Project area. Therefore this OP is not triggered.

However if such groups are identified during the Project implementation, the proponents will develop an Indigenous People Development Plan, in compliance with the OP and get it approved by the Bank.

(ix) Involuntary Resettlement (OP 4.12)

The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.[25]

The overall objectives of the Policy are given below.

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
- Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.
- Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels

[24]Excerpts from the OP 4.10. WB Operational Manual. July 2005.

[25]Excerpts from WB OP 4.12. WB Operational Manual. December 2001.

or to levels prevailing prior to the beginning of project implementation, whichever is higher.

Since the proposed Project will involve land acquisition as well as displacement of houses and other assets, a Resettlement Action Plan (RAP) has been prepared, under a separate cover, in accordance with this Policy.

(x) Projects in Disputed Areas (OP 7.60)

Projects in disputed areas may raise a number of delicate problems affecting relations not only between the Bank and its member countries, but also between the borrower and one or more neighboring countries. In order not to prejudice the position of either the Bank or the countries concerned, any dispute over an area in which a proposed project is located is dealt with at the earliest possible stage.

The Bank may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed for country A should go forward without prejudice to the claims of country B. [26]

This OP is not triggered since no part of the Project area is located in any disputed territory.

(xi) Safety of Dams (OP 4.37)

The Policy seeks to ensure that appropriate measures are taken and sufficient resources provided for the safety of dams that the WB finances. However this OP is not relevant since the proposed Project does not involve construction of dams.

(xii) Public Disclosure of Information (BP 17.50)

This BP deals with the World Bank policy on disclosure of information. It is a mandatory procedure to be followed by the borrower and Bank and supports public access to information on environmental and social aspects of projects.

Once finalized, the EIA report will be disclosed to the public and will also be available on the official website of the BWDB. EIA will also be sent to the WB InfoShop.

(xiii) Environment, Health and Safety Guidelines

The Environment, Health, and Safety (EHS)27 Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities or project by existing technology at reasonable costs. These Guidelines will be applicable to the Project.

[26]Excerpts from the OP 7.60. WB Operational Manual. November 1994.

[27] Environmental, Health and Safety Guidelines. IFC/WB Group, April 30, 2007.

Appendix C: Gate Operation Manual in Bangla

পোল্ডারের স্লুইস গেট পরিচালনার ক্ষেত্রে নিয়মাবলী

অতীতে পানি উন্নয়ন বোর্ডের কর্মচারীর মাধ্যমে স্লুইস গেটগুলো পরিচালিত হতো। বাজেট স্বল্পতার কারণে সে পদগুলো এখন স্থগিত করা হয়েছে। বর্তমানে গেটগুলো পরিচালনার দায়িত্ব সুবিধাভোগীদের উপর অর্পন করা হয়েছে। প্রতিটি পোল্ডাওে এ জন্য পানি ব্যবস্থাপনা সংস্থা (WMG, WMO, WMA) গঠন করা হয়। কৃষি উন্নয়ন ও মৎস্য সম্পদের কথা বিবেচনা করে পোল্ডার ৩৪/৩ এর গেটপরিচালনায় পানি ব্যবস্থাপনা সংস্থাগুলোকে নিম্নোক্ত বিষয়গুলো বিবেচনা করতে হবে:

- কৃষি ও মৎস্য সম্পদ ব্যবস্থাপনার সাথে সামঞ্জস্য রেখে একটি নির্দিষ্ট নিয়মের মধ্য দিয়ে প্রতিটি রেগুলেটরের গেট অবশ্যই নিয়ন্ত্রিণ করতে হবে ;
- প্রকৃত পানি ব্যবস্থাপনা বিশেষ করে কৃষি ও মৎস্য সম্পদের প্রয়োজনীতার ভিত্তিতে পানি উন্নয়ন বোর্ডের পরিচালনা ও রক্ষণাবেক্ষণ শাখা সুবিধাভোগী সংস্থা, কৃষি সম্প্রসারণ অধিদপ্তর এবং মৎস্য অধিদপ্তরের মাঠ কর্মীদের যৌথ পরামর্শক্রমে গেট পরিচালনা করতে হবে;
- শুধুমাত্র মেরামত ও ফ্ল্যাশিং ব্যতীত রেগুলেটরের ফ্ল্যাপ একটি নির্দিষ্ট স্থানে সব সময় একই অবস্থানে রাখতে হবে;
- খালে পানি সংরক্ষণ করে কৃষি কাজে সেচের জন্য বর্ষার পূর্বে (মার্চ - মে) গেট বন্ধ রাখতে হবে;
- বর্ষার সময় (জুলাই -সেপ্টেম্বর) গেট সাধারণত বন্ধ থাকবে তবে পোল্ডারের ভিতর ও বাহিরের পানির স্তর একটি নিরাপদ লেভেলের বাইরে যাতে চলে না যায় সেদিকে লক্ষ্য রাখতে হবে। এক্ষেত্রে, প্রতিদিনের বৃষ্টিপাত, নদীর অবস্থা, নদীর এবং পোল্ডারের ভিতরের পানির লেভেল বিবেচনা করে যথাযথ সিদ্ধান্ত নিতে হবে;
- মাছের সর্বোচ্চ প্রজননের সময় ডিমসহ মা মাছ (ব্রুড মাছ) ও মাছের পোনা অভিগমনের বিষয় বিবেচনা করে মে হতে জুন মাস পর্যন্ত গেট খোলা রাখতে হবে;
- বর্ষা পরবর্তী সময় (অক্টোবর-নভেম্বর) গেট এমনভাবে পরিচালনা করতে হবে যাতে খালে শুষ্ক মৌসুমেও পর্যাপ্ত পানি থাকে। এক্ষেত্রে লক্ষ্য রাখতে হবে যেন খালের পানি তীর উপচে না যায় এবং কৃষি কার্যক্রম ব্যাহত না হয়;
- ফ্ল্যাশিং স্লুইস ও পাইপ ইনলেট পরিচালনার ক্ষেত্রেওএকই নিয়ম অনুসরণ করতে হবে;
- কৃষি কার্যক্রম, শষ্যের নমুনা ও ধরণ, মাছের প্রজনন সময় ও অভিগমন ইত্যাদি পরিবর্তনশীল বিধায় সময়ের সাথে সুবিধাভোগী সংস্থার (কৃষক, মৎস্যজীবি, মৎস্যচাষি) সাথে নিয়মিত পরামর্শ করতে হবে;
- কৃষি ও মৎস্য উভয় সম্পদ বিবেচনায় নিয়ে পানি ব্যবস্থাপনা সংস্থাগুলোকে (WMG, WMO, WMA) সমন্বিত পানি ব্যবস্থাপনার উপর প্রশিক্ষণ প্রদান করতে হবে।

Appendix D: List of Dominant terrestrial and aquatic plant species found in the Polder area

Terrestrial flora			
Different type of terrestrial plant	**Local/English Name**	**Scientific Name**	**Use**
Homestead Vegetation	Supari/Indian nut palm	*Areca catechu*	Fruit and Thatching
	Narikel/Coconut	*Cocos nucifera*	Fruit and Thatching
	Kola/Banana	*Musa sp*	Fruit
	Safeda/ Sapodilla	*(Manilkara zapota*	Fruit
	Babla/Gum arabic tree	*Acacia nilotica*	Timber, fuel wood and fruit
	Khejur/ Date Palm	*Phoneix sylvestirs*	Fruit
	Akashmoni/Vachellia aroma	*Acacia auriculiformis*	Timber and fuel wood
	Raintree	*Samanea saman*	Timber and Fuel wood
	Mahogoni /American mahogani	*Swietenia macrophylla*	Timber and Fuel wood
	Nim / Neem	*Azadirachta indica*	Timber and fuel wood
	Sirish/ Monkey pod	*Albizia lebbeck*	Timber and fuel wood
	Tal/ Palmyra palm	*Boassus flabelifer*	Fruit and thatching
	Payra/Guava	*Psitium guajava*	Fruit
	Katbel/	*Limonia acidissima*	Fruit and Fuel wood
	Tetul/ Tamarind	*Temarindus indica*	Timber and Fruit
	Bamboo/Bash	*Bamboosa spp.*	HH use and Fencing
Agricultural weeds	Bagha Jongla	*Borreria articularis*	Medicinal herb
	Hatisur/Indian heliotrope	*Heliotropium indicum*	Medicinal herb
	Jhunjhuni	*Crotalaria juncea*	Vegetable
	Durba Gash/ Doab	*Cynodon dactylon*	Fooder
	Thankuni/ Centella	*Centella asiatica*	Vegetable
	Akand/ Crown flower	*Calotropis procera*	Medicinal herb
	Bondhone / Licorice weed	*Scoparia dulcis*	Medicinal herb
	Telakhucha/ Baby watermelon	*Coccinia grandis*	Vegetable and medicinal herb
Roadside Vegetation	Bamboo/Bash	*Bamboosa spp.*	HH use and Fencing
	Akashmoni/Vachellia aroma	*Acacia auriculiformis*	Timber and fuel wood
	Sirish/ Monkey pod	*Albizia lebbeck*	Timber and Fuel wood
	Tal/ Palmyra palm	*Boassus flabellifer*	Fruit and HH use
	Narikel/Coconut	*Cocos nucifera*	Fruit and Fuel wood
	Sisoo / Indian rosewood	*Dalbergia sissoo*	Timber and Fuel wood
	Khejur /Date Palm	*Phoenix sylvestris*	Fruit and Fuel wood
	Babla/ Gum arabic tree	*Acacia nilotica*	Timber and Fuel wood
	Sada Koroi /Sil Koroi	*Albizia procera*	Timber and Fuel wood
	Chambul/Raj koroi	*Albizia richardiana*	Timber
	Arjun	*Terminalia arjuna*	Medicinal and timber
	Hijol/ Freshwater mangrove	*Barringtonia acutangula*	Medicinal use
	Sada Koroi /Sil Koroi	*Albizia procera*	Timber and Fuel wood
	Mahogoni /American mahogani	*Swietenia macrophylla*	Timber and Fuel wood
	Vannt	*Clerodendron viscossum*	Medicinal herb
	Akand/ Crown flower	*Calotropis procera*	Medicinal herb
Aquatic flora			

