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



**DETAILED DESIGN OF FIVE POLDERS
Volume III: Environmental Impact Assessment
Part C: Polder No 35/1**

Joint Venture of



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



DEVCONSULTANTS LIMITED, BANGLADESH



KRANTI ASSOCIATES LTD., BANGLADESH



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MINISTRY OF WATER RESOURCES



BANGLADESH WATER DEVELOPMENT BOARD (BWDB)

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

DETAILED DESIGN OF FIVE POLDERS

VOLUME III: ENVIRONMENTAL IMPACT ASSESSMENT

PART- C: POLDER NO. 35/1

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Abbreviations and Acronyms

ASA	Association for Social Advancement
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorology Department
BRDB	Bangladesh Rural development Board
BRAC	Bangladesh Rural Advancement Centre
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
CAFOD	Catholic Fund for Overseas Development
CZPo	Coastal Zone Policy
DAE	Department of Agricultural Extension
DCSC	Design and Construction supervision Consultants
DevCon	Dev Consultants Ltd
DOE	Department of Environment
DPHE	Department of Public Health engineering
DPM	Design Planning & Management Consultants
DTW	Deep Tube well
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	hectare
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

<i>Aila:</i>	Major Cyclone, which hit Bangladesh coast on May 25, 2009
<i>Aman:</i>	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.
<i>Arat:</i>	Generally an office, a store or a warehouse in a market place from which Aratdar conducts his business.
<i>Aratdar:</i>	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.
<i>Aus:</i>	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.
<i>B:</i>	When preceding a crop means broadcast (B. Aus)
<i>Bagda:</i>	Shrimp (<i>Penaeus monodon</i>), brackish/slightly saline water species.
<i>Baor:</i>	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.
<i>Bazar:</i>	Market
<i>Beel:</i>	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
<i>Bepari:</i>	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.
<i>Boro:</i>	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.
<i>Charland:</i>	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-stream of the main channel that are created by the continual shifting of these rivers and emerge from the deposition of sand and silt from upstream
<i>Faria:</i>	Local trader/agent/intermediary.
<i>Golda</i>	Prawn (<i>Macrobrachium rosenbergii</i>), non-saline/fresh water species
<i>Gher</i>	Farm lands converted into ponds with low dykes and used for cultivation of shrimp/prawn/fish.
<i>Haor:</i>	A back swamp or bowl-shaped depression located between the natural levees of rivers and comprises of a number of <i>beels</i> .
<i>Haat:</i>	Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.

<i>Jaal:</i>	Different types of fishing net to catch fish from the water bodies.
<i>Jolmohol:</i>	Section of river, individual or group of <i>beels</i> (depression), or individual pond owned by the government but leased out for fishing. They are also called Jalkar, or Fishery.
<i>Jhupri:</i>	Very small shed for living, made of locally available materials. One type of houses used by very poor community members.
<i>Kacha:</i>	A house made of locally available materials with earthen floor, commonly used in the rural areas.
<i>Khal:</i>	A drainage channel usually small, sometimes man-made. The channel through which the water flows. These may or may not be perennial.
<i>Kharif:</i>	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).
<i>Kua/Kuri:</i>	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.
<i>Kutcha Toilet:</i>	The earthen made latrine consist of a hole without cover.
<i>Mahajan:</i>	Powerful intermediary in the value chain or traditional money lender.
<i>Perennial Khal:</i>	Water available in the khal all the year round.
<i>Pacca:</i>	Well constructed building using modern masonry materials.
<i>Rabi:</i>	Dry agricultural crop growing season; mainly used for the cool winter season between November and February.
<i>Ring Slab:</i>	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.
<i>Seasonal Khal:</i>	Water not available in the khal all the year round.
<i>Sidr:</i>	Major Cyclone, which hit Bangladesh coast on November 15, 2007.
<i>T. Aman:</i>	When preceding a crop means transplanted (T. Aman).
<i>Upazila:</i>	Upazila is an administrative subdivision of an district.
<i>Water sealed:</i>	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 35/1, 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 face 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 their 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 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 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 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

Located in Bagerhat District of southern Bangladesh, the Polder 35/1 covers a gross area of 13,058 hectare (ha) with net cultivable area of 10,400 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 key improvement and rehabilitation works to be carried out in Polder 35/1 under CEIP-I are: re-sectioning of embankment (49.70 km); construction of retired embankment (6.30 km); sea dyke (6.5 km); interior dyke (11 km); construction of 15 sluices; repairing of two sluice; construction of 17 flushing inlets; repairing of three

flushing inlets; demolishing of three flushing inlets; re excavation of drainage channels (70.50 km); slope protection of embankment (17.25 km); and afforestation on the foreshore areas (2 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 the 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 develop a Resettlement Action Plan as and where necessary 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.

Analysis of Alternatives

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. About 30 to 40 percent 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, the area under irrigation is limited to merely about 2 to 3 percent of the total Polder area. 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 Conditions

The Polder 35/1 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 covers parts of Sharankhola and Morrelganjupazilas under Bagerhat district. The Polder area is situated in five unions namely Khuolia, Dakhin Khali, Rayenda, Dhansagar and Khontakata.

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 35/1 lies in agro-ecological zone of the Ganges Tidal Floodplain.

The soil texture varies from clay to clay loam in the Polder 35/1. Non-calcareous grey floodplain soil is the major soil type in the Polder. Acid sulphate 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 gross area of the Polder 35/1 is 13,058 ha of which 10,400 ha is Net Cultivable Area (NCA). The land utilization for crop production is about 80 percent in different seasons. About 20 percent area is covered by settlements, water bodies, and other structures. The single, double and triple cropped areas are about 49 percent, 40 percent and 11 percent, respectively. Land type classification in the country is based on depth of inundation during monsoon season due to normal flooding on agriculture land. There are five land types: High Land (HL, flooding: depth 0-30 cm); Medium Highland (MHL, flooding depth: 30-90 cm); Medium Lowland (MLL, flooding depth: 90-180 cm); Low Land (LL, flooding depth: 180-360 cm); and Very Lowland (VLL, flooding depth: above 360 cm). About 11 percent, 87 percent and 2 percent of the net cultivable area in Polder 35/1 falls under HL, MHL, and MLL land types, respectively.

Farming practices within the Polder have adjusted to agro-climatic conditions as well as to physical, biological, and socioeconomic factors prevailing in area. The siltation of rivers and channels cause drainage congestion/water logging during monsoon, natural calamities like cyclones and storm surges cause devastating crop damage in the area. Scarcity of suitable non-saline water for irrigation during dry months (December through April) is a major impediment towards expansion of irrigated agriculture in the Polder. The conditions in polder are also suitable for fish cum rice cultivation. A limited variety of crops are grown due to the conditions prevailing in the area. Rice is the main crop grown because of its adaptability to diversified ecological conditions. Sugarcane and banana are annual crops of the area. Various non-rice crops like, summer vegetables, winter vegetables, jute, oilseeds and spices are also grown in the area. Total cropped area is about 16,875ha of which rice occupies about 11,220 ha and the rest 5,655 ha is covered with non-rice crops. The rice cropped area is about 66 percent of the total cropped area. Among the rice crops, T. Aman (high yield variety -HYV), T. Aman (local), T. Aus (HYV), T. Aus (local) and Boro (HYV) are contributing about 47 percent, 38 percent, 11 percent, 2 percent and 2 percent of NCA respectively.

Polder 35/1 is hydrologically linked with the Baleswar River in the east and the south, Sannasir Khal in the north and the Bhola River towards west. The main rivers of the area – the Baleswer and the Bhola – flow from north to south. The surrounding rivers have tidal influence and affect the flooding and drainage system of the polder. The internal drainage system of the polder consists of numerous *khals*. In recent years, the peripheral rivers have increased in size, especially after the occurrences of Aila and Sidr. The rivers have eroded more lands due to the deterioration of erosion protection structures and have eventually increased in width.

Land erosion and sedimentation are among the key problems in the Polder 35/1. Erosion is observed mainly in Rayenda, Southkhali, Dhansagar, Khantakata, Khaulia and other locations along the

Baleswar and Bhola rivers. Erosion has destroyed land, homes and become an environmental and social hazard. During cyclone Sidr and Aila, surge waves severely eroded the polder embankments. In addition, regular tidal waves also weaken the embankments. Sedimentation is also a problem in the polder area. Sediment characteristics are different in the tidal rivers and *khals*. The Baleswar and Bhola rivers have sandy beds and mud banks along the shore, whereas tidal creeks tend to be choked with very fine sediments. Especially in the Bhola River, the sedimentation rate is higher than in the Baleswar River and the width of the Bhola River has become narrower than before. In the tidal rivers, suspended sediments are mainly composed of silt and clay. On average, roughly 1 to 1.5 feet of sedimentation takes place in the main rivers and *khals* each year. Sedimentation in most of the internal *khals* of the polder area causes bed level to rise and reduces their conveyance capacity.

Drainage congestion is another key issue in the Polder. The water channels and *khals* of the Polder cannot drain out water properly particularly during monsoon, primarily due to high siltation in these water bodies as well as due to the malfunctioning of regulators. Drainage performance of the linked *khals* has also been gradually decreasing due to sedimentation at both upstream and downstream of the regulators. Most of the water control structures are been damaged which hampers proper drainage of the polder. Over the years, improper maintenance of internal *khals* and malfunctioning of regulators have resulted in drainage congestion. Tidal waters frequently enter the polder areas through the breached points of the embankments especially in Khontakata, Rayenda and Southkhali unions and exacerbate drainage congestion. Roughly 12 to 15% area of the polder (1,200-1,600 ha) is facing drainage problem during monsoon.

The surface water quality in Polder 35/1 is influenced by the hydrological connections of the water bodies within the polder area with the surrounding rivers. The rivers and lakes around the polder 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 qualities parameters remain within the acceptable range.

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 meteorological parameters have been accumulated from different secondary sources (Bangladesh Meteorological Department - BMD) and synchronized at district level for Bagerhat. Maximum temperature occurs in the month of April and is around 34°C and average temperature during monsoon and is about 26° C. Monthly minimum temperature ranges from 9°C to 23°C and the minimum temperature (December to February) is around 9°C to 11°C. 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.

Fish resources of the project area are diversified with different fresh and brackish water habitats. Open water fish habitat of the project area including surrounding rivers and *khal*, such as Bhola and Baleswar rivers act as major arteries of fish migration into and within the project area. These water bodies play a vital role in maintaining fish productivity of internal open water. Bulk of the commercial fish production is coming from culture fish habitats while the main catch of capture/open water habitats comes from different seasonal and perennial *khals* particularly during wet season. The numbers of fishermen in the area is decreasing due to shrinkage of open water fish habitat, loss of *khal*-river connectivity, presence of water regulatory structures on the *khals* and their improper operations, and the corresponding decrease of fish catch. On the other hand, aquaculture is developing

in suitable ponds of congestion free highland area within the Polder. The Polder area is relatively moderate in fish biodiversity inspite of a decreasing trend because of morphological changes, obstruction to spawning migration, natural and anthropogenic drying up of wild fish habitats, indiscriminate fishing, and loss of river-*khal* connectivity and water regulatory structures on *khals*, as described earlier as well.

Based on the Census Report of Bangladesh Bureau of Statistics for 2011, the population in the Polder 35/1 is 96,503. These include 46,943 males and 49,560 females. A total of 22,932 households exist in the Polder with average size of 4.2 persons per household. The density of population is about 1,037 persons per square kilometer. The overall literacy is 57 percent, with male and female literacy being 56 percent and 59 percent, respectively. The literacy in the Polder is relatively higher than the national average. According to the baseline survey, around 35 percent households reported agriculture as their main occupation. Beside this, the agriculture labor (22 percent), non-agriculture labor (10 percent), business/trading (8 percent), and service provision (3 percent) are some other occupations of the Polder inhabitants. About 30 percent of the farmers are cultivating their own land, while about 35 percent are cultivating by taking share/lease of land along with their own. The tenants/share croppers are 20 percent and absentee landlords are about 15 percent in the Polder.

Consultation and Disclosure

Nine 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 meeting. During consultation meeting all relevant issues within the water resources, land resources, socio-economic resources, and disaster aspects were discussed in detail.

During 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 national level consultation was carried out at the end of February in presence of Department of Environment, other Government Institutions, local and national Non Government Organizations. The EIA was updated incorporating findings of National level workshop.

Potential Impacts and their Mitigation

The project will include construction of 7.3 km of retired embankment, widening the base of 49.7 km of embankment and 5 km of forwarding of embankment, establishment of construction camps, dredged soil disposal on the two sides of the dredged channel and construction of flushing inlets.

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 60 ha of land are of foremost significance. The activities will acquire 3.6 ha of single cropped field, 10.45 ha of double cropped field, 9.35 ha of multi cropped field and 1.26 ha of orchard. It is estimated that about 1981 matured trees will be affected for construction of drainage sluice and flushing sluice. Of these 1,981, 1,120 trees are on the country side and 861 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 estimated that approximately 20 ha of land will be required for construction of camp establishment.

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 (Rayenda Bazar Regulator at chainage 12.5 km and Khuriakhali Khal Regulator at chainage 6.6 km) are likely to worsen the situation and exacerbate the water logging problem. Furthermore, Nalbunia, Dhansagar, Amrabunia and Dakshin Rajapur are also likely to face 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. Construction work near Bhola River will be conducted during dry season. The work will be performed in congested residential areas, the construction materials; debris from demolition of structures, dredged material will be well protected.

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. Due to reducing of saline water intrusion in polder area, the shrimp fish farming and its dependent livelihood would be impacted. Many labours who are involved in shrimp farming would be jobless.

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 35/1. 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.

Sundarbans exist in the south and west part of polder 35/1. In the south from Chainage 25500 to Chainage 29000, Bogi river is in between Sundarbans and Polder 35/1. In the west from chainage 29000 to 50,000 Sundarbans is separated by Bhola river from Polder 35/1. The main impact of the polder on the Sundarban ecosystem situated across the river is the intrusion of more water on the forest floor of Sundarban. This may enhance the height of the tidal inundation of the forest. This enhanced tidal inundation, may imbalance the natural tide inundation features of the given ecosystem. It is commonly observed that in areas that have higher tide inundations, the species composition is different than that is found in the areas that have lower tide inundations. Thus with the enhanced inundation the species composition may gradually change.

Again if the quantity of water entering the Sundarbans increases, consequently the speed at which the water enters the forest floor also increases, which in turn may cause two things, namely

- brings in more of coarser soil particles on the forest floor as it enters and majority of these get deposited on the river banks or nearby
- drains off more of the heavier detritus from the forest floor as it recedes, which otherwise would have got retained by the given ecosystem. This may ultimately cause the loss of soil fertility. Interviewing forest department it was revealed that in the past (during 1977/78) there was good growth of Shingra (*Cynometra ramiflora*) at Terabaka area under Shoronkhala range across the polder 35/1. Currently only a few of these species are available.

It is however very difficult to isolate what part or what quantum of these above said impacts are because of the polders alone. It needs to be mentioned herein that the quantum of these impacts will be lower if the width of the river between the Sundarban & Polder is more.

To address the involuntary resettlement issues arising from acquisition of 60 ha of land and loss of other private and or community structures, a resettlement action plan (RAP) has been prepared. 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 which will be included in the Environmental Action Plan prepared by the contractors. 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 due to 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 35/1 has been estimated as BDT 25.0 million (without Training and Field trip costing). The contractor needs to submit an Environmental Action Plan (EAP) based on the EIA and EMP 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 35/1 will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv) overall effectiveness of the project environmental protection measures. The monitoring plans 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

There are some areas having no embankments protection near Polder 35/1. These areas may suffer the consequences of sedimentation in Baleswar River. Telikhali, Tushkhali, Atarkhali, and Saula are some of the locations under Pirojpur district which are not under polder coverage. These areas are under the inundation risk during monsoon through the implementation of interventions in Polder 35/1 under CEIP-I. In addition, sedimentation in smaller water bodies namely Bogi lake, Bhola river may cause regular drainage congestion problems in its downstream. The navigability of rivers may deteriorate over the years. A number of smaller water bodies may be permanently silted up. The polders in the vicinity of polder 35/1 (polder 39/1, 35/2 and 37) as well as the unprotected areas (Telikhali, Atarkhali, Tushkhali, Saola, Dhanisafa etc. unions under Pirojpur district) will be more exposed to saline water intrusion. 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.

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 any 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.

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 35/1, 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 in from the Bay of Bengal encountering very large sediment inflows 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 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 (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 offering protection against tidal floods, salinity intrusion and sedimentation. The polders lands are slightly higher than sea level. The polders were designed to keep the land safe from the daily tide to allow for agriculture activities. 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 much attention to storm surges. Recent cyclones caused 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 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, in some areas soil fertility and good agriculture production 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.

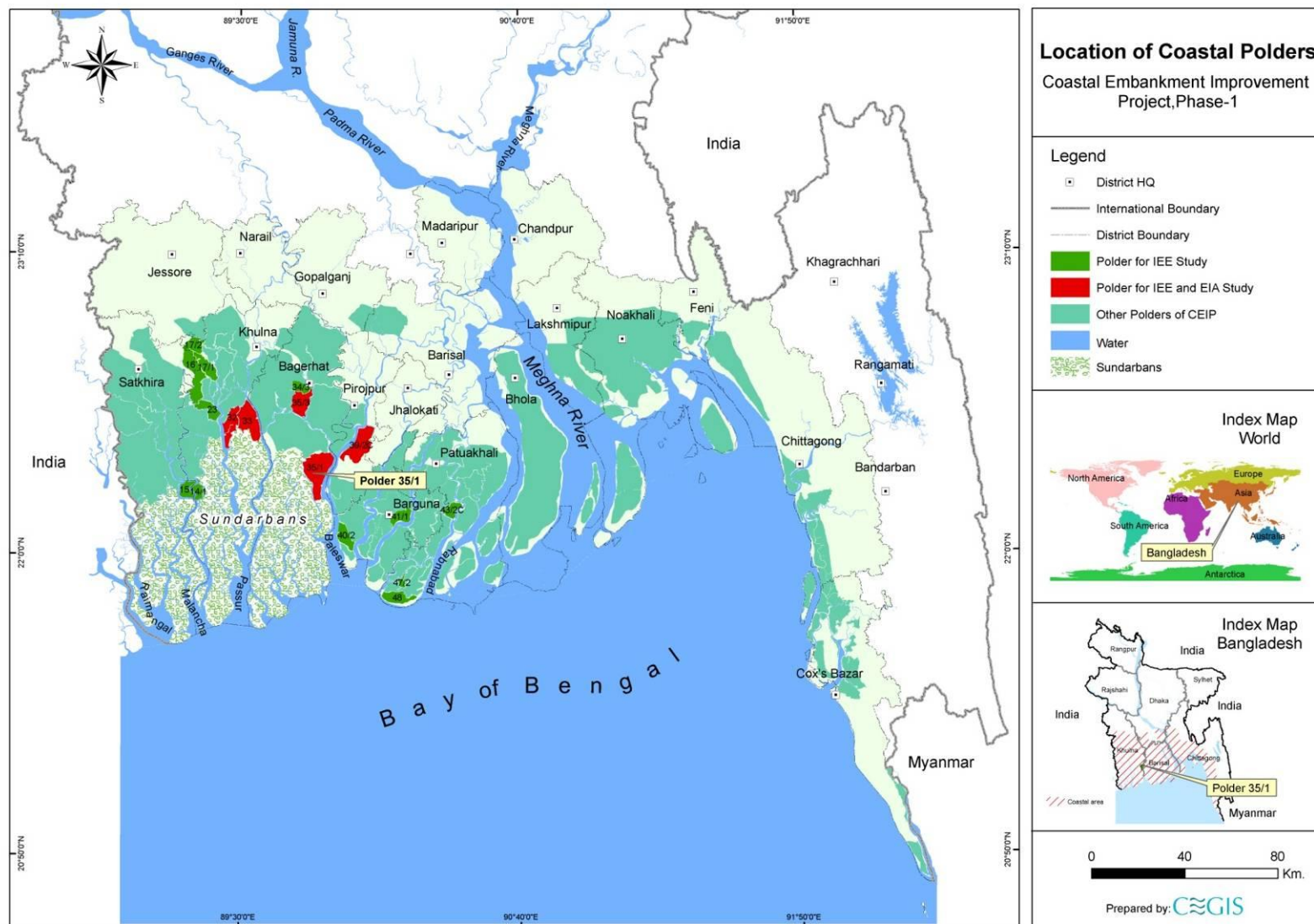


Figure 0.1: Coastal Polders

1.3 Polder 35/1 Location and Synopsis of Rehabilitation Work

The Polder 35/1 is located in Bagerhat District of southern Bangladesh (see **Figure 1.2**). The Polder covers a gross area of 13,058 hectare (ha) of which net cultivable area is 10,400 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 35/1 under CEIP-I:

- Re-sectioning of embankment :49.70 km
- Construction of retired embankment : 6.30 km
- Sea dyke :6.5 km
- Interior dyke :11 km
- Construction of sluice :15
- Repairing of sluice :2
- Construction of flushing inlets :17
- Repairing of flushing inlets :3
- Demolishing of flushing inlets :3
- Re excavation of drainage channels : 70.50 km
- Slope protection of embankment :17.25 km
- Afforestation on the foreshore areas : 2.00 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 for this Project.

Further details of the Project are presented later in 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.

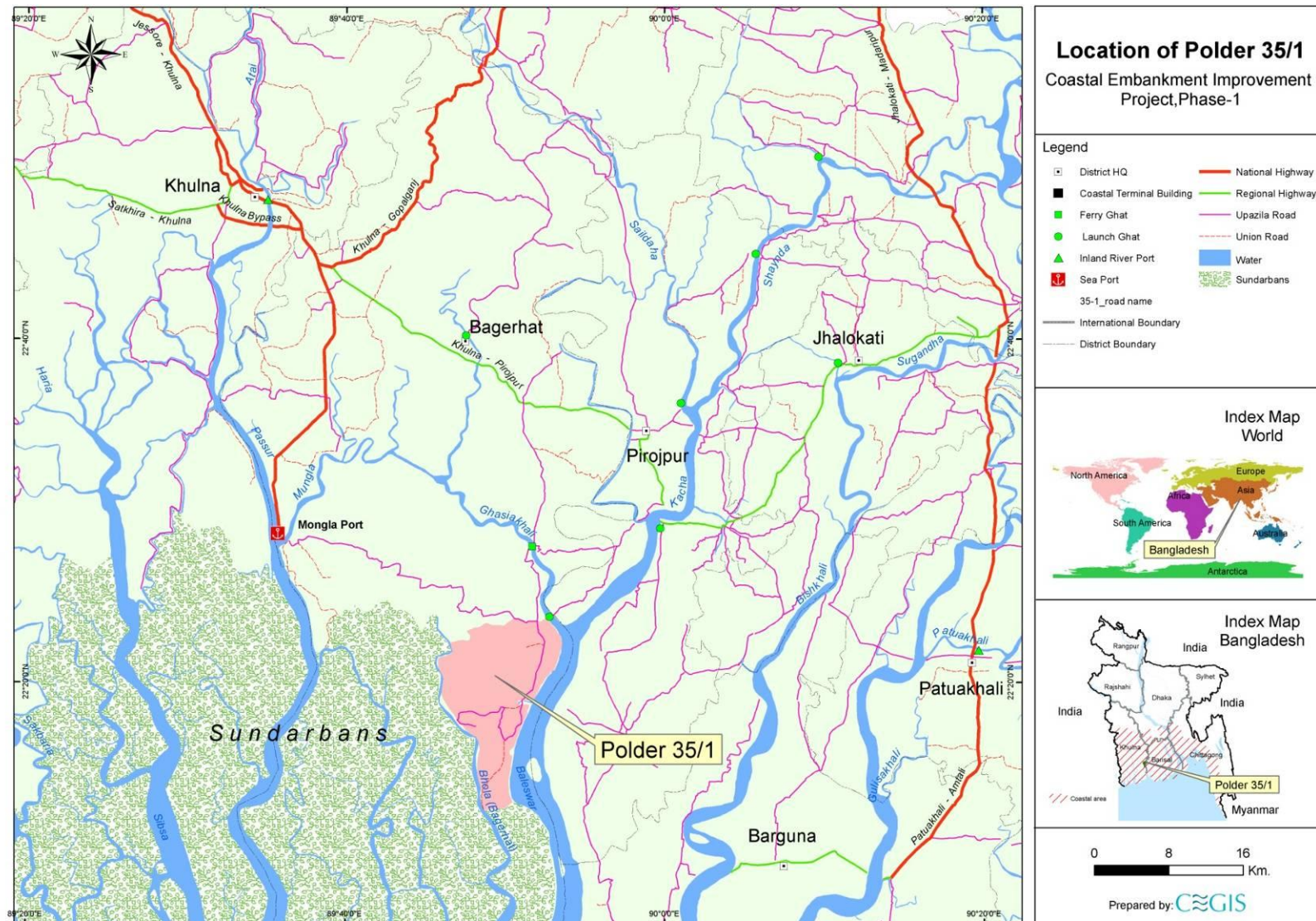


Figure 0.2: Location of Polders 35/1

1.5 Objectives of the Study

The overall objective of the EIA study of Polder 35/1 is to ensure that 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 existing environmental and social conditions of the Project area (the Project area is defined as the entire area inside the polder, work area outside the polder embankments, borrow areas 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 Structure of the Report

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

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

Chapter 3 (*Policy, 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 35/1*) 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 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 from 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*) 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.

Chapter 10 (*Cumulative and Induced Impacts*) presents analysis of cumulative impacts of the proposed Project and other projects in the area. In addition, induced impacts are also covered in the chapter.

Chapter 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.

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.

1.7 Overall Approach

The EIA study for the rehabilitation of Polder 35/1 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.

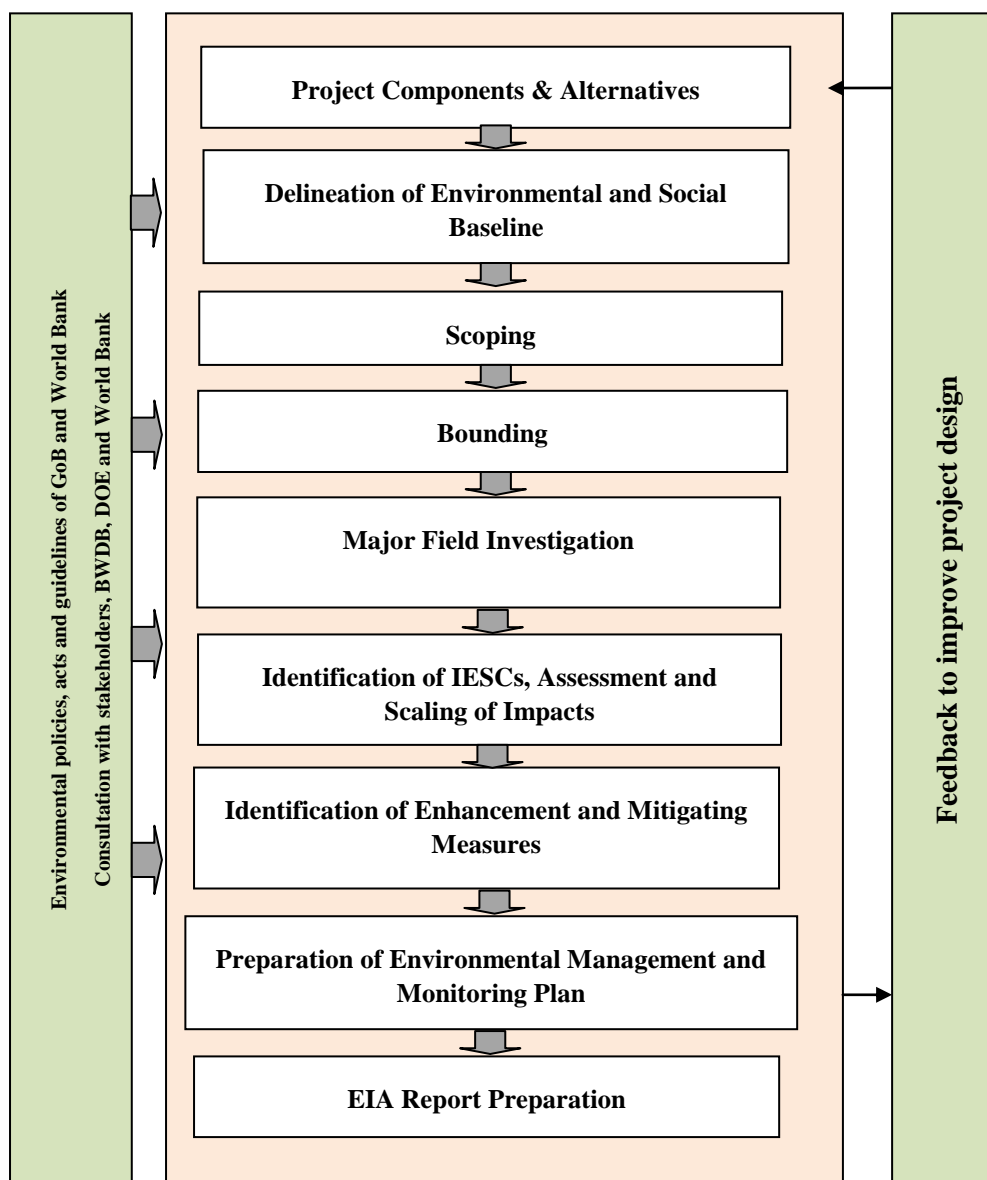


Figure 0.1: Overall approach of the EIA study

1.8 Methodology

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

1.8.1 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 area of influence is bounded by Baleshwar river to the east and south, Bhola river on the west and Shanashir khal on the north.

1.8.2 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.

1.8.3 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 Upazila¹ 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:

$$\text{Total crop production} = \text{damage free area} \times \text{normal yield} + \text{damaged area} \times \text{damaged yield}.$$

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

$$\text{Crop production loss} = \text{Total cropped area} \times \text{normal yield} - (\text{damaged area} \times \text{damaged yield} + \text{damage free area} \times \text{normal yield})$$

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), floodplain, 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 vulnerability were 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 from secondary sources. Data on income, expenditure, land ownership pattern, self assessed poverty status, migration, social overhead capitals and quality of life, disasters, conflicts of the study area, information on non-governmental organizations (NGOs), cultural and heritage features of the project area were collected mainly from primary sources through PRA and FGDs and public consultations.

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.

1.8.4 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.

1.8.5 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.

1.9 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.

1.9.1 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 0.1: 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 conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

1.9.2 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 0.2: 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

1.9.3 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 0.3: 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

1.9.4 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.

1.9.5 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

1.9.6 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.

1.9.7 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.

1.9.8 EIA Report Preparation

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

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.

1.10 National Environmental Laws

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

1.10.1 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.

1.10.2 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.

1.10.3 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.

1.10.4 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.

1.10.5 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.

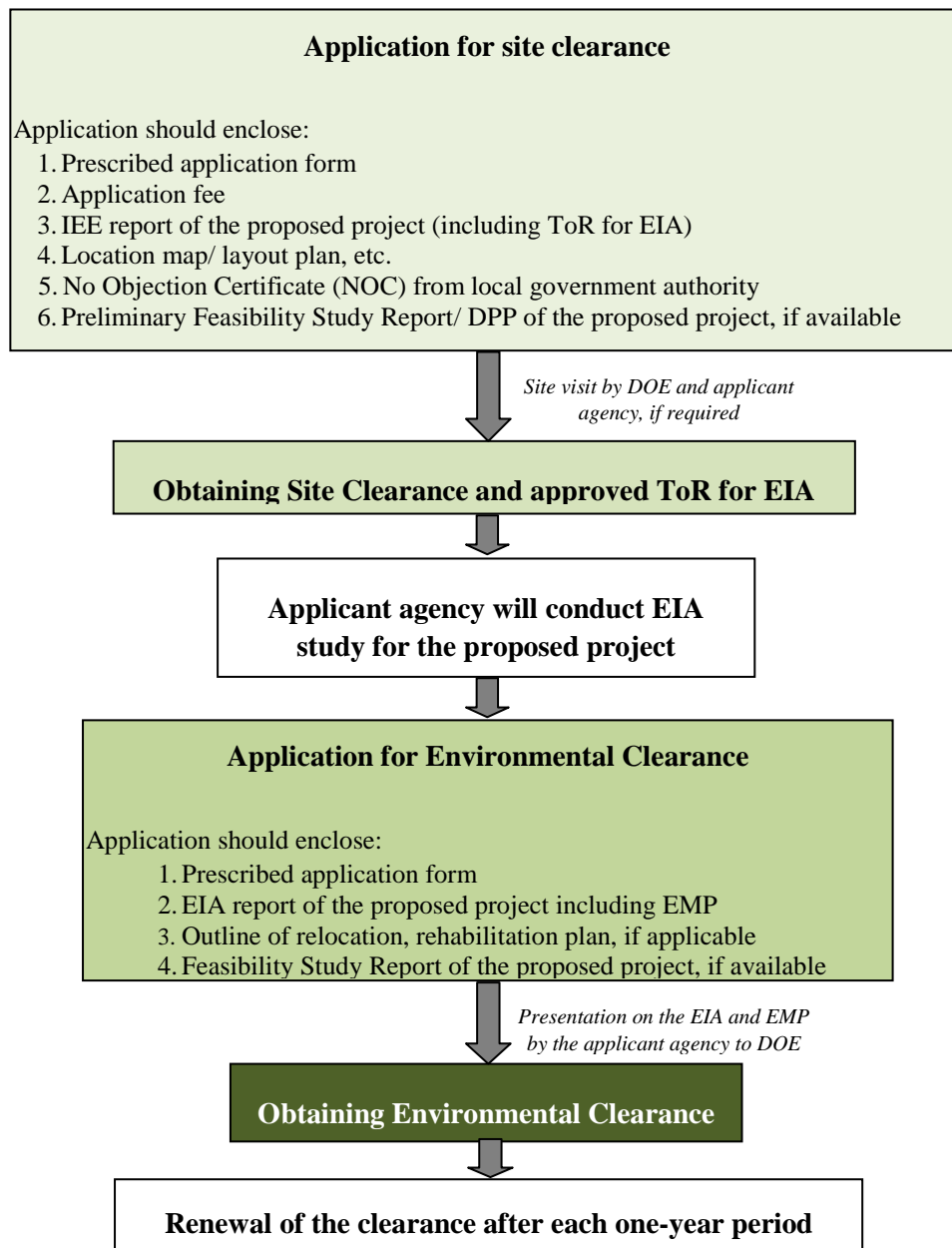


Figure 3.1: Process of obtaining Clearance certificate from DOE

1.11 Relevant National Policies, Strategies and Plans

1.11.1 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.

1.11.2 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.

1.11.3 National Water 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.

1.11.4 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.

1.11.5 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 vulnerabilities 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 CEIP-I addresses some aspects of this Policy particularly those relating to the polder improvements.

1.11.6 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.

1.11.7 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.

1.11.8 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.

1.11.9 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.

1.11.10 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.

1.11.11 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.

1.11.12 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.

1.11.13 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.

1.11.14 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).

1.11.15 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).

1.11.16 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 (*nadi sikosti*) 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

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.

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.

1.11.17 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.

1.11.18 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 properly 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.

1.11.19 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.

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 falls far too short of the real market prices.

- *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.

1.11.20 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 0.1: 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 Water Ways (1973)	Rules for removal of wrecks and obstructions	IBWTA
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	Describes the management of ground	Upazila Parishad

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
Ordinance (1985)	water resources and licensing of tube wells	
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 of fishes 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	DOArch
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

1.12 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 0.2: 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	1982	Amendment of Ramsar Convention to protect specific habitats for waterfowl	DOE/DOF
World Cultural and Natural Heritage (Paris)	1972	Protection of major cultural and natural monuments	DOA

Treaty	Year	Brief Description	Relevant Department
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

1.13 Implication of GoB Policies, Acts and Rules on CEIP and their 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.

1.14 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.

1.14.1 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 one of 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.

1.14.2 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.

