Government of the People's Republic of Bangladesh
Ministry of Water Resources

BANGLADESH WATER DEVELOPMENT BOARD

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COASTAL EMBANKMENT IMPROVEMENT PROJECT, PHASE-I (CEIP-I)

DETAILED DESIGN OF FIVE POLDERS

Volume III: Environmental Impact Assessment

Part D: Polder No 35/3

Joint Venture of

CONSULTING ENGINEERING SERVICES (INDIA) PVT. LTD., INDIA

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GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF WATER RESOURCES

BANGLADESH WATER DEVELOPMENT BOARD (BWDB)

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VOLUME III: ENVIRONMENTAL IMPACT ASSESSMENT

PART- D: POLDER NO. 35/3

Reviewed and Revised by

Independent Environmental Specialist

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Abbreviations and Acronyms

ASA	Association for Social Agency
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorology Department
BRDB	Bangladesh Rural development Board
BRAC	Bangladesh Rural Advance Committee
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CCP	Chittagong Coastal Plain
CDS	Coastal Development Strategy
CEGIS	Center for Environmental and Geographic Information Services
CEIP	Coastal Embankment Improvement Program
CEIP-I	Coastal Embankment Improvement Project, Phase I
CERP	Coastal Embankment Rehabilitation Project
CES	Consulting Engineering Services
CZPo	Coastal Zone Policy
DAE	Department of Agricultural Extension
DevCon	Dev Consultants Ltd
DOE	Department of Environment
DPHE	Department of Public Health engineering
DPM	Design Planning & Management Consultants
DTW	Deep Tubewell
EA	Environment Assessment
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
ECRRP	Emergency 2007 Cyclone Recovery and Restoration project
EDS	Environmental Data Sheet
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ES	Environmental Screening
ESBN	Estuarine Set Bag Net
FAO	Food and Agriculture Organization
FGD	Focus group Discussion

FRSS	Fisheries Resources Survey System
FWIP	Future-with-Project
FWOP	Future-without-Project
GIS	Geographical Information System
GO	Government Organization
GTPE	Ganges Tidal Plain East
GTPW	Ganges Tidal Plain West
ha	hactare
HTW	Hand Tubewell
HYV	High Yielding Variety
IDA	International Development Association (World Bank)
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
IS	Institutional Survey
IUCN	International Union for Conservation of Nature
KAL	Kranti Associates Ltd Bangladesh
KII	Key Informant Interview
KJDRP	Khulna-Jessore Drainage Rehabilitation Project
LLP	Low Lift Pump
MC	Main Consultant (for CEIP-I Feasibility study)
MDP	Meghna Deltaic Plain
MOEF	Ministry of Environment and Forest
MOWR	Ministry of Water Resources
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
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
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
SRDI	Soils Resources Development Institute
SSO	Social Service Office
STW	Shallow Tubewell
TDS	Total Dissolved Solids
TOR	Terms of Reference
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
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 act 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 June-July. Generally rain-fed, irrigation needed for HYV T. Aus.
B:	When preceding a crop means broadcast (B. Aus)
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.
Bazar:	Market
Beel:	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
Bepari:	Middleman in the marketing chain who transports the products to the other places, use of term depends on the location, sometimes also used synonymously with retailer.
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 know as charlands, are riverine lands located in the active river basins of the main rivers of Bangladesh. They are located on the banks of the river and islands in the mid-steam 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
Faria:	Local trader/agent/intermediary.
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.
Haat:	Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.

Jaal: Different types of fishing net to catch fish from the water bodies.

Jolmohol: Section of river, individual or group of *beel*s (depression), or individual pond owned by the government but leased out for fishing. They are also called Jalkar, or Fishery.

Jhupri: Very small shed for living, made of locally available materials. One type of houses used by very poor community members.

Kacha: 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. The channel through which the water flows. These may 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).

Kua/Kuri: This is a small ditch in agricultural farm that retain water during dry period. Also used as fish-trap. This also refers to deeper sites in the beel areas wherein the water is retained all through the year including the dry periods. These are sites for the natural spawning of native fishes.

Kutcha Toilet: The earthen made latrine consist of a hole without cover.

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

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

Pacca: 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 the year round.

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

T. *Aman*: When preceding a crop means transplanted (T. Aman).

Upazila: Upazila is an administrative subdivision of an district.

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. 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.

Executive Summary

The Government of Bangladesh (GoB) is planning to implement the Coastal Embankment Improvement Project, Phase I (CEIP-I), under which seventeen polders will be rehabilitated and improved in the coastal area of the country. The GoB is seeking financial assistance from the World Bank (WB) for this Project. In accordance with the national regulatory requirements and WB safeguard policies, Environmental Impact Assessments (EIAs) of the first batch of five polders have been carried out. This document presents the EIA report of Polder 35/3, which is one of these five polders.

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 from the Bay of Bengal encountering very large sediment inflows from upstream. The coastal zone, in its natural state, used to be subject to inundation by high tides, salinity intrusion, cyclonic storms and associated tidal surges. In 1960s, polderization was started in the coastal zone of the Country 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. The polders were designed to keep the land safe from regular tides and allow agriculture activities. 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. Recent cyclones caused substantial damage to the em7bankments and further threatened the integrity of the coastal polders. In addition to breaching of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused the coastal polders to suffer from water logging**,** which lead to large scale environmental, social and economical 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 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 one that only protects against high tides to one that would provide protection against frequent storm surges as well. The long term objective of the Government 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-I is the first phase of this long term program.

Location and Synopsis of Rehabilitation Work

The polder 35/3 is located in two upazilas namely, Rampal and Bagerhat Sadar of Bagerhat District of Bangladesh. The administrative and management control lies with Bagerhat O&M Division, BWDB Bagerhat under Khulna Operation and Maintenance (O&M) circle, and BWDB Khulna under southwestern zone. The Polder covers a gross area of 6,790 ha of which net cultivable area is 5,090 ha. 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 these objectives, the following key improvement and rehabilitation works will be carried out in Polder 35/3 under CEIP-I are: re-sectioning of embankment (35 km); construction of retired embankment

(5.05 km); construction of four drainage sluices; construction of ten flushing inlets; re-excavation of drainage channels (23.50 km); bank protection works (1.70 km); slope protection of embankment (0.90 km) and afforestation on the foreshore areas (26 ha) Other components of the CEIP-I 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.

The Bangladesh Water Development Board (BWDB) is the implementing agency of this Project.

Regulatory and Policy Framework

The Bangladesh Environment Conservation Act, 1995 (amended in 2002), requires that all development 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 fulfills both of these requirements.

Under the Environmental Conservation Rules (1997) a classification system has been established for development projects and industries on basis of the project objective. These categories include Green, Orange A, Orange B, and Red. The construction, reconstruction, expansion of polders and flood control embankment is categorized as Red in accordance with the DoE‘s classification. For 'Red' category projects, it is mandatory to carry out an Environmental Impact Assessment (EIA) including Environmental Management Plan (EMP) and where necessary develop a Resettlement Plan for getting environmental clearance from DoE. According to the World Bank safeguard policies, the project has been classified as Category A, in view of high risk associated with widely involved major civil works in the Project and also considering the high ecological sensitivity and vulnerability of the coastal area.

Alternative Analysis

Several alternatives were considered during the design phase of the project. These included 'no-project' alternative and technical alternatives.

The present situation of the polder is extremely vulnerable to cyclones, storm surges, wave action, and climate change effects, and the Polder is not in a state to provide required services particularly protection against tidal inundation, efficient drainage, and minimizing the impact of cyclonic surges. A significant proportion of the Polder area is vulnerable to salinity intrusion and water logging. Due to high salinity and scarcity of ground water during the periods of low rainfall, a very limited area is under irrigation. The silted up water channels are resulting in limited navigation in their waterways, declining fisheries, and increasing environmental pollution. The proposed interventions under CEIP-I have been designed to address the above mentioned problems of the Polder. If proposed interventions are not implemented, the present poor state of the Polder will continue and may further deteriorate; therefore the 'no-project' alternative is not a recommended option.

Several technical alternatives were considered to address each of the problems being faced in the Polder. These included alternatives for embankment strengthening, river bank protection works, protection of embankment slopes, replacement of drainage sluices, rehabilitation of flushing sluices, addressing water logging and drainage congestion.

Baseline Condition

The Polder 35/3 is located in the southwest region of Bangladesh near Sundarban. Topographically, this area is flat and developed by sedimentation process by the three mighty rivers of the country. The polder area is crisscrossed by a large number of creeks. The total area is basically flat with the central part a bit higher than the surrounding land. Administratively, the Polder 35/3 covers part of Bagerhat Sadar Upazila under Bagerhat district.

As a part of land resources appraisal of Bangladesh for agricultural development, the country has been subdivided into 30 agro-ecological regions and 88 sub-regions. The key parameters on the basis of which this classification has been carried out include physiography, soil properties, soil salinity, and depth and duration of flooding. These parameters are relevant for land use and the assessment of present and future agricultural potential. The Polder 35/3 lies in agro-ecological zone of the Ganges Tidal Floodplain.

The soil texture varies from clay to clay loam in the Polder 35/3. Non-calcareous grey floodplain soil is the major soil type in the Polder. Acid sulfate soils also occupy significant part of the area where it is extensively acidic during dry season. In general, most of the top soils are acidic and sub-soils are neutral to mildly alkaline.

In the polder area, about 24%, 69% and 7% of the net cultivable lands falls under High land, Medium high land and Low land respectively. The soils possess low to very high condition in the dry season and soil salinity level and pH ranges from 4.9-18ds/m and 5.2-7.6 respectively. Rice is dominant crop in the polder area. The coverage of rice area is about 85% of the NCA. The Annual rice production is about 11,658 metric ton in the polder area. Non rice crop production is about 9170 metric tons. The overall cropping intensity in the study area is about 130%.

Sedimentation is a major problem in the polder area. Sedimentation in most of the internal khals caused rise of bed level and reduced the conveyance capacity of the khals. Tidal motion dominates during pre-monsoon and post-monsoon in the polder area. Water logging exists during the dry period in the Polder due to rise in ground water table along with reduced run-off and infiltration. In the Polder, Kashimpur, Kalia under the Dema union and some parts of Malliker ber is affected by water logging problems.

The climate of the project area is tropical in nature with three seasons. The trend analysis shows that the average temperature during monsoon is about 26^0C and average annual monsoon rainfall is about 1,390 mm. As per classification of seismic zone of Bangladesh, the polder 35/3 area falls under Zone-III, which is characterized by low earthquake prone areas. Air pollution is not of much significance in the coastal area of Bangladesh. The measured air quality parameters (SPM, SOx, NOx) lie within the range of standard values for Bangladesh.

Estimated total fish production of the polder area is about 3,630 MT. Bulk of the inland fish production (3,357 MT) is coming from culture fisheries while the rest comes from capture fisheries habitats. Fish production trend from capture fisheries is declining. Perennial Khals such as *Putimari khal*, *Betbunia khal* along with other seasonal internal khals are used as feeding and shelter ground of most of the open water fishes. These khals are marked as the area of conservation significance.

Polder 35/3 falls under Ganges Floodplains and the Saline Tidal Floodplain Bio-ecological Zones. Mangrove and aquatic ecosystems support different aquatic life-forms for their survival. In general, brackish water ecosystem is dominant in the polder area. The Project area supports different types of habitats with many species of flora and fauna including globally and nationally threatened shore birds and other wildlife species. The composition of plant species in the homestead are: Narikel (*Cocos nucifera*), Supari (*Areca catechu*), Kafila (*Lanea coromandelica*), Neem (*Azadirachta indica*), Khejur (*Phoenix sylvestris*), Taal *(Borassus flabeliffer)*, Kola (*Musa* Spp.), Kanthal (*Artocarpus heterophyllus*), Sisoo (*Dalbergia sisoo*), Arjun (*Terminalia arjuna*), Rain tree (*Samanea saman*) and Bansh (*Bambusa* Spp.). The aquatic floral species observed frequently within the project area are Shapla/Shaluk (*Nymphaea* Spp.), Padma (*Nelumbo nucifera*), Kachuripana (*Eichhornia crassipes*), Kolmi (*Ipomoea fistulosa*), Dhol Kolmi (*Ipomoea fistulosa*), Khudipana (*Lemna Sp.*)**,**Topapana (*Pistia strateotes*), Kutipana (*Azolla* Sp), etc. Indian Pond Frog (*Euphlytis haxadactylus*), White-breasted Waterhen (*Amaurornis phoenicurus*), Great Egret (*Casmerodius albus*), Little Egret (*Egretta garzetta*), Indian Pond Heron (*Ardeola grayii*) are common among the fauna. Gangetic River Dolphin (*Platanista gangetica*) is available in the surrounding rivers.

The population in the Polder 35/3 is about 27,494 of which 13,660 are males and 13,834 females. A total of 6,668 households exist in the polder area. The density of population is about 1,016 persons per square kilometer. Overall status of drinking water in the area is generally satisfactory. Most of the people can collect drinking water from tube well. In the polder area, about 60 percent households have hygienic sanitation facility (water-sealed). There is no hospital in the study area. However, there are two community clinics in Dema union and another two in Molliker Ber union. Different types of roads exist within the Polder for communication of local people. Most of the internal roads are earthen followed roads brick soled, paved. There are no known historical and archeological sites declared by government in the Polder area.

Consultation and Disclosure

A number of public consultation meeting were conducted with the participation of local people, representatives of local government (Union Parishad) and BWDB's representatives. Local people showed interest to the project implementation for their existence. They have no objection to implement the project. They also expressed that if the monitoring plan is implemented properly during the pre-construction, construction, post-construction and operation period, the local people within the polder area would help the implementing agency spontaneously. The national level consultation has been carried out at the end of February in 2013 in presence of Department of Environment, other Government Institutions, local and national Non Government Organizations. The findings of National level workshop have been incorporated in the report.

Potential Impacts and their Mitigation

Significant environmental and social impacts are likely to be caused by various activities during Project phases. The major environmental factors to be impacted of the polder are classified as High, Moderate and Low. The high impacted environmental factors are: 15 hectares of land will be acquired for rehabilitation work; due to land acquisition, 113 households will lose their land within the polder area. During establishing and constructing site facilities in the Polder may potentially cause air and water contamination, noise generation. Land use pattern in the polder area will be changed temporary during construction of labor sheds, contractor's office and material stock yard. Four household, two shops will be affected during construction labour sheds.

The potential environmental and social impacts associated with the pre-construction phase of the project include loss of agricultural land, loss of biomass, siltation due to loose soil, air and noise pollution, change in landscape, displacement of people, and psychological impact on people who have to change livelihood. Among these, the impacts associated with acquisition of about 15 ha of land are of foremost significance. The activities will acquire 4.26 ha of single cropped field, 0.81ha of double cropped field, and 0.6 ha of orchard. It is estimated that about 246 matured trees will be affected for construction of drainage sluice and flushing sluice. Of these 176 trees are on the country side and 70 trees are on the river side. Establishing the contractor's temporary site facilities may involve land clearing, land leveling, excavation, and construction of buildings. It is also observed that the project will require to cut more than 20000 trees of which are mainly small. These trees are planted under Foresdt Department and NGO's afforestation plan. BWDB needs to ensure consultation with NGOs, local people and Forest Department before uprooting the trees. The potential impacts during the construction phase include air pollution, noise pollution, degradation of landscape, soil erosion, water contamination, increased siltation in water bodies, loss of agriculture, damage to fish and other aquatic fauna, traffic congestion, and safety hazards. The key construction activities that are likely to cause these environmental and social impacts include construction camp establishment and operation, equipment and material transportation, material borrowing, excavation, embankment raising, dismantling, repair and construction of regulators, re-excavation of water channels, and waste disposal. The project works on the regulators in the area Betbonia Khal, Sayabanki Khal and Mogordhara Khal, are likely to worsen the situation and exacerbate the water logging problem. Furthermore, Bansbaria, Kalia and Kashimpur area will face major drainage congestion problem and create water logging during post monsoon season. After completion of construction activities, this temporary water logging will disappear. The fish species including Paisa, Betki, Horina Chingri, Khorsula, and Chatka Chingri are reported to move between the internal *khals* and *beel* during breeding season (mid May to July). During construction activities, the fish migration between the outside rivers and internal *khals* is likely to be affected. The spawning time for open water fish in the khals is late June to August. Similarly, fish migration within the Polder between *khals* and *beels* can also be affected by the construction activities particularly the *khal* re-excavation. In addition to health and safety hazard due to heavy construction material tiger is another threat for the construction labors. The construction workers are likely to be exposed to this hazard during the construction phase. The work will be performed in congested residential areas, the construction materials; debris from demolition of structures, dredged material will be well protected.

The polder 35/3 is located besides the international route Mongla- Ghasiakhali (**Figure 9.2**). Now the route is active during high tide, but during low tide no vessels and ships can move through this way due to low height water level. Mongla to Ghasiakhali navigation route is one of the important segments of navigation route that joins the Mongla sea port and Khulna with the rest of the country. This route is the part of Indian Protocol Route and most importantly export and import of bulk goods from India that uses inland navigation also uses this route. Traffic is increasing in this route. The route is 31 km in length from the Pussur River at Mongla to the Mongla-Gahsiakhali (M-G) Canal. The cut-down of the tidal prism due to the construction of Polder 35/3 has already occurred. Strengthening of this polder may not have any significant effects on the surrounding rivers or Mongla-Ghasiakhali route. But if the, upstream flow is not ensured by the Gorai-Modhumoti river then the navigation route will lose their navigability.

The social impacts include social unrest due to conflict between local labour and outside labour, The presence of outside labor can potentially disrupt the privacy of the local population particularly women whose mobility can be negatively affected.

The potential impacts during operation phase include soil and water contamination associated with increased usage of fertilizers and hindrance in fish migration. Rain cuts and public cuts are the major causes of embankment breaching of the Polder 35/3. Lack of regular maintenance has creates 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. Mal-operation and leakage of regulators will result in salinity intrusion during the low flow season, causing severe damage to the soil, water resources, and crops in the Polder. Construction of new water control structures on water channels which are currently directly connected with the outer rivers will potentially result in reduction in fish migration.

To address the involuntary resettlement issues arising from acquisition of 97 ha of land and loss of other private and or community structures, a resettlement action plan (RAP) has been prepared. The RAP defines the entitlement criteria and estimates the total compensation to be paid to the affected people. To address the impacts associated with material and equipment transportation and traffic congestion, the contractor will prepare and implement a traffic management plan, which will ensure that sensitive receptors such as schools and busy markets and bazaars are avoided during the peak hours. To address the air and water pollution, contractor will prepare and implement a pollution control plan. Similarly, to address the safety and public health concerns, the contractor will prepare and implement an occupational health and safety plan.

On the positive aspect, the construction work will generate a significant opportunity of employment over its construction period to local people and other associated professionals. People will also be involved to carry out operation and maintenance related jobs to operate the hydraulic structures. It is expected that the agriculture production will be increased; water logging will be decreased for the project which will create jobs indirectly from agriculture, business and commercial services.

Environmental Management Plan

The environmental management plan (EMP) provides the implementation mechanism for the mitigation measures identified during the present EIA. A comprehensive EMP which focuses on managing construction phase-related impacts should suffice in managing the potential construction and operation phase impacts. The EMP will be attached with the Bidding Document. The environmental management parameter will be included in the BoQ. Since most of the contractors do not have clear understanding on the need of environmental management, some tend to quote very low price for implementation of EMP and eventually cannot implement EMP as per design. To avoid this problem, 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 total cost of EMP implementation for Polder 35/3 has been estimated as BDT 32.4 million (without Training and Field trip costing).The contractor needs to submit an Environmental Action Plan (EAP) based on the EIA and EMF in line with the construction schedule and guideline. The EAP needs to be reviewed by the supervision consultant and cleared by BWDB and World Bank.

Extensive monitoring of the environmental concerns of the Polder 35/3 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 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.

Furthermore, EMP identifies capacity building needs with respect to environmental management of the Project, in addition to defining reporting and record keeping protocol.

Impacts on Near by Area

Polder 35/3 is located downstream of the Poylahara river (Poylahara river is generated from the converging point of Daratana river and Katakhali khal, the two peripheral rivers of Polder 35/3). When sea water enters through Baleswar River during dry periods or due to tidal flow or rise in cyclonic surge, water would not be able to enter Polder 35/3 because of its high crest level. The embankments may be damaged; water may overtop the embankment and cause flooding during monsoon or due to rise in surge height.

The existing crest level of polder 34/3 is low (4.27m above sea level), and in many locations the embankment crest has even merged with the ground. As the construction procedures for Polder 34/3 is not in consideration under CEIP-I, no cumulative impacts are considered from Polder 34/3 for the time being.

Sedimentation in smaller water bodies namely Katakhali khal, Putimari river may cause regular drainage congestion problems. The navigability of rivers may further deteriorate over the years. Siltation in the rivers or water bodies outside the polder would cause drainage congestion on a more frequent basis. The smaller lakes and rivers facing east-west direction i.e. Putimari river, Katakhali khal etc. would undergo frequent congestion. Especially during low tides, Katakhali khal in the southern periphery of Polder 35/3 gradually becomes very shallow.

Institutional Responsibility and Report Requirement

The **contractor** is responsible for implementation of EMP during construction works and Project Supervision Consultant is primarily responsible for supervision of the implementation of the EMP. BWDB will conduct field inspections and surveys by the environment specialist (to be employed by BWDB on regular basis) at field. S/he will report to the Senior Environment Specialist at Head Quarter. The M&E consultant will be responsible for independent monitoring and implementation of EMP, and external monitoring and evaluation. DoE will be consulted if complicated issues arise during construction and operation stages. BWDB will apply for annual site clearance from DoE. WMOs will be trained up to ensure environmental management during project operation. Environmental Management Unit of BWDB, strengthened through this project, will ensure and oversee the environmental management during project operation.

BWDB will prepare the **Half Yearly Progress Report** on environmental management and will share with World Bank for review. Contributing development partners (if any) may join the field visit to understand the environmental compliance of the project. In addition, the effectiveness of screening, monitoring and implementation of EMP will be carried out by the third party monitoring firm along with the project component activity monitoring annually. The **Annual Environmental Audit Report** prepared by the third party monitoring firm will be shared with the safeguards secretariat.

The Environment, Social and Communication Unit (ESC) to be established to implement and manage 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 mitigation measures. At least one of the two environmental specialists must be on board before effectiveness of the project. The specialists will prepare subproject specific environment screening/assessment report with EMP, supervise the implementation of EMP and support capacity building of the field level staff of BWDB and contractor. ESC will ensure quality of the environmental screening/assessment with EMP.

1. Introduction

1.1 Background

The Government of Bangladesh (GoB) is planning to implement the Coastal Embankment Improvement Project, Phase I (CEIP-I), under which seventeen polders will be rehabilitated and improved in the coastal area of the country. The GoB is seeking financial assistance from the World Bank (WB) for this Project. In accordance with the national regulatory requirements and WB safeguard policies, Environmental Impact Assessments (EIAs) of the first batch of five polders have been carried out. This document presents the EIA report of the Polder 35/3, which is one of these five polders. The remaining four EIA reports are presented under separate covers.

Bangladesh is a low lying country. 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 from the Bay of Bengal encountering a very large volume of sediment inflowing from upstream. The strength of the tides and the flatness of the delta causes the tides to influence river processes a long way upstream in the southern estuaries. This entire area is called the coastal zone. The coastal zone, in its natural state, used to undergo to inundation by high tides, salinity intrusion, cyclonic storms and associated tidal surges.

In 1960s, polderization was started in the coastal zone of the country to convert the area into permanent agricultural lands (see Figure 1.1 for coastal polders). The polders in this area are enclosed on all sides by dykes or embankments, separating the land from the main river system and protecting against tidal floods, salinity intrusion and sedimentation. The lands inside the polders are slightly higher than sea level. The polders were designed to keep the land safe from the daily tides and allow agriculture activities inside the polder. Without embankments the coastal communities would be exposed to diurnal tidal fluctuations. These polders are equipped with in- and outlet sluice gates to control the water inside the embanked area.

1.2 Need of the Project

The coastal embankment system of Bangladesh was originally designed without significant attention to storm surges. Recent cyclones brought substantial damage to the embankments and further threatened the integrity of the coastal polders. In addition to breaching of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused the coastal polders to create water logging resulting a large scale environmental, social and economical degradation. Poor maintenance and inadequate management of the polders have also contributed internal drainage congestion along with salinity intrusion and heavy external siltation. As a result, soil fertility and agriculture production are declining in some areas inside the polders.

The above reasons have led the Government to re-focus its strategy on the coastal area from one that only protects against high tides to one that would provide protection against frequent storm surges as well. The long term objective of the Government 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-I is the first phase of this long term program.

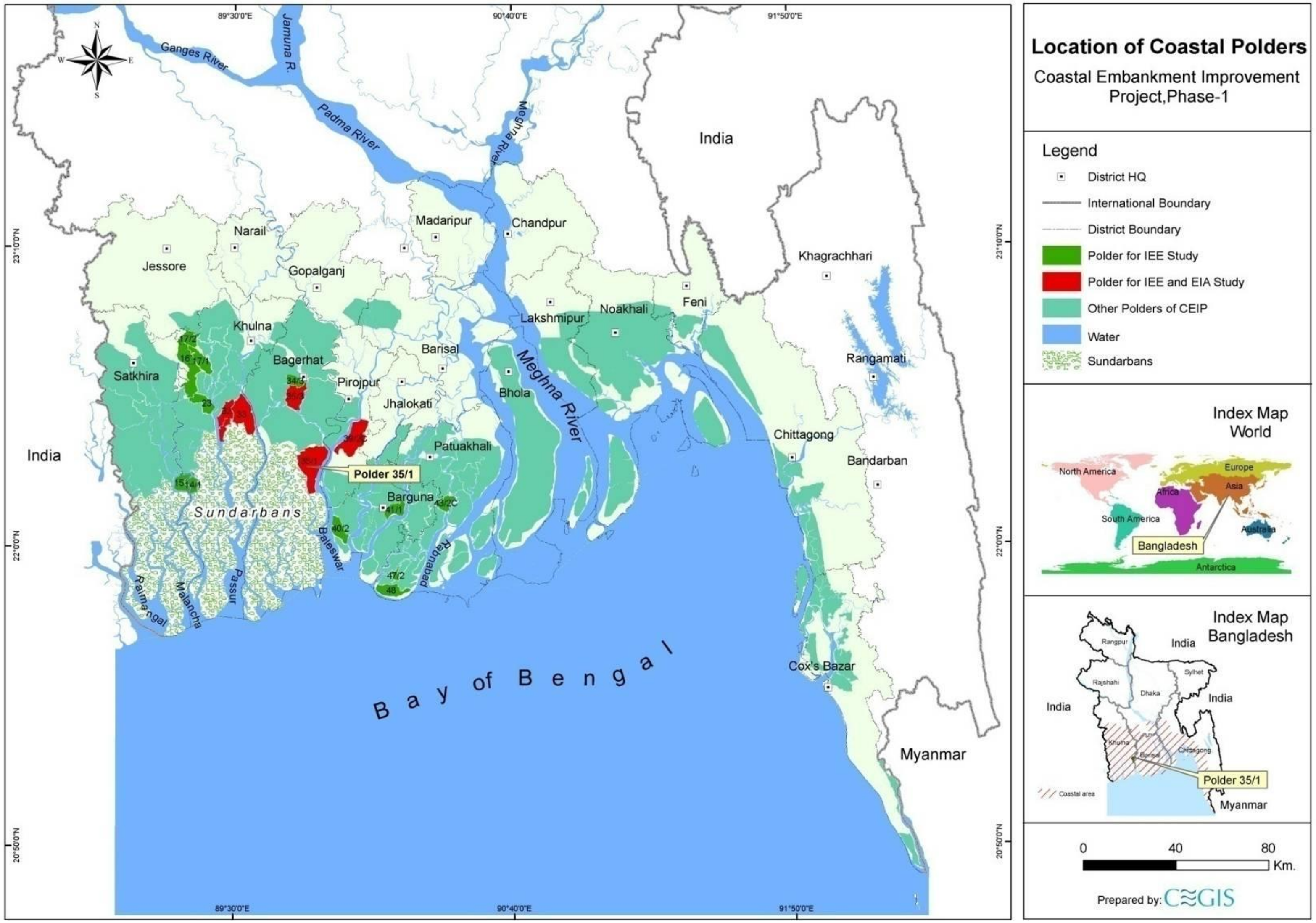

Figure 1.1: Coastal Polders

1.3 Polder 35/3 Location and Synopsis of Rehabilitation Work

The Polder 35/3 is located in two upazilas namely, Rampal and Bagherhat Sadar under Bagerhat District of southern Bangladesh (see **Figure 1.2**). The Polder covers a gross area of 6,790 ha of which net cultivable area is 5,090 ha. 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 up these objectives, the following key improvement and rehabilitation works will be carried out in Polder 35/3 under CEIP-I:

- Re-sectioning of embankment : 35.00 km
- Construction of retired embankment : 5.05 km
- Construction of drainage sluice : 4
- Construction of flushing inlets : 10
- Re-excavation of drainage channels : 23.50 km
- Slope protection of embankment : 0.90 km
- Bank protection works : 1.70 km
- Afforestation on the foreshore areas : 6.54 ha

Other components of the CEIP-I 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.

The Bangladesh Water Development Board (BWDB) is the implementing agency of the Project.

Detail information of the Project are presented in the later part of the document.

1.4 Regulatory and Policy Framework

The Bangladesh Environment Conservation Act, 1995 (amended in 2002), requires that all development 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 fulfills both of these requirements.

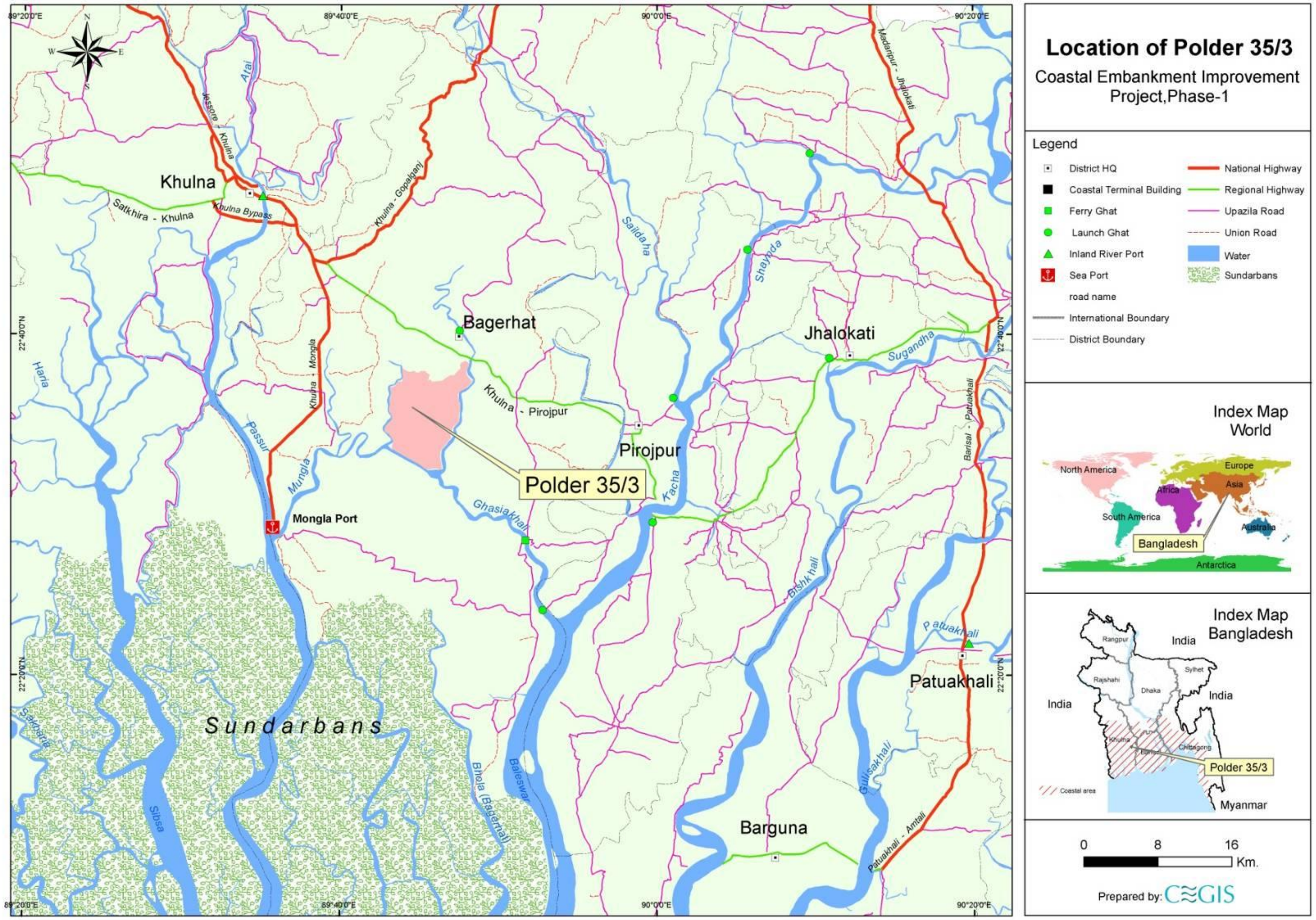

Figure 1.2: Location of Polders 35/3

1.5 Objectives of the Study

The overall objective of the EIA study of Polder 35/3 is to ensure that the environmental and social management practices are integrated in the design, construction, operation and maintenance of the polder. 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 conditions of the Project area (the Project area is defined as the entire area inside the polder, working area outside the polder i.e. the embankments, borrow pits and spoil disposal 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 Environmental Management Plan (EMP).

1.6 Scope of Works

The scope of works of the present EIA study for Polder 35/3 includes the following:

i. Carry out detail field investigation of required parameters of environmental and social baseline, especially on the critical issues.
ii. 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 Component (IESCs).
iii. Determine the cumulative environmental impacts of the project that may occur inside and outside the project area.
iv. Distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, and unavoidable or irreversible impacts.
v. Identify feasible and cost effective mitigation measures for each impact predicted as above to reduce potentially significant adverse environmental impacts to acceptable levels.
vi. Determine the capital and recurrent costs of the measures, and institutional, training and monitoring requirements to effectively implement these measures. The Consultant is required to identify all significant changes likely to be generated by the project. 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, and water logging.
vii. Consult with modeling consultants to establish conformity of the impact assessment with existing and ongoing mathematical model due to climate change developed by a number of reputed firms. The developed models may be available from the main consultant and implementing agency;

viii. 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 describe in qualitative terms.

ix. 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.

x. Identify the specific reciprocal impact of climate change and polder. Check the suggested polder height with respect to the sea level rise (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 drainage facility should be provided to avoid water logging in the surrounding area.

xi. 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.

xii. Ensure to address occupational health and safety for the construction workers in the EMP;

xiii. Develop Environmental monitoring format for regular monitoring of the project at the pre-construction, construction and operational stage;

xiv. Prepare the EIA report

1.7 Structure of the Report

Chapter 1 ***(Introduction)*** describes the background of the project objectives of the study, scope of works with a list of the 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, Legal and Administrative 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 (***Description of Proposed Interventions in Polder 35/3***) provides the simplified description of the Project and its phases, key activities, manpower, equipment, and material requirements, implementation arrangements, implementation schedule, and other related aspects.

Chapter 5 (***Analysis of Project Alternatives***) discusses various alternatives considered during the feasibility and design stage of the Project, and their environmental and social considerations.

Chapter 6 (***Environmental and Social Baseline***) describes the existing environmental and social conditions in respect of water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic aspects of the Project area.

Chapter 7 (***Climate Change***) discusses the climate change aspects in global, regional and local perspectives and the likely impacts on the Project area and its surroundings.

Chapter 8 (**Stakeholder Consultations 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. Also included in the Chapter are the disclosure requirements for the EIA.

Chapter 9 (***Assessment of Environmental and Social Impacts***) assesses the potential impacts of proposed interventions on the environmental components. The Chapter also proposes appropriate mitigation measures to eliminate, offset, or reduce the potential impacts.

Chapter 10 (*Cumulative and Induced Impacts*) assesses the impact of the project on the surrounding areas of upstream and downstream considering spatial and temporal induced impact.

Chapter 11 (***Environmental Management Plan - EMP***) specifies the implementation arrangements for the mitigation measures identified during the EIA study. The EMP includes among others mitigation plan, enhancement plan, contingency plan and the environmental monitoring plan.

2. Approach and Methodology

This Chapter presents the detailed approach and procedure employed to conduct the EIA study. Also described in the Chapter are data sources and methodology of data collection, processing and impact assessment.

2.1 Overall Approach

The EIA study for the rehabilitation of Polder 35/3 has been carried out following the DoE requirements, the Environmental Management Framework (EMF) for CEIP-I and the WB guidelines. The overall approach of the study is shown in **Figure 2.1** below.

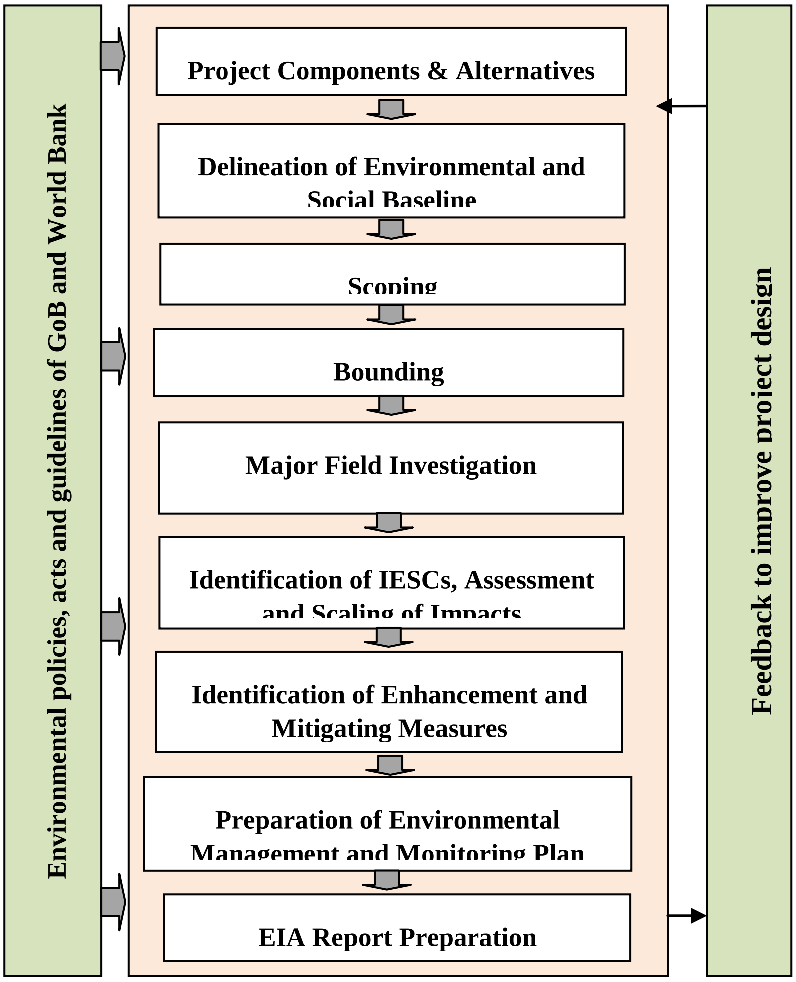

Figure 2.1: Overall approach of the EIA study

2.2 Methodology

The step-wise detail methodology followed for the EIA study is briefly described below.

2.2.1 Project Area of Influence

At the outset of the study, the Project area of influence (or Project area for short) was broadly demarcated. This included the area inside the polder where most of the Project interventions would take place, area 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 if located outside the polder, and labor camps/contractor facilities if located outside the polder. The polder is surrounded by Bhairab river to the east, Katakhali River to the south west, Bishnu River to the west and Putimari River to the North side.

2.2.2 Analysis of the Project Components and Alternatives

Detailed information on the proposed Project including objective, nature and location of interventions, construction works, and other related aspects was obtained from the Main Consultant of CEIP-I.

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

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.

2.2.3 Data Collection for Environmental and Social Baseline

Initially a reconnaissance field visit was conducted in the Project area to identify the project and its functional objectives. Subsequent to this, rapid rural appraisals (RRAs), participatory rural appraisals (PRAs), focused group discussions (FGDs) and interviews with key informants were conducted to collect data and information on the environmental and social aspects of the Project area. Local knowledgeable persons including community representatives, traders, teachers, 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.

The baseline condition of the project area was drawn according to the information collected from secondary and primary data sources through literature review, field investigations and consultations with different stakeholders. The baseline condition has been established with respect to water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic conditions including identification of problems in respect of the proposed project sites and adjoining area.

Source and methodology of both primary and secondary baseline data collection on water resources, land resources, agriculture, livestock, fishery, ecosystems, and socio-economic resources are presented in the following sections.

Water Resources

Water resource data in connection with river hydrology, river morphology, surface and ground water availability, drainage pattern, ground and surface water quality and water use were collected from secondary sources and primary data collection and analysis as well as observations by the professionals of the multi-disciplinary team backed up by feedback from the local people during field visits to the Project area. Major river systems were identified for hydrological and morphological investigation through historical and current 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), flash flood, risk of erosion and sedimentation.

Field visits at different stages of the study were made to the Project area and primary data on water resources components were collected. A checklist (Attached in **Annex- A**) was developed and used to obtain the information on different resources. Local knowledgeable persons and community representatives were also interviewed. During field visits, the multidisciplinary EIA study team members made professional observations pertaining to their individual areas of expertise.

Meteorological data such as temperature, rainfall, evapo-transpiration, and humidity were collected and analyzed for assessing local climate which are directly related to water resources of the study area and the project area. Meteorological data for selected stations were collected from the National Water Resources Database (NWRD) of Water Resources Planning Organization (WARPO), which contains long series of temporal data showing daily values for meteorological stations maintained by the Bangladesh Meteorological Department (BMD). The topographical data were collected from Geological Survey of Bangladesh and NWRD.

Land Resources

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). The land type and soil texture data was collected from Upazila[1] Land and Soil Resources Utilization Guide of Soils Resources Development Institute (SRDI). The secondary data of these parameters was 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. Land use information and maps were prepared from satellite image classification with field verification.

Agricultural Resources

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 were collected through extensive field surveys with the help of questionnaire 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.

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)

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

Livestock Resources

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 assessment (PRA) and rapid rural assessment (RRA). Livestock resources data were also collected from secondary sources from Upazila Livestock Office.

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

Fish and Fisheries

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.

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 river, *khal* (water drainage channel), flood plain, borrow pit, and *beel* (a natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system). The culture fish habitats included homestead culture fish pond, commercial fish farm, shrimp *ghers* (farm lands converted into ponds with low dykes and used for cultivation of shrimp/prawn/fish).

Capture fish habitat was assessed on the basis of species diversity and composition, identification of species of conservation significance, identification of potential fish habitat prescribing to restore for fish conservation, fish migration survey, habitat identification for fish conservation. Culture fish habitat was assessed through homestead culture fish pond survey and commercial fish farm/ *gher* survey.

Information on post harvest activities, forward and backward linkages, fishermen livelihood information, fisheries management issues, potential fish recruitment, fish infrastructure and fishermen vulnerabilitywere also collected.

Relevant secondary data were collected from the UFO's annual reports and various literature/study reports.

Fish productions for individual habitats were obtained from secondary information that was collected from the UFOs and literatures were blended with primary data in production estimation.

Ecological Resources

The ecological component of the EIA study focused on terrestrial and riverine ecology including flora, birds, reptiles, amphibians, mammals, and migratory birds. 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 imagery. Field investigation methods included physical observations, transect walk, habitat survey and consultations with local people. Field visits were carried out for establishing the ecological baseline condition. Public consultation meetings were carried out through FGD and Key Informants Interview (KII) methods. Inventory of common flora and fauna was developed based on field survey and data base of the International Union for Conservation of Nature (IUCN).

Socio-economic Data

Demographic information, such as population, occupation and employment, literacy rate, drinking water, sanitation, and electricity facilities were collected form 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.

The steps followed for collecting socio-economic data are as follows:

- Data were collected from Bangladesh Bureau of Statistics(BBS), 2001 and enumerated for 2010 the relevant literatures from BWDB and main consultant was 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 survey was conducted for primary data collection from district and upazila level.

2.2.4 Scoping

A structured scoping process was followed for identifying the Important Environmental and Social Components (IESCs) which would potentially be impacted by the proposed Project. This was achieved in two stages as follows. The EIA team made a preliminary list of the components which could be impacted by the Project. The second stage included village scoping sessions 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.

2.2.5 Assessment and Scaling of Impacts

At this stage, attempts were made to quantify the impacts of the proposed interventions of the Project as much as possible. Where quantification was not possible, qualitative impacts were assessed and scores were assigned with (P) sign for positive impacts and (N) sign for negative impacts. The magnitude of both positive and negative impacts was indicated by HN, MN, HP and MP based upon extent, magnitude, reversibility, duration and sustainability considerations. The impacts of proposed interventions, considering the climate-change scenario 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 Project 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.

2.3 Assessment Methodology

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 and their sensitivity to the change. Potential impacts can be both negative and positive (beneficial), and the methodology defined below will be applied to define both beneficial and adverse potential impacts.

The criteria for determining significance are generally specific for each environmental and social aspect but generally the magnitude of each potential impact is defined along with the sensitivity of the receptor. Generic criteria for defining magnitude and sensitivity used for the Project are summarized below.

2.3.1 Magnitude

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.

The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in **Table 2.1**.

Table 2-1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Negligible/Nil
Duration of potential impact	Long term (more than 35 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 impacts occurring	Occurs under typical operating or construction	Occurs under worst case (negative impact)	Occurs under abnormal, exceptional or	Unlikely to occur

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

2.3.2 Sensitivity

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

Table 2-2: 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

2.3.3 Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the 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

2.3.4 Mitigation Measures

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 per the **Table 2.3** require appropriate avoidance/ mitigation/compensatory measures to reduce the significance. Impacts having low to negligible significance can be left alone not needing any mitigation measures.

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. Finally, if impact reduction is not possible, compensatory measures are proposed.

2.3.5 Assessment of Residual Impacts

The final step in the impact assessment process is determining the significance of the residual impacts, which essentially are the 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. For any residual impacts having moderate significance, monitoring mechanism is necessary to ensure that their significance does not increase. No residual impacts having major or critical significance are generally acceptable.

2.3.6 Identification of Enhancement and Mitigating Measures

From literature survey, applying expert judgment and consultation with stakeholders, possible enhancement and mitigating measures were identified for beneficial and adverse effects respectively.

2.3.7 Preparation of Environmental Management and Monitoring Plan

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.

2.3.8 EIA Report Preparation

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

3. Policy, Legal and Administrative Framework

This Chapter presents a review of the national policy, legal, and regulatory framework relevant to the environmental and social aspects of the Project. Also reviewed in the Chapter are the WB environmental and social safeguard policies.

3.1 National Environmental Laws

The key national policies, strategies, and plans relevant to environmental management are briefly discussed below.

3.1.1 Bangladesh Environment Conservation Act (ECA), 1995

The Environmental Conservation Act (ECA) of 1995 is the main legislative framework relating to environmental protection in Bangladesh. This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. This Act has established the Department of Environment (DOE), and empowers its Director General to take measures as he considers necessary which includes conducting inquiries, preventing probable accidents, advising the Government, coordinating with other authorities or agencies, and collecting and publishing information about environmental pollution. According to this act (Section 12), no industrial unit or project shall be established or undertaken without obtaining, in a manner prescribed by the accompanying Rules, an Environmental Clearance Certificate (ECC) from the Director General of DOE.

In accordance with this Act, the CEIP-I will need to be cleared by DOE before commencing the project following procedures given in the Environment Conservation Rules (ECR) 1997 (discussed below). Also the Ecologically Critical Areas in coastal zone, defined by DOE under this act, will be considered while planning and designing of the CEIP-I project interventions.

The present EIA has been carried out in compliance with this Act.

3.1.2 Bangladesh Environment Conservation Act (ECA), (Amendments) 2010

The ECA 1995 was amended in 2010, which provided clarification of defining wetlands as well as Ecologically Critical Areas and included many important environmental concerns such as conservation of wetlands, hill cutting, ship breaking, and hazardous waste disposal. This amendment empowered the government to enforce more penalties than before. Moreover, affected persons were given provision for putting objections or taking legal actions against the polluters or any entity creating nuisance to affected person.

3.1.3 Bangladesh Environment Conservation Rules (ECR), 1997

The Environment Conservation Rules, 1997 were issued by the Government of Bangladesh in exercise of the power conferred under the Environment Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered:

- Declaration of ecologically critical areas
- Classification of industries and projects into four categories

- Procedures for issuing the Environmental Clearance Certificate
- Determination of environmental standards.

The Rule 3 defines the factors to be considered in declaring an area 'ecologically critical area' (ECA) as per Section 5 of ECA95. It empowers the Government to declare an area 'ECA', if it is satisfied that the ecosystem of the area has reached or is threatened to reach a critical state or condition due to environmental degradation. The Government is also empowered to specify which of the operations or processes shall not be carried out or shall not be initiated in the ecologically critical area. Under this mandate, MOEF has declared Sundarban, Cox's Bazar - Teknaf Sea Shore, Saint Martin Island, Sonadia Island, Hakaluki Haor, Tanguar Haor, Marzat Baor and Gulshan - Baridhara Lake as ECA and prohibited certain activities in those areas. Beside these, recently the government of Bangladesh has declared four rivers such as Buriganga River, Turag River, Shitalakha River and Balu River around the Dhaka City as ECA.

The Rule 7 classifies industrial units and projects into four categories depending on environmental impact and location for the purpose of issuance of ECC. These categories are: Green, Orange A, Orange B, and Red.

All existing industrial units and projects and proposed industrial units and projects, that are considered to be low polluting are categorized under "Green" and shall be granted Environmental Clearance. For proposed industrial units and projects falling in the Orange-A, Orange-B and Red Categories, firstly a site clearance certificate and thereafter an environmental clearance certificate will be required. A detailed description of these four categories of industries has been given in Schedule-1 of ECR'97. Apart from general requirement, for every Red category proposed industrial unit or project, the application must be accompanied with feasibility report, Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) based on approved ToR by DOE, Environmental Management Plan (EMP). As per ECR’97, water resources development projects fall under ‘Red’ category project. Therefore CEIP-I project is ‘Red’ category project which requires IEE, EIA and EMP for environmental clearance from DOE.

The ECR'97 describes the procedures for obtaining Environmental Clearance Certificates (ECC) from the Department of Environment for different types of proposed units or projects. Any person or organization wishing to establish an industrial unit or project must obtain ECC from the Director General. The application for such certificate must be in the prescribed form together with the prescribed fees laid down in Schedule 13, through the deposit of a Treasury Chalan in favor of the Director General. The fees for clearance certificates have been revised in 2010. Rule 8 prescribes the duration of validity of such certificate (three years for green category and one year for other categories) and compulsory requirement for renewal of certificate at least 30 days before expiry of its validity.

3.1.4 Bangladesh Environment Court Act, 2010

Bangladesh Environment Court Act, 2010 has been enacted to resolve the disputes and establishing justice over environmental and social damage raised due to any development activities. This act allows government to take necessary legal action against any parties who creates environmental hazards/ damage to environmentally sensitive areas as well as human society. According to this act, government can take legal actions if any environmental problem occurs due to CEIP-I interventions.

3.1.5 Administrative framework of DOE for clearing and monitoring of projects

According to the 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 the Department of Environment. According to the Rule 7 (1) of the Environmental Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every industrial units or projects, in consideration of their site and impact on the environment, will be 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 FC and FCD/I projects fall under the 'Red' category. For this category, it is mandatory to carry out Environmental Impact Assessment (EIA) including Environmental Management Plan (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 CEIP is shown in Figure 3.1.

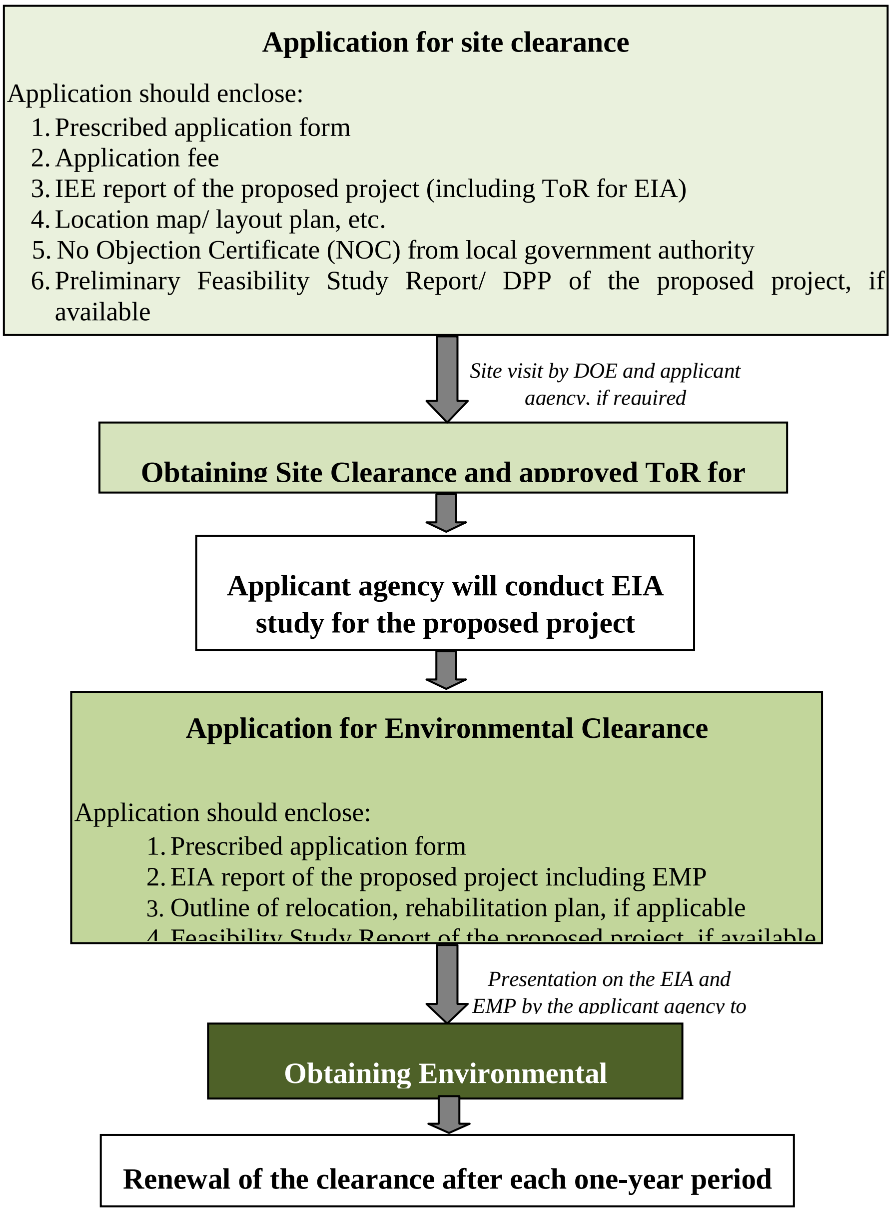

Figure 3.1: Process of obtaining Clearance certificate from DOE

3.2 Relevant National Policies, Strategies and Plans

3.2.1 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 CEIP-I and 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.

3.2.2 National Environment Management Action Plan, 1995

The National Environment Management Action Plan (NEMAP, 1995) identifies the main national environmental issues, including those related to the water sector. The main water related national concerns include flood damage, riverbank erosion, environmental degradation of water bodies, increased water pollution, shortage of irrigation water and drainage congestion; various specific regional concerns are also identified.

3.2.3 NationalWater Policy, 1999

Endorsed by the GoB in 1999, the National Water Policy (NWP) aims to provide guidance to the major players in water sector for ensuring optimal development and management of water. According to the policy, all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation, and maintenance) are required to enhance environmental amenities and ensure that environmental resources are protected and restored in executing their tasks.

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 CEIP-I. The Project design and present EIA study will be required to comply with these requirements.

3.2.4 National Water Management Plan, 2001 (Approved in 2004)

The National Water Management Plan (NWMP) 2001, approved by the National Water Resources Council in 2004, envisions to establish an integrated development, management and use of water resources in Bangladesh over a period of 25 years. Water Resources Planning Organization (WARPO) has been assigned to monitor the national water management plan. 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. Each cluster comprises of a number of individual programs, and a total of 84 sub-sectoral programs have been identified and presented in the investment portfolio. Most of the programs are likely to be implemented in coastal areas.

The CEIP has been designed in line with this Plan and addresses its key objectives for the water resource management in the coastal areas.

3.2.5 Coastal Zone Policy, 2005

The Government has formulated the Coastal Zone Policy (CZP) 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 coast of Bangladesh is known as a zone of vuMNerabilities as well as opportunities. It is prone to natural disasters like cyclone, storm surge and flood. In this regard, for reducing risk, the policy emphasizes the improvement of coastal polders and seeks to enhance safety measures by combining cyclone shelters, multi-purpose embankments, road system and disaster warning system.

The CIEP-I addresses some aspects of this Policy particularly those relating to the polder improvements.

3.2.6 Coastal Development Strategy, 2006

The Coastal Development Strategy (CDS) focuses on the implementation of the coastal zone policy. The CDS was approved at the second meeting of the Inter-Ministerial Steering Committee on ICZMP held on 13 February 2006. Nine strategic priorities, evolved through a consultation process, guide interventions and investments in the coastal zone:

- ensuring fresh and safe water availability
- safety from man-made and natural hazards
- optimizing use of coastal lands
- promoting economic growth emphasizing non-farm rural employment
- sustainable management of natural resources: exploiting untapped and less explored opportunities
- improving livelihood conditions of people especially women
- environmental conservation
- empowerment through knowledge management
- creating an enabling institutional environment

The proposed interventions under the CEIP are in line with this strategy and support most of the above listed priorities.

3.2.7 National Land Use Policy (MoL, 2001)

The National Land Use Policy (NLUP), enacted in 2001, aims at managing land use effectively to support trends in accelerated urbanization, industrialization and diversification of development activities. The NLUP urges that increasing the land area of the country may be not possible through artificial land reclamation process, which is cost-effective only in the long run. Therefore, land use planning should be based on the existing and available land resources. The policy suggests establishing land data banks where, among others, information on accreted riverine and coastal chars will be maintained. Among the 28 policy statements of NLUP, the following are relevant to coastal area:

- forests declared by the Ministry of Environment and Forests will remain as forest lands;
- reclassification of forest lands will be prevented; and
- effective green belts will be created all along the coast.

The CEIP will be designed in accordance with this Strategy and will comply with the above listed requirements.

3.2.8 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. Although the policy does not emphasize the coastal zone separately, all specific objectives are applicable to the development of coastal zone agriculture. The policy particularly stressed on minor irrigation capturing tidal water in reservoirs in coastal areas and research on the development of improved varieties and technologies for cultivation in coastal, hilly, water-logged and salinity affected areas. The policy also recognizes that adequate measures should be taken to reduce water-logging, salinity and provide irrigation facilities for crop production.

The proposed CEIP-I is expected to contribute to achieve the objectives of the agriculture policy.

3.2.9 National Fisheries Policy, 1996

The National Fisheries Policy (NFP), 1996 recognizes that fish production has declined due to environmental imbalances, adverse environmental impact and improper implementation of fish culture and management programs. The policy particularly focuses on coastal shrimp, aquaculture and marine fisheries development.

The policy suggests following actions:

- Shrimp and fish culture will not be expanded to the areas which could damage mangrove forest in the coastal region
- Biodiversity will be maintained in all natural water bodies and in marine environment
- Chemicals harmful to the environment will not be used in fish shrimp farms
- Environment friendly fish shrimp culture technology will be used
- Expand fisheries areas and integrate rice, fish and shrimp cultivation
- Control measures will be taken against activities that have a negative impact on fisheries resources and vice-versa
- Laws will be formulated to ban the disposal of any untreated industrial effluents into the water bodies.

The CEIP-I interventions may facilitate fisheries production in coastal area. The guidelines of NFP may be integrated while designing and implementing the CEIP-I interventions. However, conflicts over agriculture and fisheries cultivation may accelerate in future.

3.2.10 National Livestock Development Policy, 2007

The National Livestock Development Policy (NLDP) has been prepared to address the key challenges and opportunity for a comprehensive sustainable development of the livestock subsector by creating an enabling policy framework. Among 60 or more policy statements, the following two policy statements address the coastal zone:

- Specific areas will be identified to implement programs for fattening of cattle and livestock. For this purpose, the Chittagong Hill Tracts, the coastal areas and the islands will be included under the fattening of livestock and cattle program.
- Special programs will be taken up for the production of grass in the Chittagong Hill-tracts and the coastal areas.

As livestock is one of the key assets in coastal livelihoods, and protection of livestock from cyclones and tidal surges should be emphasized along with security of human life. The proposed CEIP-I interventions will contribute to the safety of livestock and thus increase livestock productivity in coastal areas.

3.2.11 The Forest Act, 1927 & Amendment Act 2000

The National Forestry Policy of 1994 is the revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major targets of the Policy are to conserve the existing forest areas; bring about 20% of the country's land area under the afforestation program, and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

The need of amendments of the existing forestry sector related laws and adoption of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forest Policy also recognizes the importance of fulfilling the responsibilities and commitments under international multilateral environmental agreements."

According to the Act the Government (Forest Department) can prohibit certain activities in the declared Reserved Forest area such as any intervention kindles, keeps or carries any fire; trespasses or pastures cattle, or permits cattle to trespass; causes any damage by negligence in felling any tree or cutting or dragging any timber; etc.

"26. Acts prohibited in such forests. -

(1) Any person who, in a reserved forest-

(a) Kindles, keeps or carries any fire except at such seasons as the Forest-Officer may notify in this behalf;

(b) Trespasses or pastures cattle, or permits cattle to trespass;

(c) causes any damage by negligence in felling any tree or cutting or dragging any timber;

(d) quarries stone, burns lime or charcoal, or collects, subjects to any manufacturing process, or removes any forest produce other than timber; or who enters a reserved forest with firearms without prior permission from the Divisional Forest Officer concerned, shall be punishable with imprisonment for a term which may extend to six months and shall also be liable to fine which may extend to two thousand taka, in addition to such compensation for damage done to the forest as the convicting Court may direct to be paid."

The proposed intervention should not carry out any such activities that may cause damage or adversely impact on the natural resources including wildlife of the Sundarbans Reserve Forest because the Sundarban is located about 50 km away from the polder.

3.2.12 Standing Orders on Disaster, 2010

The Standing Orders on Disaster is designed to enhance capacity at all tiers of government administrative and social structures for coping with and recovering from disasters. The document contains guidelines for construction, management, maintenance and use of cyclone shelter center.

Accordingly to the guideline, geographical information system (GIS) technology will be applied at the planning stage to select the location of cyclone shelter considering habitation, communication facilities, distance from the nearest cyclone centre. The advice of the concerned District Committee is to be obtained before final decision. The cyclone shelters should have easier communication facilities so that in times of distress delay does not occur to go there. For this reason, the road communication from the cyclone shelters should not only link up with city or main road but also with neighboring village areas. Provision of emergency water, food and sanitation and shelter space for livestock during period should also be kept in view for future construction of shelters.

Improvement of coastal polders under CEIP-I will provide better communication facilities in the coastal areas, which is crucial for emergency response to disasters.

3.2.13 National Adaptation Programme of Action (NAPA)

In 2005, the Ministry of Environment and Forest (MOEF), Government of the People's Republic of Bangladesh has prepared the National Adaptation Program of Action (NAPA) for Bangladesh, as a response to the decision of the Seventh Session of the Conference of the Parties (COP7) of the United Nations Framework Convention on Climate Change (UNFCCC). The basic approach to NAPA preparation was along with the sustainable development goals and objectives of the country where it has recognized the necessity of addressing climate change and environmental issue and natural resource management. The NAPA is the beginning of a long journey to address adverse impacts of climate change including variability and extreme events and to promote sustainable development of the country. There are 15 adaptation strategies suggested to address adverse effects of climate change. Among the 15 adaptation strategies the following strategies address the coastal region for reducing climate change induced vulnerability.

- Reduction of climate change hazards through coastal afforestation with community participation.
- Providing drinking water to coastal communities to combat enhanced salinity due to sea level rise.
- Construction of flood shelter, and information and assistance centre to cope with enhanced recurrent floods in major floodplains
- Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future.
- Promoting adaptation to coastal crop agriculture to combat increased salinity.
- Promoting adaptation to coastal fisheries through culture of salt tolerant fish special in coastal areas of Bangladesh.

The CEIP-I broadly contributes toward achieving g the aims and objectives of the climate change adaptation strategies.

3.2.14 Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009

The Government of Bangladesh has prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009. The BCCSAP is built on six pillars: (i) food security, social safety and health; (ii) comprehensive disaster management; (iii) infrastructure; (iv) research and knowledge management; (v) mitigation and low carbon development; and (vi) capacity building. Five programs have been suggested related to improvement of the water management infrastructures in coastal areas of Bangladesh under pillar 3 (Infrastructure) of BCCSAP, including:

- Repair and maintenance of existing flood embankments
- Repair and maintenance of existing coastal polders
- Improvement of urban drainage
- Planning, design and construction of river training works
- Planning, design and implementation of resuscitation of the network of rivers and khals through dredging and de-siltation work.

CEIP-I is relevant to the above mentioned programs and will contribute towards achieving the objective of other pillars such as (i), (ii) and (iv).

3.2.15 The Acquisition and Requisition of Immovable Property Ordinance, 1982

This Ordinance is the basic instrument governing land acquisition in Bangladesh. It is restricted to "legal" owners of property as supported by records of ownership such as deeds, title or agreements to compensating for land as well as any business, structure, trees and crops on the land. The owners of acquired land receive cash compensation at market value with a premium of 50 per cent on the assessed price. The law specifies methods for calculation of market value of property based on recorded prices obtained from relevant Government departments such as Registrar (land), Public Works Department (structures), Department of Forest (trees), Department of Agriculture (crops) and Department of Fisheries (fish stock).