Terrestrial flora			
Different type of terrestrial plant	**Local/English Name**	**Scientific Name**	**Use**
Free floating plant	Kochuripana / Water hyacinth	*Eichhornia crassipes*	Compost
	Topapana	*Pistia stratiotes*	
	Kutipan/ Water velvet	*Azolla pinnata*	
	Khudipana/ Duck weed	*Lemna perpusilla*	
Submerged Plant	Jhangi/ water thyme	*Hydrilla verticillata*	N/A
	Ghechu/ Floating lace plant	*Aponogeton natans*	Vegetable
	Bicha	*Vallisneria spiralis*	
Amphibian plant(Sand meadows)	Jol kolmi/ Pink morning glor	*Ipomoea aquatic*	Fuel and erosion protection
	Kochu/Taro	*Colocasia* spp.	Vegetable
	Alligator weed / Helencha	*Alternanthera philoxiroides*	Vegetable
Mangrove Vegetation	Golpata	*Nypa fruticans*	Fruit and HH use
	Keora	*Sonneratia apetala*	Timber and Fuel wood
	Choila/Ora	*Sonneratia caseolaris*	Fruit and Fuel wood
	Hogla	*Typha elephantalis*	HH use
	Chaila gash	*Hemarthria protensa*	N/A
	Gewoa	*Excoecaria agallocha*	Fuel wood
	Hargoza	*Acanthus ilicifolius*	Medicinal plant

Source: Field investigation & Local people interviewed 2016

Appendix E: List of common faunal species in the Polder area

Types of species	English Name	Scientific name	Habitat	IUCN Status-Bangladesh 2000
Amphibians	Common Toad	*Bufo melanosticus*	Wetland areas and the dried areas	NO
	skipper frog	*Euphlyctis cyanophlyctis*		NO
	Cricket Frog	*Rana limnocharis*		NO
	The Indian Bullfrog (*Hoplobatrachus tigerinus*)	*Hoplobatrachus tigerinus*		NO
Mammals	Common House Rat	*Rattus rattus*	Mostly in bamboo thickets, cropped fields, bushy areas.	NO
	Field Mouse	*Mus booduga*		NO
	Grey Musk Shrew	*Suncus murinus*		NO
	Flying Fox	*Pteropus giganteus*		NO
	Jangle Cat	*Felis chaus*		NO
	Common Mongoose	*Herpestes edwardsii*		VU
	Large Indian Civet	*Viverra zibetha*		EN
Reptiles	House Lizard	*Hemidactylus brooki*	Both wet land and dry areas	VU
	Common Lizard	*Hemidactylus frenatus*		NO
	Garden Lizard	*Calotes versicolor*		VU
	Stripes Keelback	*Amphiesma stolata*		NO
	Bengal monitor Lizard	*Varanus bengalensis*		VU
	Bengal Cobra	*Naja naja*		VU
	Checkered keelback	*Xenocrophis piscator*		NO
	Common Krait	*Bungarus caeruleus*		EN
	Common wolf snake	*Lycodon aulicus*		VU
	Rat Snake	*Ptyas mucosus*		VU
Bird	Brahminy Kite	*Heliastur indus*	Mudflats, khal systems and seasonal wetlands	NO
	Bronzed Drongo	*Dicrurus aeneus*		NO
	House Crow	*Corvus splendens*		NO
	Larged-billed Crow	*Corvus macrohynchos*		NO
	Common Mynah	*Acridotheres tristis*		NO
	Red-vented	*Pycnonotus cafer*		NO
	Magpie Robin	*Copsychus saularis*		NO
	Common tailor bird	*Orthotomus sutorius*		NO
	Barn Owl	*Tyto alba*		NO
	Blue Rock Pigeon	*Columba livia*		NO
	Spotted Dove	*Streptopelia chinensis*		NO
	Little Egret	*Egretta garzetta*		NO
	Great Egret	*Casmerodious albus*		NO
	Common Kingfisher	*Alcedo atthis*		NO
	Little Cormorant	*Phalacrocorax niger*		NO
	Pied Kingfisher	*Ceryle rudis*		NO
	Indian pond heron	*Ardeola grayii*		NO

Source: Field investigation & Local people interviewed, 2016 Note: NO= Not Threatened; VU= Vulnerable, EN= Endangered

Appendix F: Fish Species Diversity of Different Habitats in the Study Area

Scientific Name	Local name	English Name	Fish Habitat			
			River	Khal	Gher	Pond
Brackish Water Fish Species						
Liza parsia	Perse	Gold spot Mullet	H	L	NA	NA
Latescalcarifer	Bhetki/Koral	Barramundi	M	L	NA	NA
Polynemusparadiseus	Tapse	Paradise Threadfin	M	L	NA	NA
Rhinomugilcorsula	Khorsula	Corsula	M	L	L	L
Raiamas bola	Bhola	Indian Trout	L	NA	NA	NA
Acentrogobiuscyanomos	NunaBaila	Salin Goby	H	M	NA	NA
Glosssogobiusgiuris	Baila	Tank Goby	M	M	NA	NA
Gadusiachapra	Chapila	Chapila	H	L	NA	NA
Plotosuscanius	Gang Magur	Canine Catfish	L	NA	NA	NA
Setipinnaphasa	Phasa		M	NA	NA	NA
Macrobrachiumrosenbergii	Golda chingri	Giant River Prawn	L	L	L	NA
Acanthus latus	Datina	Yellow Seabream	M	L	NA	NA
Scatophagusargus	Bishtara	Spotted Butter fish	L	L	NA	NA
Penaeusmonodon	Bagdachingri	Giant Tiger Shrimp	M	L	L	NA
Metapenaeusmonoceros	Harinachingri	Greasy back Shrimp	M	M	NA	NA
Macrobrachium rude	Kathalichingri	Hairy River Prawn	M	L	NA	NA
Puntiusspp	Punti	Spot fin Swamp Barb	M	M	L	LA
Mastacembelusarmatus	Baim	Long fin Snake Eel	M	L	NA	NA
Mastacembeluspancalus	Guchi	Stiped Spiny Eel	M	M	NA	NA
Macrognathusaculeatus	Tara Baim	Lesser Spiny Eel	M	H	NA	NA
Mystusvitatus	Tengra	Mystus	H	H	L	NA
Mystuscavasius	GulshaTengra	Gangeticmystus	M	M	NA	NA
Heteropneustesfossilis	Shing	Stinging Catfish	NA	L	L	L
Channastriatus	Shol	Snakehead Murrel	NA	L	NA	NA
Channapunctatus	Taki	Spotted Snakehead	NA	L	NA	NA
Anabas testudineus	Koi	Climbing perch	NA	L	NA	NA
Ompokpabda	Pabda	-	L	L	NA	NA
Sperataaor	Aor	Cat fishes	L	L	NA	NA
Wallagoattu	Boal	Cat fishes	L	L	NA	NA
Pungasiuspungasius	Pungus	Riverine giant cat fish	L	NA	M	M
Otolithiesargentatus	Sadapoa	Puma fish	L	NA	NA	NA
Colisafasciata	Khoilsa	Banded gourami	NA	L	NA	NA
Lepidocephalusguntea	Gutum	Gutum	L	L	NA	NA
Scylla serrata	Kankra	Crab	H	H	NA	NA
Culture Fish Species						
Labeorohita	Rui	Rohu	L	NA	H	H
Catlacatla	Catla	Catla	NA	NA	H	H
Cirrhinuscirrhosus	Mrigel	Mrigel Carp	NA	NA	H	H
Rhinomugilcorsula	Khorsula	Corsula mullet	M	M	H	L
Barbodesgonionotus	Thai/Raj puti	Thai puti /Silver barb	NA	NA	M	H
Hypophthalmichthysmolitrix	Silver carp	Silver carp	NA	NA	M	M
Ctenopharyngodonidella	Grass carp	Grass carp	NA	NA	M	M

Scientific Name	Local name	English Name	Fish Habitat			
			River	Khal	Gher	Pond
Oreochromismossambicus	Tilapia	Mozambique tilapia	NA	NA	M	L
Oreochromis niloticus	Tilapia	Nile tilapia	NA	NA	M	M
Pungasius hypophthalmous	Thai Pangus	Yellow tail catfish	NA	NA	L	M
Cyprinuscarpio var. communis	Carpio	Common carp	NA	NA	L	M
Cyprinuscarpio var. specularis	Mirror carp	Mirror carp	NA	NA	L	L

Source: CEGISField Survey 2016 and Consultation with local fishers and elderly people in the study area

Note Abundance Code: H=High, M= Medium, L=Low, NA=Not available.