The coastal zone of Bangladesh falls in ten different bio-ecological zones namely the Ganges flood plain and major rivers, coastal marine water, Meghna flood plain, Sundarbans, Chakaria Sundarbans, coastal plains, offshore islands and Meghna estuarine flood plain. 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. This OP is triggered for the proposed Project. However, the proposed activities will be undertaken in an area where natural habitat has already been modified to farm lands and built-up area. Furthermore, appropriate control measures have been incorporated in the environmental management plan (EMP) (provided later in the document) to prevent any potential impacts of the Project on the nearby Sundarban, which is a protected area.

1.14.3 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.

1.14.4 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.

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

1.14.5 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 ecosystem functionality. The Bank also assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats. Furthermore, the Bank does not finance projects that contravene applicable international environmental agreements.

Though this OP is triggered during concept stage, 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.

1.14.6 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.

1.14.7 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.

1.14.8 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.

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

The OP defines the process to be followed if the project affects the indigenous people.

No indigenous people - with a social and cultural identity distinct from the dominant society that makes them vulnerable to being disadvantaged in the development process – are known to exist in the Project area. Therefore this OP is not triggered.

However if such groups are identified during the Project implementation, the proponents will develop an Indigenous People Development Plan, in compliance with the OP and get it approved by the Bank.

1.14.9 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.

1.14.10 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

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

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

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

1.14.11 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.

1.14.12 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.

1.14.13 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.

1.15 Implications of WB Policies on CEIP

The project interventions for Polder 35/1 fall under Category A, due to the complexity of environmental issues associated with project activities involving major civil works by reconstruction and rehabilitation of the coastal embankment to protect against tidal flooding and storm surges. Since the coastal area is of high ecological sensitivity and vulnerability certain negative environmental impacts may occur during the implementation and operational phase on overall polder system. 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. Bhola River is in between the west of Polder 35/1 and Sundarban the largest Mangrove forest of South Asia. Rehabilitation and reconstruction of polders may have indirect impact on the water flow quality and pattern within the channels of Sundarban.

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.

Description of Proposed Interventions in Polder 35/1

This Chapter presents a simplified description of the Project activities. Also discussed in the Chapter are the construction methodology, construction schedule, and the institutional arrangements to implement the Project.

1.16 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 and crops. However, some effectiveness of the infrastructures in most cases has been compromised through poor and inadequate maintenance and sometimes by shifting the embankments towards country sides. With the occurrence

of the frequent storms in the recent period the Coastal Embankment Systems (CES) has weakened and calls for systematic restoration and upgrading.

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-I (CEIP-I).

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 35/1 is one of the polders to be rehabilitated under the CEIP-I.

1.17 Polder Overview

The Polder 35/1 is located in two upazilas namely Sharankhola and Morelganj of Bagerhat District (see **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 five union parishads⁹ namely Khantakata, Dhansagar, Southkhali and Rayanda of Sharankhola Upazila and Khaulia of Morelganj upazila. The Polder is surrounded by Baleswar River to the east and south, Sannashir khal to the north, and Bhola River to the west. The Polder covers a gross area of about **13,058 ha** of which net cultivable area is about **10,400 ha**.

The Polder 35/1 was constructed in the period of 1961-68 with the aim of protecting low lying coastal areas from tidal flooding and salinity intrusion, developing drainage system, providing supplementary irrigation facilities, and improving communication. However protection against storm surges was not considered at that time.

Existing Water Management Infrastructure in Polder 35/1

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	: 62.75 km
i. Sea dyke	: 12.5 km
ii. Interior dyke	: 50.25 km
2. Regulators (drainage / flushing)	: 13
3. Flushing inlets	: 9
4. Flushing/pipe inlets	: 16
5. Internal <i>khangals</i> (water channels)	: 251.26 km

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

1.18 Objectives of Improving Polder 35/1 under CEIP- I

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

1.19 Water Management Problems and Issues in Polder 35/1

The Polder 35/1, much like other polders in the coastal area of Bangladesh, was designed originally to protect against the highest tides, without much attention to storm surges. Recent cyclones caused 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 suffer from water logging, which lead to large scale environmental, social and economic degradation. Poor maintenance and inadequate management of the polders have also contributed to internal drainage congestion and heavy external siltation. As a result, in some areas soil fertility and good agriculture production are declining because of water logging and salinity increase inside polders.

In Polder 35/1, currently about 30-40 percent of the polder area is facing problems of salinity and water logging primarily because of ineffective water control structures and silting of water channels. This situation is further compounded by unavailability of suitable ground water at shallow depth during April to May. As a result, the irrigated agricultural land area is now limited to only about 500 ha (around 5 percent of net area) out of total net cultivable area of 10,400 ha. In addition, the open water fisheries have been declining because of shrinking water areas, restricted movement, and environmental pollution. The absence of local water management organizations has resulted in poor operation and maintenance of the Polder and its water control structures.

The key water management problems and issue in Polder 35/1 include: (i) lack of timely repair and maintenance of water control structures and embankments; (ii) inadequate budget allocation and its inefficient use; (iii) community abuse of the infrastructure for fishing, shrimp/prawn farming through unauthorized and inappropriate water inlets which result in weakening of embankment and malfunctioning of regulators; (iv) frequent minor to major cyclone surges, particularly recent cyclones of 2007 and 2009; (v) high rate of siltation in peripheral rivers impeding drainage; (vi) inadequate plantation in the foreshore; and (vii) absence of functional community organization for operation and co-management of the polder system.

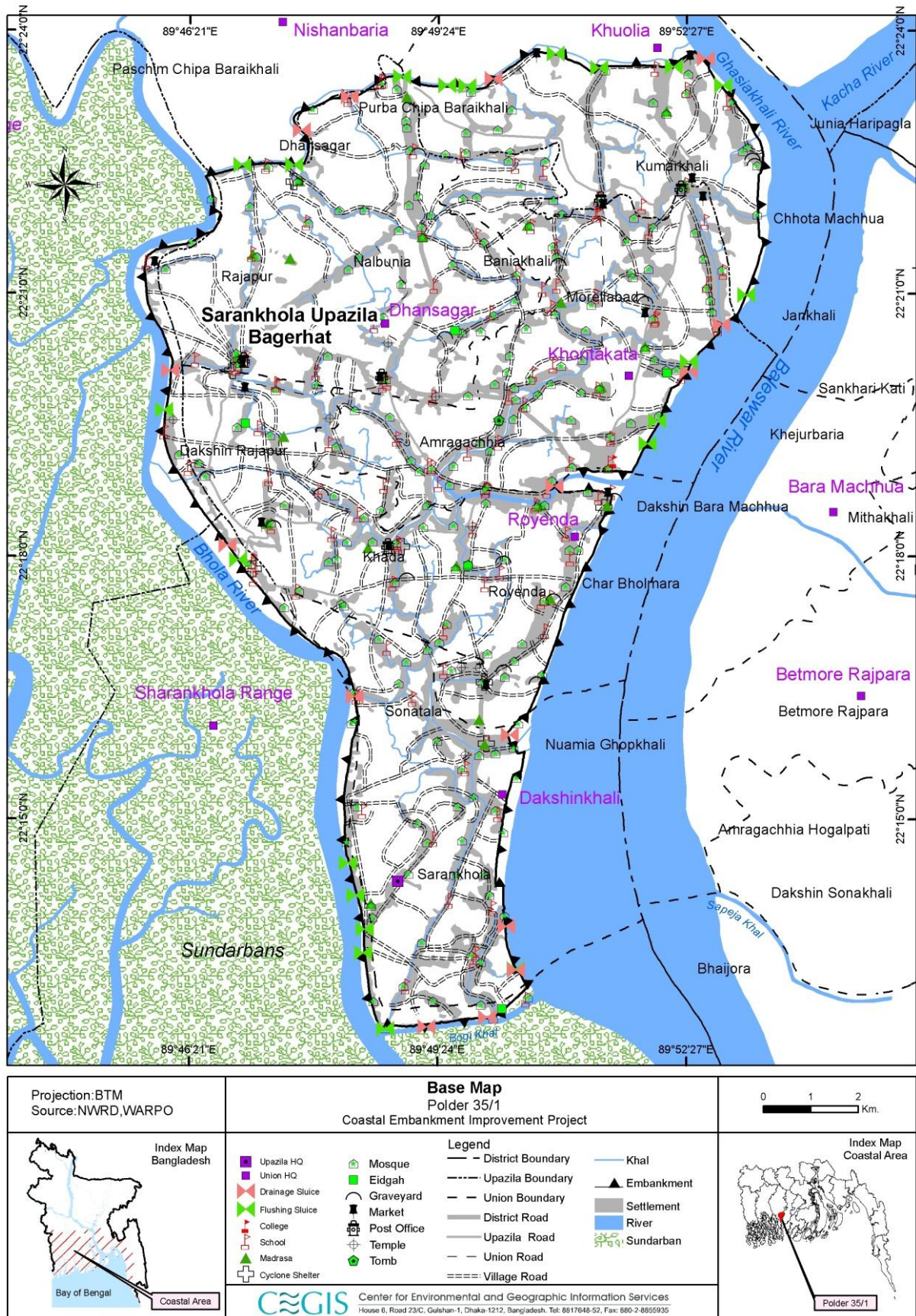


Figure 0.1: Alignment of the embankment and existing structures of the polder

1.20 Present Status of Water Management Infrastructures

1.20.1 Embankments

Present status and required works for embankments in Polder 35/1 is provided below; **Figure 4.2** shows one of the locations where the existing embankment has been damaged.

- The embankment from chainage 0 km to 0.5km has been washed away due to erosion of Baleswar River. Therefore, the embankment of this reach needs to be retired keeping sufficient set back (approximate 100 meters) distance with replacement of the existing sluice at a new location.
- The embankment from chainage 2 km to 3.80 km has been eroded. To protect the area from tidal inundation, BWDB has constructed low height ring dyke which is to be reconstructed according to the appropriate design.



Figure 0.2: Existing Alignment of Polder 35/1 at Khuolia

- The embankment from chainage 17 km to 18.5 km has been washed away during SIDR causing death to about 70 people in Chal Rayenda village as reported by the local people. A retired embankment with insufficient section has been constructed by BWDB as a temporary protection. This needs to be rebuilt conforming to the proper design with afforestation on the foreshore area.
- The embankment from chainage 19 km to 20 km, located at the back side of Tafalbaria Bazar, has been badly damaged due to river erosion. The embankment was temporarily protected by BWDB. This reach of the embankment is to be retired keeping appropriate set back distance (approximate 100 meters) with afforestation on the foreshore area.
- The Rayenda khal crosses the embankment between chainage 11 km and 14 km at a point about 1.5 km from the bank of the Baleswar River. The area between the above chainage has been protected by constructing a low height ring dyke on the either side of the Rayenda Khal. The large Rayenda Bazar and a number of other private establishments are situated in the unprotected area beyond this ring dyke and are open to the river and regularly suffer inundation during high spring tides. The ring bund has a narrower crest than the main embankment and is reported that during

The Bazar committee including people of the surrounding area is demanding protection from tidal inundation and protection embankment along the bank of Rayenda khal by shifting the alignment of the embankment towards the river bank. They also request for replacement of the sluice with adequate discharge capacity at a suitable position keeping Rayenda khal open upto sluice for navigation. At present goods are being carried to food storage through Rayenda Khal at a distance of one kilometer from the out fall of the khal. The Rayenda Khal is also being used as a harbor of sea-going vessels during cyclonic weather. It is observed that construction of embankment along the bank of Rayenda Khal covering the Rayenda Bazar is possible. For sustainability of the embankment, the slope protection with cement concrete blocks will be required at the river side.

RAYENDA BAZAR

Figure 0.3: Location of Rayenda Bazar

- The existing bank of Bhola River in between chainage 38 km and 43 km of the embankment has shifted away from the embankment leaving a strip of land about 1.5 km wide between the existing embankment and the river. Thus this portion of the embankment has become redundant and the new embankment under CEIP-1 will be aligned following the river bank. An additional sluice is proposed to be provided at a suitable location with the proposed embankment for draining out rainwater runoff from the extended area of the Polder.
- The river side slope of the embankment from chainage 4 km to 11 km has been damaged by the wave action of the River Baleswar and needs slope protection work with cement concrete blocks. Most part of this slope protection work has already been undertaken. Slope protection works for the remaining segments from chainage 4 km to 5.5 km and chainage 9 km to 9.75 km is proposed to be carried out under the proposed Project.

- The river side slope of the embankment from chainage 37.5 km to 37.9 km at Dhalir Ghope has been eroded by the river. Furthermore, the slope of the embankment is being damaged by wave action. Tender for slope protection of this segment of embankment has already been floated by BWDB under Aila fund.
- The slope of embankment from chainage 20.5km to 21km, chainage 22km to 23.5km, and chainage 24km to 24.9km has been damaged by wave action of the Baleswar River. BWDB has completed slope protection works for most part of these segments. Only afforestation on the foreshore area of these segments is required.

1.20.2 Water Control Structures

The Polder 35/1 has 13 drainage sluices, 16 pipe sluices, and 25 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 **Figures 4.4** to **4.11**.

Table 0.1: 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) (Sannashir Khal)	0 km	The sluice is under the threat of river erosion and is partially damaged.	The sluice is proposed to be reconstructed at a suitable location with the retired embankment keeping sufficient set back distance from river.
2.	Flushing Sluice-1 (FS-1) (Purba Barisal)	0.75 km	The gates are missing hence the sluice is not functioning.	Re-installation of gate is required.
3.	DS-2 (Kumarkhali)	6.6 km	There are damages to the nose-wall and upstream protection work. The sluice is not repairable.	The sluice is to be replaced.
4.	FS-2 (Khantakata)	7.78	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.
5.	DS-3 (Khantakata)	7.92 km	The length of upstream apron is not sufficient enough for flushing of sweet water in the polder area. There are damages to the either side of loose apron and flap gates are missing.	Sluice and its aprons are to be repaired.
6.	FS-3 (Rajair)	8.95 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.
7.	Pipe-Sluice (Rajair)	9.75 km	The structure is fully damaged.	The structure is to be replaced by a new sluice.
8.	DS-4 (Rayenda Bazar)	12.50 km	The sluice is in deplorable condition and the discharge capacity of sluice is	A new sluice with adequate capacity is to be constructed at a suitable

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
			inadequate.	location
9.	DS-5 (Baroitala/Zhilbunia)	14.33 km	The loose aprons of both sides of the structure are damaged.	Minor repair for the loose aprons is required.
10.	DS-6 (Tatalbari)	19.33 km	Loose aprons and nose-wall have been damaged. The structure is in deplorable condition.	A new drainage-cum-flushing sluice is to be constructed.
11.	DS-7 (Gabtala)	23.50 km	Railing and river side loose apron have been damaged. Flap gates have been corroded and gear-box is missing.	Structure needs to be repaired.
12.	FS-8 (Bogi)	25.00 km	The structure is in deplorable condition and the diversion channel has been silted up.	The sluice is to be replaced.
13.	DS-8 (Tarabaka)	26.62 km	The structure is in deplorable condition.	The structure is to be replaced by a new sluice.
14.	DS-9 (Khuria Khali)	27.90 km	The structure was constructed two years back by BWDB and is functioning well.	No repair needed at this point.
15.	FS-9 (Panirghat)	31.80 km	Loose aprons and railings have been damaged. The structure is repairable.	Structure needs to be repaired.
16.	DS-10 (North Sonatala)	36.07 km	Loose aprons and railings have been damaged and flap-gate has been corroded.	Structure needs to be repaired.
17.	DS-11 (Rasulpur)	39.7 km	The wing wall is in weak condition and reinforcement has been exposed. Aprons have also been damaged.	A new drainage cum-flushing sluice is to be constructed at a suitable location.
18.	(Rasulpur)	Between 39.7 km and 43 km	There is no drainage-sluice in this segment.	An additional sluice is to be constructed for draining excess runoff of the extended area of the polder.
19.	DS-12 (Rajapur)	44.47 km	The concrete of wing wall has seriously been affected due to salinity and reinforcement has been exposed.	Structure needs to be repaired.
20.	(Rothiar Khal)	50.60 km	There is no structure at this location.	A new drainage – cum flushing sluice is proposed to be constructed at this location.
21.	(Khajurbaria)	51.55 km	There is no structure at this location.	A new drainage – cum flushing sluice is proposed to be constructed at this location.
22.	DS-13 (Dhansagar)	54.40 km	The structure is in deplorable condition.	The structure is required to be replaced.
23.	(Dhansagar)	55.43 km	The structure is in deplorable condition.	A new sluice is required to be constructed in place of existing one with provision for improved drainage and

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
				flushing.
24.	Pipe sluice	56.40 km	The structure is in deplorable condition	A new sluice is required to construction in place of pipe sluice
25.	(Boro pori)	57.15 km	Loose aprons have been damaged and the opening of the structure is inadequate to drain out and flushing of water in comparison to its catchment area.	A new drainage-cum-flushing sluice is required to be constructed in place of existing one.
26	DS-14 (Boropori)	57.55 km	Loose aprons and railing have been damaged. There is leakage from rubber-seal. The diversion channel has been silted up.	The structure is to be replaced along with re-excavation of diversion channel.
27.	Pipe sluice (Boroikoli)	59.14 km	-	Pipe sluice is required to be replaced by a new sluice.
28.	(Andaria)	60.14 km	Loose aprons have been damaged.	The structure is to be replaced.
29.	Pipe sluice (Sannasi)	61.78 km	The structure is fully damaged.	Pipe sluice is required to be replaced by a new sluice.



Figure 0.4: Sannasi 1-Vent Regulator



Figure 0.5: Erosion-affected Embankment at Tafalbaria



Figure 0.6: Rajair Pipe Sluice



Figure 0.7: Rajair 1-Vent RCB Sluice



Figure 0.8: Khontakata 2-Vent Regulator



Figure 0.9: Khoiya Flushing Sluice



Figure 0.10: Rayanda 4-Vent Regulator



Figure 0.11: Rasulpur 2-Vent Regulator

1.21 Proposed Rehabilitation/Improvement Activities in Polder 35/1

The proposed interventions in Polder 35/1 under CEIP-I are listed in **Table 4.2** and shown in **Figure 4.12 (a-d)**.

Table 0.2: Proposed Interventions in Polder 35/1

1	Re-sectioning of embankment	49.70 km
2	Construction of retired embankment	7.30 km
3	Forwarding of embankment	5.00 km
4	Forwarding of embankment with slope protection	1.50 km
5	Construction of drainage sluices	15
6	Repairing of sluices	2
7	Construction of flushing inlets	17
8	Repairing of flushing inlets	3
9	Demolishing of flushing inlets	3
10	Re-excavation of drainage channels	70.50 km
11	Bank protection works	1.00 km
12	Slope protection of embankment	17.25 km
13	Afforestation on the foreshore areas	3.80 ha

Source: Feasibility Report of CEIP, 2012

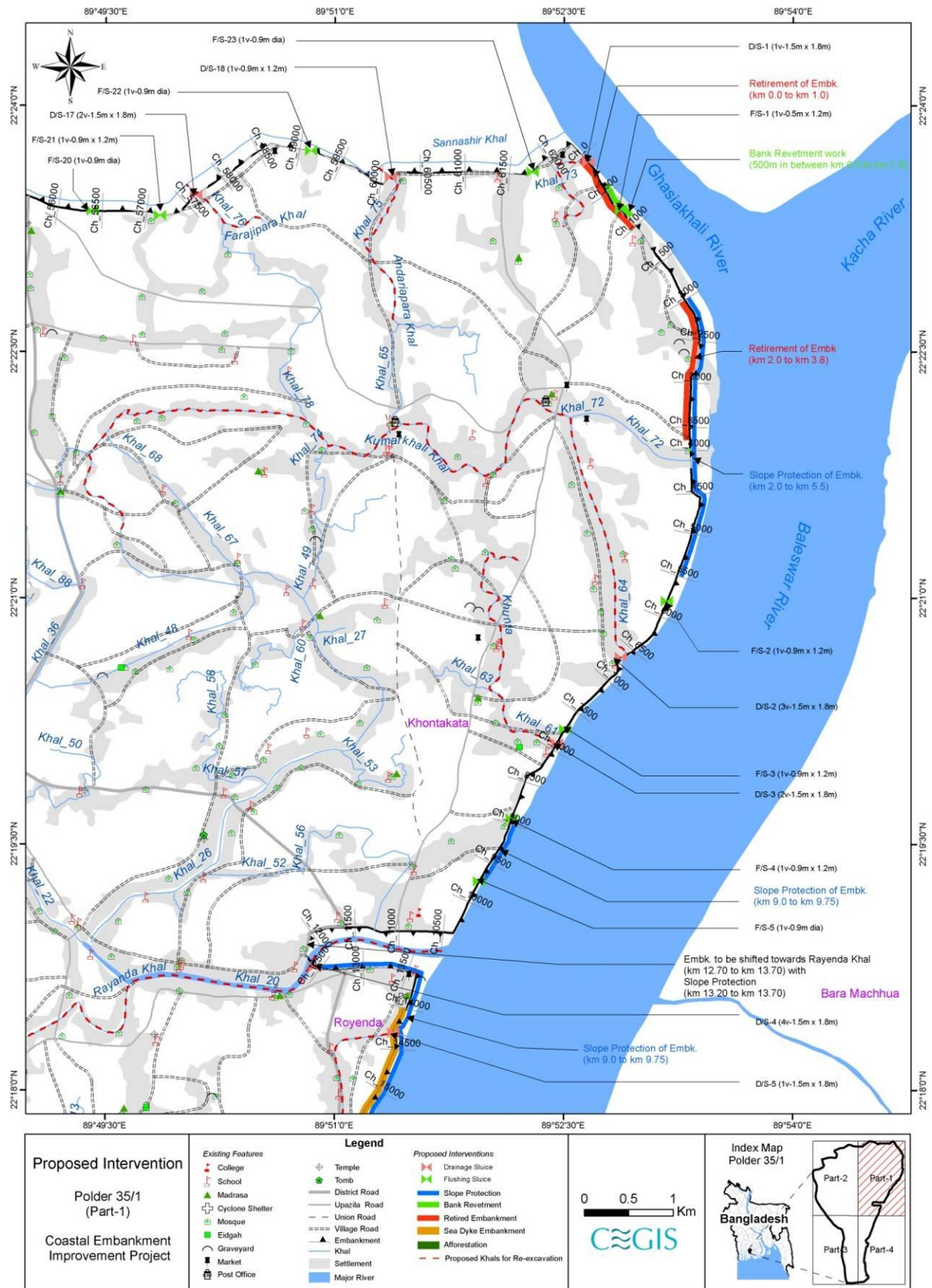
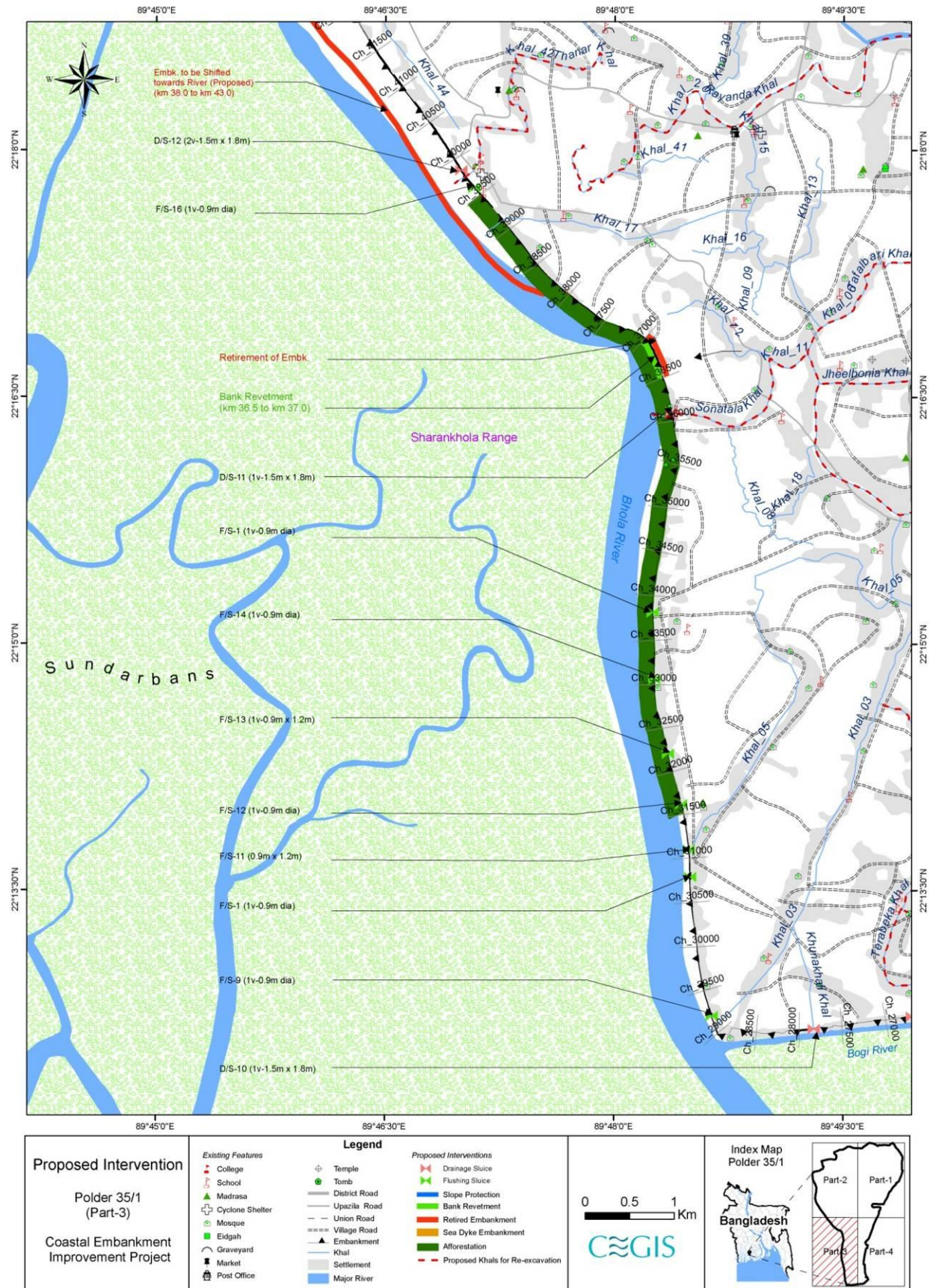


Figure 0.12 (a): Location of Proposed Interventions in Polder 35/1 (Part-1)





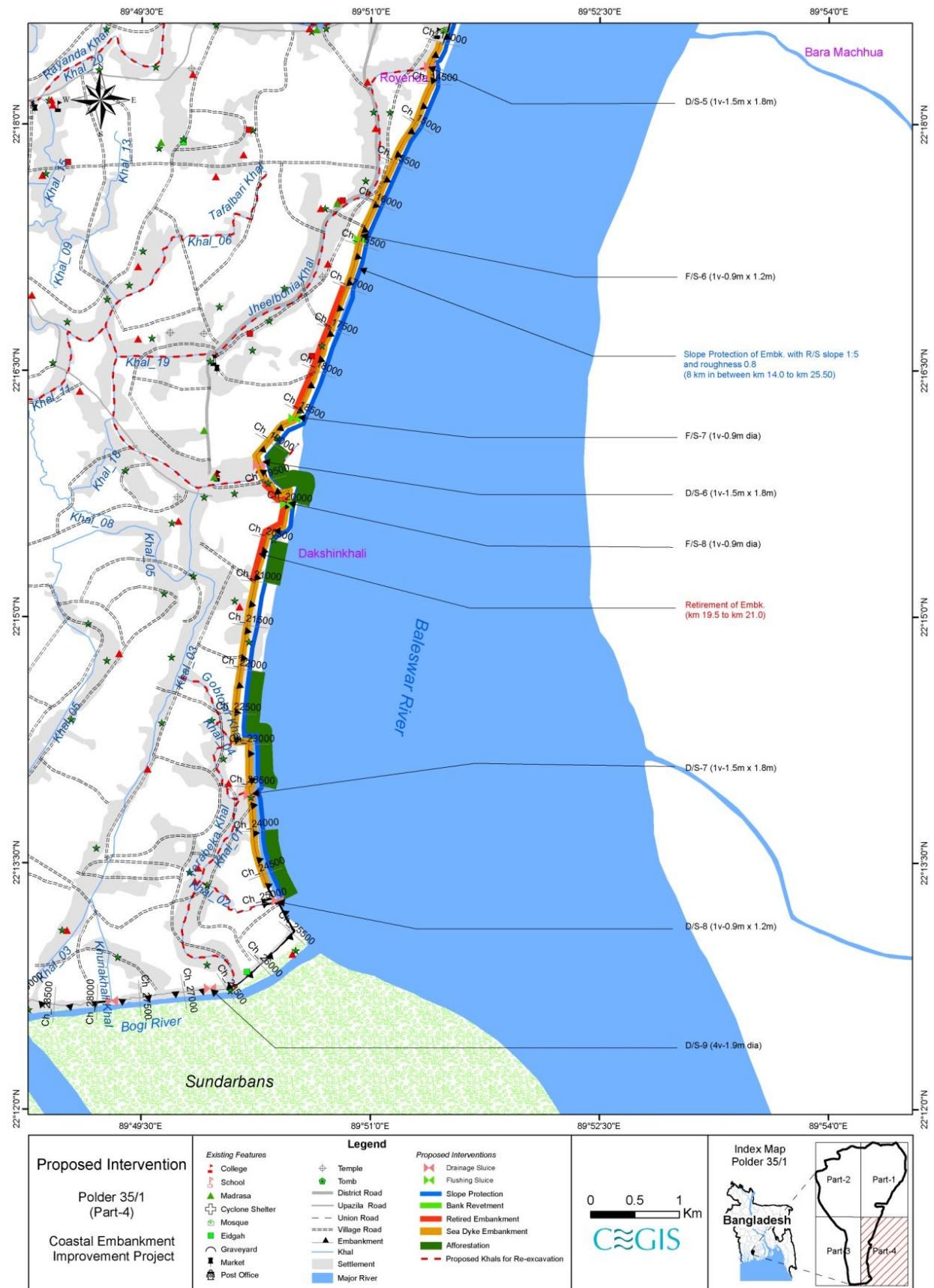


Figure 0.15 (d): Location of Proposed Interventions in Polder 35/1 (Part-4)

1.21.1 Works on Embankments

Under the proposed interventions in the Polder, a total of about 50 km of embankments will be re-sectioned and their height will be increased, a total of 6.3 km of embankments will be retired, and a total of 5 km of embankments will be forwarded, as shown in the **Table 4.3** below.

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 the commencement of construction activities for embankment works, labor sheds will be constructed with proper sanitation and other essential facilities. Suitable sites will be selected and prepared by cleaning bushes, weed, and trees for this purpose. Alignment of embankments will be fixed with adequate base width. Base stripping and removal of trees and weed will be carried out according to the 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 followed and deposited in selected areas. For constructing the embankment, soil will be placed in layers and compacted to the required specifications. The slope and shape of embankment will be finalized after proper compaction of layers. Subsequently, required turfing with grass will be carried out on embankment. Watering and fertilizing will also be provided.

Table 0.3: Detail of Works on Embankments

	Description	Chainage (km)	Embankment Height (m)	Length (km)
1	Increasing the height of embankments	10.50 to 12.50	5.00	2.00
2		26.00 to 36.50		10.50
3		37.00 to 38.00		1.00
4		43.00 to 62.50		19.50
5		1.00 to 2.00	6.00	1.00
6		3.80 to 10.50		6.70
7		13.70 to 17.00	6.50	3.30
8		18.50 to 19.50		1.00
9		21.00 to 26.00		5.00
10	Retirement	0.00 to 1.00	-	1.00
11		2.00 to 3.80	-	2.80
12		17.00 to 18.50	-	1.50
13		19.50 to 21.00	-	1.50
14		36.50 to 37.00	-	0.50
15	Forwarding of Embankment	38.00 to 43.00	-	5.00

1.21.2 Construction/Repairing of Drainage Sluices

Fifteen drainage sluices will be replaced under the proposed Project in Polder 35/1. Moreover, two sluices will be repaired under this Project. 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 by the contractor. 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 be constructed. After that the foundation treatment

required for the structure will be carried out. The concreting works along with cutting, bending and binding of reinforcement steel will then be performed as per specification. Concrete blocks will be fabricated and placed where required. After construction of approach roads, fitting and fixing of gates and hoisting device will be carried out. Subsequently, gates will be properly painted. The intake and outfall of the gate will be constructed. The concrete blocks will be fabricated for river training works and pitching works will then be conducted.

1.21.3 Construction/Repairing of Flushing Inlets

Seventeen flushing inlets will be replaced under the proposed Project in Polder 35/1. Besides, three old flushing inlets will be repaired. The details description 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.

1.21.4 Re-excavation of Drainage Channels

There are 90 water channels/*khals* in the Polder of which 17 channels will be re-excavated to decrease the drainage congestion. An estimated 0.71 million cubic meters of soil/silt will be excavated from these channels. The excavated soil will be used for strengthening the *khal* banks, in addition to making it available to the farmers. The water channels to be re-excavated under the proposed Project are presented in **Table 4.4** below.

Table 0.4: Channels to be Re-excavated

	Name of Khal	Khal Code	Length (km)	Chainage (km)
1	Terabeka	1	2.50	26.50
2	Satgharer	2	1.00	25.00
3	Gobtolar	4	2.00	23.50
4	Tafalbari	6	6.00	19.33
5	Sonatala	11	2.50	36.07
6	Jheelbonia	19	6.00	14.33
7	Rayenda	20	9.50	12.50
8	Thanar	42	3.50	39.77
9	Khunta	61	3.50	7.92
10	Kumarkhali	64	12.50	6.60
11	Sannashir	73	1.50	0.00
12	Andaria	75	2.00	60.14
13	Farajipara	76	1.00	57.67
14	Kabirajer	79	3.50	54.46
15	Rajapur	81	3.50	44.47
16	Rathiar	84	4.50	50.60
17	Khejura	90	5.50	51.55
	Total		70.5	

For re-excavation of the drainage channels, at first the required tools will be procured. A schematic diagram showing centerline and layout plan will be made for the re-excavation. 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 upstream and downstream locations of the reach, and then soil from the channels will be removed upto required depth and width. The excavated soil/sludge will 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 will be excavated using the above procedures.

1.21.5 Bank Protection and Slope Protection Works

Only one km of bank protection works will be carried out from chainage 0.5km to 1.5 km under the proposed Project. In addition, a total of 17.25 km of slope protection of embankment along the Baleswar River will be carried out from chainage 2 km to 5.5 km, 9 km to 9.95 km, 12.5 km to 14 km and 13.5 km to 25 km.

The first activity will be procurement of construction materials. The slope of the river bank as per design will be prepared. At the same time, the required concrete blocks will be casted or manufactured and guard walls will be constructed. After completion of the preparation of CC blocks, geo-textile bags will be placed along the slope and concrete blocks will be placed on them. A launching apron will be prepared with concrete blocks along with dumping of these blocks in assorted form will be completed up to toe of the river banks. Finally, turfing will be carried out on the slope or crest of the embankments. Proper drainage provision will be kept to avoid formation of rain cuts for surface run off.

1.21.6 Afforestation

Plantation of mangrove forest is proposed for afforestation on the foreshore area. The areas selected for afforestation in the Polder 35/1 are shown in **Figure 4.12**. 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 **22 ha** of foreshore area will be planted with mangroves in the Polder, whereas about **16 ha** of land will be kept for timber saplings and **6 ha** for Golpata (a local tree species). The saplings are to be planted at a spacing of 1.5m x 1.5m. **Figure 4.13** shows the typical cross-section of this plantation.