The Ministry of Land (MOL) is authorized to deal with land acquisition. The MOL delegates some of its authority to the Commissioner at Divisional level and to the Deputy Commissioner at the District level. The Deputy Commissioners (DCs) are empowered by the MOL to process land acquisition under the Ordinance and pay compensation to the legal owners of the acquired property. *Khas* (government owned land) lands should be acquired first when a project requires both *khas* and private land. If a project requires only *khas* land, the land will be transferred through an inter-ministerial meeting following the acquisition proposal submitted to DC or MOL as the case may be. The DC is empowered to acquire a maximum of 50 standard bigha (6.75 ha) of land without any litigation where the Divisional Commissioner is involved for approval. Acquisition of land more than 50 standard *bigha* is approved from the central land allocation committee (CLAC) headed by the chief executive of the Government of Bangladesh proposed by the MOL.

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

3.2.16 The East Bengal State Acquisition and Tenancy Act, 1950 (Revised 1994)

The State Acquisition and Tenancy Act (Sections 86 and 87) also define the ownership and use right of alluvion (*payosti* or reformation in situ or original site) and diluvion land (*nadisikosti*) in the country. In legal terms, eroded lands (*sikosti*) inside the alluvion-diluvion (AD) line (i.e. including submerged land or underwater land) are considered *khas* land once declared by concerned Deputy

Commissioner (DC) demarcating the AD Line.[2] However, the "original" owner(s) can claim the land if it reappears through natural process within 30 years. The original private owners cannot claim any eroded land if developed by the government through land filling for use in public purpose.

3.2.17 Constitutional Right of the Tribal Peoples Rights

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

3.2.18 Ethnic Minority Rights in PRSP 2005

Relevant strategic suggestions in the Poverty Reduction Strategy Paper (PRSP)2005 to preserve the cultural, social and economic identity and interests of the ethnic populations in and outside CHT are as follows:

- Effective recognition of ethnic minority communities and their specific needs in all relevant government policies and programs towards improving the socio-economic conditions of these communities.
- Proper actions for protecting the rights of ethnic minority people, particularly their rights to land and forests.
- Transfer of land administration in CHT to the hill districts councils in accordance with the 'Hill District Councils Acts of 1989'.
- Provide education to ethnic minority people with a curriculum that allows learning in their own language at the primary level.
- Strengthen their competence in job markets through affirmative actions at higher levels of education and skill training to promote their inclusion in mainstream economic life.
- Scale-up efforts to provide health care, clean water and sanitation facilities to ethnic minority areas in general and to the more disadvantaged groups among them in particular.
- Increase and utilize property the fund available in the Prime Minister's office for the development of the ethnic minority people of the plain lands.
- Provide wider access to electrification and telecommunications for ethnic minority communities, particularly in the Hill Tracts.

[2] The Assistant Commissioner of Lands (AC Land) in respective districts demarcates the AD Line each year in areas where rivers frequently erode their banks. According to law, if the land classified by an AD Line re-appears within 30 years from the date of erosion, the original owner(s) can claim the land.

3.2.19 GoB Laws on Land Acquisition

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

Inadequacies of 1982 Ordinance

The Ordinance, however, is not adequate to deal with the adverse impacts associated with land acquisition and involuntary displacement. Land is acquired under this ordinance but its provisions do not fully satisfy the requirements of the Bank's OP 4.12 on Involuntary Resettlement. There are no other policies in Bangladesh to complement the acquisition law in ways to assess, mitigate and monitor the adverse impacts that the affected persons may suffer. The law does not cover project-affected persons without title or ownership record, such as informal settler/squatters, occupiers, and informal tenants and lease-holders (without registration document) and does not ensure replacement value of the property acquired. The Ordinance has no provisions for resettlement of the affected households/businesses or any assistance for restoration of livelihoods of the affected persons. As a result, land acquisition potentially diminishes productive base of affected farm families and infringe impoverishment risks to those physically or economically displaced due to undertaking of infrastructure projects.

As the legal framework falls short of the provisions of the World Bank OP 4.12 on Involuntary Resettlement, the project proposes added mechanisms to meet the Bank's requirements:

- Avoid or minimize resettlement: The law only implicitly discourages unnecessary acquisition, as lands acquired for one purpose cannot be used for a different purpose. However, there are no mechanisms to monitor if this condition is actually adhered to.
- Eligibility for compensation: The law stipulates compensation only for the persons who appear in the land administration records as the owners. It does not recognize the rights of those, such as squatters, who do not possess legal title to the lands they live in or make a living from.
- Compensation: The law provides compensation for lands and other objects built and grown on them (structures, trees and orchards, crops and any other developments like ponds, built amenities, etc.). No provisions are there to assess and restore lost income stream or income sources that acquisition causes to the affected persons, be they legal titleholders or others like squatters, tenants and employees of affected businesses.
- Compensation standards: Although the law stipulates 'market prices' of the acquired lands as the just compensation, the legal assessment method almost always results in prices that are far

below the actual market prices3. Certain pricing standards, which are regarded as unrealistic, are used to assess other losses like structures and various built amenities, trees, crops and the like.

- Relocation of households and other establishments: No legal obligation is there to relocate, or assist with relocation of, those whose homesteads have been acquired or whose place of residence or livelihoods has been affected. Such persons/households, be they titleholders or squatters, are left on their own.
- Ensuring payment of compensation: Lands are legally acquired and handed over to the project execution agency as soon as the acquisition authority identifies the owners (or 'awardees'), by examining the records, and sends a legal notice advising them to claim the compensation (or 'awards'). It is the obligation of the affected landowners to prove, by producing an array of documents that the acquired lands legally belong to them. As gathering these documents is a long, expensive and cumbersome process, many landowners may remain unable to claim their awards4.
- Socioeconomic rehabilitation: The law shows no concern whatsoever about the long-term socioeconomic changes the affected persons and households might undergo in the post-acquisition period. There is no provision in the law except compensation for ensure economic rehabilitation and social reintegration of the displaced persons.

These shortfalls in the legal provisions have been widely recognized as not fulfilling the requirements of the OP 4.12, ever since Bangladesh started to address resettlement issues in the Bank-financed projects in the early 1990s starting with the Jamuna Multipurpose Bridge Project. All infrastructure agencies in Bangladesh using finance from international development financing institutions like the World Bank, the ADB, JICA, and DFID are now undertaking resettlement of project affected persons as an integral part of development projects.

3.2.20 Other Relevant Acts

There are a number of other laws and regulations applicable which are relevant for the project. These are presented in the **Table 3.1** below.

Table 3-1: Laws and Acts

Act/Law/Ordinance	Brief description	Responsible Agency
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	Rules for removal of wrecks and obstructions	IBWTA

[3]According to the law, the 'market price' is calculated by averaging the sales prices recorded in the previous one year, in terms of land characteristics by land administration units or mauzas. But it is a widely accepted fact that prices determined as such hardly reflect the true market value of the lands. As the sale/acquisition prices are grossly under-reported to evade on sale taxes, assessment of legal compensation almost always fall far too short of the real market prices.

[4]In the present land administration system, which is widely accepted as antiquated, land transactions, especially in the rural areas, often remain incomplete. Even after the sale/purchase deeds are legally executed, the sellers continue to remain as owners in the legal records until mutations are completed. As the transaction process is cumbersome and involves costs beyond those mandated by the law, and the practice that lands can be used with the deeds alone, most land transactions do not follow the process beyond deed execution. Many land purchasers are even not aware of the mutation or its significance.

Act/Law/Ordinance	Brief description	Responsible Agency
Water Ways (1973)		
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	UpazilaParishad
The Forest Act (1927)	Regulates the protection of forests reserves, protected forests and village forests	MOEF
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 offices in Government owned water bodies	DOF
The Embankment and Drainage Act (1952)	Describes the protection of embankments and drainage facilities	MOWR
The Antiquities Act (1968)	Describes the preservation of cultural heritage, historic monuments and protected sites	DO Arch
Acquisition and Requisition of Immovable Property Ordinance (1982)	Describes procedures and provides guidelines to acquisition and requisition of land	MOL
Bangladesh Labor Law (2006)	Deals with occupational rights and safety of factory workers; provision of comfortable work environment and reasonable working conditions	MOL

3.3 International Treaties Signed by GoB

Bangladesh has signed most international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversity conservation and the Kyoto protocol on climate change. An overview of the relevant international treaties and conventions signed by GOB is shown in **Table 3.2** below.

Table 3-2: Treaty or Convention and Responsible Agency

Treaty	Year	Brief Description	Relevant Department
Protection of birds (Paris)	1950	Protection of birds in wild state	DOE/DOF
Ramsar Convention	1971	Protection of wetlands	DOE/DOF
Protocol Waterfowl Habitat		Amendment of Ramsar Convention to	DOE/DOF

Treaty	Year	Brief Description	Relevant Department
	1982	protect specific habitats for waterfowl	
World Cultural and Natural Heritage (Paris)	1972	Protection of major cultural and natural monuments	DOA
CITES 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 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

3.4 Implication of GoB Polices, Acts and Rules on CEIP & Classification

The CEIP project intervention Legislative bases for environmental assessment in Bangladesh are the Environmental Conservation Act 1995 (ECA'95) and the Environmental Conservation Rules 1997 (ECR'97). Department of Environment (DOE), under the Ministry of Environment and Forest (MOEF), is the regulatory body responsible for enforcing the ECA'95 and ECR'97. According to the Rule 7 (1) of the Environmental Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every industrial units or projects, in consideration of their site and impact on the environment, will be 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 falls under Red Category. Therefore Project intervention in polder 35/1 falls under the '**Red**' category.

It is the responsibility of the proponent to conduct an EIA of development proposal, the responsibility to review EIAs for the purpose of issuing 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)**

Environment clearance has to be obtained by the respective implementing agency or project proponent (private sector) from Department of Environment (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.

The detail DoE clearance procedure is presented in the Environmental Management Framework.

3.5 World Bank's Environmental Safeguard Policies

Developers seeking financing from the World Bank are required to comply with the applicable environmental and social safeguards, operational policies (OPs) and Bank Procedures (BPs). A summary of the relevant safeguards policies considered for the Project is provided below.

3.5.1 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 4.1 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 project implementation. 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 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 FI***: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

The proposed CEIP-I has been classified as Category A, since some of the potential impacts are likely to be significant and diverse. Furthermore, Sundarban – a protected area – is in the close vicinity of the Project location, and if appropriate safeguards are not integrated in the Project design and implementation, the adverse impacts can potentially extend to this sensitive area.

3.5.2 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.

This OP is not triggered for the proposed Project since 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 (EMP) (provided later in the document) to prevent any potential impacts of the Project on the nearby Sundarban, which is a protected area.

3.5.3 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.

3.5.4 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. [5]

- 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 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.

3.5.5 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

[5] Excerpts from the OPN 11.03.WB Operational Manual. September 1986.

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.

This OP is not triggered since the proposed Project is not located in any forested area and will therefore not have any direct impact on forests. Any potential impacts on the nearby Sundarban forest will be forestalled with the help of appropriate mitigation measures included in the EMP, as stated earlier as well.

3.5.6 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.

3.5.7 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.

3.5.8 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:[6]

- 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.

[6] Excerpts from the OP 4.10.WB Operational Manual. July 2005.

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.

3.5.9 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.[7]

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 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.

3.5.10 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. [8]

This OP is not triggered since no part of the Project area is located in any disputed territory.

7 Excerpts from WB OP 4.12.WB Operational Manual. December 2001.

8 Excerpts from the OP 7.60.WB Operational Manual. November 1994.

3.5.11 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 the WB finances. However this OP is not relevant since the proposed Project does not involve construction of dams.

3.5.12 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 and Bengali translation of its executive summary 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.

3.5.13 Environment, Health and Safety Guidelines

The Environment, Health, and Safety (EHS) 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.

3.6 Implications of the World Bank Policies on CEIP & Environmental Category

The project intervention for polder 35/3 falls under Category A project, 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. There may be localized impact on the natural habitats especially on the fish spawning site and protected areas, during the implementation of the civil works.

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 operation. Although no direct impacts on physical cultural resources are expected, screening mechanism incorporated into the EA process will identify subprojects with archeological, 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 water courses 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 Pest Management Plan with prior approval from Bank.

4. Description of Proposed Interventions in Polder 35/3

The project description chapter mainly discusses the proposed rehabilitation/development activities for Polder 35/3. The construction methodology, construction schedule, and the institutional arrangements for implementation of project is also been discussed in this chapter.

4.1 Project Background

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 the tides in the Bay of Bengal which could vary in range from 3 m in the west to nearly 6 m in the north-eastern corner of the Bay near Sandwip.

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

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 are now under the protection of the coastal embankment system bringing immense benefits. 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 (ie, the volume of water displaced during a tidal cycle). 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 Pussur 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.

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 on account 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

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 ad 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.

After cyclone SIDR struck the coastal area causing severe damage to the infrastructure, lives and properties of the coastal belt, the Government of Bangladesh (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).

It had been appreciated that undertaking the rehabilitation of coastal embankment system under one or two localized projects will 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.

The Polder 35/3 is one of the polders to be rehabilitated under the CEIP-I.

4.2 Polder Overview

The polder 35/3 is located in two upazilas namely Rampal and Bagerhat Sadar of Bagerhat District (**Figures 1.2** and **4.1**). The management of the water control structures in the Polder lies with Bagerhat Operation and Maintenance (O&M) Division of BWDB. The Polder covers three unions parishads[9] namely Malliker Ber of Rampal Upazila while Dema and Karapare of Bagerhat Sadar upazila. The polder is surrounded by Bhairab River to the east, Katakhali River to the south west, Bishnu River to the west and Putimari River to the North side. The Polder covers a gross area of 6,790 ha of which net cultivable area is 5,090 ha.

Polder 35/3 was constructed during 1981-86 with the aim 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. Supplementary irrigation and indirect road communication development was also another vision in coastal polder development project. In the present context, the polder is now facing cyclonic storm surges and wave due to climate change effect.

Existing Water Management Infrastructure in Polder 35/3

The Polder is enclosed by embankment and includes various water controlling structures for draining and flushing the Polder area. Embankments were originally constructed to prevent salinity intrusion and tidal flooding. The summary of the existing infrastructure is given below.

1. Embankment : 40.00 km.
2. Regulators (drainage / flushing) : 4
3. Flushing inlets : 11
4. Internal *khals* (water channels) : 75 km.

4.3 Objectives of Improving Polder 35/3 under CEIP- I

The overall 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

[9] Union Parishad is an administrative subdivision of an upazila, which in turn is an administrative subdivision of a district.

cyclones; (c) improving agricultural production by reducing saline water intrusion which is expected to worsen due to climate change; and (d) improving the Government of Bangladesh's capacity to respond promptly and effectively to an eligible crisis or emergency.

4.4 Water Management Problems and Issues in Polder 35/3

The Polder is vulnerable to river erosion. Many segments of the embankment have been damaged and eroded in river side slope in different places mainly due to river erosion, wave action and overtopping during SIDR. Most of the length of the embankment is remained under sectioned. At some places the crest level is almost down to the ground level. The total length of the embankment will be re-sectioned as per recommended CEIP design crest level. The existing structures are in a dilapidated condition. The gates do not function properly and drainage as well as flushing of water takes place without any good control. The concrete surfaces of the structures have deteriorated. Somewhere the reinforcement is found to be exposed which has been rusted due to saline water. There are some places where there are khals but no drainage structures have been provided.

In the polder area, normally the level of salinity starts increasing from December due to reduction of upland discharge and reaches the peak in April and then falls due to high upland flow. Shifting of rainfall pattern in southwest area would influence the salinity period and level in the polder area. Saline water is stored in the ghers for shrimp culture and salinity goes to highest level during mid-March to mid-June. Saline water inundates significantly breached areas causing damage to agricultural practices. There is a conflict between shrimp culture farmer and agriculture farmer in the whole polder for saline water and sweet water during dry season.

Drainage congestion within the polders due to siltation of peripheral rivers is another problem of this polder. This is a direct consequence of the impact of polder construction which has reduced the tidal exchange volumes by about 40 percent of the volume under natural tidal regime before polders were constructed. Over the years, improper maintenance of internal khals and malfunctioning of sluices as well as lack of sluices caused drainage congestion in the polder area. Roughly 5-7% area of the polder are facing drainage problem during monsoon.

Sedimentation is also a problem in the polder area. The downstream of Bhairab and Bishnu rivers have sandy beds and mud banks along the shore whereas tidal creeks tend to be choked with very fine sediments. In the tidal rivers, suspended sediments are mainly composed of silt and clay. Sedimentation in most of the internal khals caused rise of bed level and reduced the conveyance capacity of the khals.

Vulnerability to high water levels to embankments are subject to overtopping by very high storm surges travelling up the river system. Further from the bay, the monsoon high water could even determine the embankment crest level. The resistance to high water levels has been impaired by the lowering of crest levels due to local settlement and general subsidence. Combined with the weakening of embankment due to poor maintenance and active interference for constructing unauthorized inlets has resulted in the frequent occurrence of failures and breaches, sometimes even before overtopping takes place.

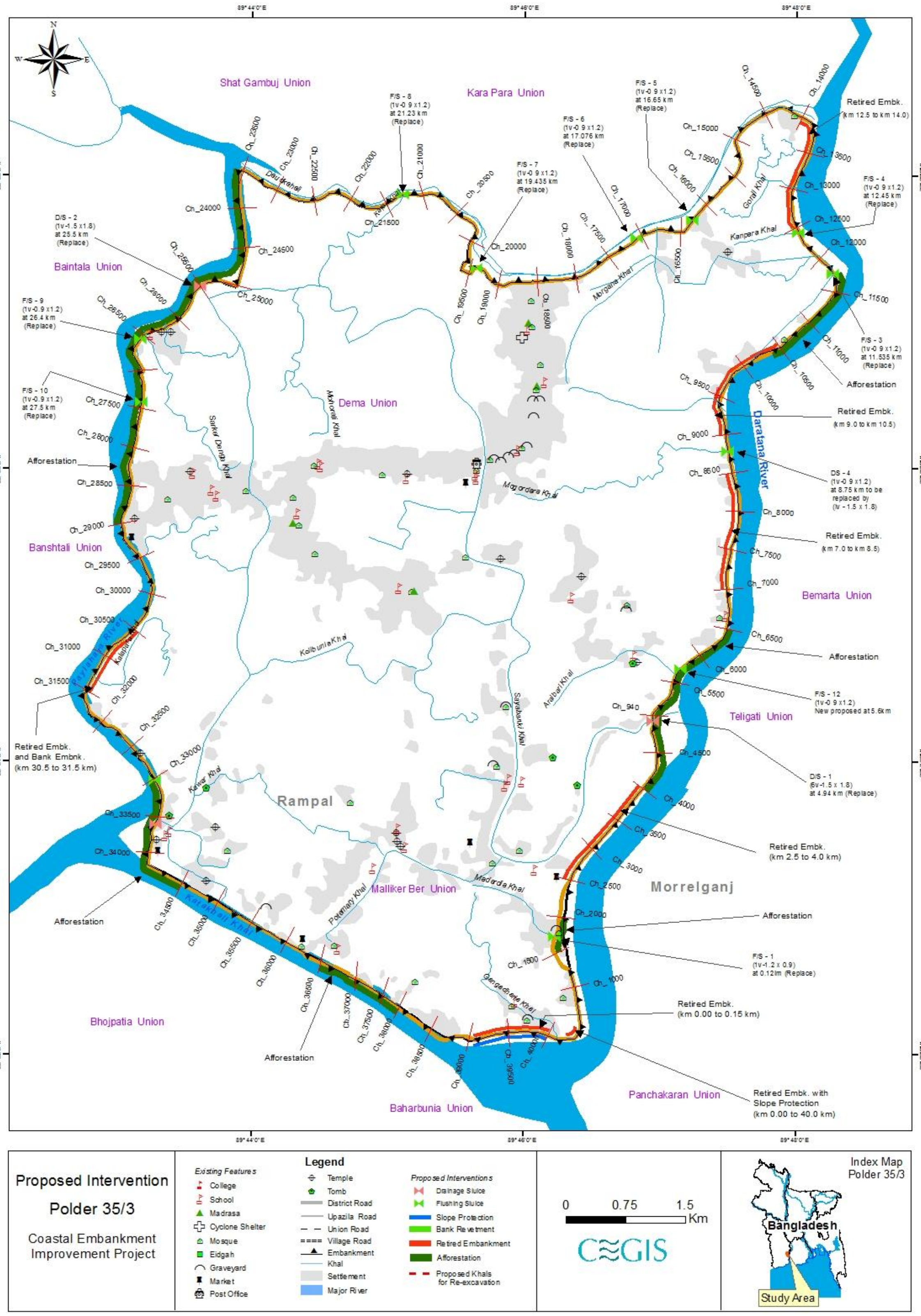

Figure 4.1: Alignment of the embankment and existing structures of the polder

4.5 Present Status of Water Management Infrastructures

4.5.1 Embankments

Present status of the embankments in Polder 35/3 and works required on them are:

- The setback distance of the river from Ch. 39.00km to Ch. 39.10km at Mallikerber has been reduced due to bank erosion of the adjacent river. As there is no means of protection other than retirement of embankment at this portion, it is proposed to construct a retire embankment with afforestation to the foreshore area. The slope of embankment from Ch.39.10km to Ch.40.00km has been eroded by the wave action. This slope of this portion has been proposed to be protected by slope protection work with CC block.
- The embankment from Ch. 1.00km to Ch. 1.50km, Ch. 35.50km to Ch.36.00km and Ch. 30.50km to Ch. 31.50km has been eroded by river erosion (Picture 4.5 to 4.6). In order to avoid retirement of embankment, only repairing of the existing embankment with bank protective works in this reaches have been proposed to prevent further erosion.
- The setback distance of the embankment from Ch. 0.00km to Ch. 0.15km, Ch. 2.20km to Ch. 3.80km, Ch. 7.00km to Ch. 8.50km, Ch. 9.00km to Ch. 10.50km, and Ch. 12.50km to Ch. 14.00km along the bank of the River Bhairab have become extremely insufficient and the bank of the adjacent river is continuously eroding. As there is no other way, the embankment in these reaches has been proposed for retirement with afforestation along the existing river bank.
- The remaining part of the embankment needs to be re-sectioned up to the design level. There is brick soling on the top at some segments of the embankment constructed by LGED. This would need to be removed to facilitate re-sectioning and after completion of re-sectioning works brick soling work are to be provided.

4.5.2 Water Control Structures

The Polder 35/3 has four numbers of drainage sluices, one pipe sluices, and 11 flushing inlet structures. The present condition of the structures along with the required remedial actions is presented in **Table 4.1** below; some photographs of these structures are provided in **Figure**s **4.3** to **4.10**.

Table 4-1: Status of Structures and Recommendations for Improvement

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
1	Drainage Sluice -1 (DS-1) (6v-1.5m x 1.8m) (Mollikerber Khal)	4.94 km	There are damages at the U/S and D/S loose apron and the structure and the structure is in deplorable condition. Presently, it is not functioning properly.	The structure is required to be replaced with provision for drainage and flushing.
2	DS-2 (1v-1.5 x 1.8m)	25.5 km	The structure is in very deplorable condition which is not repairable.	The structure is proposed to be replaced with provision for drainage

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
	(Rautir Khal)			and flushing.
3	Flushing Sluice -3 (2v-1.5 x 1.8m) (Betibunia khal)	34.00 km	The sluice is in very bad conditions	The structure is proposed to be replaced with provision for drainage and flushing.
4	DS-4 (F/S-2) (1v-0.9mx1.2m) (Panchamala)	8.75 km	There is drainage congestion in this area, as the flushing sluice is not adequate for efficient drainage.	A new drainage-cum-flushing sluice (1v-1.5 m x 1.8m) sluice is proposed to be constructed instead of the existing flushing inlet..
5	Pipe sluice (1v-0.9m) Madardia	1.55 km	RCP sluice is required to be repaired to drain out rainfall run-off.	The structure is to be repaired
6	F/S-1 (1v-0.9m x 1.2m)	0.126 km	The barrel wall is being damaged and holes are formed on top of the barrel. The sluice is not repairable.	The sluice is required to be replaced with re-excavation of diversion channel
7	F/S-3 (1v-0.9m x 1.2m)	11.535 km	The structure is not functioning well and there are some damages to the loose apron and railing. There is no lifting arrangement of gate.	The sluice is to be replaced.
8	F/S-4 (1v-0.9m x 0.9m)	12.45 km	The structure is in deplorable condition and the diversion channel has been silted up.	The sluice is to be replaced.
9	F/S-5 (1v-0.9m x 1.2m)	16.65 km	Loose aprons and railings have been damaged. The structure is repairable.	Structure needs to be repaired.
10	F/S-6 (1v-0.9m x 1.2m)	17.076 km	The gates are missing hence the sluice is not functioning.	Re-installation of gate is required.
11	F/S-7 (1v-0.9m x 1.2m)	19.435 km	There are some damages to the loose apron and railing. There is no lifting arrangement of gate.	The sluice is to be replaced.

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
12	F/S-8 (1v-0.9m x 1.2m)	21.23 km	Vertical lifting gates and flap gates are not working properly.	The sluice is required to be replaced with re-excavation of diversion channel
13	F/S-9 (1v-0.9m x 1.2m)	26.40 km	The barrel wall is damaged and holes are formed on top of the barrel. The sluice is not repairable.	The sluice is required to be replaced.
14	F/S-10 (1v-0.9m x 1.2)	27.50 km	The structure is in deplorable condition and the diversion channel has been silted up.	The sluice is required to be replaced with re-excavation of diversion channel
15	F/S-11 (1v-0.9mx1.m)	33 km	Flushing-Inlet are not in good condition, loose apron are damaged.	The sluice is to be replaced.

Note: D/S means Drainage sluices; F/S means Flushing Inlets

4.5.3 Internal khals (water channels)

The area of the polder is criss -crossed by many khals with the total length of 75 km. Most of the kahls have silted up of which Sayabanki Khal, Betibonia Khal, and Mogordara Khal are mentionable. The internal drainage channels have silted up due to lack of maintenance for a long time. Therefore, these khals are not facilitated with drainage or flushing inlets these khals are needed to be urgently re-excavated to continue the water flow inside the polder area.

Figure 4.2: Daratana river bank erosion at Bashbari

Figure 4.3: Daratana river bank erosion at Mollikerber

Figure 4.4: 6 vents sluice at Bara Bashbari

Figure 4.5: One vent sluice at Matherdia

Figure 4.6: 2 vents sluice at Betibunia

Figure 4.7: 1 vent flushing inlet at Mollikerber

Figure 4.8: Sayanbanki khal (Sobagi river) inside polder

Figure 4.9: Betbunia khal

4.6 Rehabilitation/Improvement Activities in Polder 35/3

The proposed interventions in Polder 35/3 as planned in feasibility survey under CEIP-I are listed in **Table 4.2** and shown in **Figure 4.1**.

Table 4-2: Proposed Interventions in Polder 35/3

	Proposed intervention	Quantity
1	Re-sectioning of embankment	35.00 km
2	Construction of retired embankment	5.05 km
3	Construction of drainage sluices	4
4	Construction of flushing inlets	10
5	Re-excavation of drainage channels	23.50 km
6	Bank protection works	1.70 km
7	Slope protection of embankment	0.90 km
8	Afforestation on the foreshore areas	6.54 ha

Source: Feasibility Report of CEIP, 2012

4.6.1 Works on Embankments

A total of 35.00 km of embankments will be re-sectioned under the proposed interventions. Polder height will be increased to 4.5.00mPWD and 6.3 km of embankments will be constructed as retired embankment as shown in the **Table 4.3** below.

Table 4-3: Detail of Works on Embankments

	Description	Chainage (km)	Height m (PWD)	Length (km)
1	Re-section of embankment (Increasing the height of embankments)	0.15 to 2.5	4.50	2.35
2		4.00 to 7.00	4.50	3.00
3		8.50 to 9.00	4.50	0.50
4		10.50 to 12.50	4.50	2.00
5		14.00 to 30.50	4.50	16.50
6		31.50 to 39.10	4.50	7.60
7	Retirement	0.00 to 0.15	4.50	0.15
8		2.50 to 4.0	4.50	1.50
9		7.0 to 8.5	4.50	1.50
10		9.00 to 10.50	4.50	1.50
11		12.50 to 14.0	4.50	0.50
12		30.5 to 31.5	4.50	1.0
13		39.1 to 40.0	4.50	0.9

Source: Feasibility Report of CEIP, 2012

Description of construction activities

The construction of the embankment will be carried out with the soil/earth obtained either from drain/canal re-excavation, from borrow pits, or other sources, approved by the Engineer. The earth fill materials will be well graded, homogenous and free of logs, stumps, roots, rubbish or any other ingredient, organic/ vegetable matter.

The earth will be placed in layers of 150 mm thickness with soil (minimum 30 percent clay, 0-40 percent silt, 0-30 percent sand) compacted mechanically to attain 85 to 90 percent of maximum dry density at optimum moisture content to avoid air pocket.

Before commencement of construction activities for embankment works, labor sheds should be constructed with proper sanitation and other required facilities. A suitable site shall be selected and prepared by cleaning bushes, weeds, trees etc. Alignment of embankments has to be fixed with adequate base width. Base stripping and removal of trees, weed etc will be made as per instruction of the Engineer in charge. The tools required for construction of embankments will be procured during this period. After validating the final design, excavation of soil/carried earth will be carried and deposited in a selected area. Soil will be dumped in layers. At the same time, each layer (of 1.5 feet) of dumped soil will be compacted by compactor machine. The sloping and shaping of embankment will be developed after proper compaction of layers. The slope of the embankment will be turffed with grass. Watering and fertilizers will also be provided for proper growth of grass.

4.6.2 Construction/Repairing of Drainage Sluices

Four number of drainage sluices will be replaced under the proposed interventions of the rehabilitation works of the Polder 35/3. The details description of these sluices has been given in **Table 4.1**.

At the outset of the construction activities, required construction materials (sand, cement, wood, and shuttering materials) will be procured. A suitable site of the structure will be selected and prepared accordingly. Alternative diversion channels will be constructed before the starting of construction works. After that the foundation treatment required for flushing inlets will be carried out. Then the concrete works, pipe and machine pipe along with construction of collar joints will be carried out. The gates both in the upstream of each flushing inlets will be installed. After completion of all construction activities, the approach embankments will be constructed and turfed with grass. Finally, a channel is to be excavated through lead cut and tail cut to make the flow to be channeled through the flushing gate.

Description of construction activities

At the beginning of the work i.e. during pre-construction phase for construction of drainage sluices, construction of labor shed, development of sanitation and other facilities etc should be done. During this period, required construction materials (sand, cement, wood, shuttering materials etc.) will be procured by the contractor as per tender schedule. Meanwhile, a suitable site will be selected and prepared for construction of the sluices. Before starting the construction activities of drainage sluices, Ring bund and diversion channel will have to be constructed. After that the foundation treatment required for the structure will be carried out. The cement concrete (CC) and reinforced cement concrete(RCC) works along with cutting, bending and binding of rods will then be performed as per specification. CC blocks will be prepared and placed as and where required as per design. After construction of approach roads, fitting and fixing of gates and hoisting device will be carried out. Gates will be properly painted. The intake and outfall of the gate will be constructed as per design. The CC blocks will be made for river training works and pitching works will then be conducted.

4.6.3 Construction/Repairing of Flushing Inlets

Ten flushing inlets will be replaced under the proposed interventions for rehabilitation work of Polder 35/3. Besides, one flushing inlets will be repaired. The details description has been given in **Table 4.1**.

Description of construction activities

Before starting the construction activities of flushing inlets a labor shed will be constructed with proper sanitation and other facilities. The required construction materials (sand, cement, wood, shuttering materials etc.) will be procured simultaneously. A suitable site of the structure will then be selected and prepared accordingly. Alternative diversion channels will be constructed before starting the construction works. After that the foundation treatment required for flushing inlets will be carried out. Then the RCC works, pipe and machine pipe along with construction of allied and fittings will be made along with construction of and collar joints will be made as and where required. After few days of constructions the gates both in the upstream and downstream of each flushing inlets will be executed. After completion of all construction activities, the approach embankments will be constructed and turfed with grass. Finally, a channel is to be excavated through lead cut and tail cut to make the flow to be channeled through the flushing gate.

4.6.4 Re-excavation of Drainage Channels

Three channels will be re-excavated to decrease the drainage congestion. An estimated volume of 0.67 million cubic meters of soil/silt will be excavated from these channels. The excavated soil will be used for strengthening the *khal* banks, making them available to the farmers. The water channels to be re-excavated under the project are presented in **Table 4.4.**

Description of construction activities

For re-excavation of the drainage channels, at first the required tools will have to be procured. A schematic diagram showing centerline and layout plan will be made for the re-excavation noting the design depth and width of excavation to be made. The entire channel will then be divided into a number of reaches. The excavation will be started from the upstream of the channel. Cross dams are to be provided at the starting and final locations of the reach, and then soil from the channels will be removed up to the required depth and width. The excavated soil/sludge should be disposed into a suitable place, specified by the Engineer in charge, from where the sludge or soil will not affect the channel flow by any means. After finalizing excavation on one reach, the other reach in the downstream would be excavated following structures procedure.

Table 4-4: Channels to be Re-excavated

	Name of Khal	Length (km)	Chainage (km)
1	Sayabanki Khal	14.50	4.940
2	Betibonia Khal	6.00	34.00
3	Mogordara Khal	3.0	8.75
	Total	23.50	

Source: Feasibility Report of CEIP, 2012

4.6.5 Bank Protection and Slope Protection Works

The proposed intervention of the rehabilitation works of the project includes bank protection works. Bank protection works for length of only 1.7 km will be carried out from chainage 1.0 km to 1.5 km and 30.5 km to 31.5 km of the polder. In addition, about one km of slope protection (Ch 39.1 km to 40.0 km) of embankment is to be carried out along the Paylahara River.

Description of construction activities

The construction activities involved in the bank protection and slope protection are: the construction of labor shed, creation of sanitation facility and procurement of construction materials (sand, cement, wood, shuttering materials etc.), the slope of the river bank as per design will be developed by earth. At the same time, the required CC blocks will be casted or manufactured and guard walls will be constructed. After completion of the construction of CC blocks, Geo-textile bags will be placed along the slope and CC blocks will be placed on it. A launching apron will be prepared with CC blocks along with dumping of CC blocks in assorted form will be completed up to the toe of embankment in the river banks. Finally, turfing will be made on the slope of the embankments. Proper drainage provision will be kept to avoid formation of rain cuts for surface run off.

4.6.6 Afforestation

Plantation of mangrove forest is proposed for afforestation on the foreshore area. The areas selected for afforestation in the polder 35/3 are shown in **Figure 4.11**. Establishment of green belts in these areas can reduce the effect of toe and slope erosion due to wave action and river flow and promote land accretion. About 26 ha of foreshore area will be planted with mangroves in the Polder, whereas about 20 ha of land will be kept for timber saplings and 6 ha for Golpata. The saplings are to be planted at a spacing of 1.5m x 1.5m. **Figure 4.10** shows the typical cross-section of this plantation.

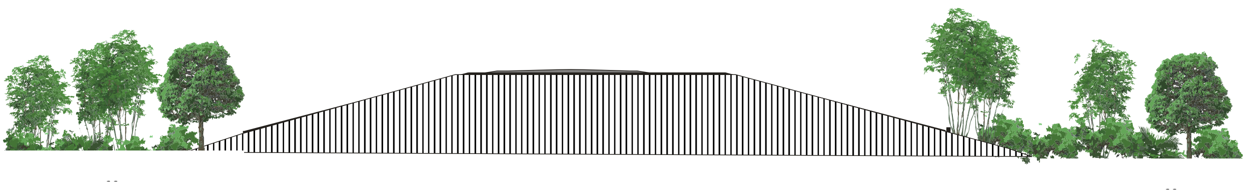

Figure 4.10: Typical Cross Section of afforestation works

The afforestation will be made at different locations on the foreshore of the polder area. Total length of afforestation will be 13 km. Detail information of afforestation with chainage is shown in **Table 4.5** below:

Table 4.5: Detail works of afforestation

Sl	Description	Chainage (km)	Length (km)
1	Afforestation	1.50 to 2.00	0.5
2		4.00 to 6.00	2.0
3		9.50 to 11.50	2.0
4		23.50 to 29.00	5.5
5		33.00 to 34.50	1.50
6		36.50 to 38.00	1.50
	Total		**13.00**

4.7 Construction Details

4.7.1 Construction Schedule

The works in Polder 35/3 under the CEIP-I are expected to be completed in four years. The construction schedule is present in **Table 4.6**.

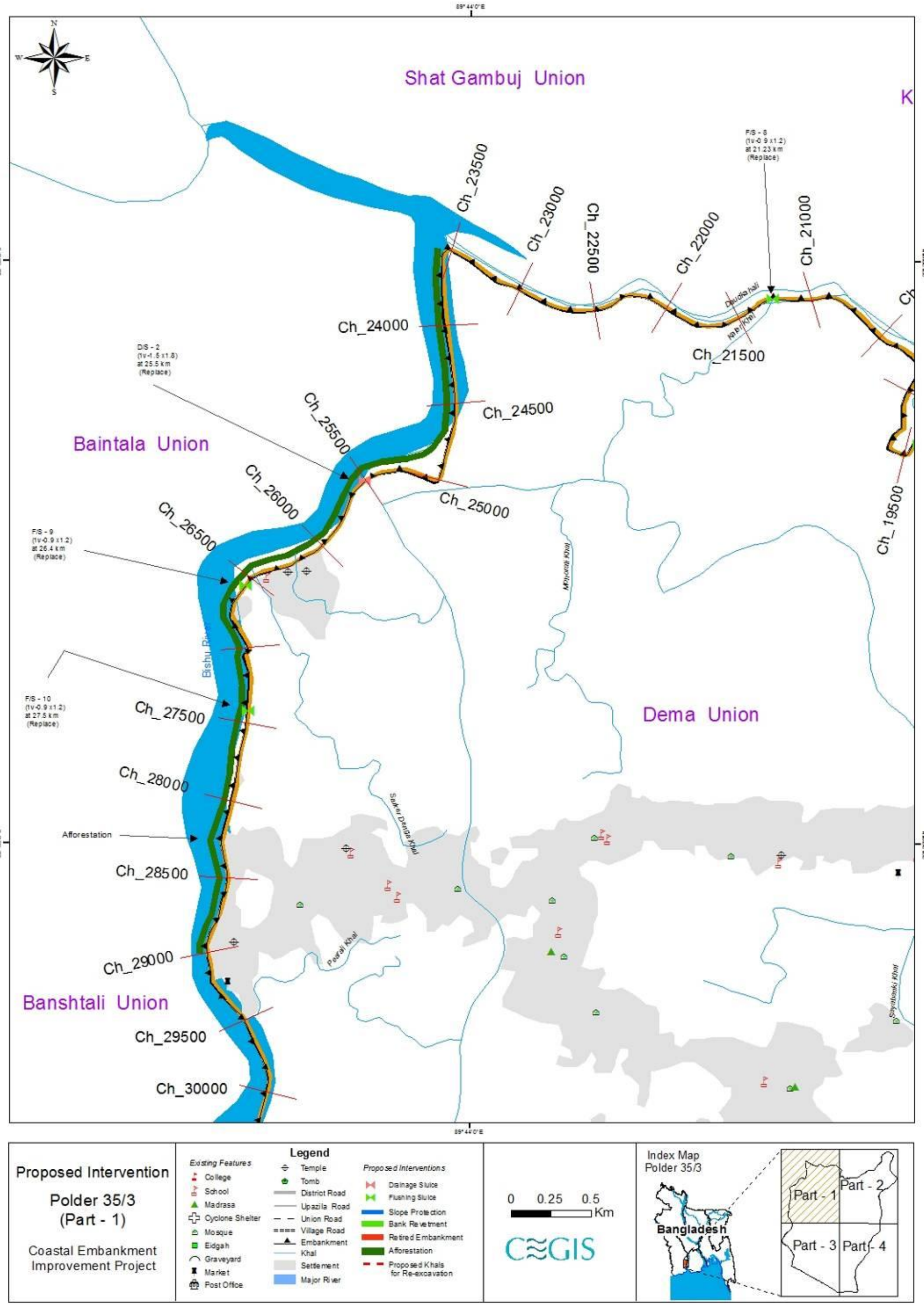

Figure 4.11 (a): Location of Proposed Interventions in Polder 35/3 (Part-1)

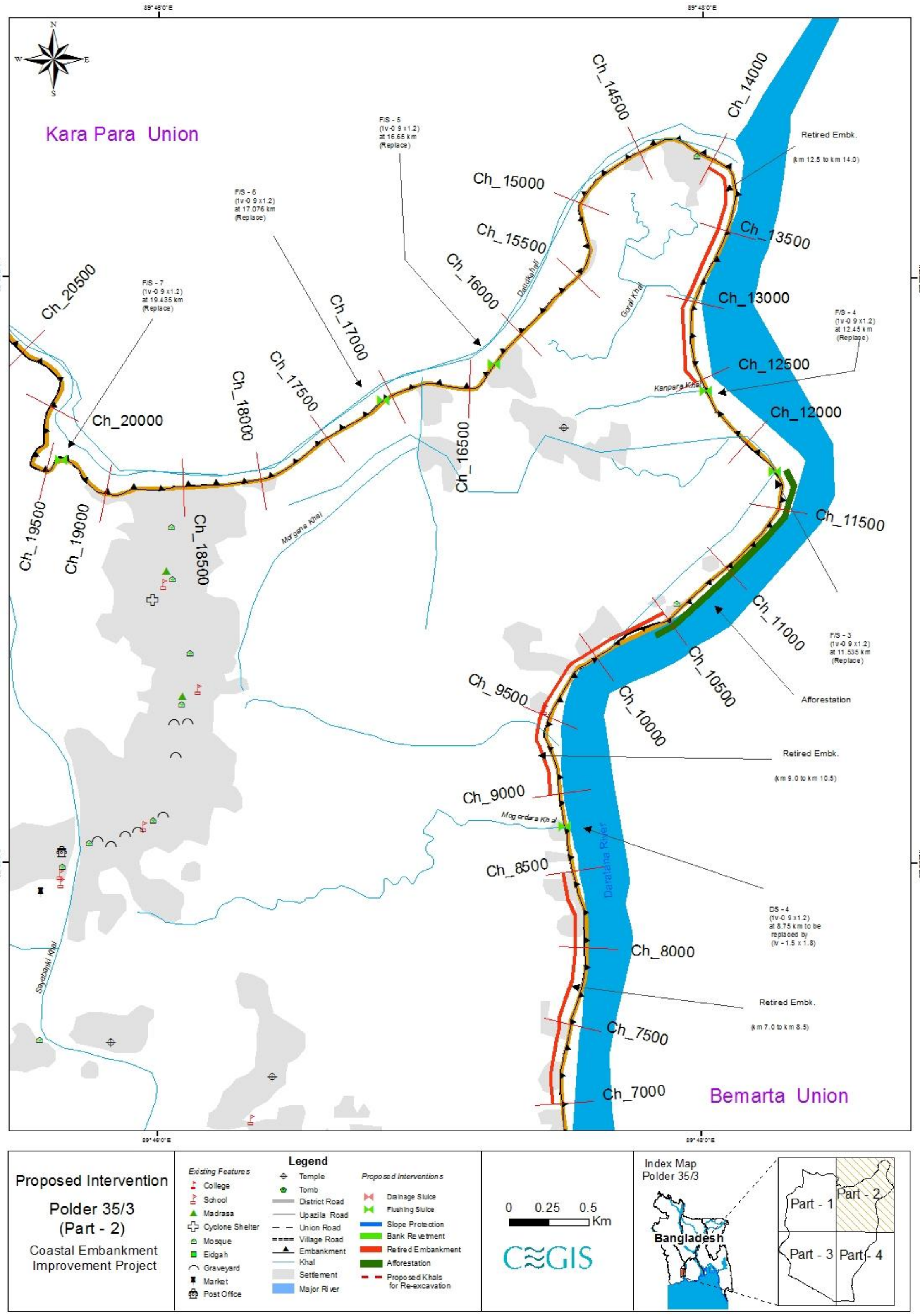

Figure 4.11 (b): Location of Proposed Interventions in Polder 35/3 (Part2)

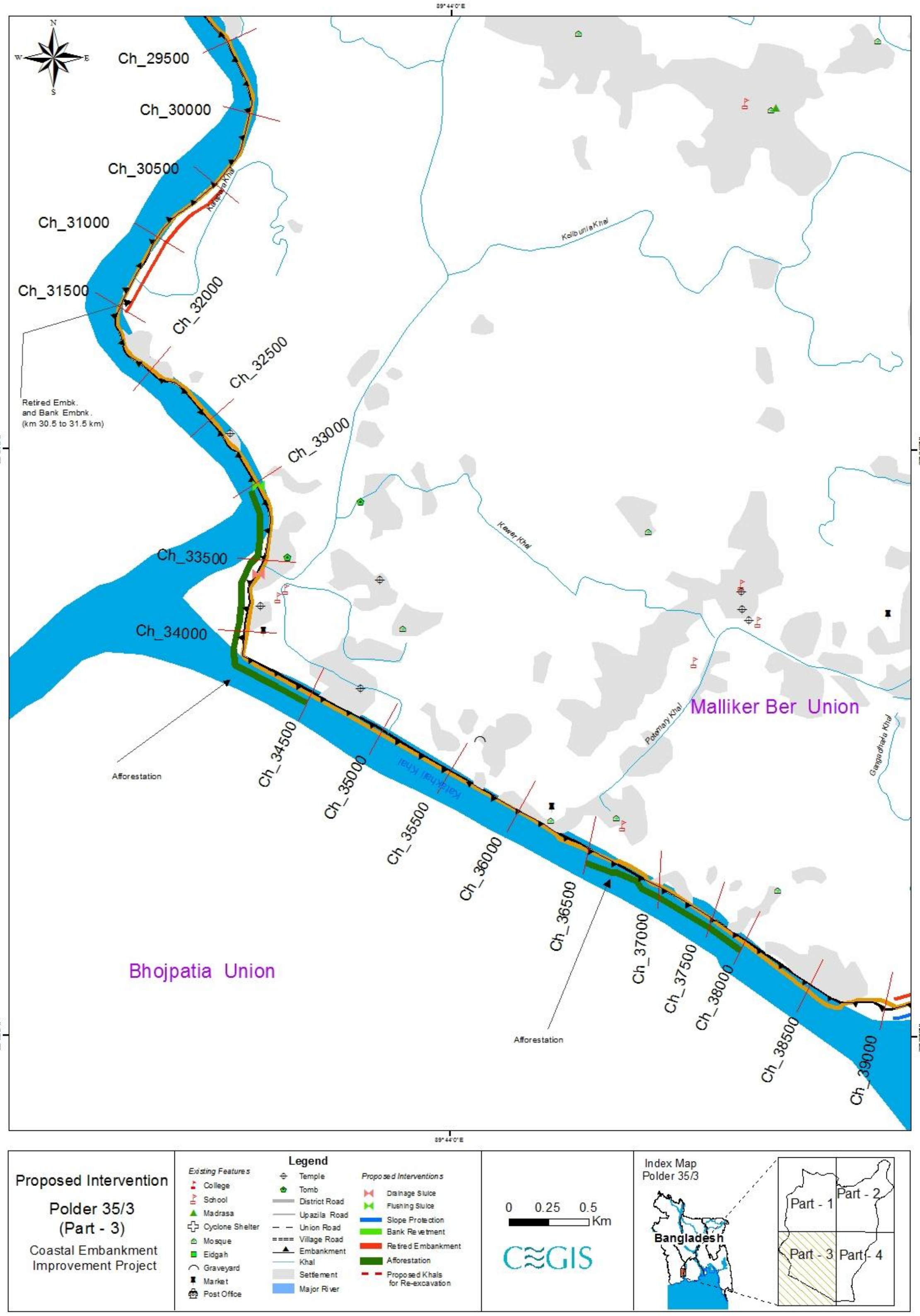

Figure 4.11 (c): Location of Proposed Interventions in Polder 35/3 (Part 3)

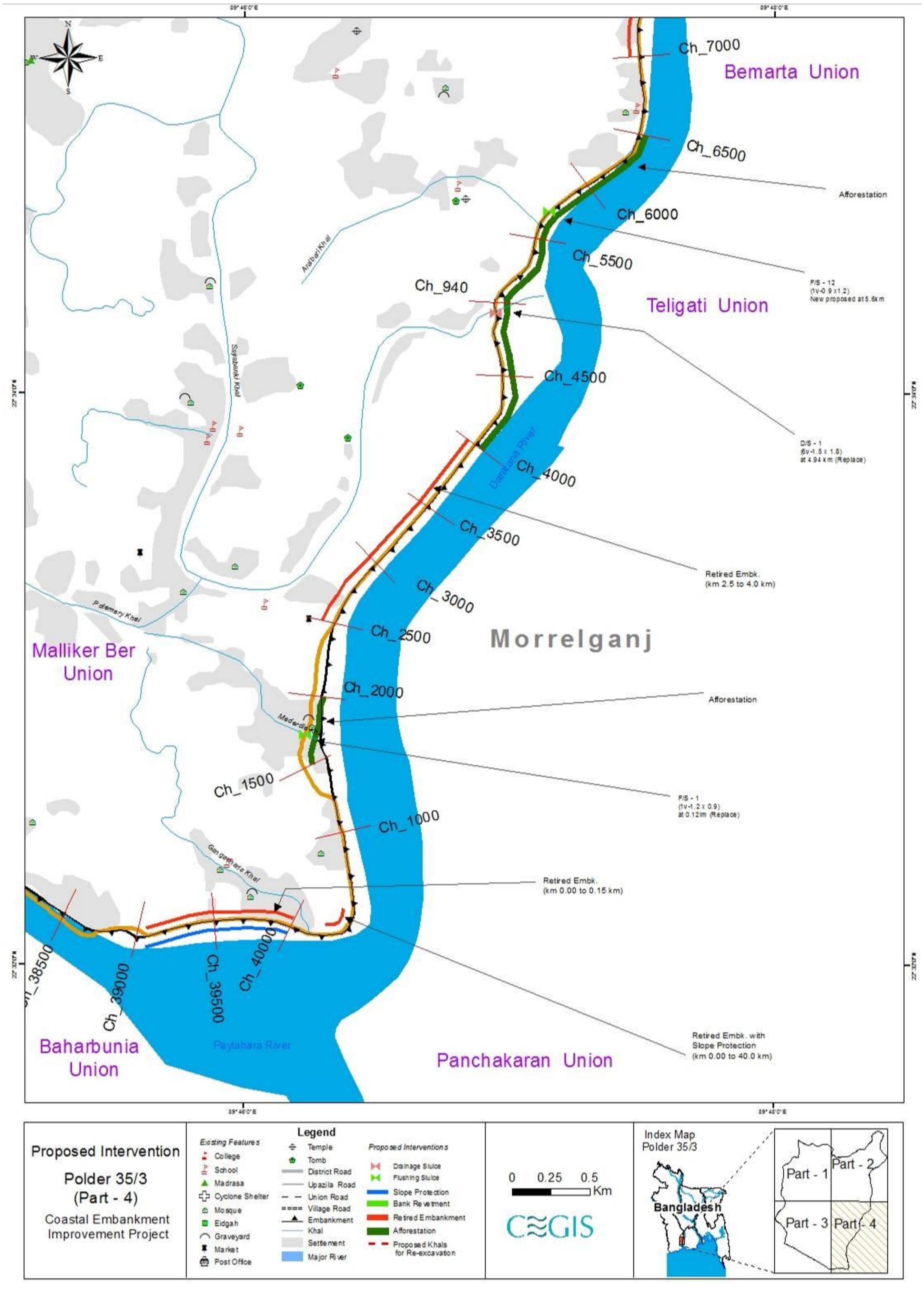

Figure 4.11 (d): Location of Proposed Interventions in Polder 35/3 (Part 4)

Table 4.6: Construction Schedule

	Description	Year 1				Year 2				Year 3				Year 4			
		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A.	**Pre-Construction Activities**																
A1	Discussion with local stakeholders about the project and interventions																
A2	Disclose rehabilitation plan																
A3	Distribute acquisition and requisition money before the construction works																
A4	Display Bill board on the intervention site for public awareness																
A5	Preparation of Stockyard for construction materials																
A6	Mobilization and site preparation																
A7	Higher Contractors through tendering procedure																
A8	Construction of labor shed and site office																
A1	*Labor shed and site office preparation*																
A2	*Installment of water and sanitation facilities*																
A3	*Installment of Garbage disposal system*																
B	**Procurement system of the project**																

	Description	Year 1				Year 2				Year 3				Year 4			
		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
B1	Procurement of construction materials																
B2	Procurement of construction machineries and equipments																
C	**Rehabilitation of embankment**																
C1	Collection of earth materials from the borrow pit area from outside of the embankment through excavator, pay loader and dump truck and trolley																
C2	Collection of earth materials from Baleswar river through dredging																
C3	Use slow moving vehicles/head load for carrying earth materials																
C4	Dumping of earthen materials on the embankment																
C5	Keeping earthen materials for drying																
C6	Breaking dried earthen materials through Clod Breaker																
C7	Embankment surface labeling through dumper machine																
C8	Embankment slope pitching and turfing																
D	**Re-excavation of Canal**																

	Description	Year 1				Year 2				Year 3				Year 4			
		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
D1	Bailing out of water with all leads and lifts by manual labor or pump, with all arrangements for protection of ring bund and side slopes of foundation pit against erosion and washout																
D2	Earth work by manual labor with clayey soil (minimum 30% clay, 0-40% silt and 0-30% sand) in construction of cross bund as per design and specification with all leads and lifts, throwing the earth in layers not exceeding 150 mm in thickness including breaking clods, rough dressing, cleaning the jungle, removing stumps, dug baling and 75mm cambering complete as per direction of Environmental specialist.																
D3	De-silting works of canal through excavator																
D4	Deposited the spoil earth both bank of the canal through pay loader , dump truck and trolley if necessary using head load as per design and specification																
D5	Earth work by manual labor in all kinds of soil in removing the gross																

	Description	Year 1				Year 2				Year 3				Year 4			
		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
	bund/ring bund, including all leads and lifts complete and placing the spoils to a safe distance (minimum 15m apart from the bank) as per design																
E	**Replacement and repairing of regulator**																
E1	construction and repairing of drainage sluices																
E2	construction and repairing of flushing inlets																
F	***Afforestation***																
F1	Land preparation																
F2	Fencing preparation and setting																
F3	Plantation of mangrove trees																

4.7.2 Construction Manpower Requirement

Technical and nontechnical manpower will be required for the Project construction works. They will include engineers, technicians, supervisors, surveyors, mechanics, foremen, machine operators, drivers, and un-skilled labor. Around 60 to 70 percent of labor will be engaged from the local area and remaining will be from outside. The estimated manpower requirement is presented in **Table 4.7**.

Table 4.7: Required manpower for construction

	Required Manpower	Number
1	Engineer	2
2	Machinery operation	38
3	Mechanics	2
4	Surveyor	3
5	Skilled labor	4,079
6	Unskilled labor	2,91,543

Source: Feasibility Report of CEIP, 2012

4.7.3 Construction Material

The construction materials required for re-sectioning and retired embankment, water regulatory sluices and flushing inlets, and bank protection work will include soil, cement, steel, and sand. Estimated quantities of these materials are presented in **Table 4.8**.

Table 4.8: Construction Materials

Sl	Description	Quantity	Sources
Re-sectioning and retired embankment			
1	Earth work	11,85,884 m^3	Borrow pits, dredging spoils from re-excavation of drainage channels
Construction of sluices and flushing inlets			
2	Cement	70,489 bag	To be procured from local market
3	Sand	4180 m^3	To be procured from Khulna
4	Stone	9,404 m^3	To be procured from Khulna
5	Steel	298 Ton	To be procured from Khulna
Bank protection			
6	CC Blocks	95,999 nos	To be made at construction site during construction
7	Stones	23,900 m^3	To be collected from Khulna

The earth for embankment re-sectioning or retired embankment will be collected from the offshore area of the polder 35/3. The spatial location of the borrow pit areas are delineated in **Figure 4.13**. The details of borrow pit area are attributed in the following table:

Table 4.9: Availability of earth in the borrow pit area

	Quantity of Earth available from Borrow pit area			**Quantity of Earth available from River bed**		**Details**
	Location (chainage)	Pit Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	
1	1) 0.15 Km to 1.0 K.m	1 Km X10 m X 1.5m	15,000 m^3	Daratana	1) 0.15 Km to 14 Km	Earth is available at borrow pit area
	2) 1.5 Km to 2.5 Km	200 m X 3 m X 1.5m	9,000 m^3			
	3) 2.5 Km to 4 Km	1k m X 50 m X 1.5m	1,12,500 m^3			
	4) 4 Km to 6 Km	2 Km X 30 m X 1.5m	90,000 m^3			
	5) 6 Km to 6.5 Km	500 m X 10 m X 1.5m	7,500 m^3			
	6) 6.5 Km to 7 Km	500m X 10 m X 1.5m	7,500 m^3			
	7) 7 Km to 9 Km	1 Km X 50 m X 1.5m	1,12,500 m^3			
	8) 9 Km to 10.5 Km	1 Km X 50 m X 1.5m	1,12,500 m^4			
	9) 10.5 Km to 12.5 Km	1 Km X 20m X 1.5m	45,000 m^3			
	10) 12.5 Km to 14 Km	1 Km X 50m X 1.5m	1,12,500 m^3			
			6,24,000 m^3			

	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed		Details
	Location (chainage)	Pit Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	
2				Putimary	1) 14 Km to 23.5 Km (River bed has been silted up and become dry during low tide period, therefore earth is to be collected from the bed of nearby Putimary Khal)	80% of earth is to be collected through excavation of khal.
3				Bishnu	1) 23.5 Km to 25.5 Km (River bed become dry during low tide period, therefore earth is to be collected from the bed of nearby Bishnu River)	80% of earth is to be collected through excavation of khal.
4	1) 25.5 Km to 28 K.m	2.5 Km X 10 m X 1.5m	37,500 m^3	Bishnu	1) 25.5 Km to 34 Km	90% of earth is available at borrow pit area.
	2) 28 Km to 30 Km	2 Km X 30 m X 1.5m	90,000 m^3			
	3) 30 Km to 32.5 Km	1 Km X 5 0m X 1.5m	75,000 m^3			
	4) 32.5 Km to 34 Km	1.5 Km X 15m X 1.5m	33,750 m^3			
			2,36,250 m^3			

	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed		Details
	Location (chainage)	Pit Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	
5	1) 0.0 Km to 0.15 Km	150m X10m X 1.5m	2,250 m^3	Katakhali	1) 0.15 Km to 34 Km	Earth is available at borrow pit area
	2) 39 Km to 40 Km	1 Km X 50 m X 1.5m	75,000 m^3			
	3) 35.8 Km to 39 Km	2 Km X 50 m X 1.5m	1,50,000 m^3			
	4) 35 Km to 35.8 Km	500m X 25 m X 1.5m	18,750 m^3			
	5) 34.5 Km to 35 Km	500m X 15 m X 1.5m	11,250 m^3			
	6) 34 Km to 34.5 Km	500 m X 30 m X 1.5m	22,500 m^3			
			2,79,750 m^3			

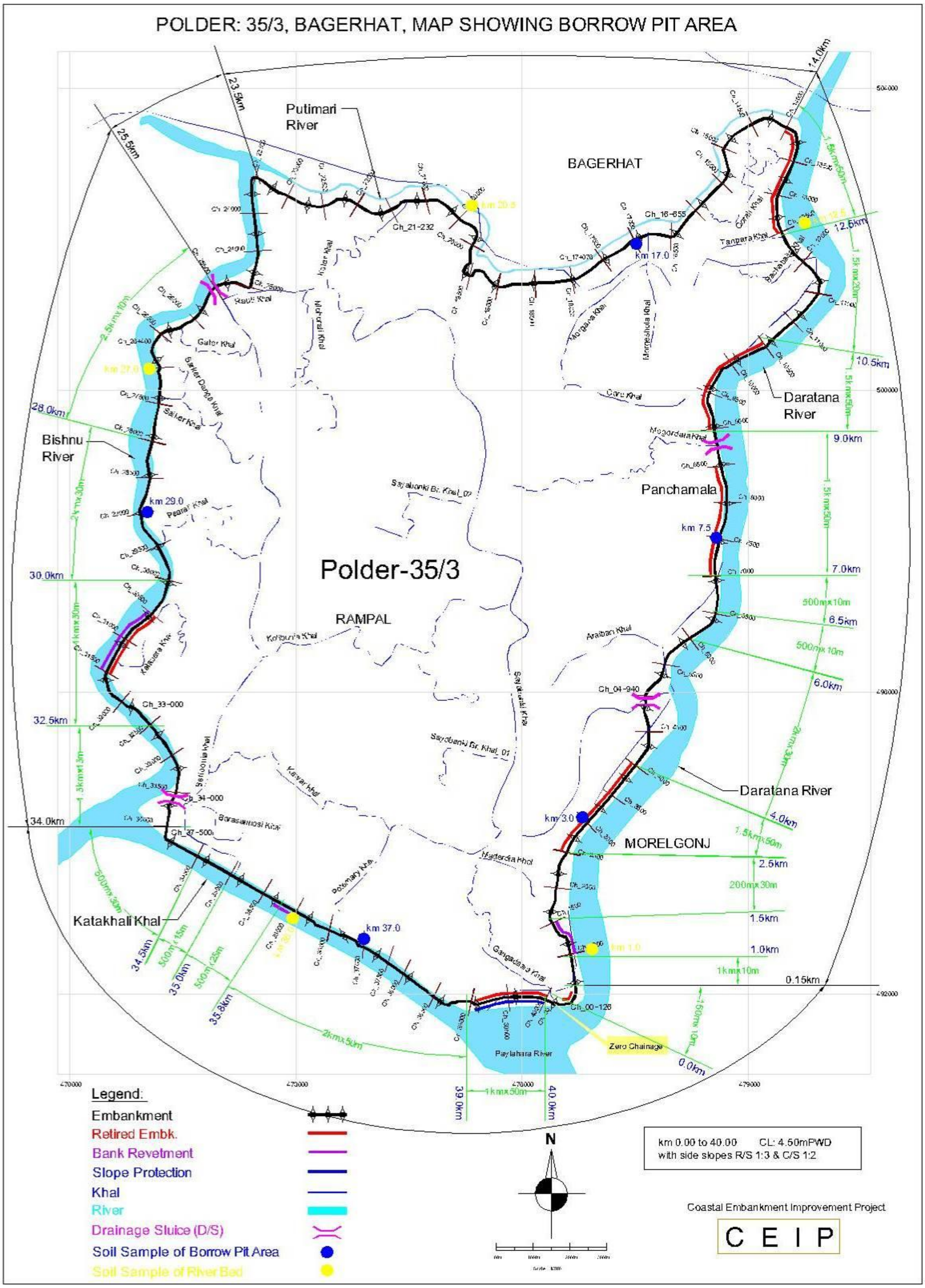

Figure 4.12: Borrow pit area of Polder 35/3

4.7.4 Construction Machinery

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 below.

Table 4.10: List of Construction Equipment and Machinery

	Description	Quantity (number)
1	Bolldozer	2
2	Dump- truck	3
3	Pay Loader	2
4	Excavator	2
5	Burge	1
6	Engine Boat	2
7	Vibrator	20
8	Compactor	4
9	Mixture Machine	20
11	Truck	2
12	Tractor	2
13	Generator	7
14	Leveling Instrument	2
15	Total Station	1
16	De-watering System	4
17	Low lift pump	4

4.7.5 Construction Camps

A total of 42 camps for labor will be established during construction period. Out of the total camps, 25 camps for embankment works, four camps for sluice works, 10 camps for flushing inlet works, one camp for slope protection works, and two camps for bank protection works will be established. Contractor will select the location of the camp through consultation with local union parishad Chairman and the local community inside the Polder, and after obtaining permission from the Supervision Consultants (Engineer).

Drinking Water and Sanitation System of Camps

A total number of 25 tube wells will be installed in the labor camps premises near the construction sites for obtaining water for the camps and also for construction activities. For sanitation, latrines will be constructed along with septic tanks for safe disposal of sewage.

4.7.6 Vehicular Traffic during Construction

During construction activities of the polder, the major quantity of earth will be carried to the embankment by mechanical equipment like excavators, pay loaders, dump trucks, trolleys and some minor quantity by manual labor.

The construction materials would be collected from the stock yard at BWBD colony Bagerhat and then would to be transported using heavy trucks for eastern areas near Paylahara River of the polder; the trucks or other vehicles will be used for district road coming from Khulna. The materials found usable from the polder may be carried through small carts, non-motorized vans and other smaller vehicles.

The equipment and construction materials including hard rock dumping materials and sluice gate equipment will be transported from Khulna on water vessels through Rupsha River and Daratana River.

4.7.7 Jetty Construction

A temporary jetty will be constructed at Daratana River near the stock yard in Bagerhat BWDB colony for unloading and stocking of construction materials. The stocked materials will then be carried to the individual sites from this place by truck, small trawllers and engine boats.

4.7.8 Project Implementation Arrangements

Overall Project Management. 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 addressing the inter-agency issues. BWDB will act as the *Project Implementing Agency* and will implement the project through a Project Management Unit (PMU).

Project Steering Committee (PSC). The PSC would be chaired by the Secretary of the Ministry of Water Resources and will include the Secretaries of other Ministries like Finance, Agriculture, Environment, Public Health Engineering, and Forestry and Wildlife, the Chief Executive officer of selected NGO, and representatives of the local/district administration as members. The PSC will oversee the project; provide policy-level guidance and inter-agency coordination for the project. The Project Director of the PMU will act as the Member Secretary of the PSC.