Appendix G: Summary of Assessed Negative Impacts

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
A. Pre-construction Phase									
Land acquisition and resettlement							•		
Deterioration of Environmental Quality (Air and Noise)	Short term	Local	Reversible (after construction phase)	Certain	Medium	Moderate	• Construction material (sand) should be covered while transporting and stock piled. • The contractors need to be cautious to avoid unnecessary honking of material carrying vehicles • The contractors should be encouraged to move all construction equipment, machineries and materials during day time instead of night. • Stockyard should be covered during non working period. • Exhaust emissions from vehicles and equipment should comply with standards. • Vehicles, generators, and equipment should be properly tuned. • Water should be sprinkled where needed to suppress dust emissions. • Speed limits should be enforced for vehicles on earthen tracks. • Vehicles and machinery should have proper mufflers and silencers.	Low	BWDB and Contractors

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
Changes in land use (preparation of construction facilities, borrow areas, others)	Short term	Local	Reversible (after construction phase)	Certain	Low to Medium	Low	• All the construction camps should be established within the area owned by BWDB. • Pay compensation/rent if private property is acquired on temporary basis, which instructions should be specified in the tender document. • Labor shed/camp should be constructing at government khas land. • Avoid impacts on local stakeholders.	Very low	
Clearances of vegetation	Sort term	Local	Reversible (after construction phase)	Certain	Low to Medium	Medium	661. Use barren land or possible low vegetated land for placing of materials stock yards 662. Fuel wood should be collected from local market. 663. The work should be completed within contacted scheduled time (4 month) 664. Labor should be made aware about local faunal species	low	
Increased Vehicular Traffic during mobilization	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• The contractor should prepare a traffic management plan (TMP) and obtain approval from the Design Consultant (DC) and Construction Supervision (CS) consultant.	Low	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Contractor also implement mobilization plan considering water vessels and launch movement in the external rivers and, avoid the launch movement time. • The TMP should be shared with the communities and should be finalized after obtaining their consent. • The TMP should address the existing traffic congestion. • Ensure minimal hindrance to local communities and commuters. • The works on embankment should be carefully scheduled to minimize impact on local markets and transportation routes. • The embankment works should be carried out in segments and soil should be placed linearly on half of the embankment, leaving the other half to be used as track. • The works of the first half when completed, and then of the other half should be undertaken. • Work schedule should be finalized in coordination and consultation with local representatives and communities. Specifically union		

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							parishad members of the Polder. • Local routes should not be blocked as much as possible. If unavoidable, alternative routes should be identified in consultation with local community. • Vehicular traffic should be moved in the Polder area and also on embankment during off peak time. No school time (10:00 Am to 14:00Pm) and day of marketing time (Hat bar) should be considered during vehicular traffic movement. • Keep provision of training on vehicular traffic moving pattern and management system for the local stakeholders using multimedia presentation and showing Video at different common population gathering places in the Polder area.		
Preparation of Facilities for Contractor and Labor force	Short term	Local	Reversible	Reversible	Medium to high	Moderate	• Contractor should prepare site establishment plan and obtain approval from the Construction Supervision Consultants (CSC) • Approval from CSC should be obtained for the location of temporary facilities. • Tree felling and vegetation clearing should be minimized to establish site facilities. • Photographic record should be maintained to record pre-		

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							construction condition of the area. • Site facilities should be established at a safe distance from communities. • Contractor should prepare and implement pollution control and waste management plans. • No untreated wastes should be released on ground or in water. • Exhaust emissions from vehicles and equipment should comply with standards. • Vehicles, generators, and equipment should be properly tuned. • Water should be sprinkled where needed to suppress dust emissions. • Speed limits should be enforced for vehicles on earthen tracks. • Vehicles and machinery should have proper mufflers and silencers. • Liaison should be maintained with the communities.		
B. Construction Phase									
Generate Noise and Vibration	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Restricting/limiting construction activities during the day time; • Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards;	Low	BWDB and Contractors

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Vehicles and machinery should have proper mufflers and silencers; • Provision of noise barriers at schools and other sensitive receptors, as needed; • Provision of PPE (ear muffs and plugs) to labor; • The construction crew should be instructed to use the proper equipment, to minimize noise levels; • Camps should be located at a safe distance from communities		
Deterioration of Air Quality	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Exhaust emissions from vehicles and equipment should comply with standards. • Proper tuning of vehicles, generators, and equipment should be carried out, to minimize exhaust emissions. • Construction material (sand/soil) should be kept covered while transporting and stock piled. • Regular water sprinkling should be carried out where needed, particularly on the earthen tracks near communities. • Vehicle speed should be on low (15 km per hour) on earthen tracks particularly near communities and school. • Vehicles and other machinery should be turned off when idle	Low	BWDB and Contractors

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Good quality fuel should be used, minimizing exhaust emissions. • Camps should be located at a safe distance from communities and schools.		
Degradation of Water Quality	Short term	Local	Reversible (after construction phase)	Certain	Medium	Moderate	• Contractor should prepare and implement pollution control plan. • Contractor workshops should have oil separators/sumps to avoid release of oily water; • Contractor should use plastic sheet or gravel in the workshop and equipment yard to prevent water contamination. • Material borrowing from the river banks should be carried out sufficiently away from the water line, minimizing the possibility of loose soil to wash away in the river. • Contractor should locate camps away from water bodies. • Contractor should prepare and implement camp waste management plan (septic tanks, proper solid waste disposal). • Contractor should not release untreated wastes in water. • Contractor should re-use spoil and excavated material where possible. • Contractor should dispose spoil at designated areas with community consent.	Low	BWDB and Contractors

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Construction material, demolition debris, and excavated soil/silt should not be allowed to enter water bodies.		
Increase of Drainage Congestion	Short term	Local	Reversible (after construction phase)	Certain	Medium	Moderate	• Construct bypass canal before replacement of drainage sluices. • Sequence of work at the drainage sluices and in the water channels should be carefully planned to avoid drainage congestion. • Contractor should ensure that drainage channels are not obstructed or clogged by the construction activities which do not causes any drainage congestion situation in crop fields.	Low	BWDB and Contractors
Increasing of Sedimentation	Short term	May extend beyond Polder	Mostly Irreversible	Likely	Medium	Moderate	• Contractor should excavate channels after dewatering them; • Contractor should not leave excavated earth and silt on channel banks; • Contractor should implement measures to protect channels from run-off from work areas and camps; and • Contractor should obtain borrow material from river banks in a manner not to increase siltation in rivers, and should not leave loose soil after excavation.	Low	BWDB and Contractors
Affects on agriculture crop production	Short term	Local	Reversible	Likely	Minor	Low	• Compensation should be paid for any crop damage.	Negligible	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Contractor should avoid cultivation fields during construction. • Contractor should avoid agricultural land for material borrowing, material stockpiling and labor camps construction. • Contractor should ensure that no vehicular movements take place inside cultivation fields. • Contractor should ensure that no material is dumped inside cultivation fields. • Re-excavated soil of canals should not be damp in agricultural land. • Contractor should maintain liaison with communities.		
Affects on irrigation	Short term	Local	Reversible	Likely	Low to Medium	Major	• Contractor should construct bypass channel before construction/repair of each sluices and Inlets. • Sequence of work at the sluices and in the water channels should be carefully planned to avoid irrigation disruption. • Contractor should ensure no negative impacts on crop irrigation. • Contractor should maintain liaison with communities. • Contractor should work during dry season.	Low	
Impacts on Fish Habitat	Short term	Local	Reversible	Certain	Medium	Major	• Contractor should construct bypass canal before	Low	BWDB and Contractor

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
and Habitat Quality							construction and repair of each drainage sluice gate and flush sluices. • Re-excavation work should be done in winter and early dry season i.e., November to February to minimize the hamper of Bagda culture along with fish culture. • Sequence of work at drainage sluice gate, flush sluices and in khals should be carefully planned to minimize impacts on fish culture and fish migration in open water area. • Excavated soil should be dumped on high land at safe distance from the bank of re-excavated khals. • By-pass canal should be dismantled just after the completion of the repairing of the sluice gates and excavation work.		
Impacts on Fish Movement and Migration	Short term	Local	Reversible	Certain	Medium	Major	• By pass canal should be excavated for facilitating the movement of fish, shrimp/prawn and other aquatic organisms during the construction period. • Fish friendly structures should be constructed in the connecting khals. • Establishment of fish sanctuaries in the deeper part of internal khals.	Low	BWDB and Contractor

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Operation and maintenance (O&M) of all water regulatory structure should be strengthened. • Proper operation of water regulatory structures and timely opening of the gate of sluice gate during fish breeding period. • Gate operation manual (in Bengali) should be prepared with the consultation of local Department of Fisheries (DoF) officials and local fishers, farmers and provide to WMAs.		
Impact on Fish Biodiversity	Short term	Local	Reversible	Certain	Medium	Moderate	• Conserve local fish species through conservation of deep pool in the major khals. • Establishment of fish sanctuaries in the deeper part of internal khals and conserve the brood fish and juvenile fishes.. • Enhance the enforcement of Fish Conservation and Protection Acts and Rules with the involvement of Department of Fisheries (DoF). • Organize orientation programme for the fishers about the Fisheries Conservation and Protection Acts. • Provide training to the fish farmers about environment friendly improved fish, prawn/shrimp culture technology.	Low	BWDB, WMA with collaboration of DoF