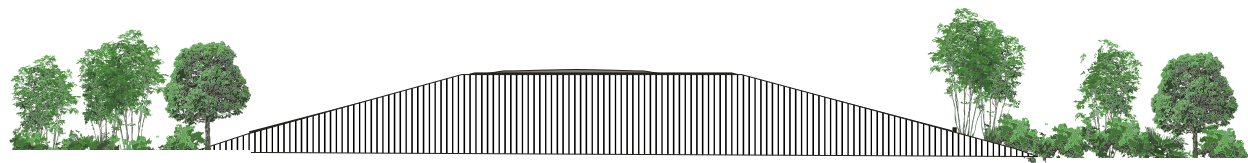


Figure 0.16: Typical Cross Section of Afforestation Works

1.22 Construction Details

1.22.1 Construction Schedule

The works in Polder 35/1 under the CEIP-I are expected to be completed in four years. The construction schedule is present in **Table 4.5**.

1.22.2 Construction Manpower Requirement

Technical and nontechnical manpower will be required for the Project construction works. The will include engineers, technicians, supervisors, surveyors, mechanics, foremen, machinery 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 4.6**.

Table 0.5: 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	<i>Labor shed and site office preparation</i>	■															
A2	<i>Installment of water and sanitation facilities</i>		■														
A3	<i>Installment of Garbage disposal system</i>		■														

	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
B	Procurement system of the project																
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																

	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
D	Re-excavation of Canal																
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																

	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
D5	Earth work by manual labor in all kinds of soil in removing the gross 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																

Table 0.6: Required Manpower for Construction Works

	Required Manpower	Number
1	Engineer	20
2	Machinery Operators	300
3	Mechanics	15
4	Surveyor	25

Source: FS Report, 2012

1.22.3 Construction Material

The construction materials required for re-sectioning and retired embankment, water regulatory sluices and flushing inlets, and bank protection work will includes oil, cement, steel, and sand. Estimated quantities of these materials are presented in **Table 4.7**. The details of availability of soil for embankment works are presented in **Table 4.8**, and shown in **Figure 4.14**.

Table 0.7: Construction Materials

	Description	Quantity	Sources
Re-sectioning and retired embankment			
1	Earth work	2,443,220 m ³	Borrow pits, dredging spoils from re-excavation of drainage channels. Borrow pits will be located on the river side of the embankment. The embankment toe will be 15 m away from the river bank. Soil will be collected from 10 m away of the embankment toe. The detail location of borrow pit is presented in Table 4.8.
Construction of sluices and flushing inlets			
2	Cement	643,507 bag	To be procured from local market
3	Sand	856.00 m ³	To be procured from Khulna
4	Stone	89,442 m ³	To be procured from Khulna
5	Steel	856.00 m ³	To be procured from Khulna
Bank protection			
6	Concrete Blocks	86,687.	To be made at construction site during construction
7	Stones	23,650 m ³	To be collected from Khulna

Table 0.8: Tentative Assessment for Availability of Soil for Embankment Works

	Location (Chainage)		Quantity of earth required (cubic meters)	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed			Total quantity of Earth available	Remarks
	From	To		Location (chainage)	Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	Quantity		
1	0.0 Km	10.5 km	432,577.00	i) 0.0 km to 1.00 km	i) 1 Km x50mx1.5m	75,000	Baleswar	0.0 km to 10.5 km			90% of Soil is available at the borrow pit area but silt is dominant with traces of sand and clay. Rest quantity of earth is to be collected from River bed.
				ii) 1.0km to 2.30 km	ii) 1.2 Km x20mx1.5m	36,000					
				iii) 2.30 km to 3.80 km	iii) 1.5 Km x70mx1.5m	157,500					
				iv) 3.80 km 5.20 km	iv) 1.4 Km x20mx1.5m	42,000					
				v) 5.20 km to 6.30 km	v) 1kmx10mx1.5m	15,000					
				vi) 6.30 km to 7.00 km	vi) 700mx30mx1.5m	31,500					
				vii) 7.00 km to 9.00 km	vii) 2kmx15mx1.5m	45,000					
				viii) 9.0 km to 9.50 km	viii) 500mx10mx1.5m	7,500					
						409,500					
2	10.5 Km	14.5 km	216,149.00				Rayenda Khal	10.50 km to 14.50 km			There is no borrow pit area at this location. So Earth is to be collected from river bed. But River bed soil is silty- clay with trace of sand.
3	14.5 Km	18.5 Km	389,934.00	i) 15.5 km 15.80 km	i) 300m x10mx1.5m	4,500	Baleswar	14.50 km to 18.50 km			50% of Earth is available at borrow area and the rest

	Location (Chainage)		Quantity of earth required (cubic meters)	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed			Total quantity of Earth available	Remarks
	From	To		Location (chainage)	Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	Quantity		
				ii) 15.8 km 17.30 km iii) 17.30 km 18.50 km	ii) 1.5 km x25mx1.5m iii) 1.20 km x70mx1.5m	56,250 126,000					quantity has to be taken from river bed. Soil of the borrow pit area is silty-clay with trace of sand.
						186,750					
4	18.5 km	29.00 Km	782,011.00	i) 18.50 km to 20 km ii) 20 km to 20.5 km iii) 20.5 km to 21.50 km iv) 21.5 km to 24.00 km v) 24.00 km to 25.5 km vi) 25.5 km to 26.5 km vii) 26.50 km to 29.0 km	i) 1.50 km x 60mx1.5m ii) 500mx80mx1.5m iii) 1 km x 70mx1.5m iv) 2.5 km x 40mx1.5m v) 1.50 km x 15mx1.5m vi) 1.0 km x 30mx1.5m vii) 2.5 km x 60mx1.5m	135,000 60,000 105,000 150,000 33,750 45,000 225,000	Baleswar, Bhola	18.50 km to 25.50 km 25.50 km to 29.00 km			90% of earth is available at borrow pit area and the soil of the borrow pit is silty-clay with trace of sand.
						753,750					
5	29 Km	38.00 km	175,144.00	i) 29.0 km to 32.0 km	i) 1.5 km x 20mx1.5m	45,000	Bhola	29.00 km to 38.00 km			Earth is available at borrow pit area and soil of the borrow pit is

	Location (Chainage)		Quantity of earth required (cubic meters)	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed			Total quantity of Earth available	Remarks
	From	To		Location (chainage)	Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	Quantity		
				ii) 33.0 km to 36.0 km iii) 36.0 km to 37.3 km iv) 37.30 km to 38.0 km	ii) 3 km x 50mx1.5m iii) 1.2km x 10mx1.5m iv) 700 km x 15mx1.5m	225,000 18,000 15,750 303,750					silty-clay with trace of sand.
6	38 Km	44.5 km	82,139.00	i) 38.0 km to 40.0 km ii) 40.0 km to 42.5 km iii) 42.5 km to 44.5 km	i) 2 km x 50mx1.5m ii) 2.5 km x 5mx1.5m iii) 2 km x 50mx1.5m	150,000 18,750 150,000 318,750	Bhola	38.00 km to 44.50 km			Earth is available at borrow pit area but silt is dominant with trace of sand and clay.
7	44.5 km	50.00 km	100,997.00	i) 44.5 km to 50.00 km	i) 5.5 km x 30mx1.5m	247,500.00	Bhola	44.50 km to 50.0 km			Earth is available at borrow pit area and soil of the borrow pit is silty-clay but top surface is organic soil.
8	50 km	55.5 km	139,047.00				Sannashir khal	50.00 km to 55.50 km			60% of earth is available at borrow pit area and soil of the borrow pit is silty-clay. But top surface is

	Location (Chainage)		Quantity of earth required (cubic meters)	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed			Total quantity of Earth available	Remarks
	From	To		Location (chainage)	Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	Quantity		
				i) 50 km to 55.5 km	i) 5.5 km x10mx1.5m	82,500.00					organic soil.
9	55.5 km	62.00 km	125,222.00	i) 55.5 km to 59.0 km	i) 3.5kmx10mx1.5m	52,500	Sannashir khal	55.50 km to 62.00 km			Earth is available at borrow pit area but silt is dominant with trace of sand and clay.
				ii) 59.0 km to 62.0 km	ii) 3kmx20mx1.5m	90,000					
						142,500					

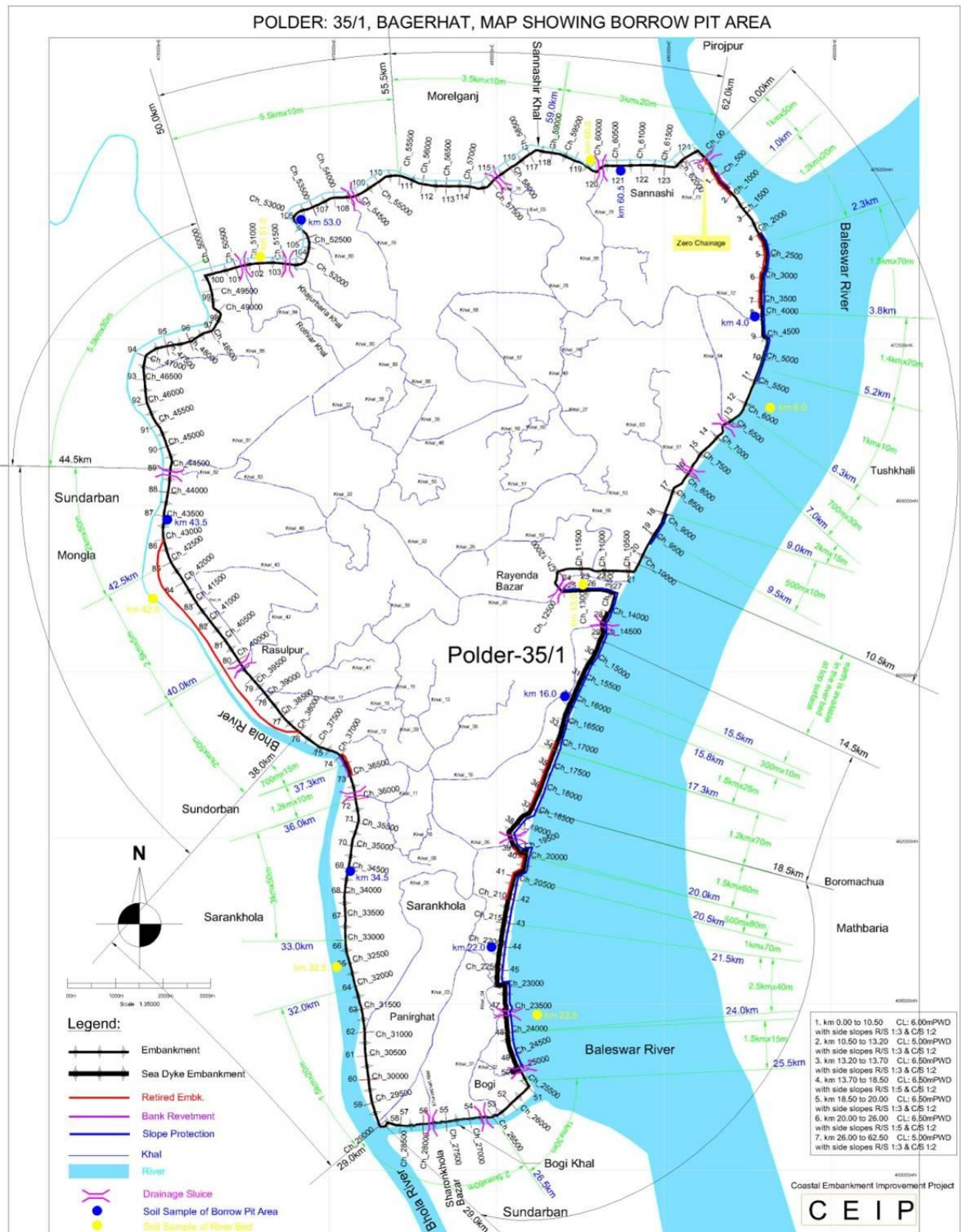


Figure 0.17: Potential Area for Borrow Material

1.22.4 Construction Machinery

A large quantity 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 0.9: List of Construction Equipment and Machinery

	Description	Quantity
1	Boll-dozer	15
2	Dump- truck	25
3	Pay Loader	15
4	Excavator	15
5	Burge	10
6	Engine Boat	15
7	Vibrator	160
8	Compactor	25
9	Mixture Machine	160
10	Mixing-Plant	4
11	Truck	15
12	Tractor	10
13	Generator	60
14	Leveling Instrument	12
15	Total Station	5
16	De-watering System	51
17	Low light pump	50

1.22.5 Construction Camps

A total of 85 camps for labor will be established during construction period. Out of the total camp, 40 camps for embankment works, 15 for sluice works, 17 for flushing inlet works, four for slope protection works, and one 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 55 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.

1.22.6 Vehicular Traffic during Construction

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.

In case of the eastern and central areas of the polder, the materials would be collected from the stock yard at Rayenda and then would to be transported using heavy trucks. The trucks or other vehicles will be used for district road coming from Pirojpur crossing the Sanyashi Khal on ferry. The materials found usable from the polder may be carried through smaller 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 Baleswar River.

1.23 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 the Project Management Unit (PMU).

Project Steering Committee (PSC). The PSC would be chaired by the Secretary of Water Resources and will include the Secretaries of Finance, Agriculture, Environment, Public Health Engineering, Forestry and Wildlife, the Chief Executive officer of selected NGO, and representatives of the local/district administration as its 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 secretary of the PSC.

Project Management Unit (PMU). BWDB will set up the PMU to oversee the development and management of the project. The PMU will be led by the Project Director (PD) appointed by BWDB. The PD will have 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 project progress, 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 staff.

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 compliance with the Environmental Management Plan and Social Action Program and together with the engineering unit implement the communication strategy. The unit will include a Senior Environmental Specialist, a Senior Social Specialists, a Senior 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, asocial specialist and are venue 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 the 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 polders and supervise all the construction. For civil works contracts, the Project Director will serve as the *Employer*, and the Project Supervision Consultant will serve as the *Engineer* for construction supervision. At the site, a *Resident Engineer*, appointed by the consultant, with a team of specialists and inspectors will supervise 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 consists 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.

1.24 Community Participation

1.24.1 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 at 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.

1.24.2 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 a 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 structure, 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.

1.24.3 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.

1.24.4 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 federating bodies functioning at the top level of the hierarchy. The office bearers of the WMF, the 5-member federating body will be selected from among the MC members of WMAs. Important personalities in the area like Member of Parliament or local leader may be nominated as the chair-person of the WMF and other members (not exceeding four) may come from the WMAs by virtue of their importance in controlling the numbers of WMGs.

1.24.5 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 have been included in the Water Management Groups (WMGs) as Functional Groups (FGs). The FGs have the scope of working in the polder O&M under the purview of WMG.

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

Embankment Settler (ES)

ESs are families selected from squatters and project affected persons who do not have any land or lost it by 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 a 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 a 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 Taka3 lacs (BDT 0.3 million) in a single contract. During formation of CBOs women participation in above mentioned groups will be ensured.

1.25 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 a vital role in safeguarding the coastal area; ensuring and increasing agricultural production; improving livelihoods of the people; and mitigating environmental damages. But these are vulnerable to storm surges; high tides; annual floods; land erosion and drainage congestion. In many cases the structures as built have not been found adequate to 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 maintaining the polder system with embankments and structural elements built over there has become a permanently important task.

The 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 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.

1.25.1 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 35/1.

Regulation of Gates

During the pre-monsoon period, the vertical lift gates of each regulator should remain closed for retention of water for irrigating rice crops by low-lift pumps (LLPs). During monsoon (*July to September*), the vertical lift gates should normally remain closed; but may be opened to regulate the water levels inside the polder and 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 the post monsoon season (*October to November*), the vertical lift gates will be operated to retain water in the drainage canals without overtopping the canal banks and increasing the soil moisture level for cultivation. In all these cases there should have enough consultation with the beneficiaries' organizations because agricultural practices, crop varieties; and cropping pattern are changing over 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 Watching 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 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.

e) 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 the most simple, cheap and cost effective maintenance works and are implemented more or less continuously. The field staffs of O&M section of BWDB supervise all preventive maintenance works.

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 that 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.

1.25.2 Maintenance Works

Maintenance of embankments and structures is the most important item of activities in the coastal polders. It is necessary and cannot be avoided because it helps 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 35/1, only those 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, cheap 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

- 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 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

- 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. 480 lacs (USD 6 million) (O & M report, CEIP, 2012).

Emergency Maintenance

Emergency works cover unforeseen interventions that require immediate actions to protect the polder as a whole or a part thereof from the adverse effects of flooding or uncontrolled saline intrusion, associated with damage of lives and properties. This type of work requiring immediate attention includes the closure of an embankment breach, the repair and replacement of flap gates, or the construction of cross dams over canals if structure fails. The estimated emergency maintenance amount is at Tk. 250.00 lacs (USD 3 million) (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.

4.11 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 35/1 project.

1.12 No Objection Certificate

The polder 35/1 is located in the southern hydrological zone in Sharankhola and Morelganj Upazila of Bagerhat District. The unions in the polder include: a) Rayenda, Southkhali, Dhansagar, Khantakata under Sharankhola upazila; and b) Khaulia under Morelganj upazila. Under these unions no archeological sites or any cultural heritage are known to exist which might affect the normal activities of the polder after rehabilitation. The No Objection Certificates (NOCs) from the union chairmen have been obtained and are attached in **Annex B**.

Analysis of Project Alternatives

This chapter presents an analysis of various alternatives considered during the Project feasibility and design stage including the ‘no project’ alternative. As much as possible, environmental and social considerations of these alternatives have also been discussed.

1.13 ‘No Project’ Alternative

The ‘no-project’ option analysis has been carried out to present a clear view of the existing situation of the Polder and to help understand the need of the proposed interventions under CEIP-I. The present situation of the polder is extremely vulnerable to cyclones, storm surges, wave action, and climate change effects, as described in **Section 1.1** of the present EIA also. Most importantly, 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. About 30-40 percent 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, the area under irrigation is limited to merely about 2-3 percent of the total Polder area. The silted water channels are resulting into limited navigation in these water ways, declining fisheries, and increasing environmental pollution.

The interventions proposed in Polder 35/1 under CEIP-I are planned to eliminate the major problems described above. To highlight the present state of various aspects in the Polder and to help understand the importance of the proposed interventions under the Project, the ‘no project’ and ‘with project’ scenarios are compared in **Table 5.1** below.

Table 0.1: Comparison of ‘No Project’ and ‘With Project’ Scenarios

Proposed Works under CEIP-1	‘No Project’ Scenario	‘With Project’ Scenario
Increasing the height (re-sectioning) of embankments (49.7 km)	At a number of locations, the embankments will further deteriorate and will drop below design level. As a result, cyclones, rise in surge heights due to global warming, and tidal actions will inundate the Polder, causing severe damage to the lives and 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. Hence, reduction in loss of lives and assets caused by the natural disasters.
	Because of submerge 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.

Proposed Works under CEIP-1	‘No Project’ Scenario	‘With Project’ Scenario
	Reduction of agricultural area, crisis situation for farmers from January to April (salinity intrusion) and May to August (flooding).	Higher and wider embankments will provide enhanced protection to Polder, facilitating enhanced agriculture activities and increased area for cultivation, thus increasing agriculture output.
	Continued silt deposition inside the Polder due to cyclonic surges and floods would 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 will remain 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 of the project.
Retirement/re-location of the existing embankment (6.3 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 deteriorating 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 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.

Proposed Works under CEIP-1	‘No Project’ Scenario	‘With Project’ Scenario
Bank revetment (1km)	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 (17.25 km)	Continued weakening of embankments; continuous subsidence of embankments due to traffic load and wave action; land resources would continue to be damaged/lost.	Slope protection works will strengthen the embankments and protect them against subsidence, wave action, and wear and tear.
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 30-40 % 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	Wind and wave action during cyclones would cause severe damage.	Effects of cyclone surge, wave action and wind could be mitigated to some extent, reducing loss of lives and assets.

Proposed Works under CEIP-1	‘No Project’ Scenario	‘With Project’ Scenario
Re excavation of Drainage Channels (70.5 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.

The above comparison clearly shows that the ‘no-project’ alternative is not a viable and recommended option and therefore it is rejected.

1.14 Site Selection Alternatives

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

Table 0.2: 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

	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, LY=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
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
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	-

	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
36	55/2D	SD, MD	Patuakhali, Dashmia	8540												MV		99					
37	55/2E	MD, ID	Patuakhali, Dashmina, Boupohol	10535												MV		123					
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	-

	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, LY=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
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 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	35/1	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	

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																							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	Amtali, Kalapara	17530	82	-	0	-	0	-	0	HRZ	15	0	0	MV	15	174	5		0	35	-
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	Satkhiria, 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 &	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

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			Satkhira																				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	-
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	-

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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	-	
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-		Uzirpur,			-		-				LRZ	5		0			25	15		13	33	-	

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	3		Agailjhara																				
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	-
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.																						

1.15 Technical Alternatives

Once the problems being faced by the Polder and its inhabitants had been identified, several technical 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 0.3: Technical Alternatives for Polder 35/1

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.

1.16 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 0.4: 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.
	protection to river bank erosion	Financial savings as the embankments will provide good road transportation routes.	Reduced traffic congestion inside the polder because of improved embankments, which will facilitate vehicular traffic	Reduction of loss of assets which would bring poverty reduction
	Prevention of salinity intrusion in the polder	Improved earning of local people during construction		Improved cropping particularly for small farmers thus alleviating poverty.
		Improved cropping pattern and boosting the local economy		
Bank revetment, slope protection	Enhanced embankment protection against tidal wave action of rivers, provide erosion protection	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.	Improved embankment stability; reduced soil erosion; and provide good means of transportation	Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people.
Foreshore plantation	Enhanced embankment protection against tidal wave action of rivers, provide erosion protection	Financial savings from reduced damages caused by the floods and storms; increased life span for the infrastructure and	Improved embankment stability; reduced soil erosion; enhanced soil quality; improved air	Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
		associated water control structures; improved earnings of local people through employment during bank revetment works and slope protection works.	quality; enhanced aesthetic value of the area.	local people; income from timber and other plantation products.
Replacement of existing drainage sluice with drainage-cum-flushing sluice and construction of new flushing sluices where needed	Better functional performance in both flushing and drainage; achieving the objectives of Polder and CEIP-I	Financial savings against damages due to water logging, drainage congestion, and salinity intrusion.	Removal of inactive sluices would improve the drainage characteristics	Better agriculture practice could be achieved which would improve cropping pattern, enhance local earnings, and reduce poverty.
		Agricultural production will be boosted as dry season rice cropping would increase	Water logging, drainage congestion would be reduced.	
Channel re-excavation	Reduce water logging and drainage congestion	Enhanced agriculture output; the dredged soil can later be used in construction works and will save construction cost	Increase navigability of water ways and fish habitats would improve, the ecosystem will be enhanced	Increase in cultivable area, increased availability of irrigation water thus increased farm income for local community; increased farm labor opportunities.

1.17 Alternatives during Construction

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

1.17.1 Material Storage

For project works in Polder 35/1, 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 Rayenda, 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.

1.17.2 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 2.44 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 one the better options 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 0.71 million cubic meters of earth will be obtained from re-excavation of channels during implementation of rehabilitation works inside the Polder. This option minimize the cost of excavation for the borrow material, though the cost of transportation to work site will be slightly more than the first option, in addition to some environmental and social impacts such as traffic congestion and air pollution within the Polder.
- Some quantity of soil can be sourced from borrow pits inside the Polder. For this purpose consent of the land owners will have to be obtained and mutually agreed compensation will have to be paid them. This option will entail cost of excavation similar to the first option but more than the second option discussed above. Other considerations including cost of transportation and environmental and social impacts are likely to be similar the ones for the second option, though land degradation may take place in addition to the air quality and traffic congestion.
- If the 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 send 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 this material has also not been finalized. This decision is likely to be taken during the construction phase.

1.17.3 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.

1.17.4 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 some minor quantity 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 Sanyashi Khal on ferries or other appropriate vessels.

Construction materials required during construction in the north side (close to Sanyashir khal) 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.

Waterways

The Polder 35/1 is surrounded by two rivers (Baleswar, Bhola) along the east-west periphery side and two khals (Bogi khal, Sonyashi khal) along the north-south periphery. Baleswar River (east), is a large river considering its depth and width. The river remains navigable throughout the year and can be used for transportation purposes during construction.

For construction works in the north, south and west portion of the Polder, Bogi khal (lake) and Bhola River can be used. However, these water bodies are small in both width and depth and therefore small boats are recommended in these water bodies. For construction in other parts of the Polder, Baleswar River is the most feasible route for waterway transportation considering the overall effectiveness in transportation through this river.

Roadways

The materials stored in the stock yard can be transported to the construction sites using different types of roads (i.e. district road, upazila road, and rural road) inside the Polder. While transporting materials to the stock yard from Khulna or other suitable locations, road ways are recommended. The district road from Khulna to Rayenda is recommended to be used for its good quality. There are two other roads entering into the Polder from the north direction crossing the Sanyashi khal (one entering Dhansagor union directly and the other entering Baniakhali mauza). But the qualities of these roads are not appropriate for easy movement of dump trucks and other larger vehicles on a more frequent basis.

Environmental and Social Baseline

This Chapter describes the existing environmental and social conditions in respect of Land and agriculture resources, water resources, environmental quality, fisheries, ecosystems, Livestock and poultry and socio-economic aspects of the Project area.

1.18 Land Resources

1.18.1 Topography

The Polder 35/1 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. Before construction of the Polder, the area used to be inundated by tidal flooding and was vulnerable to storm surges because of its flat topography. 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. In the Polder area, the elevation of the settlement and agriculture land ranges from 1.88 m to 2.77 m, and 0.98 m to 1.88 m above mean sea level, respectively. 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. **Figure 6.1** shows the elevation of the Polder.

1.18.2 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.

The Polder35/1 lies in agro-ecological zone of the Ganges Tidal Floodplain (AEZ-13) (**Figure 6.2**). The characteristics of this region are discussed briefly below.

Ganges Tidal Floodplain

This region occupies an extensive area of tidal floodplain in the southwest of the country. The Ganges Tidal Floodplain has low relief compared to the Ganges River Floodplain. The area is crisscrossed by innumerable tidal rivers and creeks whose banks generally stand less than a meter above the adjoining basins. The whole of this zones lies within the cyclone prone area.

This area is flooded during high tide, either throughout the year or during rainy season when rivers entering from the north brought in increased flows under natural conditions. In the southwest, the polder embankments have cut off this tidal flooding in places, but basin sites are flooded by rain water which accumulates during the monsoon season. The rivers are saline throughout the year in the west. In the east, they carry fresh water to the coast during rainy season and become saline only during the dry season. Most of the eastern half of the region remains non-saline throughout the year. The tidal and seasonal flooding are mainly shallow, but basins in the north are moderately-deep flooded during the monsoon season.

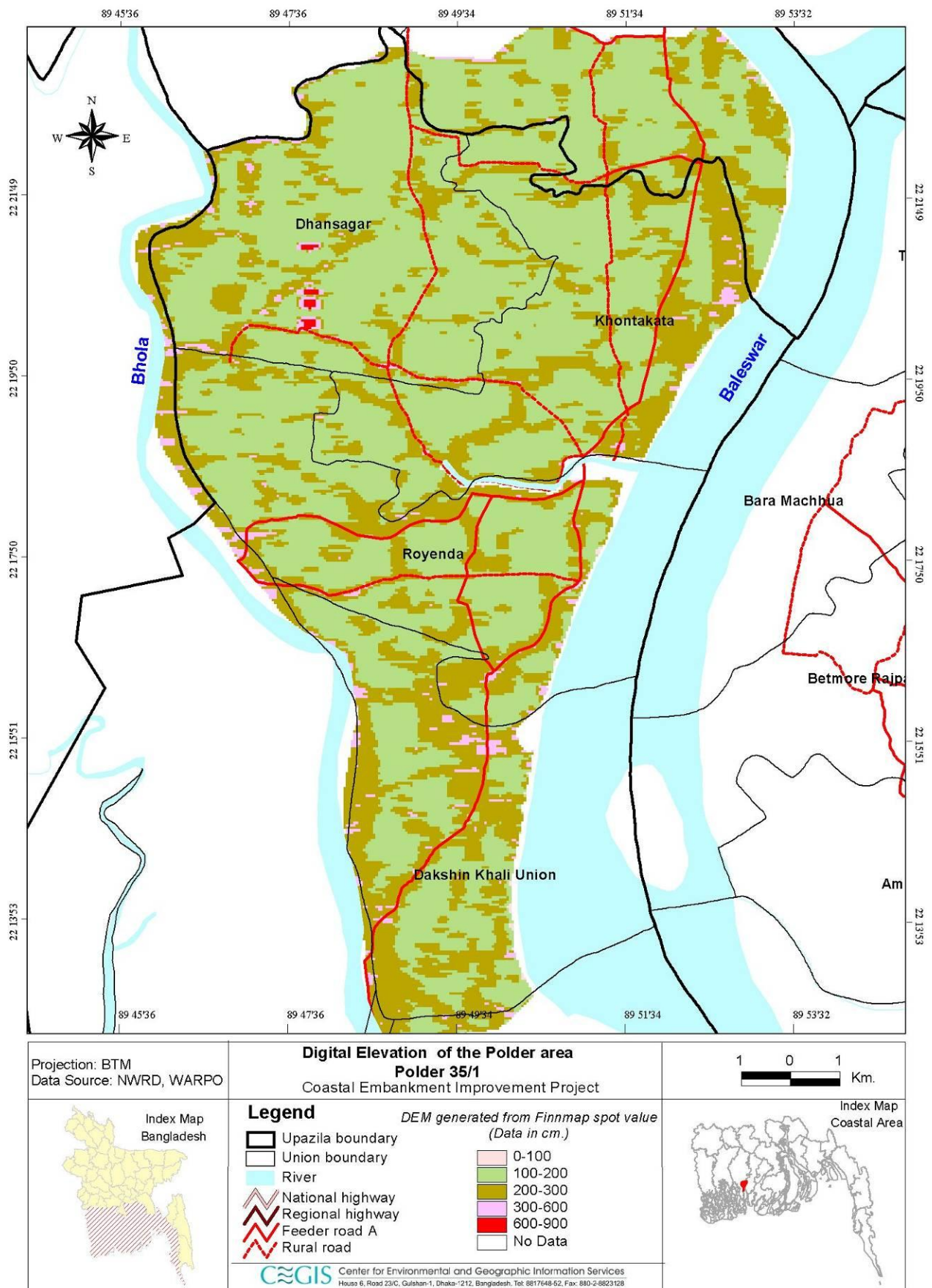


Figure 0.1: Elevation of Polder 35/1

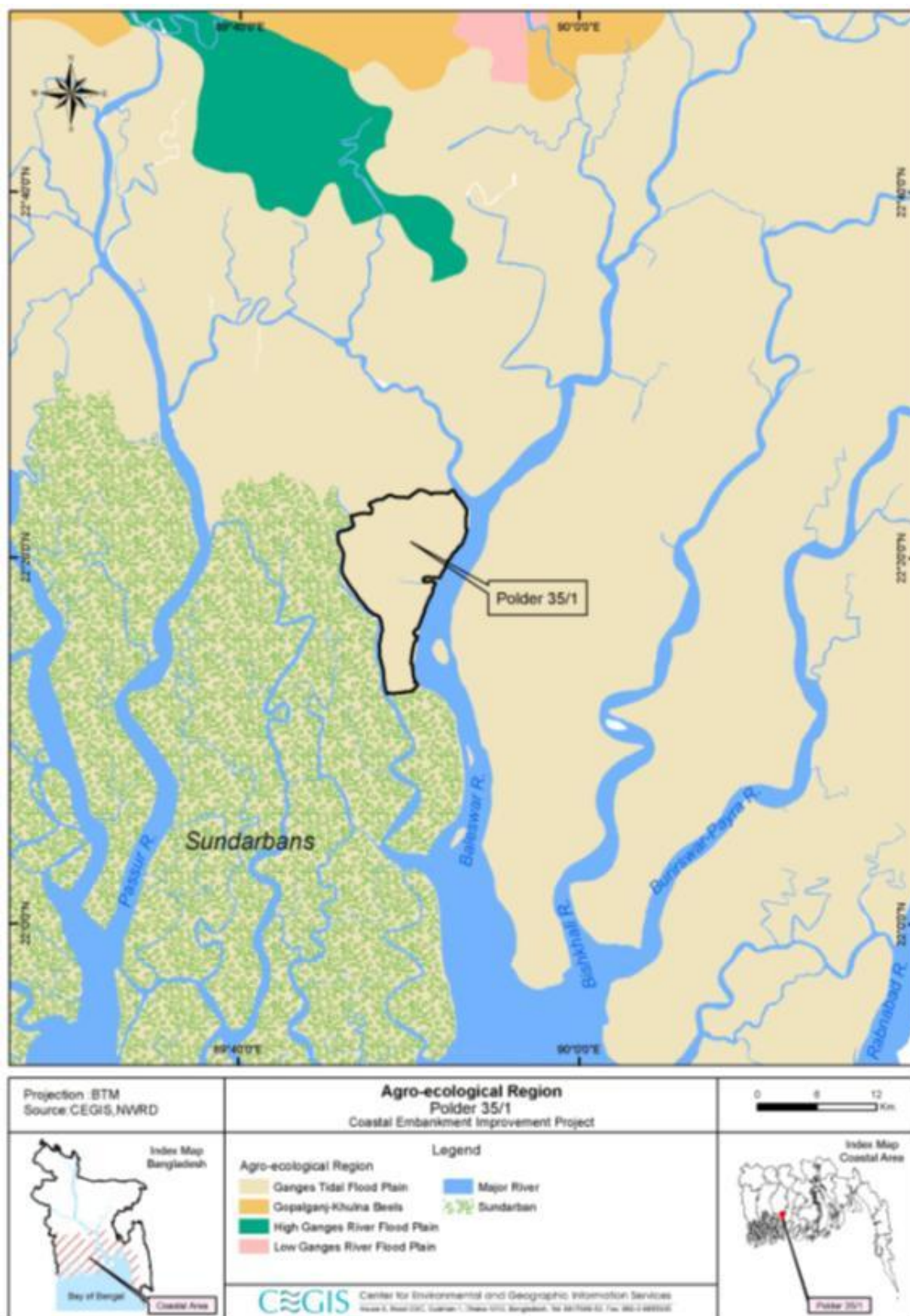


Figure 0.2: Agro-ecological Zones in the Area

1.18.3 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, and is a very important aspect for crop production. It is observed that the soil texture varies from clay to clay loam in the Polder 35/1; see **Table 6.1**.

Table 0.1: Soil Texture in Project Area

	Percentage of NCA				
	Clay	Loam	Clay Loam	Sandy Loam	Sand
Topsoil (0-15cm)	10	-	90	-	-

Source: CEGIS estimation from SRDI, 2012

1.18.4 Land Types

Land type classification in the country is based on depth of inundation during monsoon season due to normal flooding on agriculture land. There are five land types: High Land (HL, flooding: depth 0-30 cm); Medium Highland (MHL, flooding depth: 30-90 cm); Medium Lowland (MLL, flooding depth: 90-180 cm); Low Land (LL, flooding depth: 180-360 cm); and Very Lowland (VLL, flooding depth: above 360 cm).

About 11 percent, 87 percent and 2 percent of the net cultivable area in the Polder 35/1 falls under HL, MHL, and MLL land types, respectively. The distribution of land types under Polder 35/1 is shown in **Table 6.2**.

Table 0.2: Land Types in Polder 35/1

Land Types/Flooding	Area (ha)	Percent of Net Cultivable Area
High Land (0-30 cm)	1,155	11.11
Medium Highland (30-90 cm)	9,045	86.97
Medium Lowland (90-180 cm)	200	1.92
Lowland (180-360 cm)	-	-
Very Lowland (above 360 cm)	-	-
Total	10,400	100.00

Source: Feasibility Report (Agriculture) of CEIP, 2012

1.18.5 Land Use

The total area of the Polder 35/1 is 13,058 ha of which 10,400 ha is Net Cultivable Area (NCA). The land utilization for crop production is about 80 percent in different seasons. About 20 percent area is covered by settlements, water bodies, and other structures. The single, double and triple cropped areas

are about 49 percent, 40 percent and 11 percent, respectively. Land use pattern in the Polder is shown in **Figure 6.3** and presented in **Table 6.3**.