Project Management Unit (PMU). BWDB will set up a PMU to oversee the development and management of the project. The PMU, will be led by a Project Director appointed by BWDB. The PD will be of the rank of Chief Engineer, and will report directly to the Director General (DG). The PMU will have a central project office located at the headquarters of 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.

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 progress of the project, to liaise with the Bank, and to prepare annual programs, implementation reporting, updating all procurement reporting documents and financial management reporting. Procurement staff would consist of a Senior Procurement Specialist and one Procurement specialist. The Finance staff would consist of one Deputy Director Finance, two Accountants and three support staffs.

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 will spend about half of his/her time at the site to provide coordination between the PMU, the supervising consultant and the three Field Offices. In addition to the Deputy Project Director, the engineering unit will also include two Executive Engineers, two Assistant Engineers.

A Social, Environment and Communication Unit will supervise the activities compliance with the Environmental Management Plan and Social Action Program together with the engineering unit to implement the communication strategy. The unit will include a Sr. Environmental Specialist, a Sr. Social Specialists, a Sr. Forestry Specialist a Revenue Staff and a Communication Specialist.

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 three field offices.

The PMU will be supported by the following consultancy:

- An *experienced NGO* will be mobilized by the PMU to implement the social afforestation as provided in the project intervention and EMP; the Social Action Plan including the mobilization of Water Management Organization; the RAP and the EMP.
- A *Design and Construction Supervision Consultancy* Firm that will assist the PMU in preparing the detail design of the remaining interventions of the polders and supervise all construction works. For civil works, the Project Director will serve as the *Employer*, and the Project Supervision Consultant will serve as *Engineer* for construction supervision. At the site, a *Resident Engineer*, appointed by the consultant, with a team of specialists and inspectors will supervise the works of the Contractor.
- A *Monitoring and Evaluation* Consultants will provide support in monitoring project impacts and supervise the implementation of the EMP/RAP and will report to the PMU.
- *Procurement Panel.* A Procurement Panel will be appointed by BWDB to oversee the procurement process of large value contracts subject to prior review under the project. The panel is consist of two international/expatriate specialists and one national specialist.
- *An Independent Panel of Expert (IPOE).* BWDB will also appoint an IPOE 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 field of: morphology/river engineering; tidal river management/sediment specialist; geotechnical specialist, social specialist and environment/polderization specialist.

4.7.9 Community Participation

4.7.10 People's Participation of WMO/CBO

The National Water Policy (NWP) through its various provisions emphasizes the issues of participatory water management and highlights the importance of stakeholder participation for sustainable operation of the project. To ensure the stakeholders participation, Ministry of Water Resources, GoB has prepared guidelines namely *The Guidelines for Participatory Water Management (MoWR 2001)* usually known as GPWM. The aim and objectives of GPWM are as follows:

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

BWDB managers and field staffs in Divisions, Sub-Divisions and Sections offices do not have adequate expertise and experienced manpower to carry out the O&M of coastal polders properly. Moreover, in many places the numbers of field staffs are also insufficient and inadequate to the actual requirement. In this case to ensure sustainable operation of the project, participation of Water Management Organization (WMO) and Community Based Organizations (CBOs) is needed.

The GPWM has outlined a three tier organizational structure comprising 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.

4.7.11 Water Management Groups (WMGs)

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 on the basis of hydrological consideration 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 1500 ha. The areas of the units so demarcated usually comprise 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 WMG is a must.

4.7.12 Water Management Association (WMA)

A numbers of WMGs functioning in 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. Registration of WMA is a must.

4.7.13 Water Management Federation (WMF)

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 actual functioning strength of WMGs and WMAs. Usually in a district or in a bigger hydrological basin comprising of several districts may have one or more federations 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 Member of Parliament or local leader may be nominated as the chair-person of the WMF and other members (not exceeding 04 nos.) may come from the WMAs by virtue of their importance in controlling the numbers of WMGs.

4.7.14 Participation of Community Based Organizations

Community Based Organizations often termed as CBOs can also play a vital role in maintenance activities. While engaging any of the functional groups of these CBOs in this polder, care should be taken to twist and turn the methodologies slightly in some of the aspects as per local situation and project provisions so that it really fits in. Under this project, CBOs are conceived to be included in the Water Management Groups (WMGs) as Functional Groups (FGs). The FGs have the scope of working in O&M of the polder under the purview of WMG.

The following CBOs have been recommended for this polder under CEIP.

Embankment Settler (ES)

ESs are the families selected from squatters and project affected persons who do not have any land or lost it for land acquisition. They can be organized in functional groups for taking part in preventive maintenance of the embankments in specified reach (approximately 0.5 ha) where they are allowed to settle on the toe of the embankment. The maintenance activities include small earthworks, new plantation, re-plantation or enrichment in planting and maintenance of vegetation cover. ESs may be engaged in embankment maintenance activities through a contract agreement for certain period.

Embankment Maintenance Group (EMG)

EMGs are the groups formed from the destitute women (maximum 10 members per group) selected from landless families, who are responsible for carrying out preventive earthwork maintenance of a specified reach of embankment including grass turfs lying. They are the paid laborers on daily basis payment.

Canal Maintenance Group (CMG)

CMGs are the groups consisting of 10 members selected from landless people and destitute women. Under this concept, they will be responsible for preventive maintenance of canals capacity improvement inside the polder and outfall drains. Activities of CMG include the 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 volumes of actual works done.

Landless Contracting Society (LCS)

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

4.8 Operation and Maintenance Plan

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. Most of the polders were constructed in the pre-liberation period i.e during the decades of sixties and early seventies. Over and above the polders have been playing vital roles 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 cater to the diverse needs of the local people. Changes in the land use pattern also have created water management conflicts and newer dimension needs asking the structures to allow flows of water both ways. So, maintenance of the polder system with embankments and structural elements built over there has become a permanently important task.

The Coastal Embankment Improvement Program (CEIP) is one of the latest such interventions 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.

The most relevant to the current assignment i.e "Guidelines for O&M Planning and Budgeting, August 2001; CERP-II" has been consulted very carefully to prepare the O&M plan for CEIP. Moreover, all the pros and cons of polders' O&M issues with BWDB's field staffs and local stakeholders have been considered for preparation of polder O&M planning. A brief description of O&M is given below.

4.8.1 Operational Plan

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. The activities given below have been recommended for the operation plan of Polder 35/3.

Regulation of Gates

During pre-monsoon period, the vertical lifting gates of each regulator should remain closed for retention of water for irrigating Aus rice (group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season) crops by LLPs (Low lift pumps). During monsoon (*July to September)*, the vertical lifting gates should normally remain closed; but may be opened to regulate the water levels inside the polder and it 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) as soon as 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.

During post monsoon season (*October to November*), the vertical lifting 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 have enough consultation with the beneficiaries' organizations because agricultural practices, crop varieties; and cropping pattern are changing with time. 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 Surveillance of Embankments

This is a typical monitoring activity to be carried out by the BWDB O&M staff. 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.

Recommendations for the frequency of field inspections and reporting of the physical condition of canals and embankments with its associated structures and protective works by BWDB's O&M field staffs have been made quite in details in the relevant SRP reports and findings.

Regular Checking of Structures

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. The functional groups under WMGs in the polders will assist the O&M Sectional Office of BWDB to identify and report the damages for rectification.

Condition (of embankment and structures) Survey and Engineering survey

The survey data obtained by the O&M field staff 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

Preventive maintenance works are done by community-based functional groups (e.g EMGs, SMGs, and CMGs) as and when required round the year. The works are most simple, cheaper 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.

A good planning for operation of structures is very essential to avoid social conflict. In this situation, during the cropping season, monthly, weekly or daily operational adjustments will be required. Routine monitoring of water management and hydrological conditions will supply data which together with the water management plan will dictate the needs of adjusting the operational measures.

Participation of beneficiaries vis-à-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.

4.8.2 Maintenance Works

Maintenance of embankments and structures is the most important item of acti.vities 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-today tasks schedule and needs continuous efforts, maintenance of coastal polders put emphasis on simple and cost effective community-based interventions.

In the coastal Polder 35/3, the works which directly serve water management should be regularly maintained.

Preventive or Routine Maintenance

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

- All activities related to vegetative covers on embankment i.e. new (or re-) planting; enrichment planting; 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.

Periodic Maintenance

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.

- Minor Periodic Maintenance Works include:
- Minor earth works on the embankments by LCSs, i.e., shaping and minor 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 of rubber seals; and
- Re-excavation of khals (costs< Tk.2.0 lacs/km) and removal of earthen cross dams by LCSs and / or PICs;
- Major Periodic Maintenance Works include:
- 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;
- Re-excavation of Khals (costs > 2.0 lacs/km) by LCSs / PICs.

Under CEIP, the total allocated maintenance cost including preventive and periodic have been estimated as Tk. 393 lacs (O &M report, CEIP 2012).

Emergency Maintenance

Emergency works cover unforeseen interventions which require immediate actions to protect the polder as a whole or a part thereof from the adverse effects of flooding or uncontrolled saline intrusion associated with damage of lives and properties. This type of work requiring immediate attention includes the closing of an embankment breach, the repair and replacement of flap gates, or the construction of cross dams over canals if structure fails. The estimated emergency maintenance amount is at Tk. 250.00 lacs (O & M report, CEIP 2012). The budget items do not cover unforeseen works as a result of major calamities like cyclones or tidal surges. Other sources of funding viz. donor assisted emergency programs should also be explored.

4.9 Need of Resettlement Action Plan (RAP)

Any development project that requires land acquisition may entail some impacts on people or commercial units and may bring about the changes in the patterns of use of land or other natural resources. For this reason resettlement program addresses loss of affected people or commercial units for statutory compensation payment to the affected units. In this respect, Resettlement Plan must be prepared to ensure that the affected people or commercial units receive fair and adequate compensation and rehabilitation if needed. It is noted that the Resettlement Action Plan (RAP) study is conducted by another sub-consultant of CEIP-I for the Polder 35/3 project.

4.10 No Objection Certificate

The polder 35/3 is located in the southern hydrological zone in Bagerhat Sadar and Rampal upazilas of Bagerhat District. The name of the unions in the polder is: a) Malliker Ber under Rampal upazila b) Dema and c) Karapare under Bagerhat Sadar Upazila. There is no archeological site or any cultural heritage in the polder area that might affect the normal activities of the polder after rehabilitation. No Objection Certificates (NOC) from the Chairmen of the Union Parishads are attached herewith (**Annex B**), which are necessary for Environmental Clearance from DoE.

5. Analysis of Project Alternatives

This chapter presents an analysis of several alternatives considered in the Project feasibility and design phase, including the 'no project' alternative. Furthermore, environmental and social considerations of these alternatives are also discussed in the chapter.

5.1 'No Project' Alternative

A 'no-project' alternative analysis has been made to draw a clear picture of the existing situation of the Polder and to provide an understanding of the need of the proposed interventions under CEIP-I. At the moment, Polder 35/3 is extremely vulnerable to natural hazards such as cyclones, storm surges, wave action, and climate change effects, as described in Section 1.1 of the present EIA. The Polder is not in a state to provide required services particularly protection against tidal inundation, provide efficient drainage, and minimizing the impact of cyclonic surges. Roughly 15-20 percent of the entire Polder area is vulnerable to salinity intrusion and water logging. The silted water channels are resulting into limited navigation in the waterways, declining fisheries, and increasing environmental pollution and thus deteriorating aquatic environment.

The interventions proposed in Polder 35/3 under CEIP-I are planned to eliminate the aforementioned problems. To highlight the present state of different aspects of the Polder and to help understand the significance of the proposed interventions under the Project, the 'no project' and 'with project' scenarios are compared in **Table 5.1** below.

Table 5-1: Comparison of 'No Project' and 'With Project' Scenarios

Proposed Works under CEIP-I	'No Project' Scenario	'With Project' Scenario
Increasing the height (re-sectioning) of embankments (35 km)	The embankments will further deteriorate at a number of locations and will drop below design level. As a result, rise in surge heights due to global warming, hazards and tidal actions will inundate the Polder, causing severe damage to the lives and property of local people.	Higher and wide embankments would be more effective and resilient, and will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Loss of lives and assets caused by the natural disasters will be reduced.
	Because of submergence of the embankments during monsoon, transportation system would further deteriorate inside the Polder, and sufferings of local people would further increase.	Higher and wider embankments will provide enhanced protection to Polder, facilitating transportation within the Polder even during monsoon.
	Reduction of agricultural area, crisis situation would be generated for farmers from January to April (salinity intrusion) and May to August (flooding).	Higher and wider embankments will provide better protection to Polder, facilitating agriculture activities and increased area for cultivation, thus increasing agriculture output.

Proposed Works under CEIP-I	'No Project' Scenario	'With Project' Scenario
	Continued silt deposition inside the Polder due to cyclonic surges and floods would increase and cause water logging, drainage congestion and other associated problems.	Decreased silt deposition in the Polder will result into improved drainage and navigation in internal lakes/khals, increased usage of surface water for irrigation, and reduced water logging problem.
	Local farmers and labor will remain financially stressed. Livelihood opportunities would be limited, and local people will migrate outside the Polder for employment.	Enhanced agricultural activity will increase the demand for farm workers. Local people can engage themselves in the construction works inside the Polder. Improve earnings of local people during the construction phase.
Retirement/re-location of embankment (5.05 km)	Embankments will remain more vulnerable to wave action of river, Polder area will be more prone to inundation, and agricultural loss will increase due to salinity intrusion.	Retirement/relocation of embankments will result into enhanced protection against floods and wave action, decreased salinity intrusion, and increased agricultural productivity.
	Further damage to the non-retired portion of embankments, further deterioration of the transportation system	Retirement/relocation of embankments will facilitate transportation within the Polder throughout the year.
	Continued silt deposition inside the Polder due to cyclonic surges and tidal floods would increase and cause water logging, drainage congestion and other associated water management problems.	Decreased silt deposition in the Polder will result into improved drainage and navigation situation in internal lakes/khals, increased usage of surface water for irrigation, and reduced water logging problem.
Bank revetment (1.7 km)	River bank erosion would further deteriorate the embankments and land resources would be damaged/ lost.	Bank revetment will provide enhanced protection against erosion by wave action, storm surges and currents, and will result into preservation of Polder and its land/agriculture resources.
	Further subsidence of the embankments and further damage to transportation routes.	The bank revetment will protect the embankments and facilitate transportation within the Polder.
Slope protection (0.9 km)	Continued weakening of embankments; continuous subsidence of embankments due to traffic load and wave action; land resources would continue to be	Slope protection works will strengthen the embankments and protect them against subsidence, wave action, and wear and tear.

Proposed Works under CEIP-I	'No Project' Scenario	'With Project' Scenario
	damaged/ lost.	
Replacement of drainage sluices with drainage-cum-flushing sluices.	Continued use of the existing drainage sluices for both flushing and drainage would cause further damage to these structures. As a result, water logging and drainage congestion would be increased due to malfunctioning of the sluices. (Currently 15-20 % of the total area is facing water logging and this is likely to further increase in future).	Drainage-cum-flushing sluices will be more efficient and dry season rice cropping practice will be possible as sweet water can be stored and used later in the dry season for irrigation.
Replacement of the existing flushing sluices	No dry season agriculture practice will be possible. Shrimp culture during January to May, as sweet water cannot be used in the periods of low rainfall.	Replaced flushing sluices will facilitate better agriculture practices, increased dry season rice cropping, and reduced shrimp culture - thus benefiting the poor farmers.
Construction of new flushing sluices	Cultivable lands and irrigable lands will further decrease in future.	New flushing sluices will facilitate increased availability of surface water, better control on irrigation during periods of low rainfall and increased agricultural production.
Afforestation (26 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.
Re excavation of Drainage Channels (23.5 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.

5.2 Site Selection Alternatives

Since CEIP-I is a rehabilitation project, no site alternatives could to be considered. However, a comprehensive multi-criteria analysis was carried out to prioritize the polder for rehabilitation under CEIP-I. The analysis results are presented in **Table 5.2**.

Table 5-2: Results of Multi-criteria Analysis to Prioritize Polder Rehabilitation

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
1	63/1A	SD, ID, MD	Anowara	7500	48	7	11	17	6	10	6	HRZ	15	0	0	MV	15	117	5		0	59	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is partly damaged due to erosion
2	35/3	ID	Bagerhat	6790	40	9	14	8	3	8	5	MRZ	10	0	0	MV	15	89	10		0	57	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
3	32	MD	Dacope	8097	50	3	4	5	2	25	15	HRZ	15	1215	1	MV	15	108	5		0	57	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
4	59/3C	SD, MD	Companigonj	16200	42	8	13	-	0	5	3	MRZ	10	0	0	MV	15	115	5		0	46	Breach caused by the cyclonic surge and wave action.
5	48	SD, ID	Kalapara	5400	38	-	0	3	1.125	7	4	HRZ	15	0	0	MV	15	112.19	5		0	40	Severe damage of embankment due to wave action
6	14/1	ID	Koyara	2933	25	5	9	14	5	-	0	LRZ	5	450	0	MV	15	88	10		0	44	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
7	47/5	SD, ID, MD	Kalapara	7500	33	2	3	7	3	5	3	HRZ	15	0	0	MV	15	103.61	10		0	49	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
8	46	SD, ID	Kalapara	4697	40	5	7	3	1	-	0	HRZ	15	0	0	MDV	10	124.24	5		0	38	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
9	15	ID	Shymnagar	3441	27	3	5	22	8	-	0	LRZ	5	516	0	MV	15	68	15		0	48	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
10	64/2B	SD, ID, MD	Chakoria	7736	96	5	7.167	15.500	6	-	0	HRZ	15	0	0	MV	15	163	5		0	48	The embankment section is partly damaged due to erosion & wave action.
11	71	SD	Kutubdia	5116	40	0	0	20	8	-	0	HRZ	15	0	0	MV	15	72	10		0	48	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
12	47/1	SD, ID	Kalapara	2478	22	4	6.371	-	0	2	1	HRZ	15	0	0	MV	15	71	10		0	48	Breach caused by the cyclonic surge and wave action during SIDR & AILA
13	42	SD, ID, MD	Barguna Sadar	2794	28	-	0	3	1.125	2	1	LRZ	5	0	0	MV	15	80	10		0	32	Embankment damaged and erosion cost due to wave action.
14	41/6B	ID, MD	Barguna Sadar	7280	44	2	2.389	6	2.250	5	3	LRZ	5	0	0	MV	15	74	10		0	37	Embankment damaged and erosion cost due to wave action.
15	41/5	SD, ID, MD	Barguna Sadar	3880	50	4	6	3	1	1	1	HRZ	15	0	0	MV	15	104	10		0	47	Breach caused by the cyclonic surge(SIDR & AILA) and wave action. The embankment section is partly damaged due to erosion
16	65	ID	Chakaria	6649	48	-	0	16	6	2	1	HRZ	15	0	0	MV	15	119	5		0	42	The embankment section is partly damaged due to erosion
17	58/1	SD, ID	Manpura	4200	32	1	1	2	1	-	0	HRZ	15	630	1	MV	15	58	15		0	47	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
18	69/NE	ID	Moheshkhali	2226	16	2	4	8	3	-	0	HRZ	15	0	0	MDV	10	36	15		0	47	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
19	66/2	ID	Cox's Bazar & Ramu	2621	20	-	0	5	2	-	0	HRZ	15	0	0	MV	15	43	15		0	47	The embankment section is partly damaged due to erosion
20	66/4	ID	Chakaria	3324	24	9	15	5	2		0	HRZ	15	0	0	MDV	10	53	15		0	57	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
21	65/A	ID	Chakoria	806	9	-	0	5	2	-	0	HRZ	15	0	0	MV	15	18	15		0	47	The embankment section is partly damaged due to erosion
22	66/1	SD, ID, MD	Cox's Bazar	4930	20	1	1	1	0	1	1	HRZ	15	0	0	MV	15	61	15		0	47	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
23	62	SD	Bandar, Patenga & Pahartali	5600	22	-	0	5	2	-	0	HRZ	15	0	0	MV	15	59	15		0	47	The embankment section is partly damaged due to erosion
24	41/7	ID, MD	Mirzaganj	6984	51	6	10	1.50	0	3	2	LRZ	5	0	0	MV	15	84	10		0	41	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
25	56/57	ID	Bhola Sadar, Borhanuddin, Charfassion, Daulatkhan	123800	250	5	7	15	6	15	9	HRZ	15	5571	5	MV	15	534	-10		0	46	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is partly damaged due to erosion
26	33	ID	Dacope	8100	52	3	4	10	4	12	7	HRZ	15	1215	1	MV	15	128	5		0	51	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
27	65/A1	ID	Chakaria	2800	20	-	0	2	1	0	0	HRZ	15	0	0	MV	15	40	15		0	46	The embankment section is partly damaged due to erosion
28	58/3	SD	Manpura, Sudaram	1308	17	-	0	7	3	5	3	HRZ	15	0	0	MDV	10	31	15		0	46	The embankment section is partly damaged due to erosion
29	58/2	SD	Manpura	4312	28	-	0	7	2	4	2	HRZ	15	647	1	MV	15	50	15		0	50	The embankment section is partly damaged due to erosion
30	64/1C	SD, ID	Bashkhali	2151	23	1	1.115	11	4.031	-	0	HRZ	15	0	0	MDV	10	53	15		0	45	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
31	63/1B	ID, MD	Anowara	7300	21	-	0	-	0	-	0	MRZ	10	0	0	MV	15	36	15		0	40	-
32	72	SD, MD	Swandip	22700	58	9	15	-	0	-	0	HRZ	15	0	0	MDV	10	192	5		0	45	Breach caused by the cyclonic surge(SIDR) and wave action
33	17/1	ID	Dumuria	5020	45	-	0	37	14	-	0	LRZ	5	753	1	MV	15	88	10		0	44	The embankment section is partly damaged due to erosion
34	7/1	ID	Assasuni, Shamnagar	3110	34	1	1	18	7	-	0	LRZ	5	467	0	MV	15	81	10		0	38	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is partly damaged due to erosion
35	55/3	SD, ID	Galachipa, Charfassion	9845	56	-	0	-	0	5	3	HRZ	15	0	0	MV	15	236	-10		0	23	-
36	55/2D	SD, MD	Patuakhali, Dashmia	8540												MV		99					
37	55/2E	MD, ID	Patuakhali,	10535												MV		123					

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
			Dashmina, Bouphol																				
38	67/B	ID	Teknaf	900	8	-	0	7	3	-	0	MRZ	10	0	0	MDV	10	26	15	Naf River	5	43	The embankment section is partly damaged due to erosion
39	69/P1	SD	Moheshkhali	1800	13	1	1	5	2	-	0	HRZ	15	0	0	MDV	10	96	10		0	38	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
40	64/1B	ID, MD	Bashkhali	8000	53	5	7.167	-	0	-	0	HRZ	15	0	0	MDV	10	144	5		0	37	Breach caused by the cyclonic surge(SIDR & AILA) and wave action.
41	61/1	SD	Sitakunda	8769	27	1	2.150	-	0	-	0	HRZ	15	0	0	MDV	10	107	5		0	32	Breach caused by the cyclonic surge(SIDR & AILA) and wave action
42	67/A	MD	Teknaf & Ukhiya	1500	13	0	0	5	2	-	0	MRZ	10	0	0	MDV	10	48	15	Naf River	5	42	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
43	70	SD, ID, MD	Moheshkhali	3025	32	-	0	5	2	-	0	HRZ	15	0	0	MDV	10	122	5		0	32	The embankment section is partly damaged due to erosion
44	67	ID	Teknaf	2000	13	-	0	5	2	-	0	MRZ	10	0	0	MDV	10	46	15	Naf River	5	42	The embankment section is partly damaged due to erosion
45	65/A3	ID	Chakaria	604	10	0	0	-	0	1	1	HRZ	15	0	0	MDV	10	26	15		0	41	Breach caused by the cyclonic surge and wave action
46	59/2	ID	Ramgati	21255	82	6	9	4	1	1	1	MRZ	10	0	0	MV	15	190	5		0	41	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
47	3	ID	Debhata, Kaliganj	22267	64	1	1	1	0	2	1	LRZ	5	3340	3	MV	15	155	5	Issamoti River	10	40	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
48	41/1	SD, MD	Barguna Sadar	4048	34	-	0	-	0	1	0	MRZ	10	0	0	MV	15	83	10		0	35	-
49	36/1	ID	Bagerhat, Chitalmari, Fakirhat, Morelgonj, Rupsa	40343	95	0	0	40	15	-	0	LRZ	5	6051	5	MDV	10	190	5		0	40	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
50	47/2	ID, MD	Kalapara	2065	17	-	0	-	0	1	0	HRZ	15	0	0	MDV	10	39	15		0	40	-
51	47/4	SD, ID, MD	Kalapara	6600	57	0	0	-	0	-	0	HRZ	15	0	0	MV	15	150	5		0	35	Breach caused by the cyclonic surge(SIDR) and wave action
52	40/1	SD, ID, MD	Pathargatha	2105	23	-	0	-	0	-	0	MRZ	10	0	0	MV	15	91	10		0	35	-
53	40/2	SD, ID, MD	Pathargatha	4453	36	-	0	-	0	-	0	MRZ	10	0	0	MV	15	85	10		0	35	-
54	45	SD, ID	Amtali	4089	27	-	0	-	0	-	0	MRZ	10	0	0	MV	15	96	10		0	35	-
55	23	ID	Paikgacha	5910	37	1	2	19	7	-	0	LRZ	5	887	1	MDV	10	123	5		0	30	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
56	66/3	SD, ID, MD	Cox's Bazar	4832	52	-	0	11	4	-	0	HRZ	15	0	0	MDV	10	133	5		0	34	The embankment section is partly damaged due to erosion
57	55/1	SD, ID	Galachipa	10325	46	1	1	0	0	5	3	LRZ	5	0	0	MV	15	145	5		0	29	Breach caused by the cyclonic surge and wave action. The

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
																							embankment section is partly damaged due to erosion
58	55/2B	ID, MD	Galachipa	2600	30	2	2	1	0	2	1	LRZ	5	0	0	MV	15	81	10		0	34	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is partly damaged due to erosion
59	29	ID	Batiaghata, Dumuria	8218	49	2	3	13	5	-	0	LRZ	5	1233	1	MV	15	102	10		0	39	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
60	16	ID	Paikgacha, Tala	10445	45	1	2	25	9	-	0	LRZ	5	1567	1	MDV	10	108	5		0	33	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
61	68	SD, ID	Teknaf	3500	27	0	0	5	2	-	0	MRZ	10	0	0	MDV	10	95	10		0	32	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
62	64/1A	SD, ID	Bashkhali	5750	58	1	0.796	2	0.750	-	0	HRZ	15	0	0	MV	15	137	5		0	37	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
63	43/1A	ID, MD	Amtali	2675	27	0	1	-	0	2	1	MRZ	10	0	0	MDV	10	51	15		0	37	Breach caused by the cyclonic surge (SIDR) and wave action. Breach closed by constructing ring bundh
64	43/2C	SD, ID, MD	Galachipa	2753	26	1	1	-	0	1	1	LRZ	5	0	0	MV	15	54	15		0	36	Breach caused by the cyclonic surge (SIDR) and wave action
65	34/3	ID	Bagerhat	3656	17	-	0	17	6	-	0	LRZ	5	0	0	MDV	10	55	15		0	36	The embankment section is partly damaged due to erosion
66	43/2A	ID, MD	Patuakhali	5182	39	2.00	0	-	0	2	1	LRZ	5	0	0	MV	15	73	10		0	31	Breach caused by the cyclonic surge(SIDR & AILA) and wave action
67	73/1 (A & B)	SD, ID, MD	Hatiya	21377	80	4	6	28	11	-	0	HRZ	15	0	0	MV	15	219	-10		0	36	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
68	17/2	ID	Dumuria	3400	11	-	0	-	0	-	0	LRZ	5	510	0	MV	15	28	15		0	35	-
69	43/1	SD, ID, MD	Amtali	10600	65	1.50	0	1	0	-	0	MRZ	10	0	0	MV	15	128	5		0	30	Breach caused by the cyclonic surge(SIDR & AILA) and wave action The embankment section is partly damaged due to erosion
70	28/2	ID	Batiaghata	2590	20	-	0	-	0	-	0	LRZ	5	389	0	MV	15	48	15		0	35	-
71	35/3	SD, ID	Sharankhola	13058	63	2	2	21	8	-	0	HRZ	15	0	0	MV	15	126	5		0	45	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
72	61/2	SD	Mirsharai	19855	10	0	0	-	0	-	0	MRZ	10	0	0	MDV	10	54	15		0	35	Breach caused by the cyclonic surge and wave action
73	73/2	SD, MD	Hatiya	11134	48	-	0	0	0	-	0	HRZ	15	0	0	MDV	10	214	-10		0	15	The embankment section is partly damaged due to erosion
74	39/1A	SD, MD	Pathargatha	11740	58	-	0	-	0	-	0	MRZ	10	0	0	MV	15	123	5		0	30	-
75	39/2C	SD, MD	Matbaria	10748	55	-	0	-	0	-	0	LRZ	5	0	0	MV	15	122	15		0	35	-
76	41/4	SD, ID, MD	Barguna Sadar	1741	19	-	0	-	0	-	0	LRZ	5	0	0	MV	15	46	15		0	35	-
77	44	SD, ID	Amta!i,	17530	82	-	0	-	0	-	0	HRZ	15	0	0	MV	15	174	5		0	35	-

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			Kalapara																				
78	47/3	ID, MD	Kalapara	2025	20	-	0	-	0	-	0	HRZ	15	0	0	LV	5	42	15		0	35	-
79	52/53A	SD, ID, MD	Galachipa	3663	25	-	0	-	0	-	0	LRZ	5	0	0	MV	15	76	10		0	30	-
80	60	ID	Sonagazi	9150	38	-	0	-	0	-	0	MRZ	10	0	0	MDV	10	63	15		0	35	-
81	64/2A	ID, MD	Chakoria	3750	34	-	0	-	0	-	0	HRZ	15	0	0	LV	5	34	15		0	35	-
82	31	MD	Dacope	7288	47	-	0	4	2	4	2	LRZ	5	1093	1	MV	15	126	5		0	29	The embankment section is partly damaged due to erosion
83	13-14/2	ID	Koyara	17854	93	0	0	17	6	-	0	LRZ	5	2678	2	MV	15	156	5		0	34	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
84	31/Part	MD	Batiaghata	4848	29	-	0	9	3	-	0	LRZ	5	727	1	MDV	10	86	10		0	29	The embankment section is partly damaged due to erosion
85	22	MD	Paikgacha	1630	20	-	0	10	4	-	0	LRZ	5	245	0	MDV	10	50	15		0	34	The embankment section is partly damaged due to erosion
86	06-08 (Ext)	ID	Satkhira, Kalarua	8330	9	-	0	8	3	-	0	LRZ	5	1250	1	MDV	10	26	15		0	34	The embankment section is partly damaged due to erosion
87	18-19	ID	Paikgacha	3380	32	-	0	9	3	-	0	LRZ	5	507	0	MDV	10	76	10		0	29	The embankment section is partly damaged due to erosion
88	43/2E	ID, MD	Patuakhali	1650	20	-	0	-	0	6	4	LRZ	5	0	0	MDV	10	89	10		0	29	-
89	34/1	ID	Bagerhat	2212	10	-	0	8	3	-	0	LRZ	5	332	0	MDV	10	28	15		0	33	The embankment section is partly damaged due to erosion
90	9	ID	Paikgacha.	1255	8	-	0	6	2	-	0	LRZ	5	188	0	MDV	10	28	15		0	32	The embankment section is partly damaged due to erosion
91	39/2A	ID, MD	Bamna	5080	32	-	0	-	0	4	2	LRZ	5	0	0	MDV	10	88	10		0	27	-
92	55/4	SD	Galachipa	5142	33	-	0	-	0	4	2	LRZ	5	0	0	MDV	10	136	5		0	22	-
93	21	MD	Paikgacha	1417	17	-	0	5	2	-	0	LRZ	5	213	0	MDV	10	37	15		0	32	The embankment section is partly damaged due to erosion
94	20, 20/1	MD	Paikgacha	1600	23	-	0	5	2	-	0	LRZ	10	240	0	MDV	20	59	30		0	93	The embankment section is partly damaged due to erosion
95	4	ID	Assasuni	10500	80	2	2	21	8	-	0	LRZ	5	1575	1	MDV	10	153	5		0	32	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
96	1	ID	Assasuni, Debhata & Satkhira	28381	96	1	1	1	0	3	2	LRZ	5	4257	3	MV	15	171	5		0	31	Lowest Pocket Silted Up. Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
97	Kumiriya to Sonaichari Flood Control Project	SD	Sitakunda	1610	5	0	0.557	-	0	-	0	HRZ	15	0	0	MV	15	8	15		0	46	Breach caused by the cyclonic surge(SIDR & AILA) and wave action
98	41/2	SD, ID, MD	Barguna Sadar	3644	39	-	0	-	0	1	0	LRZ	5	0	0	MDV	10	118	5		0	20	-
99	43/2F	ID, MD	Amtali	4453	32	-	0	-	0	-	0	MRZ	10	0	0	LV	5	53	15		0	30	-

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100	7/2	ID	Assasuni.	10486	60	1	2	18	7	-	0	LRZ	5	1573	1	MDV	10	116	5		0	30	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
101	24	ID	Abhaynagar, Dumuria, Keshobpur, Manarampur	28340	26	-	0	-	0	-	0	LRZ	5	4251	3	LV	5	61	15		0	28	-
102	06-08	ID	Assasuni, Satkhira, Tala	18450	53	1	2	10	4	-	0	LRZ	5	2768	2	MDV	10	128	5		0	28	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
103	55/2C	ID, MD	Galachipa	6275	48	-	0	-	0	3	2	LRZ	5	0	0	MDV	10	73	10		0	27	-
104	26	ID	Dumuria	2696	29	-	0	2	1	-	0	LRZ	5	404	0	LV	5	66	15		0	26	The embankment section is partly damaged due to erosion
105	28/1	ID	Dumuria	5600	23	-	0	-	0	-	0	LRZ	5	840	1	LV	5	65	15		0	26	-
106	2	ID	Assasuni, Satkhira	11296	64	0	1	10	4	-	0	LRZ	5	1694	1	MDV	10	129	5		0	26	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
107	10-12	ID	Koyara, Paikgacha	16315	67	2	2	3	1	-	0	LRZ	5	2447	2	MDV	10	119	5		0	25	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
108	27/1, 27/2	ID	Dumuria	4260	45	-	0	-	0	-	0	LRZ	5	713	1	LV	10	109	30		0	86	-
109	41/3	ID, MD	Barguna Sadar	1053	20	-	0	-	0	-	0	LRZ	5	0	0	LV	5	43	15		0	25	-
110	41/6A	SD, MD	Barguna Sadar	3850	33	-	0	-	0	-	0	LRZ	5	0	0	LV	5	49	15		0	25	-
111	41/7A	ID, MD	Betagi	6220	39	-	0	-	0	-	0	LRZ	5	0	0	LV	5	51	15		0	25	-
112	43/2B	ID, MD	Galachipa, Amtai, Patuakhali	5460	42	-	0	-	0	-	0	MRZ	10	0	0	LV		49	15		0	25	-
113	43/2D	ID, MD	Patuakhali	6500	43	-	0	-	0	-	0	LRZ	5	0	0	LV	5	50	15		0	25	-
114	52/53B	SD, ID, MD	Galachipa	4064	34	-	0	-	0	-	0	LRZ	5	0	0	LV	5	96	10		0	20	-
115	55/2A	ID, MD	Patuakhali, Galachipa, Amtoli	7166	43	-	0	-	0	-	0	LRZ	5	0	0	LV	5	80	10		0	20	-
116	59/1A	ID	Companiganj,	15506	36	-	0	-	0	-	0	LRZ	5	0	0	LV	5	98	10		0	20	-
117	5	ID, MD	Kaliganj, Shymnagar	55061	192	2	3	12	5	-	0	LRZ	5	8259	7	MV	15	272	-10		0	24	Lowest Pocket Silted Up Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
118	25	ID	Dumuria Fultala	17400	46	-	0	-	0	-	0	LRZ	5	2610	2	LV	5	83	10		0	22	-
119	30	MD	Batiaghata	6396	40	-	0	-	0	-	0	LRZ	5	959	1	LV	5	110	5		0	16	-

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120	59/1B	ID	Sudharam, Laxipur	18218	40	-	0	-	0	-	0	LRZ	5	0	0	LV	5	156	5		0	15	-
121	59/3B	SD, ID, MD	Shudharam	31376	63	-	0	-	0	-	0	MRZ	10	0	0	LV	5	182	5		0	20	-
122	39/1B		Matbaria	13100	63	-	1	-				LRZ	5		0			138	5		0	11	-
123	41/7B		Betagi	6150		-		-				LRZ	5		0			58	15		2	22	-
124	Bibichini		Betagi	4600		-		-				LRZ	5		0			33	15		3	23	-
125	43/1B		Kalapara	3000		-		-				HRZ	15		0			63	15		4	34	-
126	CDSP-II		Sonagazi	1981		-		-				HRZ	15		0			35	15		5	35	-
127	Dumki Laukathi		Patukhali	18550		-		-				LRZ	5		0			61	15		6	26	-
128	Itbaria Labukhali		Patukhali	9650		-		-				LRZ	5		0			53	15		7	27	-
129	Mirzagonj Rampura		Mirzagonj, Patuakhali	16500		-		-				LRZ	5		0			69	15		8	28	-
130	50/51		Galachipa	6935		-		-				HRZ	15		0			138	5		9	29	-
131	54		Kalapara, Amtoli, Galachipa	13954		-		-				HRZ	15		0			174	5		10	30	-
132	Satla Bagda-1		Agailjhara, Wazirpur			-		-				LRZ	5		0			59	15		11	31	-
133	Satla Bagda-2		Uzirpur, Agailjhara			-		-				LRZ	5		0			196	5		12	22	-
134	Satla Bagda-3		Uzirpur, Agailjhara			-		-				LRZ	5		0			25	15		13	33	-
135	59/2 Ext.		Ramgati	4000		-		-				HRZ	15		0			52	15		14	44	-
136	Boychar		Hatiya			-		-				HRZ	15		0			159	5		15	35	-
137	Char Bagardona-1		Subornachar	1350		-		-				HRZ	15		0			24	15		16	46	-
138	Char Bagardona-2		Subornachar	1200		-		-				HRZ	15		0			21	15		16	46	-
139	Char Mojid		Subornachar	850		-		-				HRZ	15		0			15	15		16	46	-

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
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 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.																						

5.3 Technical Alternatives

After identifying the problems of the Polder and its inhabitants, a number of alternatives were considered to address these issues. These alternatives pertained to strengthening the Polder embankment, protection of river banks, protection of embankment slope, improving the sluices and their performance, and reducing drainage congestion and water logging. These technical alternatives are discussed in **Table 5.3** below.

Table 5-3: Technical Alternatives for Polder 35/3

Proposed Interventions	Alternative Options	Consequence
Strengthening of the embankment	No change in alignment and no re-sectioning/repairing of the existing embankment	The present vulnerable situation of the embankment and thus the entire polder would continue (similar to the 'no project' scenario discussed in earlier).
	Retirement/relocation of the existing embankment, as and where required	Partial achievements of the Project objectives. NO protection against storm surges and sea water rise.
	Backing/minor inward shifting of embankment with slope protection	Same as above.
	Re-sectioning of existing embankment with new design heights (selected option).	Higher and wide embankments would be more effective and resilient, and will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, reduction in loss of lives and assets caused by the natural disasters.
River bank protection works	No change in the existing embankment	River bank erosion would further deteriorate the embankments and land resources would be damaged/lost (similar to the 'no project' scenario discussed in earlier).
	Retirement of embankment	Partial achievements of the Project objectives; decrease in Polder area; and continued erosion of the river bank.
	Bank Revetment (selected option)	Bank revetment will provide enhanced protection against erosion by wave action, storm surges and currents, and will result into preservation of Polder and its land/agriculture resources.

Proposed Interventions	Alternative Options	Consequence
Protection of embankment slope (against wave action)	No change in the existing embankment	Continued weakening of embankments; continuous subsidence of embankments due to traffic load and wave action; land resources would continue to be damaged/ lost (similar to the 'no project' scenario discussed in earlier).
	Slope Protection (selected option)	Slope protection works will strengthen the embankments and protect them against subsidence, wave action, and wear and tear.
	Foreshore plantation (selected option)	Effects of cyclone surge, wave action and wind could be mitigated to some extent, reducing loss of lives and assets.
Replacement of drainage sluices	No change in the existing structures	Continued use of the existing drainage sluices for both flushing and drainage would cause further damage to these structures. As a result, water logging and drainage congestion would be increased due to malfunctioning of the sluices (similar to the 'no project' scenario discussed in earlier).
	Repairing of structures (possible where there is no need of re-sizing) (selected options for some structures)	For sluices which are beyond repair, this option would be similar to the 'no project' scenario described above.
	Replacement of existing Drainage Sluice with Drainage-cum-flushing sluice (selected option for some of the sluices depending upon need)	Drainage-cum-flushing sluices will be more efficient and dry season rice cropping practice will be possible as sweet water can be stored and used later in the dry season for irrigation.
	Regulators with provision for appropriate passages for fish and small boats.	In addition to the above advantages, the structures will facilitate fish migration and navigation across them. The cost of such structure is likely to be high.
Rehabilitation of flushing sluices	No change in the existing structure	No dry season agriculture practice will be possible. Shrimp culture during January to May, as sweet water cannot be used in the periods of low rainfall (similar to the 'no project' scenario discussed in earlier).
	Repair of the existing structures	For sluices which are beyond repair, this option would be similar to the 'no project' scenario described above.

Proposed Interventions	Alternative Options	Consequence
	Replacement of the existing Flushing Sluices (selected option)	Replaced flushing sluices will facilitate better agriculture practices, increased dry season rice cropping, and reduced shrimp culture - thus benefiting the poor farmers.
Constructing new water drainage structure	Not constructing any Flushing Sluices	Cultivable lands and irrigable lands will continue to decrease (similar to the 'no project' scenario discussed in earlier).
	Construction of drainage cum flushing (selected options in certain cases)	Drainage-cum-flushing sluices will be more efficient and dry season rice cropping practice will be possible as sweet water can be stored and used later in the dry season for irrigation.
	Construction of new Flushing Sluices (selected options in certain cases)	New flushing sluices will facilitate increased availability of surface water, better control on irrigation during periods of low rainfall and increased agricultural production.
Reducing water logging and drainage congestion	No action is taken.	Depth of water bodies would further decrease, and drainage congestion and water logging will further increase (similar to the 'no project' scenario discussed in earlier).
	Channel re-excavation	Depth of water bodies will increase, water logging and drainage congestion will decrease and fish habitats will increase.

5.3.1 Technical, Financial, Economic, Environmental, and Social Considerations of Selected Options

An attempt has been made to evaluate the technical, financial, economic, environmental, and social considerations of the selected options discussed above. This evaluation is presented in **Table 5.4** below.

Table 5-4: Technical, Economic, Environmental and Social Considerations

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
Re-sectioning, Retirement/ Relocation of existing 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.

<table>
<tr><th rowspan="2">Intervention</th><th colspan="4">Considerations</th></tr>
<tr><th>Technical</th><th>Financial/Economic</th><th>Environmental</th><th>Social</th></tr>
<tr><td rowspan="3"></td><td>protection to river bank erosion</td><td>Financial savings as the embankments will provide good road transportation routes.</td><td rowspan="3">Reduced traffic congestion inside the polder because of improved embankments, which will facilitate vehicular traffic</td><td>Reduction of loss of assets which would bring poverty reduction</td></tr>
<tr><td rowspan="2">Prevention of salinity intrusion in the polder</td><td>Improved earning of local people during construction</td><td rowspan="2">Improved cropping particularly for small farmers thus alleviating poverty.</td></tr>
<tr><td>Improved cropping pattern and boosting the local economy</td></tr>
<tr><td>Bank revetment, slope protection</td><td>Enhanced embankment protection against tidal wave action of rivers, provide erosion protection</td><td>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.</td><td>Improved embankment stability; reduced soil erosion; and provide good means of transportation</td><td>Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people.</td></tr>
<tr><td>Foreshore plantation</td><td>Enhanced embankment protection against tidal wave action of rivers, provide erosion protection</td><td>Financial savings from reduced damages caused by the floods and storms; 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.</td><td>Improved embankment stability; reduced soil erosion; enhanced soil quality; improved air quality; enhanced aesthetic value of the area.</td><td>Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people; income from timber and other plantation products.</td></tr>
</table>

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
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. Agricultural production will be boosted as dry season rice cropping would increase	Removal of inactive sluices would improve the drainage characteristics Water logging, drainage congestion would be reduced.	Better agriculture practice could be achieved which would improve cropping pattern, enhance local earnings, and reduce poverty.
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.

5.4 Alternatives during Construction

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

5.4.1 Material Storage

For project works in Polder 35/3, 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.

The storage site selected at this stage is located in the BWDB colony at Bagerhat, which is situated within the Polder. The required materials would be collected and transported from their respective sources to the Polder and then would be stored in the stock yard to be used during construction phase.

5.4.2 Material Sources

The sources from which the construction materials will be brought have been discussed below.

Soil for Embankments

For retirement, re-sectioning, and forwarding of embankments, about 1.18 million cubic meters of soil will be required. The following options are available for sourcing this material:

- Ample quantity of 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 will be a better option since it will minimize soil transportation needs, minimizing any additional traffic related to material transportation, having minimal negative impacts in the borrow areas since these areas will be silted-up within a few seasons, and having minimum environmental and social impacts related to excavation and transportation.
- Part of the required material can be obtained from the re-excavation of the water channel within the Polder, provided the quality of this material is technically acceptable. About 0.67 million cubic meters of earth will be obtained from re-excavation of channels during implementation of rehabilitation works inside the Polder. This option would 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 to 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 to the ones for the second option, though land degradation may take place in addition to air pollution and traffic congestion.
- If the soil from the riverside just outside the Polder embankment is not suitable, the material may be obtained from the river beds having required material quality. This option will entail higher cost of material transportation and other related environmental and social problems such as traffic congestion, air and water pollution.

At this stage, the final decision regarding the material source has not been finalized. This decision is likely to be taken during the construction phase.

Sand

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

- Sand could be procured from markets. This would entail consistent quality and assured supply, however it would also entail increased transportation cost and associated environmental and social impacts including traffic congestion 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 quality of this sand may not be consistent and this sand may need to be washed before its use.

At this stage, the final decision regarding the source of this material has not been finalized as well. This decision is likely to be taken during the construction phase.

5.4.3 Alternatives for Workforce Procurement

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

- Employing 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 bulk of the manpower from within the Polder and only bringing more skilled and technical manpower from outside. This option will entail reduced labor camp sizes, and decreased transportation needs and associated environmental and social problem. This option will also offer employment opportunities for the local community thus increasing their economic condition and also increasing the local ownership of the project. In view of these advantages, this is the preferred option for manpower sourcing.

5.4.4 Alternatives for Mode of Transportation

The major quantity of earth and other materials will be carried to the construction sites with the help of dump trucks, trolleys, other vehicles, and by manual labor. For construction purposes in the eastern and central regions of the Polder, the materials would be transported using trucks, smaller carts, non-motorized vans and other smaller vehicles. The trucks or other vehicles from outside the Polder will have to cross the Putimari river through bridges.

Construction materials required during construction in the north side (close to Putimari river) of the Polder may be transported through trucks. Materials needed in the south, east and west portion of the polder would be transported through water ways using barges, motorized boats, and other vessels. However, roadway transportation of trucks, smaller carts, non motorized vans are also possible for the eastern, southern and western parts of the polder.

Waterways

The Polder 35/3 is surrounded by Putimari river (North), Bhairab river (East), Katakhali khal (south), and Bishnu river (west). The Daratana river, Katakhali khal, and Bishnu river remain navigable throughout the year and can be used for transportation purposes during construction. However, the Putimari River is very shallow especially during the periods of low tides and hence water way transportation cannot be carried out using this route all the time.

For construction works in the east, west and south portion of the Polder, nearby rivers and khals can be used. The Bhairab River provides the most preferred waterway route. Materials can be carried through this river using large cargos or motorized boats due to its higher navigability. The Katakhali khal and Bishnu river should be used for construction works to be carried out in the south and west directions respectively. However, the Bishnu river is relatively shallow and is not suitable for transportation of large cargos where as the depth of Katakhali khal is suitable for such transportation. Therefore materials should be carried using relatively small motorized boats or trawlers through Bishnu River and large cargos are recommended for waterway transportation through the Katakhali khal.

The north periphery of the polder is surrounded by Putimari river, but the river is very shallow and is not at all suitable for waterway transportation of large cargos. Smal boats can be used for carrying out materials through this river if needed.

Roadways

The materials stored in the stock yard can be transported to the construction sites using several regional roads, district roads and rural roads. In case of transporting materials to the stock yard from Khulna or other suitable locations outside the polder, road ways are very much recommended. The Khulna-Pirojpur regional road and Malliker Ber–Bagerhat district road can be used. The regional road of Khulna-Pirojpur can be used for construction works to be carried out in the North-east periphery. However, for construction works to be carried out in the southern part, district road of Bagerhat to Bagerhat is recommended. In the western part, the district road from Dema to Khegraghat provides direct access. All the roads discussed above are of good quality for transportation of larger vehicles. There are a number of rural roads inside the polder. However, the quality and widths of these roads are not good enough for transportation of larger vehicles. The Engineer in Charge has to prioritize the routes to be used for transportation during the construction phase.

6. Environmental and Social Baseline

This chapter describes the existing environmental and social conditions in respect of water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic aspects of the Project area (the definition of Project area is given in Article 2.2.1).

6.1 Land Resources

6.1.1 Topography

Polder 35/3 is located in the southwest region of Bangladesh near Bagherhat Sadar upazila. Topographically, the sloping pattern of the polder area is mild from north to south and developed by the delta development process. Before construction of the polder, the low lying area of the polder was inundated by tidal flooding and more vulnerable due to storm surge. The area of the polder is criss crossed by many khals. The total area is basically mild slope and north portion of land is higher than the south. However, the contour map shows that the high lands are situated on the banks of the river and khals. In the polder area, the elevation of the settlement and agriculture land is in between 1.50 m to 2.15m, 0.90 m to 1.05 m respectively. **Figure 6.1** shows the topography of the Polder.

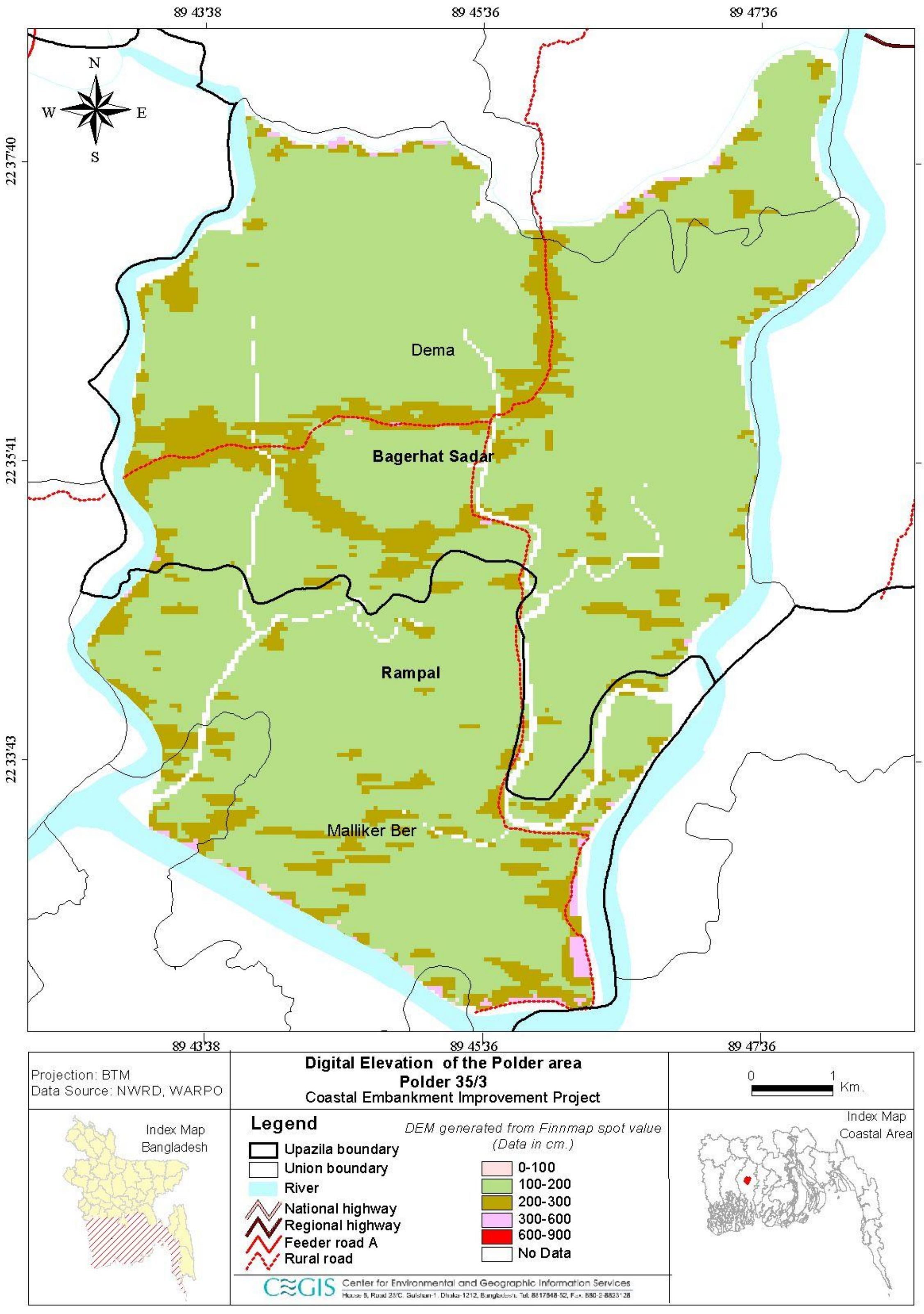


Figure 6.1: Elevation of Polder 35/3

The sea level rise caused by global warming would lead to permanent inundation, drainage congestion, salinity intrusion and frequent storm surges in the region. It is estimated that about 11 percent of the land area will be permanently inundated over the next century in the coastal region of Bangladesh.

6.1.2 Agro-ecological regions

As a part of land resources appraisal of Bangladesh for agricultural development, the country has been subdivided into 30 agro-ecological regions and 88 sub-regions. The key parameters on the basis of which this classification has been carried out include physiography, soil properties, soil salinity, and depth and duration of flooding. These parameters are relevant for land use and the assessment of present and future agricultural potential.

Polder35/3 lies under Agro-ecological zone of Ganges Tidal Floodplain (AEZ-13A &13B) (**Figure 6.2**). The characteristics of this region are discussed briefly below.

Ganges Tidal Floodplain

The soils are formed from clay loam, loam and clay sediments and are seasonally flooded, poorly drained except soils of high land areas. The high land is not inundated but medium high lands (MHL) and medium low lands (MLL) are inundated fro 4-5 and 5-6 months at various depths not exceeding 90cm and 180 cm respectively by monsoon flooding. This region occupies an extensive area of tidal floodplain land in the south-west of the country. 100 % of polder area covered this region. The Ganges Tidal Floodplain has low relief compared to the Ganges River Floodplain. The area is criss-crossed by innumerable tidal rivers and khals whose banks generally stand less than a meter above the adjoining basins. The whole of this zones lies within the cyclone prone area. The main tidal rivers in the polders areas (Polders 35/3) are Daratana, Bishnu and branch river Soabeki River, Katakhali, Putimari etc.

Most of the polder areas are shallowly flooded. The natural drainage of the land is towards the South. Most of the river banks are generally one meter above the adjoining basin centre. The lands are normally submerged during high tide twice every day. The extent of submergence increases during rainy season. The shallow basin remains wet during the early days of dry season. The practices of dry land crops are constrained due to slow and late recession of water. In this situation, the land preparation for dry land crops cannot be done in proper time. Most of the land remains fallow for this problem in the polder area.

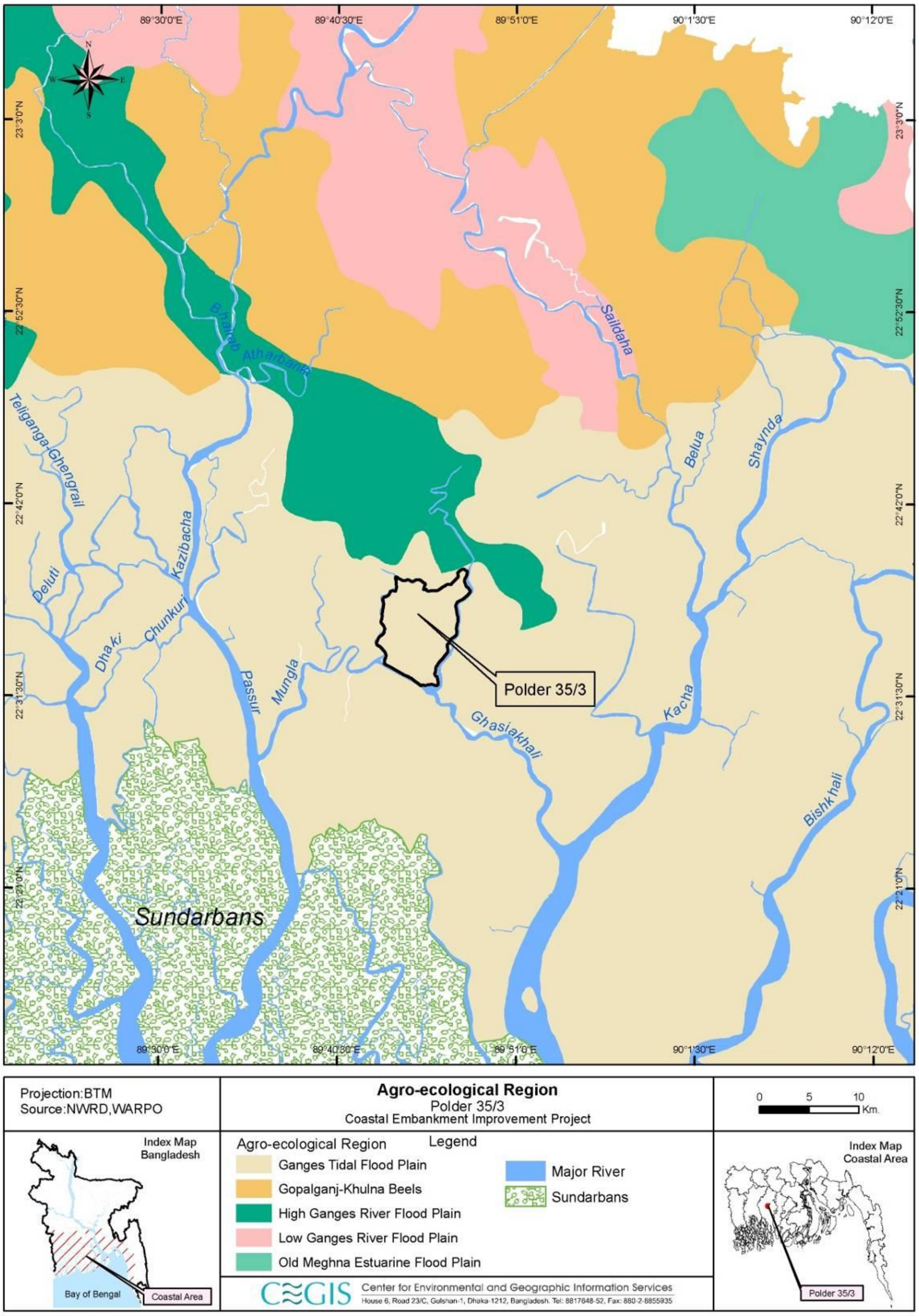


Figure 6.2: Agro-ecological Zone (AEZ) of the Polder area

6.1.3 Soil

There is a pattern of grey, slightly calcareous, heavy soils on river banks and grey to dark grey, non-calcareous, heavy silty clays in the extensive basins. Non-calcareous grey floodplain soil is the major soil type. Acid sulfate soils also occupy significant part of the area where it is extensively acidic during dry season. In general, most of the top soils are acidic and sub-soils are neutral to mildly alkaline. The soils are formed from clay-loam, loam and clay sediments and seasonally flooded, poorly drained except soils of high land areas.

Soil texture is the relative proportions of sand, silt and clay. It is very important for agriculture crop production. It is observed that the soil texture varies from clay, clay loam and loam. The soil texture has been presented in **Table 6.1**.

Table 6.1: Soil texture of the project area (Polder 35/3)

Soil texture with depth(cm)	% of NCA		
	Clay	Clay loam	Loam
Topsoil (0-15)	30	70	-

Source: CEGIS Estimation from SRDI, 2012

6.1.4 Land types

Land type classification is based on depth of inundation during monsoon season due to normal flooding on agriculture land. In the polder area, about 24%, 69% and 7% of the net cultivable lands falls under High land, Medium high land and Low land respectively. The distribution of land types under polder 35/3 is shown in **Table 6.2**.

Table 6.2: Distribution of land type in the Polder area of 35/3

Land type	Area (ha)	% of NCA
Highland	1,208	24
Medium Highland	3,529	69
Medium Lowland	353	7
Lowland	-	-
Very Lowland	-	-
Total (cultivable)	5,090	100
Gross Area	6,790	

Source: CEGIS Estimation based on field information, 2012

6.1.5 Land use

The total area of Polder 35/3 is 6,790 ha of which 5,090 ha is net cultivable area (NCA). The percentage of land utilization for crop production is about 75. About 25% area is covered by others (settlements and water bodies etc). In the polder area there has no mangrove forest. Scattered, some mangrove plants have been found near the khals and besides settlement. Golpata plants are common.

The area of single cropped is about 3,563 ha and others are fallow land. Detailed land use has been presented in **Table 6.3**.Detail land use map is shown in figure **6.3.**

Table 6.3: Present land use of the polder area

Land use	Area (ha)	%
Agriculture land	5,090	75
Single crop	3,563	70
Double crop	0	0
Triple crop	0	0
Fallow	1,527	30
Settlements	255	4
Water bodies	1,445	21
Gross area	6,790	100

Source: CEGIS Estimation, 2012

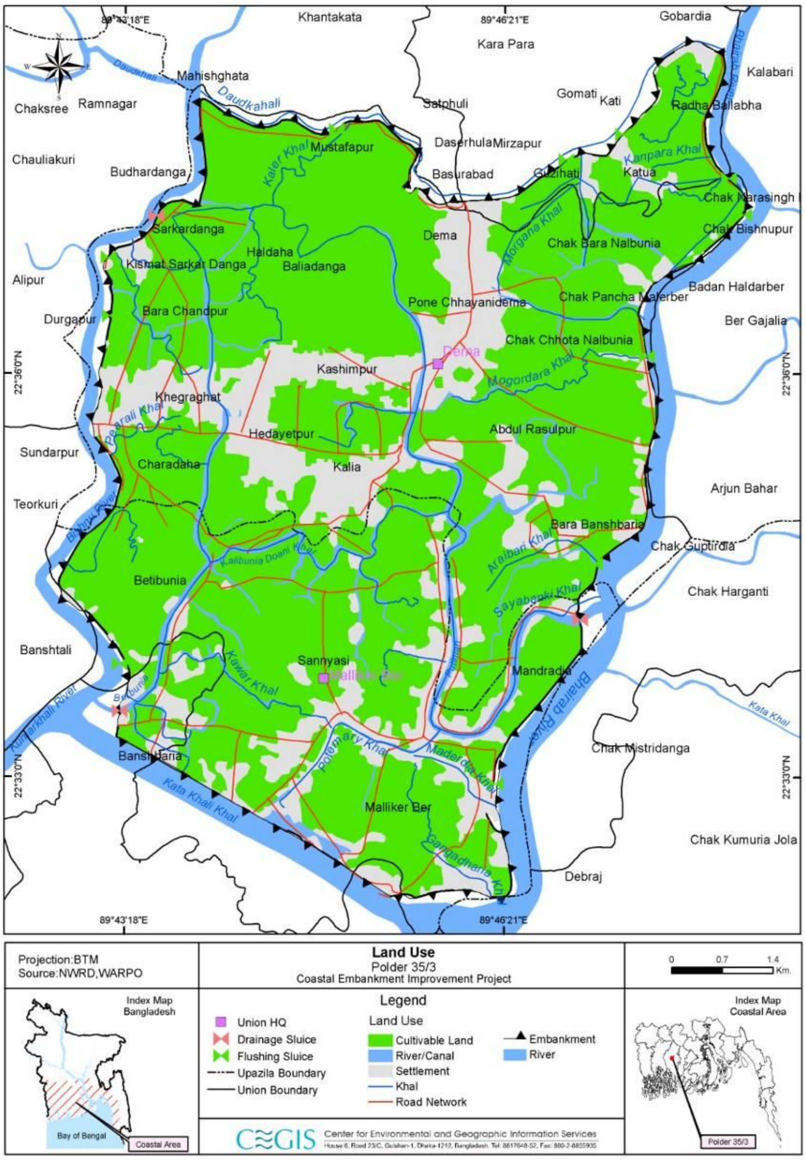


Figure 6.3: Land Use Map

6.1.6 Farming Practices

Farming practices within most of the Polder 35/3 area have adjusted to agro-climatic conditions prevailing in Kharif-I (March-June), Kharif-II (July –October) and Rabi (November-February) seasons. The crop year starts from the Kharif-I, season which is characterized by high temperature, low humidity, high evaporation, high solar radiation and early rains which cause flash floods, high rainfalls, lower temperatures, high humidity, low solar radiation and high floods that recede towards the end of the season are the characteristics of Kharif-II. The Rabi season is characterized by low temperatures, high solar radiation, low evaporation, insignificant rainfalls and low humidity. Kharif-II crops are harvest in the Rabi season and Rabi is the major planting season of Rabi crops and harvested in Kharif-I season.