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
Impact on Fish Production	Short term	Local	Reversible	Certain	Medium	Moderate	• Provide fisheries training to the fish and shrimp farmers in collaboration with Department of Fisheries (DoF) on environmental friendly improved fish/prawn culture as well as the rice-cum-golda/fish farming. • Golda (prawn) farming should be encouraged through campaign/awareness development. • Conduct skill development training on Good Aquaculture Practices (GAP)for the fish farmer to promote the quality fish and prawn/shrimp production from gher and ponds. • Stocking the fresh water fish fry (Carps and other small indigenous fish species-SIS) in the khals inside the Polder area after completion of construction works.	Low	BWDB, WMA with collaboration of DoF
Clearance of vegetation	Short term	Local	Reversible (after construction phase)	Occasional	Medium	Medium	• Collect soil from barren land as much as possible • Proper turfing should be implement at embankment slopes with local grasses and ensure regular monitoring of turf grasses till they matured • Avoid construction activities during favorable time of wild life movement (early morning and night) • Give proper compensation to the tree owners against tree felling.	Low	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Implement plantation with native species (i.e Sirish (Albizia lebbeck), Narikel (Cocos nucifera), Tal(Boassus flabelifer), Khejur(Phoneix sylvestirs), etc) at the damaged sites (sluice ground and nearer foreshore mudflats) after construction works. • Avoid construction activities during favorable time of wild life movement (early morning and night) • Keep untouched the deepest points of the khal as much as possible. • Use excavated soil spoils for khal dyke re-sectioning • Implement tree plantation with local species(Fruit and timber tree) at the khal bank side after re- excavation work where excavated soil dumped khal bank side. • Use minimum land as much as possible for excavator/ labor movement		
Outbreak of plant diseases	Short term	Local	Reversible	Occasional	Nil to Medium	Medium	• Aware labors about plant conservation who are engaged for afforestation activities • Collect saplings from nearer natural source as much as possible. • All kinds of polyethylene bags and plastic ropes should be	Nil	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							piled up in a pit for dumped or burned in a proper way • Care should be taken for physical and biological control of plant disease while raising nursery and sapling plantation (i.e.: using of disease free seeds, proper treatment of nursery soils, using appropriate doses of pesticides and fertilizers) • Pre-consultation with Forest Department and other related non-government organizations for selecting of suitable species for plantation and spacing of the saplings • Develop a pest management plan for the holistic afforestation		
Safety and Public Health Hazards	Short term	Local	Reversible	Likely	High	Major	• The contractors should prepare site specific Health, Safety and Environment (HSE) Plan and obtain approval from the Construction Supervision Consultants. The Plan should also include awareness rising and prevention measures for particularly for communicable diseases such as hepatitis B and C, and HIV/AIDS. • The WBG's EHS Guidelines should be included in the contract documents. • Liaison should be established with the Bangladesh Meteorological Department for	Moderate	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							early warning of storms and cyclones. Radio and television sets should be kept in all the labor camps for obtaining weather information. • Each contractor should prepare an Emergency Response Plan defining procedures to be followed during any emergency. This plan should be submitted to Construction Supervision Consultants for review and approval; • All workers must be provided with and use appropriate Personal Protective Equipment (PPE). First aid must be provided and there would be procedures in place to access appropriate emergency facilities; • The construction sites should have protective fencing to avoid any unauthorized entry, where appropriate and possible • Health screening of employees would be a Contractor obligation prior to laborers working on site and living in the temporary accommodation facilities. The health screening would entail normal review of physical fitness and also include a review of appropriate vaccinations. Workers would be given vaccinations where required;		

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• All employees need to carry out induction health and safety training prior to commencement of work. OHS issues would be part of the employee training plan. Training would include the provision of appropriate written or visual materials to reinforce learning. Where illiteracy levels are high, OHS issues need to be covered more frequently than normal in toolbox talks; • Public awareness training and workshops on safety and health risks should be conducted for local communities prior to and during construction operations. • Observing statutory requirements relating to minimum age for employment of children and meeting international standards of not employing any persons under the age of 16 for general work and no persons under the age of 18 for work involving hazardous activity. The construction contractor(s) would not hire people under the age of 18 on permanent contracts but would include short training activities for youth to the extent possible; • Ensuring acceptable conditions of work including observing national statutory requirements		

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							related to minimum wages and hours of work; • Ensuring no workers are charged fees to gain employment on the Project; • Ensuring rigorous standards for occupational health and safety are in place; • Contractor should establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal. • The contractor should adopt a Human Resource Policy appropriate to the size and workforce which indicates the approach for management employees (this could be part requested in the tender process); • Produce job descriptions and provide written contracts and other information that outline the working conditions and terms of employment, including the full range of benefits; • Provide health insurance for employees for the duration of their contracts; • Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts;		

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Develop a recruitment process community employees that involves local authorities in clearly understood procedures; • Employ a community liaison officer (this could be full time or part of another post's responsibilities); • Raise awareness prior to recruitment, clarifying the local hire policy and procedures, including identification of opportunities for women to participate in employment and training; • Report regularly on the labor force profile, including gender, and location source of workers; • Report regularly on labor and working condition key performance indicators, for instance hours worked (regular and overtime) during period and cumulatively, hours lost, number and type of accidents, near misses, site audits and meetings; trainings, and use of labor grievance mechanism; • Hold toolbox talks on workers' rights and the labor grievance mechanisms during the construction phase; • Organize a training program and keep training registers for construction workers;		

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system which provide workers with a safe and healthy work environment taking into account the inherent risks for this type of project. • Waste management plan to be prepared and implemented in accordance with international best practice. • Liaison with the community should be maintained.		
Hindrance for Pedestrian and Vehicle Movement	Short term	Local	Reversible	Likely	Medium	Moderate	• The works on embankment should be carefully scheduled to minimize impact on local markets and transportation routes. • The embankment works should be carried out in segments and soil should be placed linearly on half of the embankment, leaving the other half to be used as track. When the works are completed on the first half, it should be opened for local traffic while works should be undertaken on the other half of the embankment. • Work schedule should be finalized in coordination and consultation with local representatives and communities.	Low	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							• Local routes should not be blocked as much as possible. If unavoidable, alternative routes should be identified in consultation with local community.		
Social unrest between Local worker and outside worker	Short term	Local	Reversible	Likely	Medium	Moderate	• Proper awareness programs should be conducted through public consultation measures such as village scoping sessions, meetings, and placement of bill boards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officers. • Liaison with the communities should be maintained. • Cultural norms of the local community should be respected and honored. • GRM should be established to address the grievances of local as well as outside laborers. • Careful use of local natural resources and project resources, fuel, fuel-wood and electricity. • Restrictions related to consumption of alcohol and drugs. • Safe driving practices. • Respect for the local community and its cultural norms in which laborers are working. • Avoiding construction activities during Prayer time.		

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
Increased inland and waterway traffic	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Contractor to prepare and implement traffic management plan. • Contractor to establish new, temporary jetties where needed. • River crossing for material transportation during nighttime where possible and appropriate • Material transportation through rivers during high tide where needed. • Liaison to be maintained with community and BIWTA.	Low	
Seasonal Impacts (Natural Hazards)	Short term	Local	Reversible	Likely	Medium	Moderate	• Weather signals should be considered by the contractor during construction works. • Radio and television should be provided in all the labor sheds for receiving weather information through these media. • Ensuring rigorous standards for occupational health and safety are in place.	Low	
Damage to Local Infrastructure	Short term	Local	Reversible	Likely	Medium	Moderate	• The condition of the infrastructure being used for the construction and transportation activities should be regularly monitored. • All damaged infrastructure should be restored to original or better condition. • To take preventive measures for protection of local infrastructure.	Low	
C. Post Construction Phase									

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							•	Low	BWDB and WMOs
Increase of sedimentation in water channels and rivers	Long term	Local	Reversible	Likely	Medium to Low	Minor	• An ongoing program of de-silting of water channels should be considered with full community involvement and participation. • Provide silt management plan • The local government (union parishad) should be authorized to monitor the development activities. • Prepare Bangla manual for sluice gate operation and provide training to WMOs; and • Reduce conflicts between farmers and fishermen.	Negligible	BWDB and WMOs
Soil and water contamination (increased use of chemical inputs) and reduced soil fertility	Long term	Local	Reversible	Likely	High	Major	• Capacity building and awareness rising of the farmers should be carried out to practice Integrated Crop Management (ICM) and Good Agricultural Practices (GAP) in order to minimize usage of chemical inputs. • Farmers group should have close contact with DAE for adoption of various measures of IPM, ICM and GAP. • Farmers should be encouraged to use organic and green manure to increase soil fertility while avoiding water contamination. • Farmers should be encouraged to cultivate leguminous crops (N2 fixing) to enhance the soil	Moderate	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							quality as well as soil productivity.		
Increase salinity intrusion	Long term	Local	Reversible	Likely	High	Major	• Regular monitoring and careful maintenance of the water control structures should have to be ensured. • Standard operating procedures should have to be prepared and implemented for the water control structures. These procedures should be translated in bangla as well. • Capacity building of WMOs should be carried out.	Low	
Impact on Fish Habitat Condition	Short term	Local	Reversible	Likely	Low	Low	• Maintenance activities (rivers dredging and khals re-excavation) should be executed after certain interval for removing the silt from the rivers and khals bed. • Monitoring the functions of WMOs.	Negligible	BWDB
Risk of embankment failure	Long term	Local	Reversible	unlikely	High	Major	• Regular monitoring and careful maintenance of the embankment and existing water control structures especially along the eastern side of the Polder should be ensured. This monitoring should particularly be carried out before and after monsoon season. • Prevention of establishing hand tube-wells at the crest of the embankment. • Available cyclone and flood shelter should be prepared as a	Low	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact	Responsible Agency
							contingency measure during emergency situation. • WMG should develop a fund for this kind of emergency situation. • Structural measures like geo bag and sand bag should be kept in stock yard of local BWBD colony.		
							•		

Appendix H: DoE Approved ToR for Environmental Impact Assessment of Polder 34/3

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207
www.doe-bd.org

Memo No : DoE/Clearance/5196/2013/125

Date: 05/06/2013

Subject: Site Clearance in favor of Coastal Embankment Improvement Project (Phase-I).

Ref: Your Application dated 31/03/2013.

With reference to the above mentioned subject, the Department of Environment (DOE) hereby accords Site Clearance in favor of Coastal Embankment Improvement Project (Phase-I) at Satkhira, Khulna, Bagerhat, Pirojpur, Patuakhali and Barguna Districts subject to fulfilling the following terms and conditions.

I. This clearance shall only be applicable for the development of the infrastructure of the said project.
II. The project authority shall submit a comprehensive Environmental Impact Assessment (EIA) report considering the overall activity of the said Project in accordance with the TOR and time schedule submitted to the Department of Environment (DOE).
III. The EIA report should be prepared in accordance with following indicative outlines:

1. Executive summary
2. Introduction: (Background, brief description, scope of study, methodology, limitation, EIA team, references)
3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)

4a. Project activities:
- A list of the main project activities to be undertaken during site clearing, construction as well as operation
- Project Plan, Design, Standard, Specification, Quantification, etc.