Figure 0.3: Land Use in Polder 35/1

Table 0.3: Present Land Use of Polder 35/1

	Area (ha)	Percentage
Total Agriculture Land	10,400	80.00
Single Cropping	5,075	48.80
Double Cropping	4,170	40.10
Triple Cropping	1,155	11.10
Settlements	1,543	11.00
Water bodies	1,115	9.00
Gross Area	13,058	100.00

Source: Feasibility Report (Agriculture) of CEIP, 2012

1.18.6 Farming Practices

Farming practices within the Polder have adjusted to agro-climatic conditions as well as to physical, biological, and socioeconomic factors prevailing in area. The siltation of rivers and channels cause drainage congestion/water logging during monsoon, natural calamities like cyclones and storm surges cause devastating crop damage in the area. Scarcity of suitable non-saline water for irrigation during dry months (December through April) is a major impediment towards expansion of irrigated agriculture in the Polder. The conditions in polder are also suitable for fish cum rice cultivation. A limited variety of crops are grown due to the conditions prevailing in the area. Rice is the main crop grown because of its adaptability to diversified ecological conditions. Sugarcane and banana are annual crops in the area. Various non-rice crops like, summer vegetables, winter vegetables, jute, oilseeds and spices are also grown in the area.

1.18.7 Present Cropping Patterns and Intensity

Existing main cropping pattern of the polder area is *fallow - high yield variety (HYV) rice - fallow*, which is practiced in about 31 percent of the NCA. The second prominent cropping pattern is *fallow - local rice - pulses*, which is practiced in about 17 percent of the NCA. The cropping patterns *fallow - local rice - fallow* and *HYV rice - HYV rice - pulses* are practiced in about 13 percent and 11 percent of the NCA, respectively.

The single, double and triple cropped areas cover about 49 percent, 40 percent and 11 percent of the NCA in the Polder, respectively. The overall cropping intensity of the Polder area is about 162 percent. Detailed cropping patterns along with land type are presented in **Table 6.4**.

Table 0.4: Present Cropping Pattern in Polder

Land Type	Kharif-I (Mar-Jun)	Kharif-II (Jul-Oct)	Rabi (Nov-Feb)	Area (ha)	Percent of NCA
High Land	Sugarcane	Sugarcane	Sugarcane	20	0.2
High Land	Orchard	Orchard	Orchard	335	3.2
High Land	Fallow	T. Aman (rice) (HYV)	Potato	77	0.7
High Land	Fallow	T. Aman (rice) (local variety)	Potato	23	0.2
High Land	T. Aus (rice) (local variety)	Fallow	Vegetables	280	2.7

Land Type	Kharif-I (Mar-Jun)	Kharif-II (Jul-Oct)	Rabi (Nov-Feb)	Area (ha)	Percent of NCA
High Land	Fallow	T. Aman (rice) (local)	Chilies	35	0.3
High Land	Fallow	T. Aman (rice) (local)	Wheat	40	0.4
High Land	Fallow	T. Aman (rice) (HYV)	Fallow	345	3.3
Sub- total				1,155	11.0
Medium Highland	T. Aus (rice) (HYV)	T. Aman (rice) (HYV)	Pulses	1,150	11.1
Medium Highland	Fallow	T. Aman (rice) (Local)	Pulses	1,800	17.3
Medium Highland	Vegetables	T. Aman (rice) (HYV)	Fallow	230	2.2
Medium Highland	Fallow	T. Aman (rice) (HYV)	Boro (rice) (HYV)	65	0.6
Medium Highland	Fallow	T. Aman (rice) (HYV)	Pulses	545	5.2
Medium Highland	Fallow	T. Aman (rice) (HYV)	Fallow	2,888	27.8
Medium Highland	Jute	T. Aman (rice) (HYV)	Spices	5	0.1
Medium Highland	Fallow	T. Aman (rice) (Local)	Pulses	1,035	10.0
Medium Highland	Fallow	T. Aman (rice) (Local)	Fallow	1,322	12.7
Sub-total				9,045	87
Medium lowland	Oilseeds	Fallow	Spices	20	0.2
Medium lowland	Spices	Fallow	Oilseeds	20	0.2
Medium lowland	Fallow	Fallow	Boro (HYV)	160	1.5
Sub-total				200	1.9
Total				10,400	100

Sources: Feasibility Report (Agriculture) of CEIP, 2012

1.18.8 Cropped Area and Production

Total cropped area is about 16,875ha of which rice occupies about 11,220 ha and the rest 5,655 ha is covered with non-rice crops (**Table 6.5**). The rice cropped area is about 66 percent of the total cropped area. Among the rice crops, T. Aman (HYV), T. Aman (local), T. Aus (HYV), T. Aus (local)

and Boro (HYV) are contributing about 47 percent, 38 percent, 11 percent, 2 percent and 2 percent of NCA, respectively.

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:

$$\text{Total crop production} = \text{damage free area} \times \text{normal yield} + \text{damaged area} \times \text{damaged yield}.$$

Table 0.5: Cropped Area, Production and Crop Damages in Polder 35/1

Crop name	Total Cropped Area (ha)	Damage Free Area		Damaged Area		Total Production (tons/year)	Production Lost (tons/year)
		Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)		
Rice-T. Aus (Local)	280	280	2.46	-	-	689	-
Rice-T. Aus (HYV)	1,150	1,150	3.54	-	-	4,071	-
Rice-T. Aman (Local)	4,255	3,191	2.15	1,064	1.3	8,244	904
Rice-T. Aman (HYV)	5,310	3,717	3.85	1,593	1	15,903	4,540
Rice-Boro (HYV)	225	225	3.3	-	-	743	-
Total rice	11,220	8,563		2,657		29,650	5,444
Sugarcane	20	20	30	-	-	600	-
Orchard	335	335	10.5	-	-	3,518	-
Summer Vegetables	230	173	10	58	6	2,070	230
Wheat	40	40	2.6	-	-	104	-
Chilies	35	35	1	-	-	35	-
Pulses	4,530	4,530	1	-	-	4,530	-
Potatoes	100	100	15	-	-	1,500	-
Winter Vegetables	280	196	10	84	5	2,380	420
Spices	45	45	3	-	-	135	-
Oilseeds	40	40	2	-	-	80	-
Total non-rice	5,655	5,514		142		14,952	650
Total	16,875	14,077		2,799		44,602	6,094

Source: Feasibility Report (Agriculture) of CEIP, 2012

1.18.9 Crop Damage

Crop damage data for the years 2007-2011 has been collected from the field in consultation with stakeholders/farmers and officials of the DAE. The data from outside and inside the embankments, drainage congested areas and salinity affected areas are considered for this purpose. Average annual crop damage along with damaged area has been evaluated. Crop production loss has been calculated using the formula:

$$\text{Crop production loss} = \text{Total cropped area} \times \text{damage free yield} - (\text{damaged area} \times \text{damaged yield} + \text{damaged free area} \times \text{damage free yield}).$$

In the Polder about 2,657 ha and 142 ha area of rice and non-rice crops respectively, was affected due to drainage congestion, drought, salinity, natural calamities, pest and diseases infestation. Total production loss of rice and non-rice crops has been estimated as 5,444 metric ton and 650 metric ton, respectively (**Table 6.5**).

1.18.10 Agricultural Inputs

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, tri superphosphate (TSP) and muriate of potash (MP). The quantities of fertilizer used by majority of farmers in Polder 35/1 are generally lower than the recommended doses and the proportions of urea, TSP and MP applied are unbalanced. The use of urea is higher than other chemical fertilizers. Some farmers use manure for vegetables, oilseeds and chilies. Unbalanced use of chemical fertilizers affects the soil health which would be ultimately reflected in crop yields.

Table 0.6: Fertilizer and Pesticide Use in Polder 35/1

Crop Name	Fertilizer (Kg/ha)						Cost of Pesticides (Tk/ha)
	Urea	TSP	MP	Gypsum	Zinc	Manure	
T. Aus(LV)	109	89	35	-	-	-	780
T. Aus(HYV)	196	178	133	-	-	-	900
T. Aman (Local)	109	89	35	-	-	-	880
T. Aman (HYV)	145	80	40	-	-	-	1,200
Boro (HYV)	217	178	100	-	-	-	4,000-5,000
Summer Vegetables	150	50	30	-	-	250	620
Wheat(HYV)	217	100	108	-	-	-	-
Chilies	174	220	217	-	-	-	400-500
Pulses	-	-	-	-	-	-	-
Potatoes	250	135	170	-	-	-	2,500-3,000
Winter Vegetables	120	80	70	-	-	-	1,500
Spices	120	60	40	-	-	200	300
Oil seeds	165	90	60	-	-	-	1,000
Banana	240	150	90	-	-	-	1,500

Source: Feasibility Report (Agriculture) of CEIP, 2012

The use of pesticides depends on the degree of pest infestation. Majority (80 percent) of the farmers apply pesticides in T. Aus (local/HYV rice), T. Aman (local/HYV rice), Boro (rice), chilies, potatoes, vegetables and spices. The major insects as reported by the farmers are yellow stem borer, rice hispa, ear cutting caterpillar, brinjal shoot, and fruit borer, and fruit weevil. Local farmer have reported that

they are using different types of pesticides such as Ripcord, Furadan (granular), Basudin (liquid) and Theovit (powder) to prevent pest infestation in rice, vegetables and other crops. Farmers of the Polder area apply pesticides once or twice in a season.

Seeds

Seed plays a crucial role in crop production. Quality seed is important to get optimum yield from any crop. More than 85 percent germination rate, free from disease infestation and high yield potential need to be considered for seed selection.

Most of the farmers in the project area use their own seeds in case of local variety, such as T. Aus and T. Aman. Medium and small farmers meet their requirement from neighboring farmers or local markets. Various improved crop seeds (HYV/hybrid) are provided by the government and private seed dealers. Market price of the private dealer seeds is higher than seeds provided by the government. The salt tolerant varieties are not available in the market and the farmers are also not aware of them. The seed rate for different crops is presented in **Table 6.7**.

Table 0.7: Inputs Used in Different Crops in Polder 35/1

Crop Name	Seed (Kg/ha)	Irrigation cost (Tk)	Equipment used for cultivation		Power tiller cost
			Power tiller (%)	Bullock	
T. Aus (LV)	40-42	-	80	20 own	5000
T. Aus (HYV)	35-40	-	80	20 own	4000-5000
T. Aman (Local)	40-45	-	80	20 own	4000-5000
T. Aman (HYV)	30-35	-	80	20 own	4000-5000
Boro (HYV)	30-35	-	1600-2000	20 own	4000-5000
Summer Vegetables	3-4	500-700	80	20 own	4000-5000
Wheat (HYV)	140	-	80	20 own	4000-5000
Chilies	1-1.5	-	80	20own	4000-5000
Pulses	75-80	-	Before harvesting	20own	4000-5000
Potatoes	3800-4000	2000-2500	80	20 own	4000-5000
Winter Vegetables	2.5	1000	80	20 own	4000-5000
Spices	600	300	80	20 own	4000-5000
Oil seeds	7-8	-	80	20 own	5000
Orchard(Banana)	2470	1000	80	20 own	5000

Source: Feasibility Report (Agriculture) of CEIP, 2012

Irrigation

Irrigation is provided mainly for HYV Boro crops in the Project area. Irrigation coverage of the study area is about 2 percent (225 ha) of the total NCA during the dry season. As of now, surface water is the only source of irrigation. Peripheral rivers (Baleswa and Bhola) and *khals* (Sannashir khal, Maddhya Barisal khal, Rayenda khal, Tetulbari khal, Rajoir khal, Khontakata khal, Kaiya khal,

Kumarkhali khal, Bogi khal, Terabaka khal) are the sources of irrigation water. Most of the farmers provide irrigation for raising seedlings, land preparation and transplantation up to mid March. The salinity of the surface water gradually increases and reaches around 10.0 dS/m during April-May, which is far above tolerance limit ($EC < 2.0-4.0$ dS/m). The surface water salinity comes down to around 1.5 dS/m during monsoon season.

Farmers of the Polder area are practicing rice-golda (prawn) during T. Aman season from the month of June when relatively non-saline water is available in the rivers and *khals*. During Boro season they can easily use this storage water for irrigation purpose by low lift pumps (LLPs). Aus (HYV), Aus (local), T. Aman (HYV) and T. Aman (local) crops in the Project area are grown under fully rain-fed conditions.

Farm Labor

In the Project area, mostly manual labor is used for cultivation. Therefore, agricultural labor is considered as one of the essential inputs for crop production. The labor requirement does not remain the same throughout the year and varies from crop to crop. The average labor used in the Project area is presented in **Table 6.8**.

Table 0.8: Labor Used for Different Crops in Project Area

Crop	Labor(Person/ha)
T. Aus (Local) (rice)	150
T. Aus (HYV) (rice)	150
T. Aman (Local) (rice)	160
T. Aman (HYV) (rice)	160
Boro (HYV) (rice)	170
Sugarcane	180
Orchard	140
Wheat	180
Chilies	170
Pulses	120
Potatoes	200
Summer Vegetables	180
Winter Vegetables	180
Spices	140
Oilseeds	120

Source: CEGIS estimation, 2012

1.19 Water Resources

1.19.1 River System

Polder 35/1 is hydrologically linked with the Baleswar River in the east and the south, Sannasir Khal in the north and the Bhola River towards west. The main rivers of the area – the Baleswar and the Bhola – flow from north to south. The surrounding rivers have tidal influence and affect the flooding and drainage system of the polder. The Baleswar River is a perenneial river flow. The avegage width of river is 1644 meters. It is more than 60 times wide at the downstream compared with its starting width. During the monsoon the flow increases and rising waters overflow its banks into the floodplains. This is a tidal river and the mximum range of tidal in this river is three meters. Boats ply through the year round. The internal drainage system of the polder consists of numerous *khals* namely *Terabeka Khal*, *Satgharer Khal*, *Tafalbaria Khal*, *Sonatala Khal*, *Jheelbonia Khal*, *Thanar Khal*, *Khunta Khal*, *Kumarkhali Khal*, *Farajipara Khal*, *Kabirajer Khal*, *Rajapur Khal*, *Rayenda Khal*, *Khejurtalar Khal*, *Khontakata Khal*, *Andaria Khal*, *Sannasi Khal*, *Boroikoli Khal*, *Rothiar Khal*, *Rasulpur Khal*, *Dhansagar Khal*, *Gabtala Khal*, and *Rajoir Khal*. In recent years, the peripheral rivers have increased in size, especially after the occurrences of Aila and Sidr. The rivers have eroded more lands due to the deterioration of erosion protection structures and have eventually increased in width. **Figures 6.4 to 6.7** present some photographs of the rivers and *khals* of the area.

1.19.2 Navigation in Rivers and Khals

The Baleswar is a large river and remains navigable throughout the year, while Bogi Khal (lake), Sanyashir Khal, and Bhola River are small water bodies in both width and depth and remain navigable only during the wet season. For waterway communication, the Baleswar River is the most feasible route considering its size and depth. The internal lakes/*khals* of the polder are suitable for the movement of mostly small non-motorized boats only.



Figure 0.4: Baleswar River during high tide



Figure 0.5: Bhola River during high tide



Figure 0.6: Rajoir Khal inside polder during low tide



Figure 0.7: Sannasi Khal inside polder during high tide

1.19.3 Land Erosion and Sedimentation

Land erosion is a common problem in the southwest coastal areas of Bangladesh. In Polder 35/1, erosion is found mainly in Rayenda, Southkhali, Dhansagar, Khantakata, Khaulia and other locations along the Baleswar and Bhola rivers. Erosion has destroyed land, homes and become an environmental and social hazard. During Sidr and Aila, surge wave action severely eroded the polder embankments. In addition, regular tidal waves also weaken the embankments.

Sedimentation is also a problem in the polder area. Sediment characteristics are different in the tidal rivers and *khals*. The Baleswar and Bhola rivers have sandy beds and mud banks along the shore, whereas tidal creeks tend to be choked with very fine sediments. Especially in the Bhola River, the sedimentation rate is higher than in the Baleswar River and the width of the Bhola River has become narrower than before. In the tidal rivers, suspended sediments are mainly composed of silt and clay. On average, roughly 1 to 1.5 feet of sedimentation takes place in the main rivers and *khals* each year. Sedimentation in most of the internal *khals* of the polder area causes bed level to rise and reduces their conveyance capacity.

1.19.4 Tropical Cyclones and Tidal Flooding

The cyclones Sidr (2007) and Aila (2009) directly affected about 60% of the polder population. The storms also affected the Sundarbans, which provides natural protection to the south west of Bangladesh. During Aila, surge water entered the polder area by overtopping the left bank of the Baleswar River and the right bank of the Bhola River. As a consequence, the embankments at various locations, particularly along the Baleswar at Tafalbaria, Shouthkhali, and Khantakata were badly damaged. Resident communities reported that about 40-50% of area of the polder (3,698 to 4,622 ha) has been regularly inundated since the 2007 cyclone. At present, most of the embankments and structures are in poor condition, especially along the Baleswar River. Around 35% of the polder area (3,235 ha) is under threat of high tide and cyclones.

Cyclones have been hitting the coasts of Bangladesh very frequently in the recent decades. From 1901-1957 only 11 cyclones hit the coastal areas of Bangladesh, while from 1957 to 2009 as many as 55 cyclones hit the area. Therefore over 52 years, the number of cyclones hitting the 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), the 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.

1.19.5 Drainage Congestion and Water Logging

The water channels and *khals* of the Polder cannot drain out properly particularly during monsoon, due primarily to high siltation in these water bodies as well as due to the malfunctioning of regulators. Drainage performance of the linked *khals* has also been gradually decreasing due to sedimentation at both upstream and downstream of the regulators. Most of the water control structures are damaged which hampers proper drainage of the polder. Over the years, improper maintenance of internal *khals* and malfunctioning of regulators have resulted in drainage congestion particularly in the **Baniakhali, Nalbunia, Rajapur, Amragachhia** and **Morellabad** areas of the polder. Tidal waters frequently enter the polder areas through the breached embankments especially in Khontakata, Rayenda and Southkhali unions and exacerbate drainage congestion. Roughly 12-15% area of the polder (1,200-1,600 ha) is facing drainage problem during monsoon. The spatial distribution of drainage congestion in the polder is shown in **Figure 6.8**.

In the polder, about 2.5% of the gross area is affected by water logging. As a consequence of the deteriorating hydraulic structures, drainage congestion and water logging has been increasing in recent years, as reported by the polder inhabitants (CEGIS field survey, 2012).



1.20 Environmental Quality

Air, noise, water and soil quality were measured during the field survey. The locations are mentioned in the following tables. 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 6.9**.

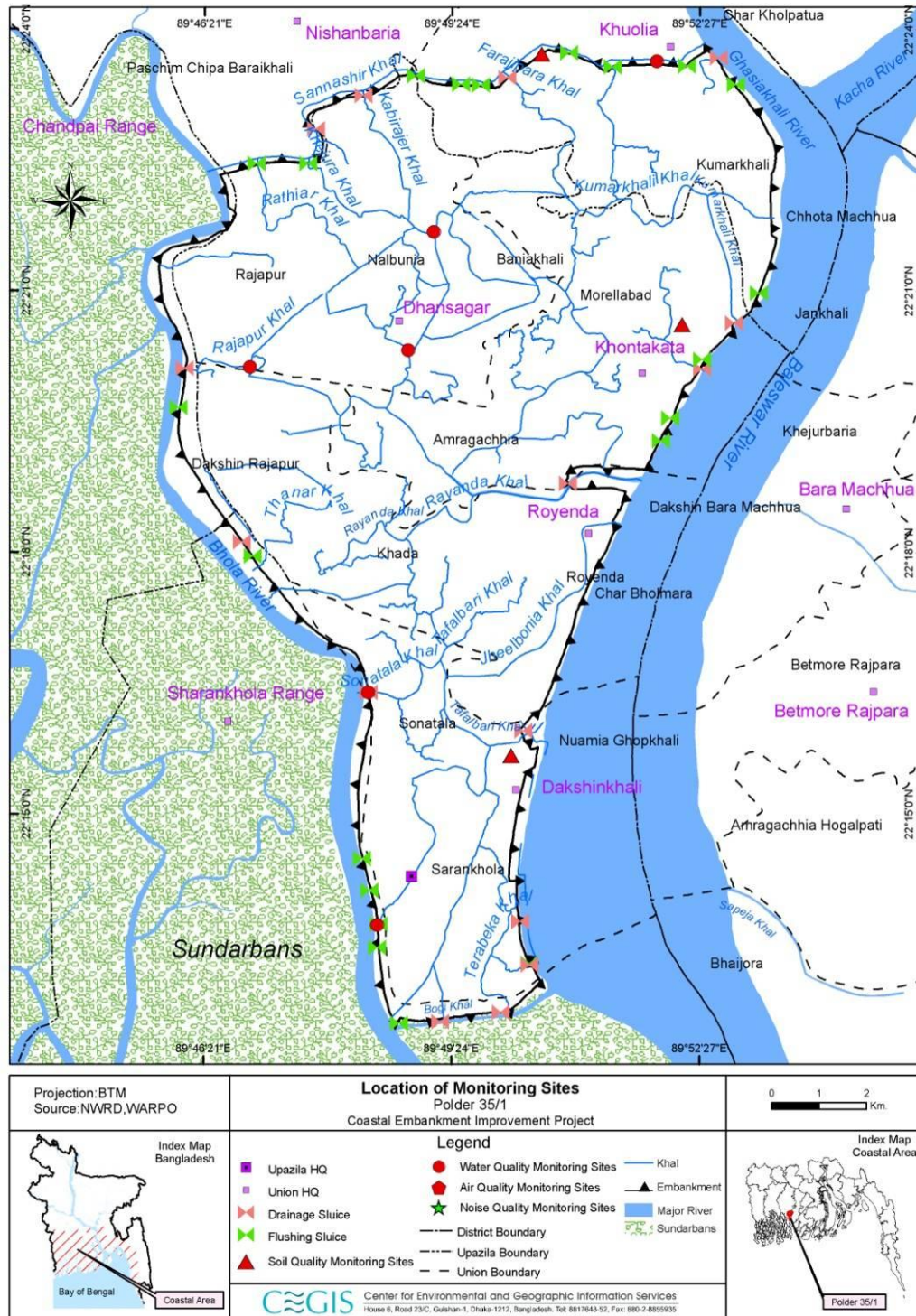


Figure 0.9: Locations of Air, Noise, Water and Soil Quality Monitoring Stations

1.20.1 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. There is no heavy industry within the Polder. **Table 6.9** presents the ambient air quality measured at Sarankhola, Bagerhat district. The values suggest that the concentrations of the key air quality parameters (suspended particulate matter - SPM, oxides of sulphur - SO_x, and oxides of nitrogen - NO_x) are well within the standard values for Bangladesh given in **Table 6.10**.

Table 0.9: Ambient Air Quality Parameters in Project Area

Sample Location	Air Quality Parameters		
	SPM (µg/m ³)	SO _x (µg/m ³)	NO _x (µg/m ³)
In front of upzila polli unnyon board office, Sarankhola, Bagerhat	140	11	20
Bus stand more	155	10	21
Thana moor, Sarankhola, Bagerhat	150	9	18
In front of Upazila health complex office	148	8	16

Source: CEGIS field survey, May 2012

Table 0.10: Standards of Ambient Air Quality

	Concentration in µg/m ³		
	SPM	SO ₂	NO _x
Industry	500	120	100
Commercial	400	100	100
Residential and rural area	200	80	80
Sensitive	100	30	30

Source: Environment Conservation Rules, 1997

1.20.2 Noise

Vehicular traffic on road is the key source of noise in the Polder, as shown in **Table 6.11** below. Some of the measured noise values exceed the prevailing standards, which are given in **Table 6.12**.

Table 0.11: Daytime Noise Levels in Project Area

	Location	Noise Level (dB)			
		Normal Condition	Normal Condition (Average)	With Traffic	With Traffic (Average)
1	Rayenda panch rasta more	61.9	63.3	80.2	82.425
		67.3		82.3	
		60.0		83.0	
		64.0		84.2	
2	Pollimongol, Dhansagar	60.9	60.84	74.8	72.97
		66.3		72.5	
		64.1		71.6	

	Location	Noise Level (dB)			
		Normal Condition	Normal Condition (Average)	With Traffic	With Traffic (Average)
3	Rayenda bazar	54.5			
		58.4			
		62.4			
		64.8	64.97	70.7	70.8
		62.0		71.9	
		68.1		69.8	
*All measurements have been taken during daytime.					

Source: CEGIS field survey, December 2012

Noise levels exceeding 80dB (with traffic situation) is usually considered as noise pollution in Bangladesh. However the permissible limits for the country are less [Table 6.12]. The study area can be regarded as a mixed area, and the noise levels observed in the study area has been found to be exceeding the permissible limits for daytime.

Table 0.12: Noise Standards in the Country

	Limits in dB	
	Daytime	Night time
	(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

1.20.3 Water Quality

The effectiveness of the Polder built in sixties and onwards is declining 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 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 EIA 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 and are presented below.

Surface Water Quality

The surface water quality in Polder 35/1 is influenced by the hydrological connections of the water bodies within the polder area with the surrounding rivers. The rivers and lakes around the polder i.e.

the Baleswar River, Sanyashi canal (north), Bogi Lake (south) and Bhola 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 qualities parameters remain within the acceptable range. **Table 6.13** presents the water quality measured in selected locations of the polder. The standard values of these indicators set by the DoE, Bangladesh are also shown for comparison purposes.

Table 0.13: Water Quality in Polder 35/1

Sample Location		Water Quality Parameters					
		Salinity (ppt)	Temperature (°C)	TDS (ppm)	EC (mS/cm)	DO (mg/L)	pH
Sonyasi Khal		3	22.0	1,654	1.88	5.6	7.0
Bidhanshagor Khal		-	20.9	1,357	1.45	5.4	7.0
Amragachia khal		-	23.1	1,298	1.65	5.1	7.1
Rajapur khal		4	22.5	1,456	2.01	5.8	7.0
Shonatola sluice		4	22.2	1,624	2.35	6	7.0
Shonatola joler gate		1‰	21.5	1,632	1.96	5.7	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 about 30% of the polder area is thus affected. This happens because of the following reasons: (i) about 6% 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 (0-4 parts per thousand) as shown in **Table 6.13** above, since rain water inside the polder was still present and tidal flow from the ocean was yet to intrude.

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 lower in the dry season than in the wet season. The values of DO inside the polder (measured in the month of December) ranged between 5 to 6 mg/l, which complies with the DoE standards for irrigation as well as for fisheries and aquatic life.

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. The temperature of water bodies affects fish habitats and their oxygen holding capacity. The mean temperature of the water bodies inside the polder area ranged from 20°C to 23°C (**Table 6.5**) in December. This value lies within the DoE standards for both irrigation and fish habitats.

Total Dissolved Solids (TDS). The natural range of TDS 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 (ranging between 1,200 and 1,700 mg/l – see **Table 6.13**) because of 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 determine the variety and abundance of plants and animals in a given aquatic situation.

Electrical Conductivity (EC). EC as a water quality indicator is useful 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 ($TDS = 640 \times EC$), the effects of which have been discussed above. The values of EC inside the polder ranged between 1.5 and 2.5 mS/cm. The higher values of EC indicate that the water bodies inside the polder area are more affected by saline water than fresh water.

Ground Water (GW) Quality

The groundwater quality parameters, measured in the polder during the month of May, were found to comply with the drinking water quality standards (ECR'97). The ground water quality of the polder area is presented in **Table 6.14**.

Table 0.14: Groundwater quality at Sharankhola

	Groundwater Quality Parameters						
	Temp (°C)	pH	Chloride (mg/l)	Iron (Fe) (mg/l)	SS (mg/l)	Arsenic (As) (mg/l)	Coliforms
Tube well water of upazila primary school, Sharankhola, Bagerhat	25.2	7.45	532	0.88	4	0	Nil
Drinking water quality standard as per ECR'97		6.5 – 8.5	150 – 600	0.3 – 1.0	10	0.05	50 or less

Source: CEGIS field survey, May 2012

1.20.4 Soil Quality

Soil Salinity

The soil has very low to very high saline content in the dry season (2 - 24.4 ds/m) and soil pH ranges from 6.5-7.0 (Field Survey, 2009-2010). The fertility level is generally high with medium to high organic matter content.

Soil sample were collected for polder 35/1, The collected soil samples were sent to the Agrochemical & Environmental Research Division, Institute of Food and Radiation Biology of Atomic Energy Research Establishment, Savar, Dhaka for detecting 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 (furan) exists in the soil samples.

Table 0.15: Pesticide Residues Analysis Report

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

1.20.5 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 28°C to 34°C. Maximum temperature occurs in the month of April and is around 34°C and average temperature during monsoon is about 26° C. Monthly minimum temperature ranges from 9°C to 23°C and the minimum temperature (December to February) is around 9°C to 11°C. **Figure 6.10** shows the monthly maximum, mean and minimum temperature at Mongla station.

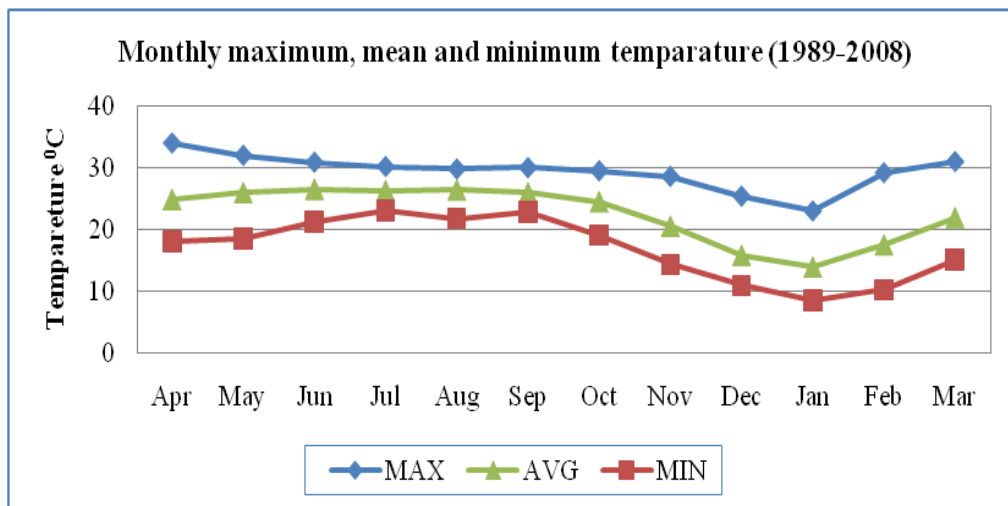


Figure 0.10: Temperature Data for Project Area

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 35/1 is increasing by approximately 0.027 °C each year (see **Figure 6.11**).

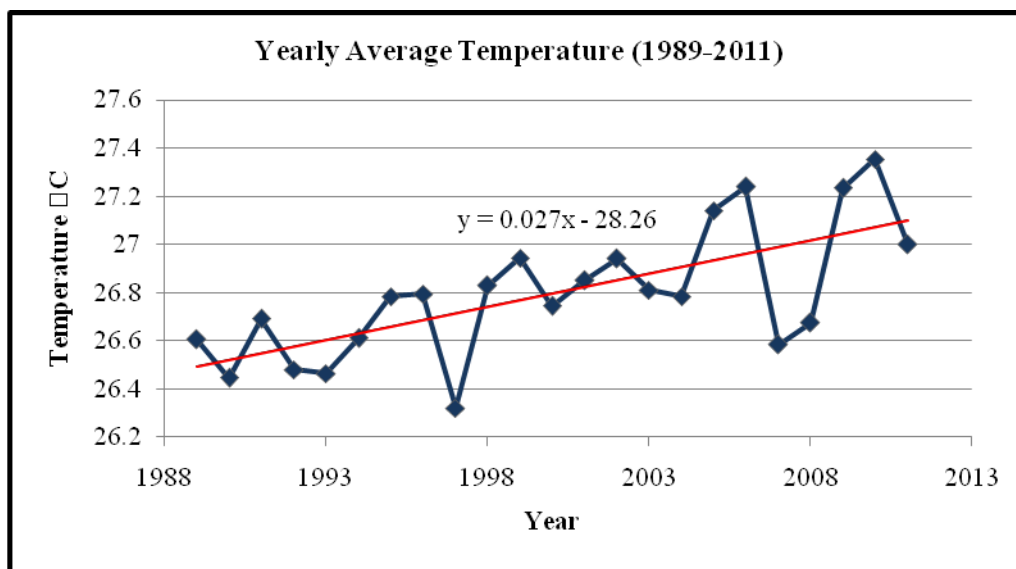


Figure 0.11: Yearly Average Temperature in Project Area

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 6.12** shows humidity data for the Project area.

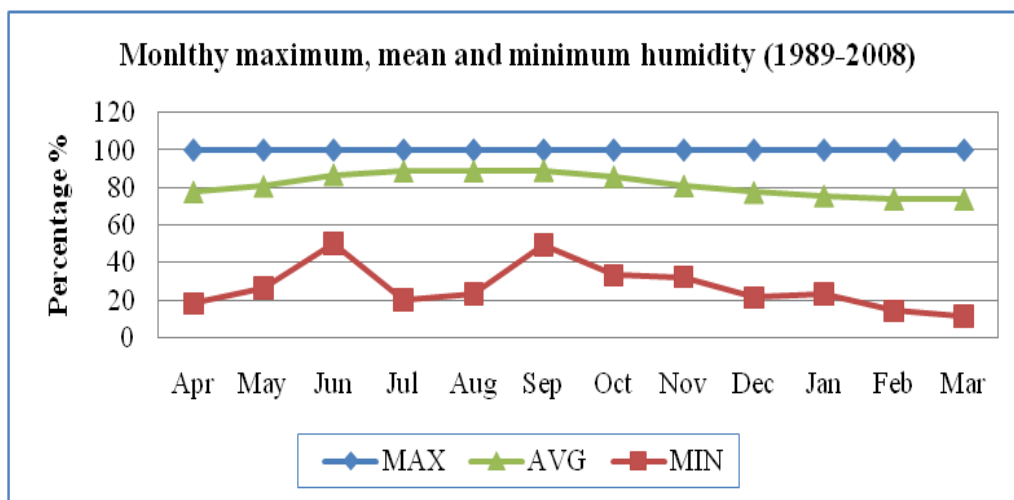


Figure 0.12: Humidity Data for Polder Project Area

Data of yearly average relative humidity have also been collected from the BMD station at Mongla. The trend analysis for the relative humidity values of Polder 35/1 shows that the humidity increases by approximately 0.021 percent each year (see **Figure 6.13**).

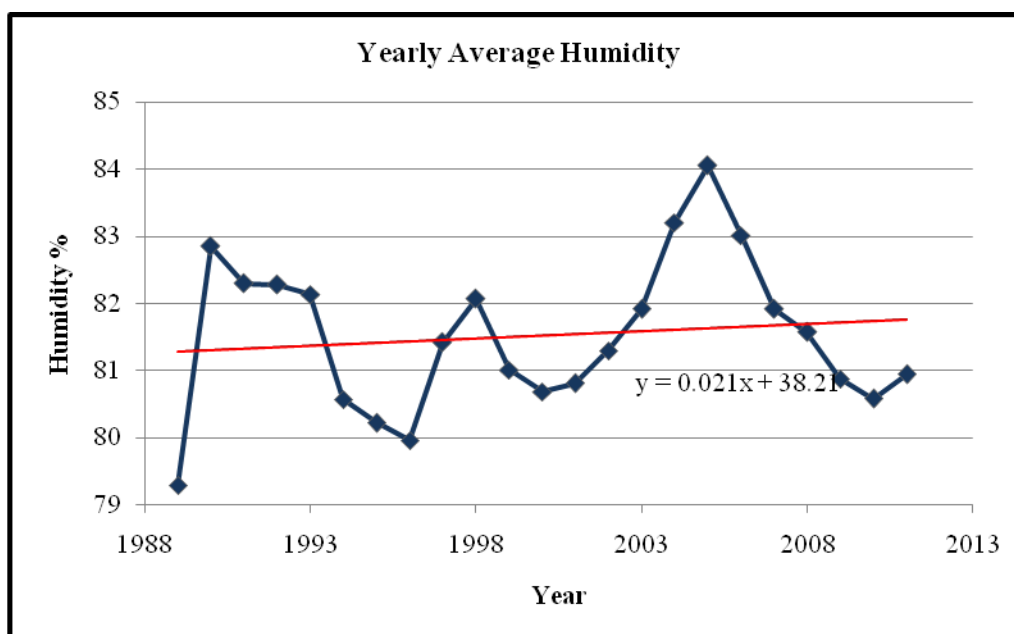


Figure 0.13: Average Yearly Humidity in Project Area

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 6.14**.