The farming practices in Polder 35/3 are complicated due to physical, biological, climatological and socioeconomic factors. The siltation of rivers and channels caused drainage congestion/ water logging during monsoon, natural calamities like cyclone and surge etc cause devastating crop damage in the polder area. Scarcity of sweet water for irrigation during dry season is also responsible for the non expansion of the agriculture farming practices. On the other hand, saline surface water creates very favorable environment for brackish water fish culture. The environment of polder is also suitable for fish cum paddy cultivation. Some farmers of polder areas are practicing Boro HYV. A limited variety of crops are grown due to unfavorable situation prevailing in the polder area. Sugarcane and Orchard (Banana) are annual crops in the polder area. Rice is the main crop grown because of its adaptability in diversified ecological conditions. S. Vegetables, T. Aus (LV), T Aman (HYV), T. Aman(LV) and Boro HYV, Potato, Chilli, W. Vegetables, Pulses, Wheat, Oilseeds are grown in Kharif-I, Kharif-II and Boro/Rabi seasons respectively.

6.1.7 Present Cropping pattern and intensity

The dominant cropping patterns in the polder area are Fallow-T Aman (HYV) –Fallow and Fallow-T Aman (LV) - Fallow which are about 31.6% and 27% of the net cultivable area respectively. Detailed existing cropping pattern of the polder area along with land type is presented in Table 6.10. In kharif-I season; Sugarcane, Orchard, Vegetables and T Aus (LV) crops are grown on about 9.0% of the NCA. About 89% of the NCA remained fallow in the Kharif-I season. In Kharif-II season; rice is the main crop covering about 87.3%. The area of T Aman Local (LV) and T Aman (HYVs) are being practiced in 55.7% and 31.6% respectively. About 12% of the net cultivable area remained fallow. In Rabi/Boro season, Boro and different types of dry land crops are being practiced. About 22.6% and 9.7 % are covered for Boro and dry land crops respectively. About 67.7% of the NCA remained fallow in this season. The overall cropping intensity in the study area is about 130% (**Table 6.4**).

The dominant cropping pattern is Fallow-Lt Aman- Fallow which is practiced in about 54% of the NCA. Fallow-HYVAman-Fallow is the next cropping pattern covering about 15% of the NCA. Fallow- Fallow-HYV Boro cropping pattern is practiced about 1% of the NCA.

In kharif-I season, 100% of the NCA remained fallow. In Kharif-II season, HYV Aman and Lt Aman are grown in about 15% and 54% of the NCA respectively. In this season, about 31% area remained fallow. During Rabi/Boro season, 1.0% area is covered by HYV Boro and the rest 99% of NCA remained fallow. About 30% of the NCA remained fallow throughout the year. These lands are being used for brackish water shrimp culture. Rice cum fish (white fish) is a common practice in the polder area during kharif –II season. Shrimp has not been included for calculating the cropping intensity in the polder area. About 3,563 ha land is used for single crop. The cropping intensity is about 70% in the polder area.

Figure 6.4: View of Boro crop land in the study area

Table 6.4: Cropping Pattern by land type

Land Tpe	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-February)	Present			
				Area (ha)	No.of crop	Total cropped area	Cropping intensity %
High land(F0)	Sugarcane	Cont'd	Cont'd	7	0.1	7	
High land(F0)	Orchard	Cont'd	Cont'd	43	0.8	43	
High land(F0)	Fallow	Fallow	Potato	45	0.9	45	
High land(F0)	Fallow	T. Aman(LV)	Spices	25	0.5	50	
High land(F0)	Fallow	T. Aman	Chilli	10	0.2	20	
High land(F0)	Fallow	Fallow	W. Vegetables	55	1.1	55	
High land(F0)	S.Vegetables	T.Aman(LV)	Fallow	361	7.1	722	
High land(F0)	Fallow	T.Aman(HYV)	Fallow	400	7.9	400	
High land(F0)	Fallow	Fallow	W.Vegetables	142	2.8	142	
High land(F0)	Fallow	T.Aman(LV)	Wheat	120	2.4	240	
Sub-total				1,208	23.7	1,724	142.71
Medium highland(F1)	Fallow	T.Aman(LV)	Boro(HYV)	900	17.7	1800	
Medium highland(F1)	Fallow	T.Aman(LV)	Fallow	1374	27.0	1374	
Medium highland(F1)	Fallow	T.Aman(HYV)	Fallow	1205	23.7	1205	
Medium highland(F1)	T.Aus(LV)	T.Aman(LV)	Pulses	50	1.0	150	
Sub-total				3,529	69.3	4,529	128.34
Medium lowland(F2)	Fallow	Fallow	Boro(LV)	247	4.9	247	
Medium lowland(F2)	Fallow	Fallow	Oilseeds	30	0.6	30	
Medium lowland(F2)	Fallow	Fallow	Pulses	76	1.5	76	
Sub-total				353	6.9	353	100
Total				5,090	100	6,606	129.78

Sources: Feasibility report, 2012

6.1.8 Cropped Area and Production

Total cropped area is about 6,606 ha in the polder area of which 5,642 ha area is covered with rice. The coverage of rice area is about 85% of the NCA. Among the rice, T. Aus (LV), T. Aman (LV), T Aman (HYV), Boro (LV) and Boro (HYV) are contributing about 0.8%, 50% , 29%, 4.4% and 16% respectively. Non-rice cropped area is about 964ha which is about 15% of total NCA. The non-rice crops such as Sugar cane, Orchard, Wheat, Chilli, Pulses, Potatoes, S. Vegetables, W. Vegetables, Spices and Oilseeds are grown (**Table 6.5**).

The total crop production has been calculated on the basis of damage-free area and damaged area. In the damaged free area, the normal yield of crops has been considered under the study. In the damaged area the damaged yield against the damaged area has been considered. This may be expressed as:

Total crop production = damage free area × normal yield + damaged area x damaged yield. The main agricultural production comes from the rice crops.

Total rice production is about 11,658 metric ton in the polder area. Among the rice, T. Aus (LV), T. Aman (LV), T Aman (HYV), Boro (LV) and Boro (HYV) are contributing about 0.5%, 36% 32%, 5% and 27 % respectively. Non rice crop production is about 9170 metric tons. The production of non-rice crops such as Sugar cane, Orchard, Wheat, Chilies, Pulses, Potatoes, S. Vegetables, W. Vegetables, Spices and Oilseeds produced about 175, 516, 780, 14, 158, 810, 4061, 2551, 75 and 30 metric ton respectively(**Table 6.5**).

Table 6.5: Cropped area, crop productions and damage in the polder area

Crop name	**Total Crop Area (ha)**	**Damage free area**		**Damaged area**		**Total production (ton)**	**Production lost (ton)**
		Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)		
Rice-T.Aus(LV)	50	25	1.5	25	0.8	58	18
Rice-T.Aus(HYV)	-	-	-	-	-	-	-
Rice-T,Aman(LV/LIV)	2,840	1,988	1.6	852	1.2	4,203	341
Rice-T.Aman(HYV)	1,605	1,284	2.5	321	1.5	3,692	321
Rice-Boro(LV/LIV)	247	247	2.25	-	-	556	-
Rice-Boro(HYV)	900	900	3.5	-	-	3,150	-
Total rice	5,642	4,444		1,198		11,658	679
Sugarcane	7	7	25	-	-	175	-
Orchard	43	43	12	-	-	516	-
Wheat	120	120	6.5	-	-	780	-
Chilli	10	10	1.4	-	-	14	-
Pulses	126	126	1.25	-	-	158	-

Potatoes	45	45	18	-	-	810	-
S.Vegetables	361	253	13.5	108	6	4,061	812
W. Vegetables	197	167	14	30	7	2,551	207
Spices	25	25	3	-	-	75	-
Oilseeds	30	30	1	-	-	30	
Total non-rice	964	826		138		9,170	1,019
Total	6,606	5,270		1,336		20,828	1,698

Source: Estimation from field information, 2012

6.1.9 Crop damage

Crop damage data have been collected within inside embankments considering drainage congested areas, and salinity affected areas in consultation with stakeholders, farmers and officials of the DAE. Annual crop damage (paddy production losses) along with area has been evaluated. Crop production loss has been calculated using the formula: Crop production loss = Total cropped area normal yield - (damaged area ×damaged yield+ damage-free area × normal yield).

About 1,198 ha area of rice crops (T Aman HYV 321 ha, T Aman Local 852 ha and Lt. Aus 25ha) are damaged. About 679 metric ton of paddy is lost from this area due to drainage congestion, heavy rain fall, pest and disease infestations, drought and salinity, natural calamities (Aila, Sidr etc.) etc. About 138ha of non-rice crops (S. Vegetables 108ha and W. Vegetables 30ha) are damaged. About 1,019 metric tons of Vegetables production (S. Vegetables 812 metric tons and W. Vegetables 207 metric tons) is lost (**Table 6.5**).

6.1.10 Agricultural input use

Fertilizer and Pesticides Application

The rate of use of fertilizer per hectare varies considerably from farmer to farmer depending on soil fertility, cropping pattern and financial ability (Table 6.6). The major fertilizers used in this area are Urea, TSP and MP. Farmers opined that higher price, low quality and lack of different agricultural inputs, such as seeds, over doses use of chemical fertilizers and pesticides. Urea is used abundantly compared other organic fertilizers which would affect the soil health and yield. The present scenario clearly indicates that farmer’s has lack of knowledge on update information and essential plant nutrients deficiencies and agricultural technology are the common problems for restricting the proper crop cultivation in the polder.

Almost all the farmers (100%) applied pesticides in T. Aus (LV/HYV), T. Aman (LV/HYV), Chilies, Potatoes, summer and winter Vegetables and Spices crops. The highest pesticides used in Potato (taka 2000/ha), and T. Aman (Tk.1500) (**Table 6.6**). The polders farmers applied pesticides two or three more times. They used pesticides under or over dose. The use of pesticides depends on the degree of pest infestation. The major insects as reported by the farmers are yellow stem borer, rice hispa, ear cutting caterpillar, brinjal fruit and shoot borer, fruit weevil etc. Local farmer reported that they are using different types of pesticides such as Sumithion, Furadan and Kuratar granular, liquid and powder etc. to prevent pest infestation in Rice, Potatoes, Spices and Vegetables croplands.

Table 6.6: Present level of crop production input used within Polder 35/3

Crop Name	Seeds used/ ha (Kg)	Fertilizer (Kg/ha)						Irrigation cost	Pesticide /ha (Tk)	Used cultivation equipments		Cost power tiller
		Urea	TSP	MP	Gypsum	Zinc	Manure (Cow dung/compost)			Power tiller (%)	Bullock	
T.Aus (HYV)	35	195	178	135	10	10	-	-	1500	85	15*	4500
T.Aman (LV)	45	110	89	35	-		-	-	1200	90	10	4000
T.Aman (HYV)	35	152	133	67	16	-	-	-	1500	90	10	5000
S. Vegetables	3-4	130	100	67	-	-	-	-	2000	90	10	4000
Chilli	3	60	50	30	-	10	-	200	500	85	15	5000
Pulses	35	40	30	20	-	-	-	-	-	85	15	4000
Potatoes	3500	250	135	170	55	11	-	3000	2000	90	10	5000
W. Vegetables	2-3	120	80	70	-	-	-	1000	1500	85	15	4500
Spices	2-3	120	60	40	-	-	200	300	300	85	15	4500
Oil seeds	10-12	165	90	60	-	-	-	-	1000	90	10	4500

*Source: Based on main consultant and field information, 2012 *Cost/ha Taka 2000-2500/-*

Irrigation

Irrigation is provided to Boro (HYV) crop which is about 18% of the NCA. Irrigation also provided to other crops like Chilies, Potato, W. Vegetables and Spices in dry season. Surface water is the major source of irrigation. Most of the farmers provide irrigation with the help of surface water for raising seedlings, land preparation and transplantation upto mid March. The salinity of the surface water gradually increases and reaches beyond the tolerance limit during April-May (EC> 10.0 dSm^{-1}). But they cannot use this source for irrigation purpose due to salinity of water from the start of March to May. The surface water becomes fresh due to onset of monsoon during rainy season (EC< 1.5 dSm^{-1}). T. Aus (LV),T. Aman (LV),T. Aman (HYV) are grown in rainfed condition.

Seeds

The role of seeds is very important for growing crops. Selection of seeds has to be made carefully. More than 85% germination rate, free from disease infestation and high yield potential need to be considered. The different (HYV/Hybrid) varieties crop seeds are available in the local market. Most of the farmers used their own seeds in case local variety such as T. Aus and T. Aman. The farmers reported that private dealers' seed quality is poor and market price is higher than BADC seeds. The seed rate used in the polder area is 35kg, 3-4 kg, and 45 kg, 35kg, 3kg, 35kg, 3500kg, 2-3kg, 2-3kg and 10-12 kg for T. Aus(HYV), S. Vegetables, T. Aman (LV), T. Aman (HYV), Chilies, Pulses, Potato, W. Vegetables, Spices and Oil seeds respectively (**Table 6.6**).

6.2 Water Resources

6.2.1 River System

The area of Polder 35/3 is located in the southwestern hydrological zone in Bagerhat district of Bangladesh. The hydrological description of the polder area has been defined based on the river system of Daratana and Bishnu rivers which are the main rivers along the east and west boundary and Katakhali River along the southwest and Putimari River in the north periphery of the polder. These rivers are perennial. Average width of Daratan, Putimary and Bishnu River is 286 m, 50 m and 146 m respectively. These surrounding rivers with tidal influence control the flooding and drainage dynamics of the polder. There are numerous khals inside the polder namely Putimarikhal, Sayanbankikhal (Sobagi river), Batbuniakhal, Motherdiakhal, Hetalbuniakhal, Keblatolakhal, Raotirkhal, Tanpara khal, Saragachhia Khal. Morgang khal, Khajar khal, Betilbunia khal, Rautier gang, and other khals having tidal effect which controls the main drainage system and supplementary irrigation during monsoon. Polder 35/3 is also located besides the international navigation route. The name of route is Ghasiakhali. **Figures 6.5** to **6.8** present some photographs of the rivers and *khals* of the area.

Figure 6.5 Bishnu river western side of the polder

Figure 6.6: Dharatana river eastern side of the polder

Figure 6.7: Sayabankikhal (Sobagi river)

Figure 6.8: Betbunia khal inside the polder

6.2.2 Navigation in Rivers and Khals

Polder 35/3 is surrounded by Putimari river (North), Daratana River (East), Katakhali khal (south), and Bishnu river (west). The Daratana River, Katakhali khal, and Bishnu River remain navigable throughout the year. Large cargos and motorized boats/ trawlers can navigate along the Daratana River and Katakhali khal. The Bishnu River becomes shallow during the periods of low rainfall and hence, does not provide suitable navigability for transportation of large cargos in the dry season. The Putimari River is very shallow especially during the periods of low tides. It is therefore not suitable for waterway transportation of large cargos. Small boats are to be used for transportation through this river. The internal lakes/khals of the Polder are suitable for the movement of mostly small non-motorized boats only.

6.2.3 Drainage Congestion and Water Logging

In the study area, there are many khals and channels with tidal influences. Most of these khals run from the north to the south and provide drainage of the project area. These channels are also interconnected by lateral channels running from the east to the west and draining into the main rivers. During monsoon, water does not drain out properly due to high siltation in external rivers and internal Betibunia, Mogordhara and Sayabanki khals of the polder. The spatial distribution of drainage congestion in the Polder is shown in **Figure 6.9**. Drainage congestion is a common issue in the total polder area though intensity varies from place to place. The drainage performance through linked khals has been gradually decreasing due to sedimentation at both the upstream and downstream of the sluices. Over the years, improper maintenance of internal khals and malfunctioning of sluices as well as lack of sluices caused drainage congestion in the polder area. About 5-7% area (some places of Bara Bashbaria under Dema union, Madardia of Mollikerber union) of the polder are facing drainage problem during monsoon.

In the Polder, roughly 2 percent of the gross area (Kashimpur, Kalia under the Dema union and some parts of Malliker ber) is affected by water logging problems. In recent years, as a consequence of gradual deterioration hydraulic structures, the drainage congestion and water logging problems have been increasing, as reported by the Polder inhabitants (CEGIS field survey, 2012).

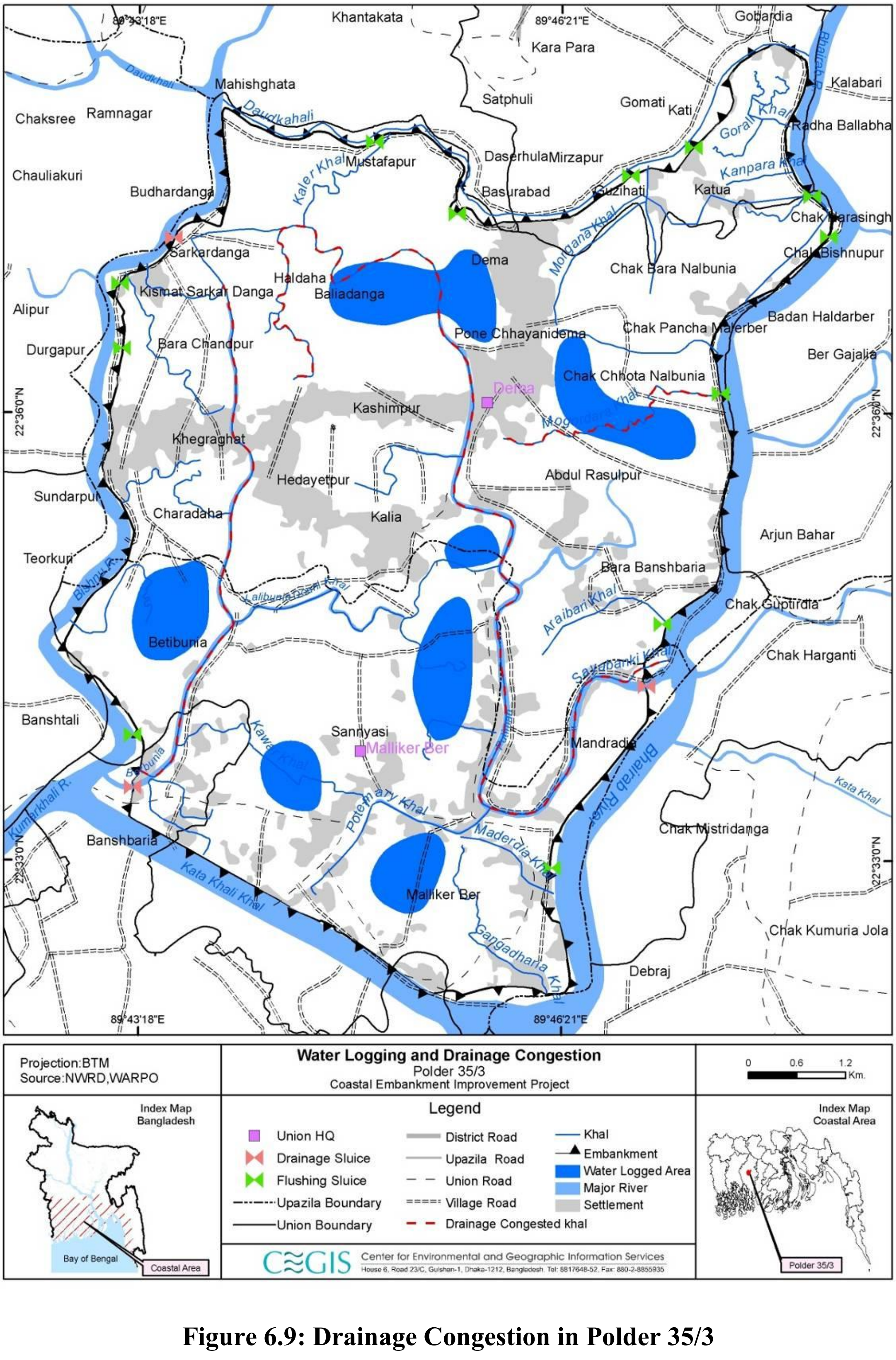


Figure 6.9: Drainage Congestion in Polder 35/3

6.2.4 Tropical Cyclones and Tidal Flooding

Tropical cyclones are a major threat to the coastal areas, causing loss of human lives and livestock and severe damage to crops and fisheries and. In the last 125 years, more than 42 cyclones have hit the coastal areas. Recently, the most devastating cyclones hit the Southwest coast under Bagerhat district in 2007 (Sidr) and 2009 (Aila). These cyclones directly affected 70% people of the polder area. Sidr was extremely destructive for the Sundarbans and the natural protection of surface water of Bangladesh. Aila hit the polder in May 2009. During Aila, surge water entered the polder area by overtopping the right bank of Daratana river and left bank of Bishnu river. As a result, the flood control embankment was damaged in some locations. The consultations made with the local people reported that during Aila, about 30-40% area along the right bank of Daratana River and left bank of Bishnu river was inundated and water stayed for more than one month. At present, the total length of the embankment is in a damaged condition, especially most vulnerable along the riverside area. About 30% of the polder area is under heavy threat of future disasters, if any. Tidal motion dominates during pre-monsoon and post-monsoon. However, fresh water of the rivers plays a very important role, especially during monsoon. During storms and cyclones, the short waves and storm surges are morphologically important for the polder.

Cyclones have been hitting the coasts of Bangladesh very frequently in the recent decades. From 1901-1957 only 11 cyclones had hit the coastal areas of Bangladesh, while from 1957 to 2009 a total number of 55 cyclones have hit the area. So, in the last 52 years, the number of cyclones hitting coastal areas of Bangladesh has increased 5 times compared to the previous 57 years. (BMD)

In a frequency study carried out by Hennon, P. et al. (2010), Bay of Bengal has been found to be the second most frequently visited place in the world by cyclones with about 20 cyclones per decade.

6.2.5 Land Erosion and Sedimentation

In southwest costal area, erosion is a common problem. Erosion is found mainly in Mollikerber, Karapara and Dema union along the Bishnu and Dratana rivers. Erosion engulfed local people’s land, homes and have become an environmental and social hazard. During Sidr and Aila, the surge wave action eroded the full flood control embankment seriously.

Sedimentation is also a problem in the polder area. Sediment characteristics are different in the tidal rivers. The downstream of Bhairab and Bishnu rivers have sandy beds and mud banks along the shore whereas tidal creeks tend to be choked with very fine sediments. In the tidal rivers, suspended sediments are mainly composed of silt and clay. On an average, roughly 1 to 1.5 ft sedimentation took place in most of the main khals in the polder area each year. Sedimentation in most of the internal khals caused rise of bed level and reduced the conveyance capacity of the khals. **Figure 6.10** and **Figure 6.11** show the embankment conditions at two different places of the area.

Figure 6.10: Embankment damaged at Bashbaria

Figure 6.11: Embankment of the polder at Mollikerber

6.3 Environmental Quality

Air, noise, water and soil quality were measured during the field survey. The locations are mentioned in the following table. The objective of the measurement was to set up a strong baseline which will help to monitor the impact of the present during construction and operation phase. The locations for air, water, noise and soil quality are shown in **Figure 6.12.**

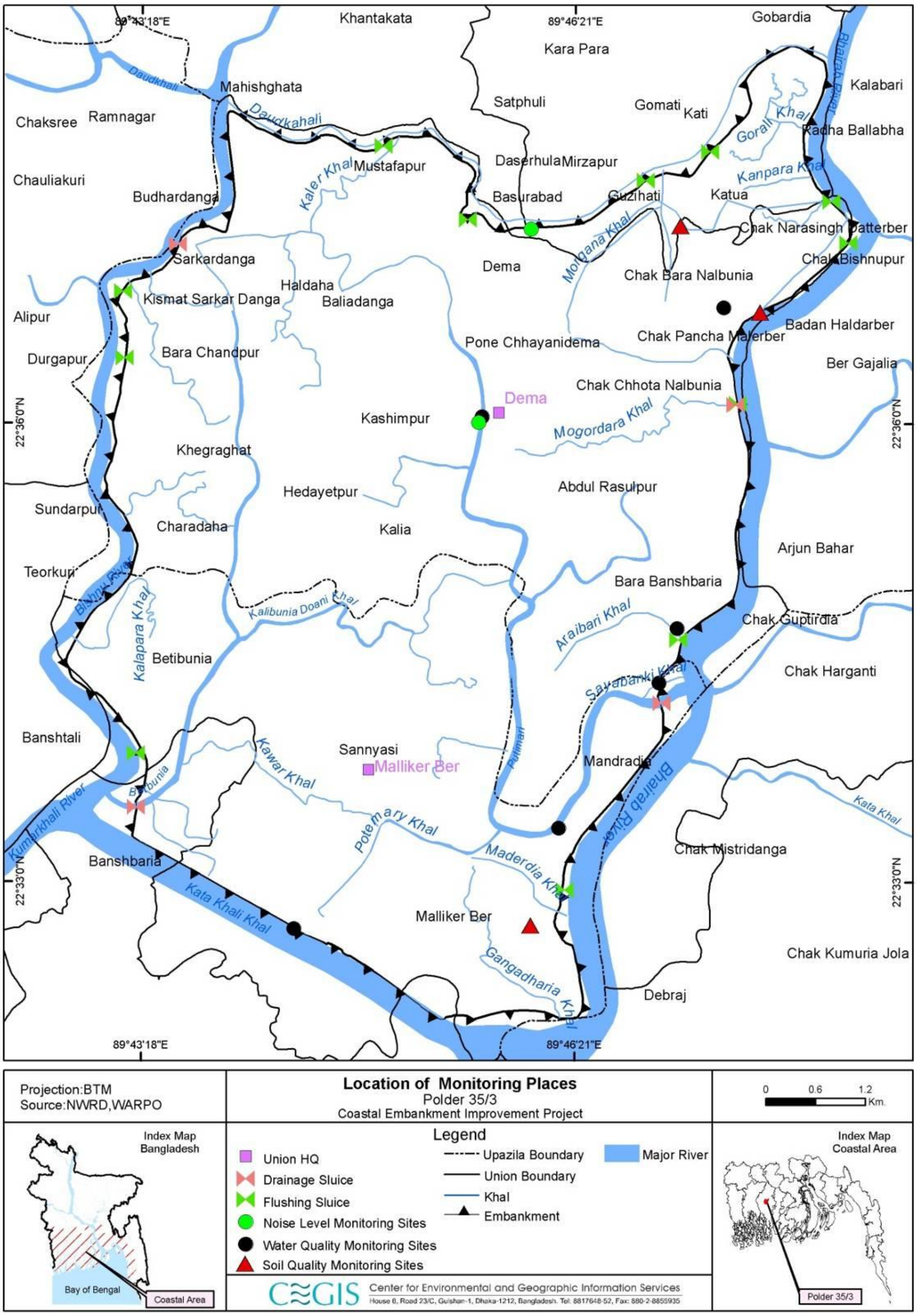


Figure 6.12: Locations of Noise, Water and Soil Quality Monitoring Stations

6.3.1 Air Quality

Air pollution is not of much significance in the coastal area of Bangladesh. From field visits, it was observed that overall air quality in the study area is good. The standards of ambient air quality should be maintained at the project site. The standards of air quality are given in Table 6.7.

Table 6.7: Standards of ambient air quality

Areas	Concentration of micrograms per meter cube		
	SPM (μg/m3)	SO_2 (μg/m3)	NO_x (μg/m3)
Industry	500	120	100
Commercial	400	100	100
Residential and rural area	200	80	80
Sensitive	100	30	30

Source: Environment Conservation Rules, 1997

Table 6.8 shows the air quality data measured at Rampal upazila, under Bagerhat district. The values suggest that the concentrations of the measured air quality parameters (suspended particulate matter - SPM, oxides of sulpher - SOx, and oxides of nitrogen - NOx) lie within the range of standard values for Bangladesh (See Table 6.7).

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

Sample Location	Air Quality Parameters		
	SPM(μg/m3)	SOx(μg/m3)	NOx(μg/m3)
Bazar area, Rampal upazila sadar, Bagerhat	125	<25	20
Hedayetpur, Bagerhat	118	<25	22

Source: CEGIS field survey, December 2012

6.3.2 Noise

The noise level for both the normal situation and situation with traffic has been analyzed in the field. The values of noise level are shown in Table 6.9:

Table 6.9: Daytime noise levels of the study area

Sl. no	Location	Noise level (dB)				GPS
		Normal condition	Normal condition (Average)	With traffic	With traffic (Average)	
1	Mirzapur, Near Dema Bridge	63.8	60.95	76.4	84.3	N 22°37'19.0" E 89°45'52.4"
		58.1		92.2		
2	Kashimpur bazaar	68.4	68.4	76.5	76.5	N 22°36'03.2"

Sl. no	Location	Noise level (dB)				GPS
		Normal condition	Normal condition (Average)	With traffic	With traffic (Average)	
						E 89°45’30.4”
All measurements have been taken during daytime.						

Source: CEGIS field survey, December 2012

Table 6.10 shows the standard values for noise in Bangladesh. Noise levels exceeding 80dB (with traffic situation) are usually considered as Noise pollution in our country. However the permissible limits for the country are less (Table 6.9). The study area can be regarded as a mixed area, and the noise levels observed in the study area have been found to be exceeding the permissible limits of mixed zones for daytime.

Table 6.10: Standards of Noise levels for different zones of Bangladesh

Zone Class	Limits in dB	
	Daytime	Nighttime
	(6 am – 9 pm)	(9 pm-6 am)
Silent zone	45	35
Residential zone	50	40
Mixed	60	50
Commercial zone	70	60
Industrial zone	75	70

Source: Bangladesh Gadget, 2006

6.3.3 Water Quality

As described earlier, there has been a decline in the effectiveness of the Polder because of the lack of repair and maintenance of embankments and water control structures as well as frequent attacks by minor to major cyclonic surges, and absence of functional community organizations. As a consequence, during the periods of low rainfall, the surface water of the entire area gets affected by salinity intrusion.

In order to provide a clear view of the existing condition of the water quality inside the Polder area, a number of water quality parameters – including salinity, dissolved oxygen (DO), temperature, electrical conductivity (EC), pH, total dissolved solids (TDS), chlorides (Cl), suspended solids (SS), and arsenic (As) - were selected by the study team for monitoring and evaluation. The surface water and ground water was analyzed during the field level survey conducted in two different periods of the year. The surface water quality was measured at six different locations in the month of December and the ground water quality was tested in the month of May. The results obtained in the two field surveys provided an understanding of the water quality in the Polder, discussed below.

6.3.4 Surface Water Quality

The surface water quality in Polder 35/3 is influenced by the hydrological connections of the internal water channels with the surrounding rivers of the polder. The rivers and lakes around the Polder i.e. the Daratana River (north), Putimari river (north), Katakhali khal (south) and Bishnu river (west) provide tidal inflow into the Polder during the periods of high tide or low rainfall. The water bodies inside the Polder are mostly free flowing khals, and apart from salinity intrusion during January to April, the other water quality parameters remain within the acceptable range. **Table 6.11** presents the values of the water quality parameters measured in a number of selected locations of the Polder. The standard values of these indicators set by DoE, Bangladesh have also been shown for the comparison purposes.

Table 6.11: Water Quality in Polder 35/3

Sample Location		Water Quality Parameters					
		Salinity (ppt)	Temperature (°C)	TDS (ppm)	EC (mS/cm)	DO (mg/L)	pH
Botolbunia Khal (Chok ponchomala		3	22.2°C	1622	2.17	7.2	7
Araibari Khal (Barabashbaria)		-	23.0°C	1668	2.27	3.4	7.1
Sobaki Khal Gate (Barabashbaria)		-	22.9°C	1635	2.1	5.9	7.1
Sobaki Khal (Madardi, Rastar mathar bazar)		-	23.1°C	1254	1.66	5.4	7
Kata River (Molliker Ber, Aulia bazar or Praner bazar)		3	22.7°C	1278	1.54	5.6	7.2
Kulimari Khal, Kashempur Bazar, Dema		-	22.5°C	1339	1.89	5.8	6.9
Standard Value (Bangladesh)	Irrigation	-	20-30	-	-	5.0	7.0-8.5
	Fishing	-	20-30	-	-	4.0-6.0	6.7-9.5

Source: CEGIS field survey, December 2012

Salinity. During monsoon the salinity levels are very low because of the increased amount of fresh water in the water bodies. The level of salinity starts increasing from January due to the reduction of upland discharge and reaches the peak in April and then starts decreasing again. Saline water intrudes the areas near the breached embankments causing damage to agricultural practices.

In the dry season, the overall salinity levels both in soil and surface water are high and roughly about 15-20 percent of the Polder area is affected. This happens because of the following reasons: (i) about 3-4 percent of the polder area is under golda (prawn) culture, (ii) saline water enters through breached embankments, and (iii) malfunctioning of sluices with/without gates. However in the month of December, the salinity value was low (0-3 parts per thousand) as shown in **Table 6.11** above, since rain water inside the Polder was still present and tidal flow from the ocean was yet to intrude. The embankments and water controlling structures have experienced significant deterioration over the years and as a result the salinity values inside the polder have increased. Especially after the occurrences of Aila and Sidr, the salinity intrusion in the polder during dry season has become a common phenomenon.

Dissolved Oxygen (DO). This is an essential parameter for the metabolic process that produces energy for growth and reproduction of fishes and other aerobic aquatic biota. Decrease in DO values below the critical level of 3 mg/l causes death of most fishes and other aerobic aquatic organisms. DO is relatively low in dry season than in wet season. The values of DO inside the Polder (measured in the month of December) ranged between 5 to 6 mg/l at some places, which complies with the DoE standards for irrigation as well as for fisheries and aquatic life. However, values found in Araibari khal were lower than the range of standard values for irrigation and fisheries whereas the water of the Botolbunia khal has higher DO values.

pH. The hydrogen ion concentration of water is expressed by its pH value. A pH value of 7 indicates a neutral solution, neither alkaline nor acidic. In most of the water bodies of the Polder, the pH range is found well within the DoE standards**.**

Temperature. Temperature of water bodies affects the fish habitats and their oxygen holding capacity. The mean temperature of the water bodies inside the Polder area was around 22°C- 23°C (**Table 6.11**), in December. This value lies within the DoE standards for both irrigation and fish habitats.

Total Dissolved Solids (TDS). The natural range of total dissolved solids concentration for most lakes occupying open basins is usually between 100 and 200 mg/l. However the values of TDS were found very high inside the Polder area (ranged between 1,200-1,700 mg/l (see **Table 6.11**) because of the saline water intrusion. Livestock and wildlife may be adversely affected by drinking this water containing excessive dissolved solids. Continuous use of such water may cause a general loss of condition, weakness, scouring, reduced production, bone degeneration and ultimately death. TDS may influence the toxicity of heavy metals and organic compounds for fish and other aquatic life. This takes place primarily because of the antagonistic effect of hardness on metals. The quantity and quality of dissolved solids often determines the variety and abundance of plants and animals in a given aquatic situation.

Electrical Conductivity (EC). EC is a useful water quality indicator for estimating the amount of minerals, assessing the effect of diverse ions on chemical equilibrium, physiological effects on plants or animals, and corrosion rates. It is an indirect measure of the TDS (TDS = 640 × EC), the effects of which have been discussed above. The values of EC inside the Polder ranged between 1.5 - 2.5 mS/cm. The higher values of EC indicate that the water bodies inside the Polder area are more affected by saline water rather than fresh water.

Ground Water (GW)

The ground water quality parameters, measured in the Polder during the month of May were found to comply with the drinking water quality standards (ECR’97). The values of the ground water quality parameters of the Polder area as well as the standard values of these parameters set in ECR’97 are presented in **Table 6.12**

Table 6.12: Groundwater Quality at Bagerhat Sadar

Sample Location	Temp (°C)	pH	Chloride (mg/l)	Iron (Fe) (mg/l)	SS (mg/l)	Pb (mg/l)	Coliforms	As (mg/l)
DTW of Karakara primary school, Bagerhat sadar upazila, Bagerhat	24.2	7.56	514	0.98	5	>0.02	Nil	0
Drinking water quality standard as per ECR'97		6.5 – 8.5	150 – 600	0.3 – 1.0	10	0.05	Nil	0.05

Source: Laboratory Test, May 2012

6.3.5 Soil Quality

The soils possess low to very high condition in the dry season and soil salinity level and pH ranges from 4.9-18ds/m and 5.2-7.6 respectively. But Mollikerber Union soil salinities level and soil pH range from about 2.0-12.0 ds/m and 6.-8.2 (Land Zoning Report of Bagerhat Sadar and Rampal Upazila, Ministry of Land January2011).

Soil sample were collected for Polder 35/3. The collected soil samples were sent to the Agrochemical and Environmental Research Division, Institute of Food and Radiation Biology of Atomic Energy Research Establishment, Savar, Dhaka for detect pesticide residues. As the desired pesticide residues were analyzed with a detection limit of 0.004 ppm using GC-MC (Thermo Electron & Pekin Elmer). The analyzed result shows that no pesticide (furadan) exists in the soil samples.

Table: 6.13: Pesticide Residues Analysis Reports

	Location	Sample ID	Carbofuran (ppm)
1	Polder35/3	1A(0-15cm)	ND
2	Polder35/3	1B(15-30cm)	ND

Here, ND: Not detected, LOD = 0.004ppm, LOQ = 0.01ppm

6.3.6 Climate and Meteorology

The climate of the project area is tropical in nature with three seasons namely summer/pre-monsoon from March to May, monsoon from June to October, and winter season from November to February. The rainy season is hot and humid with about 88 percent of the annual rainfall in the area. The winter is predominately cool and dry. The summer is hot and dry interrupted by occasional heavy rainfall. The Project area lies in the south west part of Bangladesh, where monsoon comes in the month of June and recedes in the late October. Data on metrological parameters have been accumulated from different secondary sources (Bangladesh Meteorological Department - BMD) and synchronized at district level for Bagerhat. Summary of the analysis of metrological parameters are given in the following sections.

Temperature

The meteorological data of the area measured at Mongla station shows that the monthly maximum temperature varies from 28ºC to 34ºC. Maximum temperature occurs in the month of April and is around 34ºC and average temperature during monsoon is about 26º C. Monthly minimum temperature ranges from 9ºC to 23ºC and the minimum temperature (December to February) is around 9ºC to 11ºC. **Figure 6.13** shows the monthly maximum, mean and minimum temperature at Mongla station.

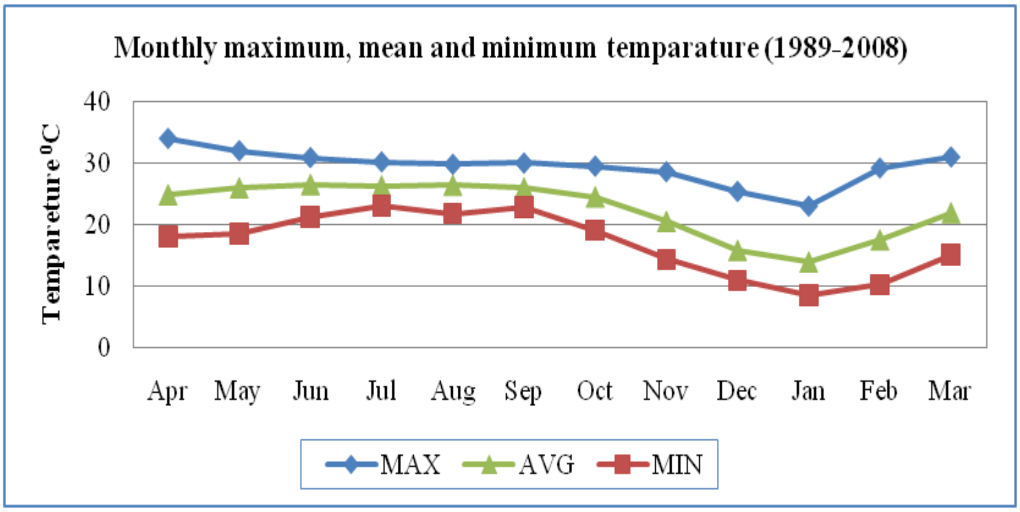


Figure 6.13: Temperature Data for Project Area

Yearly data of average temperature have also been analyzed for the same station (from 1989-2011). The trend analysis shows that the average temperature for polder 35/3 is increasing by approximately 0.027 °C each year (see **Figure 6.14**).

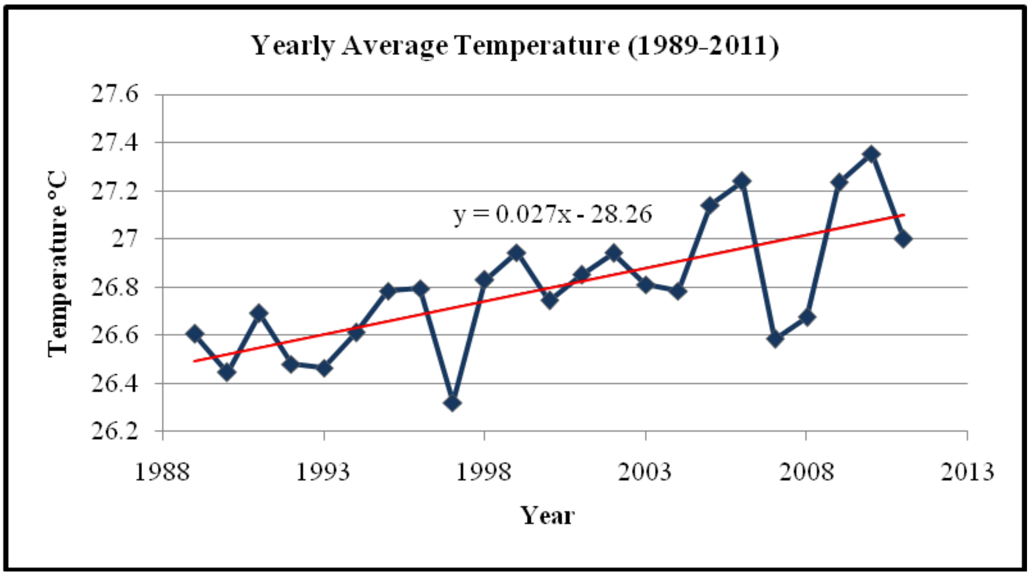


Figure 6.14: Yearly Average Temperature in Project Area

Humidity

The monthly average relative humidity measured at Mongla stations varies from 74 percent to 89 percent during a year. Even in the winter season the humidity is above 75 percent. **Figure 6.15** shows humidity data for the Project area.

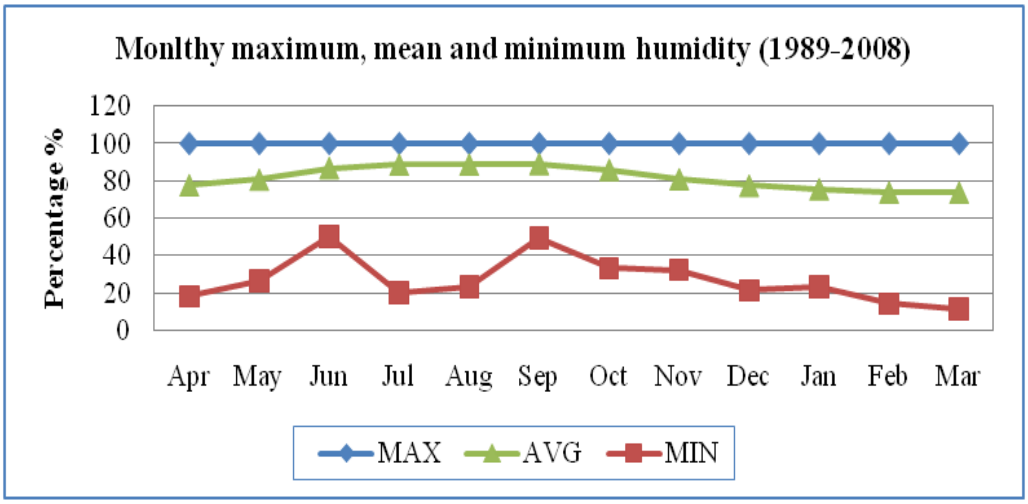


Figure 6.15: Humidity Data for Polder Project Area

Data of yearly average relative humidity have also been collected from the BMD station at Mongla. The trend analysis for the relative humidity of polder 35/3 shows that the humidity increases by approximately 0.021 percent each year (**Figure 6.16**).

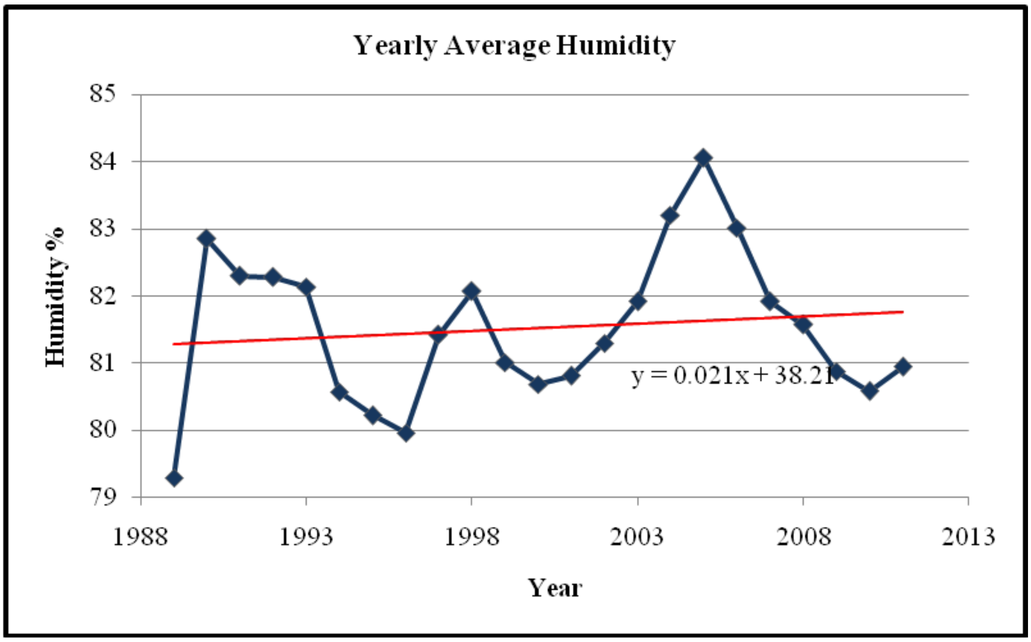


Figure 6.16: Average Yearly Humidity in Project Area

Rainfall

The annual average rainfall in the Project area is 1,946 mm. Monthly maximum rainfall was recorded as 983 mm in the month of June 2002. The average rainfall during monsoon is about 1,390 mm in the Project area. The mean monthly cumulative rainfall measured at Mongla is shown below in **Figure 6.17**.

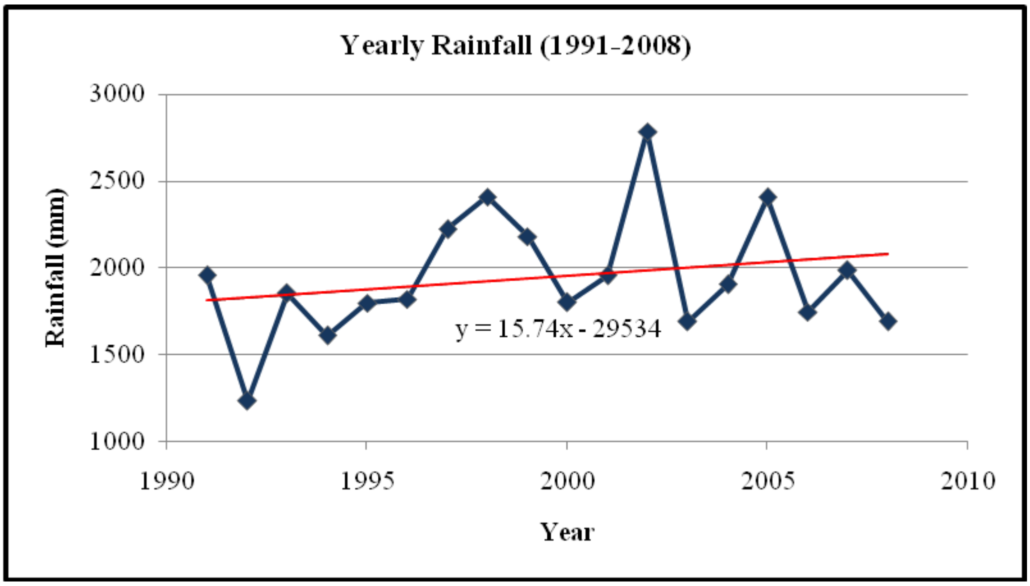
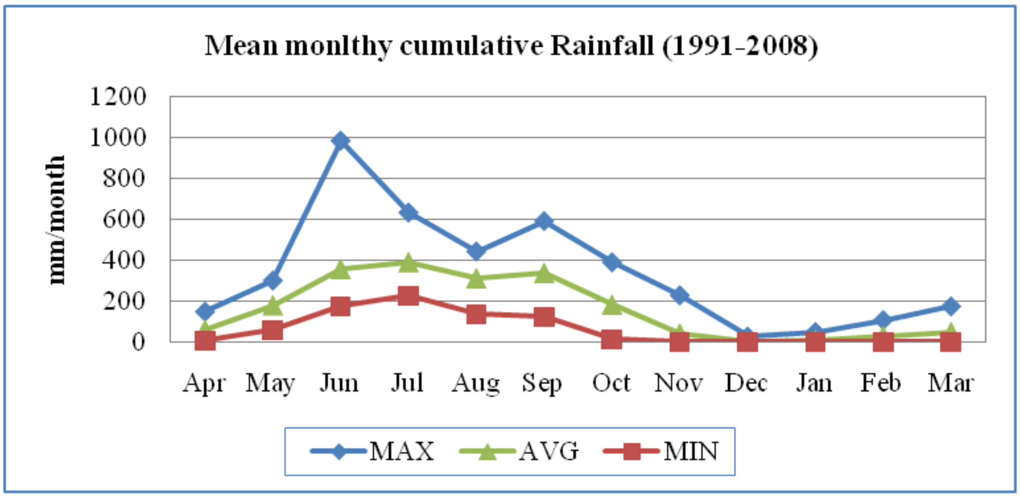


Figure 6.17: Rainfall Data for Project Area



A trend analysis has also been carried out collecting the yearly rainfall data from the BMD station at Mongla. The trend reflects that each year, the rainfall in the Project area has been increasing by approximately 15.74 mm (see **Figure 6.18**).

Figure 6.18: Rainfall Trent in Project Area

Evaporation

The monthly average evaporation in the Project area varies from 3 to 5 mm per day in a year. The monthly maximum average evaporation (16 mm/ day) occurs in the month of July.

6.4 Fisheries Resources

Fisheries resources of the study area are diversified with different fresh and brackish water fish habitats. Open water fish habitat of the study includes rivers and khal, such as *Dharatana river, Bishnu river and Katakhali khal*, internal khals such as *Pachabulia khal, Ghirarkata khal, Khager khal, Moderdona khal, Abdul Rasulpur khal, Andhari khal, Putimari khal, Dhalipara khal, Sota khal, Bhigorer khal, HetaMNani khal, Betbunia khal, Kironbabur Gater khal, Moragang, etc* which are acting as major arteries of fish migration into the polder area. These are playing vital role in maintaining fisheries productivity of internal open water. Bulk of the commercial fish production is coming from culture fish habitats and capture fish habitat. The productions from the capture fisheries come from the capture habitat e.g. different seasonal and perennial canals and borrow pits. The study area is surrounded by two rivers system and one khal such as *Daratana River* (60% of rivers; perennial in nature), *Bishnu River* (30% of rivers; perennial in nature) and *Katakhali khal* (10% of rivers; perennial in nature). The fish production from the peripheral river is 28 MT which has not been considered in the fish production estimation. Fish production trend is declining gradually from the open water sources. The numbers of fishers has decreased due to decrease of open water fish habitat, loss of khal-river connectivity, water regulatory structures on the khals and improper operations. Aquaculture is developing in suitable ponds of congestion free highland area in polder 35/3.

Figure 6.19: Open water fish habitat in the study area (Chabagi River)

The area is relatively moderate in fish biodiversity. But the fish biodiversity has the further decreasing trend because of morphological changes, obstruction to spawning migration, natural and anthropogenic drying up of wild fish habitats, indiscriminate fishing, loss of river-khal connectivity and water regulatory structures on khals. Aquatic environmental quality is unsatisfactory in the study area though some pollutants are released from crop fields and are substantially causing damage to fish. On the other hand, water quality of internal khal degrades particularly during dry season. Moreover fish migration from Daratana river to internal khals through Putimari khal and Bhishnu river to internal khals through Betbunia khal is obstructed due to improper management of water regulator on khal off-take. Fisheries sector is contributing financial benefit in small scale to the local economy and improvement of local livelihoods.

Major fisheries problems and issues so far identified during baseline survey in the study area were as follows:

- siltation of internal khals are causing loss to the year round river-khal connectivity;
- indiscriminate fishing using monofilament gill net, net jal, etc and overexploitation of fishes by using huge number of narrow meshed ESBN (Estuarine Set Bag Net) fishing;
- reduction of spawning and feeding grounds;
- Viral disease
- indiscriminate harvest of shrimp PL (Post Larvae) by local dwellers;
- hindrances to fish migration and movement due to improper management and mal-functioning of the water regulatory structures along with encroachment and barriers;
- lack of quality fish seed and feed for the improved aquaculture practices. Moreover, increased salinity adversely affect pond fish culture;
- lack of trained farmer
- Insufficient loan facilities for aquaculture practices.

6.4.1 Fish Habitat Description

Habitat Classification

Fish habitats of the study area are primarily classified in broad categories e.g. Bagda (3531 ha) and Golda gher (1018 ha), Borrow pit (14ha), External River (271ha), Khal (272), Floodplain (815ha) and different types of ponds like homestead (62 ha) and commercial pond (14ha). All types of fish habitat are shown in the following **Figure 6.20.**

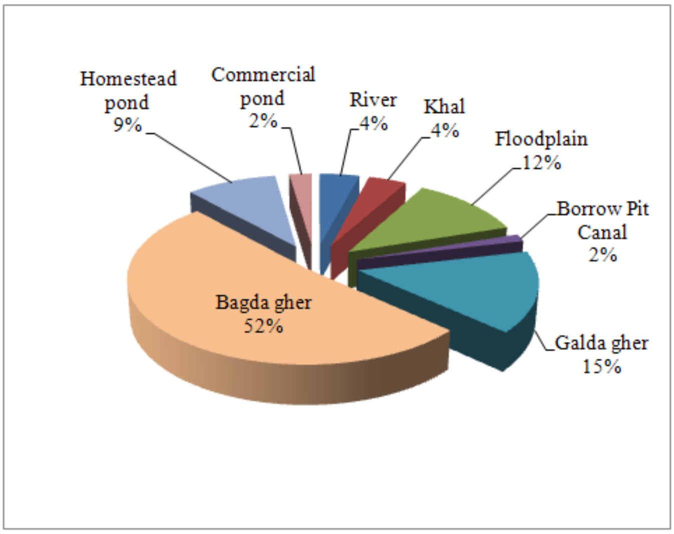


Figure 6.20: Fish Habitat Classification of the study area

Habitat distribution

Most of the study area fish habitats are situated in Bagerhat Sadar Upazila followed by Rampal Upazila. Among the unions of those two upazils, Dema union occupies about 51% of the total fish habitat followed byMallikerber and Karapara as shown in the **Figure 6.21.**

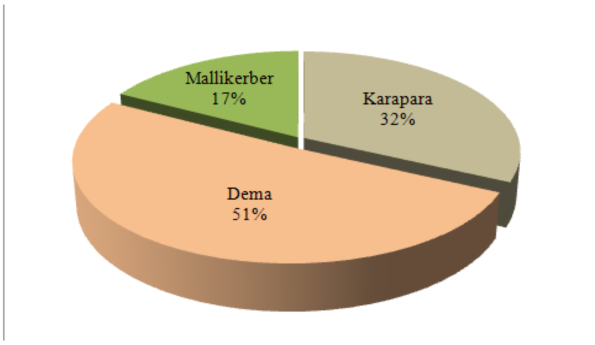


Figure 6.21: Distribution of fish habitat at different Union

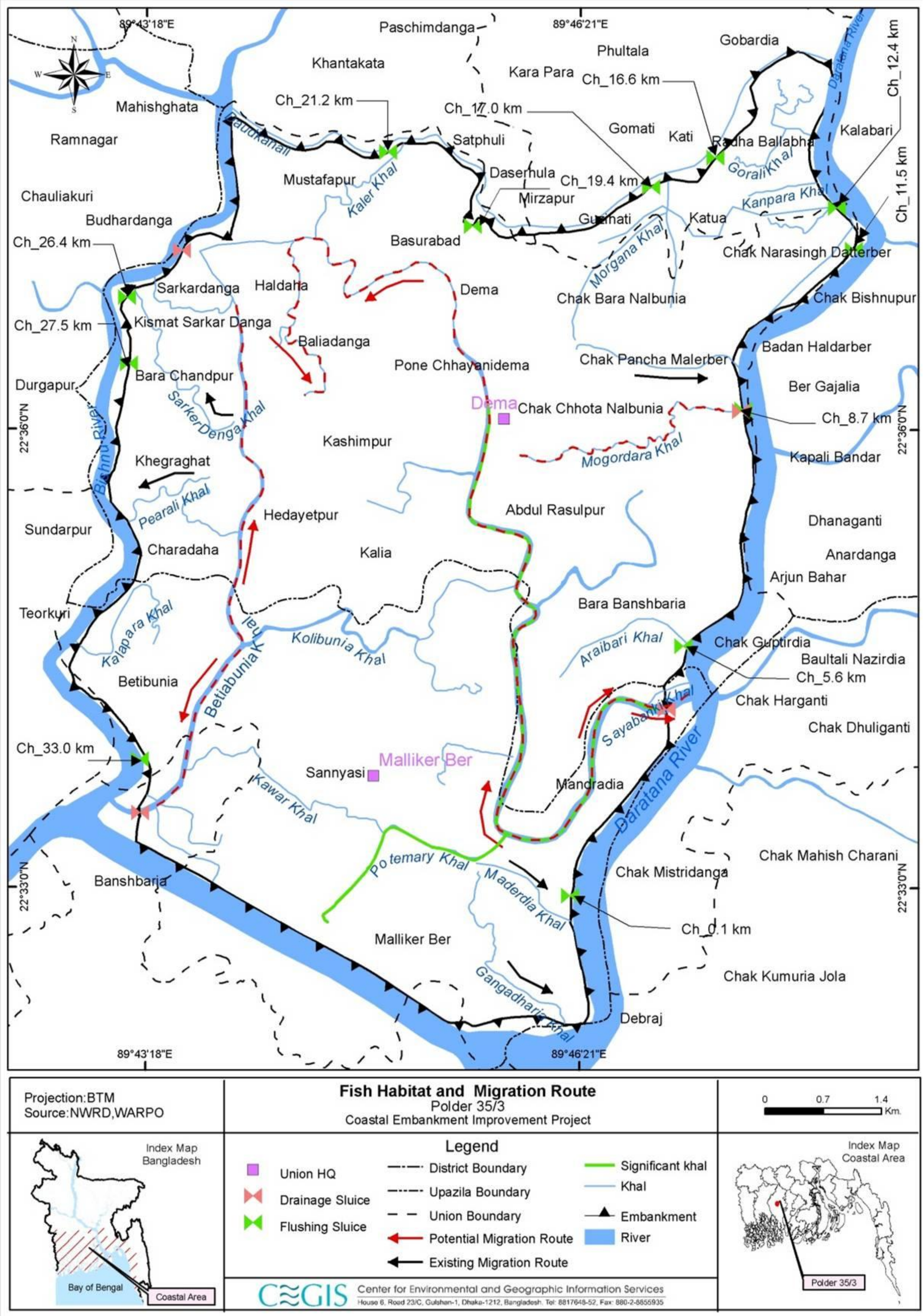


Figure 6.22: Fish habitat and migratory routes of the study area

Capture fisheries

The total fish habitat in the polder area is 8,561 ha. Out of this capture fish habitat of the polder area is 1,827 ha which is distributed in internal river and khal, borrow pit and floodplain as shown in the following **Table 6.14**.

Table 6.14: Fish habitat status of the study area

	Fisheries Category	Habitat Types	Area (Ha)
1	Capture	Internal River	353.07
2		Khal	339
3		Borrow pit canal	122
4		Floodplain	1,013.18
Sub-total			*1,827.25*
5	Culture	Galda gher	1316
6		Bagda gher	4413
7		Homestead pond	805
8		Commercial pond	200
Sub-total			*6,734*
Grand Total			**8,561.25**

Source: Draft Final of Fisheries Report, Volume - 1 (from main consultant)

The study area includes a number of seasonal and perennial canals/khals mentioned above. Among these *Putimari khal*, *Betbunia khal*, *Soebagi nadi*, etc are important as fish habitat.

Figure 6.23: Natural fish habitat of the study area

Average depth of internal khals is 1-1.5 m which is sufficient for fish habitation. Depth of seasonal canals of the study area is insufficient for sheltering fish juveniles are getting silted up. Local people reported that siltation rate in the internal fish habitats of the polder area is 2-3 cm per year. Khal beds are silted up due to deposition of loosened soil comes from agriculture field and tidal action carry lot of sediment.

Culture fisheries

Aquaculture practice is expanding gradually in the polder area. Various types of fish culture systems are adopted by the local people including mono-, poly-, and mix-culture. Exclusively poly-culture practice is adopted by the local people. Estimated area under culture fisheries is 6,734 ha. Most of these ponds are non-commercial and traditional in nature.

Figure 6.24: Fish culture in different types of pond

6.4.2 Fish Production

Estimated total fish production of the polder area is about 3,630 MT (**Table 5.15**). Bulk of the inland fish production (about 92%) is coming from culture fisheries while the rest comes from capture fisheries habitats. Fish production trend from capture fisheries is decline of the polder area and also in external rivers of Bishnu and Daratana. The production is declining mostly due to obstacles to fish migration and decreasing of fish habitat. Aquaculture is expanding gradually in the area by converting the cultivated land, as well as the medium low lands of the polder area.

Table 5.15: Fish production from different habitats of the study area

	Fisheries Category	Habitat Types	Total production (MT)
1	Capture	External River	38.48
		Khal	50.85
		Borrow pit canal	30.50
		Floodplain	153.97
	Sub-total		*273.81*
2	Culture	Galda gher	1,292.30
3		Bagda gher	1,103.25
4		Homestead pond	611
5		Commercial pond	350
	Sub-total		*3,356.54*
Grand Total			3,630.35

Source: Draft Final of Fisheries Report, Volume - 1 (From main consultant)

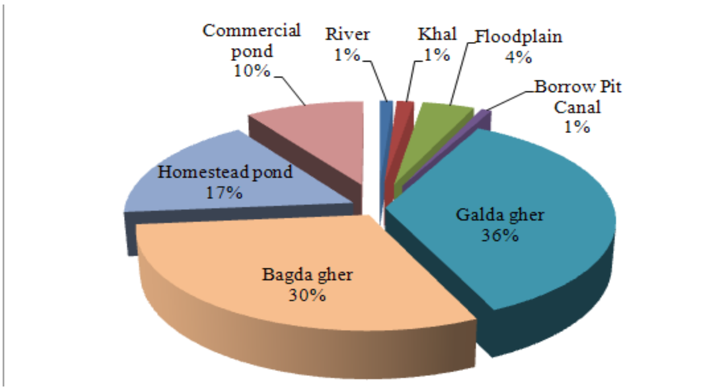


Figure 6.25: Fish production (%) from different sources of the polder area

6.4.3 Fishing Effort

Fisher number

It was reported during the field investigation and consultations with the local people that about 2% of the total households are engaged in commercial fishing while about 8% of households are involved in part time fishing and 5% of households are in subsistence level fishing in and around the habitats of the study area. Fisher mostly comes from the Muslim (75%) and rest of (25%) from Hindu communities. They usually catch fish in the nearby tidal floodplain, external rivers and khals. The available fisheries occupations of the area are mainly fishing, fish trading and fish farming.

Around (5-10) % women of the traditional fishermen families are involved in collection of shrimp PL in the study area.

Fishing Season

Monofilament Gill net (Current jal) fishing is the major fishery of the study area. Seine net (Ber jal), drag net (net jal), cast net (Jhaki jal), push net (Thela Jal/Khochon), badha jal, golsha jal and fish trap (Borshi, Aton/Charu) fishing are also prominent in the study area fish habitats. Fishing in seasonal canals as well as in peripheral rivers starts in May and continues up to March. Rest of the time, they are mainly engaged in other fishing. The traditional fishermen catch fish in the rivers and perennial khals which are still open all the year round in most cases. The seasonality of major fishery is furnished in the Table 6.16.

Table 6.16: Fishing seasonality of the study area

Seasonality of fishing types

Fishing types	Boishakh (Apr–May)	Jaishthya (May–Jun)	Ashar (Jun–Jul)	Sravon (Jul–Aug)	Bhadra (Aug–Sep)	Ashyin (Sep–Oct)	Kartik (Oct–Nov)	Agrahayan (Nov–Dec)	Paush (Dec–Jan)	Magh (Jan–Feb)	Falgun (Feb–Mar)	Chaitra (Mar–Apr)
Gill net (Current jal)	Low	Low	Medium	Medium	High	High	High	High	High	Medium	Low	Low
Scine net (Ber jal/Kaitu)	High	High	High	High	Medium	Medium	No occurrence	No occurrence	No occurrence	No occurrence	High	High
Cast net (Jhaki jal)	Low	Low	Low	Medium	Medium	High	High	High	Medium	Medium	Low	Low
Push net (Thela jal	No occurrence	No occurrence	No occurrence	No occurrence	Medium	High	High	Low	Low	No occurrence	No occurrence	No occurrence
Drag net (Net jal)	No occurrence	High	High	High	No occurrence	No occurrence	No occurrence	No occurrence	No occurrence	High	High	No occurrence
Badha jal	Medium	Medium	Medium	High	High	High	High	High	Medium	Medium	No occurrence	No occurrence
Golsha	Low	Medium	Medium	Medium	High	High	High	Medium	Medium	Low	Low	Low
Trap gear (Charu/Aton)	No occurrence	No occurrence	No occurrence	Low	Medium	Medium	Medium	High	High	High	Low	Low
Lining (Borshi)	Low	Low	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low

High / Medium / Low / No occurrence

Source: Field survey, 2012

Fishing Crafts and Location

The commercial fishers of the study area catch fish in the peripheral rivers by using engine boat, Jala nauka and dingi fishing boats.