4b. Project schedule: The phase and timing for development of the Project

4c. Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.

4d. Map and survey information
Location map, Cadastral map showing land plots (project and adjacent area), Topographical map, Geological map showing geological units, fault zone, and other natural features.

5. Baseline Environmental Condition should include, inter alia, following: (Identification and Quantification of Physical Situation that has been proposed to be changed)
   - Physical Environment : Geology, Topology, Geomorphology, Land-use, Soils, Meteorology, and Hydrology
   - Biological Environment : Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora and Fauna
   - Environment Quality : Air, Water, Soil and Sediment Quality
   - Relate baseline in both Quantitative and Qualitative term with the anticipated outcomes, achievement of goals, objectives and changes due to project interventions
6. Socio-economic environment should include, inter alia, following:
   - Population: Demographic profile and ethnic composition
   - Settlement and housing
   - Traffic and transport
   - Public utilities: water supply, sanitation and solid waste
   - Economy and employment: employment structure and cultural issues in employment
   - Fisheries: fishing activities, fishing communities, commercial important species, fishing resources, commercial factors.
7. Identification, Prediction and Evaluation of Potential Impacts (identification, prediction and assessment of positive and negative impacts likely to result from the proposed project).
   In identification and analysis of potential impacts'-the 'Analysis' part shall include the analysis of relevant spatial and non-spatial data. The outcome of the analysis shall be presented with the

1/2

scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man maid or natural, wildlife, socio-economic aspect shall be incorporated in detail.

8. Management Plan/Procedures:
   For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not mitigable, will be identified as residual impacts Both technical and financial plans shall be incorporated for proposed mitigation measures.
   An outline of the Environmental Management Plan shall be developed for the project.
   In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).
9. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)
   Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)
10. Conclusion and Recommendations

IV. Without approval of EIA report by the Department of Environment, the project authority shall not be able to open L/C in favor of importable machineries.

V. Without obtaining Environmental Clearance, the project authority shall not be able to start the physical activity of the project.

VI. Violation of any of the above conditions shall render this clearance void.

VII. The project authority shall submit the EIA along with an application for Environmental Clearance, the applicable fee in a treasury chalan and the no objection certificates (NOCs) from the local authority to the head office in Dhaka with a copy to the Khulna and Barisal Divisional Office of DOE.

VIII. This clearance is valid for one year from the date of issuance and the project authority shall apply for renewal to Head Office with a copy to the Khulna and Barisal Divisional Office of DOE at least 30 days ahead of expiry.

IX. This Site Clearance Certificate has been issued with the approval of the appropriate authority.

05.06.2013

(Syed Nazmul Ahsan)
Deputy Director (Environmental Clearance)
&
Member Secretary
Environmental Clearance Committee
Phone # 02-8181778

Mr. Md. Sarafat Hossain Khan
Superintending Engineer & Project Coordinator
Coastal Embankment Improvement Project (Phase-I)
Bangladesh Water Development Board (BWDB)
72, Gre[illegible] Dhaka-1205.

<u>**Copy Forwarded to :**</u>

1) PS to Secretary, Ministry of Environment and Forest, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Khulna/Barisal Divisional Office, Khulna/Barisal.
3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

2/2

Appendix I: Checklist for PCM

Environmental Impact Assessment (EIA) under CEIP-1

Issues of the Public/Stakeholder Consultation Meeting

The possible issues that would be discussed in the public consultation meetings are:

1. Productivity (e.g. agriculture and fishery)
2. Livelihood options
3. Vulnerability issues
4. Ecological imbalance
5. Resource redistribution
6. People's perception, opinion and attitude
   - 6.1. Major problems
     - 6.1.1. Problems in productivity
     - 6.1.2. Problems in service and facilities
     - 6.1.3. Infrastructural problems
   - 6.2. Attitude of the people towards the project
   - 6.3. Impact (positive and negative) of the project and mitigation measures
     - 6.3.1. Alternative sites
     - 6.3.2. Mitigation measures for planners
     - 6.3.3. Mitigation measures of implementing agency
7. Income restoration and generation issues
   - 7.1. Current income generating activities
   - 7.2. Type of occupation
   - 7.3. Income-generating activities
   - 7.4. Current market situation (job opportunities, competition, land price and market price situation)
   - 7.5. Skill development and IGA
8. Social development support
   - 8.1. Name of NGOs prevailing in the study area
   - 8.2. Social safeguard and safety nets
   - 8.3. Community interventions
9. Gender issues
   - 9.1. Unemployment of female labor force
   - 9.2. Literacy rate of female students
   - 9.3. Anticipated changes in the wage rate
   - 9.4. Health issues of women
10. Participation of women in service and facilities

FGD issues

The issues that were discussed in the focus group discussions are:

1. People's perception, opinion and attitude
    1.1. Initial discussion about the selected Important Social Components (ISCs)
    1.2. Attitude of the people towards the project
    1.3. Impact (positive and negative) of the project and mitigation measures
2. Demographic distribution
    2.1. Population distribution
    2.2. Major age group
    2.3. Dependency ratio/status)
3. State of Education
    3.1. Impact of illiteracy
    3.2. Variation in school Attendance between girls and boys
    3.3. Variation in drop-out between girls and boys
4. Health Situation
    4.1. Prevalent diseases
    4.2. People's health seeking behavior
    4.3. Local health facilities
5. Employment and Occupation
    5.1. Existing occupations in the locality
    5.2. Major occupations
    5.3. Reasons of unemployment
    5.4. Impacts of unemployment
    5.5. Occupation problems/conflict
    5.6. Impacts of variation in water level on employment
6. Service and Facilities)
    6.1. Existing housing tenancy and structure
    6.2. Drinking water and sanitation facilities in the locality
    6.3. Energy Facility
    6.4. State of market Facility
7. Gender Issues
    7.1. Unemployment of female labor force
    7.2. Literacy rate of female students
    7.3. Anticipated changes in the wage rate
    7.4. Health issues of women
    7.5. Participation of women in service and facilities
    7.6. Women leadership
8. Poverty and food security status
    8.1. Number of working days, disaggregated by seasons and occupations
    8.2. Status of subsistence, disaggregated by seasons
    8.3. Usual food menu

8.4. Adaptation strategies during poverty state

9. Ethnicity

9.1. Major ethnic groups
9.2. Cultural conflict and coexistence
9.3. Potential impacts of project on ethnic groups

10. Archaeological/heritage sites

10.1. Major archaeological/heritage sites
10.2. Cultural values
10.3. Potential impacts of project

Appendix J: Comments and Responses (IPOE)

Comments and Responses on EIA report of Polder 34-3 under SI	**Comments by IPOE (Professor Dr.Ainun Nishat)**	**Responses by CEGIS**
1	Scoping and bounding need to be mentioned in approach and methodology chapter	It has already been incorporated in the report (sections 2.2.3 & 2.2.4). This chapter has also been re-organized according to the EIA steps
2	Characteristics of brackish fish species and indicative fish species in the Polder area	Characteristics of brackish fish species and indicative fish species have been addressed in section 6.2.10
3	Mention exist velocity to the gate	Exist velocity has been mentioned in section 10.15.3
4	Timing of the fish fry movement	It has been mentioned in the report (section 6.2.10 and figure 6.11)
5	Restore the connectivity /Boat pass or some other way to be provided as per as for boat movement	Boat pass arrangement has been suggested in the report(section 10.15.1 in Chapter 10)
6	Operation of gate through WMA which should be formed before operation of the gate	It has been mentioned in section 5.9 and section 10.15.2
7	Do they belief that the project can be managed and operated by the existing staff?	Insufficient and mentioned in the report(section 10.15.2)
8	Operation of the gates to be voiced/point out by the EIA team	A detailed gate operation plan has been provided in the report (section 5.9 in chapter 5). In addition, gate operation plan in Bengali has been prepared and provided in Appendix -E
9	Flap gates to be replaced by manual gate for allowing fish migration	In order to facilitate fish migration and prevent saline water intrusion both flap gate and vertical lifting gate have been provided
10	Polder to be used for paddy cultivation not shrimp cultivation, but shrimp cultivation is economically viable and mostly occupied by local influential people. How to solve this problem?	A doable plan has been suggested in section 10.15.3 (chapter 10) considering conflict between gher owners and farmers
11	Actual requirement of staff for Polder management to be addressed	It has been addressed in section 5.9.1. BWDB may recruit sluice khalashi for each of the Drainage Sluices for smooth operation of the gates as per initial

Comments and Responses on EIA report of Polder 34-3 under SI	**Comments by IPOE (Professor Dr.Ainun Nishat)**	**Responses by CEGIS**
		practice. It has also been suggested to form Polder management committee comprising BWDB field officials and LGI and land owner for proper management of water issues in the Polder area.
12	Stakeholder list may be collected from BWDB before conducting the EIA disclosure meeting	Will be collected as per suggestion

Appendix K: Comments and Responses (World Bank)

Sl	Comments by WB	Responses by EIA Consultant	Action taken
1	Strategic/Sectoral Assessment: Given that multiple Polders are being considered and they are part of a larger government intervention, it is recommended to clarify in the EIAs if any Strategic or Sectoral Environmental Assessment has been conducted in relation to the Coastal Zone Policy (2005), the Coastal Development Strategy (2006) or similar government plans informing the rehabilitation of Polders, and if so, how those Assessments inform the site-specific EIAs	A strategic Environmental Assessment (SEA) has been carried for CEIP-1 before conducting the EIA study.	It has been mentioned in Executive Summary and Chapter-1 (Introduction);
2	Selection Criteria: Similarly, the EIA states that "This Polder is one of the 17 Polders selected for rehabilitation through feasibility study under CEIP-1.". The EIA, in the Executive Summary and other relevant sections (e.g. Alternative Analysis) should explain any environmental criteria that was used to select the Polders.	Preliminary 17 Polders were selected for rehabilitation in feasibility study considering physical conditions as well as damages of the Polder. Afterwards, these Polders were selected through screening matrix. In environmental point of view, multi-criteria analysis was conducted which has been mentioned in SEA report.	It has been mentioned in Executive Summary and Chapter-1 (Introduction).
3	Past Experiences: Since a number of Polders under Works Package 1 have started the construction phase, it is recommended to include a brief explanation of any past experiences or evidence on terms of potential significant adverse environmental impacts (e.g. loss of fauna, impacts on sensitive ecosystems, fisheries, etc.) associated	This issue will be considered.	Environmental audit report (by Sheladia/BETS - Feb/2017) has identified several issues that need to be followed up by PMU for total compliance.