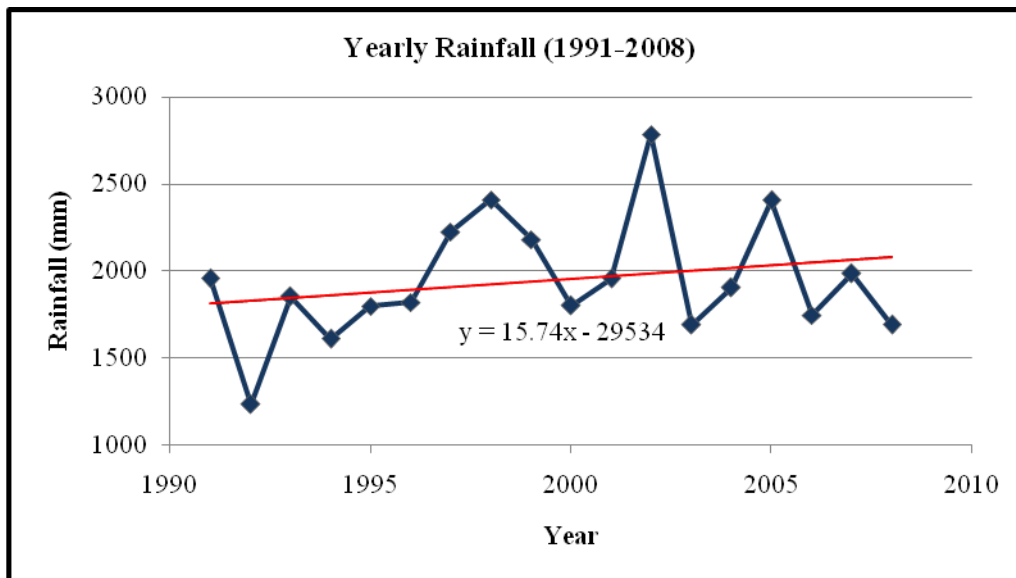


Figure 0.14: Rainfall Data for Project Area

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 6.15**).

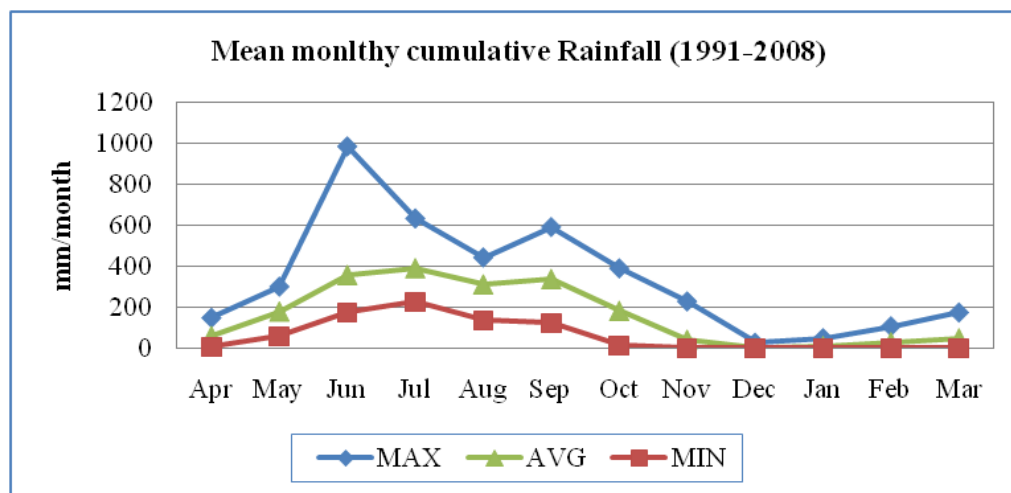


Figure 0.15: Rainfall Trent in Project Area

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.

1.21 Fisheries Resources

Fish resources of the Project area are diversified with different fresh and brackish water habitats. Open water fish habitat of the Project area including surrounding rivers and *khal*, such as Bhola and Baleswar rivers, Kumarkhali khal, Madda Barisal khal, Rajor khal, Khontakata khal, Koyer khal, Rayenda khal, Tafalbari khal, Gabtola khal, Bogi khal, Chalitagonia khal, Rasulpur khal, Uttar Rajapur khal, and Bandakata khal act as major arteries of fish migration into and within the Project area. These water bodies play a vital role in maintaining fish productivity of internal open water. Bulk

of the commercial fish production is coming from culture fish habitats while the main catch of capture/open water habitats comes from different seasonal and perennial *khals* particularly during wet season. The numbers of fishermen in the areas are decreasing due to shrinkage of open water fish habitat, loss of *khal*-river connectivity, presence of water regulatory structures on the *khals* and their improper operations, and the corresponding decrease of fish catch. On the other hand, aquaculture is developing in suitable ponds of congestion free highland area within the Polder.

The Polder area is relatively moderate in fish biodiversity though with a decreasing trend because of morphological changes, obstruction to spawning migration, natural and anthropogenic drying up of wild fish habitats, indiscriminate fishing, and loss of river-*khal* connectivity and water regulatory structures on *khals*, as described earlier as well. Aquatic environmental quality is satisfactory in the Polder though some pollutants are released from cultivation fields affecting fish production. The water quality of internal *khals* is likely to be degraded particularly during dry season due to improper management of water regulators.

The key fisheries problems and issues identified during baseline survey are as follows:

- indiscriminate fishing using monofilament gill net, and overexploitation of fishes by using huge number of narrow meshed estuarine set bag nets for fishing;
- siltation of internal *khals*, causing loss to the year round river-*khal* connectivity;
- indiscriminate harvest of post larvae shrimp 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.
- increasing of salinity which adversely affects pond fish culture;
- insufficient loan facilities for aquaculture practices; and
- insufficiently trained farmers in the Polder area.

1.21.1 Fish Habitats

Habitat Classification

Fish habitat of the Polder area can be classified under two broad categories: capture fisheries and culture fisheries. Internal *khals* are considered under capture fish habitat, whereas the ponds are classified under culture fisheries, comprising of four types including prawn ponds (*galda gher*), shrimp pond (*bagda gher*), homestead ponds and commercial ponds. Fish habitat in internal *khals* occupies about 7 percent of the total fish habitat whereas culture fish ponds occupy about 93 percent of the water bodies of the Polder area. Fish habitats inside Polder are shown in **Figure 6.16**.

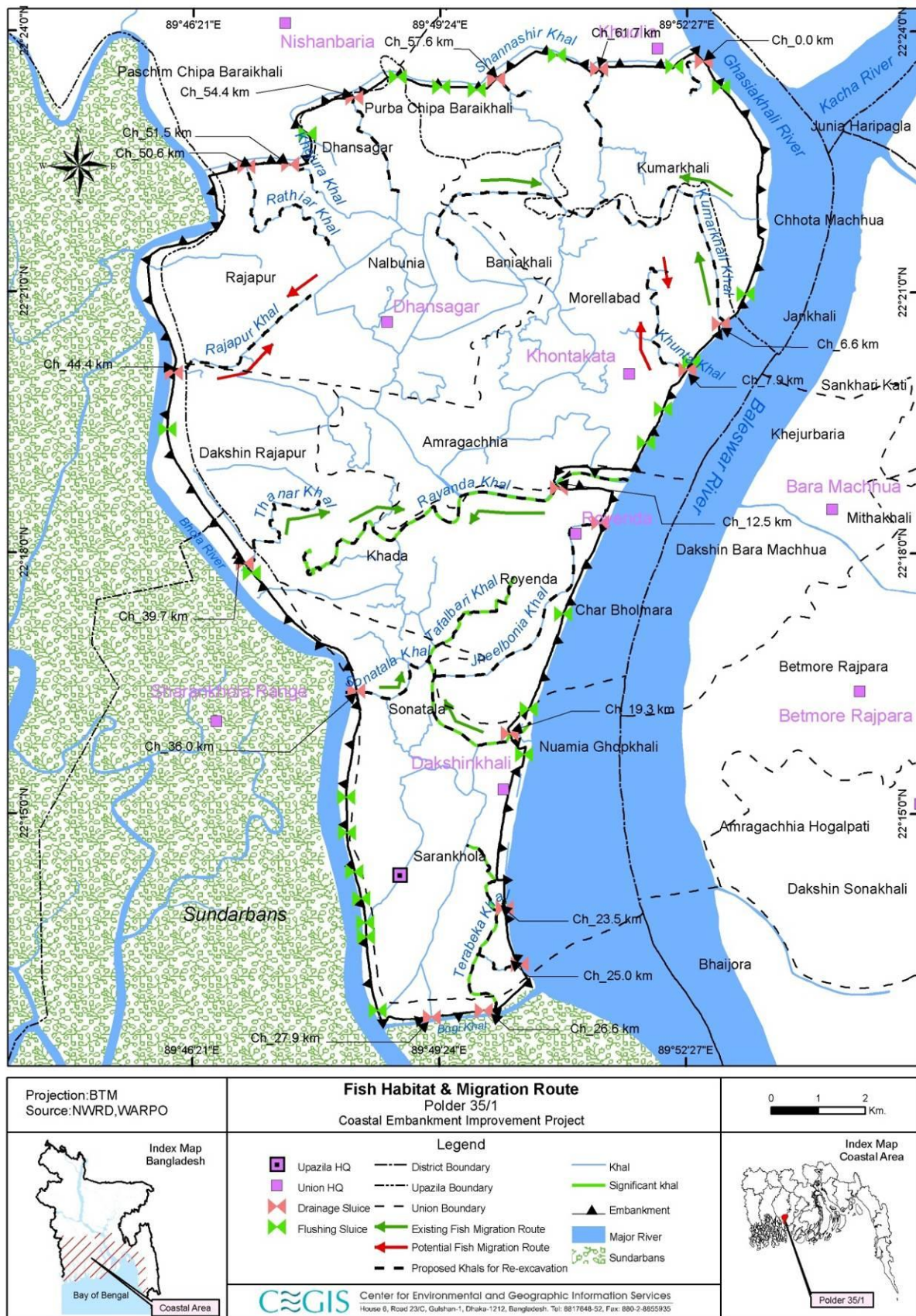


Figure 0.16: Fish Habitats and Migration Routes in Polder 35/1

Habitat Distribution

Nearly 87 percent of the Polder area fish habitats are situated in Sarankhola Upazila followed by Morrelganj Upazila. The open water fish habitat of the Polder covers about 187ha while the culture fish habitat covers about 2,359ha, as shown in **Table 6.16**.

Table 0.16: Fish Habitats in Polder 35/1

	Fisheries Category	Habitat Types	Area (ha)	Percent of Total Area of Fish Habitat
1	Capture	Khal	187.0	7.3
2	Culture	Prawn ponds (galda gher)	622.0	24.4
3		Shrimp ponds (bagda gher)	38.5	1.5
4		Homestead ponds	1,602.0	62.9
5		Commercial ponds	96.0	3.8
	Sub-total		2,358.5	92.7
Grand Total			2,545.5	100.0

Source: Draft final of fisheries report, Volume-I, CEIP, 2012

The Rayenda khal, Tafalbari khal, Gabtola khal, and Chalitagonia khal provide major migration routes for brackish fish species.

Average depth of internal *khals* is about 1-1.5 m which is sufficient for fish habitation, whereas depth of seasonal *khals* such as Maddy Barisal Khal, Rajor Khal, Kuntakata Khal, Kayar Khal, Bogi Khal is inadequate for sheltering fish juveniles. Local people report that siltation rate in the internal fish habitats of the Polder is about 1-2 cm per year. *Khal* beds are silted up due to deposition of sediments coming from agriculture fields and tidal action.

In an area of about 622 ha of farm-land under prawn culture (*galda*) with other fishes are being farmed/cultivated by individual land owners in a scattered manner. This practice has been found in Chairman bari, Bidhansagar at Dhansagar union, Madha khantakata at Khankata union, and Malia Rajapur at Royenda union. On the other hand, shrimp (*bagda*) is cultivated in an area of only about 39 ha. The farming pattern is shrimp (*bagda*), followed by mixed farming of rice and prawns (*galda*).

1.21.2 Fish Production

The estimated total fish production of the Project area is about 2,205 metric tons. Bulk of the inland fish production (about 99 percent) comes from culture fisheries while the rest comes from capture fisheries habitats (see **Table 6.17** and **Figure 6.17**). Fish production trend from capture/open water fisheries is declining in the Project area. The production is declining mostly due to obstacles to fish migration and shrinkage 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 0.17: Fish/Prawn/Shrimp Production from Different Habitats in Project Area

	Fisheries Category	Habitat Types	Area (ha)	Total Production (MT)	Percent of Production
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	Fisheries Category	Habitat Types	Area (ha)	Total Production (MT)	Percent of Production
1	Capture	Khal	187.0	24.0	1.1
2	Culture	Prawn ponds (<i>galda gher</i>)	622.0	778.0	35.3
3		Shrimp ponds (<i>bagda gher</i>)	38.5	9.0	0.4
4		Homestead pond	1,602.0	1,184.0	53.7
5		Commercial pond	96.0	211.0	9.6
	<i>Sub-total</i>		2,358.5	2,182.0	98.9
Grand Total			2,545.5	2,206.0	100

Source: Draft final of fisheries report, Volume-I, CEIP, 2012

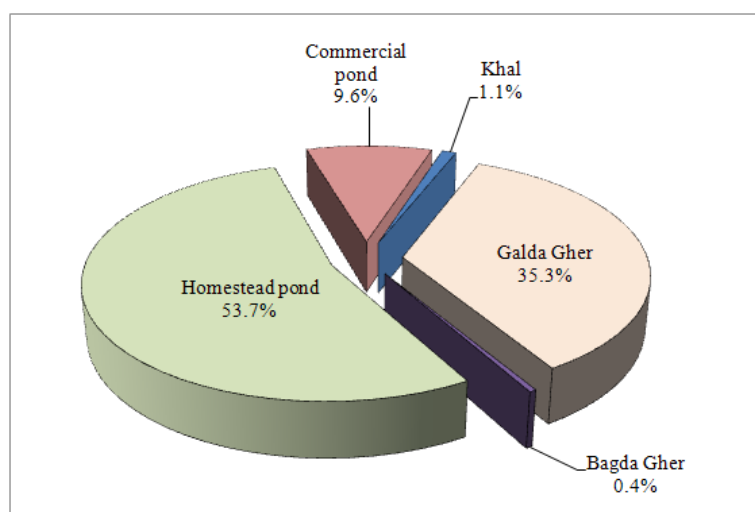


Figure 0.17: Fish/Prawn Production (percent) from Different Sources in the Polder

1.21.3 Fishing Effort

Fishermen

It is reported during the field investigation and consultations with the local people that about 10 percent of the fishermen households are engaged in commercial fishing while about 30 percent of households are involved in part time, and 60 percent of households are in subsistence level fishing in and around the Polder area. Fishermen are mostly Muslim (80 percent) and rest (20 percent) comes from Hindu caste. They usually catch fish in the nearby tidal floodplain, rivers and *khangs*. The available fisheries occupations of the area are mainly fishermen, fish traders, and fish farmers. Around 5-10 percent women of the traditional fishermen families are involved in collection of post larvae shrimp in the Polder area.

Fishing Method and Seasons

Fishing in the Polder area is mostly carried out with the help of monofilament gill net (*current jal*). In addition, seine net (*ber jal*), drag net (*net jal*), cast net (*jhaki jal*), push net (*thela jal/khochon*), *badha jal*, *golsha jal* and fish trap (*borsi*, *aton/charu*) are also used for fishing in the Polder area. Fishing in seasonal canals as well as in peripheral rivers starts in May and continues up to next March. Most of fishermen are involved in collection of post larvae prawn and post larvae shrimp from May to July and January to February, respectively. During rest of the time of the year, they are mainly engaged in other fishing. The seasonality of major fishery is furnished in the **Table 6.18**.

The traditional fishermen catch fish in the rivers and perennial *khals*. The commercial fishermen of the Project area catch fish in the peripheral rivers by using engine boats, *jala nauka* and dingy boats.

Table 0.18: Fishing seasonality of the Polder area

Seasonality of fishing types													
Fishing types	Seasonality												
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
	Boishakh	Jaishthya	Ashar	Shravan	Bhadra	Ashwin	Kartik	Margashirsha	Pausa	Magha	Phalgun	Chaitra	
Current jal													
Chandi													
Poma jal													
Net jal													
Badha Bendi jal													
Jhaki jal													
Charu/Aton													
	High		Medium			Low		No occurrence					

Source: Field Survey, 2012

Fishing Gears

Six 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) *chandi jal*, which is used to catch ilish fishes; (c) *poma jal*, which is used to catch Poa fish; (d) cast net, locally known as *jhaki jal*, which is used to catch rui, katla, puti, pua, bagda, golda, and phasa; (e) drag net locally known as *net jal* which is used to catch post larvae shrimp and prawn; (f) *badha jal*, which is used to catch baila, chingri, punti, tengra, gulsha as well as other type of small fishes. Around 20 percent of fishermen have fishing boats and around 70 percent fishermen have fishing gears/nets. Traditional fishing gears of the Polder area are cast net (*jhaki jal*), drag net (*net jal*), lining (*borshi*), fishing traps (*aton*) (see **Figure 6.18**)



Jhaki jal

Net Jal

Figure 0.18: Different Types of Fishing Gears – Jaki Jal (left) and Net Jal (right)

1.21.4 Fish Migration

The riverine and Polder area resident fish species migrate for spawning and feeding through open and regulated *khals* from late June to August. Perennial *khals* such as Rayenda khal, Tafalbari khal, Gabtola khal, and Chalitagonia khal along with other seasonal internal *khals* are used as feeding and shelter ground of most of the open water fishes. 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. Due to siltation and water control structures hamper the migration of fish and other aquatic biota. Local people within the Polder report that overall fish migration status is poor to moderate in the Project area due to the following reasons:

- 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.

1.21.5 Fish Biodiversity

The Project area is moderate in fish biodiversity though biodiversity of fishes has been declining 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 (rice) cultivation are some of the causes of gradual declining of fish abundance and biodiversity. The Polder area comprises an assemblage of both fresh and brackish water fish species (see **Figure 6.19**).



Figure 0.19: Fish Species of the Polder

List of the fishes of different habitats of the Project area is presented in **Table 6.19**.

Table 0.19: Indicative Fish/Prawn/Shrimp Species Diversity in the Polder

Scientific Name	Local Name	Habitat Type			
		River	Khal	Gher	Fish pond
Brackish water species					
Macrobrachium rosenbergii	Golda (prawn)	P	P	P	P
Macrobrachium rudi	Bagda (shrimp)	P	P	P	A
Metapenaeus monocerus	Harina	P	P	P	A
Macrobrachium malcolmsoni	Sotka Icha	P	P	A	A
Polynemus paradiseus	Ramchos	P	A	A	A
Clarias batrachus	Kain	P	A	A	A
Apocryptes bato	Dogri	P	P	A	A
Setipinna phasa	Phasa	P	P	A	A
Tenualosa ilisha	Ilish	P	A	A	A
Sperata aor	Ayre	P	P	A	A
Sillaginopsis panijus	Tular dandi	P	A	A	A
Mystus vitatus	Tengra	P	P	P	A
Mystus cavasius	Gulsha tengra	P	P	P	A
Pseudapocrytes elongatus	Chewa	P	P	A	A
Osteobrama cotio	Dhela	P	A	A	A
Mugil persa	Persa	P	P	P	A
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 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
Aorichthyses aor	Ayre	P	A	A	A
Mystus vitatus	Tengra	P	P	A	A
Mystus cavasius	Gulsa	P	P	A	A

Scientific Name	Local Name	Habitat Type			
		River	Khal	Gher	Fish pond
<i>Glossogobius giuris</i>	Baila	P	P	A	A
<i>Leander styliferus</i>	Gura chingri	P	P	A	P
<i>Culture fish species</i>					
<i>Labeo rohita</i>	Rui	P	A	A	P
<i>Catla catla</i>	Catla	P	A	A	P
<i>Cirrhinus mrigala</i>	Mrigal	P	A	A	P
<i>Sarotheradon nilotica</i>	<i>Nilotica</i>	A	A	A	P
<i>Telapia mossambica</i>	Telapia	A	A	P	P
<i>Ctenopharyngodon idella</i>	Grass carp	A	A	P	P
<i>Puntius gonionotus</i>	Thai sarputi	A	A	P	P
<i>Pangasius pangasius</i>	Pungas	P	A	A	P

A=Absent and P=Present

Source: Field survey, 2012

1.21.6 Species of Conservation Significance

Fish species which are locally unavailable for last 10 years or have become rare as reported by the local fishermen and concerned elderly people are given in **Table 6.20**.

Table 0.20: List of Species of Conservation Significance

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
<i>Lates calcarifer</i>	Koral	✓	
<i>Macrobrachium rudi</i>	Katali chingri	✓	
<i>Wallago attu</i>	Boal	✓	
<i>Channa marulius</i>	Gajar	✓	
<i>Anabas testudineus</i>	Koi	✓	
<i>Aspidoparia morar</i>	Moral	✓	
<i>Acanthopagrus latus</i>	Datina	✓	
<i>Setipinna phasa</i>	Phasa		✓
<i>Glossogobius giuris</i>	Baila		✓

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
<i>Channa punctatus</i>	Taki		✓
<i>Channa triatus</i>	Shol		✓
<i>Channa marulius</i>	Gojar		✓

Source: Field survey, 2012

1.21.7 Area of Conservation Significance

The Rayenda khal, Tafalbari khal, Gabtola khal, and Terabeka khal are used as feeding and spawning ground of most of the open water fishes. These khals are marked as the area of conservation significance.

1.21.8 Fish Marketing, Post Harvest Facilities and Damages

Local fishermensell bulk of their catch either directly to the local fish market (Sannasir Bazar, Amtali Bazar, Rayenda Bazar, Tafalbari Bazar, Gabtola Bazar, Chaltagonia Bazar, Sarankhola Bazar, Rasulpur Bazar, Rajapur Bazar, Baniakhali Bazar, Amragachia Bazar, Bangla Bazar, and Bandakata Bazar) or to fish traders or buyers (*beopari*) coming from places like Bagerhat and Khulna. Fish farmers sell their fishes to the fish traders coming from Bagerhat and Khulna.

Price of shrimp (*bagda*) is 300 Tk per kg and of prawn (*golda*) is 550 Tk per kg. No structured fish landing center is found in the area. Ice from ice plants is used for cooling/freezing the harvested fish. No well-equipped fish storage facility is available in the area. Transportation facility at root level is moderately developed. There is no private or government hatchery inside the Polder. Availability of fish feeds for culture ponds is insufficient. Fish seeds for culture fishery are collected from the fish hatcheries and nurseries which are situated at Bagerhat and Khulna.

Average daily incomes of commercial, part time and subsistence level fishermen are Tk300-400, Tk 200-250 and Tk 100-150, respectively. Income level of commercial fishermen is decreasing. Consequently, they are changing their occupation.

Tidal floods as well as riverine flood sometimes washout the pond fish, damaging the pond dykes, and causing loss to the *gher* and pond owners.

1.22 Ecological Resources

The Polder area is located in the southern part of the country which occupied important ecosystems. The area enriches by tidal river system and possesses numerous internal canals, mangroves, creeks, and homestead. The polder area and its surroundings are moderately abounded with local vegetation as well as faunal species.

1.22.1 Bio-ecological Zone

Bangladesh has been divided into 25 bio-ecological zones considering the ecosystem features and species diversity (Nishat et al, 2002). The Polder 35/1 falls in three bio-ecological zones: the saline tidal floodplain (10), the Sundarban (7a), and the Ganges flood plain (4b) (see **Figure 6.20**). Details of the three zones are described below.

Saline Tidal Floodplain

Saline tidal floodplain bio-ecological zone is located in the administrative districts of Satkhira, Khulna, Bagerhat, Jhalokathi and Borguna and 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 most of the year in Sundarban. The rivers carry fresh water throughout the year to the east and northeast, but saline water penetrates more and more towards west mainly in the dry season, and in the southwest in most or the entire monsoon season. In the northeast, there is moderately deep flooding during the monsoon season, mainly due to accumulation of rainwater on the land when 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, and boxes (Bari, 1978).

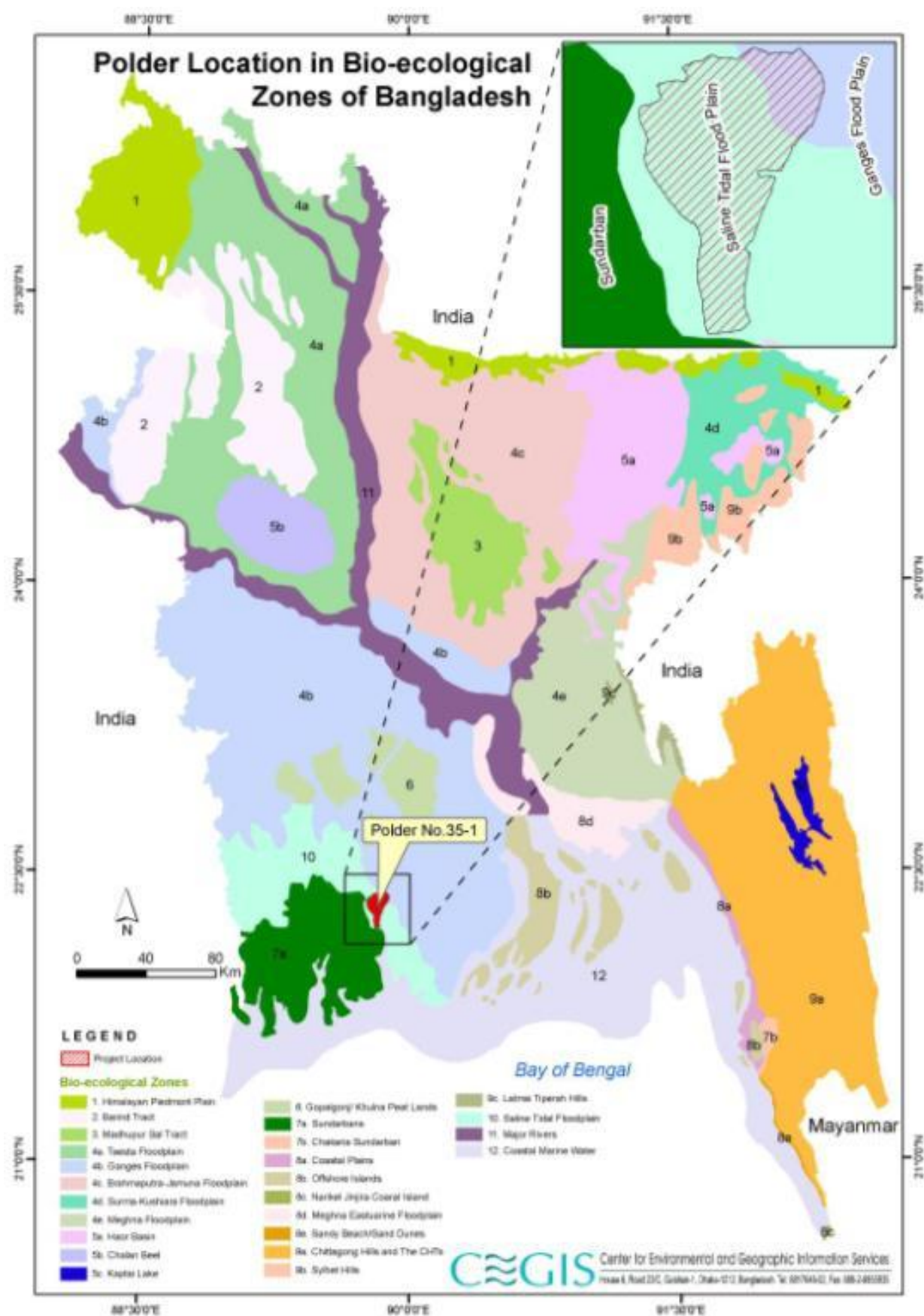


Figure 0.20: Bio-ecological Zones of the Project Area

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

The Sundarban

The Sundarban mangrove forest is situated in the southwest of Bangladesh, and extends from the international boundary with India along the Harinbhanga-Raimangal-Kalindi river system in the west and Baleswar River in the east. At present, only the Baleswar River is directly linked to the river Ganges which principally ensures the in-flow of freshwater in the eastern part of the Sundarban. The Bangladesh Sundarban now covers an area of about 5,770 km², of which 4,016 km² island and the remaining 1,761 km² is under water, in the form of rivers, canals and creeks (Hussain and Karim, 1994). However, about 150 years ago, the Sundarban was twice its present size (Kabir, 1999). About 62 percent of the forest lies in the administrative districts of Bagerhat, Khulna and Satkhira in Bangladesh. This mangrove tract constitutes 44 percent of the total forest area in Bangladesh and contributes about 50 percent of the total revenue derived from the forestry sector (Tamang, 1982). But the most important value of the Sundarban stems from the protection it affords to millions of people against the ravages of cyclonic storms and tidal waves, which frequent the area from the Bay of Bengal. The mangrove of the Sundarban is unique compared to the non-deltaic coastal mangrove forests. For instance, unlike in the cases of the latter, the Rhizophoraceae is of only minor importance and the dominant species are the Sundri (*Heritiera fomes*) of the Sterculiaceae family, from which the Sundarban takes its name, and the Gewa (*Excoecaria agallocha*) of the Euphorbiaceae family. Other dominant plant species include: the Passur (*Xylocarpus mekongensis*), Ohundal (*Xylocarpus granatum*), Kankra (*Bruguiera gymnorhiza*), Keora (*Sonneratia apetala*), Baen (*Avicennia* spp.), Golpatta (*Nypa fruticans*) and Goran (*Ceriops decandra*) (FD and RIMS, 2002). According to Prain (1903), the Bangladesh Sundarban houses a total of 334 plant species, representing 245 genera; however, these include principally woody and herbaceous species. This mangrove tract is also both diverse and complex in terms of faunal riches. Of the 425 species of wildlife recorded in the Sundarban, 49 are mammals, 315 birds, 53 reptiles and 8 amphibians (Rashid et al., 1994, and Reza et al., 2000). Moreover, it is now the only refuge left for the national pride of Bangladesh: the Bengal tiger (*Panthera tigris*). In addition, its waterways and canals have been recognized as one of the richest fish-nurseries in the region (Kabir, 1999). Despite the combination of high tidal flow velocity, heavy silt load and low light penetration, a remarkable diversity of finfish and shellfish exists inside the Sundarban forest and in the adjacent marine zone of the northern Bay of Bengal (Bernacsek, 2001a, 2001b). These are mainly of marine origin, but several freshwater species have been able to take advantage of low salinity and freshwater conditions in the northern part of the forest.

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*), and Panibaj (*Salix tetrasperma*). 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., and *Hemarthria* sp. 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, and bats are common mammals of this bio-ecological zone.

1.22.2 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 Project area is also near the Sundarban's Sharankhola Range which is divided by Bhairab River. The area supports the following three types of ecosystem with flora and fauna:

- Terrestrial Ecosystem
- Aquatic Ecosystem
- Mangrove Ecosystem

Terrestrial Ecosystems

The major divisions found within the terrestrial ecosystems of Polder 35/1 are i) agricultural land, ii) settlement/ homestead vegetation iii) embankment and roadside vegetation, iv) fallow lands. The terrestrial ecosystem can be divided into two categories: 1) natural vegetation; and 2) human influenced vegetation. Natural vegetation includes wooded areas, grassland and other natural habitats. Human influenced vegetation includes homestead gardens, orchards, plantation, cropland and other planted or cultivated habitat. 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.). See **Figure 6.21** for this habitat type in the Project area.

The agricultural lands are used predominantly for rice production. Agricultural lands are fragmented around the homesteads and used for producing one or two rice crop and some vegetables. The crop field vegetation has low diversity of all types, but it is more important for searching food and shelter of wildlife. Areas at the edge of crop fields and between the cultivable plots provide important cover for smaller animals. Solitary trees or shrubs amid the large tract of crop field provide perching and roosting place for raptors and other insectivorous birds.



Figure 0.21: Terrestrial Habitat in the Polder 35/1

The major species (weed) growing with the crop in this area are *Alternanthera sessilis*, *Ageratum conyzoides*, *Heliotropium indicum*, *Cyperus cephalotes*, *Digitaria longiflora*, *Amaranthus spinosus*, *Polygonum sp.*, *Oxalis corniculata* and *Cynodon dactylon*. Fallow lands are areas that are usually left out of crop production due to some physical constraints. These areas provide space for grazing and habitat for several plant and wildlife species.

Roadside vegetation of the Polder area is dominated by Dhol Kalmi, Taal (*Borassus flabellifer*), Khajur (*Phoenix sylvestris*), Rendi koroi (*Albizia saman*), Sissoo (*Dalberzia sissoo*), and Chambol (*Albizia richardiana*). Jiga/Kocha (*Lennea coromandelica*) is very commonly used as fencing plant along both sides of roads which passed through settlement. Embankment sides are exclusively dominated by Babla (*Acacia nilotica*) tree, Bhat (*Clerodendrum viscosum*), Dutura (*Datura metal*), Biskantali (*Polygonum Sp.*), Veranda (*Ricinus communis*) and Telakucha (*Coccinia grandis*) 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. Details of the terrestrial and crop field's species diversity are given in **Annex C: Table 1**.

Aquatic Ecosystems

Aquatic habitat in this area includes external rivers, internal channels, some seasonal wetlands and homestead ponds (**Figure 6.22**). Wetlands govern necessary nutrients and other elements for whole ecosystems, as it is an important type. Seasonal wetland is mainly floodplains, which inundates in the monsoon. Moreover, nearby seasonal aquatic ecosystems are abounded not only with numerous aquatic floras but also with many aquatic wildlife species including birds, fish amphibians and reptiles. Aquatic ecosystems of this polder may be classified into four major categories as follows:

- The surrounding rivers
- Internal *khals*/Channels
- Prawn/Shrimp (*golda/bagda*) farms and
- Homestead's ponds and ditches.

The polder area is surrounded by the Baleshwar and Bhairab river systems and many canals also pass through the entire area, prawn/shrimp (*golda/bagda*) 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 comparatively high diversity of plant population. Internal canals possess some marginal vegetation. All major canals are connected with surrounding tidal rivers. The common floral species observed frequently within the project area are Shapla/Shaluk (*Nymphaea Spp*) Kachuripana (*Eichhornia crassipes*), Dhol Kolmi (*Ipomoea fistulosa*), Khudipana (*Lemna Sp*), and Topapana (*Pistia strateotes*). Details of the aquatic species diversity are given in (**Annex C: Table 2**).



Figure 0.22: Aquatic Habitats of the Polder 35/1

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. Many coral reef fish, for example, spawn in mangrove forests. The young fish stay in the forest, where there is plenty of food and they can shelter from predators, until they are old enough to move to the reef. In addition, mangrove ecosystem is nesting and migratory sites for hundreds of bird species, as well as home to a wide variety of reptile, amphibian, and mammal species. The Polder area supports mangrove ecosystem (Figure 6.23). Hargoza (*acanthus illicifolious*) is a small shrub, available in the river and canal sides. Ora (*Sonneratia caseolaris*), Kewra (*Sonneratia apetalla*) and Gewa (*Excoecharia agallocha*) are sighted in areas with tidal flow. Hada/Tiger fern (*Achrostichum aureum*) is another bush plant frequently found all over the polder area. Details of the mangrove species diversity are given in (**Annex C: Table 3**).