Fishing Gears

Seven types of nets/gears are used for fishing: (a) Mono filament net, locally known as Current jal, which is used to catch poa, ghagla, chingri, tengra, gulsha, along with other estuarine fish; (b) Seine net, locally known as Kaitu, which is used to catch all types of small and big fishes; (c) Cast net, locally known as Jhaki jal, which is used to catch rui, katla, puti, pua, bagda, golda, phasa, etc. (d) Push net, locally known as Thela jal/Khochon, which is used to catch punti, tengra, chingri, etc.; (e) Drag net locally known as Net jal which is used to catch PL (post larvae) of shrimp and prawn; (f) Badha jal, which is used to catch baila, chingri, punti, tengra, gulsha as well as other types of small fishes; (g) Golsha jal, which is used to catch rui, katla, mirka, etc. Around 20% of fishers have fishing boats and around 70% fishers have fishing gears/nets. Traditional fishing gears of the polder area are cast net (Jhaki jal), drag net (net jal), push net (Thela jal/Khochon), lining (Borshi), fishing traps (Aton), etc.

Figure 6.26: Local fishing boat (Dinginauka)

Figure 6.27: Cast net (Jhakijal)

6.4.4 Fish Migration

The riverine and study area resident fish species migrate through open and regulated khals to some extent during the period of late June to August. Perennial Khals such as *Putimari khal*, *Betbunia khal* along with other seasonal internal khals are used as feeding and shelter ground of most of the open water fishes (**Figure 6.22**). Fish species such as Phaisa, Betki, Bagda, Golda, Horina Chingri, Tengra, Gulsha, Khorsula, and Sotka Chingri migrate horizontally to these water bodies as part of their life cycle. Peripheral rivers along with internal river and khals of the polder area have silted up naturally and structures on the khals cause the reduction the length of successive migration routes. Due to siltation and water control structures hamper the migration of fish and other aquatic biota. According to field survey and consultation with local people the fish migration status is poor to moderate in the study area due to the reasons are Most of the water control structures are non-functional, lack of proper technical knowledge of the local stakeholders for gate operation, lack of gate operation manual, absence of Water Management Organizations (WMOs), and absence of fish friendly gate/ladder.

6.4.5 Fish Biodiversity

The study area (polder area with external rivers) is moderate in fish biodiversity though the biodiversity of fishes has the declining trend over the years. Obstruction in fish migration routes, morphological changes of internal khals, siltation of fish habitats, squeezing of spawning and feeding grounds and further expansion of both culture fishery and Aman cultivation are responsible for gradual decline of fish abundance and biodiversity. The study area comprises of an assemblage of both fresh and brackish water fish species.

Figure 6.28: Major fishes occupying the catch composition of study area fish habitats

Checklist of the fishes of different habitats reported by local fishermen has been analyzed to draw a tentative scenario of the local fish biodiversity of the study area. List of the fishes of different habitats of the study area is presented in **Table 6.17**.

Table 6.17: Indicative fish species diversity of different fish habitats in the study areas

Scientific Name	Local Name	Habitat Type			
		River	Khal	Gher	Fish pond
Brackish fish species					
Macrobrachium rosenbergii	Golda	P	P	P	P
Macrobrachium rudi	Bagda	P	P	P	P
Metapenaeaus monocerus	Harina chingri	P	P	P	P
Acentrogobius cyanomos	Nuna Baila	P	P	A	A
Gudusia chapra	Chapila	P	P	A	A
Pama pama	Poa	P	P	P	A

Mugil corsula	Kholla/Bata	P	P	P	A
Latescal carifer	Vetki	P	A	A	A
Fresh water fish species					
Channa straitus	Shol	A	P	A	A
Channa punctatus	Taki	A	P	A	P
Puntius titco	Tit punti	P	P	A	A
Mastacembelus spp.	Boro baim	P	P	A	A
Mastacembelus pancalus	Chirka baim	P	P	A	A
Sperata aor	Ayre	P	A	A	A
Mystus vitatus	Tengra	P	P	A	A
Mystus cavasius	Gulsa	P	P	A	A
Leander styliferus	Gura chingri	P	P	A	P
Culture fish species					
Labeo rohita	Rui	P	A	A	P
Catla catla	Catla	P	A	A	P
Cirrhinus mrigala	Mrigal	P	A	A	P
Sarotheradon nilotica	*Nilotica*	A	A	A	P
Telapia mossambica	Telapia	A	A	P	P
Ctenopharyng odonidellus	Grass carp	A	A	P	P
Ompok pabda	Pabda	P	P	A	A
Glossogobius giuris	Baila	P	P	A	A

Here, A=Absent and P=Present

6.4.6 Species of Conservation Significance

Fish species variety those are locally unavailable for last 10 years or have become rare as reported by the local fisher and concerned elderly people are given in the following table 6.18.

Table 6.18: List of species of conservation significance

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
Notopterus chitola	Chital	√	
Nandus nandus	Veda	√	
Clarius batrachus	Magur	√	
Acanthopagrus latus	Datina		√
Heteropneustes fossilis	Shing		√
Channa marulius	Gozar		√

6.4.7 Area of Conservation Significance

Putimari Nadi and Soebagi Nadi etc are used as feeding and spawning ground of most of the open water fishes. These are marked as the area of conservation significance. There is no scope for fish sanctuary development in the existing khals in the polder area.

6.4.8 Fish Marketing and Post Harvest Facilities

Fish edible quality is in good condition for human intake. Local fishermen sell bulk of their catch either directly to the local fish market (*Kashempur Bazar, Dema Bazar, Kalia Bazar, Karapara, Barakpur, Sannasi Bazar, Mollikerber bazaar*, etc.) or to fish traders or buyers (*Bapari*) coming from Bagerhat, Khulna, Satkhira, etc. Fish farmers' sell their fishes to the fish traders. The present price of carp fish, shrimp (*bagda*) and prawn (*golda*) are 120 tk/kg, 500tk/kg and 700tk/kg respectively. Real fish godown (*arats*) are lacking in this polder area. No structured fish landing center are found in the area. Ice from ice plants is used for icing the harvested fish. Good fish storage facility is not available. Transportation facility at root level is moderately developed. There is no private/ Govt. hatchery inside the polder area. Availability of fish feeds for culture ponds are insufficient. Fish seeds for culture fishery are collected from the fish hatcheries and nurseries which are situated in Bagerhat, Khulna, etc. Post Larvae (PL) are collected from Daratana and Bishnu River. Fish feeds are also collected from the fish feed mills at Bagerhat, Khulna, etc. Quality of fish feeds is a threat for the fish farmers.

Presently, average daily income of commercial fisher, part time fisher and subsistence level fisher are Tk. 300-400, Tk. 200-250 and Tk. 100-120 respectively. Income level of traditional fisher is decreasing. Consequently, they are changing their occupation. They are also vulnerable to the musclemen that are responsible to convert open water fish habitats into culture fishery as well as natural degradation of fish habitats. A person involved in fish culture is mostly practicing both traditional and modern method.

6.5 Ecological Resources

Polder 35/3 is located in the southern ecosystems of the country. It is encircled by tidal river system and possesses numerous internal canals and homestead ponds. The polder area is moderately abounded with local vegetation as well as dweller faunal species. Frequent natural calamity and changing of land use is deteriorating it's habitat quality and original ecological feature.

6.5.1 The Bio-ecological Zone

The World Conservation Union (IUCN) has divided the whole country into 25 Bio-ecological Zones. These zones are primarily centered on physiography, climate, soil types, flooding depth and biodiversity. Polder 35/3 is encompassing two of these Bio-ecological Zones namely: the Ganges Floodplains and the Saline Tidal Floodplain. Map 5.8 shows the project location in Bio-ecological Zones of Bangladesh. A brief description of these two Bio-ecological zones is presented below.

The Ganges Floodplain

Ganges Floodplain is the active meandering floodplain of the Ganges River. The floodplain mainly comprises of a smooth landscape of ridge, basins and old channels. The Ganges channel is constantly shifting within its active floodplain, and eroding as well as depositing large areas of charlands in each flooding season. Both plants and animals move and adapt with the pattern of flooding (Brahmer, 1996). The floodplain is characterized by mixed vegetation and support a habitat of rich bio-diversity to some extent due to the presence of a lot of stagnant water bodies and channels, rivers and tributaries. Beels and other water bodies support good amount of free floating aquatic vegetation. Homestead forests are prominent with both cultivated and wild plant species. In this zone, the dominant floral types are the Panimorich (*Polygonum orientale*), Jhanji (*Hydrilla verticillata*), Topapana (*Pistia strateotes*), Chechra (*Schenoplectus articulatus*), Sada Sapla (*Nymphaea nouchali*), Keshordam (*Ludwigia adscendens*), Kolmi (*Ipomoea sp*), Tamarind (*Tamarindus indica*), Panibaj (*Salix tetrasperma*) etc. Moreover, Grasses are abundant in Ganges floodplain and begin to grow as soon as the floodwater begins to recede. *Cyperus rotundus, C. deformis, Eleocharis* sp*., Hemarthria* sp. etc are the notable grass species.

Major groups of oriental birds are present in this zone by one or more species. In addition, a large number of migratory birds are found here during the winter. Beside this, different species of freshwater tortoise and turtles are found in the rivers and ponds. Among the amphibian species, toads, frogs and tree frogs are well known. Foxes, Jackals, rats, mice, squirrels, bats etc are common mammals of this bio-ecological zone.

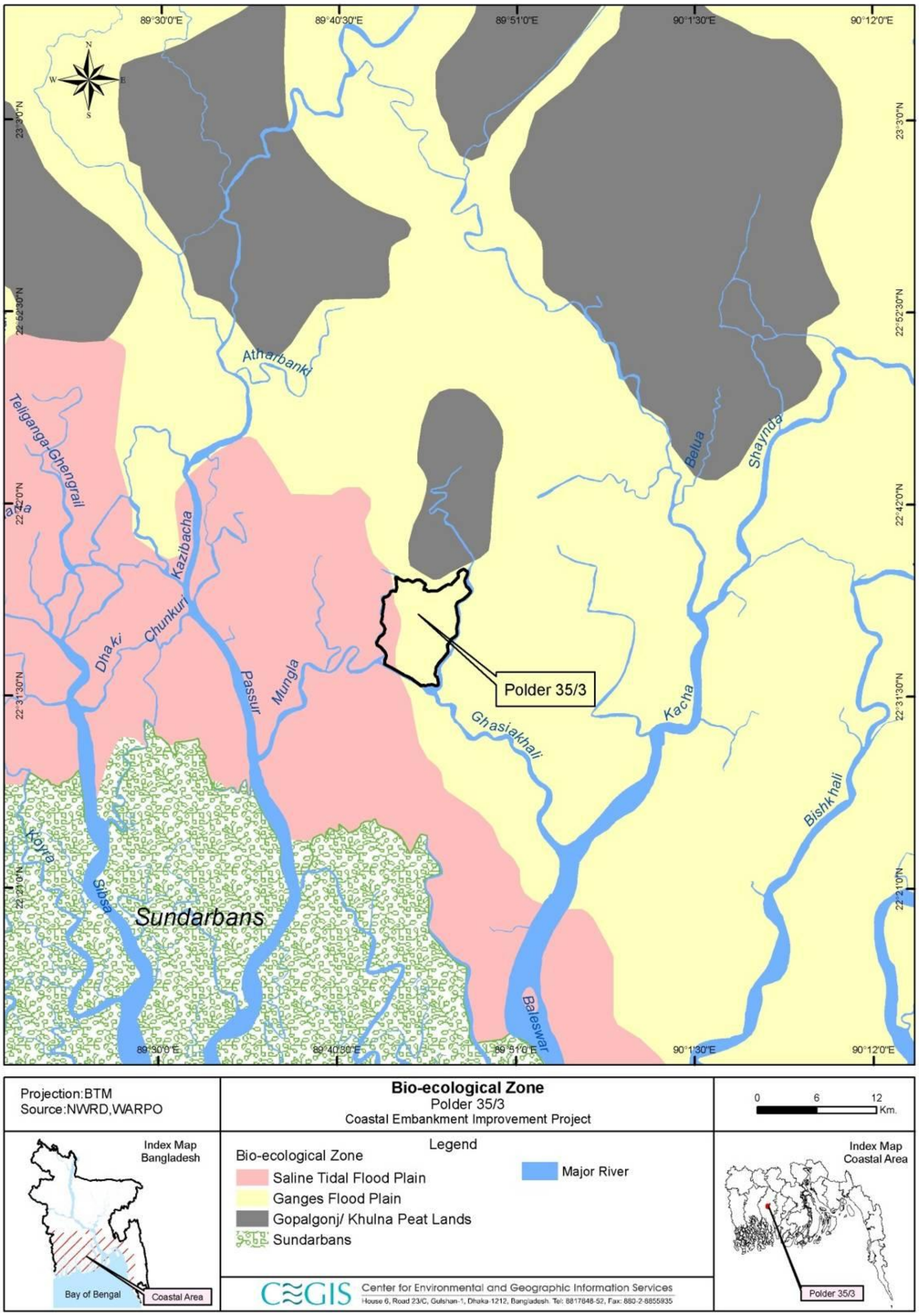


Figure 6.29: Location of Polder area in Bio-ecological Zones of Bangladesh and bio-ecological features of the Polder 35/3.

Saline Tidal Floodplain

Saline tidal floodplain bio-ecological zone, which is located the administrative district of Satkhira, Khulna, Bagerhat, Jhalokathi and Borguna has a transitional physiography. It has a low ridge and basin relief, crossed by innumerable tidal rivers and creeks. Local differences in elevation are less than 1 m. The sediments are mainly composed of non-calcareous clays, although in the riverbanks, they are silty and slightly calcareous. The soil is non-saline throughout the year over substantial amount of areas in the north and east, but they became saline to varying degrees in the dry season in the south west and are saline for much of the year in Sundarban. The rivers carry fresh water throughout the year to the east and northeast, but saline water penetrates increasingly further inland towards the west mainly in the dry season, and for most or all of the monsoon season in the southwest. In the northeast, there is moderately deep flooding during the monsoon season, mainly due to accumulation of rainwater on the land when the water level in Ganges distributaries and the lower Meghna are high. Elsewhere, there is mainly shallow flooding at high tide, either throughout the year or only in the monsoon season, except where tidal flooding is prevented by embankments. Within embankments, seasonal flooding only occurs through accumulation of rainwater (Brammer, 1996).

Except for the Sundarban, the floral diversity of this zone is similar to those of adjoining zones. Innumerable indigenous weeds grow in beel areas. Several types of palms and bamboo clumps grow in almost all the villages. Mango *(Mangifera indica)* and Jackfruit *(Artocarpus heterophyllus)* supply the commonest timber and are used for making doors, windows, boxes etc. (Bari, 1978).

The zone affords very lucrative place to game bird watchers. At the advent of winter season, numerous game bird which include wild goose, wild duck, cranes, spines, jungle fowl and various waterfowl, begin to flock both in the Sundarban, and the beel and char areas of this zone. Mangrove, the network of rivers and expanse of beels of this zone teem with different species of fishes.

6.5.2 Ecosystems

The Project area occupies terrestrial as well as aquatic ecosystems. The Project area supports different types of habitats with many species of flora and fauna including globally and nationally threatened shore birds and other wildlife species. The area supports the following three types of ecosystem with flora and fauna:

- Terrestrial Ecosystem
- Aquatic Ecosystem
- Mangrove Ecosystem

Terrestrial ecosystems

Homesteads, embankments and crop fields are the sub-types of terrestrial ecosystems. Homestead is the major type of terrestrial ecosystem in terms of biological productivity and wildlife habitats. The composition of plant species in the homestead are: Narikel (*Cocos nucifera*), Supari (*Areca catechu*), Kafila (*Lanea coromandelica*), Neem (*Azadirachta indica*), Khejur (*Phoenix sylvestris*), Taal *(Borassus flabeliffer)*, Kola (*Musa* Spp.), Kanthal (*Artocarpus heterophyllus*), Sisoo (*Dalbergia sisoo*), Arjun (*Terminalia arjuna*), Rain tree (*Samanea saman*) and Bansh (*Bambusa* Spp.). From the vegetation long profile (**Figure 6.29**), Narikel occupied top of the canopy coverage followed by Raintree *(Albizia Saman)*, Supari *(Areca catechu)*, Khejur *(Phoenix sylvestris)*, Sissoo *(Dalberzia sissoo)* and other dicotyledones. Marginal vegetation is quite common in each homestead periphery.

Koroach *(Pongamia pinnata)*, Kodam *(Anthocephalus cadamba)* and *Dumur (Ficus hispida)* are common at the species level.

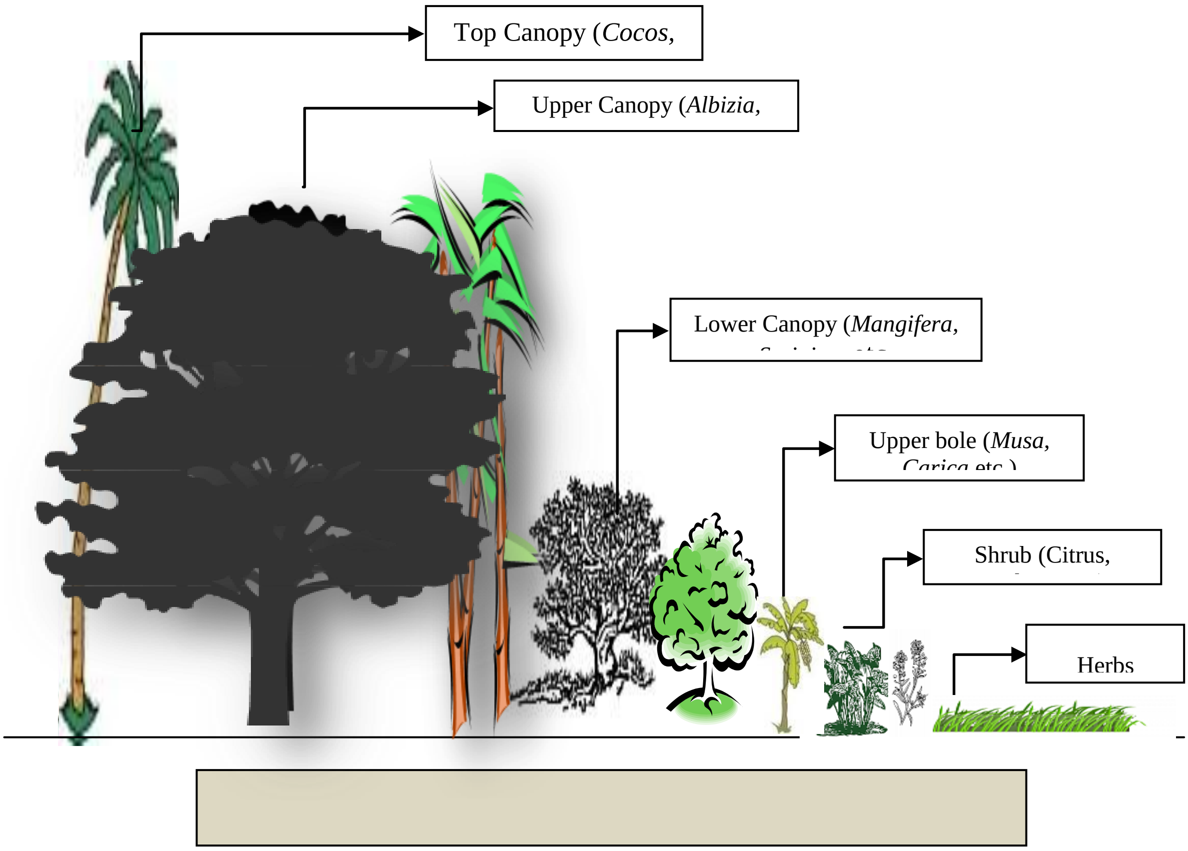


Figure 6.30: Typical Terrestrial Vegetation Long Profile of the Polder 35/3

Crop fields are mainly used for paddy cultivation once or twice in a year and contain least diversity of flora and fauna. Except crop species many types of weeds (herbs and shrubs) are observed in crop field. But their density and diversity is relatively low in water logged area than flood free area. Among the agricultural weeds, *Cynodn dactylon, Cyperus sp, Leucus aspera, Croton bonplandianum* are common. Crop field support feeding ground for various local avifauna. Crop fields are converted to saline water shrimp farm resulting in habitat destruction of the polder area.

Roadside vegetation of the polder area is dominated by Taal (Borassus flabellifer), Khajur (Phoenix sylvestris), Rendi koroi (Albizia saman), Sissoo (Dalberzia sissoo), Chambol (Albizia richardiana) etc. Rangchita, Jiga/Kocha (Lennea coromandelica) are very commonly used as fencing plant along both sides of roads which passed through settlement. Embankment sides are exclusively dominated by Babla (Acacia Arabica) tree. Cactus (Euphrobia Sp), Bhat (Clerodendrum viscosum), Dutura (Datura metal), Biskantali (Polygonum Sp.), Veranda/Castor Oil (*Ricinus communis*) and Telakucha (Coccinia grandis) etc. are common small plants of this habitat. Durba (Cynodon dactylon) is a common grass species which is exclusively dominant and cover top soil of the embankment.

Aquatic Ecosystems

Aquatic ecosystems of this polder may be classified into four major categories as follows:

- The surrounding rivers,
- Internal canals,
- Shrimp farms and
- Homestead ponds and ditches.

The polder area is encircled by the Baleshwar and Bhairab river systems and many canals also pass through the entire area, shrimp farms locally known as 'Gher' are also available there. The shrimp farms add some aquatic area to the main aquatic ecosystems to support different aquatic life-forms for their survival. Homestead's ponds are normally used for domestic purpose. Ditches exist between settlement and crop fields which bear comparative high diversity of plant population. There is no free floating or rooted floating hydrophytes inside the river water due to continuous flow of tidal action. Internal canals possess some marginal vegetation. All major canal are connected with surrounding tidal rivers.

The findings of the baselines studies on aquatic biology are divided mainly into two groups: flora and fauna. The floral species observed frequently within the project area are Shapla/Shaluk (*Nymphaea* Spp.), Padma (*Nelumbo nucifera*), Kachuripana (*Eichhornia crassipes*), Kolmi (*Ipomoea fistulosa*), Dhol Kolmi (*Ipomoea fistulosa*), Khudipana (*Lemna Sp.*)**,** Topapana (*Pistia strateotes*), Kutipana (*Azolla Sp*), etc. Indian Pond Frog (*Euphlytis haxadactylus*), White-breasted Waterhen (*Amaurornis phoenicurus*), Great Egret (*Casmerodius albus*), Little Egret (*Egretta garzetta*), Indian Pond Heron (*Ardeola grayii*) are common among the fauna. Gangetic River Dolphin (*Platanista gangetica*) is available in the surrounding rivers.

Mangrove Ecosystem

Mangroves are a unique ecosystem hosting incredible biodiversity: migratory birds, marine creatures and reptiles in addition to associated species of flora. They function as a natural water treatment system; as spawning grounds for fish they provide several resources to local communities who directly or indirectly depend upon them for their livelihoods and sustenance. Biodiversity, the diversity of life forms – plants, animals, microbes – is the ecological basis of life. Mangrove ecosystem plays a central role in transferring organic matter and energy from the land to marine ecosystems. The dense root systems form a home for fish, crabs, shrimps, and molluscs. They also serve as nurseries for juvenile fish.

River levees, khal bank or even homesteads margins of the polder have scattered mangrove vegetation. At the species level, Hargoza *(Acanthus illicifolious)* is a small shrub, available in the river and canal sides. Ora *(Sonneratia caseolaris)*, Kewra *(Sonneratia apetalla)* and Gewa *(Ecoecharia agallocha)* are sighted in areas with tidal flow. Hada/Tiger fern *(Achrostichum aureum)* is another bush plant frequently found all over the polder area.

Figure 6.31: Vegetation pattern along shoreline of the polder show mangrove succession

6.5.3 Wildlife

Bangladesh is a part of the Indo-Burma biodiversity hotspot. The coastal zone contains several ecosystems that have potential conservation values. These ecosystems are not only biodiversity hotspots, but they also provide the ecological foundations for common property resources. The wildlife species are generally classified as amphibians, reptiles, birds and mammals. Of the amphibians, Indian Toad (*Bufo melanostictus*), Ornate Microhyla (*Microhyla ornata*), Bullfrog (*Hoplobatrachus tigerinus*) and Common Tree Frog (*Polypedates leucomystax*) are common within the project site. The reptiles species observed during the survey were large in number compared to the amphibians. The House Gecko (*Hamidactylus flaviviridis*), Common Garden Lizard (*Calotes versicolor*), Jerdon's Calotes (*Calotes jerdoni*), Little Skink (*Mabuya macularia*), Bengal Monitor (*Varanus bengalensis*), Checkered Keelback (*Xenochropis piscator*), Striped Keelback (*Amphiesma stolata*) were found frequently during the survey. The Black Drongo (*Dicrurus macrocercus*), House Crow (*Corvus splendens)*, Large-billed Crow (*Corvus macrorhynchos*), Common Kingfisher (*Alcedo atthis*), Asian Pied Starling (*Sturnus contra*), Common Myna (*Acridotheres tristis*), Jungle Myna (*Acridotheres fuscus*), Oriental Magpie Robin (*Copsychus saularis*), Red-vented Bulbul (*Pycnonotus cafer*), Spotted Dove (*Streptopelia chinensis*), Baya Weaver *(Ploceus philippinus*), Indian Pond Heron (*Ardeola grayii*), Little Cormorant (*Phalacrocrocorax niger*), Garganey (*Anas querquedula*), Little Stint (*Calidris minuta*) and Common Sandpiper (*Actitis hypoleucos*) are also available throughout the polder area. The large mammals are in peril due to habitat destruction and hunting pressures. Mammal species are not very frequent within the site but few of them like Mongoose (*Herpestes edwarsii*), Bengal Fox (*Vulpes bengalensis*), Jungle Cat (*Felis chaus*), House Rat (*Rattus rattus*), Field Mouse (*Mus booduga*), Asian House Shrew (*Suncus murinus*), Indian Otter (*Lutra perspicillata)*, Indian Flying Fox (*Pteropus gangeticus*) were found. Gangetic River Dolphin (*Platanista gangetica*) roams in surrounding rivers.

6.6 Livestock and Poultry

Livestock and poultry, being an essential element of integrated farming system, play an important role in the economy of the polder area. Livestock provide significant draft power for cultivation, threshing and crushing of oil seeds; cow dung as a source of manure and fuel; a ready source of funds; and meat, milk and eggs for human consumption. Most of the households raise poultry and livestock, a practice that significantly reduce poverty through generating income and employment. About 60% of households of the polder area are rearing cows/bullock, 5% of household are rearing buffalo, 40% household are rearing goat, 50% of household are rearing duck and 80% of household are rearing chicken. Detailed livestock and poultry population in the polder area are presented in **Table 6.19**.

Table 6.19: Present Status of livestock /Poultry in Polder 35-3

Livestock/Poultry	Households having Livestock/Poultry (%)	Livestock/Poultry/households (Nos.)
Cow/bullock	60	3 (11,993)
Buffalo	5	4 (1,332)
Goat	40	4 (10,661)
Sheep	-	-
Duck	50	5 (16,658)
Chicken	80	7 (37,313)

- *Source: CEGIS Estimation,2012; Parenthesis indicate total number of livestock/poultry*

Figure 6.32 : Livestock of the polder area

Figure 6.33:Poultry population in the polder area

6.6.1 Feeds and Fodder

The owners of the livestock population are facing problems in respect of availability of fodder and feeds during the month of July to December. Rice straw is the main fodder. Oil cake and Bhushi are the other common fodders in this polder area. Shortage of grazing areas throughout the year aggravates the feed problem for the animal population. 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.

6.6.2 Livestock and Poultry Diseases

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 livestock population is affected by different diseases. Major poultry diseases are Ranikhet, Fowl

Pox, and Cholera. The most vulnerable period is round year for spreading diseases to livestock and poultry populations. The major cause of livestock and poultry diseases is wet condition in the coastal area.

6.7 Socio-economic Resources

6.7.1 Area and Location

The Polder 35/3 covers parts of Bagherhat Sadar and Rampal upazilas under Bagerhat district. The Polder area falls in four unions namely Dema, Kara Para, Bhojpatia and Malliker Ber as shown in **Table 6.20**.

Table 6.20: Unions and Upazilas in Polder 35/3

District	Upazila	Unions	Percentage of Union Area within Polder
Bagerhat	Bagherhat Sadar	Dema	92
	Rampal	Kara Para	12
		Bhojpatia	7
		Malliker Ber	80

Source: Spatial GIS Analysis, CEGIS, 2012

6.7.2 Demography

Based on the Census Report of Bangladesh Bureau of Statistics (BBS) for 2011, the population in the Polder 35/3 is 27,494. This includes 13,660 males and 13,834 females. A total of 6,668 households exist in the polder with average size of 4.12 persons per household. The density of population is about 1,016 persons per square kilometer. The key demographic data of the Polder is presented in **Table 6.21**.

Table 6.21: Demographic Data of Polder

Households	Population			Size of House Hold
	Total	Male	Female	
6,668	27,494	13,660	13,834	4.12
		49.68%	50.32%	

Source: Population Census 2011, BBS

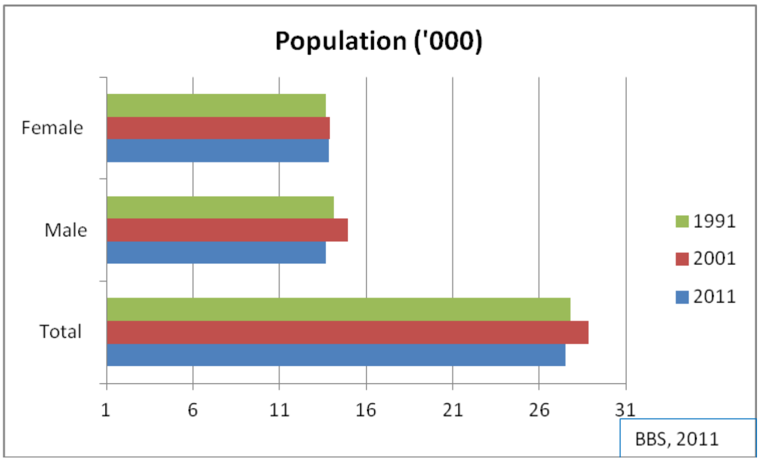


Figure 6.34: Trend of population in the study area

Population trend is shown in thousands in the above figure (**Figure: 6.30**). It is found that total number of population is decreasing in the year 2011. The number of female member remains same but the number of male member changes slightly.

Table 6.22 shows the age group composition of the people of the polder area. About 36 percent of the population is less than 30 years and 10 percent is over 60 years of age. The data shows that around 40 percent of the population depends on the 60 percent of the earning members of their households. Hence the dependency ratio is 67.

Table 6.22: Age Distribution in Polder

Age Range (Years)	0-4	5-9	10-14	15-19	20-24	25-29	30-49	50-59	60-64	65+
Percent of Population	8	11	11	8	8	9	27	8	3	7

Source: Population Census 2011, BBS

6.7.3 Livelihood

Occupation

According to the baseline survey, around 72 percent households report agriculture as their main occupation. About 21 percent population is engaged in service sector and only 7 percent is engaged in industrial sector. Most of the population is engaged in agriculture and service sector. (**Table 6.23**)

Table 6.23: Main Occupation in Polder

Union	Agriculture (%)		Industry (%)		Service (%)	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Dema	33	15	-	2	7	10
Kara Para	8	9	2	8	8	24
Bhojpatia	2	1	-	-	1	1
Malliker Ber	31	10	4	9	5	12

Source: Population Census 2011, BBS

Male and female are equally engaged in livelihood activities. However, participation of female member is nominal in comparison to male participation. In the polder area only 4 percent female members are working whereas 96 male members are engaged in income generating activities. (**Figure 6.35**)

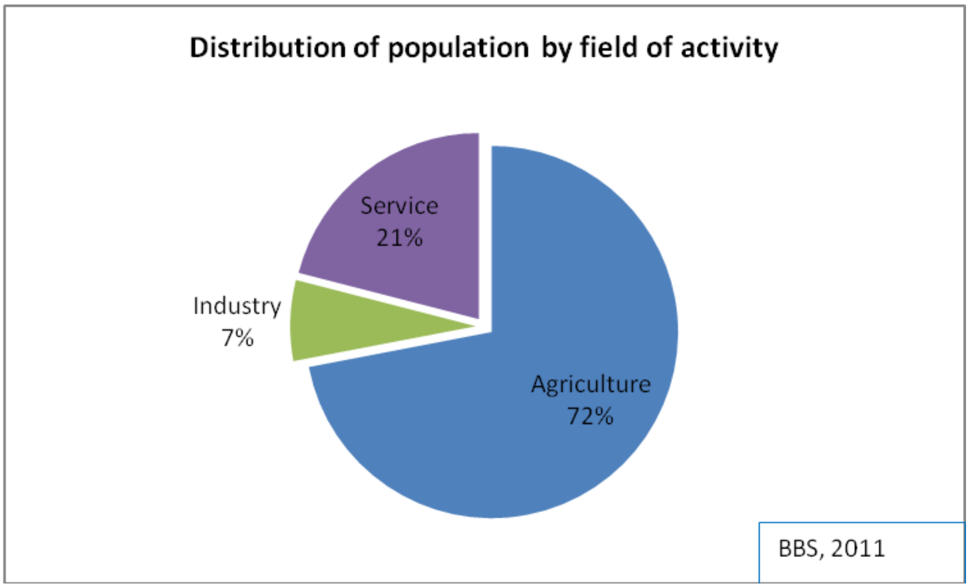


Figure 6.35: Distribution of population by field of activity

Employment

In the Polder, about 37 percent of total population is employed, 36 percent is engaged in household work, only one percent is looking for work and about 26 percent of total population is not working (it includes children and physically challenged population). **Figure 6.34** shows the employment status of the people in the Polder area.

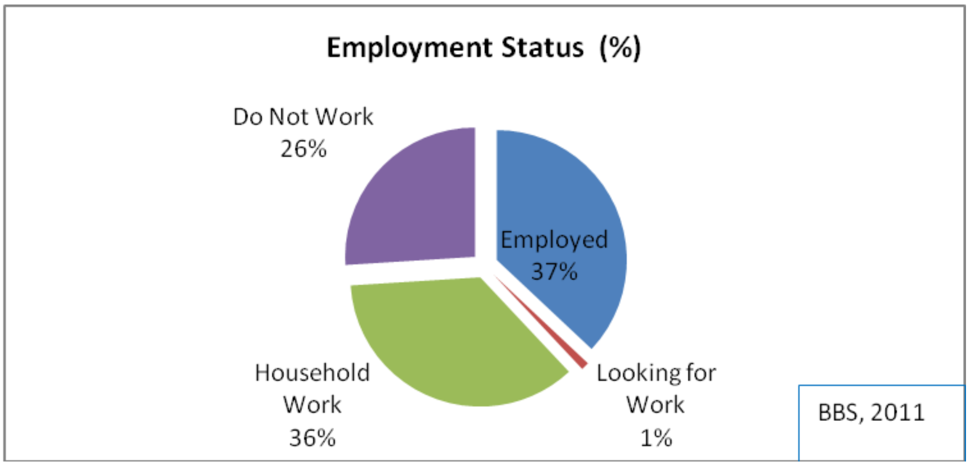


Figure 6.36: Employment status in the polder area

The following table (**Table 6.24**) shows the distribution of employment status by male and female in the polder area. It is found that only one percent female members are employing whereas 36 percent male members are employing in the study area.

Table 6.24: Employment status in Polder

Union	Employed (%)		Looking for Work (%)		Household Work (%)		Do Not Work (%)	
	Male	Female	Male	Female	Male	Female	Male	Female
Dema	41	1	1	-	1	33	10	16
Kara Para	11	1	-	-	-	10	3	4
Bhojpatia	2	-	-	-	-	1	-	1
Malliker Ber	23	1	-	-	-	24	8	9

Source: Population Census 2011, BBS

6.7.4 Quality of Life

Housing Condition

In the Project area, overall housing condition is not satisfactory. On an average only 5 percent houses are pucka (made of bricks and mortar) whereas 80 percent are kutcha (made of wood/bamboo, and other local materials). **Figures 6.38** to **6.41** present some photographs of these housing types. Statistics show that Kara para union comprises the highest pucka household (13.7%) whereas Dema, Malliker Ber and Bhojpatia unions comprise the highest kutcha households (respectively 93%, 85% and 82%). It can be concluded that the people living in the study area belong to extremely poor category in term of housing type.[10]

Table 6.25: Housing condition in the study area

Union	Type of Structure (%)			
	Pucka	Semi-pucka	Kutcha	Jhupri
Dema	2.8	3.4	92.9	0.9
Kara Para	13.7	22.9	59.2	4.2
Bhojpatia	0.6	1	82.5	15.9
Malliker Ber	1	2	85.1	11.9

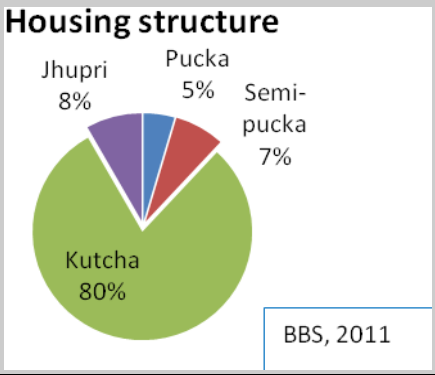


Figure 6.37: Housing Types in Polder Area

Source: Population Census 2011, BBS

[10] 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-pucka**: 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) **Pucka**: House which is made by fully concrete, cement, and iron.

Figure 6.38: *Jhupri* house

Figure 6.39: *Kutcha* house

Figure 6.40: Semi-Pucka House

Figure 6.41: Pucka House

Drinking Water

Overall status of drinking water in the area is generally satisfactory. Most of the people can collect drinking water from tube well. The detail is presented in **Table 6.26**, which shows that coverage of tube-well is insignificant in both Malliker Ber and Bhojpatia unions (comprise respectively 25% and 41%).

Table 6.26: Source of Drinking Water in Polder

Union	Sources of Drinking Water (%)		
	Tap	Tube-well	Other
Dema	0.1	80.2	19.7
Kara Para	8.1	85.7	6.2
Bhojpatia	0.5	40.6	58.9
Malliker Ber	2.9	24.5	72.5

Source: Population Census 2011, BBS; and Baseline Survey, 2012.

The figure below (**Figure: 6.42**) shows the trend of drinking water source from 1991 to 2011 year. It is found here that the coverage of tube-well is gradually increasing in the study area. People cannot collect drinking water from tap in 1991 but the tendency is found both in 2001 and 2011 years.

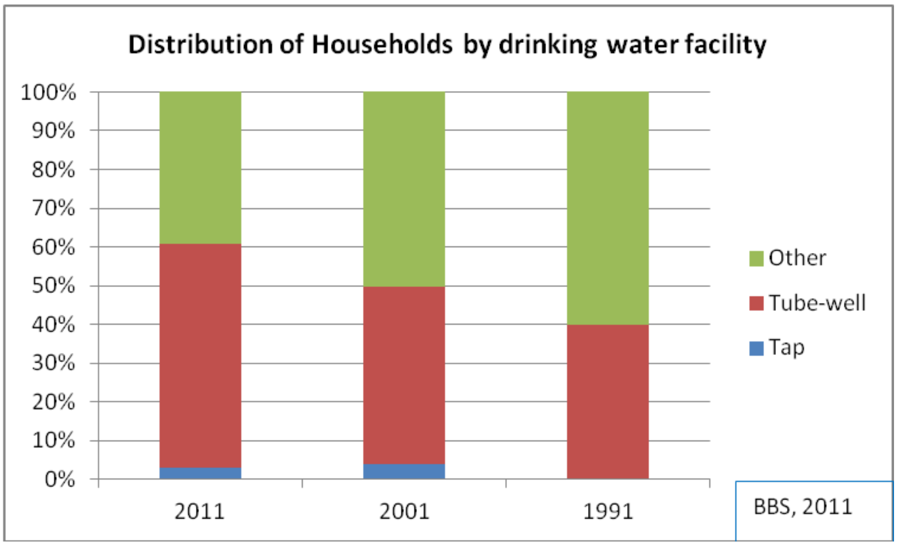


Figure 6.42: Housing Types in Polder Area

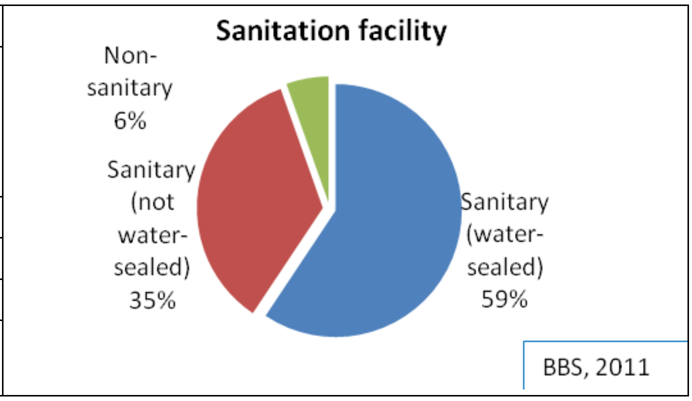
The water quality analysis result for drinking water i.e. arsenics or coliforms was mentioned in baseline chapter of water resources.

Sanitation

The sanitation facilities[11] adopted by households of the Project area are presented in **Table 6.27 and Figure 6.43**. It shows that about 59 percent households have hygienic sanitation facility (water-sealed), 35 percent have not water-sealed sanitation facility and only 6 percent have non-sanitary sanitation facility.

Table 6.27: Sanitation Facilities in the Polder

Union	Type of Structure		
	Sanitary (water-sealed)	Sanitary (not water-sealed)	Non-sanitary
Dema	24.5	21.3	0.8
Kara Para	60.9	14.1	0.5
Bhojpatia	31.3	25	6.1
Malliker Ber	32.7	28.1	6.3



[11] 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.

Figure 6.43: Sanitation facility in study area

Source: BBS and Baseline Survey, 2012.

Sanitation facility is quite satisfactory in Kara Para union (61% eater-sealed sanitary) whereas it covers only 25%, 31% and 32% respectively for Dema, Bhojpatia and Malliker Ber unions.

Figure 6.44: Sanitation facility in the polder area.

Health Profile of Polder People

The health profile of the local people living in the Polder is presented in the **Table 6.28**. According to the ranking, the incidence of diarrhea is the most prevalent ailment in the area. Dysentery, skin diseases, and common fevers are also common in the Polder.

Table 6.28: Disease Profile in the Polder

Disease	Ranking by Incidence
Diarrhea	1
Dysentery	2
Skin diseases	3
Influenza/Common fever	4
Cough/cold	5
Chicken pox	6
Typhoid	7
Gastric	8
Asthma	9
Hypertension	10
Diabetes	11
Hepatitis	12

Source: CEGIS fieldwork, 2012

Health Services and Facilities

Field findings show that there is no hospital in the study area. However, there are two community clinics in Dema union and another two in Molliker Ber union. The local people are to receive health service and facility from peripheral hospital situated outside the polder area (**Table 6.29**).

Table 6.29: Health service facilities in the study area

Union Name	No of Community Clinic	Outside of Polder
Karapara	-	Bagerhar Sadar
Dema	02	Bagerhar Sadar, Rampal
Mollikerber	02	Rampal

Source: CEGIS fieldwork, 2012

It is found that about 45 percent people tend to receive health service from quack and 20 percent from trained physicians. About 10 percent cannot receive treatment facility due to their impoverishment (**Figure: 6.45**).

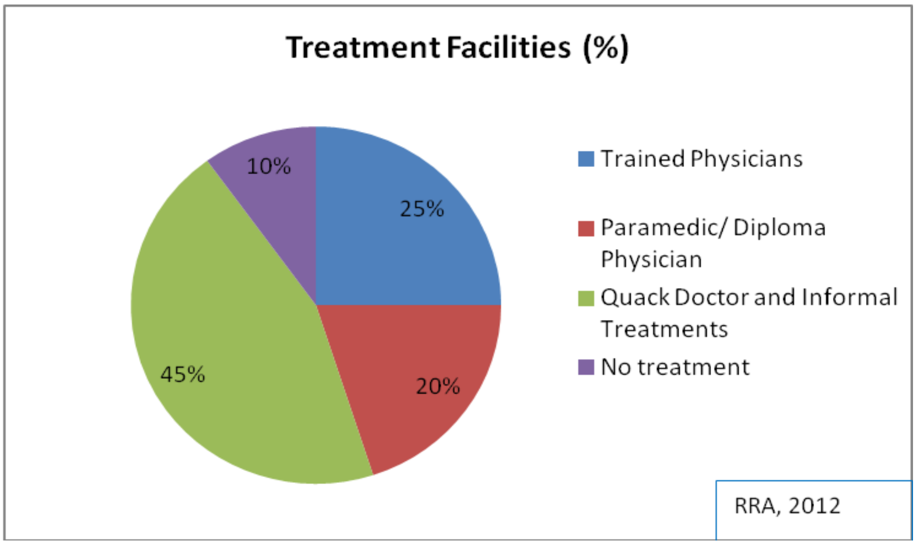


Figure 6.45: Health Service Providers in Polder

However, quality of health services and facilities is quite poor as reported by the local people. People responded that they are not satisfied in health services and facilities at all.

Figure 6.46: Union health and family planning sub-centre

Education

In the study area literacy rate is satisfactory in terms of national average (57.44). In all four unions literacy rate exceeds the national average. It is found that the highest literacy rate in Kara Para union (65.5%). Literacy rate for both male and female is also quite satisfactory (**Table 6.30**).

Table 6.30: Literacy Rate at Polder 35/3 Area

Union	Literacy Rate (%)		
	Total/Both	Male	Female
Dema	60.5	60.7	60.2
Kara Para	65.5	67.6	63.4
Bhojpatia	64.5	65.2	63.9
Malliker Ber	61.4	62.9	59.9

Source: Population Census 2011, BBS

The following figure (**Figure: 6.47**) shows the trend of literate rate. It shows that overall literacy rate is increasing gradually. The tendency of being educated is growing among men and women.

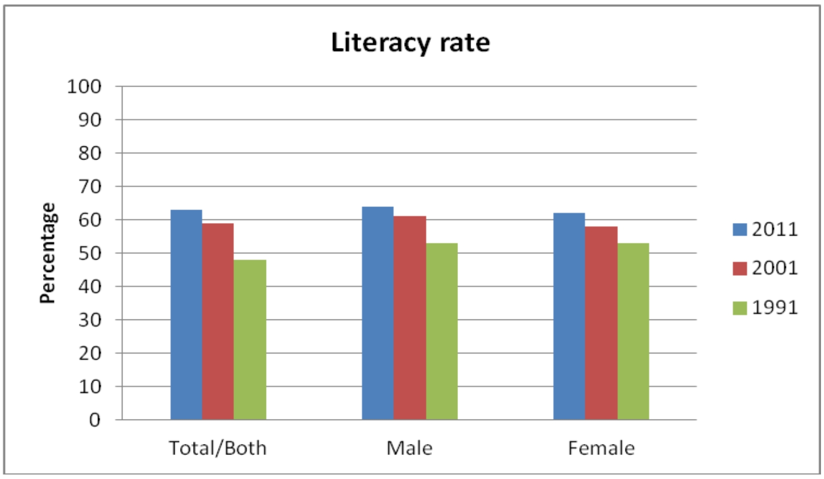


Figure 6.47: Trend of literacy rate in the polder 35/3 area

Electricity

Electrification as reported in the Population Census is not satisfactory in the Project area. On an average, only 33 percent households are under electricity coverage. Very few households use solar electricity in the Project area. **Figure 6.48** shows the percentage of electricity connection in different unions of the Polder areas. It shows that Kara Para union has the highest electricity coverage (69%).

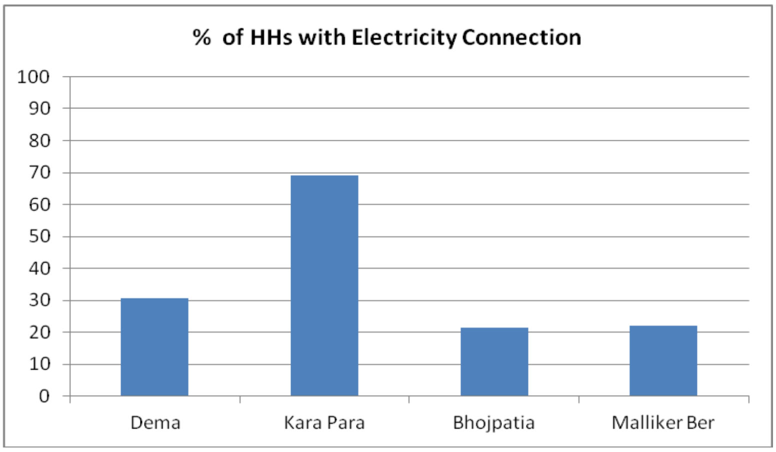


Figure 6.48: Trend of electricity facility.

6.7.5 Poverty and Safety Nets

Landownership Pattern

Landownership pattern can be an indicator of the poverty incidence in the area. The results of the RRA shows that about 22 percent of households are landless and the remaining 78 percent are having land for mainly agriculture use and also for settlement and commercial uses (see **Table 6.31**).

Table 6.31: Landownership Pattern in Polder

Land Ownership Classes	Households (%)
Landless/ No land	22
Marginal	09
Small (0.05 to 2.49 acres)	40
Medium (2.5 to 7.49 acres)	25
Large (7.5 acres and above)	04

Source: CEGIS fieldwork, 2012

In the Project area the Agricultural Census conducted by BBS in 2008 has found that most of the land is under small holding category. Small holdings[12] comprise 84 percent and medium holdings comprise 14 percent whereas large holdings comprise only 2 percent (**Figure 6.49**).

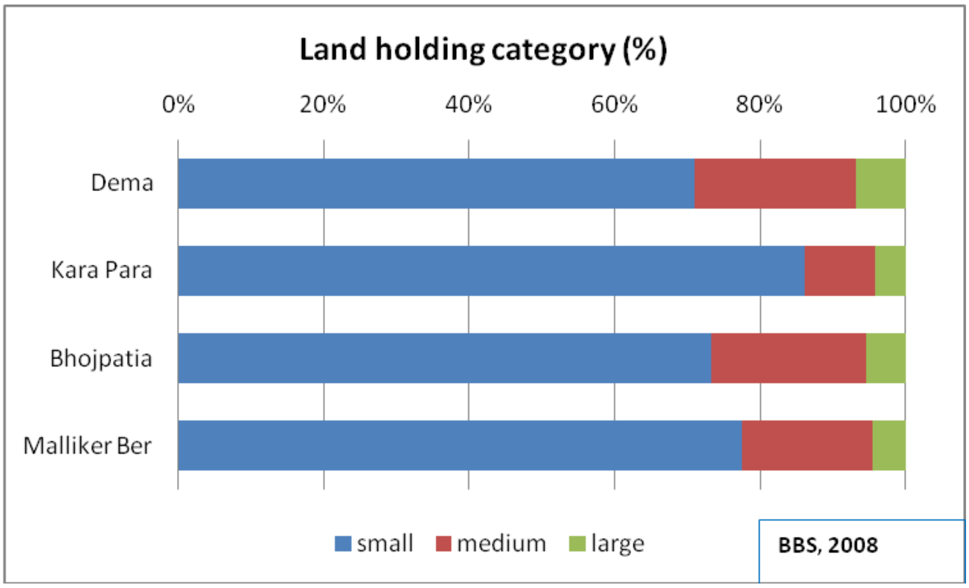


Figure 6.49: Land holding categories in project area

Income Poverty

[12] Agricultural Census by BBS defined farm holding into three broad categories such as- a) **small**: having minimum cultivated land 0.05 acre but operated land more than this minimum but up to 2.49 acres; b) **medium**: having operated land in between 2.50 to 7.49 acres; and c) **large**: having operated land 7.50 acres and above.

Income poverty profile has been prepared by the participants of the RRA themselves through a self-assessment exercise. The assessment is based on the year-round income along with the food consumption of the inhabitants within three different categories (**Figure 6.50**). It is observed that about 30 percent of the households in average are in the 'deficit' category. These households have been identified in the RRA as the poor households of the Polder area. 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.

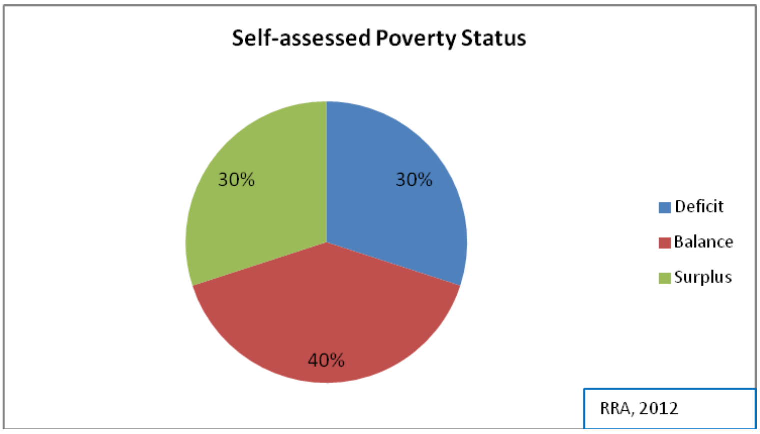


Figure 6.50: Self Assessment of Poverty Status

Income and Expenditure

The income and expenditure at the household level in the Polder area is shown in **Table 6.32**. Around 62-70 percent households have reported that their income and expenditure level is over 5,000 taka per month.

Table 6.32: Annual Income and Expenditure Level

Range in Taka	Percentage (%) of Households	
	Income	Expenditure
Up to 12,000	-	-
12,001 to 24,000	10	12
24,001 to 60,000	20	26
60,001 to 108,000	40	42
108,001 to 240,000	20	13
More than 240,000	10	7

Source: CEGIS fieldwork, 2012

Natural Disasters

The local inhabitants of Polder 35/3 have identified tidal flooding, salinity intrusion and cyclones as the major hazards in the area. Details about the disasters and their affects in the area are presented in **Table 6.33**.

Table 6.33: Affects of Recent Natural Disaster in Project Area

Disaster		Affected Area (%)	Affected House Holds (%)	Crop Damaged (%)	Major Damaged Crop
Tidal Flood	2007, 2009 and 2010	100	90	90	Rice
Salinity	2007, 2009, 2011	40	40	30	Rice
Cyclone	2007 (Sidr), 2009 (Aila)	100	100	90	Rice

Source: CEGIS fieldwork, 2012

Social Safety Nets and Poverty Reduction Measures

The major social safety nets and poverty reduction programs initiated in the area include the Vulnerable Group Development (VGD), Food/Taka for Work (F/TFW), Food for Education/Cash for Education, Rural Maintenance Program (RMP), Old Age Allowance, Freedom Fighter Allowance and Integrated Poverty Reduction Program. These programs have created food security as well as social safety nets among the targeted poor households and vulnerable communities (**Table 6.34**).

Table 6.34: Households Served by Different Social Safety Nets Programs

Social Safety Net Programs	Households/Communities Served (%)
Vulnerable Group Development (VGD)	6
Food/Taka For Work (F/TFW) of PIO	4
Food for Education/Cash for Education	10
Rural Maintenance Programme (RMP)	6
Old Age Allowance	5
Freedom Fighter Allowance	3
Integrated Poverty Reduction Program of BRDB	6

Source: CEGIS fieldwork, 2012

A number of local and national NGOs are working in the Project area. The main activities of these NGOs are to operate micro credit programs among the rural poor and landless women/men. The major NGOs working in the area include BRAC (Bangladesh Rural Advancement Centre), ASA (Association for Social Advancement), Udayon Bangladesh, Help, Uttaran, (**Table 6.35**). These NGOs are serving with micro credit while BRAC, ASA, Uttaran are working for non-formal education, Health, human rights, water and sanitation, gender and children development programs. About 40 percent of households are found to benefit from the NGOs interventions.

Table 6.35: NGOs and their Programs in Project Area

NGOs	Type of Programs						
	Credit	Education	Water and Sanitation	Health	Human Rrights	Gender	Children
BRAC	✓	✓	✓	✓	✓	✓	✓
ASA	✓	✓	-	-	✓	✓	-
Udayon Bangladesh	✓	-	-	-	-	-	-
Help	✓	-	-	-	-	-	-
Uttaran	✓	✓	✓	-	✓	✓	-

Source: CEGIS fieldwork, 2012

Figure 6.51: Some glimpses of social safety net programs

6.7.6 Social Capital

Roads

Various types of roads provide means of communication mostly within the Polder. Overall about 141 km of road network exists in five unions of which 29 km roads are paved, 34 km roads are brick soled and 78 km roads are earthen. **Table 6.36** presents data on road network in the Project area; **Figure 6.52** presents some photographs of these roads.

Table 6.36: Road Network in Polder

Name of Union	Type of Road	Description	Length (Km)
Karapara	Herringbone/Brick soling	Putimari bridge-Radhaballabh sluice, Nomans shop- Kurer khal	3.0 1.0
	Earthen road	Rdhaballabh-Gujihati, Putimari bridge-East side	2.0 1.0
Mollikerber	Paved	Kashipur-Mollikerber Madrasa, Sannyasi bazaar-Aulia bazaar	5.0 4.0
	Herringbone/Brick soling	Sannyasi east side-Betibunia, Aulia bazaar-Madrasa bazaar, Aulia bazaar-Hakim Sarkarer bari Sannyasi bridge-Matrimingol school Sannyasi -Choto sannyasi	20.0
	Earthen road	Rural road	45.0
Dema	Paved	Dema bridge-Khegraghat bridge, Hedayetpur bazaar-Kashimpur bazaar	10.0 10.0
	Herringbone/Brick soling	-	10.0
	Earthen road	-	30.0

Source: CEGIS fieldwork, 2012

Figure 6.52: Muddy and soling roads in the Polder area.

There are two major transport routs in the polder area through which most of the polder living people communicate.

- Dema Bridge to Khegraghat Bridge via Kashipur Bazar
- Dema bridge to Matherdia launch ghat via Kashipur Bazar

Main vehicles using the Polder roads include motorbikes, bicycles, vans, and auto rickshaws. Due to poor road conditions, most of the traffic constitutes motorcycles and bicycles in the Polder area. It is found that, the total 347 vehicles entered inside the polder and 378 vehicles existed from the polder at Dema bridge bus station. Similarly, the total 677 vehicles entered to inside to polder and 754 vehicles existed from the polder at Dasani bus station.

Table 6.37: Traffic volume in the polder 35/3 area

Road name : Near Dema Bridge; Mollikerber-Kashimpur to Bagerhat, and Rampal -Khegraghat to Kashimpur																											
GPS location	**N**-22°37'19.0", **E**-89°45'52.4"										Survey period: 8 hours																
Type of Vehicles	**7:00 - 8:00**		**8:00-9:00**		**9:00-10:00**		**10:00-11:00**		**11:00-12:00**		**12:00-13:00**		**13:00-14:00**		**14:00-15:00**		**15:00-16:00**		**16:00-17:00**		**17:00-18:00**		**18:00-19:00**		**Total (T)**	**Factors (F)**	**T** x **F**
	Entry	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**			
Van	5	3	4	8	6	4	3	11	4	6	5	4	4	5	6	4	3	3	4	7	4	6	5	8	122	0.5	61
Motocycle	2	4	5	6	4	7	5	6	4	9	5	7	6	6	2	4	6	6	7	8	4	5	8	8	134	0.75	100.5
Rickshaw	5	3	3	4	6	2	3	4	2	5	4	4	5	5	2	6	3	6	5	5	3	7	3	6	101	0.5	50.5
BiCycle	6	5	4	3	5	3	2	6	3	4	6	8	4	8	5	6	6	4	5	4	7	8	8	4	124	0.5	62
Car	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	1	0	0	1	0	7	1	7
Jeep	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	3	1.75	5.25
Bus	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	6
Truck	0	1	0	2	1	0	2	0	0	0	0	2	3	1	4	4	3	2	0	3	3	4	2	5	42	3	126
Pickup/ Mini Truck	2	0	1	0	3	2	0	0	0	0	3	3	5	2	1	3	2	1	0	2	0	4	3	2	39	1.75	68.25
Auto Ricksaw	3	2	1	4	4	4	5	5	2	7	6	4	2	5	4	3	2	3	3	4	4	5	5	2	89	0.75	66.75
Tempo	1	3	3	4	5	5	4	4	6	6	4	4	3	6	4	3	5	4	4	6	5	3	3	4	99	1	99
																										Sum	652.25

Source: Baseline survey, CEGIS, 2012

The above table (Table:00) shows the traffic volume in the study area. It is estimated following the standard PCU[13] (Passenger Car Unit) and found that traffic volume for 8 hours is 81.53 vehicles/ hour (652.25/8 = 81.53).

Waterways

There are four navigation routs in the study area namely Daratana river, Katakhali khal, Putimari river and Bishnu river. Among these Daratana river and Katakhali khal are the main navigation routes. The navigation varies considering dry and wet season.

Figure 6.53: navigation in the polder area.

The main modes of communication through waterways are launch and trawlers. People communicate and carry goods and commodities through these routes. The following table (**Table 6.37**) shows the main navigation path along with type of vehicles.

Table 6.38: Major Navigation Routes in the Area

Sl. No	Navigation Route/River	Navigation Path	Type of Vehicle
1	Daratana river	Bagerhat-Motherdia ghat-Tushkhali ghat Bagerhat -Motherdia-Geodhora (Trawler) Bagerhat-Motherdia- Panchgaon (Trawler) Bagerhat -Motherdia-Shonirjhor (Trawler) Bagerhat-Motherdia-Shekhpara (Trawler) Bagerhat-Motherdia- Khaluikhali (Trawler) Bagerhat-Motherdia-Debraj Bagerhat-Morelgonj-Moshishali ghat-Fullhata ghat (Trawler)	Launch, Trawler, Cargo, Fishing Boat (to Sea)
2	Katakhali khal river	Bagerhat-Motherdia-Khulna Planner bazaar ghat to opposite lounch ghat (Trawler)	Cargo, Trawler
Source: Baseline survey, CEGIS, 2012			

[13] PCU (Passenger Car Unit) is a metric used in Transportation Engineering, to assess traffic-flow rate on a roadway. A Passenger Car Unit is essentially the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car.

Educational Institutions

According to the field findings there are 19 primary schools, 4 junior schools, 5 secondary schools and 3 Madrashas in the study area (**Table 6.39**). All of the institutions are locating in Dema and Molliker Ber unions. However, these institutions are easily accessible and students can attend in the schools smoothly.

Table 6.39: Academic Institutions

Type of education institutions	Dema	Malliker ber
Primary school	10	9
Junior School	2	2
Secondary school	2	3
Madrasha	2	1

Source: CEGIS field work, 2012

Figure 6.54: Educational Institutions in the Polder Area

Markets

There are 7 markets/bazaars in the study area, among them three in Dema union and four in Molliker Ber union (**Table 40**). All of the bazaars are located in Dema and Molliker Ber unions which are serving the local people.

Table 6.40: Markets in Project Area

Unions	Nos of markets/bazaar	Name of the Markets/bazaar
Dema	3	Khegraghat, Kashimpur, and Choto Sannyashi
Molliker ber	4	Madardia, Aulia/Plan, Mdrasa, and Baro Sannyasi bazar

Source: CEGIS database, 2012


Figure 6.55: Typical Market/Bazaars in Polder 35/3

6.7.7 Gender and Women

The restriction on women mobility, male-female wage discrimination, mortality, health and nutrition, and girl education are some of the key gender issues in the Polder 35/3. Women have little role in decision making at the family level and in the society and they are facing gender discrimination in terms of social and economic activities. Recent studies have revealed that the women/girls of Polder 35/3 are facing discrimination regarding social and economic affairs of family and society. **Figure 6.56** shows scope of decision making by women in the Polder area.

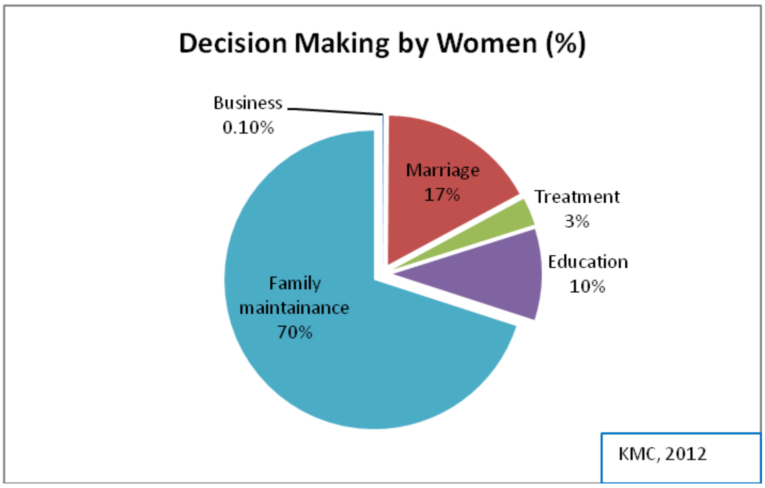


Figure 6.56: Scope of Decision Making by Women

Women mobility in the area is mostly localized except when going for medical treatment, fetching water, farming activities, and visiting relatives.