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	to such projects as well as the track record of the Project in managing such impacts and the effectiveness and efficiency of the set of proposed mitigation measures, especially those related to water management and biological/ ecological aspects (shrimp culture, fish sanctuaries, etc.). We think the project is already in a situation to learn from the experience and to introduce adjustments (if necessary) and to avoid copying exactly the same measures from other Polders without reflecting on them.		
4	DoE Clearance. Has the EIA been awarded by the DoE clearance? What is the status of the process? Has the IEE been processed and issued?	EIA report of Polder 34/3 has not been awarded by DoE yet because this report is in the process of finalization. After finalization, it will be submitted at DoE for Clearance.	IEE report was submitted to DoE and obtained site clearance.
5	Legal framework. How does the EIA and the project apply the policy, legislative and regulatory framework? The chapter presents a compilation of laws and regulation, but how the project understands and ensures its compliance? It is also important to understand how such laws will be implemented and enforced, in the specific circumstances of the project. It is important therefore to conduct a gap analysis to confirm whether the national	This Chapter has already been addressed elaborately and appended in the report (Appendix-B).	The updated Chapter has been appended (Appendix-B).

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	framework enables or requires risk and impacts to be addressed in accordance with Bank requirements. Where this is not the case, options need to be identified to address such gaps.		
6	Climate change. The exercise to bring climate change data to the EIA and to make the CC case is interesting. However, the EIA does not conclude how project design responds to those projections and how project design mitigates the effect of climate change. What is the connection between data and the model utilized for project design?	It may be mentioned here that drainage modeling of the coastal Polder has been carried out by IWM to find out the design parameters for drainage channel systems, drainage regulator, river bank, slope protection works. Climate resilient coastal embankment crest level has been design considering the combined effects of cyclone storm surge effects and cyclone induced wind wave. The model has been developed and simulated considering climate change condition considering with and without interventions by IWM, 2016	It has been mentioned in Section 4.4.
7	Enhancement of conflicting uses. In various sections the EIA mentions an existing conflict between Gher owners and farmers in the Polder. We believe that this is an important aspect that the EIA does not analyze beyond these general mention. The EIA should explain how the interventions of the Project would impact this existing conflict and the EMP should include specific measures to address it.		This issue has been addressed in the section 6.4.11and section 10.14.4
8	Section: 5.5.7. Afforestation. How does the EMP follow the BWDB		Yes, the afforestation plan will be implemented as per regulations of BWDB.

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	afforestation regulations? How is the EMP including the detail information on plantation program (Table 10.6). It would be good to articulate this chapter with EMP.		As per comments, afforestation plan has been articulated in EMP Chapter 10; Section 10.10.1
9	Re-excavation of drainage khals. Local people may be encouraged to take earth from the spoils. How will the aptitude of use of the earth be determined?	As per consultation, local people are interested to take re-excavated materials for beneficial use of the community.	
10	Construction schedule. How does the construction schedule impact social and community events? The EIA reports on some cultural property presence in the area of influence that might be important to consider.		It has been considered in section 5.7.1, Table 5.9.
11	Manpower requirement. We recommend torevisit the numbers of Table 5.10. Otherwise it suggests a huge labor influx (36,000).		The figure mentioned in table 5.10 has been revised based on the experience from the works implementation in Package-1.
12	Project implementation arrangements. We mentioned this in previous reviews before. This section should be adjusted to describe the realism and level of implementation of the proposed arrangements. What we want to say is that part of these arrangements are already existing, such as the IPoE and at this stage of project development and evolution it would be good to reflect about these existing arrangements and how they have performed		This issue has been considered and updated the report accordingly - Chapter 5, Section 5.8.

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	in other Polders. It is very important to describe in the EMP how the mandate and role of the different stakeholders discussed in section 5.9 articulates with the EMP. Many operational activities described in this section have clear implications at the EMP level. Capacity issues should be discussed.		
13	Sensitive receptors. How is the baseline defined for education and health affected by the project? Please also discuss how the market/growth centers and the cultural heritages and common property resources in the Polder would be affected by the project. They have been included in the baseline, as part of the area of influence.	Selection of sensitive receptors as well as growth Centre and common resources properties within 500 m distance from the embankment have been considered	It has been considered in Sections 6.4.5 and 6.4.6;
14	Pest management. Para 470 includes the development of a pest management plan for the holistic afforestation. It would be good to capture the experience from the afforestation actions delivered for the Polders under construction.	The afforestation plan has not been taken up in package-1 because the construction works under this project is in progress	
15	Compensation mechanisms. Where in the report is the compensation criteria to establish the payments to the owners against tree felling? How is this implemented?	A detail Resettlement Action Plan (RAP) is being prepared by the Consultant. According to the plan, payment to the owners against tree felling will be established. It would be included after getting the RAP report.	
16	EMP and mitigation measures. EMP follows the same footprint as	This chapter is being updated according to the comment	

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	previous reports. In the case of the mitigation measures it is not clear who is responsible for implementation, where and when. This is not fixed by the EMP. While each impact included a reasonable set of mitigation measures, the EMP chapter of the report includes a generic mitigation guideline. While this is useful it is not enough to guide the preparation of the detailed EMP and the contractor EMP. For example, in terms of obstruction of fish movement and migration, who is going to implement the six proposed mitigation measures, when and where? Is the estimated implementation cost enough to ensure all the proposed mitigation measures? Our impression is that not all the proposed mitigation measures have been included in the Table 11.1? Our recommendation is to cut and paste to bring to the table the mitigation measures included in the environmental assessment chapter. The more accurate and defined the EMP is, the better can support the future bidding document directly.		
17	Construction Camps: In various sections of the EIA it is stated that labor sheds and camps will be		It has been considered in section 5.7.2;

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	constructed, but the EIAs should clarify if such labor sheds/camps will house workers or not. If those structures are to house workers it is recommended to include in the EMP section a reference to internationally recognized guidelines for construction and operation of such camps, such as the IFC/EBRD workers accommodation guidelines http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/learning+and+adapting/knowledge+products/publications/publications_gpn_workersaccommodation. Please state if the project will involve labor influx or not following the bank definition.		
18	Traffic Management: The EIAs identify risks and impacts related to the project-related traffic and there are different mitigation measures mentioned in different sections of the EIAs. It is recommended to consolidate traffic-related mitigation measures and ensure that they are consistent throughout the document, and also to clarify the scope of key elements of the Traffic Management Plan that should be prepared. Increase of Vehicular Traffic during mobilization – it is recommended to	National and WB noise standards have been included in the report to comply Noise levels from vehicles, equipment and machinery etc.	Section 8.3.5, Table 8.3

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	include procedures to ensure: adequate signaling for traffic and pedestrian safety, speed limits for project-related trucks when crossing heavily populated areas and dust control measures. This also applies to Hindrance of Pedestrian and Vehicular Movement. Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards. Include reference parameters and link.		
19	Mangrove Afforestation: On the foreshore area mangrove species will be replanted and that "Mangrove vegetation has immense contribution to protect the embankments and charland from tidal surge, provides fuel and thatch materials to the local inhabitants as well as creates ideal habitats for the local avifauna and other wild animals." Given the importance of mangroves, and the fact that survival rates of replanted mangroves tends to be very low it is recommended that the EIAs include a specific description of the ration of seedlings to be planted for each lost mangrove tree as well as a survival and growth rate targets and corresponding monitoring indicators.	Survival rate of each mangrove species are illustrated in FinalInterimReport on AdditionalTasksAssignedSeptember,2013 (Feasibility report on Afforestation)	This issue has already been included in EMP (Section 8.6.5, Section 10.10.1 and Table 10.6)
20	EHS Guidelines: The section on *Environment,*		The health and safety issue has been

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	Health and Safety Guidelines should specify that the most relevant EHS Guideline is the General one and provide a link in the document: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines		considered and the guideline has been linked in the report (Section 8.4.14)
21	Pesticides: The interventions under the proposed Project may result in an increased availability of irrigation water through cleaning and excavation of watercourses in the Polder. This increased water availability can in turn potentially increase the usage of chemical fertilizers and pesticides. During regular environment monitoring during operational phase if the water and soil pollution is observed, the proponent will be responsible for preparing a Pest Management Plan with prior approval from Bank." On the above, please clarify: a) parameters to be used to determine if there are exceedances in water and soil pollution linked to use of pesticides; and b) what agency will be responsible for preparing and implementing Pest Management Plan, conduct capacity building in Integrated Pest Management (IPM) and Integrated Crop	Level of chemicals including heavy metals will be measured during monitoring to check if the environmental quality standards (EQS) are exceeded in which case IPM and ICM will be prepared by the Department of Agricultural Extension (DAE). Objective of the infrastructure project is agricultural crop production which has been addressed. DAE will be the agency responsible for agricultural crop production through reduced dependence on agro-chemicals.	