Figure 0.23: Mangrove inside the Polder

1.22.3 Fauna

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 within the project area (**Figure 6.24**) are generally classified as amphibians, reptiles, birds, and mammals.

The amphibian species were identified during field visit, amongst them Dicroglossidae was found highest in number. The members of this family usually prefer rice fields, ponds, grasslands, gardens, arable lands, homestead forests, roadsides, drainage, and ditches. Skipper Frog is available in water body like stream. Among amphibians, the Skipper Frog (*Euphlyctis cyanophlyctis*) is common and found in all wetland habitats and has been the most successful in adapting to the altered habitat. Indian Bullfrogs are also common here. Common Toad (*Duttaphrynus melanostictus*) is the only toad found within the site. Asian Brown Tree Frog (*Polypedates leucomystax*) is the tree dwelling frog belongs to the family Rhacophoridae, usually found in homestead forests, roadsides, and around human habitation. It is arboreal whose niche preferences were branches of the trees, tree holes, from lower to mid canopy, bushy areas, and nearby stagnant water bodies.

The reptiles species observed during the survey were House Gecko (*Hamidactylus flaviviridis*), Common Garden Lizard (*Calotes versicolor*), Little Skink (*Mabuya macularia*), Bengal Monitor (*Varanus bengalensis*), Checkered Keelback (*Xenochropis piscator*), Striped Keelback (*Amphiesma stolata*) found frequently during the survey. The snake population found in water body is Checkered Keelback (*Xenochropis piscator*), Common Wolf Snake (*Lycodon aulicus*) commonly observed in this area. Monocled Cobra (*Naja kaouthia*) are occasionally seen which are recorded in IUCN Red List. Terrestrial snakes' are found within the study area is Indian Rat Snake, Monocled Cobra, and Banded Krait. Indian roofed turtle (*Pangshura tectum*) and Median Roofed Turtle (*Pangshura tentoria*) are common whereas Brown Roofed Turtle (*Pangshura smithii*) is very rare.

Common and uncommon bird species found in the project areas are India Pond Heron, Little Egret, Cinnamon Bittern, Cotton Pigmy Goose, Little cormorant, White breasted Water Hen, Common Kingfisher, Lesser Whistling Duck, and Bronzed winged Jacana, Brhaminy Kite, and Pied Kingfisher. Common terrestrial bird species found within the project area are Common Myna, Pied Starling; Red vented Bulbul, Asian Magpie Robin, Green Bee-eater, Jungle Crow, House Crow, Common Tailor Bird, and House Sparrow.

The large mammals are in peril due to habitat destruction and hunting pressures. Mammal species are not very common within the area but few of them like Common Mongoose, Jungle Cat (*Felis chaus*),

House Rat (*Rattus rattus*), Field Mouse (*Mus booduga*), Asian House Shrew (*Suncus murinus*), Indian Otter (*Lutra perspicillata*), and Indian Flying Fox (*Pteropus gangeticus*) were found. Ganges River Dolphin (*Platanista gangetica*) is found in surrounding rivers. Fishing cat is also found in the area. The cat's main feeds are fish and for surviving the cat's aquatic habitat is very important. Details of the wildlife species diversity is given in (Annex C: Table 4).



1.23 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 provides 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 household consumption.

Most of the households in the Project area raise poultry and livestock, a practice that significantly reduces poverty through generating income and employment. Detailed status of livestock population in the Polder is presented in **Table 6.21**.

Table 0.21: Present Status of Livestock and Poultry in Polder 35/1

Livestock/Poultry	Number of Livestock
Cow/bullock	16,032
Buffalo	-
Goat	8,806
Sheep	550
Duck	16,815
Chicken	176,870

Source: Feasibility Report (Agriculture) of CEIP, 2012

1.23.1 Feeds and Fodder

The owners of the livestock are facing problems in respect of fodder availability during March to December due to shortage of grazing lands. In the *kharif-I* and *kharif-II* seasons, the lands are generally covered with rice crop in the Polder area. Rice straw is the main fodder for cattle. Bran of wheat and rice, oil cakes, and powder of cereal crops are the other common fodders, but the availability of these feeds in the Project area is limited. Shortage of grazing land throughout the year aggravates the feed problem for the livestock. Poultry population at family level survives by scavenging and generally no feed supplements are provided. However, at times kitchen waste becomes feed for the poultry.

1.23.2 Livestock and Poultry Diseases

Livestock and poultry in the Polder are mainly constrained due to diseases and death of the population. Outbreak of disease is causing a considerable economic loss in livestock and poultry farming. Every year livestock population is affected by different diseases like foot and mouth disease, anthrax, torka, and diarrhea. The cyst in head is a common disease of goat. Major poultry diseases are duck plague, paralysis, new castle, fowl pox, and dysentery. The most vulnerable period is between July and October (rainy season) for spreading diseases to livestock and poultry. The duck plague generally occurs in summer. However, some diseases prevail round the year.

During monsoon season, the wet condition of the animal shelter promotes various kinds of diseases to the bullocks and cows. The unhygienic condition of the courtyards during this season may also spread the diseases to the poultry birds.

1.24 Socio-economic Resources

1.24.1 Area and Location

The Polder 35/1 covers parts of Sharankhola and Morrelganjupazilas under Bagerhat district. The Polder area falls in five unions namely Khuolia, Dakhin Khali, Rayenda, Dhansagar and Khontakata as shown in **Table 6.22**.

Table 0.22: Unions and Upazilas in Polder 35/1

District	Upazila	Unions	Percentage of Union Area within Polder
Bagerhat	Morrelganj	Khuolia	25
	Sharankhola	Dakshin Khali	62
		Rayenda	79
		Dhansagar	100
		Khontakata	86

Source: Spatial GIS Analysis, CEGIS, 2012

1.24.2 Demography

Based on the Census Report of Bangladesh Bureau of Statistics (BBS) for 2011, the population in the Polder 35/1 is 96,503. These include 46,943 males and 49,560 females. A total of 22,932 households exist in the Polder with average size of 4.2 persons per household. The density of population is about 1,037 persons per square kilometer. The overall literacy is 57 percent, with male and female literacy being 56 percent and 59 percent, respectively. The literacy in the Polder is relatively higher than the national average. The key demographic data of the Polder is presented in **Table 6.23**. Population trend is presented in the Figure 6.25.

Table 0.23: Demographic Data of Polder

Households	Population			Size of House Hold	Literacy Rate (above 7 years)(%)		
	Total	Male	Female		Total (National Avg.: 51.8)	Male (National Avg.: 54.1)	Female (National Avg.: 49.4)
22,932	96,503	46,943	49,560	4.20	57.44	55.96	58.76
		48.64%	51.36%				

Source: Population Census 2011, BBS

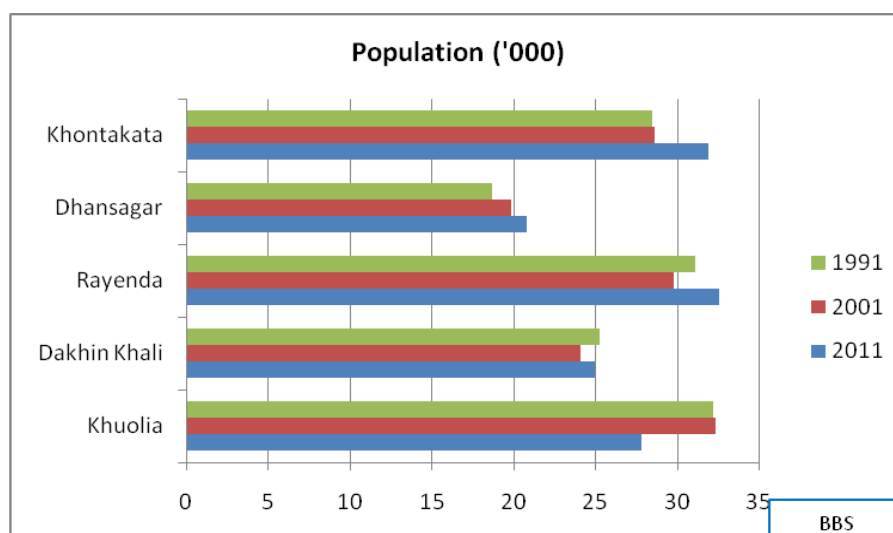


Figure 0.25: Trend of population in the study area.

It is found that in some area the number of people is increasing and in some cases the number is decreasing. It is also observed that percentage of women is higher than that of men.

Table 6.24 shows the age group composition of the people of the Polder area. About 36 percent of the population is less than 15 years and 9 percent is over 60 years of age. The data shows that around 45 percent of the population depends on the 55 percent of the earning members of their households. Hence the dependency ratio is 49:51.

Table 0.24: 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	10	13	13	8	7	8	23	7	3	6

Source: Population Census 2011, BBS

1.24.3 Livelihood

Occupations

According to the baseline survey, around 35 percent households report agriculture as their main occupation. Beside this, the agriculture labor (22 percent), non-agriculture labor (10 percent), business/trading (8 percent), and service provision (3 percent) are some of the other occupations of the Polder inhabitants (see **Table 6.25**).

Table 0.25: Main Occupation in Polder

Main Occupation	Percent of Households
Agriculture	35
Agriculture Labor	22
Non Agriculture Labor	10
Service	3
Fishery	7
Business	8
Remittance	1
Forestry/ Horticulture	2
Livestock rearing	2
Others	10
Total	100

Source: CEGIS fieldwork, 2012

According to the field surveys, about 30 percent of the farmers are cultivating their own land, while about 35 percent are cultivating by taking share/lease of land along with their own. The tenants/share croppers are 20 percent and absentee land lords are about 15 percent in the Polder.

Employment

In the Polder, about 38 percent of total population is employed, 38 percent is engaged in household work (mostly women), and about 23 percent of total population is not working (it includes children and physically challenged population). **Table 6.26** shows the employment status of the people in the Polder area.

Table 0.26: Employment Status in Polder

Unions	Employment Status (%)			
	Employed	Looking for Work	Household Work	Do Not Work
Khuolia	36	1	41	23
Dakhin Khali	42	1	34	22
Rayenda	44	0	35	21
Dhansagar	31	1	45	22
Khontakata	35	1	34	30
Overall	38	1	38	23

Source: Population Census 2011, BBS

1.24.4 Quality of Life

Housing Condition

In the Project area, overall housing condition is not satisfactory. On an average only 2 percent houses are pukka (made of bricks and mortar) whereas 87 percent are kutcha (made of wood/bamboo, and other local materials). **Figures 6.26 to 6.29** present some photographs of these housing types. Statistics show that Rayenda union comprises the highest pukka household (4 percent) whereas Dakhin Khali and Dhansagar unions comprise the highest kutcha households (respectively 97 percent and 87 percent). It can be concluded that the people living in the study area belong to extremely poor category in term of housing type.¹⁰ **Figure 6.30** presents the data for housing types of Project area.

¹⁰ BBS distinguishes housing structures into four classes such as- i) **Jhupri**: House which consists of mud walls of 1.5 to 3.0 ft thickness that carry the roof load. Earthen floor, thatch or CI sheets are used as roofing material. There is no monolithic joint between the wall and the roof. ii) **Katcha**: Walls: Organic materials like jute stick, catkin grass, straw, and bamboo mats with split bamboo framing. In some areas wall are made by earth. Foundation: Earthen plinth with bamboo or timber posts. Roof: Thatch-rice or wheat or maize straw, and catkin grass, with split bamboo framing; iii) **Semi-pucca**: Walls: Bamboo mats, CI sheet, timber or bamboo framing. In some areas wall are made by earth, sometimes part or full brick. Foundation: Earthen plinth; Brick perimeter wall with earth infill; Brick and concrete also used. Roof: CI sheet with timber or bamboo framing; and iv) **Pucca**: House which is made by (fully) concrete, cement, and iron. Split are bamboo framing. In some areas wall are made by earth. Foundation: Earthen plinth with bamboo or timber posts. Roof: Thatch-rice or wheat or maize straw, and catkin grass, with split bamboo framing; iii) **Semi-pucca**: Walls: Bamboo mats, CI sheet, Timber or bamboo framing. In some areas wall are made by earth, sometimes part or full brick. Foundation: Earthen plinth; Brick perimeter wall with earth infill; Brick and concrete also use. Roof: CI sheet with timber or bamboo framing; and iv) **Pucca**: House which is made by fully concrete, cement, and iron.



Figure 0.26: *Jhupri* house



Figure 0.27: Kutch house

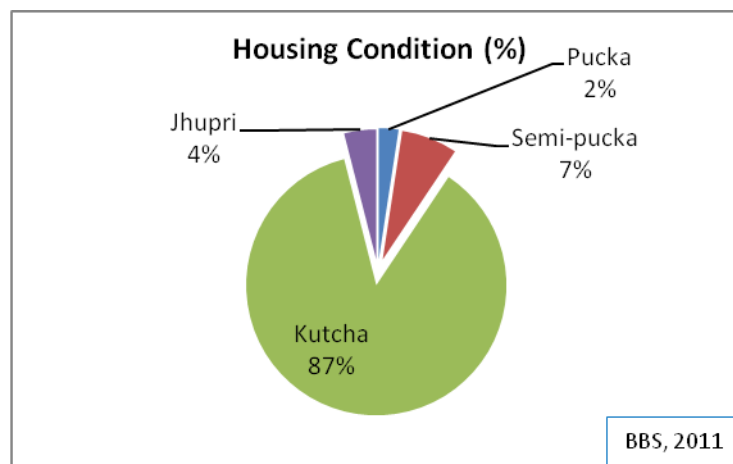


Figure 0.28: Semi-pucka house



Figure 0.29: Pucka house

Figure 0.30: Housing Types in Polder Area

A total of 17,170 people have been identified including 9,010 males (52.47 percent) and 8,160 female (47.52 percent) living near or on the embankments which means that on average 272 people (65 households) are living on/near per kilometer of the embankment (see **Table 6.27**).

Table 0.27: Households Living on/near Embankment in Polder 35/1

Gross Area (Ha)	Length of the Embankment (km)	HHs Living on/near Embankment	Total Population Living on/near Embankment		
			Male	Female	Total
13,058	63	4,088	9,010	8,160	17,170

Source: Census of PAUs conducted by KMC in Dec 2011-Feb 2012

Drinking Water

Overall status of drinking water in the area is generally satisfactory. Most of the people can collect drinking water from tube well or hand pumps, whereas in 2001 only 68 percent of the population had access to safe groundwater. The detail is presented in **Table 6.28**, which provides data from BBS as well as RRA carried out during field investigations for the present EIA. According to the RRA, majority of households (58 percent) use water from protected ponds while 35 percent households use tube well.

Table 0.28: Source of Drinking Water in Polder

Drinking Water Sources	Households Reported by BBS (%)	Households as per RRA (%)
Tap	0.32	-
Tube well	98.00	35.00
Protected Ponds (reserved for drinking purposes only)	-	58.00
Other (rain water, river water)	1.68	7.00

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

Sanitation

The sanitation facilities adopted by households of the Project area are presented in **Table 6.29**, in which both BBS and RRA based information has been included. According to the RRA information, around 92 percent of households used the ring slab type sanitation facilities in the Polder 35/1 area. The information from BBS shows that about 86 percent household have toilet facilities in which 31 percent are with water-sealed type and another 56 percent with non water-sealed type, while 13 percent households have no sanitary latrines.

Table 0.29: Sanitation Facilities in the Polder

RRA Data (2012)		BBS Data (2011)	
Toilet Types	Households (%)	Toilet Types	Households (%)
Water Sealed	2	Sanitary (water-sealed)	31
Ring Slab	92	Sanitary (not water-sealed)	56

RRA Data (2012)		BBS Data (2011)	
<i>Kutcha</i>	06	Non-sanitary	13
No Facilities	-	No Facilities	1

Source: Population census 2011, BBS and Baseline Survey, 2012.

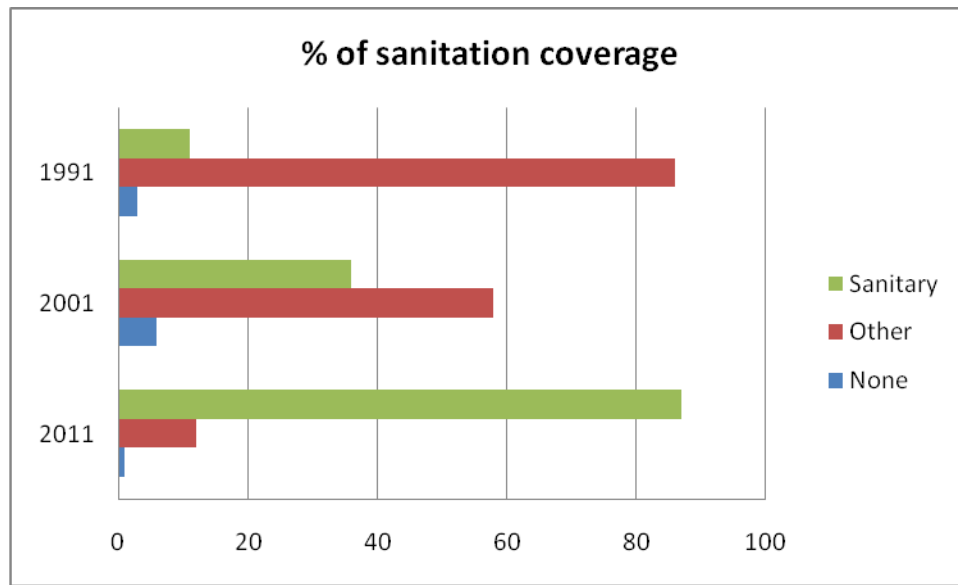


Figure 0.31: Trends in sanitation at study area

The trends in sanitation over the years are now changing. As shown in **Figure 6.31**, in 1991, about 86% households were practiced in other types of sanitation i.e non water-sealed, kutcha latrines while in 2001 this scenario was slightly improved. But in the year of 2011, about 87% of households are now under sanitation coverage in whole polder area. **Figures 6.32** and **6.33** present photographs of some latrine types in the Polder.



Figure 0.32: Kutcha Latrine



Figure 0.33: Ring Slab Latrine

Health Profile of Polder People

The health profile of the local people living in the Polder is presented in the **Table 6.30**. 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 0.30: Disease Profile in the Polder

Disease	Ranking by Incidence
Diarrhoea	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

There is a public hospital, one family welfare center and six community clinics located within the Polder 35/1. Around 90 percent of people in Polder receive treatment services mainly from the quack doctors. The qualified physicians serve about 25 percent of the population while paramedics/diploma physicians serve about 20 percent of the population. Only 10 percent has no access to any sort of health and treatment facilities due to their ignorance as well as poverty (see **Figure 6.34**).

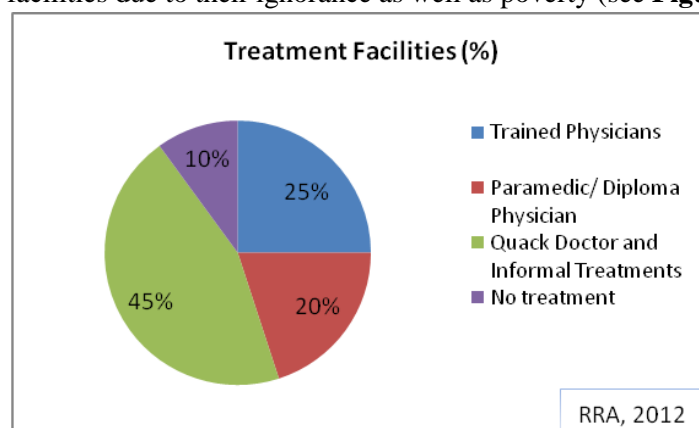


Figure 0.34: Health Service Providers in Polder

Quality of health services and facilities is quite poor as reported by the local people. People are much more aware to receive treatment facilities from registered physicians. Some people obtain treatment from private clinic and upazila health centers.

Education

In the study area literacy rate is moderate in terms of national average (57.44) (see **Table 6.31**). However, in overall assessment the study area, like other part of Bangladesh, is backward in position in term of education. Among three upazilas (covered by the project area), the literacy rate at Dhansagar union is quite good (60%). At the union level almost 57% of total people are literate (both sexes) per union. But Dakhin Khali union shows lower percentage (52%).

Table 0.31: Literacy Rate at Polder 35/1 Area

Union	Total/Both	Male	Female
Khuolia	55	54	56
Dakhin Khali	52	50	54
Rayenda	57	54	59
Dhansagar	60	60	60
Khontakata	64	63	65
ProjectArea	57	56	59

Source: Population Census 2011, BBS

In the polder area, there are 113 schools 24 Madrashas and 3 colleges. Local people opined that in earlier time they preferred to send their children to earning rather than to schools. The tendency is gradually diminishing and turned to positive approach to education. Literacy rate of the Polder 35/1 is now improving as shown in **Figure 6.35**.

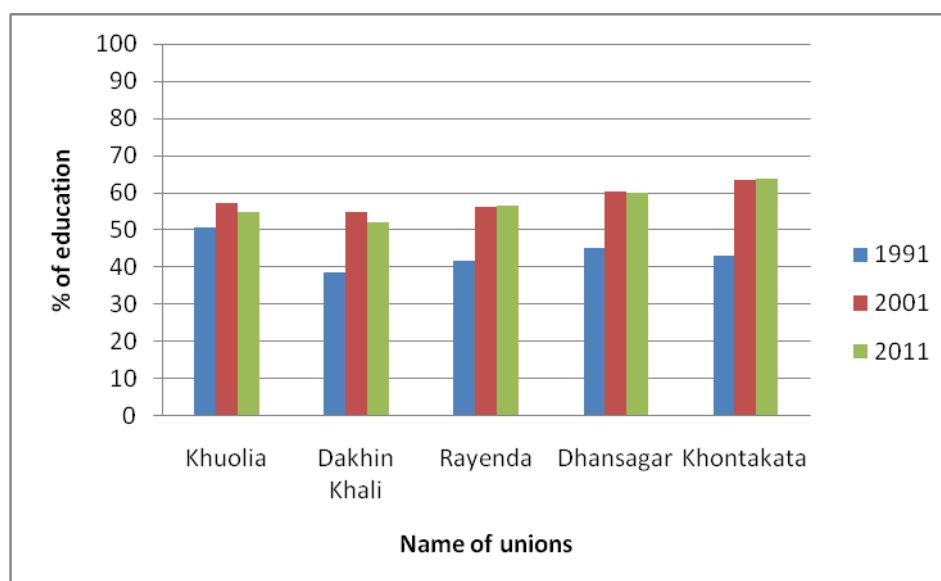


Figure 0.35: Trend of Literacy Rate in Polder 35/1

Electricity

Electrification as reported in the Population Census is not satisfactory in the Project area. On an average, only 23 percent households are under electricity coverage. Very few households use solar electricity in the Project area. **Figure 6.36** shows the percentage of electricity connection in different parts of the Polder areas.

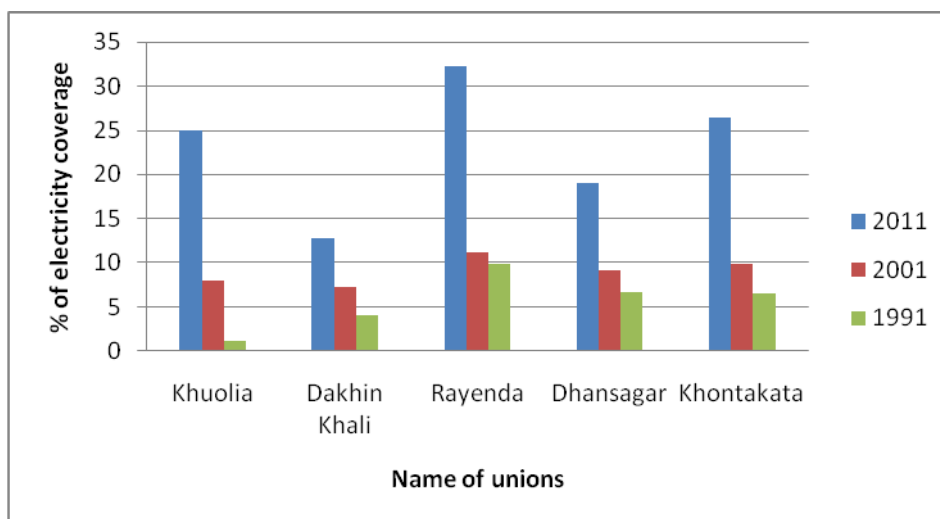


Figure 0.36: Electrification in Polder

1.24.5 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 6.32**).

Table 0.32: 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 holdings¹¹ comprise 84 percent and medium holdings comprise 14 percent whereas large holdings comprise only 2 percent (see **Figure 6.37**).

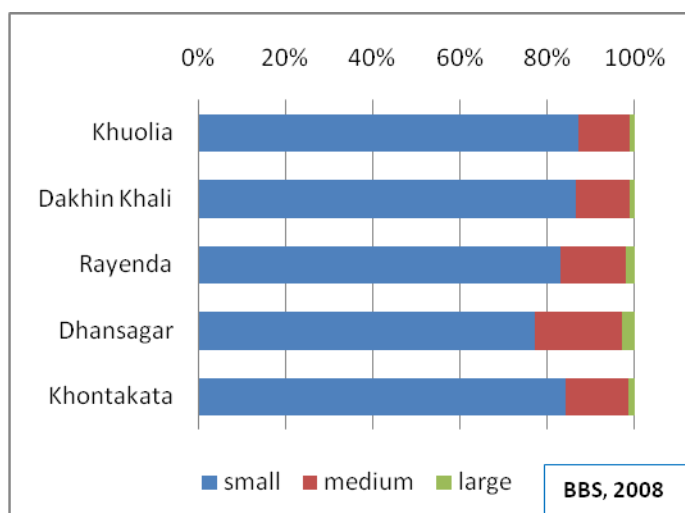


Figure 0.37: Land Holding Categories in Project Area

Income Poverty

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 (see **Figure 6.38**). 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.

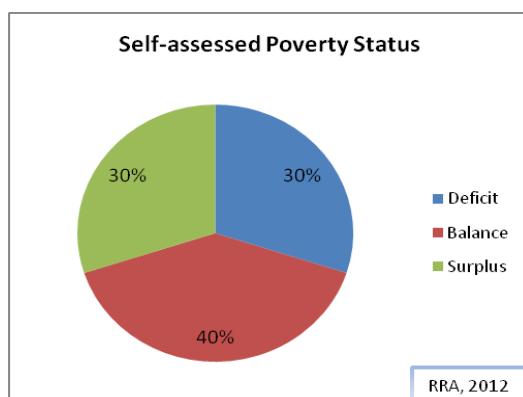


Figure 0.38: Self Assessment of Poverty Status

¹¹ 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 upto 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 and Expenditure

The income and expenditure at the household level in the Polder area is shown in **Table 6.33**. Around 62-70 percent households have reported that their income and expenditure level is over 5,000 taka per month.

Table 0.33: 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 35/1 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 6.34**.

Table 0.34: 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	100	90	Rice
Salinity	2007, 2009, 2011	50	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, 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 (see **Table 6.35**).

Table 0.35: 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, national and international 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 Bangladesh Rural Advancement Centre (BRAC), Association for Social Advancement (ASA), Udayon Bangladesh, Help, Uttaran, UK Muslim AID, World Fish Centre, Catholic Fund for Overseas Development (CAFOD), European Union, and Islamic Relief World Wide (see **Table 6.36**). 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 0.36: NGOs and their Programs in Project Area

NGO	Type of Programs							
	Credit	Education	Water and Sanitation	Health	Human Rights	Gender	Children	Disaster
BRAC	✓	✓	✓	✓	✓	✓	✓	-
ASA	✓	✓	-	-	✓	✓	-	-
Udayon Bangladesh	✓	-	-	-	-	-	-	-
Help	✓	-	-	-	-	-	-	-
Uttaran	✓	✓	✓	-	✓	✓	-	-
UK Muslim Aid	-	✓	✓	✓	✓	-	-	✓
World Fish Centre	-	-	-	-	-	-	-	✓
CAFOD	-	-	-	-	-	-	-	✓
European	-	-	-	-	-	-	-	✓

NGO	Type of Programs							
	Credit	Education	Water and Sanitation	Health	Human Rights	Gender	Children	Disaster
Union								
Islamic Relief World Wide	-	-	-	-	-	-	-	✓

Source: CEGIS fieldwork, 2012

1.24.6 Social Capital

Roads

Various types of roads provide means of communication mostly within the Polder. Overall about 538 km of road network exists in five unions of which 67 km roads are paved, 105 km roads are brick soled and 366 km roads are earthen. **Table 6.37** presents data on road network in the Project area; **Figure 6.39** presents some photographs of these roads.

Table 0.37: Road Network in Polder

Unions	Type of Road	Length (Km)
Khuolia	Paved	11.00
	Brick soling	12.50
	Earthen	29.25
Khontakata	Paved	17.00
	Brick soling	34.00
	Earthen	61.00
Dhansagor	Paved	18.00
	Brick soling	-
	Earthen	36.00
Royenda	Paved	20.00
	Brick soling	50.00
	Earthen	140.00
Dakhin Khali	Paved	01.00
	Brick soling	8.00
	Earthen	100.00
Total		537.75

Source: CEGIS fieldwork, 2012



Figure 0.39: Roads in Polder 35/1

The major road in the Polder area is from Pollimongol to Tafalbari via Royenda Bazar. There are some local roads that are also functional in whole year. The major road routes are:

- Morrelganj to Sarankhola
- Baniakhali to Manikjore
- Morrelganj to Royenda
- Dhansagar to Baniakhali
- Rajeswar to DakshinRajapur
- Purba Chipa Baraikhali to Royenda.

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. **Table 6.38** shows that there are two bus stations in the project area. A total of 383 vehicles enter the polder and 378 vehicles are deployed from the polder at the Rayenda bus station. Similarly, a total of 319 vehicles enter the polder and 339 vehicles are deployed from the polder at the Polymongal bus station.

Table 0.38: Traffic Volume (7:00 am to 7:00 pm) in Polder 35/1

Type of Vehicles	Rayenda Bus Station		Polymongal Bus Station	
	To the polder	From the polder	To the polder	From the polder
Van	78	74	54	73
Motorcycle	77	76	100	91
Rickshaw	0	0	0	0
Bi-Cycle	97	85	83	80
Car	2	1	3	1
Jeep	1	2	0	2
Bus	31	41	31	42
Truck	18	14	20	14
Pickup/Mini Truck	21	20	22	22
Auto Rickshaw	58	65	6	14
Tempo	0	0	0	0
Total	383	378	319	339

Source: Baseline survey, CEGIS, 2012

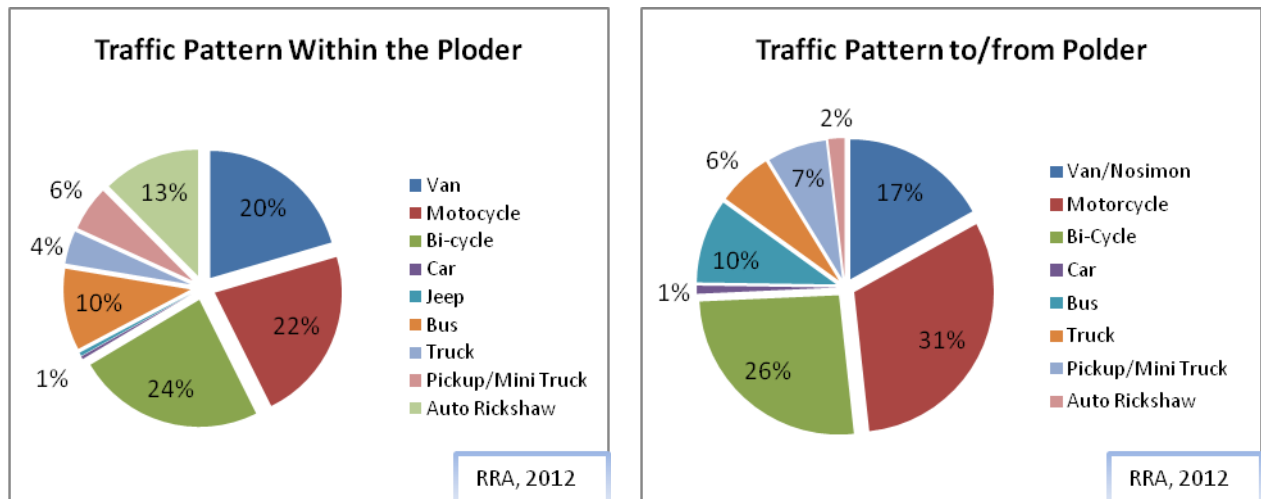


Figure 0.40: Traffic Pattern in the Polder Area

Waterways

The water ways are the most important means of communication in the area. The length of navigation routes under the Class-I category in the Polder area is 4 km and Class-II is 23 km (NWRD, WARPO, 2012)(see **Table 6.39**). There exist seven launch jetties (*ghats*) within the service area of the Polder. Due to the siltation of the rivers and canals/*khals*, the extent of waterway communication within the Polder is gradually decreasing. **Figure 6.41** presents some photographs of these waterways.

Table 0.39: Navigation Routes in the Project Area

Navigation Routes	Minimum Channel Depth (m)	Minimum Horizontal Clearance (m)	Total Length (km)
Class –I	3.66	76.22	4
Class –II	2.13	76.22	23
Class –III	1.52	30.48	--
Class –IV	Less than 1.52	20.00	--

Source: NWRD Database, WARPO, 2012



Figure 0.41: Baleswar River near Polder 35/1 and a Connecting Canal

With the passing of time, waterway communication particularly within the Polder is being replaced largely by road communication due primarily to siltation of *khals* and channels.

No national navigation routes exist in the Project area. There are, however, some local/regional navigation routes that are functional only for two to three months in the wet season. These routes are shown in the **Table 6.40** below.

Table 0.40: Major Navigation Routes in the Area

River	Navigation Path	Type of Vehicles
Boleswar	Morelganj-Sannyasir-Kanarmukh-Tafalbarikhal- Machua Sarankhola Forest range-Bagi-Sapleja	Rocket, Launch, Trawler, Barges, Fishing Boats
Bhola	Machua- Tafalbarikhal-Bagi-Saronkhola-SaolaBharani-Pasur river-Khulna	Barges, Trawlers

Source: CEGIS fieldwork, 2012

The regional and local routes are suspended during the dry season months (November to April). According to the local people, the cost of passenger and goods transportation has increased. Therefore, they were deeply interested in having the navigation facilities restored, as it is an easy and cost-effective means of communication in the area. **Tables 6.41** and **6.42** present the traffic data in the area.

Table 0.41: Internal Navigation in Polder Area

Type of Vehicles	Quantity
Launch	1
Trawler	1
Cargo Boats	2
Dredger	1
Small fishing boat	5
Total	10

Source: CEGIS fieldwork, 2012

Table 0.42: External Navigation in Polder Area

Vehicle Type	Quantity
Launch/Rocket	1
Trawler	1
Cargo Boats	2
Small fishing boat	3
Large fishing boat	5
Total	12

Source: CEGIS fieldwork, 2012

Educational Institutions

According to the data collected by CEGIS, 113 schools, three colleges and 24 *Madrasas* (religious schools) exist in the Polder area (see **Table 6.43**). Some students also go to Bagerhat and Pirojpur for higher education. The educational institutions are mostly concentrated in larger settlements although

primary schools are distributed equally in all unions of the area. **Figure 6.42** presents some photographs of these institutions in the Polder.

Table 0.43: Academic Institutions (CEGIS Data)

Union	School	College	Madrasa
Khuolia	16	-	2
Khontakata	30	-	10
Royenda	33		4
Dakhin khali	12	1	3
Dhansagar	22	2	5
Total	113	3	24

Source: CEGIS field work, 2012



Figure 0.42: Educational Institutions in the Polder Area (typical school cum cyclone shelters)

Markets

One growth center and sixteen rural markets are situated in the Project area (NWRD, WARPO, 2012), where people buy necessary commodities and sell their agricultural products and other goods. **Table 6.44** presents their distribution in different parts of the Polder. **Figure 6.43** presents some photographs of these markets in the Polder. In addition, a number of rural *haats* (shops) are also situated in different places in the Polder.