Mortality rate of the pregnant mother during delivery period has reduced in the area (20/1000). 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 mortality rate. About 15 percent women are living with good health condition and the rest are suffering from various diseases such as low blood pressure and premature delivery. About 20 %

women are getting proper nutrition and about 10% have access to the health centers, which are around 15 km away on average from their residence.

However, this scenario is now changing, though slowly, as it can be gauged through women literacy rate which is increasing gradually and it is now 58% in Polder 35/3 area, while the school attendance rate of both sexes is almost equal, as shown in **Figure 6.57**. This should bring about further improvement in the role and status of women in the household as well as in the society.

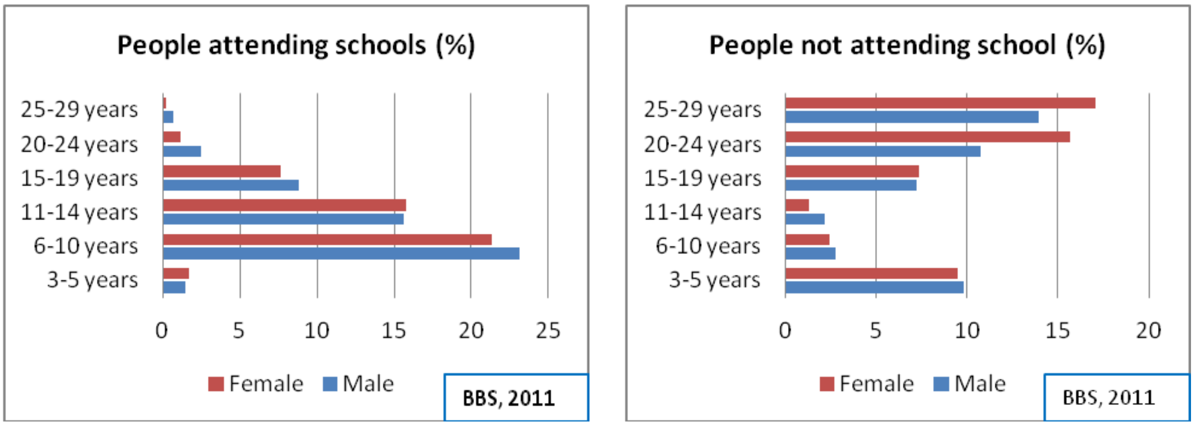


Figure 6.57: School Enrolment

6.7.8 Vulnerable Communities

In the Project area, three types of people could be considered as vulnerable. These include marginal farmers having less than Taka 6,000 monthly income, fishermen, and women headed households. Local economy is mostly agriculture based and most of the land owners cultivate their land by themselves. Some of the land lords give their land for sharecropping to the marginal farmers and other vulnerable groups. Some people of the Project area depend on fishing from the open water bodies. As per survey, about 7.3% male population and 0.20% female population is involved in fishing or fish culture. Besides, almost all households catch fish for their daily use during monsoon.

6.7.9 Common Property Resources

The common property places/resources of the area are different social amenities e.g. mosques, graveyards, temples, cremation grounds, playgrounds and *Eidgahs* (place for offering Eid prayers). These are used frequently by the local people for the purposes of religious, social and cultural gathering. Besides these, the BWDB embankment is also used very commonly for different livelihood purposes of the local inhabitants. According to the CEGIS fieldwork, about 523 common property places exist in Polder 35/3, as shown in **Table 6.41**.

There are no known historical and archeological sites declared by government in the Polder area.

Table 6.41: Common Property Places/Resources in Polder 35/3

Union	Type of common property resources							Total
	School	Madrasha	Crematorium	Market/Bazaar	Mosque	Temple	Tomb	
Karapara	-	-	-	-	10	1	1	12
Dema	14	2	2	3	28	10	-	59
Molliker ber	14	1	3	4	20	5	1	48
Total	28	3	5	7	58	16	2	119

Source: CEGIS fieldwork, 2012

7. Climate Change

7.1 Overview

Climate change refers to a change in the state of the climate parameters that can be identified by changes in the mean and the variability of it properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of anthropogenic activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (*Fourth Intergovernmental Panel on Climate Change - IPCC Synthesis Report, 2007*).

7.2 Regional Context

Asia is very likely to be warm during this century; the warming is likely to be well above the global mean in central Asia, the Tibetan Plateau and northern Asia, above the global mean in East and South Asia, and similar to the global mean in Southeast Asia. It is very likely that summer heat waves/hot spells in East Asia will be of longer duration, more intense, and more frequent. It is very likely that there will be fewer very cold days in East Asia and South Asia.

Boreal winter precipitation is very likely to increase in northern Asia and the Tibetan Plateau, and likely to increase in eastern Asia and the southern parts of Southeast Asia. Summer precipitation is likely to increase in northern Asia, East and South Asia and most of Southeast Asia, but it is likely to decrease in central Asia. An increase in the frequency of intense precipitation events in parts of South Asia, and in East Asia, is very likely.

Extreme rainfall and winds associated with tropical cyclones are likely to increase in East, Southeast and South Asia. Monsoonal flows and the tropical large-scale circulation are likely to be weakened.

The above mentioned regional level climate change impacts were assessed in the second national communication report of Bangladesh.

7.3 Local Context

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). 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 likely implications due to climate change considered in this study for the coastal areas of Bangladesh:

7.3.1 Sea Level Rise and Coastal Inundation

Bangladesh is vulnerable to current coastal hazards and anticipated Sea Level Rise (SLR) because of its low elevation. Drainage congestion and water logging are already an alarming problem in Bangladesh specifically in polder area and likely to be exacerbated by SLR and increased river flooding. It is reported that inundated areas might increase up to 3 percent (2030s) and 6 percent

(2050s) primarily in coastal low lying areas (0 – 30 cm, Khan et al., 2006, using upper estimates of SLR). Large uncertainties are associated with regional to district level estimates of inundation which is due to the compounding effects of the variable rates of uplift and sedimentation, river flooding and erosion. Siltation is gradually increasing in the project area due to SLR. As a result of reduced upstream flow, the silt flocculate/deposit in the riverbed which restricts removal of excess water from the countryside and causes drainage congestion.

7.3.2 Tidal Flooding

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 climate change impact (sea level rise).

A recent study entitled 'Climate Change Impacts on Food Security in Bangladesh' assessed future flooding scenarios for Bangladesh (Yu et al., 2010). In this study, MIKE 11 and MIKE BASIN models were used for generating river flow, discharge and finally flooding. In this study Bangladesh has been divided into 16 sub regions for incorporating the spatial and temporal variation in flooding in different parts of the country. In defining the sub regions the MPO/NWMP Plan Unit and district boundaries are considered to be whole. These sub regions are classified based on various climatic, agricultural and flooding characteristics. In the classification process of sub regions similar topography, flooding characteristics etc. have been considered with great importance. The results of the flooding analysis have been presented utilizing the MPO flood depth classification. This classification includes five flood phases/land type, based on a three-day maximum flood depth, theoretically with an exceedence return probability of 1 in 2 years (MPO, 1987). In this classification F0 is 0-30 cm; F1 is 30-90 cm; F2 is 90-180 cm; F3 is 180-300 cm and F4 is over 300 cm. **Figure 7.1** illustrates the percentage changes in flooded area in each sub region due to climate change in the 2030s and 2050s. The results show an increase in flooded area in the coastal region of Bangladesh.

7.3.3 Salinity Intrusion

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. In 2007, Institute of Water Modelling (IWM) and CEGIS jointly carried out a study on "Investigating the Impact of Relative Sea-Level Rise on Coastal Communities and their Livelihoods in Bangladesh" and assessed that in base condition about 10 percent of coastal area is under 1 part per thousand (ppt) salinity and 16 percent area is under 5 ppt salinity and this area will increase to 17.5 percent (1 ppt) and 24 percent (5 ppt) by 2050 considering 88 cm sea level rise. So, there will be an increase of around 8 percent in the area under 5 ppt salinity levels due to sea level rise. The area of influence of 5 ppt salinity line under different sea level rise scenarios are show in **Figure 7.2**. The intrusion of salinity will increase soil salinity and surface water salinity and might affect agriculture crop production.

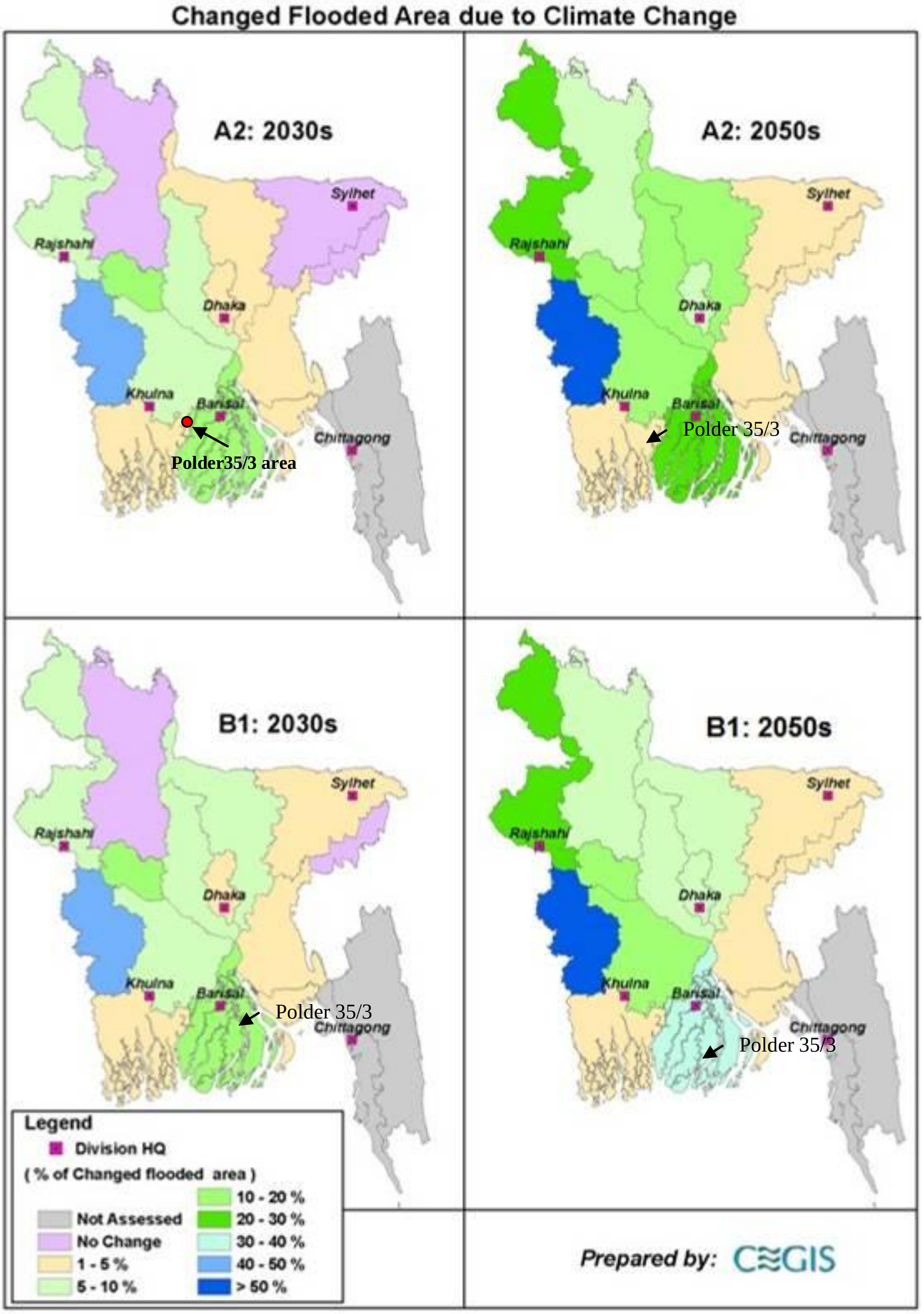


Figure 7.1: Changes in flooded area in Bangladesh in the 2030s and 2050s

(Source: Hassan et. al., 2010)

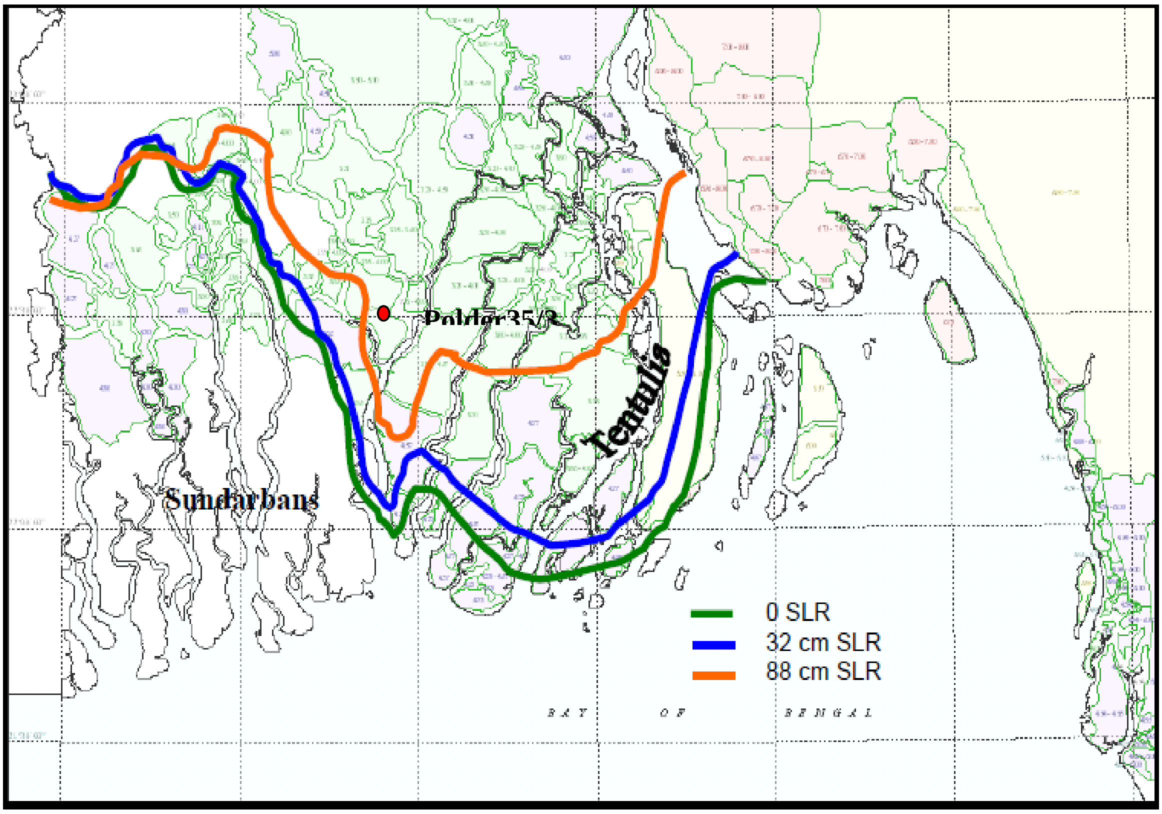


Figure 7.2: Five ppt isohaline line for different sea level rise in dry season (IWM and CEGIS, 2007)

7.3.4 Cyclones and Storm Surges

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

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 (**Figure 7.3**) and 16 cyclones (**Table 7.1**) have occurred in the last 25 years. The following table represents the occurrence of cyclone is more frequent due to climate change (T. Islam, 2009). Last devastating cyclone (SIDR) hit the study area and project site on 2007. The project area (Polder35/3) is located in the wind risk zone of Bangladesh.

The area is vulnerable to cyclone and storm surge. During SIDR, surge water entered the polder area by overtopping the right bank of the Bhairab (Daratana) River. As per local community perception, the site has experienced the maximum surge height during cyclone SIDR. As per local perception, the area was inundated by the surge of 4.42 m during Aila.

Table 7.1: Major Cyclones Hitting 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			

7.3.5 Rainfall, Drainage, and Water logging

The rainfall is likely to increase by about 26 percent in the month of March - May; and 13 percent in the month of June- August (4th IPCC). As a consequence, flooding inundation will change demanding efficient drainage for crops.

The drainage of coastal polders mainly depends on the tidal characteristics of the surrounding rivers and degree of siltation of these rivers. In 2008, Institute of Water Modeling (IWM) carried out a study on "Impact of Sea level rise in coastal river of Bangladesh" and assessed that present study mainly focused the change in the tidal characteristics of the surrounding rivers due to sea level rise and its impact on inundation area of the polder.

The result shows that high water level at the surrounding rivers of polders increases in the range of 30-80 cm for sea level rise of 32 cm and 88 cm respectively. This rise will eventually hamper the smooth drainage of a number of polders. Inundation area in few polders causing drainage congestion due to sea level rise is presented in **Figure 7.4**.

Sea level rise will deteriorate drainage conditions to a large extent. 17 polders (light green in **Figure 7.4**) out of 35 will be facing acute drainage congestion where as the present performance of the polder 35/3 is unsatisfactory.

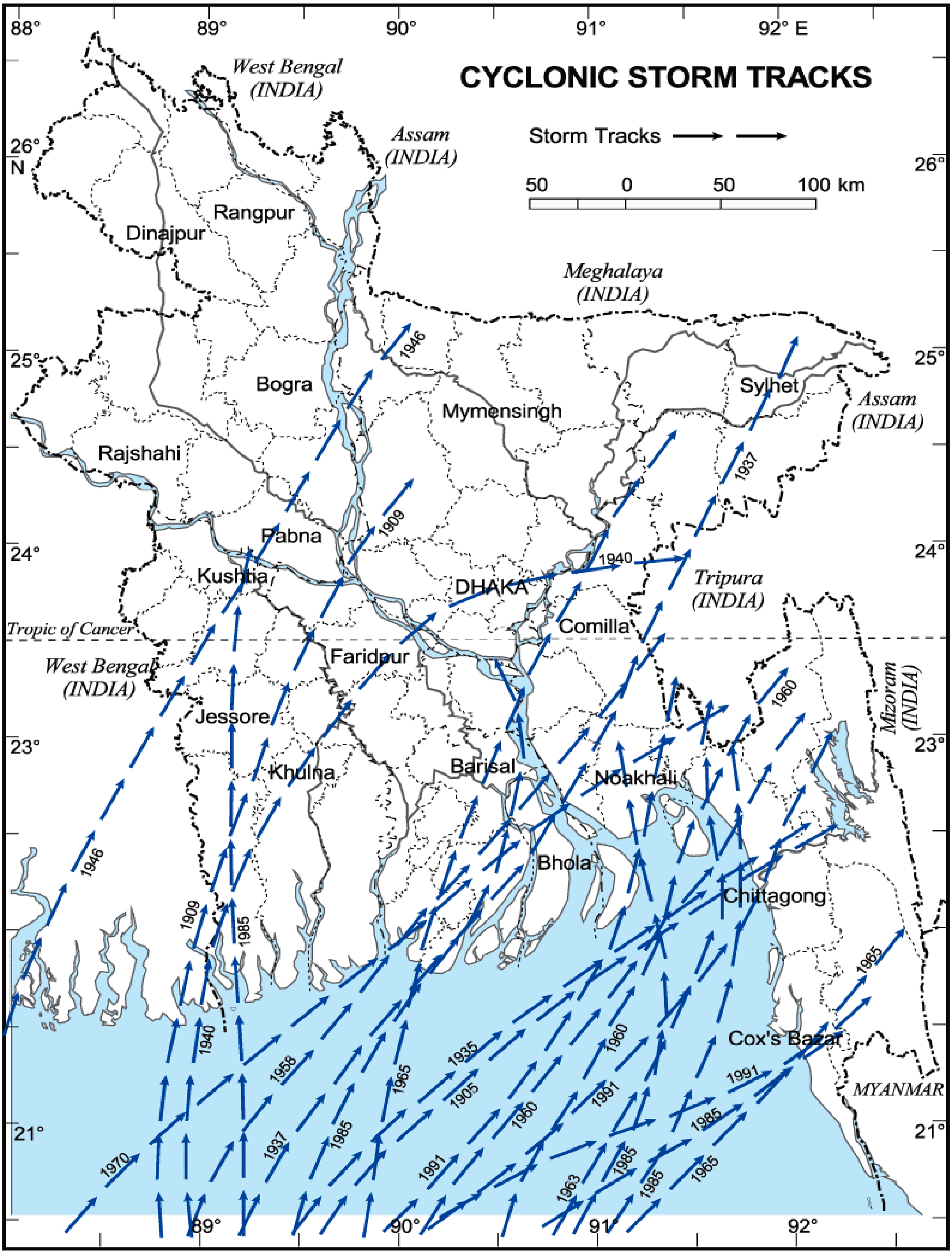


Figure 7.3: Previous Cyclonic Storm Tracks

(Source: MCSP, 1993)

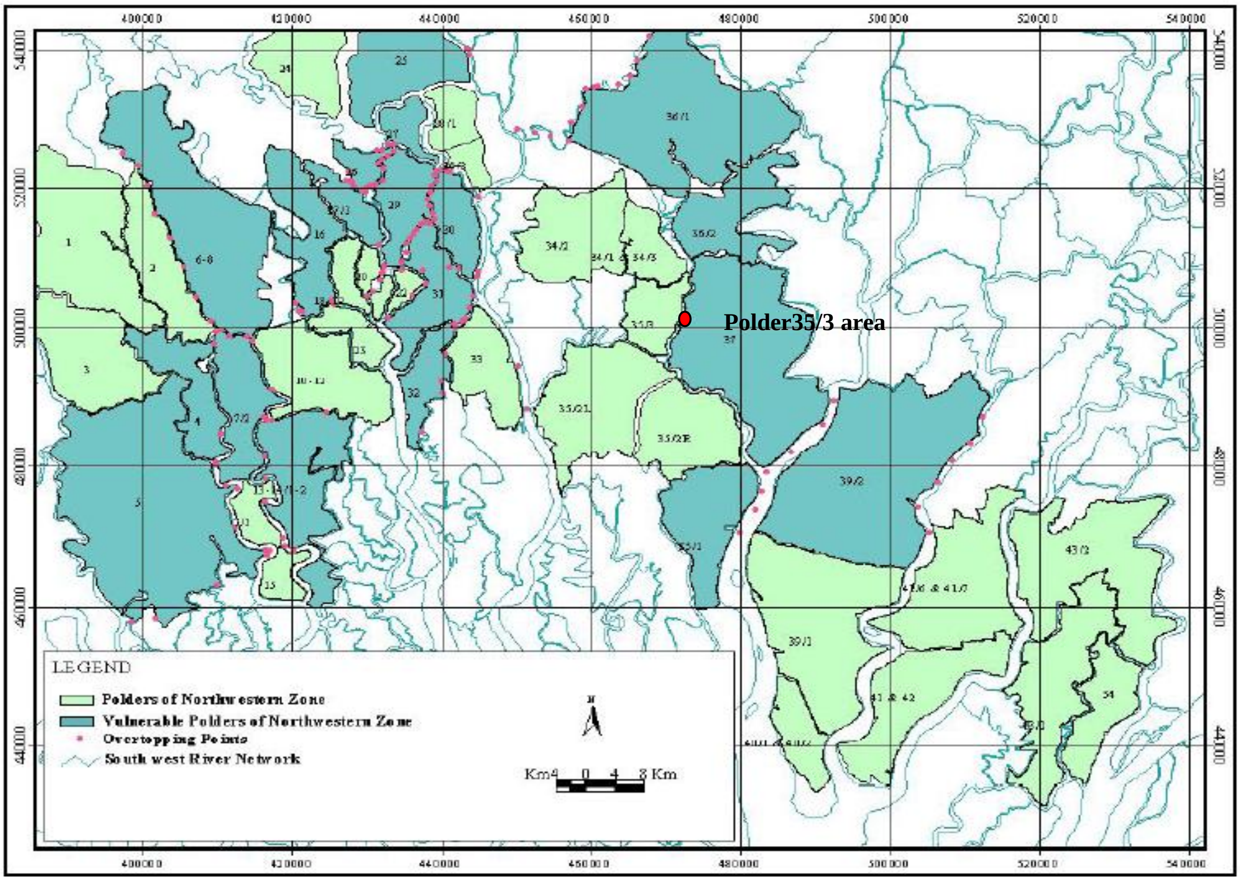


Figure 7.4: Drainage Congestion in Affected Polders due to Sea Level Rise

7.3.6 River Erosion and Accretion

Bangladesh is a riverine country and morphology of the rivers is highly dynamic. Disastrous riverbank erosion is mainly associated with the major river systems of the country. The main rivers are braided and form islands or chars between the braiding channels. These chars (many of which are inhabited) move with the flows and are extremely sensitive to bring changes in the river conditions (CEGIS, 2009). River erosion not only causes people's displacement but also leads to massive financial loss. River erosion is commonly observed in the entire coastal area specifically in Meghna estuary region.

The magnitude of erosion and accretion in the Meghna estuary (**Figure 7.5**) for the period of 2008-2010 is represented in the following figure. During this period the extent of accretion was 250 km^2 while that of erosion was 153 km^2 with a corresponding net accretion of 97 km^2. Extension of mainland of Noakhali towards the sea continued like the previous period with a net accretion rate of 4.3 km^2/yr. Significant amount of accretion occurred in Bhola Island with a net accretion rate of 27.6 km^2/yr. Both erosion and accretion process occurred along shoreline in Chittagong district with a net accretion rate of 8.5 km^2/yr. Erosion was observed in Patuakhali and Lakshmipur district with a net erosion rate of 3.2 and 2.8 km^2/yr respectively.

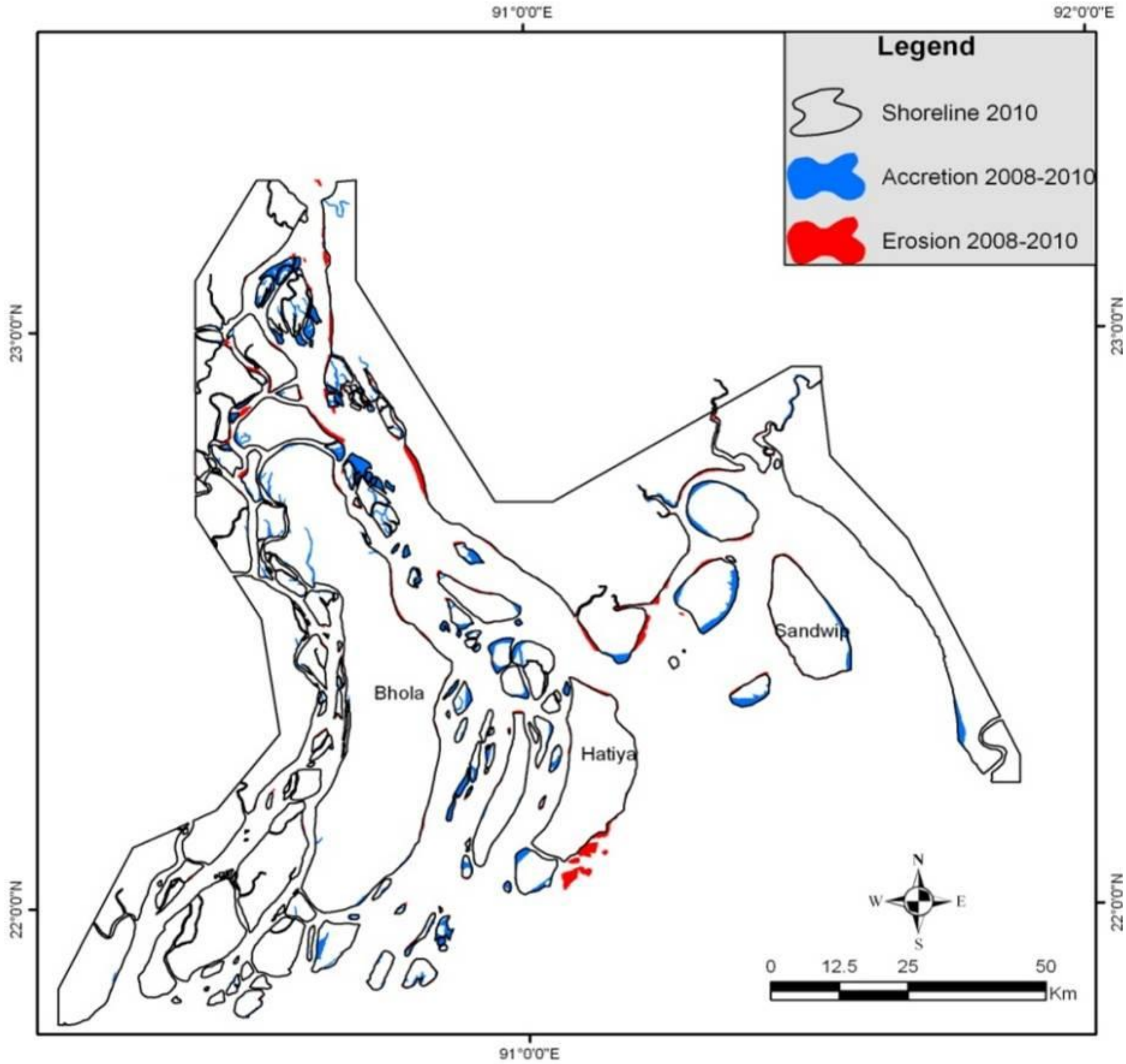


Figure 7.5: Erosion and Accretion of Land in the Meghna Estuary from 2008 to 2010

7.4 Adaptation Strategy for Climate Change Impacts in the Project Area

7.4.1 Adaption at Local level

Local people of the project area are already facing different natural problems due to climate change. Specifically drainage congestion, tidal flooding, water logging, storm surges and salinity intrusion are the major natural hazards in the project area, some of which can be linked with the climate change phenomenon. People have reported that the occurrences of the natural hazards are more frequent than before in the project area. Locally the following adaptation measures have been practiced in different physical, environmental and social sectors in coastal belt of Bangladesh for adapting climatic hazards.

- People switching their livelihood from agriculture to shrimp culture.
- High yielding and salinity tolerance verities of paddy are being introduced in the project area.
- Social and homestead forestry is being increased due to protect their life and properties from the strong wind velocity during cyclone.
- People raise the plinth level of their houses due to adapt water logging and flooding.
- Peoples introduce floating vegetable gardening system and case culture in the water logging area.
- Rain water harvesting system is being adopted to mitigate their drinking water problem during dry season.

7.4.2 Adaptation at Rehabilitation and Improvement planning

The IPCC projections have been considered in the hydrologic and hydro-dynamic modeling of the feasibility study of the CEIP-I. The climate change projections have been considered to determine the design criteria and finally these outcomes have been adopted in the planning and design of rehabilitation and improvement plan. The following criteria and the projected climate change information have been used in the design and planning of the interventions for taking care of climate change scenario in 2050.

- Sea level rise of 50 cm ;
- 10 percent increase in maximum wind speed of cyclones; and
- Rainfall increase by 26 percent from March through May; and 13 percent increase from June through August.

These considerations have ultimately led to determine new height (4.27m) of the embankment of polder 35/3 and improved drainage system to cope with the impact of climate change.

8. Stakeholder Consultations and Disclosure

This Chapter provides details of the consultations held with the stakeholders at the Project site and framework for consultations to be carried out during construction phase. Also included in the Chapter are the disclosure requirements for the EIA.

8.1 Overview

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 gather local knowledge 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.

According to the EIA Guidelines of the DoE, public participation 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.

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.

8.2 Objectives of Stakeholder Consultations

The following objectives have served as the moving force for the design, implementation and fact findings during the participation process:

- To provide key Project information and create awareness 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.

8.3 Identification of Stakeholders

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

8.3.1 Primary Stakeholders

Primary stakeholders are people who would be directly benefited or impacted by a certain project intervention. In case of the proposed Project in Polder 35/3, the primary stakeholders include the people living within the Project area particularly those who reside within and in the immediate vicinity of the Polder. The primary stakeholders of the Project include the farmers, fishermen, local business community as well as the households to be displaced, women groups, and caretakers of community properties. Primary stakeholders identified and consulted during the present EIA include communities to be benefitted and/or affected by the Project, local leaders, community members and other local representatives.

8.3.2 Secondary Stakeholders

This category of stakeholders pertains to those who may 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. In this Project NGOs, concerned government departments, and line agencies fall under this category.

Secondary stakeholders for the Project include local government institutions (LGI), Bangladesh Water Development Board, the Ministry of Water Resources, Department of Forest, other government agencies, academia, NGOs, the World Bank, and general public at large.

8.4 Approach and Methodology

Participatory approach was followed in conducting the public consultation meetings in the Polder 35/3. The consultants discussed first with the BWDB officials and then the Upazila Parishad Chairman (UZPC) and/or the Upazila Nirbahi Officers (UNOs) and the Project Implementation Officers (PIOs) of the polder area to share the Feasibility and EIA process of the CEIP-I. The BWDB and local government officials/representatives were consulted to identify the potential stakeholders at the Polder level. With the available support from the UNOs and/or PIOs, the union level public representatives as well as the key persons were contacted over telephone and informed about the specific consultation meetings and requested them to be present in the meeting. In this way, the venue, date and time of the consultation meetings were fixed. Later, the consultant team organized the meetings at the local level. The participants provided their names, occupations and addresses in each meeting.

Focus group discussions (FGD) were carried out during in the public consultation process. In order to conduct the FGD and consultation meetings, two checklists were prepared covering the aspects including an overview of the proposed CEIP-I, information on the ongoing EIA process, and seeking information on the problems of the area with their potential solutions, the local needs and demands have been discussed by giving equal opportunity to all participants attending in the meeting. During consultation meeting all relevant issues within the water resources, land resources, socio-economic resources, and disaster aspects were discussed in detail.

During the FGDs and consultation meetings, the EIA team displayed maps of the Project area, shared the initial concepts on proposed interventions and facilitated the response of the participants. The stakeholders of the Polder 35/3 were asked to share their needs, problems, possible sustainable solutions, and their views on the Project interventions. The stakeholders' perceived views on important environmental and social components (IESCs) and Project's impacts on them, along with perceived benefits, risks, threats and demand from the Project were identified during discussions.

8.5 Public Consultation Meetings and FDGs

8.5.1 Consultation Process

A number of consultation meetings and FGDs were conducted at different locations of the Polder 35/3. The details of these meetings and FDGs are presented in **Table 8.1** and some photographs of these meetings are given in **Figures 8.1** to .**8.7** and more photogaraphs are given in **Annex-F.**

Table 8-1: Consultation Details

Sl	District	Upazila	Union	Meeting venue	Type of consultation	Meeting date	Time
1	Bagerhat	Bagherhat Sadar	Dema	Dema UP	PCM	22/05/2012	10:00
2	"	"	Kara Para	Katuria	FGD	07/03/2012	9:30
3	"	"	Dema	Bansh Bari	"	06/03/2012	9:30
4	"	Bagherhat Sadar	Dema	Boro Bashbaria 6 Vent sluice gate	"	13/12/2012	15:00
5	"	"	Kara Para	RadaBallav	"	13/12/2012	17:00
6	"	Rampal	Maliker Ber	Plan Bazar	"	13/12/2012	16:00
7	"	"	Kara Para	Gujihati	"	14/12/2012	14:30
8	"	"	Dema	Sarkardanga	"	14/12/2012	10:00
9	"	"	"	Khegraghat Bazar	"	14/12/2012	11:00
10	"	Rampal	Maliker Ber	Madardia Launch Ghat	"	14/12/2012	08:00

Figure 8.1: PCM in Dema UP, Bagerhat Sadar

Figure 8.2 Open discussion during PCM

Figure 8.3: Open discussion during PCM

8.5.2 Consultation Participants

The main participants of the consultation meetings included public representative, farmer, trader and daily-wage laborers of the Polder 35/3 and nearby areas. A total of 57 participants attended these consultations. The participant details are provided in **Table 8.2** below. List of participants are given in **Annex-D**.

Table 8-2: Participant Details

Sl	Meeting venue	Type of consultation	Type of Participants	No. of participants
1	Dema UP	PCM	Primary and secondary stakeholders	45
2	Katuria	FGD	Primary stakeholders	07
3	Bansh Bari	"	"	08
4	Boro Bashbaria 6 Vent sluice gate	"	"	15
5	Rada Ballav	"	"	8
6	Plan Bazar	"	"	7
7	Gujihati	"	"	13
8	Sarkardanga	"	"	12
9	Khegraghat Bazar	"	"	7
10	Madardia Launch Ghat	"	"	8

Figure 8.4: FGD at Dema Union


Figure 8.5: FGD at Kara Para Union

8.6 Issues discussed in FGDs and Meetings

At the outset of the meetings and FGDs, 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)
  - Water management (flood control, drainage, irrigation)
- Land resources:
  - cropping practice,
  - 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 (ilMNess, diseases, poor nutrition)
  - Quality of life (poor housing and sanitation facilities, scarcity of drinking water, fuel and fodder)
- Disasters:
  - Cyclones
  - River erosion
  - Associated damages
- The sustainable and integrated solutions of the main problems being faced in the Ploder:
  - Water resource management
  - Agriculture and fisheries management
  - Land resource management
  - Disaster management.

8.7 Community Concerns and Suggested Solutions

The outcomes of the FGDs and consultation meetings in terms of concerns and the suggested solutions were noted and organized by themes are presented in the **Table 8.3** below.

Table 8-3: Community Concerns and Suggested Solutions

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
Overall	Water logging, tidal flooding, salinity intrusion and cyclone are the main community concerns in the polder 35/3 area.	Comprehensive rehabilitation of the polder should be taken up at the earliest with the active involvement of the local community.
Water Resources	The salinity of Bhairab and Bishnu River is high in the dry season, i.e. December to May. Normally the intensity of salinity starts to increase from December due to reduction of upland discharge and reaches the peak in April and then falls due to high upland flow. The water of Bhairab and Bishnu River is non-saline, during the monsoon period i.e. June to November. Intrusion of saline water is the prime problem that has been identified by the stakeholders. The prawn/shrimp farming has been established here for short term benefit. Around 30% area has been covered by *gher* for prawn/shrimp farming. These farming exercises have caused reduced crop production in the agricultural lands. Salinity intrusion in the polder is high due to low height of embankment and damaged gates of the structures. The main cause of water salinity is unplanned *bagda* shrimp cultivation. The cultivators store saline water for shrimp culture. Besides, illegal control/operation of sluice gates/ regulators and cutting of embankment for entering saline water in shrimp *ghers* are also responsible for water salinity in the polder area especially in Mollikerber, Karapara and Dema. Local powerful persons, including the political leaders illegally interfere on	The intrusion of saline water should be controlled by the improvement of embankment at the Bansbaria, Sarkerdanga and Madardia sites. Re-excavation program in internal canals, increased height of the embankment and improvement of sluice gates are very essential; Scope of storage will improve dramatically within internal khals with proper functioning of associated water control structures; *Borrow pit* of embankment of should be re-excavated and the slope of embankment should be constructed with earth materials; The re-excavation of rivers and khals are urgently needed for the improvement of irrigation facilities and removal of drainage congestion/water logging in Polder 35/3 area; Construction of sufficient freshwater reservoirs, i.e. protected ponds; Need formation of water management Organizations (WMOs) for proper management of water control infrastructures, i.e. embankment, sluice gate, regulator, inlets, bridge, culverts etc and growing of consciousness among the community in the project; Need awareness building about water management among the communities; The Government should rehabilitate the farmers affected by salinity intrusion;

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	the water control/ management infrastructure. Water logging is another problem in the project area, especially at Chak Ponchamala that covers 5-7% to the entire area. Scarcity of fresh water is one of the main problems in the study area during dry season. Malfunctioning of water control structures and lack of reserve sweet fresh water in *khals* for irrigation during dry season are responsible for this. Absence of embankment along the rivers also makes the surface water unavailable for the users. Saline water is being trapped for long time in vast area and this is responsible for intrusion of salinity in the groundwater aquifers. The people of the study area are suffering from tidal flooding every year. PCM participants commented that about 100% areas is affected due to tidal flooding, 60% household and 80% crops were damaged due to the Sidr and Aila. Pond is the main source of drinking water. According to the participants, about fifty percent people depend on pond water for household chores and drinking as well. The availability of surface water become low because of low rainfall in recent years, therefore pond water level is going down and creating scarcity of usable water. Deep Tube Well (DTW) is the major source (75%) of drinking water in the polder area. But, local people opined that, due to salinity problem in tube well water, they are using pond water. DTW needs to be installed to a depth of about 1000-1200 feet for getting saline free groundwater. But it is very expensive for most households. Degraded habitat in the river due to	Re-excavation of khal networks and draining out of the water into Bhairab and Bishnu system by constructing flashing sluice gate; Salt tolerant varieties of rice need to be practiced and in this regard necessary extension works need to be organized by the respective departments; All khals should be kept free from illegal occupier; Ensure water distribution by compartmentalization/zoning system for shrimp cultivation, white fish and agriculture practice through WMOs. In most cases the people expressed opinion to protect river bank rather construction of the embankment.

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	fugitive dust particles and turbidity of water. Reduction of spawning and feeding grounds. The conflict between farmer and shrimp gher owner are present to some extent. Erosion is found mainly in Mollikerber, Karapara and Dema union along the Bishnu and Bhairab rivers. Erosion has rendered local people's land, homes and become an environmental and social hazard. During Sidr and Aila, the surge wave action has eroded the flood control embankment seriously. Sedimentation is also a problem in the polder area. Sediment characteristics are different in the tidal rivers. The downstream of Bhairab and Bishnu Rivers have sandy beds and mud banks along the shore whereas tidal creeks tend to be choked with very fine sediments. In the tidal rivers, suspended sediments are mainly composed of silt and clay. On an average, roughly 1 to 1.5 ft sedimentation took place in most of the main *khals* in the polder area each year. Sedimentation in most of the internal *khals* caused rise of bed level and reduced the conveyance capacity of the *khals*. So, the internal *khals* are causing loss to the year round connectivity with rivers and *khals*.	

8.8 Consultations during RAP Preparation

A number of stakeholder consultations were conducted in the Project area while preparing the resettlement action plan (RAP) for the proposed Project in the Polder 35/3. These are discussed below.

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 RAP. A total of four formal stakeholder meetings were held with different communities in the

Polder 35/3. 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. The salient details of these consultations carried out in Polder 35/3 are presented in Table 8.4; some photographs of these meetings are presented in **Figures 8.6** and **8.7**.

Table 8-4: Consultation Meetings Held in Polder 35/3

Location, Date and Time	Category of Participants
Katuria Bazar March 07, 2012 at 10.20 am	Land owners, farmers, fishermen, businessmen, teachers, UP members, and Project Affected Persons (PAPs)
Plan Bazar, December 13, 2012 at 11.00 am	Businessmen, land owners, service providers, teachers land owners, and PAPs
Bansh Bari, December 13, 2012 at 11.00 am	Farmers, Ex-Chairman, land owners, businessmen, local elites, and PAPs
Gujihati Bazar, December 14, 2012 at 2:30pm	Shop owners, daily wage laborers, businessman, local elites, and PAPs

Figure 8.6: Meeting at Malliker Ber Union

Figure 8.7: Meeting at Dema Union

During these meetings, the key features of the proposed interventions in Polder 35/3 under CEIP-I, its key benefits, its potential impacts particularly relating to resettlement and displacement, the process for determining people to be affected, compensation payment procedure, GoB's laws and World Bank's policy on involuntary resettlement, and cut-off-date for listing assets to be affected were discussed. The relocation requirements and availability of alternative lands in the surrounded area suitable for relocation were disclosed to the communities to be affected. Views of the stakeholders were obtained on the Project and its potential impacts, encroaching government land, relocation requirements, compensation process, and alternative options. Consultations were also conducted with women and other vulnerable groups and their views obtained on their livelihood aspects, Projects impacts, and compensation options.

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 cyclone Aila and Sidr. They demanded adequate compensation and other benefits for the loss of their assets and livelihood, as well as alternative place for relocation of their houses and business. The inputs from the stakeholder meetings have been used to develop measures and principles to address the resettlement impacts.

8.9 EIA Disclosure

Regional Workshop

The EIA report and Bengali translation of its executive summary was disclosed to the public on 13th January, 2013 in Dacope, Khulna. The main aim of the meetings was to present the findings of the final draft report on FS and EIA and having feedback from the local stakeholders attended. The report was also finalized through incorporation of comments and suggestions got from the meetings. The communities including the persons to be affected of polder 35/3 by the Project expressed their views in favor of the Project and wanted early implementation to protect them from natural disasters. They demanded following actions to be taken immediately. These are:

- The intrusion of saline water might be controlled by the improvement of embankment.
- Need awareness building among the communities about water management;
- Ensure proper compensation for affected people
- O & M for embankments and sluice gates in the polder area
- Need formation of Water Management Organizations (WMOs) to manage properly water control structures
- New embankment is required to be constructed by developing village road.

National Workshop

Coastal Embankment Improvement Project (CEIP) organized a national workshop on the “Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA)” studies under CEIP at Spectra Convention Centre, Gulshan 1, Dhaka on 28 February 2013. Mr. Md Shaikh Altaf Ali Senior Secretary, Ministry of Water Resources, Government of the People’s Republic of Bangladesh was the chief guest of the Workshop, while Mr. Mohammad Azizul Haque, Director General, Bangladesh Water Development Board (BWDB) and Dr. Sultan Ahmed, Director, Natural Resource Management, Department of Environment (DoE) were the special guests. The meeting was chaired by Mr. Salim Bhuiyan, Chief Planning, BWDB.

The program started with registration of the participants at 9:30 am. The main program then started at 10:00 am through recitation from the holy Quran. Mr. Sarafat Hossain Khan, Project Coordinator, CEIP, BWDB made the introductory speech. After that Mr. Md. Waji Ullah, Deputy Executive Director (Operations) and Team Leader of Environmental Studies of CEIP presented the findings of the Environmental study and EA findings of five polders. Mr. Kh Khairul Matin presented the Social Impact Assessment (SIA).

Figure 8.8: Welcome Speech by the Project Coordinator of CEIP

Figure 8.9: Presentation of EIA findings by Team Leader of Environmental Study

Figure 8.10: Participants of the Workshop

Figure 8.11:Chief Guest delivering his speech

National experts from multi disciplinary fields such as engineers, agriculturists, economists, sociologists as well as local stakeholders were present in that workshop.

Finishing the presentation, the floor was opened for all to take part in discussion on the presentation. The participants attended and exchanged their views on different issues which were noted by the professionals of CEGIS with a view to furnishing the final report.

Findings of the National Workshop

The comments and Suggestions from participants are as follows:

i. Impacts on health and hygienic need to be considered in the study
ii. Subsidence due to climate change needs to be included in the study
iii. The cumulative impacts of five polders are assessed in the study why not for the other polders to be constructed in future?

iv. The cumulative impacts has used “may increase/decrease”. This should be more specific.

v. As fisheries sector specially Shrimp Gher plays vital role in economy of coastal region, a Fisheries Specialist is to be included in the proposed Institutional Framework of the EMP of CEIP

vi. Mal-functioning of structures to be defined in the report

vii. Net value of fisheries impact to be provided

viii. Fish-friendly structure should be constructed. The location of these structures is important.

ix. Involvement of DoE during implementation of project activities should be ensured.

8.10 Framework for Consultations during Project Implementation

The stakeholder consultation is a continued process, and should be maintained throughout the project. The consultations carried out during the present EIA and reported in this Chapter are essentially a first step in this process. During the subsequent project phases as well, participation of the project stakeholders need to be ensured. **Table 8.5** charts out the proposed participation framework during different project Phases.

Table 8-5: Participation Framework

Project Stage	Proposed Tool	Stakeholders to be Consulted	Responsibility
Project Design Phase	Meetings with institutional stakeholders (carried out during the present EIA and RAP preparation); meetings with grass root stakeholders (carried out during the present EIA and RAP preparation)	Institutional stakeholders; Grass root stakeholders, including the communities to be affected by the Project.	EIA consultant.
Project Construction Phase	Information disclosure (sharing of the project objectives, project components, major benefits, potential impacts, mitigation measures and Resettlement Plan with the affected communities and other stakeholders).	Institutional stakeholders; Grass root stakeholders, including the communities to be affected during the project implementation.	BWDB; Supervision Consultants; Contractors
	Consultations and liaison	The communities around the work sites, borrow areas, and access routes	BWDB; Supervision Consultants; Contractors
	Grievance Redressal Mechanism and Social Complaint Register (discussed later in the document).	The affected communities.	BWDB; Supervision Consultants; Contractors
	Consultations with the communities during Compliance Monitoring and Effects Monitoring (discussed later in the document).	Affected communities.	BWDB; Supervision Consultants; Contractors
	Consultations with the project affectees / communities during the external monitoring (discussed later in the document).	Affected communities.	External monitoring consultants.
	Consultations with the project affectees / communities during the site visits by the WB monitoring mission.	Project site staff; Contractors; Affected communities.	WB monitoring mission.
Project Operation Phase	Community participation in O&M activities (see Section 4.9)	Institutional stakeholders; Grass root stakeholders, including the beneficiary communities.	BWDB

9. Assessment of Environmental and Social Impacts

9.1 Preamble

This Chapter identifies the environmental and social impacts that may potentially be caused by various Project phases, and also proposes appropriate mitigation measures to avoid, offset, reduce, or compensate these impacts. Potential Intervention which may cause potential environmental impacts during pre-construction, construction, and O/M stages have been identified in Chapter 4. The project influence area has been identified in Article 2.2.1 of Chapter 2. The following detailed investigations are being carried out or proposed to assess the magnitude of these prioritized impacts:

- Census survey to assess the extent of land acquisition and resettlement, loss of vegetation, occupation, income and poverty levels of the affected households, etc.
- Polder drainage model developed using the existing calibrated and validated Southwest Regional Model as base model has been used to understand the impact of project intervention to improve the existing drainage system and impact of climate change with the existing drainage system and with modified drainage system.
- Environmental quality baseline monitoring of air, noise, surface water, groundwater and soil,
- Ecological surveys comprising vegetation, wildlife and fisheries covering both mainland and Charland,
- Charland surveys comprising socioeconomic status and environmental settings,
- Expert consultations, focus group discussions, and public consultations.

It is to be mentioned here that some of the studies are in progress, the results of the selected investigations completed to date are discussed in this chapter. Most of the project activities are yet to be finalized (for example locations for afforestation component, locations of construction yards, operational arrangement of the sluices during the operation period). Similarly the detailed bills of quantities and equipment usage are yet to be ascertained. Therefore, this report has to be further improved as per suggestions and future need.

Table 9-1: List of Environmental Components and Updating of EIA report by BWDB

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
Natural Environment			
Topography	Topography analysis for the afforestation component of the project	Sites for the location of the afforestation component are underway. The possible locations have been identified. However, the	End of August, 2013

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
		team is now out for field checking.	
	Topography analysis for construction camp.	Sites for construction camp will be decided by the contractors	End of December, 2013
Topsoil	Total Loss of Top Soil	Will be finalized once the information regarding the construction yards and exact locations of borrow pits are obtained	End of December 2013
Landscape	Landscaping to the side slopes of the embankment and surrounding areas to tree plantation	Location, length and geometry of the afforestation area are yet to be finalized	End of August, 2013
Ecological Environment			
Endangered Species	None	None	None
Vegetation	Change in vegetation from the project	Require additional information for area of construction yards and afforestation	End of December 2013
Wetlands	Total Impact on the wetlands	Require additional information for area of wetland coverage (if any) for the construction yards	End of December 2013
Environment Quality			
Noise Quality	Noise quality impact	Type and number of	End of December 2013

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
	around all facilities during construction	equipment, vehicles, dredger etc to be used by the contractors, Their locations, time and extent of works etc.	
Air Quality	Air quality impact around all facilities during construction	Type and number of equipment, vehicles, dredger etc to be used by the contractors, Their locations, time and extent of works etc.	End of December 2013
Soil Quality	Total amount of lands adjacent to proposed facilities including construction yard, borrow and dredged material	Requires final location and amounts of lands for construction yards and stacking of construction material and dredged spoil.	End of December 2013
Wastes	Total wastes likely to be generated at different proposed facilities during construction works. Total population to be occupied at the construction camps	Input requires form the contractors about the required number of skilled and unskilled labors.	End of December 2013
Spoils	Dredged Spoil amount and how it will be managed. Preliminary finding say that it will be kept on the two sides of the dredged canal	The contractor needs to come up with the dredged spoil management plan	End of December 2013

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
Socio Economic Environment			
Agriculture	Land needed for the construction camp set up, widening of embankment base, afforestation	Pending on finalization of design, plan for land acquisition	End of December 2013
Health and Hygiene	Analysis on the total workers likely to take part in the construction	Pending on the output of the contractors plan	End of December 2013
Transport	Number and type of construction equipment, vehicles, their possible routes which will conflict with the existing transport	Pending on the outcome from contract units	End of December 2013
Road Accidents	Number and type of construction equipment, vehicles, their possible routes which will conflict with the existing transport	Pending on the outcome from contract units	End of December 2013
Water Transport Accidents	Number, type of water transport for carrying equipment and their possible access routes	Pending on the outcome from contract units	End of December 2013
Irrigation	Irrigation affected by the construction	Pending work-plan from the contractors for rehabilitation of the hydraulic structures	End of December 2013

9.2 Impact Screening

As part of the environmental impact assessment process, a screening matrix was used tailored specifically to the proposed Project, focusing the potential environmental impacts during the design, construction and operation phases. The matrix examined the interaction of project activities with various components of the environment. The impacts were broadly classified as physical, biological and social, and then each of these broad categories further divided into different aspects. The potential impacts thus predicted were characterized as follows:

- High negative (adverse) impact;
- Low negative impact;
- Insignificant impact;
- High positive (beneficial) impact;
- Low positive impact; and
- No impact.

The matrix of polder 35/3 is provided in **Table 9.2 (**next page**)**. The negative impacts predicted in this manner were the 'unmitigated' impacts. Appropriate mitigation measures were recommended as part of this EIA, thus 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.

Table 9.1: Environmental and Social Screening Matrix (Unmitigated)

	Physical					***Biological***		***Social and Socioeconomic***												
Project Phases and Activities	Soil Erosion/Contamination	Air Quality	Surface Water Quality	Groundwater Quality	Water Availability and Consumption	Natural Vegetation	Wildlife/Aquatic Fauna	Resettlement	Blocked Access Routes	Noise and Vibration	Impacts on Agriculture and grazing	Impacts on Fisheries	Flooding	Vehicular Traffic	Safety Hazard	Damage to Infrastructure	Public Health	Aesthetic Value	Gender and Cultural Issues	Employment Opportunities
Design Phase and Pre-Construction Phase																				
Land Acquisition	0	0	0	0	0	0	0	HN	0	0	0	0	0	0	0	0	0	0	0	0
Contractor Mobilization	MN	MN	MN	0	0	MN	MN	0	MN	MN	MN	MN	0	HN	HN	HN	MN	0	MN	MP
Construction Camp Establishment	MN	MN	MN	0	0	MN	MN	MN	MN	MN	MN	MN	0	MN	HN	MN	MN	MN	MN	MP
Construction Phase																				
Equipment / Material Transportation	MN	MN	MN	0	0	0	0	0	MN	MN	MN	MN	0	MN	HN	MN	MN	0	MN	MP
Operation of Construction Camp	HN	MN	HN	MN	MN	0	MN	0	MN	MN	0	MN	0	MN	HN	MN	HN	0	MN	MP
Site Clearance	MN	MN	MN	0	0	MN	MN	0	MN	MN	MN	MN	0	MN	HN	MN	MN	MN	MN	HP
Borrow and disposal area management	HN	MN	HN	0	0	MN	MN	0	MN	MN	HN	MN	MN	MN	HN	MN	HN	MN	MN	HP
Excavations of water channels	MN	MN	HN	0	0	MN	HN	0	MN	MN	0	HN	MN	MN	HN	MN	MN	MN	MN	HP
Re-sectioning of Embankments	HN	MN	MN	0	0	MN	0	0	HN	MN	MN	0	MN	MN	HN	MN	MN	MN	MN	HP
Retirement of Embankments	HN	MN	MN	0	0	MN	0	0	HN	MN	MN	0	MN	MN	HN	MN	MN	MN	MN	HP
Installation/replacement/repair of Regulators	HN	MN	MN	0	0	0	MN	0	HN	MN	0	MN	HN	MN	HN	MN	MN	MN	MN	HP
Demobilization	MN	MN	MN	0	0	MN	MN	0	MN	MN	MN	MN	0	HN	HN	HN	MN	0	MN	MP
Operation Phase																				
Operation of Regulators	MN	0	HN	0	MN	0	MN	0	0	0	HN	HN	HN	0	0	0	0	0	0	MP
Repair and Maintenance	MN	0	MN	0	0	0	MN	0	MN	MN	HN	HN	HN	MN	MN	0	0	0	0	MP
Monitoring	0	0	0	0	0	0	0	0	0	0	0	0	0	MN	0	0	0	0	0	MP

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

9.3 Impacts during pre-construction Phase

Site development involves the following activity:

- Mobilization of equipment, construction material/vehicles
- Clearing of sites
- Collection of earth materials from borrows pits and Daratana river, Putimary river, and Bishnu river bed.
- Construction of civil amenities and development and
- Establishment of temporary construction yards

The activities will cause the following environmental impacts

9.3.1 Damages due to Project Intervention and Land Acquisition

Impact

About 15 ha of land will need to be acquired to construct embankments and water control infrastructure. In addition, houses, shops, common properties, and trees will be affected by the project affectees. The details of these damages in Polder 35/3 are presented in **Tables 9.3** to **9.6**.

Table 9.3: Type of Land to be Acquired in Polder 35/3

Description	Area (ha)
Houses	3.85
Single cropped fields	4.26
Double cropped fields	0.81
Orchard	0.62
Pond	1.2
Shrimp Culture	3.65
Canal or *Beel*	0.61
Total	15.00

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Table 9.4:Primary Structures to be Affected in Polder 35/3

Description	Quantity	Covered Area (square feet)
Pucca (made of bricks and mortar)	4	1331
Semi pucca	80	23990
Katcha	324	66439
Total	408	91760

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Table 9.5: Secondary Structures to be Affected in Polder 35/3

Description	Quantity
Pucca latrine (numbers)	5
Slab latrine (numbers)	23
Katcha latrine (numbers)	2
Tube well (numbers)	5
Boundary wall (running feet)	161
Chatal	7350
Gates (numbers)	30
Water tanks (cubic feet)	100

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Table 9.6:Common Properties to be Affected in Polder 35/3

Description	Quantity
Mosque	9
Mandir	0
Club House	1
School/Pathshala	0
Graveyard	0
Government Office	1
Madrasa (religious school)	2
Latrine	0
Political Party office	0
Clinic	0
Miscellaneous	1
Total	14

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity as described in Chapter 2.

Mitigation

The resettlement cost estimate is provided below.

Table 9.7: Resettlement Budget for Polder 35/3

Description	Amount (BDT)
Compensation for land acquisition	18,768,006
Compensation for structures	26,374,355
Compensation for Trees	21,856,800
Compensation for Fish Stock	817,680
Other Resettlement Benefits	78,879,401

Description	Amount (BDT)
Capacity building training for EA	1,000,000
Development of Resettlement sites	1,000,000
Operation cost for RAP Implementing Agency/ INGO	5,000,000
Operation cost for External Monitoring Agency	2,000,000
Contingency @ 10% of the above	8,787,940
Total Estimate Budget (in BDT)	96,667,341
Total budget in USD (1 USD=82 BDT)	1,178,870

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

The project has the provision for implementation of resettlement action plan, social action plan and environmental management plan. The following measures will be implemented to address the damages due to project intervention and land acquisition:

- Effective implementation of the Resettlement Action Plan (RAP) prepared in accordance with OP 4.12 will be ensured.
- Compensation will be paid prior to commencement of the project construction in accordance with RAP. Complete documentary record will be maintained for compensation assessment and payment.
- Contractor will maintain liaison with communities.
- Grievance redress mechanism (GRM) will be established.
- “Chance Find”Procedures will be followed for social common properties lke mosques

Residual Impacts

Despite implementing the above mitigation measures, the impacts associated with the involuntary resettlement are not likely to be fully eliminated, essentially because of the severity and extent of the involuntary resettlement. The significance of residual impact will therefore be **Moderate**, and regular monitoring will be essential to ensure that RAP is effectively implemented and the community grievances related to resettlement are promptly addressed.

Figure 9.1: Key Potential Impacts in Polder 35/3

9.3.2 Conflicts because of absence of proper land ownership legal document

Impact

Different segments of embankment (about 8.05 km), shifting of water control structures and excavation of alternative canal will be rehabilitated in the polder 35/3. Presently, Planning and Design consultant has prepared Land Acquisition and Resettlement Action Plan as per guidelines of acquisition and requisition of immovable property ordinance, 1982 (ordinance II of 1982). In the polder, about 15 hectares of land will be acquired for rehabilitation work. Due to land acquisition, 113 households will lose their land within the polder area. In this case, the details of the land acquisition plan, process and cost including the list of the PAPs are incorporated in the RAP report prepared by planning and design consultants (FS). During distribution of compensation, conflicts may arise due to absence of proper legal document in connection with the land ownership.

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

Mitigation

This conflict would be reduced, if the compensation could be disbursed by the Local Government Authority in presence of Union Parishad Chairman and Upazila Nirbahi Officer (UNO) of the Upazila. Additionally, the list of the PAPs will be disclosed in the prominent places e.g. market places, Union Parishad office of the polder. This mechanism could reduce the conflict of land ownership of the polder area.

Residual Impact

With the help of above mitigation measures, the impacts associated with the land acquisition and requisition are likely to be mostly addressed and the significance of residual impact will be Moderate.

9.3.3 Preparation of facilities for contractor and labor force

Impact

During establishing and constructing site facilities in the Polder may potentially cause air and water contamination, noise generation, and other impacts. **Figure 9.1** shows the key locations in the Project area where this impact is likely to take place. All the labour camps will be built on the BWDB's land avoiding tree cutting, to the extent possible. If the proper drainage and sewerage facilities are not considered during establishment of facilities, the water quality as well as aquatic condition of the Maderdia khal, Sayabanki khal, Mogordana khal, Betibonia khal may deteriorate (Figure 4.1).

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

Mitigation

The removal of vegetation and trees will be mitigated by preparing a proper landscaping plan and a budget for future tree planting and landscaping measures to be implemented after completion of the project. The plan will be prepared during the first year of construction and will be provided to the Supervision Consultants/environmental monitoring unit for review and approval. These activities will be monitored by the Environmental and Social Monitoring Unit (ESMU). The following measure should be implemented to address the above concerns:

- Contractor will prepare site establishment plan and obtain approval from the Construction Supervision Consultants (CSC)
- Approval from CSC will be obtained for the location of temporary facilities.
- Tree felling and vegetation clearing will be minimized to establish site facilities
- Photographic record will be maintained to record pre-construction condition of the area
- Site facilities will be established at a safe distance from communities
- Contractor will prepare and implement pollution control and waste management plans
- No untreated wastes will be released on ground or in water
- Exhaust emissions from vehicles and equipment will comply with standards
- Vehicles, generators, and equipment will be properly tuned.
- Water will be sprinkled where needed to suppress dust emissions
- Vehicles and machinery will have proper mufflers and silencers
- Liaison will be maintained with the communities.

Residual Impacts

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**.

9.3.4 Changes in Land Use

Impact

Land use pattern in the polder area will be changed temporary during construction of labor sheds, contractor's office and material stock yard. Materials stock yard will be set up in the premises of BWDB colony at Bagerhat Sadar near Daratana River. But, a total of 42 camps for labour will be constructed near the water regulatory structure. These temporary facilities will be implemented in the existing acquired land of BWDB. The details environmental and societal features have been attributed in the **Table 9.7** according to chainage.

Table 9.7: Number of features displaced during establishment of labour Shade

Chainage (Km)	Structure	Number of trees and Household					
		C/S			R/S		
		Homes	Shop/others	Trees	Homes	Shop/others	Trees
1.5	F/S-1	0	0	20	0	0	10
4.94	D/S-1	0	0	25	0	0	5
5.60	F/S-12	0	0	0	0	0	0
8.75	D/S-4	4	2	73	0	0	0
11.53	F/S-3	0	0	0	0	0	0
12.45	F/S-4	0	0	2	0	0	3
16.65	F/S-5	0	0	0	0	0	0
17.00	F/S-6	0	0	0	0	0	0
19.43	F/S-7	0	0	0	0	0	0
21.23	F/S-9	0	0	0	0	0	0
25.5	D/S-2	0	0	10	0	0	15
26.4	F/S-9	0	0	11	0	0	0

Chainage (Km)	Structure	Number of trees and Household					
		C/S			R/S		
		Homes	Shop/others	Trees	Homes	Shop/others	Trees
027.50	F/S-9	0	0	0	0	0	12
34.00	D/S-3	0	0	35	0	0	25
Total		4	2	176	0	0	70

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

Mitigation

The following measures will be implemented to address the above concerns:

- Establish all these facilities within the area owned by BWDB avoiding less tree cutting;
- Arrange floating vessels with facilities near the river besides embankment for arranging accommodation for labours. These facilities can minimize the tree cutting and reduce the land use loss.
- Avoid construction of labour sheds at Ch 8.75 km because of there has some big timber trees.
- Pay compensation/rent if private property is hired for accommodation on temporary basis;
- Consult communities and representative of local government (Union Parishad) during labour shade establishment
- All the temporary shops will be re-constructed by the contractor after completion of rehabilitation works and the owner of the shop can be used as gate operator by the Bangladesh Water development Board.
- The project has an afforestation component. The Senior Environment Specialist of PMU and Design Consultant (DC) will ensure the afforestation plan is prepared based on the number and species of trees to be cut. The ration of number of trees to be cut to trees to be planted will be 1:4 (as per DoE guideline). Moreover, the species willbe chosen according to the species are cut. Vegetation coverage will also be introduced for slope protection of polders. The mitigation measure will reduce the negative impact substantially in the long run. The overall impact will be negative to positive in the long run. However, there will be transition phase of impact between immature tree at early stage and mature tree at later stage.