Sl	Comments by WB	Responses by EIA Consultant	Action taken
	Management (ICM), as stated in the EIA, in a way that it would effectively mitigate the impact; this allocation of responsibilities if important given that this is basically an infrastructure project and not an agricultural project and purchase and handling of pesticides is not part of project activities.		
22	Periodic Maintenance Works: The EIAs should describe the environmental management procedures that will be in place during the operational phase of the project for conducting "Major Periodic Maintenance Works", which could have considerable impacts.		It has been mentioned in the report Section 5.9.2.
23	IPoE Assessment: What was the result of the IPoE review of the EIA?	IPoE has reviewed the draft EIA report of Polder 34/3 and has made some comments. Accordingly, the report has been updated.	The comments and responses has been appended in the report (Appendix-J)
24	Disclosure and consultation: Please include final details on disclosure and consultation of the EIA	Initially, consultation meetings have been conducted. Disclosure meeting at regional and national level have also been conducted	Mentioned in Chapter 11.

Appendix L: Participants listof PDM

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক
অবহিতকরণ সভায় অংশগ্রহণকারীদের তালিকা

স্থান : বাগেরহাট সদর উপজেলা পরিষদ মিলনায়তন

সময় : ১০:০০

তারিখঃ ২৭ জুলাই, ২০১৭

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
01	Dr. Ashraful Alam	CEGIS	01815290847	[illegible]
02	মো: শহীদুল ইসলাম	LEO	01700820188	[illegible] 27.7.17
03.	মো: [illegible]	জেলা প্রাণিসম্পদ [illegible] বাগেরহাট	01730350930	[illegible] 27.07.17
04.	[illegible]	[illegible]	01733224826	[illegible] 27.7.17
05	মরিয়াম বেগম	ইউ. পি. সদস্য ২,৩ ওয়ার্ড [illegible]	01766392394	marium
06.	রেহানা পারভীন	ED Shaplaful	01711965829	[illegible]
07	নির্মল চন্দ্র বসু	ডাক বিভাগ [illegible] বাগেরহাট সদর	01716963982	[illegible] 27/07/17
08	শেখ আবুবকর সিদ্দিক	ইউ. পি. সদস্য [illegible]	01710457274	[illegible] 27.07.17
09	[illegible]	ইউ. পি. সদস্য [illegible]	01712-182489	[illegible]
10	[illegible]	" "	[illegible]	[illegible]
11	G.M. Abid Hossain	Upazilla Co-operative officer	01712-813618	[illegible]
12.	Md. Zakir Hossain.	SAE/S.O BWDB, Bagerhat,	01715-039425	[illegible]
13-	[illegible]	U.P. [illegible]	01937583073	[illegible] 27-7-17
14.	[illegible]	UAO [illegible]	01718832120	[illegible] 27/7/17
15	মোহাম্মদ [illegible]	[illegible]	0178-941987	[illegible]

আয়োজনে
CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক
অবহিতকরণ সভায় অংশগ্রহণকারীদের তালিকা

স্থান : বাগেরহাট সদর উপজেলা পরিষদ মিলনায়তন

তারিখ: ২৭ জুলাই, ২০১৭

সময় : ১০:০০

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
১৬	মো: রাকিব হোসেন	UE, LGED	01712-626039	[illegible]
১৭.	মো: [illegible]	[illegible]	01827566771	[illegible]
১৮.	মোঃ জাকিদুর রহমান	সদস্য ২নং কাড়াপাড়া ইউ: পি: [illegible]	01740-936346	[illegible]
১৯.	মোঃ [illegible]	[illegible]	01920-509578	[illegible]
২০.	মোঃ [illegible]	[illegible]	01712-[illegible]	[illegible]
২১	[illegible]	[illegible]	01769916596	[illegible]
২২	[illegible]	[illegible]	01689392858	[illegible]
২৩.	[illegible]	[illegible]	01718-003243	[illegible]
২৪.	[illegible]	[illegible]	01761 922523	[illegible]
২৫	মো: [illegible]	[illegible]	01845945319	[illegible]
২৬	[illegible]	[illegible]	01727-215638	[illegible]
২৭	মো: [illegible]	[illegible]	01711399005	[illegible]
২৮	আবেদা সুলতানা	১নং কাড়াপাড়া ৪-৫-৬ সদস্যা	01711579396	Abeda
২৯	এস.এম. [illegible]	AEO, [illegible]	01718-655955	[illegible]
৩০	মো: [illegible] রহমান	[illegible]	01714-515525	[illegible]

আয়োজনে

CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক
অবহিতকরণ সভায় অংশগ্রহণকারীদের তালিকা

স্থান : বাগেরহাট সদর উপজেলা পরিষদ মিলনায়তন

সময় : ১০:০০

তারিখ : ২৭ জুলাই, ২০১৭

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
০১।	[illegible]	[illegible]	[illegible]	[illegible]
০২।	আরিফ	সাংবাদিক	01731215965	[illegible]
০৩।	[illegible]			[illegible]
০৪।	[illegible]	বাগেরহাট	01936025108	[illegible]
০৫/	[illegible]	[illegible]	01799119906	[illegible]
০৬	[illegible]	বাগেরহাট [illegible]	0192063887 95	[illegible] ২৭.০৭.১৭

আয়োজনে
C≋GIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক অবহিতকরণ সভায় অংশগ্রহণকারীদের তালিকা

স্থান : বাগেরহাট সদর উপজেলা পরিষদ মিলনায়তন

সময় : ১০:০০

তারিখ: ২৭ জুলাই, ২০১৭

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
৩৭	মো: নূরুল [illegible]	UNO বাগেরহাট সদর উপজেলা	0711071929	[illegible]
৩৮	[illegible]	চেয়ারম্যান, [illegible] ইউ.পি	01716-211795	[illegible] 27.07.17
৩৯	[illegible]	[illegible]	০১৭১২৮১৭০৮২৮	[illegible]
৪০	শেখ [illegible]	চেয়ারম্যান [illegible] ইউ.পি.	01711340182	[illegible] 27.7.2017
৪১	মিসেস দিলরুবা খানম	[illegible]	01713910304	Dibuba
৪২	[illegible]	[illegible]	01861774519	[illegible] 27/07/17
৪৩	মো: [illegible]	C.A to [illegible]	01970886256	[illegible] 27.07.17
৪৪	[illegible]	[illegible]	01722193680	[illegible]
৪৫	মো: [illegible]	সদর উপজেলা	01915-951441	[illegible]
৪৬	মমতা সেন	সদর উপজেলা	01742332449	মমতা/সেন
৪৭	[illegible]	[illegible]	01521316731	[illegible]
৪৮	[illegible]	[illegible]	01718-455026	[illegible]
৪৯	[illegible]	[illegible]	01788961033	[illegible]

আয়োজনে

CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক অবহিতকরণ সভায় অংশগ্রহণকারীদের তালিকা

স্থান : বাগেরহাট সদর উপজেলা পরিষদ মিলনায়তন

সময় : ১০:০০

তারিখ: ২৭ জুলাই, ২০১৭

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
৫০.	মো: মুজিবর রহমান খান	চেয়ারম্যান সদর উপজেলা পরিষদ	০১৭১৮৩৬৬৫৬৮০	[illegible]
৫১.	সরদার ওবায়দুর রহমান	ভাইস চেয়ারম্যান সদর উপজেলা	০১৯১৮-৫৫১০০৫৪	[illegible]
৫২.	জাহাঙ্গীর আলম	[illegible]		জাহাঙ্গীর
৫৩.	[illegible]	[illegible]	01718988327	[illegible]
৫৪	মো: হাকিম [illegible]	[illegible]	01748641682	[illegible]

আয়োজনে

CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

Appendix M: WB Comments on CEIP EIA Draft Report – Package 3

The EIA has been conducted by the Center for Environmental and Geographic Information Services (CEGIS). The team has conducted numerous field visits and ensured participation of the community of Polder 16 during field survey and public consultations in order to carry out the study.

The key improvement works to be carried out in Polder 16 under CEIP-1 are: re-sectioning of embankment (43.00 km); construction of retired embankment (2.00 km); bank protection works (0.30 km); slope protection of embankment (1.00km); construction (replacing) of 10 number of drainage sluices; construction (replacing) of 20 (twenty) flushing sluices; repair of 2 drainage sluices, demolishing of flushing inlet (01); re-excavation of drainage channels (20 km) and afforestation of (24.0 ha). Other components of the CEIP-1 will include implementation of social action plan and environmental management plan; supervision, monitoring and evaluation of project impacts; project management, technical assistance, trainings, and technical studies; and contingent emergency response.

Overall, the EIA is comprehensive and can be streamlined to avoid repetition especially regarding project description and mitigation measures proposed in EIA. The EIA will be also benefitted from including the additional mitigations measures, clarifying project description and implementation arrangement. Please revise the EIA for Polder 16 for another review.