Table 0.44: Markets in Project Area

Union	Bazaar/Growth Centers	Name of Bazaars
Khuolia	6	<ul style="list-style-type: none"> Chairman bazaar Pollimongal bazaar Pother Bazaar Banikhali bazaar Amtoli bazaar Sonnasi launch ghat Bazar
Khontakata	3	-
Royenda	1	-
Dakhinkhali	3	-
Dhansagar	4	-
Total	17	-

Source: CEGIS database, 2012



Figure 0.43: Typical Market/Bazaars in Polder 35/1

1.24.7 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 35/1. 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 35/1 are facing discrimination regarding social and economic affairs of family and society. **Figure 6.44** shows scope of decision making by women in the Polder area.

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.

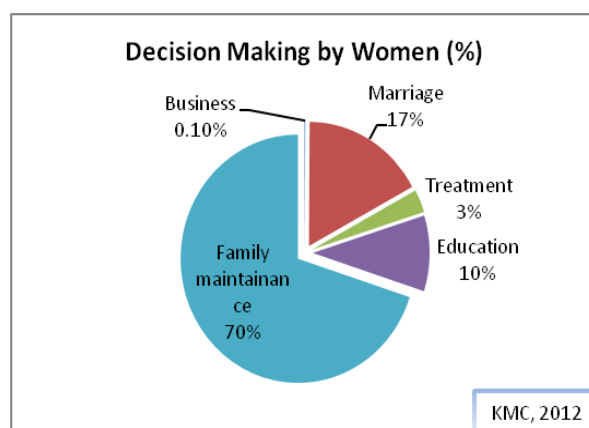


Figure 0.44: Scope of Decision Making by Women

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 percent women are getting proper nutrition and about 10 percent 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 percent in Polder 35/1 area, while the school attendance rate of both sexes is almost equal, as shown in **Figure 6.45**. This should bring about further improvement in the role and status of women in the household as well as in the society.

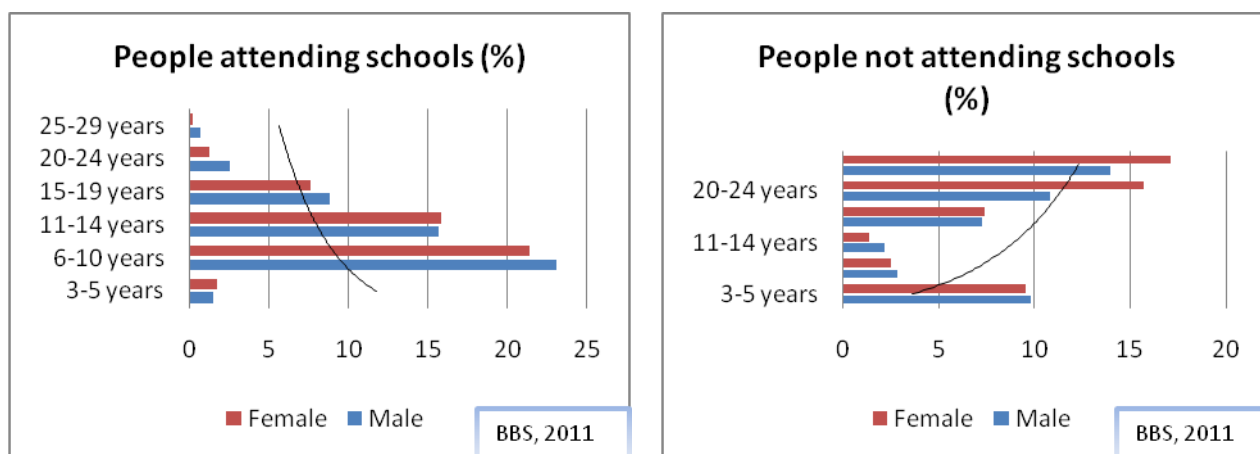


Figure 0.45: School Enrolment

1.24.8 Vulnerable Communities

In the Project area, three types of people could be considered as vulnerable. These include marginal farmers having less than Taka 5,000 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 percent male population and 0.20 percent female population is involved in fishing or fish culture. Besides, almost all households catch fish for their daily use during monsoon.

1.24.9 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 35/1, as shown in **Table 6.45**.

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

Table 0.45: Common Property Places/Resources in Polder 35/1

Union	College	Cyclone Shelter	Eidgah	Graveyard	Crematorium	Market/Bazaar	Mosque	Post Office	Madrassa	School	Temple	Total
Khuolia	-	-	-	1	-	6	30	-	2	16	4	59
Khontakata	-	-	-	-	2	3	102	-	10	30	6	153
Royenda		-	-	-	-	1	87	-	4	33	19	144
Dakhinkhali	1	-	-	-	1	3	67	-	3	12	7	94
Dhansagar	2	-	-	-	-	4	34	-	5	22	6	73
Total	3			1	3	17	320		24	113	42	523

Source: CEGIS fieldwork, 2012

Climate Change

1.25 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 its 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 (*Forth Intergovernmental Panel on Climate Change -IPCC Synthesis Report, 2007*).

1.26 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.

1.27 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:

1.27.1 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 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 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.

1.27.2 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.

1.27.3 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 5ppt 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.

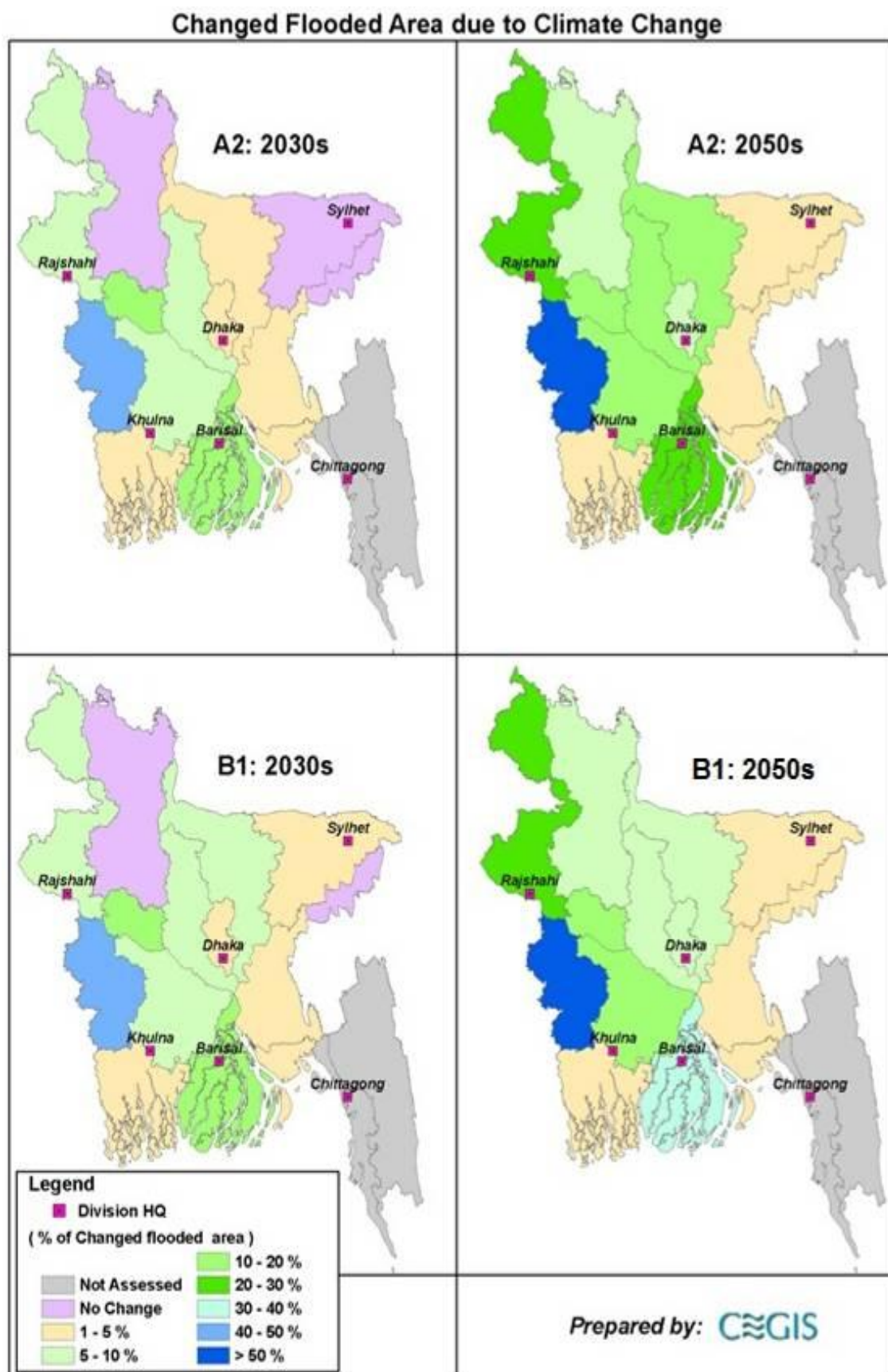


Figure 0.1: Changes in flooded area in Bangladesh in the 2030s and 2050s
(Source: Hassan et. al., 2010)

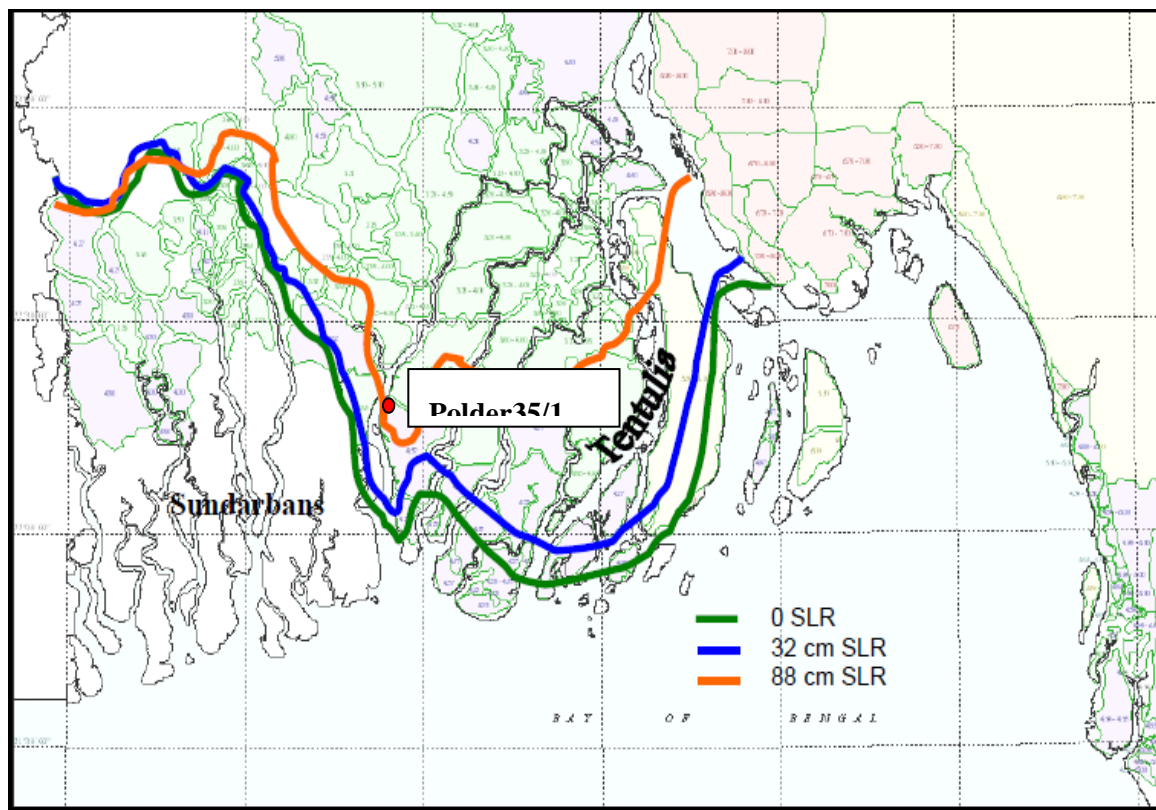


Figure 0.2: Different sea level rise in dry season (IWM and CEGIS, 2007)

1.27.4 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 study 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 (Aila) hit the study area and project site on 25th may 2009. The project area is located in the wind risk zone of Bangladesh.

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

Table 0.1: 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
<i>Source: MCSP, 1993; Bangladesh Meteorological Department and field survey, 2010</i>			

1.27.5 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 present performance of these polders is satisfactory.

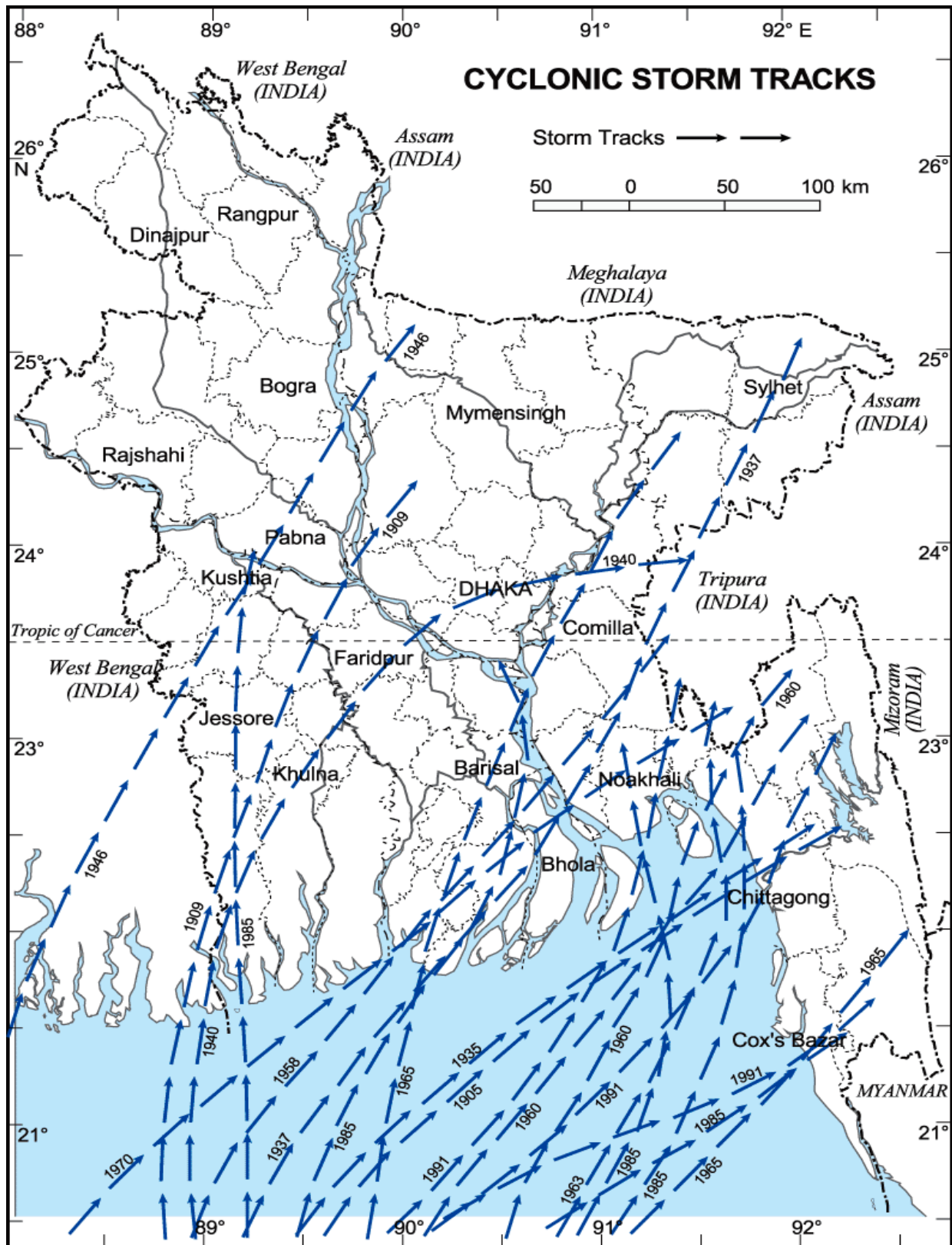


Figure 0.3: Previous Cyclonic Storm Tracks

(Source: MCSP, 1993)

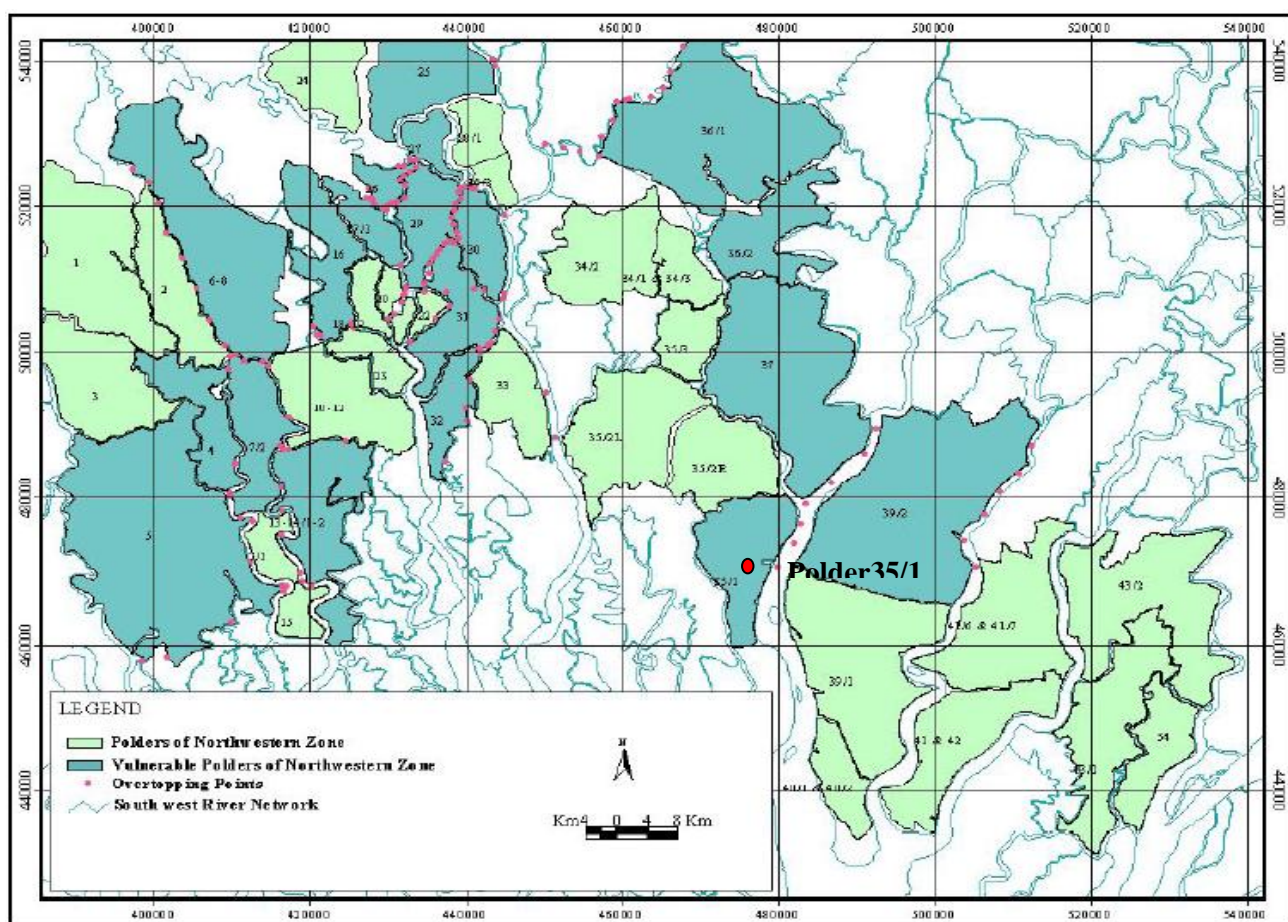


Figure 0.4: Drainage Congestion in Affected Polders due to Sea Level Rise

1.27.6 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 km² while that of erosion was 153 km² with a corresponding net accretion of 97 km². Extension of mainland of Noakhali towards the sea continued like the previous period with a net accretion rate of 4.3 km²/yr. Significant amount of accretion occurred in Bhola Island with a net accretion rate of 27.6 km²/yr. Both erosion and accretion process occurred along shoreline in Chittagong district with a net accretion rate of 8.5 km²/yr. Erosion was observed in Patuakhali and Lakshmipur district with a net erosion rate of 3.2 and 2.8 km²/yr respectively.

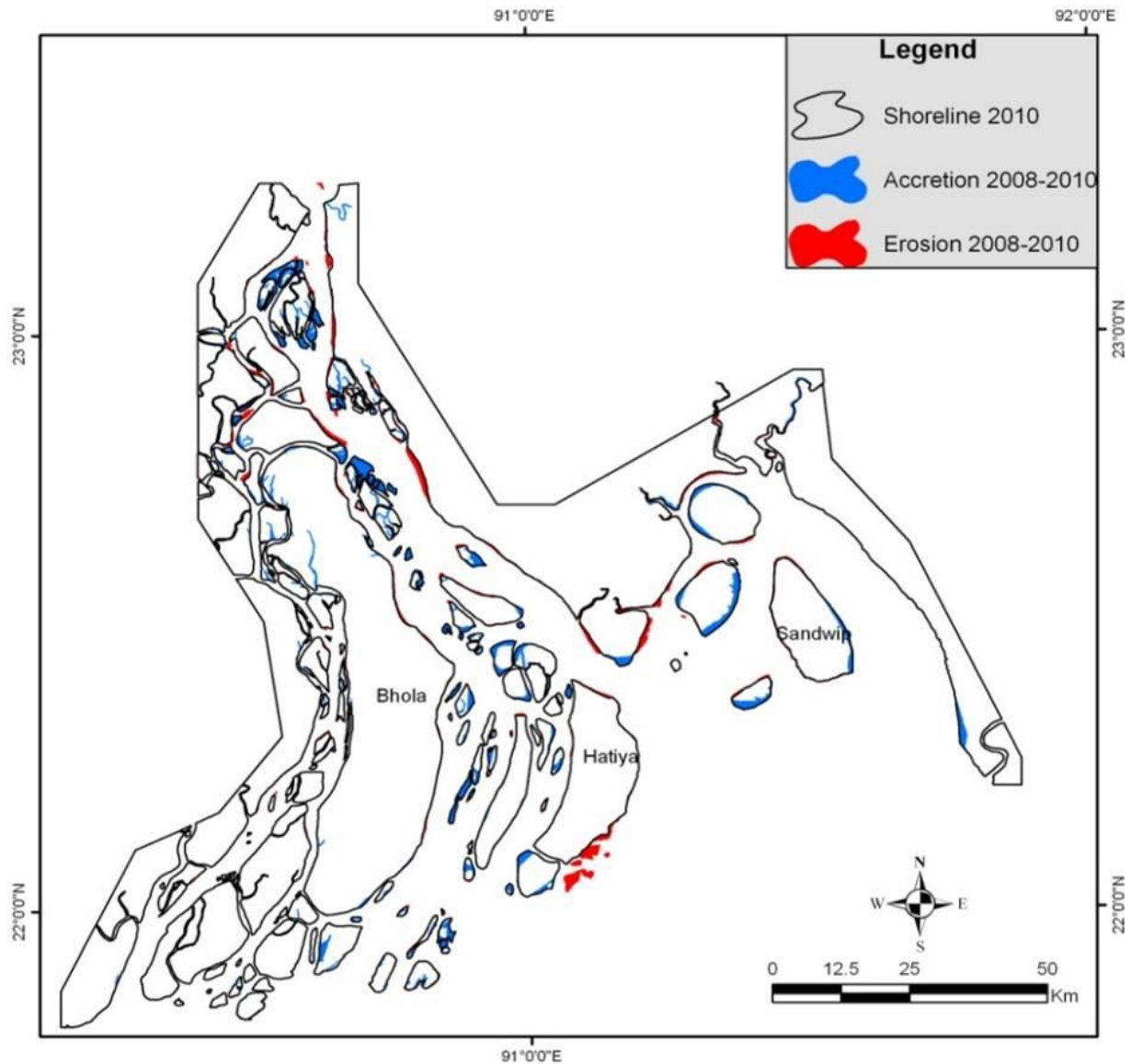


Figure 0.5: Erosion and Accretion of Land in the Meghna Estuary from 2008 to 2010

1.28 Adaptation Strategy for Climate Change Impacts in Project Area

1.28.1 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 varieties 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 cage culture in the water logging area.
- Rain water harvesting system is being adopted to mitigate their drinking water problem during dry season.

1.28.2 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 of the embankment and improved drainage system to cope with the impact of climate change.

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.

1.29 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.

1.30 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.

1.31 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.

1.31.1 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 35/1, 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.

1.31.2 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.

1.32 Approach and Methodology

Participatory approach was followed in conducting the public consultation meetings in the Polder 35/1. 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 35/1 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.

1.33 Public Consultation Meetings and FDGs

1.33.1 Consultation Process

A number of consultation meetings and FGDs were conducted at different locations of the Polder 35/1. The details of these meetings and FGDs are presented in **Table 8.1** and some photographs of these meetings are given in **Figures 8.1 to .8.6 and Annex-G (photo album)**.

Table 0.1: Consultation Details

District	Upazila	Union	Meeting Venue	Meeting Date
Bagerhat	Morrelganj	Khuolia	Khuolia	09/03/2012
Bagerhat	Sarankhola	Royenda	Bogi village	10/03/2012
Bagerhat	Sarankhola	Dhansagor	Dhansagor UP	24/05/2012
Bagerhat	Sarankhola	Dhansagar	Gazir Bridge	16/12/2012
Bagerhat	Sarankhola	Dhansagar	Pollemongol	16/12/2012
Bagerhat	Morelganj	Khuolia	Chairman Bazar, (Purbo Chipa Baraikhali)	16/12/2012
Bagerhat	Sarankhola	Dakhin khali	Royenda	17/12/2012
Bagerhat	Sarankhola	Dakhin khali	Chaltiabunia	17/12/2012
Bagerhat	Sarankhola	Dhansagor	Bandakata Bazar	18/12/2012



Figure 0.1: Meeting at Dhansagor



Figure 0.2: Meeting at Dhansagor



Figure 0.3: Female Participation in Consultations



Figure 0.4: Discussion by EIA Team



Figure 0.5: Participants of a FDG



Figure 0.6: Close Discussions during a FDG

1.33.2 Consultation Participants

The main participants of the consultation meetings included public representative, farmer, trader and daily-wage laborers of the Polder 35/1 and nearby areas. A total of 57 participants attended these consultations. The participant details are provided in **Table 8.2** and **Annex-E**.

Table 0.2: Participant Details

Venue	Type of Participants	No. of Participants
Khuolia	Fisherman, farmers, Boatmen	08
Bogi village	Businessmen, traders, shop keepers, service providers, farmer	07
Dhansagor UP	BWDB representatives, teachers, UP Chairman, UP members (Male/Female), farmer, Fishermen, local notable persons, healthcare assistants, businessmen, traders, and representatives of NGOs.	42
	Total	57

1.34 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 (illness, 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 Polder:
 - Water resource management
 - Agriculture and fisheries management
 - Land resource management
 - Disaster management.

1.35 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 0.3: 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 35/1 area.	Comprehensive rehabilitation of the polder should be taken up at the earliest with the active involvement of the local community.

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
Water Resources	<p><i>Surface Water:</i> While tidal flooding and salinity are increasing gradually, cyclones of 2007 (<i>Sidr</i>) and 2009 (<i>Aila</i>) damaged crops and assets of most of the households. These two cyclones severely aggravated the above problems in the Polder 35/1. Scarcity of non-saline/fresh water is one of the main problems in the Polder area during dry season.</p>	Re-excavation of internal canals for improved drainage and enhanced storage of post-monsoon water for dry season irrigation.
	<p><i>Water Management:</i> Internal water management in terms of drainage and irrigation is seriously hampered due to malfunctioning of the water control structures and two large openings in the embankment caused by cyclone. About 12-15% of the Polder area is facing drainage and water logging problems particularly during monsoon.</p> <p>This situation is primarily due to lack of regular repair and maintenance, which has been exacerbated by two consecutive major cyclones.</p> <p>The embankment from Rejeshwar to Tafalbaria (17.00-18.50 km) was washed away during Cyclone Sidr causing the death of about 70 people in Char Rayenda village.</p> <p>The Rayenda Bazar and many other private establishments are situated in the unprotected area i.e. outside embankment. As a consequence, the Rayenda Bazar and other private establishments are open to the river and regularly suffer inundation during high spring tides.</p> <p>All the existing drainage sluices are in poor condition, and have become almost non-functional without gates or with damaged ones. Further, high rate of siltation in rivers and internal khals is posing a serious threat to drainage. As a consequence, effective drainage is not happening causing pockets of water logging.</p> <p>Water Users Group/Committees are not in place.</p>	<p>Improvement of embankment (increased height, slope repairing) at various locations including Tafalbaria, Southkhali, and Khontakata sites.</p> <p>Replacement/reconstruction of existing water control structures and construction of additional ones to improve drainage efficiency.</p> <p>Formation of Water Management Organizations (WMOs) to manage the system in partnership with BWDB.</p>

1.36 Environmental Aspect from 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 35/1. 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 35/1. 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 35/1 are presented in **Table 8.4**; some photographs of these meetings are presented in **Figures 8.7** and **8.8**.

Table 0.4: Consultation Meetings Held in Polder 35/1

Location, Date and Time	Category of Participants
Chairman Bazar January 05, 2012 at 10.20 am	Land owners, farmers, fishermen, businessmen, teachers, UP members, and 31 Project Affected Persons (PAPs)
Sonnashir Bazar, January 05, 2012 at 11.00 am	Businessmen, land owners, service providers, teachers, land owners, and 20 PAPs
Rayenda Bazar, Sher-E Bangla School, January 05, 2012 at 12.00am	Farmers, Ex-Chairman, land owners, businessmen, local elites, and 8 PAPs
Rayenda Bazar, January 05, 2012 at 3.30pm	Shop owners, daily wage laborers, businessman, local elites, and 10 PAPs



Figure 0.7: Meeting at Chairman Bazar



Figure 0.8: Meeting at Sonnasy Bazar

During these meetings, the key features of the proposed interventions in Polder 35/1 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 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.

1.37 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 Feasibility Study 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 35/1 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 8.9: Welcome Speech by the Project Coordinator of CEIP



Figure 8.10: Presentation of EIA findings by Team Leader of Environmental Study



Figure 8.11: Participants of the Workshop



Figure 8.12: 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 have 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.

1.38 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 0.5: 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.

Project Stage	Proposed Tool	Stakeholders to be Consulted	Responsibility
	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

Assessment of Environmental Impacts

1.39 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 Char land,
- Char land 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. Similarly the detailed bills of quantities and equipment usage are yet to be ascertained. **Table 9.1** presents a list of items required for the finalization of the EIA report.

Table 0-1: 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 team is now out	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
		for field checking.	
	Topography analysis for construction camp.	Sites for construction camp will be decided by the contractors	End of December, 2013
oil	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
scape	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 around all facilities during	Type and number of equipment, vehicles, dredger etc to be used by	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
	construction	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
Socio Economic Environment			
Agriculture	Land needed for the construction	Pending on finalization of design, plan for	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
	camp set up, widening of embankment base, afforestation	land acquisition	
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

1.40 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:

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

The matrix 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 0.1: Environmental and Social Screening Matrix (Without application of mitigation measures)

Project Phases and Activities	Physical					Biological		Social and Socioeconomic												
	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	HN	MN	MN	0	0	0	MN	0	HN	MN	0	MN	HN	MN	HN	MN	MN	MN	MN	HP

	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
Regulators																				
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.

1.41 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 borrow pits and Baleshwar and Bhola river bed and Rayenda canal
- Construction of civil amenities and development and
- Establishment of temporary construction yards

The activities will cause the following environmental impacts

1.41.1 Damages due to Project Intervention and Land Acquisition

Impact

About 60 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 35/1 are presented in **Tables 9.3 to 9.6**.

Table 0.3: Type of Land to be Acquired in Polder 35/1

Description	Area (ha)
Houses	30.50
Single cropped fields	3.60
Double cropped fields	10.45
Multi cropped fields	8.35
Orchard	1.26
Pond	2.50
Shrimp Culture	0.68
Canal or <i>Beel</i>	1.40
Others	1.26
Total	60.00

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

Table 0.4: Primary Structures to be Affected in Polder 35/1

Description	Quantity	Covered Area (square feet)
Pucca (made of bricks and mortar)	36	15,591
Semi pucca	610	158,147
Katcha	801	140,581
Total	1,447	314,319

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

Table 0.5: Secondary Structures to be Affected in Polder 35/1

Description	Quantity
Pucca latrine (numbers)	15
Slab latrine (numbers)	290
Katcha latrine (numbers)	1
Tube well (numbers)	2
Boundary wall (running feet)	442
Gates (numbers)	187
Water tanks (cubic feet)	1,319

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

Table 0.6: Common Properties to be Affected in Polder 35/1

Description	Quantity
Mosque	20
Mandir	1
Club House	2
School/Pathshala	2
Graveyard	3
Government Office	1
Madrasa (religious school)	4
Latrine	2
Political Party office	0
Clinic	0
Passenger Shed	1
Miscellaneous	8
Total	44

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 35/1

Description	Amount (BDT)
Compensation for land acquisition	91,439,516
Compensation for structures	121,309,075
Compensation for Trees	6,002,850
Compensation for Fish Stock	68,200
Other Resettlement Benefits	69,431,495
Capacity building training for EA	1,000,000

Description	Amount (BDT)
Development of Resettlement sites	5,000,000
Operation cost for RAP Implementing Agency/ INGO	10,000,000
Operation cost for External Monitoring Agency	2,000,000
Contingency @ 10% of the above	30,625,114
Total Estimate Budget (in BDT)	336,876,250
Total budget in USD (1 USD=82 BDT)	4,108,247

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 like 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 35/1

1.41.2 Loss of Agricultural Land

Impact

The project will involve 7.3 km of construction of retired embankment, widening base of 49.7 km of embankment and 5 km of forwarding of embankment, establishment of construction camps, dredged soil disposal on the two sides of the dredged channel and construction of flushing inlets (**Table 4.2**). The activities will acquire 3.6 ha of single cropped field, 10.45 ha of double cropped field, 9.35 ha of multi cropped field and 1.26 ha of orchard.

Mitigation

Since the estimated loss of agriculture land has already be determined based on the current alignment, the contractor will ensure construction work or establishment of construction camp will not further cause loss of agriculture land. The contractor will set up the plan for location of construction camp, stock piling of construction material and dredged spoil to cause minimum disturbance to agriculture land. The contractor needs to reflect the above planning in the Environmental Action Plan. The following steps will be followed to cause minimum disturbance to agriculture land:

- The contractor will identify the potential sites for establishing the temporary facilities in consultation with the BWDB, DCSC (Design Consultant and Supervision Consultant), and local communities. The sites will be finalized after obtaining approval from DCSC.
- All temporary facilities will preferably be located within the area owned by BWDB
- If the BWDB-owned land is not sufficient, contractor will consider floating camps outside the Polder. Such camps will be equipped with all necessary facilities to avoid river water pollution, and safeguard measures to protect labor from health and safety hazards.
- Ensure that no private structure or property is affected by the temporary facilities.
- Pay compensation/rent if private property is acquired on temporary basis.
- Consult and maintain liaison with the communities.

Residual Impacts

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

1.41.3 Clearing of Trees

Impact

There will be loss of vegetation during pre-construction stage due to clearing of land for base widening of polder, realignment of polder, establishment of construction camp, construction of drainage and flushing sluices, excavation of borrow pit etc. Table 9.8 provides the list of trees affected due to the rehabilitation/reconstruction of polder 35/1. It is estimated about 11,159. matured trees will be affected due to project activities.