9.3.5 Fisheries

Impact

The construction of embankments and dredging of canals and rivers have important consequences on flood plain ecology. Open water fish habitat of the study includes rivers and khal, such as *Dharatana river, Bishnu river and Katakhali khal*, internal khals such as *Pachabulia khal, Ghirarkata khal, Khager khal, Moderdona khal, Abdul Rasulpur khal, Andhari khal, Putimari khal, Dhalipara khal, Sota khal, Bhigorer khal, HetaMNani khal, Betbunia khal, Kironbabur Gater khal, Moragang, etc* which are acting as major arteries The fish spawning will be impacted if canal excavation and collection of earth from Dartana, Putimary, Bishnu and Katakhali rivers happens during spawning period. Table 4.4 shows Betibonia canals will be re-excavated. New drainage sluice (Table 4.1 and Figure 9.1) DS-3 for Betibonia will be constructed to ensure adequate discharge capacity. The spawning time for open water fish is late June to August. Re-excavation of the canals and collection of earth from river bed will increase the turbidity of water which will cause a suspension of sediments, and thus, an increase in turbidity for the affected water column. Increased turbidity along with the suspended sediments can affect fish behavior such as feeding, avoidance, territoriality, and homing behavior.

Mitigation

The contractor will prepare the work plan for re-excavation of canals, collection of earth from Bhola and Baleshwar river and construction of sluices avoiding late June to August, during reexcavation of Betibonia canals and placement of drainage sluice DS-3.

9.3.6 Increased Vehicular Traffic during Mobilization

Impact

During contractor mobilization, equipment, machinery, material, and manpower will be transported to the Polder resulting in additional traffic on roads and in waterways. This traffic may potentially cause traffic congestion particularly at roads and jetties. **Figure 9.1** shows the key locations in the Project area where this impact is likely to take place.

The significance of this potential unmitigated impact has been assessed as **Moderate to Major**.

Mitigation

The following measures will be implemented to address the above concerns:

- The contractor will prepare a traffic management plan (TMP) and obtain approval from the Design Consultant (DC) and Construction Supervision (CS) consultant. The TMP will be shared with the communities and will be finalized after obtaining their consent.
- The TMP will address the existing traffic congestion particularly at the Rayenda and Sonnasir bazaars. Similarly, schools will be avoided during the school time. Project-related traffic will be minimized during the peak traffic hours (from 8 am to 2 pm).
- Ensure minimal hindrance to local communities and commuters.
- Liaise with local communities and concerned authorities

9.3.7 Increased Inland and Waterway Traffic

Impact

Transportation of construction materials is a key concern during implementation of project intervention. Two broad options are available for carrying construction materials to the Project stockyards in the Polder. The first option for construction materials in the north side (close to Putimari river) of the Polder may be transported through in road way. As such, material transportation along Khulna-Bagerhat road may cause traffic congestion and hindrance to other commuters, travelers, and transporters due to additional movement of vehicle.

Second option would involve water way transportation for construction works in the east, west and south portion of the Polder. A temporary jetty will be constructed in Daratana River near the stock yard in Bagerhat BWDB colony for unloading and stocking of construction materials. The river (Daratana) is wide and remains navigable throughout year. A few numbers of motorized boats and country boats move through this channel. Therefore, construction of jetty and material transportation along the waterways may not create significant water way traffic problems.

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor to prepare and implement traffic management plan for loading and unloading of construction materials at the jetty sight.

- Avoid movement of construction materials at daytime due to smoothning the regional launch movement.
- River crossing for material transportation during nighttime is suitable for reducing water way traffic problems.
- Material transportation through rivers during high tide.
- Liaison to be maintained with community and BIWTA.

Residual Impacts

With the help of above mitigation measures, the impacts associated with additional traffic on roads and along water ways are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.8 Noise

Impact

Mobilization of construction vehicles for equipment and material transport will deteriorate the noise level at the surrounding sites. The traffic volume will be increased both in the road and river. A number of schools and settlement are in the surrounding areas. It is expected the equipment to be used for excavation from borrow pit and their noise level at 7m distance are excavator: 80 dBA and scrapper 86 dBA and generator. Bangladesh standard is 60 dBA at the mixed zone during daytime. The increased traffic volume is anticipated to increase the noise pollution. Table 6.11 shows the noise level is already above the Bangladesh standard.

Mitigation

The contractors need to aware the vehicle drivers not to use hydraulic horns and to avoid unnecessary honking. The contractors will encourage the vehicles to come during day time.

9.3.9 Preparation of Facilities for Contractor(s) and Labor Force

Impact

Establishing the contractor's temporary site facilities may involve land clearing, land leveling, excavation, and construction of buildings. These activities may potentially cause air and water contamination, noise generation, safety hazards, hindrance to local communities, and other similar impacts. **Figure 9.1** shows the key locations in the Project area where this impact is likely to take place. The significance of this potential unmitigated impact has been assessed as **Moderate to Major**.

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor will prepare site establishment plan and obtain approval from the DCSC
- Approval from DC & CS will be obtained for the location of temporary facilities.
- Tree felling and vegetation clearing will be minimized to establish site facilities
- Photographic record will be maintained to record pre-construction condition of the area
- Site facilities will be established at a safe distance from communities
- Contractor will prepare and implement pollution control and waste management plans

- No untreated wastes will be released on ground or in water
- Exhaust emissions from vehicles and equipment will comply with standards
- Vehicles, generators, and equipment will be properly tuned.
- Water will be sprinkled where needed to suppress dust emissions
- Speed limits will be enforced for vehicles on earthen tracks
- Vehicles and machinery will have proper mufflers and silencers
- Liaison will be maintained with the communities.

9.3.10 Issues Addressed during Design Phase for Polder 35/3 to Avoid Environmental Impact

The following tasks have been taken into account during design phase to avoid the negative environmental impact:

- To reduce the drainage and water logging and promoting fish migration canals need to be re-excavated have already been identified. The list of khals (canals) to be considered for re-excavation are presented in Table 4.4
- The locations for borrow pit is identified and presented in Table 4.8. However the soil quality to meet the requirement of earth volume needs to be addressed. If the currently chosen borrow pits does not satisfy the soil quality criteria, the Senior Environment Specialist of the PMU will update the information.
- The list of sluices requires reconstruction and repairement have already been listed in Table 4.1.
- Table 4.5, Colum II states that the dredged material will be put on two sides of the canals which is a usual practice by BWDB. It is recommended to keep the dredged spoil 15 m away from the canal side. The contractor will ensure sufficient fencing has been provided to avoid any possible accidents
- Tidal River Management will not be followed in any place of polder 35/1.

9.4 Impacts during construction Phase

Reconstruction and rehabilitation of embankment and polder area will involve the following tasks during construction phase:

- ✓ Mobilization of equipment, construction material/vehicle
- ✓ Placement and compaction of earth
- ✓ Re-excavation of canals
- ✓ Demolition of non-repairable hydraulic structures
- ✓ Disposal of canal excavated wastes

9.4.1 Drainage congestion during replacement of drainage regulators

Impact

The major drainage canals in the polder area are Betbonia Khal, Sayabanki Khal and Mogordhara Khal, which canals are connected with water control structures (Figure 9.2). If the replacement of regulators is not properly replaced during initiation of construction works then the Bansbaria, Kalia and Kashimpur area will face major drainage congestion problem and create water logging (Figure 6.9). Additionally, dewatering and spoil earth from the three above mentioned khals would create disturbance to the natural drainage system during earthwork.

The significant of this potential unmitigated impact has been as **Moderate** on the Basis of impact magnitude and receptor sensitivity.

Mitigation

This drainage problem will be removed by construction of alternate canals at each and every site of the regulator during replacement of regulators.

Residual Impacts

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

9.4.2 Loss of agriculture land

Impact

About 5 ha (Ch 0.00-0.5 km; Ch 2.5-4.0 km; Ch.7.0.-8.5 km; Ch.9.0 to 10.5km; Ch.12.5 to 14.0 km; Ch.30.5 to 31.5 km and Ch. 39.1 to 40.0km) of agriculture land will be lost during construction of 5.05 km retired embankment. This includes single cropped (4.26 ha) and double cropped (0.86) land.

The losses of production due to acquired agriculture land are given in **Table 9.8.** In addition, construction activities, movement of construction machinery, project related vehicular traffic, material borrowing, material stockpiling, waste disposal or camp establishment can potentially damage crops or affect the cultivated land. .During collection of earth from the borrow pit. No agriculture land will be impacted in the Project area as all spoil earth will be collected from offshore area through manual excavation and rivers of Daratana, Putimary, Bishnu, and Katakhali through dredging.

Table 9.8: Loss of crop production for construction of retired embankment

Name of Crops	Area(ha)	Yield(Ton/ha)	Production loss (m.ton)
T. Aman (HYV)	2.22	3.5	7.8
T. Aman (LV)	1.5	2.2	3.3
Boro (LV)	0.25	2.5	0.6
Oilseeds	0.3	1.0	0.3
Potato	0.5	14.0	7.0
winter vegetable	0.2	13.80	2.8
Pulses	0.1	0.8	0.2
Total			221.9

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

Mitigation

The following measures will be implemented to mitigate the above addressed issue

- Compensation will be paid for any crop damage.
- Contractor will avoid cultivation fields during construction.
- Contractor will avoid agricultural land for material borrowing, material stockpiling, and labor camps.

- Contractor will ensure that no vehicular movements take place inside cultivation fields.
- Contractor will ensure that no material is dumped inside cultivation fields.
- Contractor will maintain liaison with communities.

Residual Impacts

With the help of above mitigation measures, the impacts on the agriculture resources are likely to be adequately addresses and the significance of residual impact will be **Low or negligible**.

9.4.3 Disturbance of fish habitat and migration

Impact

Fourteen existing water control structures (flushing and drainage sluices) will be replaced by new sluices. All sluices are connected with the khals of the polder. These khals lost their natural fish migration system during construction of polders under the Coastal Embankment Project (CEP) in the sixties. Brackish fish migration has also been disrupted due to the lack of proper and timely operation and maintenance of sluices. In spite of thse obstacle, fish species like *Paisa, Betki, Horina Khorsula, and Chatka Chingri* migrates through these khals. Rauti khal Ch. 25.5 km), Betobonia khal (Ch 33.5 km) and Sayabank Khal (Ch 4.94 km) are playing vital role for its. Some of these brackish fish species are still found to move in the internal khals and beel during breeding season. During construction period, this fish migration will be hampered. But the problems are reversible.

The significant of this potential unmitigated impact has been as **Moderate** on the Basis of impact magnitude and receptor sensitivity.

Mitigation

- Gate operating by Water Management Group during monsoon season should be ensured
- During construction of replaced sluices, by pass canal will be provided for continuation of fish migration.
- Proper operation and maintenance of sluices will mitigate the disturbed migration problem.
- Arrange training for WMG after construction regulators

Residual Impacts

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

9.4.4 Impacts on Benthic Fauna

Impact

Benthic communities play important role in food chain not only for lentic (standing water) but also for lotic (flowing) water bodies. Construction activities including re-excavation of 3 *khals*, dredging of Dartana, Putimari, Bishnu river and Katakhali and discharge of solid wastes and waste effluents can potentially impact the benthic communities of the water bodies. Most of the construction activities will be implemented during dry season, during which time the benthic fauna would be more vulnerable.

Mitigation

The following measures will be implemented to address the above concerns:

Contractor will not release untreated wastes on soil or in water.

Contractor will carry out *khal* excavation in segment thus minimizing impacts on benthic fauna.

Residual Impacts

With the help of the above mitigation measures, the Project's impacts on benthic fauna will be somewhat reduced. After the construction phase, these resources are likely to fully recover gradually. The significance of the residual impacts has therefore been assessed as **Low**.

9.4.5 Disturbance of Flora and Fauna

Impact

During rehabilitation of embankment about 3,500 number of tree will be cut down. These clearances of plant will have temporary impact on landscape or scenic beauty around the project areas. Loss of plants will indirectly affect the fauna habitats. As such, this floral and faunal composition may be affected locally during construction phase.

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

Mitigation

- Only identified tress on the basis of feasibility report will be cleared during construction.
- Contractor will prepare a tree cutting plan and re-plantation plan, obtain approvals from DC&SC, and will carry out compensatory tree plantation towards the end of construction phase. A plant nursery will be established for this purpose with selected tree species (eg, Geoa, Kewra and Babla) in the beginning of the Project.
- Project people will be restricted from killing the wild animals and birds.
- Regular monitoring will be assumed so that any kind of illegal activities related to forest cut, killing of birds etc. inside or outside of the polder will be conducted.
- Noise pollution will be restricted during day time periods and levels will be properly monitored.

Residual Impacts

With the help of above mitigation measures, the impacts on benthic fauna are likely to be adequately addresses and the significance of residual impact will be **Low or negligible**.

9.4.6 Safety and Public Health Hazards

Impact

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 for surrounding population.

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 for 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.

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

Mitigation

The following measures will 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 Health, Safety and Environment (HSE) Plan and obtain approval from the Construction Supervision Consultants. The Plan will also include awareness raising and prevention measures for particularly for communicable diseases such as hepatitis B and C, and HIV/AIDS.
- 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 temporary facilities including labor camps will meet minimum safety, hygine and sanitation requirements (safe drinking water, proper sewage disposal, solid waste management, general cleanliness, protection against disease vectors, protection against weather elements, fire fighting, and other similar essential services).
- 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 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;
- All site staff will undergo screening against communicable diseases. Communicable disease careers will not be employed at the site.
- 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 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 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 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 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 of employees for the duration of their contracts;
- 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;
- 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 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 available.

- o Firefighting equipment will be made available at the camps and worksites.
- o The camp staff will be provided safety including fire fighting training.
- o 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

With the help of above mitigation measures, the impacts associated with safety and health hazards are likely to be mostly addressed and the significance of residual impact will be **Moderate.**

9.4.7 Soil and water contamination due to wastes

Impact

Wastes particularly effluents from the work sites may contaminate the soil and water. Construction material, demolition debris, or fuel/oils may enter the river or other water bodies causing contamination. The contractor's camps 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 soils and water resources of the area. Soil and 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. **Figure 9.1** shows the key location where these impacts are likely to take place. The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

- Contractor will prepare and implement pollution control plan and submit with the EAP
- Contractor will prepare and implement pollution control plan considering the following aspects and issues:
- Workshops will have oil separators/sumps to avoid release of oily water.
- Avoid repairing 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
- 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 will regularly monitor the condition of its fleet.
- Material borrowing from the river banks will be carried out sufficiently away from the water line, minimizing the possibility of loose soil to wash away in the river
- Location of camps away from communities and drinking water sources
- Prepare and implement camp waste management plan (septic tanks, proper solid waste disposal);
- Untreated wastes will not be released on ground or in water
- Spoil and excavated material will be re-used where possible
- Community consent will be considered during dispose spoil
- Construction material, demolition debris, and excavated soil/silt will not be allowed to enter water bodies.

Residual Impacts

With the help of mitigation measures, the impacts on the water resources are likely to be adequately addresses and the significance of residual impact will be **Low**.

9.4.8 Soil erosion

Impact

The construction activities particularly near banks of rivers and other water bodies can potentially cause soil erosion. In particular, erosion can take place along the banks of Daratana river, Bishnu river, Putimary river, and Katakhali *khal*, increasing the risk of damage to nearby settlements and infrastructure (see **Figure 9.1**). Similarly, material borrowing can also potentially cause soil erosion (see **Figure 4.14** for potential location of borrow area). Soil erosion can increase the sediment load and turbidity in the water bodies thus decreasing the amount of sunlight penetrating in the water. The significance of this potential unmitigated impact has been assessed as **Major** if not properly treated.

Mitigation

The following measures will be implemented to address the above concerns:

- Avoid operating heavy construction machinery and vehicles close to the banks of rivers and water channels (*khals*)
- Implement appropriate erosion control measures (e.g. stone pitching) where needed
- Re-contour borrow areas where needed
- Protect untreated embankment slopes
- Avoid works in rainy season.

Residual Impacts

With the help of above mitigation measures, the impacts associated with soil erosion are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.4.9 Clearing of trees

Impact

During re-sectioning of embankment, construction of retired embankment and bank protection works, a total of 20,974 trees located on private land would be required fell down. Most of the trees are timber. Detail of affected trees is presented in Table 9.9.

Table 9.9: Trees to be affected in Polder 35/3

Types	Big	Medium	Small	Plant	Total
Fruit trees	1389	1123	1575	1078	5165
Timbers trees	12	3620	8257	2640	14529
Banana	365	254	336	25	980
Bamboo	0	200	100	0	300
Totals	***1766***	***5197***	***10268***	***3743***	***20974***

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Since most of the trees are timber species, these are implemented by NGO and Forest Department's afforestation program. The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

- PMU needs to conordinate with Forest Depaerment before causing any kind of disruption to the trees planted under other program.
- Contractor will carry out tree census thoroughly what numbers of trees need to be cut during construction activities.
- Thick and dense vegetated area will be avoided to prepare the labour shed as far as possible;
- Contractor will prepare a tree plantation plan will be prepared for compensation of loss of trees. Trees will be planted at the end of the construction period during wet season. It is recommended to establish a nursery with selected tree species (Geoa, Kewra and Babla) in the beginning of the project in order to reduce the purchasing cost of saplings. All saplings will be planted and monitored according to section 4.6.6 under project description chapter;
- Contractor will avoid dumping of spoil earth in and material borrowing from vegetated areas;

Residual Impacts

With the help of above mitigation measures, the impacts on the floral resources are likely to be adequately addressed and the significance of residual impact will be **Low to negligible**.

9.4.10 Pollution of external surface water of the rivers

Impact

External waterway may pollute by the material and equipment transportations due to spillage of oil from vessels. Surface water will also be polluted due to waste water discharge from the labour shed. In some cases, construction debris of the 14 regulators may fall into the adjacent surface water, which will create the turbidity of the surface water resources. This localized problem may have short term effects on environment, which is reversible through application of proper mitigation measures.

Huge amount of carried earth will be used on the embankment for re-sectioning and retirement work, which is collect from borrow pits. Twenty borrow pits (Figure 1, Annex-3) are located on the river side of the embankment. Due to tidal effect, these boro pits area will be filled up within one or two years naturally.

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

Mitigation

Contractors will be instructed by the environmental monitoring specialist to use proper vessels or trawler (i.e. engine boat) to carry construction materials to the construction sites for protecting spillage of oil from vessels or engine boats. Simultaneously, the environmental monitoring specialist will check the fitness of the vessels, water quality and waste management systems of labour shed. This monitoring will be carried out once a week, which has been mentioned in the monitoring section.

Residual Impact

With the help of above mitigation measures, the impacts associated with surface water are likely to be adequately addressed and the significance of residual impact will be **Negligible**.

9.4.11 Noise

Impact

The construction activities particularly demolition of existing structures, excavation, compaction, operation of construction machinery, and vehicular traffic will generate noise and vibration which are likely to affect the nearby communities. In addition, camp sites may also generate noise.

Increased 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; in addition sensitive receptors including nine schools along the embankment are likely to be more severely affected by noise (see **Figure 9.1** for the locations of these schools and settlements). Table 9.10 shows the noise level to be expected from the equipment. According to ECR’97 60 dBA is applicable for mixed area in Bangladesh.

Table 9.10: Noise Level from Machineries

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

Noise and vibration from construction activity may also disturb wildlife in the area. For schools (Figure 9.1) near the embankment which located at mouza of Malliker ber (Ch. 39.00 km), Berhonia (Ch. 34.00 km), Kismat sarkar Danga (Ch. 26.5 km) and one college (Ch. 34.00) will face noise pollution during construction works. It will trigger problem for the children's of these schools and the college student. It will also create problem during prayer time in Kismat Sarkar temple (Ch. 26.00km). The locations of Academic institution and religious/prayer center near the embankment are within 200 to 300 meter range.

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

Mitigation

The following measures will be implemented to address the above concerns:

- Demolition of the regulators will not be carried out during the school time (8 am to 1 pm) particularly near the schools
- 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 will 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 will be instructed to proper use the equipment, to minimize noise levels
- Camps will be located at a safe distance from communities.
- Liaison with the communities will be maintained and grievance redress mechanism will be established at the site.

Residual Impacts

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

9.4.12 Air quality

Impact

All the rehabilitation and improvement works related with the embankment improvement like earth works from borrow pit area, dumping of earth on the embankment for re-sectioning, vehicle and generator emissions will negatively affect the air quality and dust levels temporarily. In the polder area the value of SPM, Sox and NOx are 125μ/m^3, <25 μ/m^3 and 20 μ/m^3 at Rampall Upazila Sadar respectively. But in rural areas the value of SPM, SOx and NOx are 118 μ/m^{3,} >25 μ/m^3 and 22 μ/m^3 respectively. These values are within the limit of DoE, Bangladesh standard (**section 6.1.2 in Chapter 6**).

All the construction works will be implemented during dry season and might increase some emissions and air borne dust. These emissions and dust are a nuisance for local dwellers and animals and can create health hazard. The main effect on air quality during construction is caused by increased dust and emission levels from construction machinery, excavation and cement mixing. The construction activities will generate airborne dust as well as CO, NOx, SOx and SPM. However, these emissions will be restricted to the construction site of the polder area.

Exhaust gasses and dust caused by moving vehicles and dust from construction activities may be blown to the thirteen settlement areas, which are near the rehabilitation sites (Figure and will cause a nuisance to the local population and animals. These negative impacts will also affect the workers and the people of the polder and create health hazards. The location of sensitive receptors (schools, markets and mosques) near the work sites is shown in the Figure 9.1 considering chainage.

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

Mitigation

During field survey, it has been observed that the airborne dust is minimum in the polder area, which is not harmful for dwellers of the polder. However, some emissions will be generated during construction phase, which can be mitigated by proper air quality management. The Contractor will fit all vehicles and machinery with proper exhaust systems and emission control devices. Machinery and vehicles causing excess pollution will be banned in the project. Dust generation from construction sites will be restricted as much as possible and water sprinkling will be carried out as appropriate. Vehicle speed will be on low (15 km per hour) on earthen tracks particularly near settlements. Air quality will be properly monitored, especially near the thirteen settlement sites (**Figure 9.1**).

Residual Impacts

With the help of above mitigation measures, the impacts associated with air quality deterioration are likely to be adequately addresses and the significance of residual impact will be **Low**.

9.4.13 Hindrance and damages during mobilization and transport of construction materials

Impact

Four markets are located in the polder near the embankment. During marketing time, all the stakeholders use the embankment as road for carrying their goods for buying and selling and other purposes. Earth work for re-sectioning of embankment may create short term disturbances for the inhabitants of polder.

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

Mitigation

- The works on embankment will be carefully scheduled to minimize impact on local markets and transportation routes.
- The embankment works will 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. When the works are completed on the first half, it will be opened for local traffic while works will be undertaken on the other half of the embankment.
- Work schedule will be finalized in coordination and consultation with local representatives and communities.
- Local routes will not be blocked as much as possible. If unavoidable, alternative routes will be identified in consultation with local community.
- GRM will be put in place.

Residual Impacts

With the help of above mitigation measures, the impacts on hindrance and damages to materials during mobilization are likely to be adequately addresses and the significance of residual impact will be **Low**.

9.4.14 Hindrance for pedestrians and vehicles movement during re-sectioning of embankment

Impact

About four numbers of markets are located in the polder near the embankment. The names of the markets are Khegra ghat Bazar and Rastermata Bazar. During hat and marketing time, all the stakeholders use the embankment as road for carrying their goods for buying and selling and other purposes. Earth work for re-sectioning of embankment may create short term disturbances for the inhabitants of polder.

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

Mitigation

- Re-sectioning work should be done segment wise
- Alternative road can be used. Otherwise alternative road should be constructed by the contractor.

- Earth work for re-section of embankment during hat day can be shorted for essay movement of local people.
- Water way can be used especially along the Daratana river during construction period
- All the works will be conducted in presence of Union Parishad Chairman and members.
- Project Implementation Officer (PIO) will be informed during construction and finishing of earth works of embankment.

Residual Impact

With the help of above mitigation measures, the impacts on pedestrians and vehicles movement are likely to be adequately addressed and the significance of residual impact will be **Low**

9.4.15 Social and gender issues

Impact

During construction of all rehabilitation/development activities under this project, around 60 percent of construction workers will be recruited from within the Polder while the remaining will come from other side of the polder. 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.

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.

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

Mitigation

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;
- Safe driving practices;
- Respect for the local community and its cultural norms in which laborers are working.
- Avoiding construction activities during Prayer time.

Residual Impacts

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**.

9.4.16 Disturbance of water way navigation

Impact

Existing external waterway navigation around the construction site will be disturbed for certain times during construction for transportation of construction materials. The polder 35/3 is located besides the international route. The name of route is Mongla- Ghasiakhali (**Figure 9.2**). This route is presently under active silting up process. Now the route is active during high tide, but during low tide no vessels and ships can move through this way due to low height water level. Mongla to Ghasiakhali navigation route is one of the important segments of navigation route that joins the Mongla sea port and Khulna with the rest of the country. This route is the part of Indian Protocol Route and most importantly export and import of bulk goods from India that uses inland navigation also uses this route. Traffic is increasing in this route. The route is 31 km in length from the Pussur River at Mongla to the Mongla-Gahsiakhali (M-G) Canal.

During the last couple of decades, many of the tidal rivers in the southwest were found to be silted up rapidly and as a result they were unable to drain the tidal plains surrounded by the embankments (polder). Due to the reduction of tidal volume resulting from empoldering, the tidal rivers do not have its pre-polder flow area. As the tidal pumping process is able to bring huge sediment in this area, rivers can adjust its dimension (width and depth) very rapidly. A chain of such feed-back process has been initiated in this area in the late 1980s, effects of which are still continuing.

The cut-down of the tidal prism due to the construction of Polder 35/3 has already occurred. Strengthening of this polder may not have any significant effects on the surrounding rivers or Mongla-Ghasiakhali route. But if the, upstream flow is not ensured by the Gorai-Modhumoti river then the navigation route will lose their navigability.

All the above mentioned localized problems may have short term effects on communication system of the area, which are reversible.

Mitigation

- Contractors will be instructed and monitored by the environmental monitoring specialist to use traffic management plan.
- Movement of vessels or engine boat during fog and bad weather situation will be avoided.
- Additional temporary jetties where needed will be established for materials distribution. Liaison will be maintained with community and BIWTA.

Residual Impact

With the help of above mitigation measures, the impacts associated with additional traffic on roads and along water ways are likely to be adequately addressed and the significance of residual impact will be **Low.**

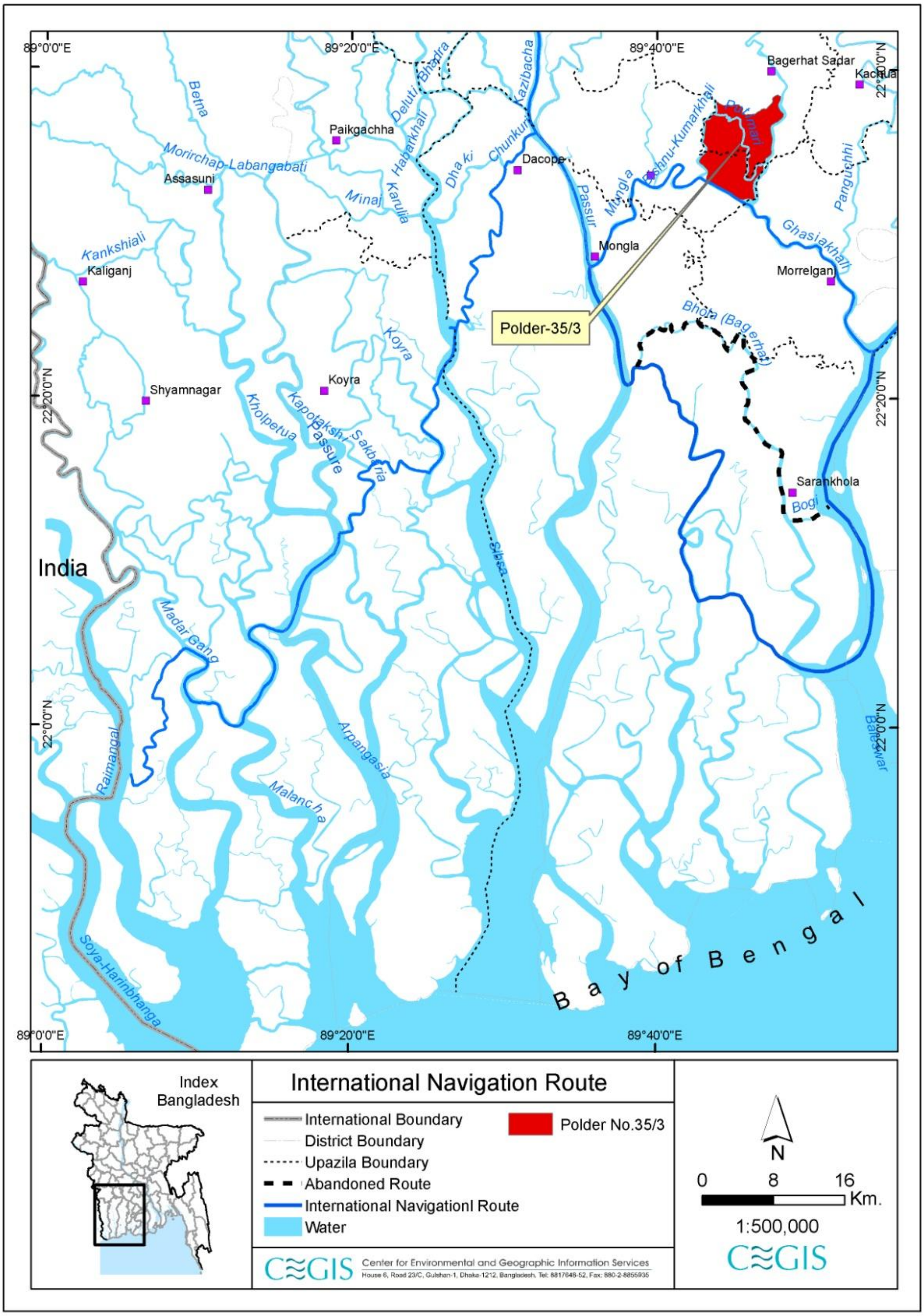


Figure 9.2: International Navigation route surrounding the polder 35/3

9.5 Impacts during Post-construction Phase

9.5.1 Risk of embankment failure

Impact

Rain cut and wave action from Daratana river were the major causes of embankment breaching of this 35/3 polder. Lack of regular maintenance created weaker point at the sensitive points of the polder. Mal-maintenance and increasing intensity and magnitude of the cyclone and storm surge simultaneously accelerate the risk of embankment failure. The eastern embankment (ch. 0.00 km to 13.5 Km) and western embankment (Ch. 33.00 km to 33.50 km and Ch. 33.00 km to 40.00 km is more susceptible to breach.

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

Mitigation and contingency plan

Regular precise monitoring and careful maintenance of the embankment and existing water control structure especially to the eastern part will be ensured. This monitoring will strictly be followed during pre- and post-monsoon. 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. Moreover, structural measures like geo bag, sand bag etc will be kept in local BWBD office of Bagherhat district.

Residual Impacts

With the help of above mitigation measures, the impacts associated with risk of embankment failure are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.5.2 Drainage congestion and increased sedimentation in water channels and rivers

Impact

Polder 35/3 is facing severe drainage congestion due to siltation of khals and external rivers specifically Daratana and Bishnu River [Figure 9.1 (a)] is silted up due to lack of flow from the upstream. During monsoon, water does not drain out properly due to high siltation in internal Betbunia, Mogordhara and Sayabanki khals of the polder. This problem is localized and it would be reversible by proper re-excavation works of khals, which have been considered in Feasibility Study. It is a long term problem for local people, and has been generated 15 years back due to lack of sediment management and malfunctioning of water control structures. In future, the low lying areas of the polder (see **Figure 6.8 in Baseline Chapter**) may be faced severe drainage congestion due to anthropogenic activities.

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

Figure 9.2 (a): Silted up Bishnu River

Mitigation

- The following measures will be implemented to address the above concerns:An ongoing program of de-silting of water channels will be considered with full community involvement and participation. WMGs will take the lead for this purpose.
- Proper land zoning plan will be prepared in the Polder for controlling unplanned development works.
- The local government (union parishad) will be authorized to monitor the development activities.
- Proper training program in connection with land zoning and monitoring system will be undertaken by the development authorities of Bangladesh.
- A research program will be carried out for polder-wise land zoning plan preparation in future.
- Prepare Bangla manual for sluice gate operation and provide training to WMOs; and
- Reduce conflicts between farmers and fishermen.

Residual Impacts

With the help of above mitigation measures, the impacts associated with drainage congestion are likely to be mostly addressed and the significance of residual impact will be **Moderate**.

9.5.3 Deterioration of soil fertility

Impact

Non-calcareous Grey Floodplain soil is the major component of general soil types in the polder area. The fertility level of the soil is generally high with medium to high organic matter content. The fertility status of the polder area will remain unchanged in future without project condition. On the other hand, the surface water of the rivers contains silts from the river, which would contribute to increase the soil fertility of the polder area. It is expected that implementation of the interventions would increase cropping intensity of the polder area. At present cropped area are 6,606 ha. After implementation of rehabilitation works total cropped area would be about 8,736 ha of which paddy would be about **6,710** ha. This will allow expansion of area under irrigated cultivation of *boro* and *aus* varieties of. This expansion of irrigated cultivation is likely to result in increased use of chemical inputs including fertilizers and pesticides. Run-off from such cultivation fields may potentially pollute the water bodies and even drinking water sources thus causing health hazards for the communities. This runoff may also lead to eutrophication of the water bodies, a phenomenon which would decrease the dissolved oxygen in the water and thus negatively affecting the aquatic fauna. The impacted possible contamination and reduced soil fertility locations are delineated in the **Figure 9.1** under the expansion of Boro filed area. The estimated agriculture inputs have been given in the baseline chapter under **section 6.8.10**.

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

Mitigation

- A Pest Management Plan will be prepared before the completion of the construction phase of the project.
- Organic manure will be used to increase soil fertility;
- Dhaincha and leguminous crops will be cultivated in the polder area;
- Farmers group will have close contact with DAE for adoption of various measures of IPM/ICM;
- Integrated Pest Management (IPM) and Integrated Crop Management (ICM) will be practiced.

Residual Impacts

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 residual impact will be **Moderate**.

9.5.4 Impact of tidal flooding

Impact

The tidal flooding is one of the major problem in coastal zone of Bangladesh, specifically polder 35/3 is facing severe tidal flooding after Aila for the existing breach points of the embankment and low height of the embankment. This is a localized problem and would be reversible through proper rehabilitation works, which have been considered in the Feasibility Study. This is a short term problem for local people. If the proposed implementation works are not implemented immediately, the problem will be further aggravated severely in the low lying area like Malliker Ber, Mandaria, Bara Banshbaria, Chak Narashing (in between ch 1.00 km to 13 km) and Betbonia will be flood.

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

Mitigation and enhancement

Regular monitoring of seepage of surface waters from Daratana River through the regulators will be checked during dry seasons and necessary steps will be taken to check seepage, if any. Afforestation program will be taken at both side of the embankment, which will help to strengthen the embankment.

Residual Impacts

With the help of above mitigation measures, the impacts associated with tidal inundation are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.5.5 Reduced fish migration

Impact

Construction of new water control structures on water which are currently direct connected with the outer rivers will potentially affect fish migration in the *khals (see* **Figure 6.15**). This can potentially result in decrease of fish population in the polder.

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

Mitigation

The following measures will be implemented to address the above concerns:

- Proper sluice gate operation allowing fish migration.
- provide training to WMOs;
- Transferring juvenile fish from rivers to Polder.

Residual Impacts

With the help of the above mitigation measures, the impacts on fish habitat and migration are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.5.6 Impacts on shrimp farming and livelihood

Imapct

Shrimp farming is a common practice in the polder area. A significant number of farmers are involved in shrimp farming in this area. It is more profitable than paddy. Shrimp export contributes significantly to the local and national economic development, employment and income generation as well as livelihood improvement. Improved drainage system, or protection of saline water intrusion by embankment and water control structures, the salinity problem will be reduced within the project area. As a result, rice area would be increased compared to its base condition. On the other hand, shrimp farm area would be adversely impacted due to reduction in saline prone area and would be reduced to corresponding shrimp production. It is expected that the livelihood of the shrimp farmers will be impacted unfavorably no doubt. Many local labours who are exclusively engaged in shrimp farming will become jobless.

Mitigation

1. Prospective of golda farming should be encouraged through campaigning and by providing training on improved culture practices as well as rice-cum-golda farming within available sweet water;
2. Alternative income generation i.e. livestock rearing, poultry and integrated fish culture may create scope of alternative income for shrimp farm labour;
3. Shrimp farming is not environmentally sound practice. In shripmp farm area, there is no green environment due to salinity intrusion. But after completion of the CEIP project, people will be benefitted by different type of by-products like paddy straw, vegetable garden, yard

garden, poultry and livestock and finally food security from their crop fields. So it may ensure the proper extension service as well as proper training for betterment of life and livelihood;

4. Shrimp farming is suitable and profitable for only rich farmer but not for landless people, marginal and small farmer. Considering poverty reduction the proposed CEIP project will be very helpful for landless people, marginal and small farmer as a whole.

9.6 Positive Impact of the Project

9.6.1 Employment Generation

The construction work will generate a significant amount of employment over its construction period to local people and other associated professionals. People will also be involved to carry put 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.

9.6.2 Gender Promotion

Construction work requires various types of skilled and unskilled labors. It is found that in Bangladesh a portion of construction labors are female. These females are vulnerable to natural disaster and mostly distressed and widow who are dependent on others and do not have any definite source of income. Therefore, employment access to them in the construction works and during operation/maintenance phase is significantly positive.

9.6.3 Livelihood Development

The project is expected to increase resilience of people within Polder 35/3. Agriculture production increase, reduction of drainage congestion, income generation is expected to improve the livelihood of the people.

9.6.4 Affroestation

The project will promote afforestation which is expected to largely mitigate the negative impact associated with felling off the trees. However the impact is expected to be positive in the long run.

9.6.5 EMP Promotion

The project has in built component which will facilitate implantation of Environmental Management Plan. Under the project, the capacity building for environmental management of BWDB and WMO will be performed. The project is expected to have long term positive impact on institutional development of BWDB and WMO for ensuring environmental sustainability.

9.7 Summary of Assessed Impacts

A summary of these impacts and their significance discussed in the sections above is presented in **Table 9.9**.

Table 9.9: Significance of environmental Impacts

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
A. Pre-construction Phase								
Conflicts because of absence of proper land ownership legal document	Long term	Local	Irreversible	Certain	High	Major	• RAP to be prepared • Compensation to be paid prior to construction in accordance with RAP • Maintain liaison with communities. • Grievance redress mechanism (GRM) in place	Moderate
Increased traffic volume for contractor mobilization	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	• Contractor to prepare and implement mobilization plan. • Liaise with local communities and concerned authorities • Ensure minimal hindrance to local communities and commuters.	
Changes in land use : preparation of construction facilities, borrow areas, others	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	• Establish all these facilities within the area owned by BWDB • Pay compensation/rent if private property is acquired on temporary	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							basis • Consult communities • Avoid impacts on communities.	
nstruction Phase								
Air quality deterioration (dust, combustion gases)	Short term	ɔcal	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Exhaust emissions from vehicles and equipment to comply with standards • Proper tuning of vehicles, generators, and equipment • Covering construction material (sand/soil) while transporting and stock piled. • Water sprinkling where needed • Speed limits for vehicles on earthen tracks • Turn off engine when idle • Use of good quality fuel • Locate camps at a safe distance from communities. • Liaison with the communities will be maintained and grievance	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							redress mechanism will be established at the site.	
Noise and vibration	ort term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Restricting/limiting timing of construction activities • Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards. • Vehicles and machinery to have proper mufflers and silencers • Provision of noise barriers at schools and other sensitive receptors • Provision of PPE (ear muffs and plugs) to labor • Instruction for proper use of equipment • Liaison with community • Locate camps at a safe distance from communities.	Low
Increased traffic load in water way	Short term	Local	Reversible (after construction	Certain	Medium to high	Moderate	• Contractor to prepare and implement traffic management plan	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
			phase)				• Contractor to establish new, temporary jetties where needed • River crossing during nighttime where possible and appropriate • Material transportation through rivers during high tide where needed (eg, Bogi Khal) • Liaison with community and BIWTA.	
Tree cutting during embankment re-sectioning and labor shade preparation	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Contractor will carry out tree census thoroughly what numbers of trees need to be cut during construction activities. • Thick and dense vegetated area will be avoided to prepare the labour shed as far as possible; • Contractor will prepare a tree plantation plan will be prepared for compensation of loss of trees. Trees will be planted at the end of the	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							construction period during wet season. It is recommended to establish a nursery with selected tree species (Geoa, Kewra and Babla) in the beginning of the project in order to reduce the purchasing cost of saplings. All saplings will be planted and monitored according to section 4.5.6 under project description chapter; • Contractor will avoid dumping of spoil earth in and material borrowing from vegetated areas;	
Soil and water contamination: large volume of construction wastes, leakage, spillage of oil from vessels and engine boat, camp wastes,	Short term	Local	Reversible (after construction phase)	Certain	High	Major	• Contractor to prepare and implement pollution control plan • Oil separators/sumps for workshops • Avoid repairing vehicles and machinery in the field • Use plastic sheet or gravel	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
disposal of demolition material, spoil, and excavated silt							in the workshop and equipment yard • Dispose contaminated soil appropriately ensuring that it does not contaminate water bodies or affect drinking water sources • Contractor will ensure that there is no leakage or release of fuel, oil or any other affluent/waste in the water • Locating camps away from communities and drinking water sources • Preparing and implementing camp waste management plan (septic tanks, proper solid waste disposal); • Do not release untreated wastes on ground or in water • Re-use spoil and excavated material where possible	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							• Disposal of spoil at designated areas with community consent • Construction material and excavated soil/silt will not be allowed to enter water bodies.	
Drainage contestation/water logging	Short term	Local	Reversible	Occasiona l	Medium to high	Moderate	• Constructing bypass canal during construction of all regulators • Ensuring that drainage channels are not obstructed or clogged • No water ponding near cultivation fields • Avoid works during rain; • Avoid works during high tide.	Low
Loss of agriculture	Short term	Local	Reversible	Likely	Medium	Moderate	• Compensation to be paid for any crop damage • Avoiding agricultural land for labor camps • Avoiding cultivation fields during construction • No vehicular movements inside cultivation fields	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							• No material dumping inside cultivation fields • Maintain liaison with communities.	
Affects on irrigation	Short term	Local	Reversible	Likely	High	Major	• Constructing bypass canal during construction of all regulators • Proper sequencing of works on regulators and sluices • Ensuring no negative impacts on crop irrigation • Maintain liaison with communities.	Low
Hindrance of fish migration	Short term	Local	Reversible	Likely	Moderate	Moderate	• Constructing bypass canal during construction of all regulators • Proper sequencing of works on regulators and sluices; • During monsoon runoff will be diverted to adjacent depressions and from there to river after settling • Transferring fish from	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							rivers to Polder water channels where appropriate. • Maintain liaison with communities.	
Affects on benthic communities	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	• Do not release untreated wastes on soil or in water. • Carry out *khal* excavation in segment thus minimizing impacts on benthic fauna.	Low to medium
Damage / disturbance to flora and faunal resources	Short term	Local	Reversible	Likely	Medium	Moderate	• No material to be borrowed from faunal habitat areas • Avoid dumping of spoil earth in faunal habitat areas • Do not release untreated wastes on soil or in water • Labor not to indulge in hunting, trapping, or shooting wild animals. • Carry out compensatory tree plantation for tree felling • Avoid dumping of spoil	Negligible

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							earth in vegetated areas; • Enhance flora environment by planting fruit trees and mangrove plants; • Use grasses to assist slope and soil stability.	
Damage to floral resources	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	• Carry out compensatory tree plantation for tree felling • Avoid dumping of spoil earth in vegetated areas; • Enhance flora environment by planting fruit trees and mangrove plants; • Use grasses to assist slope and soil stability. • No material to be borrowed from and no waste to be disposed in Sundarban.	Negligible
Hindrance for Pedestrian and Vehicle Movement	Short term	Local	Reversible	Likely	Medium	Moderate	• The works on embankment will be carefully scheduled to minimize impact on local	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							markets and transportation routes. • The embankment works will 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. When the works are completed on the first half, it will be opened for local traffic while works will be undertaken on the other half of the embankment. • Work schedule will be finalized in coordination and consultation with local representatives and communities. • Local routes will not be blocked as much as possible. If unavoidable, alternative routes will be identified in consultation with local community • GRM will be put in place.	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
Safety and Public Health Hazards	Short term	Local	Reversible	Likely	High	Major	• 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. • Each contractor will establish a comprehensive Health and Safety Plan aimed at preventing accidents, injuries and work-related diseases. This plan will be submitted to BWDB and World Bank for review and approval; • Each contractor will prepare an Emergency Response Plan defining procedures to be followed during any emergency. This plan will be	Moderate

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							submitted to BWDB and World Bank 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; • 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	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							required; • Hazards require staff training. 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 will be conducted for local communities prior to and during construction operations. • Observing statutory	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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 related to minimum wages and hours of work;	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							• Ensuring no workers are charged fees to gain employment on the Project; • Ensuring 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	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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; • 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	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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 work environment taking into account the inherent risks for this type of project.	
Local labour vs outsider labour conflict	Short term	Local	Reversible	Likely	Medium	Moderate	• 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,	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Upazila Nirbahi Officer (UNO) and BWDB local officers. • Cultural norms of the local community will be respected and honored. • GRM will be established 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.	
Damage to	Short term	Local	Reversible	Likely	Medium	Moderate	• The condition of the	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
infrastructure							infrastructure being used for the construction and transportation activities will be regularly monitored. • All damaged infrastructure will be restored to original or better condition.	
st Construction Phase								
Risk of embankment failure	Long term		Reversible	unlikely		Major	• Regular repair and maintenance of embankment and regulators.	Low
Drainage congestion and increased sedimentation in *khals* and rivers	Long term		Reversible			Major	• Provide water shed management training to WMOs • Prepare Bangla manual for sluice gate operation and provide training to WMOs; and • Reduce conflicts between farmers and fishermen. • Program for on-going de-silting of water channels. • Implement small scale tidal river management	Moderate

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							(TRM)	
Soil and water contamination (increased use of chemical inputs) and reduced soil fertility	Long term		Reversible			Major	• Using IPM method for reducing pesticide use; • Awareness raising of communities	Moderate
Tidal flooding	Long term		Reversible			Major	• Provide water shed management training to WMOs; • Prepare Bangla manual for sluice gate operation and provide training to WMOs and • Reduce confliction between farmers and fishermen	Low
Reduced fish migration	Long term		Reversible		Medium	Moderate	• Proper sluice gate operation allowing fish migration. • provide training to WMOs;	low

10. Cumulative and Induced Impact

This Chapter attempts to present analysis of cumulative impacts of the proposed Project and other projects in the area. In addition, induced impacts are also covered in the chapter.

10.1 Cumulative Impacts of CEIP interventions

As shown in Figure 10.1, Polder 35/3 is surrounded by a number of rivers and lakes/khals. There is Putimari River on the north, Daratana River on the east, Katakhali khal on the south and Bishnu river on the west. Figure 12.1 shows the location of the Polder along with the surrounding polders. The polder has hydrological connections with Polder 35/3 under CEIP-I. The other polders under CEIP-I are located far from this polder and therefore the cumulative effects of these other polders on Polder 35/3 are not foreseeable.

Polder 35/3 is located downstream of the Poylahara river (Poylahara river is generated from the converging point of Daratana river and Katakhali khal, the two peripheral rivers of Polder 35/3). When sea water enters through Baleswar river during dry periods or due to tidal flow or rise in cyclonic surge, water would not be able to enter Polder 35/3 because of its high crest level. The diverted water would partly move on the upstream of Baleswar river to affect Polder 39/1. While a significant portion of river water would affect Polder 35/3. The embankments may be damaged; water may overtop the embankment and cause flooding during monsoon or due to rise in surge height. Infrastructural damage may be caused due to flooding of Polder 35/3.

The polder 35/3 is located in the south direction of polder 34/3 under CEIP (Figure 10.1). The feasibility studies have been completed for polder 34/3 and the construction activities are to be initiated later on under a different phase (after the implementation of CEIP in Polders 32, 33, 35/3, 35/3, and 39/2C). The existing crest level of polder 34/3 is low (4.27m above sea level), and in many locations the embankment crest has even merged with the ground. As the construction procedures for Polder 34/3 is not in consideration under CEIP-I, no cumulative impacts are considered from Polder 34/3 for the time being.

10.2 Other projects around polder 35/3

Apart from CEIP, there are some other development projects implemented by the Government of Bangladesh (GoB) and a number of Non Government Organizations (NGOs) at or near polder 35/3. The activities of these projects may generate cumulative impacts on the polder. Table 10.1 and Table 10.2 show lists of various projects undertaken by the GoB and NGOs frequently in the districts of Bagerhat and Khulna.

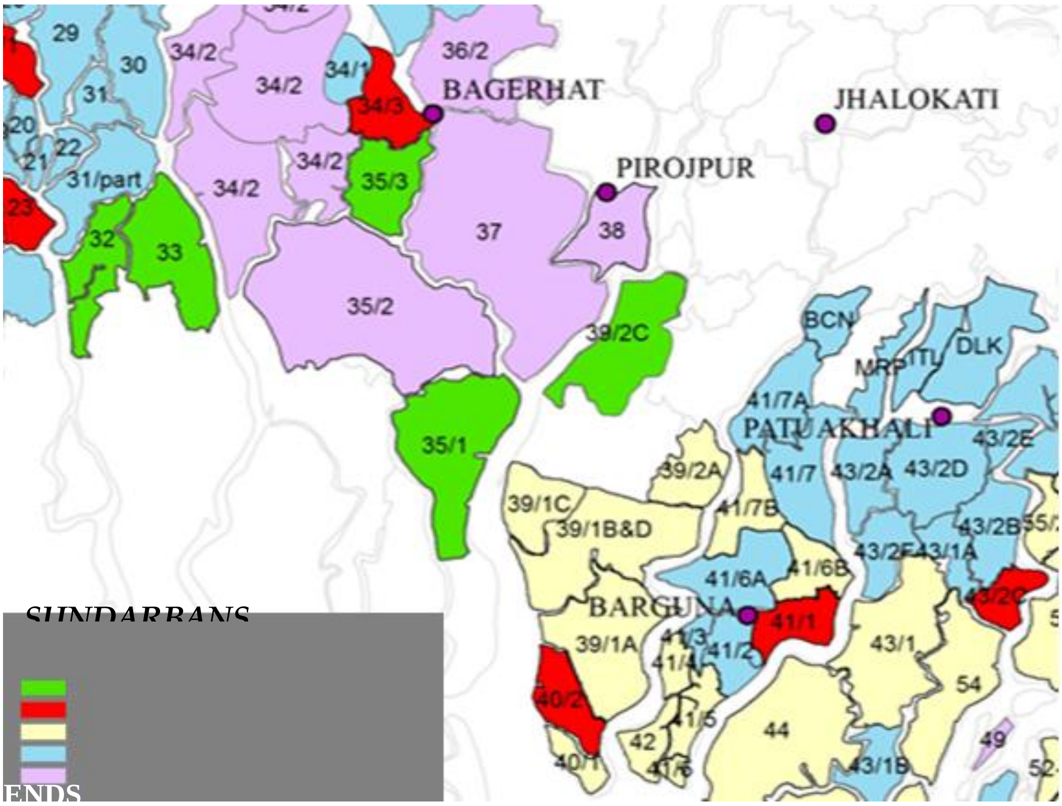


Figure 10.1: Locations of polders under CEIP-I

Table 10.1: List of other projects implemented by the GoB

Agency	Project Name	Duration	Location
DMB, BWDB, FAO, LGED	Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)	2008-ongoing	Pirojpur, Barguna, Barisal, Bagerhat, Bhola, Khulna etc.
BWDB	Protection from Saline Water at Nazirpur and its Surrounding Areas	1994-2004	Pirojpur, Bagerhat
LGED	Flood Rehabilitation Project in the Area of Rural Development Project-18 (Greater Khulna, Jessore and Kushtia District)	2000-2003	Khulna, Satkhira, Bagerhat
	Greater Khulna District Infrastructure Development Project	2000-2004	Khulna, Satkhira, Bagerhat
DoF	Extension of Culture Technology of Marine Shrimp	1997-2004	Khulna, Bagerhat, Satkhira & Cox’s Bazar
RHD	Development of Signboard-Morelganj-Rayenda-Sharankhola Road		Bagerhat
BEPZA	Mongla EPZ (Phase-1)	1998-2004	Khulna
KCC	Solid Waste Disposal and Environmental Improvement in Khulna City Corporation	1996-2004	Khulna

Table 10.2: List of projects implemented by the NGOs

Agency	Project Name	Duration	Location
WRDS	Dissemination and standardization of hydroponics (floating garden) in waterlogged areas as an adaptation to the impact of climate change	2003-2005	Gopalganj, Bagerhat, Jessore
RIC	Sundarbans Biodiversity Conservation Project	2000-2004	Pirojpur
CDP	CDP-CARE RVCC Partnership Project: Collection and Dissemination of Information on Climate Change in South West Bangladesh: Development of Central Information Centre (CIC)	2003-2005	Bagerhat, Khulna, Satkhira, Jessore, Narail and Gopalganj
CCEC	Sundarban Conservation through Crab Fattening	2002-2003	Khulna

10.3 Cumulative Impacts of other projects in the study area

Due to the implementation of various large or small scale projects in the study area, a few cumulative impacts are generated in Polder 35/3. These impacts may be direct or indirect, major or minor in the context of Polder 35/3, but the consequences of such impacts need to be investigated. The cumulative impacts found in polder 35/3 for different projects are discussed below:

a) Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)

For facilitating recovery from damage to livelihoods and infrastructure caused by Cyclone Sidr and to build long-term preparedness through strengthened disaster risk management, the GoB implemented the “Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)” in a total number of 13 districts (Barguna, Bagerhat, Barisal, Khulna, Bhola, pirojpur, Jhalokati, Noakhali, Feni, Chittagong, potualkhali, Sathkhira, Laksmipur) of Bangladesh.

However, the locations of the polder under ECRRP are relatively far from Polder 35/3. The most nearby polder under ECRRP is Polder 39/1C, which is located about 30 kilometers downstream from Polder 35/3 (along the left bank of Baleswar River). The social consultations made with the local people and stake holders revealed that the development of polder 39/1C does not generate any notable cumulative impact in Polder 35/3.

b) Other GoB projects

Apart from ECRRP and CEIP there are other projects undertaken by the GoB at or near the study area (Table 9.1). There are foreseeable impacts generated by such projects into polder 35/3.

To provide protection from salinity intrusion in Nazirpur, BWDB implemented a project naming “Protection from Saline Water at Nazirpur and its Surrounding Areas” from 1994 to 2004. This project still causes hydrological influence in polder 35/3. The social consultations made with local people revealed that the flow of Daratana and Bishnu rivers is marginally influenced (in terms of flow velocity and other flow parameters) due to the salinity protection project implemented in Nazirpur. In recent years, flow has increased in the Daratana and Bishnu rivers.

There is a flood rehabilitation project implemented by LGED, at local level in Khulna, Satkhira, Bagerhat districts. The project improved the local scenario with a few social impacts in polder 35/3.

The effective implementation of the project ensured development, and hence many people from polder 35/3 preferred such developed places of Khulna, Sathkhira, Bagerhat for employment. LGED also implemented an infrastructure development project during 2000-2004 which eventually improved the communication system, thus affecting the overall socio-economy.

In 1998, Bangladesh Forest Department (BFD) extended the culture technology of marine shrimp on macro scale in Khulna, Bagerhat, Sathkhira and Cox's bazaar. The project continued upto 2004, seeing viral attacks (of white spot syndrome virus, taura syndrome virus, and infectious hypodermal and haematopoietic necrosis virus) on shrimps in the later stages of the project implementation. However, the popularity of shrimp culture spread in local level. At present, shrimp culture in polder 35/3 during dry season is a very common practice. The culture of shrimp is not labor intensive, thus creates more unemployment. In the dry season, a number of places in the embankment were cut down to allow the entry of saline water; this reduced the strength of the embankment by creating weak points. One notable positive impact of shrimp culture in polder 35/3 is that it ensured overall socio-economic development of the area.

Another project that affects the polder is the "Development of signboard-rayenda-sharankhola road", a project implemented by the Roads and Highways Division (RHD). This road will aid in the improvements in the communication system of Bagerhat. The people living in Polder 35/3 would find it convenient to travel to Rayenda, Sarankhola (of Polder 35/3). Hence the socio-economic development would be enhanced.

The Mongla EPZ, Phase-1 project completed in 2004 and the cumulative impacts it presently generates are negligible. The Khulna City Corporation (KCC) implemented the "Solid waste disposal and environmental improvement" project in 1996-2004. This project improved the surrounding environment, as the disposal of waste does not affect Sundarbans as the way it used to do before. The quality and navigability of Katakhali khal have seen significant improvements due to the implementation of the project by KCC.

c) NGO projects

In recent times, there are few projects implemented in Bagerhat by several NGOs. Most of these projects are awareness building projects. CDP implemented an awareness building project to disseminate information on climate change in the southwest region of Bangladesh. Apart from that, a number of projects were implemented as a measure of climate change adaptation (crab fatting, floating garden etc.). These non structural projects have mostly been able to spread awareness against climate change, biodiversity conservation etc. People of Polder 35/3 have been positively affected to some extent due to the implementation of such awareness building projects.

10.4 Induced impacts caused by CEIP

In polder 35/3, implementation of interventions may cause minimal effects to a number of environmental and social components in a longer period. Impacts may also be found in different locations outside the polder. The following sections provide detailed discussions on a number of spatially and temporally induced impacts of polder 35/3.

a) Sedimentation

The proposed interventions will safeguard the polder against direct intrusion of tidal water during high tides or cyclonic hazards. The river water carrying huge amount of sediments will move further downstream or upstream and may cause siltation in the water bodies outside the polder. Sedimentation is assumed to be taking place in the surrounding Daratana, Putimari and Bishnu rivers and new morphological changes may be established outside the polder. Most of the areas near Polder 35/3 are without polder protection. These areas may severely suffer the consequences of sedimentation in Bishnu and Daratana river. Raripara, Chomra, Debraj etc. locations of Polder 37 and Banstali, Dakshin Khanpur etc. locations under Polder 34/2 are would be under heavy threat of being inundated during monsoon as embankment construction process around these polders are still ongoing.

In addition to the above mentioned aspects, sedimentation in smaller water bodies namely Katakhali khal, Putimari river may cause regular drainage congestion problems. The navigability of rivers may further deteriorate over the years. A number of smaller water bodies may be permanently silted up. The following satellite image (Figure 10.1) shows the locations of Polder 35/3 in the district of Bagerhat along with the nearby unions (Raripara, Chomra, Debraj, Banstali, Dakshin Khanpur etc.).

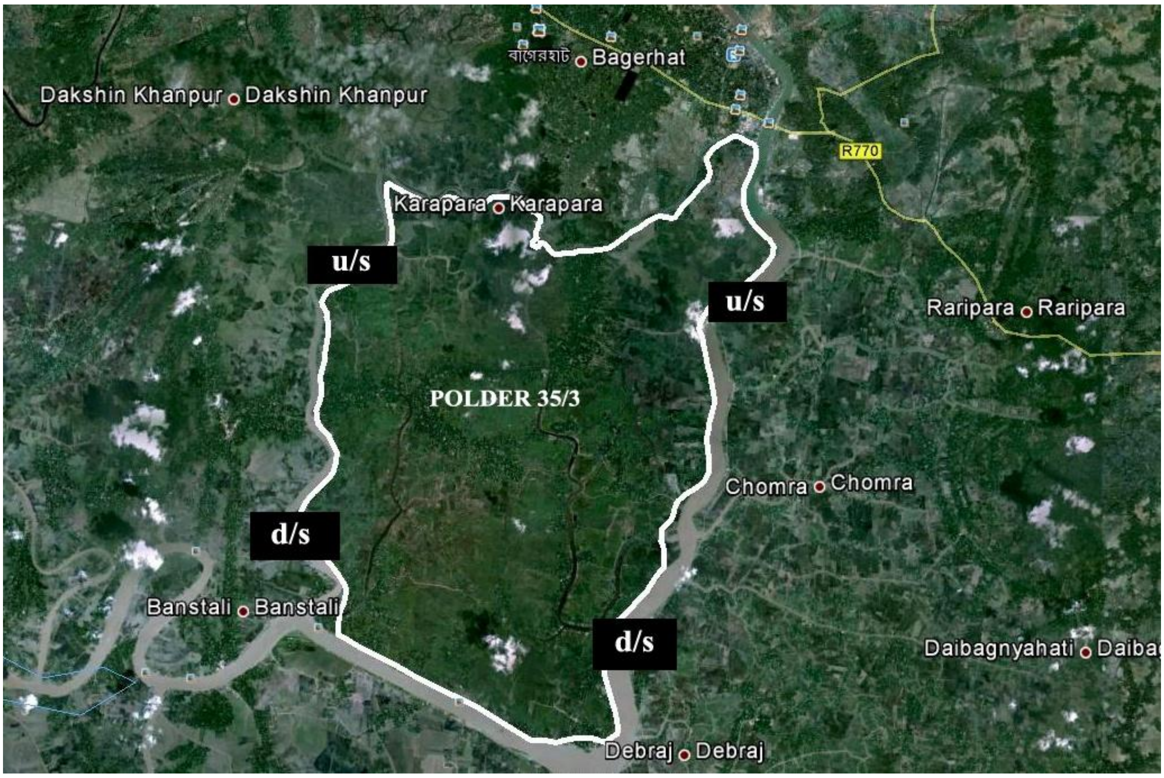


Figure 10.2 : Satellite Image polder 35/3

b) Erosion

The blockage of tidal flow into the polder will result the flow of the peripheral rivers (Bishnu and Daratana rivers in particular) to be diverted further downstream and upstream. This may lead to erosion on the river banks of the unprotected areas (Parts of Polder 34/2, 35/2 and 37). There will be severe damage to some parts of Polder 34/3 (Gobardia, Kati, Gomati etc.). Areas with no bank protection would be more vulnerable to tidal flow. In future, the effects on nearby areas due to erosion may be severe; a large number of people may lose their residences, the agricultural lands can be reduced.

c) Drainage congestion

Siltation in the rivers or water bodies outside the polder would cause drainage congestion on a more frequent basis. The smaller lakes and rivers facing east-west direction i.e. Putimari river, Katakhali khal etc. would undergo frequent congestion. Especially during low tides, Katakhali khal in the southern periphery of Polder 35/3 gradually becomes very shallow.

d) Flooding

Tidal water would not be able to enter polder 35/3 during monsoon, as a result the nearby areas which are not protected will be inundated. Loss of assets of the people living in Raripara, Chomra, Debraj, Banstali, Dakshin Khanpur etc. unions under Bagerhat district may take place due to flood. The nearby areas with no or insufficient polder protection will be severely affected to cyclones and other hazards in future.

Table 10.3 shows the design crest levels of embankments in polder 35/3 and 34/3. In most parts of Polder 34/3, embankments have damaged severely over the years and at some places, embankments have even merged with the ground surface. The increased flow of the river would therefore cause further damage to Polder 34/3.

Table 10.3: Crest level of embankments of a few polders

Polder Number	Crest level (mPWD)
35/3	4.5 (design)
34/3	4.27 (existing at some places)

Source: Data collected by CEIP

e) Water quality

The development of the polder would generate increased amount of wastes. The disposal of wastes would deteriorate the quality of surface water in the nearby water bodies. Pollution will also increase in the downstream. Furthermore, due to increase in agricultural area, more agriculture practices and industrialisation are expected. Therefore, water pollution by chemical fertilizer, pesticides and industrial effluents may increase outside the polder as well.

The polders in the vicinity of polder 35/3 (Polder 34/3, 34/2, 35/2 and 37) will be vulnerable to salinity intrusion as the river water outside polder 35/3 would be headed up. Therefore, saline water will enter into the nearby areas from January to April. Due to salinity intrusion for a longer period, water quality and soil quality may further deteriorate.

f) Food security

The proposed interventions would drive economic development inside the polder. Thus, the polder area may provide food security to the surrounding areas. In future, polder 35/3 would not only be able to resist the damage of cyclonic hazards or flooding; but may also provide safety against food crisis for the probable damaged Polders.

g) Cropping pattern

The implementation of the proposed interventions would increase water availability in the polder during dry season Boro cropping practice. Therefore, stakeholders will be able to sell their products to other nearby districts (Pirojpur, Barguna, Barisal, Khulna etc.). Again, the salinity intrusion in other nearby areas that are not protected by embankments would prevent dry season boro cropping. Areas that would be subjected to the intrusion of saline water for a longer period will possess high soil salinity and therefore, such lands would not yield good production and be suitable for agricultural practice in future.

h) Habitat of flora-fauna

Depth of smaller water bodies outside the polder i.e. Katakhali khal, Putimari river would be reduced due to increased sedimentation, as well as other factors. Due to reduced depth of surrounding water bodies, the fish habitat as well as fish production may decrease in future. The terrestrial flora may be increased where as the aquatic flora and fauna may be decreased significantly.