WB Comments	Responses
General: The document title is “EIA” however it includes social aspects as well. Why it is called as EIA rather than ESIA?	Only the baseline information related to the various social aspects has been included in this document, which is appropriate and essential to understand the ground situation of the project area in relation to the ensuing environmental conditions and ecological/natural resources. This report, in fact, is not a social impact assessment; hence the document title only mentions EIA as per the contract.
Executive Summary: Please include EMP/ESMP table, EMP/ESMP implementation cost and monitoring table in Executive Summary.	EMP/ESMP, monitoring plan with cost has been included in the executive summary
Introduction: Please enlarge Map 1.1 so that locations of all Polders in Package 3 can be identified	As per comment, location map has been corrected and replaced
Policy and Regulatory Framework: Section 3.7 is overlapped with the figure. Please resolve it	It has been resolved
OP7.50 is triggered for the project. Please revise the text.	The rivers around the Polder are local rivers and not international rivers. The OP 7.50 was mentioned in the report by mistake which has already been deleted from the report.
Methodology: Please explain how impact assessment methodology from para. 40-45 relates to impact screening explained in Section 7.	Method for impacts screening has been explained in this chapter
Climate Change impacts: The climate change impact doesn’t mention the flood and storm surges effects which is relevant to the Polder. It only covers the rainfall and the temperature projections.	This issue has been considered and addressed in the report in Chapter 4.5

WB Comments	Responses
Project Description: Please clarify the details of afforestation activities including who will be responsible for implementation of afforestation, location of afforestation, afforestation period, types of tree species used.	The contractor will work with the Senior Forestry Specialist at PMU for afforestation; indigenous tree species will be selected for plantation; afforestation period is pre-monsoon (Apr-May); local NGOs/CBOs/WMOs will be hired and will be responsible for maintenance of the saplings under social forestry guidelines. It has been described in Afforestation plan of Chapter 10 alongwith Table 10.7
Para 138 states temporary labour camp for local labour during preparing CC block will be established. Please include the basic information of camp sites such as land requirement, number of camp sites, what kinds of facilities would be constructed. Please also assess the potential labor influx. Labor influx plan should be prepared as a part of EMP/ESMP where appropriate.	Details of labour camps information has been discussed in description of construction activities (Chapter 5, mainly in Chapters 5.6, 5.6.1 and 5.6.2 etc.) Labour influx plan has been prepared in EAP/ESMP of Packgae-1 and Package-2 and it will be followed for Polders of Package-3
This EIA does not include the environmental and social impact assessment of CC block manufacturing plants. Please prepare the separate assessment	There is no bank/slope protection work for rehabilitation of Polder 34/3 (Table 5.3). Thus, the number of CC block requirement for rehabilitation/repair of hydraulic regulators will be less, which could be prepared manually, that indicates no necessity for establishing automated CC block plant in Polder 34/3
Table 5.12 shows construction materials for re-sectioning of embankment and drainage sluices/flushing inlets. Please also explain how to procure the other construction materials used for other project activities such as river bank protection and slope protection. Please also clarify how many CC block manufacturing plants will be established.	There will be no need for establishing automated CC block manufacturing plant in Polder 34/3 as mentioned Chapter 5.6.4
Para 146 A Social, Environment and Communication Unit: Is this unit established only for Package 3? Is this the same Environmental and social unit for Package 1? Please explain.	It is the same SECU at PMU for all the Packages
Para 148 Would DCSC/ supervise/assist implementation of safeguard instruments such as EMP or RAP? Please clarify	Clarified and the relevant paragraph has been rephrased/mentioned
The EIA study presumes that the invert level of the drainage sluice gate have been fixed in manner that about 50-60% of water will be retained in the khal to facilitate in irrigation, fisheries, environment and other purposes. Please explain the reasons that this assumption is made.	As per design of Drainage Sluices (DS), The invert level of DS are fixed inconsideration of the lowest water level. Hence, the canals bed level which are below the invert level have the capacity of retain some water within it. The water needs to be used for irrigation, fisheries and domestic purposes.
Baseline Condition: Land use: No natural vegetation such as forest and wetland? It is not clear in Table 6.1.	There is no natural/mangrove forest or vegetation or beel (wetland) within the Polder area which has been mentioned in Table 6.1. There are homestead vegetation area along with the settlement, mentioned in the Table
Mangrove: Please show the distribution of Mangrove on a map. Is it also possible to show the size of mangrove forest areas?	It has already been mentioned in the above response
Has endangered river dolphins been recorded in the rivers along the Polder? Please clarify.	Yes, freshwater river dolphin (*Platanista gangetica*) occurs in the peripheral rivers.

WB Comments	Responses
Analysis of Alternative: Para 370: Please clarify which, either procuring sand from market or sand collected from riverbed, is the proposed option.	This section has been revised as per comment
Technological alternative analysis is not really conducted. Please include the technological alternative for each proposed work. For example, as a technological alternative for construction of replacement of the existing flushing sluices, would the repair of existing flushing sluices be considered?	Status of the drainage structures has been provided in Table 5.2, along with recommendationfor remedy, which explains the reasons for replacement/construction of the drainage structures/flushing sluices as well as repair of flushing sluices.
Mitigation measures: Please clarify how to manage the excavated soil/silt from drainage channels.	Management of excavated soil/silt from drainage channels have been discussed in section 5.5.6 and a conceptual soil dumping location is shown in figure 5.1
Table 8.1- Please include the potential impacts on involuntary resettlement.	Data is not available as the RAP consultant was not provided it.
Please clarify the contractor will prepare Traffic Management Plan to address potential E&S impacts including traffic safety, noise, vibration and air pollution.	Traffic Management Plan has been prepared by the contractor and included in the Contractor's EAP and C-ESMP for the Package 1 and Package-2 and it will be followed for the Package 3 Polders.
All the mitigation measures proposed in Section 7 should be reflected in EMP table which needs to be developed in Section 9.	All mitigation measures proposed in chapter 8 have been reflected in EMP Table (Table 10.1 in Chapter 10)
Please analyze the impacts related to labor and propose the comprehensive mitigation measures including OHS, management plans for workers camp and labor conditions.	Addressed in Chapter 8.4.15entitled “Safety and Health hazard”
Please analyze the impacts related to community security, health and safety and propose comprehensive mitigation measures.	impacts related to community security, health and safety as well as mitigation measures have been addressed in section 8.4.15
Please include the impact analysis and mitigation measures for sand excavation from riverbed.	There will be no sand extraction from the river bed for any kind of activities related to the rehabilitation of the Polder. Mentionable that repair of embankment will be done by borrow pit earth and sand will be carried from the outside area rather than river bed for concreting and other construction works.
Please clarify the prohibition of clearance trees as a mitigation measure in para.385 as indicated in para .384.	Not clear
Please add in para 385 that an approval needs to be obtained from DCSC for clearance of vegetation	It has been added in the report
Please add in para 385 that the contractor needs to prepare flora and fauna protection plan	It has been added in the report
Para 394 (Noise) - Please propose the following measures to be implemented by contractor: installation of acoustic enclosures around generators, notification of major noise generating activities to affected people, prohibition of vehicle movement during night time, monitoring noise in the nearby community where appropriate, preparation of noise and vibration management plan as a part of pollution control plan proposed in para 398.	This issue has been addressed in the report
Para 398 (Soil and water contamination) - Please propose the following measures to be implemented	This issue has been addressed in the report

WB Comments	Responses
by contractor: Installation of temporary drainage works (channels and bunds) and/or temporary sediment basins where sediment and erosion control are required, preparation of spill control procedure, workshops fully bunded with impervious floors and walls, all containers, drums and drums in good condition, storing all liquid fuels in fully bunded storage containers, refueling only within bunded areas, provision of spill kit and other oil spill response tools, preparation of Emergency Response Plan , refueling only within bunded area.	
Para 402(Aggravated Sedimentation) - Please propose the following measures to be implemented by contractor: preparation of borrow area management plan and obtaining necessary permits from government, use of only approved quarry and borrow sites, anti-erosion measures including use of retaining walls and gabions where required.	This issue has been addressed in the report
Para 406 (Impacts on agricultural lands) – Please implement drainage and erosion control measures at the work sites near agricultural fields.	This issue has been addressed in the report
Para 430 (Vegetation/Afforestation) - Please propose the top soil at the construction/ rehabilitation sites should be stored and used for plantation and redevelopment of vegetation.	This issue has been addressed in the report
Para 433 (Road communication) - Please propose the following measures to be implemented by contractor: provision of clear demarcation of the work sites, application of no authorized entry, appropriate warning signs at strategic locations.	This issue has been addressed in the report
Cumulative Impacts: Necessary mitigation measures need to be proposed based on the analysis of cumulative impacts. Currently, no mitigation measures are proposed.	It has been mentioned in the report (section 9.3)
Please also include the assessment of impacts on rivers/watercourses hydrology and fish migration.	Assessment of impacts on rivers/watercourses hydrology and fish migration have been incorporated in the report (sections 9.3.1
EMP (ESMP): Section 9 should present EMP table consolidating all the mitigation measures proposed in Section 7, ECoP and mitigation measures proposed in Appendix E.	Considered and all mitigation measures have been presented in Table 10.1 (Chapter 10)
Environmental and social staff in PMU – It is not clear if the separate Environmental and Social and Communication Unit (ESCU) will be developed for Package 3, or the same institutional arrangement will be maintained. If the same institutional structure is maintained, the expansion of ESCU should be made since the significant increase of supervision/monitoring works regarding EMP/ESMP implementation is expected.	The same institutional structure will be maintained for all packages including Package 3
Para 503- Reference is made on Appendix 10 Environmental Management Framework yet there is neither Appendix 10 nor EMF.	It was written by mistake. This write up has already been removed from the para.
Please revisit Table 10.1 ECoP. There are a number of incomplete or too generic guidance. Please clarify who does what.	???

WB Comments	Responses
Monitoring Plan- Please add noise monitoring at nearby communities (where necessary) and visual inspection of spill	It has been added
Para 519- Please clarify DDCS will prepare a monthly report on the status of EMP/ESMP implementation.	The issue has been clarified in Chapter 10.8.5
Afforestation (Para 530) - Please confirm that there are four locations for foreshore plantation (according to Map 5.2), and its selection criteria. Please also explain who will be responsible to develop afforestation plan and its implementation.	A detailed afforestation plan has been mentioned inChapter 10.10
Para 534- Please replace the term EMF with EMP.	Corrected as per comment
Please include Environmental Committee for the mechanism of project monitoring and supervision.	An ESCU (Environmental and Social Communication Unit) for supervision and monitoring for activities related to implementation works has been mentioned in the report. The ESCU is monitoring the EMP implementation works under Package -1 and Package-2 of CEIP-1. Therefore, further environmental committee is not required.
Stakeholder Consultation: Please include the responses to the comments received at Public Disclosure Meeting (para 592).	This paragraph has been revised according to comment.