For improvement of the polder, the risk of inundation might be transferred to nearby unprotected areas. Therefore tidal flood plain for capture fisheries may increase in that area where as overtopping chances for culture fisheries pond may be further aggravated.

i) Migration and biodiversity

The siltation in peripheral rivers and canals of polder 35/3 may hamper fish migration. In course of time, fish migration may be fully obstructed. As a result, the fisheries biodiversity for both fresh and brackish water may marginally decrease. Due to protection of polder from flood water, huge water will move towards the Shashikhali Khal, Poylahara river and the upstream and downstream of Darata, Bishu rivers during high tide. This increased volume of water will enhance fish migration in these regions. Consequently, fish migration of surrounding canals will be improved. In future, the salinity tolerant fish species will dominate while fresh water fish species may decrease. Biodiversity of aquatic life may decrease in the Daratana and Bishnu rivers.

j) Housing condition

The embankment giving protection around the polder area would prevent the intrusion of surface water during monsoon. As a result, the nearby unprotected areas may be subjected to flooding at regular intervals. This may eventually deteriorate the housing conditions of the people in nearby areas (Polders 34/3, 35/2, 34/2 and 37)

k) Land use

The implementation of proposed interventions may indirectly affect the land use of nearby areas. Due to increased surge created in the larger surrounding rivers (Bishnu and Daratana) Polder 37 and 34/2 and a few other unions of Bagerhat district (Karapara, Satphull etc. locations in the north and Chak betkanta, Banshbaria etc. locations in the south) would undergo flooding on a more frequent basis. Agricultural areas may be reduced. However, the increased salinity of surface water during dry season might encourage local people to culture shrimps. In future, the local residences of the nearby areas would be affected due to flood and other disasters. More erosion may take place in the river banks causing significant reduction of lands.

l) Employment opportunities

The development of the polder would create better employment opportunities of local people. Employment will be properly distributed and in the nearby areas the employment opportunities would be enhanced as well. In a few years time, due to the development of polder 35/3, new employment opportunities would also be created. This will encourage people from outside the polder to visit the polder for work and improve their economic status.

10.5 Conclusion

Most of the cumulative and induced impacts discussed above are found to be marginal during the assessment made in the study. However, these impacts are important from the context of the project as implementation of the proposed interventions do not only depend on the scenario of the polder but also its surroundings. The changes that may be caused by the aforementioned induced and cumulative impacts need further assessments to be evaluated on a quantitative basis. A detailed study on such impacts would be needed to provide a more vivid perception.

The cumulative and induced impacts discussed in this chapter have covered the physical impacts causing infrastructural damage as well as those affecting the people and their property. Many of the impacts stated above have not been directly harming the interventions under different projects. But these impacts have caused significant changes either to the overall socio-economy or environment.

While assessing the cumulative impacts, the adjacent areas or Polders have been assessed. The minimal effects caused by the polders located beyond the adjacent ones could not be analyzed because of the constraints generated due to limited time frame, information unavailability etc. Therefore, further studies may be carried out in future on cumulative and induced impacts for the entire study area to quantify the cumulative and induced impacts if needed. Also for considering the polders outside the adjacent polders of 35/3, more detailed studies are recommended.

11. Environmental Management Plan

This Chapter presents the Environmental Management Plan (EMP) for the CEIP-I activities in the Polder 35/3. The EMP essentially provides the implementation mechanism for the environmental and social mitigation measures discussed in **Chapter 9**.

11.1 Objectives of EMP

The basic objective of the EMP is to manage, prevent, and mitigate potentially adverse impacts of Project interventions in the Polder 35/3. 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 9**.
- Assign 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.
- Assess environmental training requirements for different stakeholders at various levels.
- Describe communication and documentation requirements.

The EMP should be included in all the bid documents of Polder 35/3 and will become a part of the civil works contract. The strict implementation of the EMP and project management's strict enforcement of the adequate construction practices and standards will greatly reduce the negative impacts of the Project.

11.2 EMP Components

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

These components are discussed in **Sections** below.

11.3 Institutional Arrangement

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. The institutional arrangements proposed to implement the EMP of Polder 35/3 are described below.

11.3.1 Overall Responsibility

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, Design and Construction Supervision Consultants (DCSC), and contractors.

11.3.2 Construction phase

Environment and Social Staff in PMU

As described in **Section 4.8**, 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 (ESC)Unit .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 ESC unit will maintain liaison with WB safeguards team, regulatory agencies, and other stakeholders during the Project implementation. The ESC unit will also coordinate with the environmental staff of the Construction Supervision (CS) Consultants. In order to effectively manage the EA process and EMP implementation, the ESC will be established and made operational before awarding the contract to contractor. ESC will be responsible for updating the EIA after receiving the pending information.

Environment and Social Staff with Construction Supervision (CS) Consultants

The CS consultants will be responsible for overall supervision of polder rehabilitation related activities. The CS consultants will ensure quality control and report to PD. The CS will also assist the ESC for ensuring environmental compliance and monitoring of progress including EMP and/or ECP implementation. The CS will supervise the contractors, ensuring design compliance and quality of works. For supervising the EMP implementation, CS will have dedicated and adequately qualified and experienced environmental staff including field-based environmental monitors (EMs). The EMs will supervise and monitor contractors to ensure compliance with the EMP. The CS consultants' environmental staff will maintain coordination with the ESC unit for the effective implementation of EMP and other environmental commitments and obligations of the Project.

Contractor's Environment Supervisors

The construction contractors will have adequate number of dedicated, properly qualified and experienced, site-based Environment 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 CS (Ems) at the site level. The ESs will also be responsible to conduct environmental trainings for the construction crew.

11.3.3 Post-construction Phase

BWDB core unit has posts of 4 Assistant Chief and 2 Deputy Chief to oversee the overall environmental compliance of BWDB implemented projects. Under CEIP, the ESC unit will provide training to the BWDB people responsible for monitoring of environmental compliance. Thus 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 fish migration. Water Management organizations (WMO) will be formed under the Bangladesh Guidelines for Participatory Water Management (Nov 2000) and involve the beneficiary communities. WMOs will be trained by BWDB to ensure environmental management during project operation. 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.

11.3.4 Need of sound O&M regime

BWDB field offices have a little amount of fund for Operation and Maintenance (O&M) of large scale water resources projects which is not only inadequate to cover the exact requirement of major preventive maintenance works; but also in most cases it is so meagre compared to the total needs that even no minor maintenance work is possible to undertake. Thus for the years together vital works of preventive maintenance are deferred and eventually pushed down to expensive rehabilitation measures. The Coastal Embankment Improvement Program (CEIP) is one of the latest such interventions 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 is required which will continue to remain. BWDB should ensure preparation of ***Detail operation and Maintenance of polder*** which will include ***standing operation procedure for hydraulic structure***.

11.3.5 Need of Inter-agency coordination and MoUs

The proposed interventions of CEIP may affect many sectors in the coastal region, it is very much essential to maintain liaison and coordination with all stakeholders, especially with all institutions who are implementing their development projects in the coastal area. BWDB will need to coordinate with major stakeholders such as PAPs, BIWTA, WMOs, FD, DoF, DoE, DAE, BADC, SRDI, LGED, BRDB, DC, DLS, MoL, LGI (Upazila and Union Parishad) and NGOs. Coordination with all relevant stakeholders and agencies should be done by the Project Director, CEIP and particular member of the project implementation unit within BWDB. Inter-agency co-ordination mechanism can be institutionalized as follows:

- Forming coordination committee with the provision of regular review meeting with specific intervals
- Signing Memorandum of Understanding (MoU) or contract among stakeholders, if needed for particular information sharing or for implementing particular tasks specified in the EMP
- Involvement of stakeholders in the implementation and O &M of the sub-projects
- Regular capacity building programme for stakeholders through training/ seminar/ workshop

During implementation of the EMP, the institutional mechanism for inter-agency co-ordination can be assessed using the following:

a. Co-ordination committee formation
b. MoU or contract signed among stakeholder for involvement in CEIP
c. Stakeholders consultation workshops

11.4 Mitigation Measures& Plan

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.

Mitigation measures should be considered starting with Environmental Assessment process. It is important therefore, that there is 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. Good Environmental Construction guidelines has been compiled in Appendix 10 of Environmental Management Framework.

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 welfare measures.
- operational control procedures
- management systems

Based on the past experience, a generic Mitigation Measures for EMP has been presented in Table 11.1below for reference. This can be used as a reference material for comprehending the scope of the EMP. Table 11.1 will be used in conjunction of the polder specific mitigation measure stated in Chapter 9. BWDB will be responsible for implementing the EMP with the help of Contractor and Construction Supervision Consultants. Detail responsibility of the agencies should be given in the EIA study reports.

Table 11.1: 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 should be identified. • Selection of Borrow Areas for earthen material collection. • No objection from land owner/Revenue authorities as applicable • Contractor shall ensure that borrow materials used for embankment filling is free of pollutants • Disposal of excess soil should 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 as per design, 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 0.5 km from toe line. • Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. • Grazing land. • Lands within 1km of settlements. • Environmentally sensitive areas such as reserve forests, protected forests, sanctuary, wetlands. Also, a distance of 500 m should be maintained from such areas. • Unstable side-hills. • 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.
Excavation operation and	To minimize the adverse impact during excavation of material following measures are need to be undertaken: • Adequate drainage system shall be provided to the excavated area

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Management of Excavated Material	• 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. • Overburden 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 River Dredging	• Deposition of dredged material should 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.
Contamination of soil by fuel and lubrication	
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
Soil Erosion and siltation	The Contractor shall • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds) • All the work 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
Dredging	• Disturbance can be minimized if mechanical excavators work from one bank. If the channel is too wide, the digger must work within the channel. Disruption can

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	be minimized by diverting the river down one side of the channel and dredging the other side while it is 'dry'. Smaller plant equipment generally limits the level of impact on bank-side and in-stream habitats.
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 should • 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 • 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 on an as required basis 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 least500 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 3: Agriculture Management	
Loss of Top Soil	• Soil from fallow lands/ non-agricultural lands should 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/afforestation. • Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• 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 • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion • Spread the topsoil to maintain the physico-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 should 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 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 should be avoided.
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: Ecology Management	
Flora	
Vegetation Clearance	• Tree felling should be performed upon preliminary notification to the relevant authority (District Forest Office, DoE). • Preparation of maps in GIS format, cadastral description of trees to be felled, marking, and supervision of Forest Department are necessary elements of the

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	procedure. • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Fruit and timber trees owned by local population will be compensated at their replacement cost according to market prices
Plant Management	• Tree seedlings are planted in a way that minimizes damage to the soil, while facilitating seedling survival. Tree seedling species are selected appropriate for maintaining long-term productivity. • Focus on tree species suitable for site condition • Prevent unreasonable species resulting in slow growth, less water and soil conservation and pest or disease outbreaks • Local species as planting materials, since natural selection and succession are most suitable for local climates and natural conditions • Ensure avoid single species or clone monoculture • Choose suitable species for berm, turfing and side
Planting	• Leave set back requirements around streams, restricted areas e.g. native vegetation, protected riparian strips, historic and heritage sites, research areas. • For nursery raising, physical and biological controls are practiced to control the pests and diseases in the nurseries. • Do not plant spread-prone species on sites where there is a high risk of uncontrollable wilding spread beyond the boundaries of the plantation. • Consider appropriate species, patterns and layout when planting areas with high visual values and/or with important recreational values
Polypropylene Bags Handling	• Make a Borrow Pit at each site for collection of poly bags • Collect all bags at the pits after plantation • If feasible, inform private sector to collect those bag for recycling
Pest Management to Nursery	• During outbreak of any deadly plant disease develop a plan to manage pest in coordination with neighbors by identifying existing pests and diseases and the risks for the introduction of new pests and diseases. • Share the plan with Bank before application.
Water Management	• Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from nursery • Divert runoff from undisturbed areas around the harvesting site • Stockpile of fertilizer or agrichemical away from drainage lines • Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, fertilizer waste and transport to an approved waste disposal site
Fauna	
Construction works in the surrounding lands	• Pre-entry survey and prevention of damage to fauna prior to start up • Limit the construction works within the designated sites allocated to the contractors • Not be permitted to destruct active nests or eggs of migratory birds • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.
ECoP 6: Fisheries Management	
Construction works in the rivers and on the surrounding	• Critical breeding areas of major fish species should be identified and declared as sanctuaries. • Creation of small lagoons and pools that may trap the fishes will be avoided.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
lands	• Creation of artificial waterfalls and other barriers for migration will be avoided. • Natural river channel will be reinstated after completion of construction works
Hydraulic Structure	• Sufficient free flow will be guaranteed in the design and construction work to ensure free pass of migrating fishes. • Hydraulic structure will be operated considering fish migration and spawning time • A guideline for area specific hydraulic structure operation guideline should be developed
Dredging	• Ensure dredging activity will create minimum sediment load in the water • Avoid dredging during spawning period of fish
ECoP 7: Socio-Economic Management	
Construction Camp Management	
Siting and Location of construction Camps (MRDI, 2011)	• Locate the construction camps at areas which are acceptable from environmental, cultural or social point of view. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • BWDB should endorse detailed layout plan for the development of the construction camp submitted by the contractor. The plan should show the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters
Construction Camp Facilities	The following facilities should 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. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved disposal sites
Fuel supplies for cooking and heating purposes	• Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Conduct awareness campaigns to educate workers to protect the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Health and Hygiene	• Provide adequate health care facilities within construction sites • Provide first aid facility round the clock. Maintain stock of medicines in the facility • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas • Train all construction workers in 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) • And HIV information, education and communication for all workers on regular basis • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant 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 should 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 should be done in local languages at the construction and labor camp sites. • Wages should 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 Engineer, EMU and/or the concerned BWDB staff/Engineer‘s representative
Rehabilitation of Labor and Construction Camp	At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include: • Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas. • Soak pits, septic tanks shall be covered and effectively sealed off. • Debris (rejected material) should be disposed of suitably. • Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed. • If the construction camp site is on an agricultural land, preserve top soil and good earth can be spread back for a minimum 30cm for faster rejuvenation of the land. • Proper documentation of rehabilitation site is necessary. This shall include the following: • Photograph of rehabilitated site; • Land owner consent letter for satisfaction in measures taken for rehabilitation of site; and • Undertaking from contractor; In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. The rehabilitation is mandatory and should be include in the agreement with the landowner by the contractor. Also, he would have to obtain a certificate for

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	satisfaction from the landowner.
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 Engineer 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 the 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 safety goggles, helmets, masks, books, 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 maintained as per BS provisions and to the satisfaction of the Engineer.
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.
Malarial Risk	• The Contractor shall, at his own expense, conform to all anti-malarial instructions given to him by the Engineer and the EMU, including filling up any borrow pits which may have been dug by him.
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 Engineer. • 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.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Traffic Management	• Special consideration shall be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night • The temporary traffic detours in settlement areas shall be kept free of 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 such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the cross section.

11.5 Chance-Find Procedures for Physical Cultural Property

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 archeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;
- Protect artifacts as well as possible using plastic covers, and implement measures to stabilize the area, if necessary, to properly protect artifacts;
- Prevent and penalize any unauthorized access to the artifacts; and
- Restart construction works only upon the authorization of the relevant authorities (e.g. Upazila Nirbahi Officer, Deputy Commissioner and Department of Archeology).

11.6 Monitoring Plan

Extensive monitoring of the environmental concerns of the CEIP project 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.

The Monitoring activities during design/preconstruction period are:

(i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and

(ii) checking that the contract documents' (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.

Environmental monitoring during construction phase is a function of supervision, and the essential purpose is to ensure adherence to the EMP and RAP. 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. This monitoring will be carried out by the Design and Supervision Consultants on a regular bassis. Additional monitoring will be carried out by the Environmental and Social Unit.

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 11.2 and Table 11.3

Table 11.2: Environmental Monitoring Plan during Construction and Operation of Rehabilitation and Improvement of Polders System

(Source: MRDI, 2011, LGED, 2011)

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	CS, M&E Consultant, BWDB
Operation of borrow site	Borrow pit/site	Visual inspection of borrow site and ensuring operational health and safety	monthly	Contractor	CS, 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	CS, 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	CS, 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	CS, BWDB
Erosion	Side slopes	Visual inspection of	At the end	Contractor	CS, M&E

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
	of the embankments and material storage sites	erosion prevention measures and occurrence of erosion	of filling activity		Consultant, BWDB
Hydrocarbon and chemical storage	Construction camps	Visual Inspection of storage facilities	Monthly	Contractor	CS, BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Monthly	Contractor	CS, 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	CS, BWDB
	Material storage sites	Visual inspection to ensure dust suppression work plan is being implemented	Monthly	Contractor	CS
Air Quality (PM_{10}, $PM_{2.5}$)	Close to School/ Madrasha, Hospital &Villages	Air quality monitoring	Half Yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB
Noise	Construction sites	Visual inspection to ensure good standard equipment are in use	Weekly	Contractor	CS, M&E Consultant, BWDB
	Construction sites	Ensure work restriction between 09:00 pm-6:00 am close to School/ Madrasha, Hospital & Villages	Weekly	Contractor	CS, M&E Consultant, BWDB
Surface Water Quality (TDS, Turbidity,	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Half Yearly	Contractor through a nationally recognized	CS, M&E Consultant, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
pH, DO, BOD, COD etc)				laboratory	
Drinking Water Quality(TDS, Turbidity, 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	CS, M&E Consultant, BWDB
Sanitation	Construction camp/site	Visual Inspection	Weekly	Contractor	CS, 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	CS, M&E Consultant, BWDB
Flora and Fauna	Project area	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute	CS, M&E Consultant, BWDB
Cultural and archeological Sites	At all work sties	Visual observation for chance finding	Daily	Contractor	CS, M&E Consultant, BWDB
Reinstatement of Work Sites	All Work Sites	Visual Inspection	After completion of all works	Contractor	CS, M&E Consultant, BWDB
Safety of workers Monitoring and reporting accidents	At work sites	Usage of Personal Protective equipment	Monthly	Contractor	CS, M&E Consultant, BWDB
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
Air Quality (Dust PM_{10}, $PM_{2.5}$)	At the baseline monitoring	24 hours Air quality monitoring	Yearly	BWDB through a nationally	M&E Consultant

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
	site			recognized laboratory	
Flora and Fauna specially fisheries	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Agriculture	In the project area	Compare the production with the baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Operation of hydraulic structure	In the project area	Visual inspection and public feedback	Yearly	BWDB	M&E Consultant

Table 11.3: Environmental Monitoring Plan during Construction and Operation of Afforestation

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Implementation					
Plant 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	CS, BWDB, M&E Consultant
Water Quality	Water bodies near nursery	Odor and chemical testing	Half yearly	Contractor through nationally recognized laboratory	CS, BWDB, M&E Consultant
Waste Management	Work site and Nursery	Visual inspection of collection, transportation and disposal of grasses, debris and is deposited at designated site	Weekly	Contractor	CS, BWDB, M&E Consultant
	Work site and Nursery	Visual inspection of Water bars & cut-offs .sediment traps to	Beginning of work	Contractor	CS, BWDB, M&E Consultant

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		prevent water pollution caused by run-off from harvesting areas			
Nursery Embankment Management	Nursery	Visual inspection of height of embankment, possibility of water logging and connection to the water bodies	Beginning of each nursery	Contractor	CS, BWDB, M&E Consultant
During Operation and Management					
Multilevel belt of trees	Polder top and along the polder	Visual inspection	yearly	BWDB through nationally recognized institution	M&E Consultant
Flora and Fauna	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Erosion	Along Alignment	Visual Inspection presence of gullies or erosion	Yearly	BWDB	M&E Consultant

The location of monitoring places are shown Annex-C

Qualitative Spot Checking Indicators

Moreover a rapid environmental monitoring will be carried out according the following checklist in terms of visual judgment during field visit as an indirect control to implement Environmental Mitigation plan. Table 11.4 can be followed during project construction and operation process.

Table 11.4: Spot Checking Indicator

Parameter	Visual Judgment		
	Poor	Moderate	Satisfactory
Workers Safety			
Camp Site Management			
Plant Site Management			
Borrow Area Management			
Top Soil Prevention			
Waste Management			
Occupational Health and Safety			
Stockpiling of construction materials			
Reporting and Documentation			

Third Party Validation

BWDB will engage independent consultants to conduct a third party validation (TPV) of the EMP implementation on a 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 remediation.

11.7 Documentation, Record keeping and Reporting

11.7.1 Record Keeping

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. **ESC** unit will assist BWDB for keeping those records initially. The trained BWDB staff will take the responsibility of record keeping and monitoring during operation phase.

11.7.2 Monitoring Records

Quantitative Physical Monitoring

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. CS will regularly monitor and provide information to ESC for updating the database. CS will provide the following information bi-weekly to ESC, 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.

The monitoring data would be continually processed as it is received, so as to avoid a buildup of unprocessed data.

General Site Inspections and Monitoring

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 9 and Section 11.4**, during the construction phase. The Site Inspection Checklist would be supported by sketches, as necessary.

11.7.3 Information Sources

A complete and up-to-date file of all relevant sources of information will be maintained by the ESC unit 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.

11.7.4 Non-Compliance Report

Any breaches of the acceptable standards specified, would be reported to the PMU using a standard form, i.e. a Non-Compliance Report (NCR).

A copy of each completed NCR would be held on file by CS, 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.

11.7.5 Monthly Internal Reports by CS

The CS will prepare a monthly report for issue to the ESC 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.

11.7.6 Half Early Progress Report by BWDB

ESC of BWDB will prepare the **half yearly progress report** on environmental management and will submit to the World Bank for review during construction phase. The progress report will summarize the information presented in Article 11.6.5.

11.7.7 Environmental Audit Report & Third Party Monitoring Report

It is expected BWDB will conduct annual environmental audit. 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. The Third Party Monitoring report will also be shared with Bank. The Bank would also supervise the environmental compliance as part of regular implementation support missions.

11.8 Contractual arrangements for EMP implementation

Since many contractors do not have clear understanding the need of environmental management, some quoted very low price for implementation of EMP and eventually cannot implement EMP as per design. To avoid this problem, 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 an **Environmental Action Plan (EAP)** based on the EIA in line with the construction schedule and guideline. The EAP needs to be reviewed by the supervision consultant and cleared by BWDB and World Bank.

11.8.1 Guideline to Incorporate Environmental Management in Bid Document & Preparation of EAP

- Prepare cost estimates, to be incorporate in Bid Documents.
- Environmental Management Plan 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.
    - The contractor has to ensure that sufficient numbers and good quality Personnel Protective Equipment (PPE), will 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.

11.9 Guideline for Compensation and Contingency Plan during Project Period

Compensation becomes necessary when project impacts cannot be satisfactorily mitigated. This can be paid in cash or kind and the emphasis will 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 will be given as per provision of the Resettlement Action Framework. Any disputes over the compensation will be handled by the Grievance Redress Committee.

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.
- Have a place designated as emergency shelter and ensure proper water supply, power supply and sanitation at this site.
- Accidental spill of harmful chemicals – train some members on how to confine such a spill and minimize potential danger to humans and other animals.
- Fire – keep fire extinguisher or emergency water pump ready at local project office.
- Personal injury – keep a first aid box at the project office. Have a plan for quickly transporting a seriously injured person to the nearest hospital.

11.10 EMP Implementation Cost

The estimated costs for the environmental management and monitoring activities are set out in **Table 11.5** below. The cost has been estimated based on previous project works of BWDB.

Table 11.5: Tentative Cost Estimates for Environmental Management and Monitoring*

Sl. No	Description of EMP activities	Cost Million BDT	Cost Million US$
1	Crop compensation to the direct loser land owner/ share croppers of construction sites /damage to dredge spoils	1.40	0.017
2	Construction of alternative or bypass channels at each construction sites	3.5	0.043

Sl. No	Description of EMP activities	Cost Million BDT	Cost Million US$
4	Conservation and stocking of threatened fish species (4 spots of Betibonia, Mogordhara and Sayabanki khal)	0.50	0.006
5	Awareness program on plant and wild life conservation	1.00	0.012
6	Campaigning and providing training on improved culture practices as well as the rice-cum-golda farming	0.5	0.006
7	Social forestry program along both sides of the embankment and other khas areas	Included in afforrestation budget	-
8	Emergency budget allocation for closing breach points of embankments and repairing the damage of structure	10.00	0.566
9	Monitoring cost to fish biodiversity, migration, fish production	1.0	0.012
10	Waste disposal arrangement	2.00	0.024
11	Water quality monitoring	1.0	0.012
12	Air and noise quality monitoring analysis	1.0	0.012
13	Soil and water salinity monitoring	0.50	0.006
15	Land acquisition and compensation cost	Budget included in RAP report	
16	Capacity building and training	4.00	0.049
17	Consultancy services cost for supervisions and monitoring	6.00	0.073
Total Cost of EMP		32.4	0.838

11.11 Grievance Redress Mechanism

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 EMF 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.

11.11.1 Grievance Redress Focal Points

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 PMO, Dhaka. 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 Upazila Administration)	:	Member
5. Representative from Local Women's Group	:	Member
6. Representative from the PAP Group	:	Member

Members of the GRCs will be nominated by the Executive Engineer at division level and approved by the Project Director, PMO, BWDB, Dhaka.

11.11.2 Grievance Resolution Process

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.

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 PMO for further review. The Project Director will assign the ESC at PMO 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.

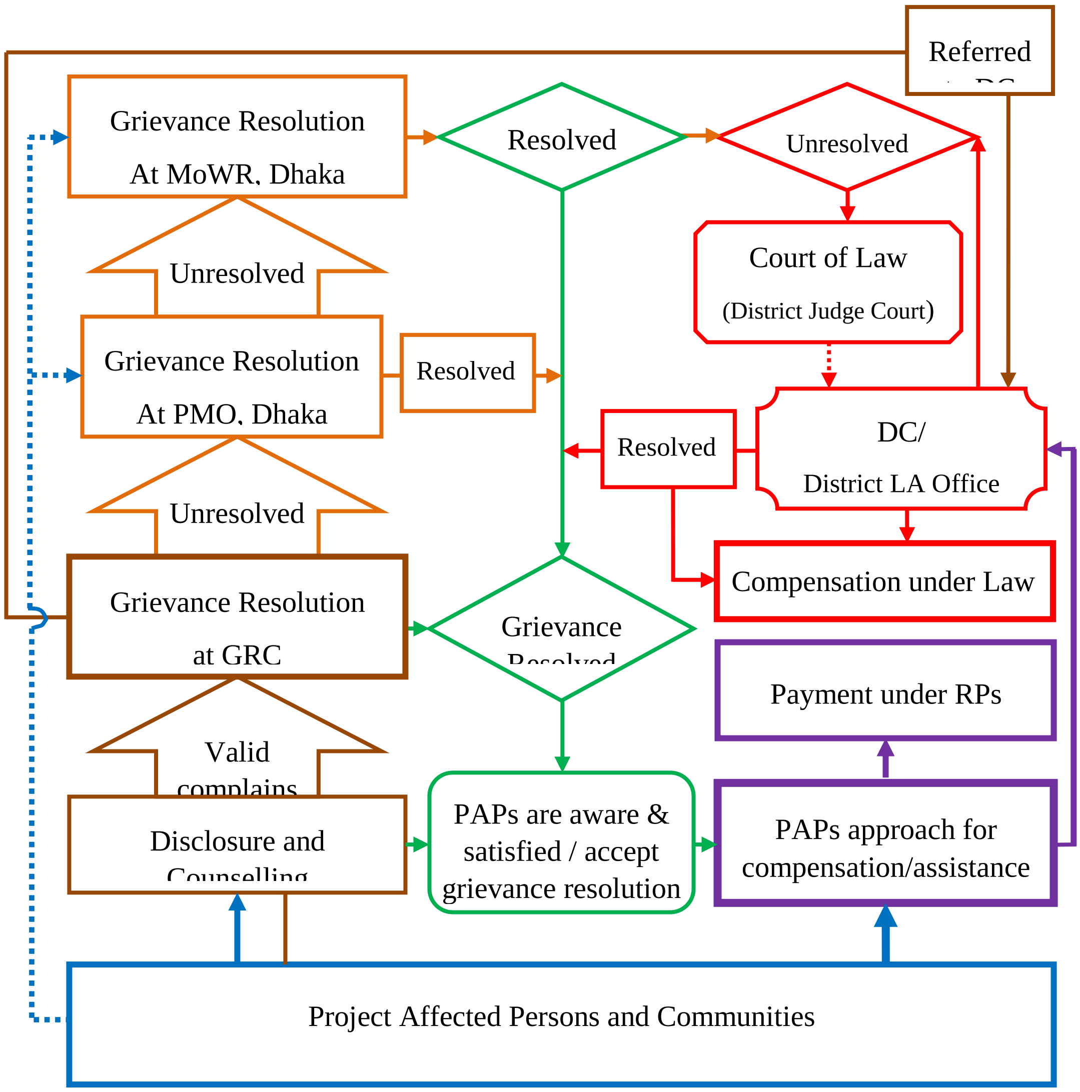


Figure 11.1: GRM Process Flow Chart

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:
    - Where a GRC member is removed, appoint another person in consultation with the Project Director.
- 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.

11.11.3 GRM Disclosure, Documentation and Monitoring

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 on the scope of the GRC, the procedure for lodging grievances cases and the procedure of grievance resolution at the project level.

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:

- **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.
- **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.
- **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.

Grievance resolution will be a continuous process in RP implementation. The PMO 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 PMO will also prepare periodic reports on the grievance resolution process and publish these on the BWDB website.

11.12 Capacity Building

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 Environmental specialist, Consultant environmental specialist, and ESC 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 11.6** provides a summary of various aspects of the environmental and social trainings to be conducted at the construction site. PMU may revise the plan during the Project implementation as required.

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 11.6: Environmental Trainings

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; DC & CS staff	DC & CS & ESC	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; DC & CS; selected contractors' crew	DC & CS & ESC	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, ESC, Contractor	Before and during construction activities

Capacity building training programs will 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
- 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 will be arranged before implementation of the interventions in the polder area. Detail plan can be made by the proposed ESC Unit of BWDB.

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EIA Study Team

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

1. Water Resources Engineer/ Team Leader:	2. Md. Waji Ullah
3. Water Resource Expert:	4. Md. Sarfaraz Wahed
5. River Morphologist:	6. Nazneen Aktar
7. Socio-Economists:	8. Dr. Dilruba Ahmed 9. Subrata Kumar Mondal
10. Soil and Agriculture Specialist:	11. Mujibul Huq
12. Agronomist	13. Dr.Anil Chandra Aich
14. Fishery Specialists:	15. Mohammed Mukteruzzaman 16. Ashraful Alam
17. Ecologist/Junior Ecologists:	18. Ashoke Kumar Das 19. Mohammed Amanat Ullah 20. Mohammad Kamruzzaman
21. Environmentalist:	22. Dr. Ashraful Alam
23. Geographical Information System (GIS)/Remote sensing (RS) specialist:	24. Kazi Kamrull Hassan
25. GIS/RS Analysts:	26. Mohammed Saidur Rahman 27. Hasan Tawfique Imam
28. Junior Engineers/Junior environmental Engineers:	29. Syed Ahsanul Haque, 30. Mohammed Shibly Shadik 31. Mohammed Shakil Ahmed 32. Mohammed Jafrul Alom 33. Kanak Kanti Kar

The report has been reviewed by K.B. Sajjadur Rasheed, PhD, Environment Specialist, former Professor of Geography and Environment, University of Dhaka.. On behalf of BWDB, an Internation Independent Environment Specialist, Mr. Mohammad Omar Khalid reviewed the document.

Annex A: Checklist for Field Survey 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)[14]	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)											
Barrage											
Pipe Sluices											
Irrigation Inlets											
Bridge/Culverts											

14 VG – Very Good, G – Good, M – Moderate, B – Bad, VB – Very Bad

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)[15]	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

Union	Area (%)	Causes

15 G – Good, MD – Moderately Damaged, CD – Completely Damaged

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:

Checklist for Land Resources, Agriculture and Livesock Information Collection

Center for Environmental and Geographic Information Services (CEGIS)

Land Resources:

1. 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)

2. Cropping Pattern by land type

Land Type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-February)	% of area

3. Crop calendar

Crop name	Seedling		Transplanting/Sowing		Harvesting	
	Start	End	Start	End	Start	End

4. 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*

5. Crop damage

Name of hazard	**Ranked**	**Timing**	**Causes**
Flood			
Drought			
Pest infestation*			
Others:			
**List name of pest and pesticide by crop*			

6. 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

7. 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

8. Livestock and poultry production

Name of livestock and Poultry	**% of HH having Livestock/Poultry**	**No. of Livestock/poultry per HH**
Cow/Bullock		
Buffalo		
Goat		
Sheep		
Duck		
Chicken		

9. ***Feed and Fodder***

Name of livestock and Poultry	**Feed/Fodder Scarcity (Timing)**	**Causes**	**Remarks**
Cow/Bullock			
Buffalo			
Goat			
Sheep			
Duck			
Chicken			

10. ***Diseases***

Name of livestock and Poultry	**Name of Disease**	**Disease (Timing)**	**Causes**	**Remarks**
Cow/Bullock				
Buffalo				
Goat				
Sheep				
Duck				
Chicken				
Note: Support Services-				

11. ***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: 1. 2. 3. Culture Fisheries: 4. 5. 6.	a. Total No. of fisher HHs: b. %/No. of CFHHs: c. %/No. of SFHHS: d. No. of Days spend annually in fishing by CFHHs: SFHHs:	River																
		Beel (Leased/non leased)																

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
Indiscriminate Fishing Activities: 7. 8. 9.	e. Hrs/Day spend in fishing by CFHHs: SFHHs:	Khal																
		Floodplain																
		Swamp Forest																
		Fish pond																
		Baor																
		Other																

Fish Migration		Fish Biodiversity		Species List					Species Composition				
				River	Khal	Beel	Pond	Other	Group	River	Khal	Beel	Pond
Previous Migration Status		Fish diversity status (Poor/Moderate/Rich)/%							Major carp				
									Exotic carp				
									Other carp				
									Catfish				
									Snakehead				
Present Obstacle to fish migration:	1. 2.	Reasons of increase or decrease	1. 2.						Live fish				
									Other fish				
									Prawn				

											Hilsa				
	3.				3.										
Important breeding, feeding and over wintering ground															
					4.										
					5.						Rui				
											Catla				
	Species:										Mrigel				
	1.				1.						Koi				
Horizontal Migration pattern	2.	Season (Months):	Routes:	Significant areas	2.						Sarpunti				
	3.										Large prawn				
	4. 5.				3.						Small Pprawn				
					Rare:						Silver carp				
	Species:										Carpu				
	1.										Grass carp				
Vertical Migration Pattern	2.										Tengra				
	3.	Season (Months):	Habitats:	Species of Conservation Significance	Unavailable:						Chapila				
	4.										Others				
	5.														

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 vuMNerability:		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:	
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 (Number, location and name):		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.

Checklist for Ecological Information Collection

Center for Environmental and Geographic Information Services (CEGIS)

(1) Basic Information

Date		Prepared by	
Name of the Polder			
BWDB Circle Name			
District/s		Upazila/s	
Location of the FGD			

(2) **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	

(3) **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		

(4) Terrestrial Wildlife Check List

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			

(5) 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

(6) 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

(7) 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] 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

(8) 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	

Main occupation by population	% of population
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

2.8 Self assessed poverty for year round

Sl. No.	**Poverty status**	**Percentage of households**
1	Deficit	

Sl. No.	Poverty status	Percentage of households
2	Balance/Breakeven	
3	Surplus	

Sources: RRA

Housing (photographs)

Sl. No.	Housing status	% of hhs having
1	Jhupri	
2	Kutcha	
3	Semi Pucka	
4	Pucca	

Source: RRA

2.10 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

2.11 Sanitation (photographs)

Sl. No.	Toilet types	Percentage of households under each type
1	Water Sealed	
2	Ring Slub	
3	Kacha	
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	

Sl. No.	Disease	Ranking by incidence	Sl. No.	Disease	Ranking by incidence
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:

____

____

____

____

____

____

c. 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

a. Percentage of household having electricity facility: ....**BBS**
b. 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

3.7.1 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)

4.2 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		

Reasons of Conflicts	Present status of problem	Solution they want with location
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					

Sl. No.	Major Disaster	Severely affected year	% of area affected	% of hhs affected	% of crop damage	Major crop damaged
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

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			

Sl	Issue/Question	Response/Suggestion		
	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			

Sl. No.	Name	Address	Phone Number
8			
9			
10			
11			
12			
13			
14			
15			

8.2.3 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

a. 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.

Name	Age	Occupation	Address/Phone No.

Annex B: No Objection Certificate

মোঃ শাহজাহান দুলাল
চেয়ারম্যান
মোবাইল : 01715-167027
: 01922-881094

১নং ধানসাগর ইউনিয়ন পরিষদ
শরণখোলা, বাগেরহাট।

সূত্র : .... তারিখ : ২৪/০৫/২০১২ ইং।

অনাপত্তি পত্র

এই মর্মে প্রত্যয়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্বব্যাংক কর্তৃক গৃহীত উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের (CEIP) বাগেরহাট জেলার শরণখোলা উপজেলার অধীন পোল্ডার ৩৫/৩ (শরণখোলা ও মোরেলগঞ্জ উপজেলার অন্তর্গত) পুনর্বাসন ও উন্নয়নের জন্য এ ব্যাপারে ১নং ধানসাগর ইউনিয়নের জনগণের কোন আপত্তি নেই।

উক্ত প্রকল্প বাস্তবায়িত হলে এলাকার জনগণের সার্বিক আর্থসামাজিক পরিবর্তন হবে। তাছাড়া বাগেরহাট জেলার পোল্ডার নির্মাণ কাজে ১নং ধানসাগর ইউনিয়নের জনগণ সার্বিক ভাবে সহযোগিতা করবে।

২৪/০৫/১২

মোঃ শাহজাহান দুলাল
চেয়ারম্যান
১নং ধানসাগর ইউনিয়ন পরিষদ
শরণখোলা, বাগেরহাট।

বিস্‌মিল্লাহির রহ্‌মানির রাহিম

২নং খোন্তাকাটা ইউনিয়ন পরিষদ

চেয়ারম্যান ঃ মোঃ মতিয়ার রহমান খান

ডাকঘর ঃ রায়েন্দা বাজার, উপজেলা ঃ শরণখোলা, জেলাঃ বাগেরহাট।

সূত্র .... তারিখ ...২৪।০৫।২২

অনাপত্তি পত্র

এই মর্মে প্রত্যয়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্ব ব্যাংক কর্তৃক গৃহিত উপকূলীয় বাঁধ উন্নয়ন কর্মসূচীর আওতায় (CEIP) বাংলাদেশ পানি উন্নয়ন বোর্ডের অধীন পোল্ডার ৩৫/৩ মোড়েলগঞ্জ ও শরনখোলা উপজেলায় অবস্থিত প্রকল্পটির জরুরী ভিত্তিতে পুনর্বাসন ও উন্নয়নের কাজ করলে অত্র এলাকার জনগনের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম জনগনের সক্রিয় অংশগ্রহণে পরিচালিত হবে। তাছাড়াও বাংলাদেশ পানি উন্নয়ন বোর্ডের নির্মানকাজ চলাকালীন সময় অত্র ইউনিয়নের জনগন সার্বিক ভাবে সহযোগিতা করবেন।

২৪/০৫/22

মোঃ মতিয়ার রহমান খান
চেয়ারম্যান
২নং খোন্তাকাটা ইউনিয়ন পরিষদ
শরণখোলা, বাগেরহাট

১৬নং খাউলিয়া ইউনিয়ন পরিষদ

চেয়ারম্যান ঃ মোঃ আবুল খায়ের হাওলাদার
পোঃ সন্ন্যাসী বাজার, থানাঃ মোড়েলগঞ্জ,
জেলাঃ বাগেরহাট।

সূত্রঃ................ তারিখঃ ২৪/০৫/২১

অনাপত্তি পত্র

এই মর্মে প্রত্যায়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্ব ব্যাংক কর্তৃক গৃহীত উপকূলীয় বাঁধ উন্নয়ন কর্মসূচীর আওতায় (CEIP) বাংলাদেশ পানি উন্নয়ন বোর্ড এর অধীনে বাগেরহাট জেলার শরনখোলা উপজেলার অন্তর্গত পোল্ডার ৩৫/১ প্রকল্পটির জরুরি ভিত্তিতে পূনর্বাসন ও উন্নয়নের কাজে আমার ও অত্র এলাকার জনগণের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম জনগণের সক্রিয় অংশগ্রহনে পরিচালিত হবে। তাছাড়াও বাংলাদেশ পানি উন্নয়ন বোর্ড এর প্রকল্প বাস্তবায়নের সময় অত্র ইউনিয়নের জনগণ সার্বিকভাবে সহযোগিতা করবেন।

মোঃ আবুল খায়ের হাওলাদার
চেয়ারম্যান
১৬ নং খাউলিয়া ইউঃ পরিষদ
মোড়েলগঞ্জ, বাগেরহাট।

Annex C: Additional Figure

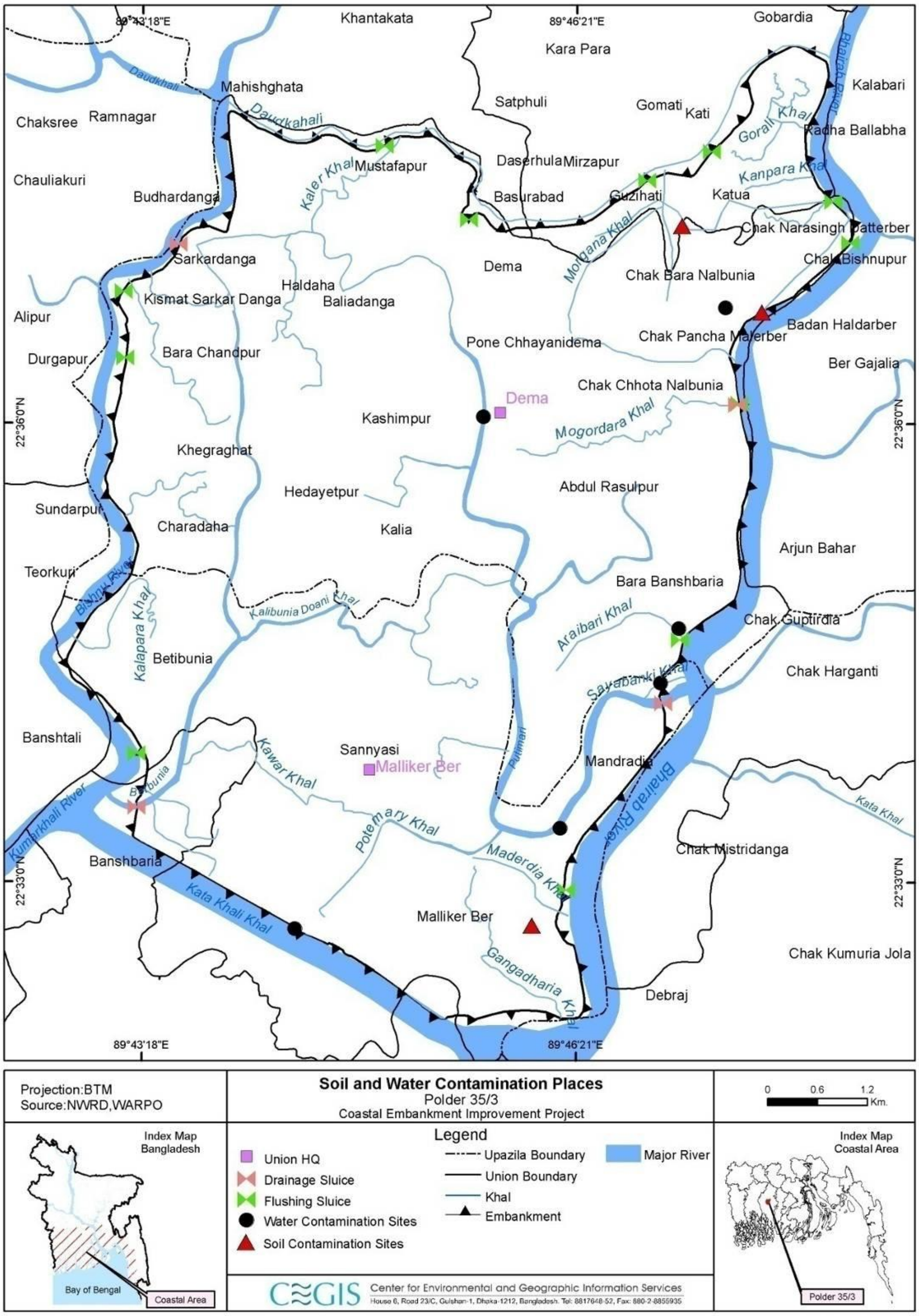

Figure1: Soil and Water Contamination places of Polder 35/3

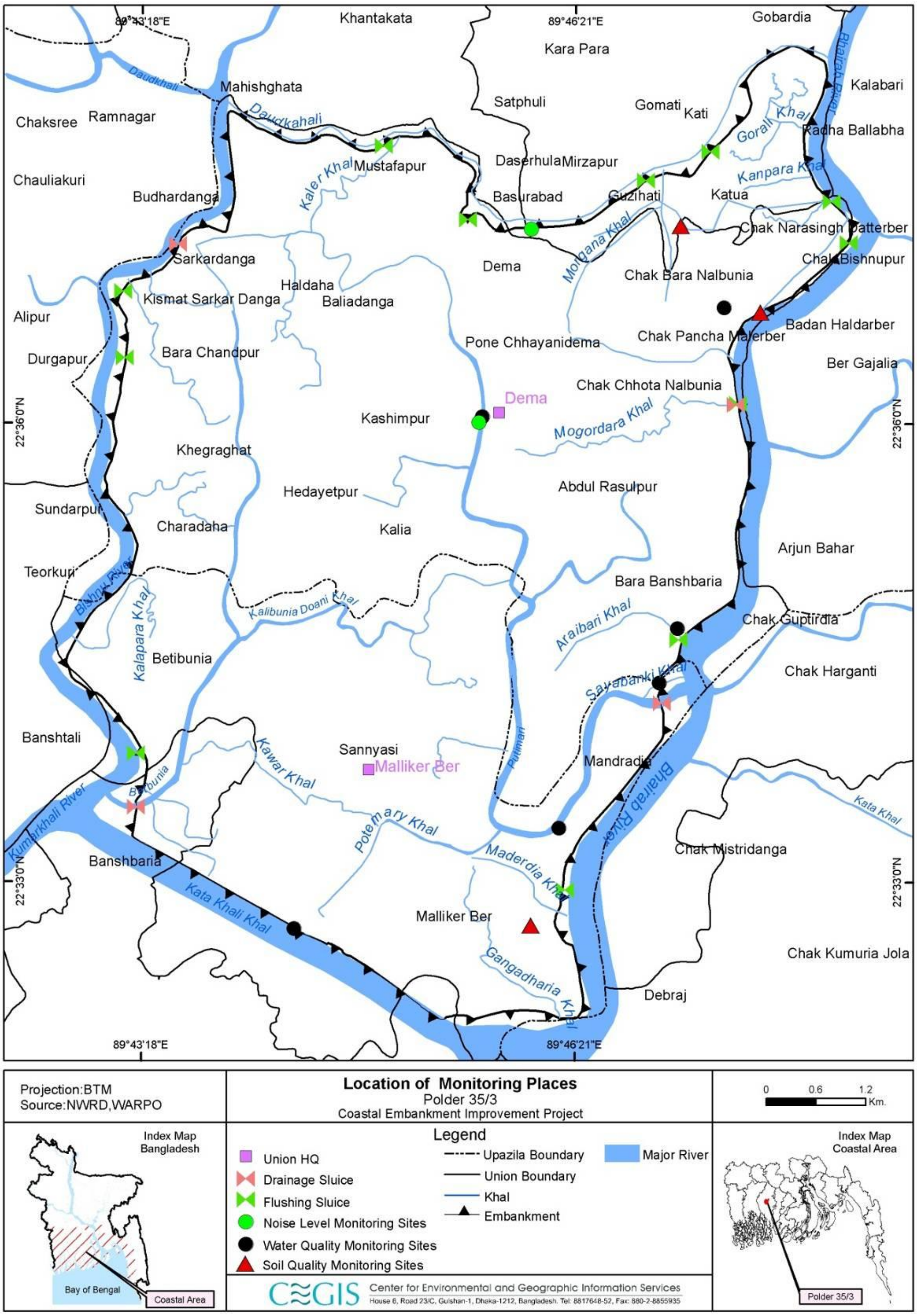

Figure2: Location of monitoring places in Polder 35/3

Annex D: List of participants of PCM and FGD

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ ঢেমা ইউনিয়ন পরিষদ মিলনায়তন তারিখঃ ২২ মে ২০১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১।	মোঃ মান্নান মল্লিক	চেয়ারম্যান	01718-317679	[illegible] 22.5.2012
২।	মোঃ শামসেরআলী	উপ-বিভাগীয় প্রকৌশলী	০১৭১২২৫২৫১৬	[illegible] ২২/৫/১২
৩।	সাফিয়া বেগম	সদস্যা ঢেমা ইউনিয়ন	০১৭৫৬৬০৮০৭৭	সাফিয়া
.	আছিয়া বেগম	সদস্যা ঢেমা ইউনিয়ন	০১৭২৪২৮০৮১৬	আছিয়া
৪।	লিপিকা বেগম	ঢেমা	নাই	লিপিকা
৫।	নাজরিন বেগম	ঢেমা	নাই	নাজরিন
৬।	ইসমতআরা বেগম	ঢেমা	নাই	ইসমতআরা
৭।	দলিআক্তার	ঢেমা	নাই	[illegible]
৮।	সাহিদা বেগম	ঢেমা	নাই	সাহিদা
৯।	নকীব মাহমুদ আহম্মেদ	পিঃ, সিঃ, ঢেমা	নাই	[illegible]
১০	মোঃ লোকমান	কৃষক	নাই	লোকমান
১১	জুলফিকার নাজমুল [illegible]	চেয়ারম্যান	01937589165	[illegible]
১২	[illegible] ইসলাম	চেয়ারম্যান [illegible]	01711340182	[illegible] ২২.৫.২০১২
১৩	মুহাম্মদ মামুন [illegible]	[illegible]	01714703619	[illegible] ২২/০৫/১২
১৪	বিকাশ রানী [illegible]	১নং ওয়ার্ড ৪,৫,৬, সদস্যা	01934805387 01960070419	[illegible] ২২/৫/০১২

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ [illegible] ইউনিয়ন পরিষদ মিলনায়তন তারিখঃ ২২ মে ২০২২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১৫	[illegible]	[illegible]	[illegible]	
১৬	মোঃ আবু জাফর	সদস্য [illegible]	01712-690425	[illegible]
১৭	[illegible]	[illegible]	[illegible]	[illegible]
১৮	ফকির [illegible]	ইউ,পি, সদস্য	01736331662	[illegible]
১৯	[illegible]	ইউ পি সদস্য	01712730830	[illegible]
২০	[illegible]	ইউ পি সদস্য	01721041965	[illegible]
২১	মাওঃ মোঃ আনিছুর রহমান	শিক্ষক	01714571320	[illegible]
২২	[illegible]	ইউ, পি, সদস্য	01740-610301	[illegible]
২৩	[illegible]	ইউ পি সদস্য	[illegible]	[illegible]
২৪	নকীব মোঃ [illegible]	চাষি	[illegible]	[illegible]
২৫	শেখ নাসির উদ্দিন	ইউ পি সদস্য	0175200885	[illegible]
২৬	মোঃ [illegible] হাবিবুর রহমান	কৃষক	01710620398	[illegible]
২৭	শেখ আঃ হাকিম	কৃষক	নাই	আঃ হাকিম
২৮	[illegible]	[illegible]	01724039256	[illegible]
২৯	[illegible]	[illegible]	01712061374	[illegible]
৩০	রকিব হোসেন	শিক্ষক	01710 030883	[illegible]

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ ডেমা ইউনিয়ন পরিষদ মিলনায়তন তারিখঃ ২২ মে ২০২২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
৩১	নবীন আবেদীন	ছাত্র/ ডেমা	০১৭১৯-৭৮২০৩	[illegible]
৩২	অজয় মন্ডল	ব্যবসায়ী	নাই	অজয়
৩৩	তপু মল্লিক	কৃষক	নাই	[illegible]
৩৪	বিকাশ [illegible]	ঐ	—	[illegible]
৩৫	মোঃ তরিকুল [illegible]	ঐ	—	[illegible]
৩৬	অসীম মণ্ডল	ঐ	—	[illegible]
৩৭	নাজমুল	ইমাম	—	[illegible]
৩৮	আঃ রহমান	সংগঠক	—	[illegible]
৩৯	[illegible]	দোকান মালিক	—	[illegible]
৪০	সমীর [illegible]	সমাজকর্মী	—	সমীর
৪১	[illegible] উদ্দিন	সমাজকর্মী	—	[illegible]
৪২	[illegible]	NGO কর্মী	—	[illegible]
৪৩	[illegible]	"	—	[illegible]
৪৪	বৈদ্যনাথ [illegible]	মৎস্যচাষী	—	বৈদ্য [illegible]
৪৫	শাহানা বেগম	গৃহিণী	—	শাহানা

Table B1: Gujihati, Kara Para, Bagherhat Sadar, Bagerhat. (FGD-1)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Shariful Islam	40	Farmer	01712612853
2	Md. Sukur Gazi	40	Farmer	01924986080
3	Md. Yunus Talukdar	39	Fish farmer	01937883650
4	Md. Keramot Ali	60	Farmer	Mirzapur
5	Md. Abu Noman Talukdar	62	Business	01718444966
6	Md.Abdul Mozid	42	Farmer	01939197859
7	Md. Salam Sheikh	38	Business	01712250190
8	Md. Hayat Ali	45	Farmer	01713195598
9	Md. Nurul Islam	48	Farmer	01712148759
10	Md. Ismail Hossain	53	Fish farmer	01712330082
11	Md. Lutfor Sheikh	44	Farmer	Mirzapur, Karapara
12	Alamgir Talukdar	47	Farmer	Mirzapur, Karapara
13	Sheikh Mukto	60	Farmer	Gujihati, Karapara
14	Md. Haque Mollah	38	Farmer	01915939915
15	Md. Tajul Islam	47	Fish Farmer	01718043692

Table B2: Sarkardanga, Dema, Bagherhat Sadar, Bagerhat (FGD-2)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Nizam Talukdar	55	Farmer	01720361277
2	Md. Gias Haoladar	35	Farmer	Sarkardangda
3	Md. Faruq Haolader	32	Fisherman	Sarkardangda
4	M d. Sultan Haolader	41	Business	01911775945
5	Subul Dush	21	Student	Sarkerdangda
6	Uttom Kumar	31	Farmer	Sarkerdangda
7	Polash Haolder	29	Fisherman	Sarkerdangda
8	Abdur Rashid Khan	36	Land less	Sarkardanga

Table B3: Khegraghat Bazar, Dema , Bagherhat Sadar, Bagerhat (FGD-3)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Sheikh Siddique	45	Farmer	Khegraghat
2	Md. Abdul Hakim	35	Business	Khegraghat
3	Md.Elias Sheikh	46	Van Puller	Khegraghat
4	Md.Helal Uddin	36	Business	Khegraghat
5	Md. Sheikh Abdul Latif	40	Business	01929394688
6	Rabindranath Mistri	49	Farmer	01721759403
7	Md. Nurul Islam	43	UP Member	01752008850

Table B4: Madardia Launch Ghat, Mollikerber, Rampal, Bagerhat (FGD-4)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Haoladar Abdus Salam	45	UP Member	01925175601
2	Md. Mosarraf	40	Business	01190674139
3	Md. Shohag Sheikh	38	Business	01827591157
4	Md. Lablu Haoladar	35	Business	01965440703
5	Md. Hasan Sheikh	40	Business	01927621626
6	Md. Kamal Haoladar	45	Farmer	01927033513
7	Md.Moslem Ali Sheikh	50	Farmer	01917873684
8	Sayed Ali Khan	52	Farmer	01920586077
9	Mobakker Ali	45	Farmer	01946514571
10	Razia Begum	38	House wife	01922871993
11	Laltu Haoladar	44	Fishermen	01721886660
12	Jafor Haoladar	55	Teacher	01937877686
13	Md. Monirul Islam	34	Business	01735746012

Table B5: Boro Bashbaria 6 Vent sluice gate, Dema, Bagherhat Sadar, Bagerhat (FGD-5)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Abdul Razzak haoladar	28	Farmer	01923361445
2	Md. Mollik Sadeque	35	Farmer	01934718036
3	Biran Sikdar	58	Teacher	Bashbaria
4	Md. Sultan Haoladar	48	Farmer	01718207876
5	Md. Jakir Haoladar	40	Business	01725614321

6	Md. Bachchu	28	Business	01935347747
7	Md. Shahidul Islam	48	Boatman	Bashbaria
8	Md. Nur islam haoladar	35	Business	01921451563
9	Md. Altab Hossain	45	Business	Bashbaria
10	Md. Rubel Haoladar	25	Farmer	01925214093
11	Mahbub Haoladar	22	Farmer	Bashbaria
12	Md. Sohaban Haoladar	32	Farmer	Bashbaria

Table B6: Rada Ballav, Kara Para, Bagherhat Sadar, Bagerhat (FGD-6)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Uttam Kumar	28	UP Member	01934720722
2	Sreemoty Nomita rani	35	House wife	Rada Ballav
3	Md. Faruq shake	24	Farmer	Rada Ballav
4	Md. Sultan Halder	48	Farmer	Rada Ballav
5	Md. Sarwar Hosain	40	Business	Rada Ballav
6	Jashim Uddin	28	Farmer	Putimari
7	Md. Altab Hossain	48	Fishermen	Putimari

Table B7: Plan Bazar, Maliker Ber, Bagherhat Sadar, Bagerhat (FGD-7)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Abdul Karim	45	Farmer	Plan Bazar
2	Md. Usman Haoladar	55	Farmer	Plan Bazar
3	Md. Firaz Ahmed	42	Business	Sannasi
4	Md. Shahidul Islam	28	Farmer	Sannasi
5	Md. Abdus Salam	50	Farmer	Plan Bazar
6	Md. Sahdat Hossain	44	Business	Paschim Mollikerber
7	Md. Al Amin	26	Farmer	Paschim Mollikerber
8	Md. Mannan Sheikh	45	Farmer	01944228098

Annex E: TOR for Environmental Impact Assessment (EIA) of Polder 35/3

*Backg*round

Bangladesh Water Development Board (BWDB) requires to conduct Environmental Impact Assessment (EIA) study for Polder 35/3 under CEIP, as per the findings of IEE study as well as the guidelines of DOE and World Bank. The EIA reports will be submitted to DOE for obtaining environmental clearance. The EIA study should be conducted according to following scope of works.

Objective

The objective of the EIA study is assessment of environmental impacts and preparation of environmental management plan for implementing the sub-projects without harming the environment.

Scope of works

i) Carry out detail field investigation of required parameters of environmental and social baseline, especially on the critical

ii) 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 Component (IESCs).

iii) Determine cumulative environmental impacts of the project that may occur inside and outside the project area.

iv) Distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, and unavoidable or irreversible impacts.

v) Identify feasible and cost effective mitigation measures for each impact predicted as above to reduce potentially significant adverse environmental impacts to acceptable levels.

vi) Determine the capital and recurrent costs of the measures, and institutional, training and monitoring requirements to effectively implement these measures. The Consultant is required to identify all significant changes likely to be generated by the project. These would include, but not be limited to, changes in the coastal erosion and accretion due to alteration of tidal currents, changing fish migration routes, destruction of local habitats, and water logging, etc.

vii) Consult with modeling consultants to establish conformity of the impact assessment with existing and ongoing mathematical model due to climate change developed by a number of reputed firms. The developed models may be available from the main consultant and implementing agency;

viii) 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 describe in qualititative terms.

ix) Describe alternatives that were examined in the course of developing the proposed project and identify other alternatives that would 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, vuMNerability, 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.

x) Identify the specific reciprocal impact of climate change and 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 drainage facility should be provided to avoid water logging in the surrounding area.

xi) Prepare a detailed Environmental Management Plans along with the 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.

xii) Ensure to address Occupational health and safety for the construction workers in the EMP;

xiii) Develop Environmental monitoring format for regular monitoring of the project at the pre-construction, construction and operational stage;

xiv) Prepare the EIA report

Structure of the EIA report

EIA report should be prepared as per following key contents, but not limited to:

1. Executive Summary
2. Introduction: *This section will include (i) purpose of the report and (ii) extent of the IEE study.*
3. Methodology of EIA
4. Policy, Legal and Administrative Framework: *This section will describe relevant environmental policies, rules and administrative procedures that need to be followed for the proposed project.*
5. Project Description: *This section will provide a brief but clear picture about (i) type of project; (ii) category of Project; (iii) need for project; (iv) location (use maps showing general location, specific location, and project site); (v) size or magnitude of operation;(vi) proposed schedule for implementation)*
6. Analysis of Alternatives: *This section will describe analysis of alternatives in terms of project location and technical designs and associated environmental impacts.*

7. Environmental and Social Baseline: *This section will provide sufficient information on the existing environmental and social baseline resources in the area affected by the project, including the following:*

   (i) Physical Resources: (e.g. atmosphere, topography, air quality etc.)

   (ii) Water Resources: (e.g. hydrology, surface water and groundwater system, sedimentation, tidal influence, etc.)

   (iii) Land and Agriculture resources: (e.g. land type, landuse, cropping pattern, crop production, etc.)

   (iv) Fisheries resources: (e.g. fisheries diversity, fish production, etc.)

   (v) Ecology: (e.g. ecosystems, wildlife, forests, rare or endangered species, protected areas, coastal resources, etc.)

   (vi) Socio-economic condition: (e.g. population and communities (e.g. numbers, locations, composition, employment), health facilities, education facilities, socio-economic conditions (e.g. community structure, family structure, social well being), physical or cultural heritage, current use of lands and resources for traditional purposes by Indigenous Peoples, structures or sites that are of historical, archaeological, paleontological, or architectural significance, economic development (e.g. industries, infrastructure facilities, transportation, power sources and transmission, mineral development, and tourism facilities, etc.)).

8. Climate Change: *Climate change aspects in global, regional and local perspectives and the likely impacts on the Project area and its surroundings should briefly discus in this section.*

9. Stakeholder Consultation and Disclosure: *This section will describe the process undertaken to involve the public in project design and recommended measures for continuing public participation; summarize major comments received from beneficiaries.*

10. Significant Environmental and Social Impacts: *Significant environmental and social impacts due to project location, and related to project design, construction, and operations phase should discus detail in this section.*

11. Cumulative and Induced Impacts: *Cumulative impacts of the proposed Project and other projects as well as induced impacts should provide in this section.*

12. Environmental Management Plan: *The environmental management plan (EMP) will include institutional arrangement for EM, mitigation and enhancement plan, compensation and contingency plan as well as monitoring plan. The EMP should also include tentative cost of implementation of the plan.*

13. List of References

14. Annexes:

    Checklist for Environmental and Social Survey

    Records of Consultations (list of participants and photographs)

    Data and Unpublished Reference Documents

Annex F: Photo Album Polder 35/3

Figure1: Bashbari 6 vent Drainage sluice

Figure 2: Betibunia 2vent Drainage sluice

Figure 3: Motherdia 1 vent Drainage sluice

Figure 4: Sarkardanga 1 vent Drainage sluice

Figure 5: Water salinity testing in field

Figure 6: Taking GPS reading of the Polder

Figure7: River bank erosion at Radabhallob

Figure 8: River erosion at Baro Banshbaria

Figure 9: Shifting of house at Panchamal due to retired of embankment

Figure 10:Embankment used as rural road

Figure 11: Madardia launch ghat

Figure 12:Navigation in Bhairab river

Figure 13: Navigation in Bhairab river

Figure 14: Navigation in Bhairab river

Figure 15: Internal navigation at Putimari river

Figure 16: Internal navigation at Betibunia khal

Figure 17: Kutcha road in the polder

Figure 18: Heringbone Road in the polder

Figure 19: Pucca Road in the polder

Figure 20: Pucca Road in the polder

Figure 21:View of Aman crop land

Figure 22:View of Rice cum fish culture in the Polder

Figure 23:Farmers ploughing own land for Boro cultivation

Figure 24: Soil Sample Collection in Paschim Mollikerber

Figure25:Cattle on the embankment

Figure 26: Buffaloes inside the Polder

Figure 27: Fishing boat

Figure 28: Saline water entering into Shrimp gher

Figure 29: Fishing by khepla jal

Figure 30: Fish precessing for marketing

Picture 31: Shrimp gher

Picture 32: Bagda harvesting from gher

Figure 33: Crab farm inside the Polder

Picture 34: Crab collection from gher

Figure 35: Sonnyasi bazar in Polder area

Figure 36: Planer bazar along the embankment

Figure 37: Gujihati Jam-e- Mosque

Figure 38: Madardia Launch ghat jam-e-Mosque

Figure 39: Dema Karamatia Fazil Madrasa

Figure 40: Sonnyasi High School

Figure 41: Khegra ghat Govt. Primary School

Figure 42: Alhaz Fohim Uddin Orphanage

	
Figure 43: Semi Pucca House at Radabhallob	**Figure 44: Kutcha house at Baro Banshbaria**
	
Figure 45: House on the Embankment	**Figure 46: Kutcha house in the Polder area**
	
Figure 47: Source of drinking(Pond) water inside the Polder	**Figure 48: Source of drinking wate r(Tube well)**

Figure 49: PSF/ Source of drinking water

Figure 50: Collection of drinking water

Figure 51: Pucca toilet in the Polder

Figure 52: Ring Slab toilet in the Polder

Figure 53: Kutcha toilet in the Polder

Figure 54: Hanging toilet at Bansh bari

FGD

Figure 55: FGD at Baro Bashbaria

Figure 56: FGD at Khegraghat Bazar

Figure 57: FGD at Madardia Launch Ghat

Figure 58: FGD at Gujihati

Figure 59: FGD at Rada Ballab

Figure 60: FGD at Sarkardanga

Public Consultation Meeting (PCM)

Figure 61: PCM in Dema UP, Bagerhat Sadar

Figure 62: PCM in Dema UP, Bagerhat Sadar

Figure 63: Open discussion during PCM

Figure 64: Open discussion during PCM

Figure 65: Open discussion during PCM

Figure 66: Open discussion during PCM