Table 0.8: Trees to be Affected in Polder 35/1

Types	Big	Medium	Small	Plant	Total
Fruit trees	915	214	779	421	2,329
Timbers trees	33	101	808	124	1,066
Banana	2,207	1,802	1,610	1,810	7,429
Bamboo	141	75	109	10	335
Totals	3,296	2,192	3,306	2,365	11,159

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

Mitigation

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 will be 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.

1.41.4 Fisheries

Impact

The construction of embankments and dredging of canals and rivers have important consequences on flood plain ecology. The fish spawning will be impacted if canal excavation and collection of earth from Baleshwar and Bhola rivers happens during spawning period. The Rayenda khal, Talfalbari khal, Gabtola khal, and Chalitagonia khal are used as feeding and spawning ground of most of the open water fishes for polder 35/1. These khals are marked as the area of conservation significance. Table 4.4 shows Rayenda and Talfalbari canals will be re-excavated. New drainage sluice (Table 4.1 and Figure 9.1) DS-4 for Rayenda Bazar and DS-6 at Talfalbari 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 Rayenda and Talfalbari canals and placement of drainage sluice DS-4 and DS-6.

1.41.5 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. Of particular importance are nine schools within 500 m of the embankment, Rayenda bazaar (chainage 12.5 km), and Sonnashir bazaar (chainage 61 km). The

bazaars already face traffic congestion and additional project-related traffic will aggravate this problem.

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

1.41.6 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.

1.41.7 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.

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**.

1.41.8 Issues Addressed during Design Phase for Polder 35/1 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 repairment have already been listed in Table 4.1.
- Table 4.5, Column 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.

1.42 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

1.42.1 Drainage Congestion and Water Logging

Impact

The Project activities particularly on regulators and sluices and in water channels may block or clog water drainage channels, potentially causing temporary water logging in the surrounding areas and negatively affecting the cultivation and the associated communities. In particular, areas along Rayenda Khal and Khuriakhali Khal are already facing drainage congestion problems (see **Figure 6.8**). The Project works on the regulators in the area (Rayenda Bazar Regulator at chainage 12.5 km and Khuriakhali Khal Regulator at chainage 6.6 km) are likely to worsen the situation and exacerbate the water logging problem. Furthermore, Nalbunia, Dhansagar, Amrabunia and Dakshin Rajapur are also likely to face water logging during post monsoon season. After the completion of construction activities, this temporary water logging will disappear.

In addition, excavation of seventeen *khals* in the Polder (see **Table 4.4**) is likely to disturb the drainage which takes place through these channels. The significance of this potential unmitigated impact has been assessed as **Major**

Mitigation

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

- Contractor will construct bypass canal before construction of each regulator particularly at Rayenda Bazar and Kumarkhali because these are the major drainage channels in the Polder,
- Sequence of work at the regulators and in the water channels will be carefully planned to avoid drainage congestion.
- Contractor will ensure that drainage channels are not obstructed or clogged by the construction activities especially the Rayenda khal because this channel is the major drainage channel in the Polder.
- Contractor will ensure that construction activities do not cause any water ponding near cultivation fields particularly at the tail end of the Rayenda and Kumarkhali khals.

Residual Impacts

With the help of above mitigation measures, the impacts associated with water logging are likely to be adequately addressed and the significance of residual impact will be **Low**. In addition, the drainage congestion and water logging induced by the construction activities will disappear once the construction is over, as mentioned earlier.

1.42.2 Loss of Agriculture

Impact

Agriculture is the most important economic and livelihood activity in the Polder as discussed in **Chapter 6**. The construction activities, movement of construction machinery, project related vehicular traffic, material stockpiling, waste disposal, or camp establishment can potentially damage crops or affect the cultivated land. Unless mitigated the impact of sedimentation due to project activities will be major.

Mitigation

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

- 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
- Compensation will be paid for any crop damage
- Contractor will maintain liaison with communities.

Residual Impacts

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

1.42.3 Affects on Irrigation

Impact

Irrigation is vitally important for the agricultural activities in the Polder. Construction activities particularly on regulators and in water channels can potentially disrupt the crop irrigation thus negatively affecting cultivation (see **Figure 4.12** for Project interventions in the Polder). The works on sluices can cut off the incoming water from the river, while the excavation works in water channels can affect water conveyance through them. Locations of these structures are: chainage 0 km (D/S-1), 6.6 km (D/S-2), 7.92 km (D/S-3), 12.5 km (D/S-4), 14.33 km (D/S-5), 19.33 km (D/S-6), 23.5 km (D/S-7), 25 km (D/S-8), 27.9 km (D/S-9), 36.07 km (D/S-10), 39.77 km (D/S-11), 44.47 km (D/S-12), 54.46 km (D/S-13), 57.67 km (D/S-14), 60.14 km (D/S-15), 50.6 km (D/S-16), and 51.55 km (D/S-17).

Mitigation

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

- Contractor will construct bypass canal before construction of each regulator. The contractor needs to provide plan for bypass canal in the EAP.
- Sequence of work at the regulators and in the water channels will be carefully planned to avoid irrigation disruption.
- Contractor will ensure no negative impacts on crop irrigation
- Contractor will maintain liaison with communities.

Residual Impacts

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

1.42.4 Impacts on Fish Habitat and Migration

Impact

About 15 existing drainage sluices will be replaced by new ones as part of the Project. All of these sluices are connected with the *khals* of the Polder. Construction activities on these sluices can potentially affect aquatic habitat and fish migration in the *khals* (**Figure 6.16** for fish migration routes

in the Polder). Though the habitat in these *khals* is already modified as a result of construction of embankments and sluices in 1960s, some fish migration between outside rivers and internal *khals* still takes place particularly along those, which do not have any water control structure. In addition, 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 the 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* excavation (see **Table 4.4**). The significance of this potential unmitigated impact has been assessed as **Major**.

Mitigation

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

- Contractor will construct bypass canal before construction of each regulator
- Sequence of work at the regulators and in the water channels will be carefully planned to minimize impacts on fish and their migration.
- Fish (particularly juvenile fish) will be transferred from rivers to Polder water channels where appropriate.
- Contractor will maintain liaison with communities.

Residual Impacts

With the help of 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**.

1.42.5 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 17 *khals*, dredging of Baleswar and Bhola rivers 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**.

1.42.6 Damage / Disturbance to Faunal Resources

Impact

No significant faunal resources exist in the Polder primarily because of the presence of human settlements and cultivation fields, and most of the species that now exist in the area are essentially

those which have adapted to the modified habitat. Hence the Project activities are not likely to have any significant impact on the faunal resources of the Polder. Release of untreated waste effluents and contaminants in the rivers and water channels potentially affect the wildlife resources of the area. In addition, the south-western side of Sundarban may face disturbances due to construction activities particularly noise generation, any material borrowing or waste generation inside the Forest.

Mitigation

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

- No material will be borrowed from and no waste will be disposed in Sundarban.
- Liaison with the Forest Department will be maintained to forestall any negative impacts on Sundarban.
- Contractor will not release untreated wastes on soil or in water
- Labor will not indulge in hunting, trapping, or shooting wild animals.

Residual Impacts

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

1.42.7 Impacts on Floral Resources

Impact

A large number of trees of different species and varying sizes exist along the embankments of the Polder 35/1. During the construction works, more than 11,000 of these trees will need to be felled to increase the width and height of the embankments and for other project interventions. In addition, establishment of labor camps and other temporary facilities, material stockpiling, material borrowing, and waste disposal can potentially affect the natural vegetation and trees.

Mitigation

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

- 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.
- Contractor will avoid dumping of spoil earth in and material borrowing from vegetated areas;
- Construction camps and other facilities will be located so as to minimize vegetation loss and tree felling
- Contractor will enhance flora environment by planting fruit trees and mangrove plants;
- No material to be borrowed from and no waste to be disposed in Sundarban.

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**.

1.42.8 Air Quality Deterioration

Impact

Construction machinery and Project vehicles will release exhaust emissions, containing carbon monoxide (CO), sulfur dioxide (SO₂), oxides of nitrogen (NO_x), and particulate matter (PM). These emissions can deteriorate the ambient air quality in the immediate vicinity of the Project sites (particularly along the embankment, and around the channel excavation sites and borrow areas – see **Figure 4.12** for the Project interventions in Polder 35/1). Furthermore, construction activities such as excavation, leveling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions. These emissions pose health hazards for the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will be exposed to air contamination caused by the Project activities. Of particular importance are nine schools which are located near the embankment (see **Figure 9.1**). If proper mitigation measure is not followed, the significance of this potential unmitigated impact has been assessed as **Moderate**.

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 (10 am to 1 pm) particularly near the schools
- Exhaust emissions from vehicles and equipment will comply with standards
- Proper tuning of vehicles, generators, and equipment will be carried out, to minimize exhaust emissions.
- Construction material (sand/soil) will be kept covered while transporting and stock piled.
- Water sprinkling will be carried out where needed, particularly on the earthen tracks near communities.
- Vehicle speed will be on low (15 km per hour) on earthen tracks particularly near communities.
- Vehicles and other machinery will be turned off when idle
- Good quality fuel will be used, minimizing exhaust emissions.
- 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 air quality deterioration are likely to be adequately addressed and the significance of residual impact will be **Low**.

1.42.9 Soil and Water Contamination

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 impact will be major if proper mitigation measure is not followed.

Mitigation

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

- Contractor will prepare and implement pollution control plan and submit with the EAP
- Contractor workshops will have oil separators/sumps to avoid release of oily water.
- Contractor will 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
- Contractor will locate camps away from communities and drinking water sources
- Contractor will prepare and implement camp waste management plan (septic tanks, proper solid waste disposal);
- Contractor will not release untreated wastes on ground or in water
- Contractor will re-use spoil and excavated material where possible
- Contractor will dispose spoil at designated areas with community consent
- Construction material, demolition debris, and excavated soil/silt will not be allowed to enter water bodies.

Residual Impacts

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

1.42.10 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 Baleswar river, and Terabeka, Satgharer, Gobtolar, Tafalbari, Sonatala, Jheelbonia, Rayenda, Thanar, Khunta, Kumarkhali, Sannashir, Andaria, Farajipara, Kabirajer, Rajapur, Rathiar and Khejurakhal, 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**.

1.42.11 Sedimentation

Impact

Borrowing material from the river banks may potentially cause increased sediments in the rivers. Similarly, re-excavation of water channels (see **Table 4.4** for the list of channels to be re-excavated) if carried out in water can potentially increase their sediment load. Excavated material from the channels if left along their banks may again enter the water thus increasing their sediment load. In addition, construction material, loose earth/soil, demolition debris, and other materials may enter the river or other water bodies causing increased sediments in them. Run off from construction sites, material yards, camps, and other temporary facilities may enter water bodies increasing their sediment load (see **Figure 9.1** for the potential locations of sedimentation). Unless mitigated the impact of sedimentation due to project activities will be major.

Mitigation

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

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

Residual Impacts

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

1.42.12 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 9.9 shows the noise level to be expected from the equipment. According to ECR'97 60 dBA is applicable for mixed area in Bangladesh.

Table 0.9: 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

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**.

1.42.13 Safety and Public Health Hazards

Impact

Construction work near Bhola River will be conducted during dry season. This area is near Sundarban and prone to attacks by the Royal Bengal Tigers. The construction workers are likely to be exposed to this hazard during the construction phase.

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.

Mitigation

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

- All the construction work near Bhola River will be conducted in the presence of Forest Guards for safety of labor against the tiger attacks. Construction workers' awareness raising will be carried out regarding the risks and their avoidance. Nighttime works will not be carried out in tiger-prone areas. Camps will be protected against tigers and periphery fencing and lighting will be carried out. Appropriate arrangements will be made to frighten the tigers to keep them away from the work areas.
- 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, hygiene 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 carriers 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.
 - Firefighting equipment will be made available at the camps and worksites.

- The camp staff will be provided safety including fire fighting training.
- 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**.

1.42.14 Increased Inland and Waterway Traffic

Impact

Transportation of construction materials is a key concern during the Project since the Polder 35/1 is located in a remote area of Bagerhat district. Two broad options are available for carrying construction materials to the Project stockyards in the Polder. The first option would involve transportation along Khulna-Mongla port-Sannashi launch jetty -Rayanda Bazar inside the Polder. The second option would involve road transportation from Khulna to Ghasiakhali ferry jetty and from there, ferry transportation to Rayanda Bazar inside the Polder.

Material transportation along the major roads and waterways may not create a significant problem, however, additional traffic at smaller jetties such as the one at Ghasiakhali may cause traffic congestion and hindrance to other commuters, travelers, and transporters.

Similarly, for the material transportation from the stock yard to the construction sites, Polder's internal roads can be used; alternatively, the outer rivers can also be used for this purpose. However not all water bodies around the Polder are suitable for material transportation (eg, Bogi *khal*).

Mitigation

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

- Contractor to prepare and implement traffic management plan
- Contractor to establish new, temporary jetties where needed (eg, at Ghasiakhali jetty)
- River crossing for material transportation during nighttime where possible and appropriate
- Material transportation through rivers during high tide where needed (eg, Bogi *Khal*)
- 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**.

1.42.15 Hindrance for Pedestrian and Vehicle Movement

Impact

Eight markets are located in the polder near the embankment; these include Pollimongol Bazar, Chairman Bazaar, Sannashir Bazaar, Sannashir Bazaar, Khantakata Bazaar, Rayenda Bazar, Terabaka Bazaar and Bandakata Bazar (see **Figure 9.1**). These markets play an important role by providing source of livelihood of the Polder inhabitants as well as meeting the daily needs of the people. Construction activities along the embankments are likely to disrupt these markets. In addition, the tracks (mostly brick soled) on the embankments are the key transportation routes both for pedestrians and vehicles in the Polder connecting the communities and markets. The construction activities along these embankments will result in removal of these tracks thus causing communication and transportation problems to the local population.

Mitigation

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

- 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 the floral resources are likely to be adequately addressed and the significance of residual impact will be **Low**.

1.42.16 Social and Gender Issues

Impact

It is envisaged that about 60 percent construction workers will be recruited from within the Polder while the remaining will come from other areas. The presence of outside laborers in the area may create friction and conflict between the local labor and outside labor, and between local community and outside labor.

Presence of a large number of outside labor can potentially cause encroachment in the privacy of local population particularly women and their mobility can be negatively affected.

Mitigation

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**.

1.42.17 Damage to Local Infrastructure

Impact

There could be some inadvertent damage to the roads, electricity lines, water channels, jetties, and other structures during the construction activities, transportation of equipment and material, and associated vehicular traffic (see **Figure 9.1**).

Mitigation

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

- The condition of the infrastructure being used for the construction and transportation activities will be regularly monitored.
- All damaged infrastructure will be restored to original or better condition.

Residual Impacts

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

1.43 Impacts during Post-construction Phase

1.43.1 Impact of Tidal Flooding

Impact

The tidal flooding is one of the major problems in coastal zone of Bangladesh, and Polder 35/1 is facing severe tidal flooding after Sidr for the existing breach points of the embankment and low height of the embankment. The vulnerable points of the project area are Purbo Amtali and Rayenda

Bazar at chainage 32km which have been facing flooding during high tide. This is a localized problem and would be reversible through proper rehabilitation works, which have been considered in the Feasibility Study. If the proposed implementation works are not implemented immediately, the problem will be further aggravated.

Rayenda bazaar is a major market in the Polder area. This bazaar (with about 180 shops) is regularly flooded during high tide and damages their valuable properties and livelihoods. However, the rehabilitation plan has not considered any kind of flood protection measure for this area.

Mitigation

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

- Embankment (about 3.5 km long) will be constructed around the Rayenda Bazar to protect tidal flooding during high tide. The existing embankment could not be shifted near the Rayenda khal because there is no set back distance between Rayenda khal and bazaar.
- Regular monitoring of embankment, regulators, and seepage of surface waters from Baleswar River through the regulators will be conducted during dry seasons and necessary steps will be taken to check seepage, if any.
- Afforestation will be undertaken at both side of the embankment, which will help strengthen the embankment.

1.43.2 Risk of Embankment Failure

Impact

Rain cuts and public cuts are the major causes of embankment breaching of the Polder 35/1. Lack of regular maintenance has created weak point at the sensitive locations of the embankment. Mal-maintenance and increasing intensity and magnitude of the cyclone and storm surge simultaneously have accelerated the risk of embankment failure. Counter clockwise circulation of the cyclone of the Bay of Bengal will make the eastern embankment more susceptible to breaches.

Mitigation

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

- Regular monitoring and careful maintenance of the embankment and existing water control structures especially along the eastern side of the Polder will be ensured. This monitoring will particularly be carried out before and after monsoon season.
- Available cyclone and flood shelter will be prepared as a contingency measure during emergency situation.
- WMG will develop a fund for this kind of emergency situation.
- Structural measures like geo bag and sand bag will be kept in local BWBD office at Rayanda Bazar.

1.43.3 Drainage Congestion and Increased Sedimentation in Water Channels and Rivers

Impact

Drainage congestion is a key issue in southwest zone of Bangladesh, and Polder 35/1 is facing this problem due to siltation of *khals* and external rivers, as discussed in **Section 6.2.5**. Specifically, Bhola River is silted up due to reduced flow from the upstream. This problem is localized and reversible by proper re-excavation of *khals*, which has been considered in Feasibility Study (see **Table 4.4**). However, it is a recurring problem and silt deposition in the rivers outside and water channels inside the Polder is likely to continue. Particularly, the low lying areas of the Polder and tail ends of *khals* (**Figure 6.16**) may face severe drainage congestion in the future.

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**.

1.43.4 Increase Salinity Intrusion Due to Leakage of Regulators

Impact

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. The Proposed project has been designed to address such damages which are currently caused by the salinity intrusion. Mishandling and or poor upkeep and maintenance of these control structures will undermine the very objective of the Project. Salinity is likely to increase in Sonyasi, Bidhanshagor, Amragachia, Rajapur, and Sonatola mauzas.

Mitigation

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

- Regular monitoring and careful maintenance of the water control structures will be ensured.
- Standard operating procedures will be prepared and implemented for the water control structures. These procedures will be translated in Bangla as well.
- Capacity building of WMOs will be carried out.

1.43.5 Water Contamination and Reduced Soil Fertility

Impact

At present, about 225 ha of land are under *boro* (rice) cultivation. According to the initial estimates, about 2.3 Mm³ of water will be available from the internal canal system, after the completion of the proposed Project. This will allow expansion of area under irrigated cultivation of *boro* and *aus* varieties of rice to about 3,880 ha. This expansion of irrigated cultivation is likely to result in decreased soil fertility and increased use of chemical inputs especially fertilizers. Runoff 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.

Mitigation

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

- Farmers will be encouraged by BWDB in collaboration with Department of Agriculture (DAE), if necessary, through WMG to use organic manure to increase soil fertility while avoiding water contamination
- Farmers will be encouraged to cultivate leguminous crops to enhance the soil quality
- Pest Management Plan will be prepared before the completion of the construction phase of the project.

1.43.6 Reduced Fish Migration

Impact

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 (see **Figure 6.16**). This can potentially result in decrease of fish population in the Polder (see **Table 6.17**) thus adversely affecting the fish catch and fishermen. Longer term monitoring of fish catch assessment in canal and river is required to identify real impact from the hydraulic structure operation activities.

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.

1.43.7 Impact on Shrimp farming and Livelihood

Impact

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. The significance of this potential unmitigated impact has been assessed as **Moderte**.

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 shrimp 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.

1.43.8 Impacts on Sundarbans

Impact

Sundarbans exist in the south and west part of polder 35/1. In the south from Chainage 25500 to Chainage 29000, Bogi river is in between Sundarbans and Polder 35/1. In the west from chainage 29000 to 50,000 Sundarbans is separated by Bhola river from Polder 35/1. The main impact of the polder on the Sundarban ecosystem situated across the river is the intrusion of more water on the forest floor of Sundarban. This may enhance the height of the tidal inundation of the forest. This enhanced tidal inundation, may imbalance the natural tide inundation features of the given ecosystem. It is commonly observed that in areas that have higher tide inundations, the species composition is different than that is found in the areas that have lower tide inundations. It has been observed that the species such as Sundri (*Heritiera fomes*), Passur (*Xylocarpus moluccensis*), Kakra (*Bruguiera gymnorhiza*), etc. prefer lower tide inundation. As against this, species such as Jhana (*Rhizophora mucronata*), Goran (*Ceriops decandra*), etc. prefers higher inundation. Thus with the enhanced inundation the species composition may gradually change. Secondary information obtained from interviewing local forestry officer reveals that the proportion of Goran on the patch of forest north of "Dabrir Bhorani" across the Shoronkhola Range has increased tremendously and population of crabs have reduced significantly.

Again if the quantity of water entering the Sundarbans increases, consequently the speed at which the water enters the forest floor also increases, which in turn may cause two things, namely

- brings in more of coarser soil particles on the forest floor as it enters and majority of these get deposited on the river banks or nearby
- drains off more of the heavier detritus from the forest floor as it recedes, which otherwise would have got retained by the given ecosystem. This may ultimately cause the loss of soil fertility. Interviewing forest department it was revealed that In the past (during 1977/78) there was good growth of Shingra (*Cynometra ramiflora*) at Terabaka area under Shoronkhola range across the polder 35/1. Currently only a few of these species is available.

It is however very difficult to isolate what part or what quantum of these above said impacts are because of the polders alone. It needs to be mentioned herein that the quantum of these impacts will be lower if the width of the river between the Sundarban & Polder is more.

Mitigation

1. Although there is no definite study on how much width should be maintained between the river and polder to have no impact on Sundarbans, the study advised to avoid any kind of realignment for polder 35/1 from chainage 25500 to 50,000.
2. The long term monitoring study under the project will incorporate the study on the impact on the ecology of Sundarbans.
3. BWDB will continue to monitor the ecology on Sundarbans due to project intervention and will guide the design consultant for finalizing the design of other polders close to Sundarbans like Polder 15 under this project.

1.44 Positive Impact of the Project

1.44.1 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.

1.44.2 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.

1.44.3 Livelihood Development

Polder 35/1 was one of the worst affected polders during cyclone Sidr. The project is expected to increase resilience of people within Polder 35/1. Agriculture production increase, reduction of drainage congestion, income generation is expected to improve the livelihood of the people.

1.44.4 Afforestation

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.

1.44.5 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.

1.45 Summary of Assessed Impacts

A summary of these impacts and their significance discussed in the sections above is presented in **Table 9.9**.

Table 0.9: 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								
Involuntary resettlement	Long term	Local	Irreversible	Certain	High	Major	<ul style="list-style-type: none"> • 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. 	Moderate
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	<ul style="list-style-type: none"> • The contractor will identify the potential sites for establishing the temporary facilities in consultation with the BWDB, DCSC, and local communities. The sites will be finalized after obtaining approval 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)		
							<p>DCSC.</p> <ul style="list-style-type: none"> All temporary facilities will preferably be located within the area owned by BWDB If the BWDB-owned land is not sufficient, contractor will consider floating camps outside the Polder. Such camps will be equipped with all necessary facilities to avoid river water pollution, and safeguard measures to protect labor from health and safety hazards. Ensure that no private structure or property is affected by the temporary facilities. Pay compensation/rent if private property is acquired on temporary basis. Consult and maintain liaison with the communities. 	
Increased traffic for contractor mobilization	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	<ul style="list-style-type: none"> The contractor will prepare a traffic management plan (TMP) and obtain approval from the DCSC. The TMP will 	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)		
							<p>be shared with the communities and will be finalized after obtaining their consent.</p> <ul style="list-style-type: none"> 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. 	
Impacts associated with construction of temporary facilities	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	<ul style="list-style-type: none"> Contractor will prepare site establishment plan and obtain approval from the DCSC Approval from DCSC will be obtained for the location of temporary facilities. Tree felling and vegetation clearing will be minimized to establish site facilities Photographic record will 	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)		
							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.	

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)		
B. Construction Phase								
Drainage congestion and water logging	Short term	Local	Reversible	Occasional	Medium to high	Major	<ul style="list-style-type: none">Contractor will constructing bypass canal before construction of each regulator particularly at Rayenda Bazar and Kumarkhali because these are the major drainage channels in the Polder,Sequence of work at the regulators and in the water channels will be carefully planned to avoid drainage congestion.Contractor will ensure that drainage channels are not obstructed or clogged by the construction activities especially the Rayenda khal because this channel is the major drainage channel in the Polder.Contractor will ensure that construction activities do not cause any water ponding near cultivation fields particularly at the tail end of the Rayenda and Kumarkhali khals.	Low
Soil and water contamination: large volume of	Short term	Local	Reversible (after construction)	Certain	High	Major	<ul style="list-style-type: none">Contractor to prepare and implement pollution control 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)		
construction wastes, leakage, spillage of oil from vessels and engine boat, camp wastes, disposal of demolition material, spoil, and excavated silt			phase)				<ul style="list-style-type: none"> • Oil separators/sumps for workshops • Avoid repairing vehicles and machinery in the field • Use plastic sheet or gravel 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 • Disposal of spoil at designated areas with 	

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)		
							community consent <ul style="list-style-type: none"> Construction material and excavated soil/silt will not be allowed to enter water bodies. 	
Soil erosion	Short term	Local	Mostly Irreversible	Likely	High	Major	<ul style="list-style-type: none"> Avoid operating heavy machinery close to the banks of rivers and water channels (khals) Implement appropriate erosion control measures (eg, stone pitching) where needed Re-contour borrow areas where needed Protect untreated embankment slopes Avoid works in rainy season. 	Low
Sedimentation	Short term	May extend beyond Polder	Mostly Irreversible	Likely	High	Major	<ul style="list-style-type: none"> Protect untreated embankment slopes Excavate channels after dewatering them. Excavated earth and silt not to be placed on channel banks Implement measures to protect channels from run-off from work areas and camps Obtain borrow material from river banks in a 	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)		
							manner not to increase siltation in rivers; do not leave loose soil after excavation.	
Damage to agriculture	Short term	Local	Reversible	Likely	High	Major	<ul style="list-style-type: none"> • 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 • No material dumping inside cultivation fields • Maintain liaison with communities. 	Low
Affects on irrigation	Short term	Local	Reversible	Likely	High	Major	<ul style="list-style-type: none"> • 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 to fish migration	Short term	Local	Reversible	Likely	Medium to high	Major	<ul style="list-style-type: none"> • Constructing bypass canal during construction of all regulators • Proper sequencing of works on regulators and sluices; • During monsoon runoff 	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)		
							will be diverted to adjacent depressions and from there to river after settling <ul style="list-style-type: none"> • Transferring fish from rivers to Polder water channels where appropriate. • Maintain liaison with communities. 	
Safety and Public Health Hazards	Short term	Local	Reversible	Likely	High	Major	<ul style="list-style-type: none"> • All the construction work near Bhola River will be conducted in the presence of Forest Guards for safety of labor against the tiger attacks. Construction workers' awareness raising will be carried out regarding the risks and their avoidance. Nighttime works will not be carried out in tiger-prone areas. Camps will be protected against tigers and periphery fencing and lighting will be carried out. Appropriate arrangements will be made to frighten the tigers to keep them away from the work areas. • Liaison will be established with the Bangladesh 	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)		
							<p>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.</p> <ul style="list-style-type: none"> • 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 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 	

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)		
							<p>be procedures in place to access appropriate emergency facilities;</p> <ul style="list-style-type: none"> • 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; • 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 	

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)		
							<p>frequently than normal in toolbox talks;</p> <ul style="list-style-type: none"> 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 	

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)		
							<p>requirements related to minimum wages and hours of work;</p> <ul style="list-style-type: none"> • 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 	

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)		
							<p>and terms of employment, including the full range of benefits;</p> <ul style="list-style-type: none"> • 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 	

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)		
							<p>workers;</p> <ul style="list-style-type: none"> 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. 	
Air quality	Short term	Local	Reversible	Certain	Medium to	Moderate	<ul style="list-style-type: none"> Demolition 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)		
deterioration (dust, combustion gases)			(after construction phase)		high		<p>regulators will not be carried out during the school time (8 am to 1 pm) particularly near the schools</p> <ul style="list-style-type: none"> Exhaust emissions from vehicles and equipment will comply with standards Proper tuning of vehicles, generators, and equipment will be carried out, to minimize exhaust emissions. Construction material (sand/soil) will be kept covered while transporting and stock piled. Water sprinkling will be carried out where needed, particularly on the earthen tracks near communities. Vehicle speed will be on low (15 km per hour) on earthen tracks particularly near communities. Vehicles and other machinery will be turned off when idle Good quality fuel will be used, minimizing exhaust emissions. Camps will be located at a 	

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)		
							safe distance from communities. • Liaison with the communities will be maintained and grievance redress mechanism will be established at the site.	
Noise generation	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• 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	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)		
							minimize noise levels <ul style="list-style-type: none"> • 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. 	
Increased inland and waterway traffic	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	<ul style="list-style-type: none"> • Contractor to prepare and implement traffic management plan • 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. 	Low
Affects on benthic communities	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	<ul style="list-style-type: none"> • 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	Short term	Local	Reversible	Likely	Medium	Moderate	<ul style="list-style-type: none"> • No material to be borrowed from and no waste to be disposed in 	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)		
faunal resources							<p>Sundarban.</p> <ul style="list-style-type: none"> Do not release untreated wastes on soil or in water Labor not to indulge in hunting, trapping, or shooting wild animals. 	
Damage to floral resources	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	<ul style="list-style-type: none"> Contractor will prepare a tree cutting plan and re-plantation plan, obtain approvals from DCSC, 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. Contractor will avoid dumping of spoil earth in and material borrowing from vegetated areas; Construction camps and other facilities will be located so as to minimize vegetation loss and tree felling Contractor will enhance flora environment by planting fruit trees and mangrove plants; 	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)		
							<ul style="list-style-type: none"> No material to be borrowed from and no waste to be disposed in Sundarban. 	
Hindrance for Pedestrian and Vehicle Movement	Short term	Local	Reversible	Likely	Medium	Moderate	<ul style="list-style-type: none"> 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 	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)		
Social Unrest	Short term	Local	Reversible	Likely	Medium	Moderate	<ul style="list-style-type: none"> GRM will be put in place. 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. 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 	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)		
							activities during Prayer time.	
Damage to infrastructure	Short term	Local	Reversible	Likely	Medium	Moderate	<ul style="list-style-type: none"> The condition of the infrastructure being used for the construction and transportation activities will be regularly monitored. All damaged infrastructure will be restored to original or better condition. 	Low
C. Post Construction Phase								
Tidal flooding	Long term	Local	Reversible	Likely	High	Major	<ul style="list-style-type: none"> Embankment (about 3.5 km long) will be constructed around the Rayenda Bazar to protect tidal flooding during high tide. The existing embankment could not be shifted near the Rayenda khal because there is no set back distance between Rayenda khal and bazaar. Regular monitoring of embankment, regulators, and seepage of surface waters from Baleswar River through the regulators will be conducted during dry seasons and necessary steps will be taken to check seepage, if any. 	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)		
							<ul style="list-style-type: none"> Afforestation will be undertaken at both side of the embankment, which will help strengthen the embankment. 	
Risk of embankment failure	Long term	Local	Reversible	unlikely	High	Major	<ul style="list-style-type: none"> Regular monitoring and careful maintenance of the embankment and existing water control structures especially along the eastern side of the Polder will be ensured. This monitoring will particularly be carried out before and after monsoon season. Available cyclone and flood shelter will be prepared as a contingency measure during emergency situation. WMG will develop a fund for this kind of emergency situation. Structural measures like geo bag and sand bag will be kept in local BWBD office at Rayanda Bazar. 	Low
Drainage congestion and increased sedimentation in	Long term	Local	Reversible	Likely	High	Major	<ul style="list-style-type: none"> An ongoing program of de-silting of water channels will be considered with full community involvement 	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)		
<i>khals</i> and rivers							<p>and participation. WMGs will take the lead for this purpose.</p> <ul style="list-style-type: none"> • 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. 	
Increase salinity intrusion due to leakage of	Long term	Local	Reversible	Likely	High	Major	<ul style="list-style-type: none"> • Regular repair and maintenance of regulators • Prepare Bangla manual for 	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)		
regulators							sluice gate operation <ul style="list-style-type: none"> • provide training to WMOs; • Proper standard operating procedures (SOPs). 	
Soil and water contamination (increased use of chemical inputs) and reduced soil fertility	Long term	Local	Reversible	Likely	High	Major	<ul style="list-style-type: none"> • Using IPM method for reducing pesticide use; • Awareness raising of communities 	Moderate
Reduced fish migration	Long term	Local	Reversible	Likely	Medium	Moderate	<ul style="list-style-type: none"> • Proper sluice gate operation allowing fish migration. • provide training to WMOs; • Transferring juvenile fish from rivers to Polder. 	low

Cumulative and Induced Impacts

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.

1.46 Cumulative Impacts of all CEIP Interventions

Bangladesh, specially the southern coastal region, has been formed through the delta development process under the influence of three mighty rivers: the Ganges, the Brahmaputra and the Meghna. The coastal area is crisscrossed by these major rivers and their tributaries and distributaries along with several minor rivers and channels. Under tidal influence, the area is inundated twice every day during high tide. Sediments carried by these upstream rivers as well as sediments from the Bay of Bengal during high tide enter into the floodplain spilling over from the rivers and channels. In between the high and low tide, the sediments get deposited on the floodplain contributing to the delta development process. Water with reduced load of sediments flows back to the Bay of Bengal during low tide. This process continued for hundreds of years in the southern coastal region of Bangladesh thereby maintaining a balance between subsidence and sedimentation.

In the late 1960s, Coastal Embankment Project (CEP) was implemented by the then East Pakistan Water and Power Development Authority (EPWAPDA) presently functioning as Bangladesh Water Development Board (BWDB). Under the CEP, polders were created by constructing embankments along the riverbank with provision of sluice gates to control entry and exit of water from the river into the poldered areas. The main objective of creating polders was to check entry of saline water for increasing agricultural crop production, specially transplanted aman rice (T. Aman) in the wet season.

The CEP contributed substantially to increased agricultural crop production for the next two decades when it was observed that the sediments were getting deposited on the river bed so much so that the river beds became higher than the poldered areas by early 1990s. Most of the sluices were covered by the deposited sediments and went out of operation. These phenomena created tremendous drainage congestion within the polders to such an extent that the land went out of cultivation, homestead as well as roads, schools, colleges, markets, mosques, temples, graveyards were inundated.

Since the coastal polders will be rehabilitated and improved in phases, it is a great concern that the improvement of one polder might have impacts on flooding or salinity pattern outside the polder. For instance, when considered individually, the raising and strengthening of embankments in a given polder to withstand higher storm surges will benefit the people inside the polder and will have very little long term impact. The higher embankment has an impact only during the rare occurrence of a storm surge affecting that particular polder (say once in 10 years or so), and that also for a day or two. Such events do not cause long term morphological change or salinity impacts except within polders that have been flooded. However, there is a related impact on storm surge levels outside the polder. If more and more polders are protected from storm surges by higher embankments, their cumulative effect would drive the storm surge levels even higher, and possibly further upstream along the river system. Preliminary analysis of the location and proposed design specification (including climate change impacts) of 17 polders in the first phase of CEIP shows that most of the polders will not have significant impact on storm surge level and cumulative impact on other polders, as they are located either on the bank of big river and sea or far from the coast on the northern side of the Sundarbans. Only a few polders (39/2C, 41/1, 43/2C, 47/2) might face slight impact of increasing storm surge level and cumulative impact on other surrounding polders.

The potential cumulative impacts of the CEIP interventions in the first batch of five polders (32, 33, 35/1, 35/3, and 39/2C) are discussed below.

Polders 31, 23 and 10-12 are adjacent to the Polder 32, and they are located along the Sibsa River (**Figure 10.1**). It is proposed in the detail design study that the crest level of Polder 32 is raised up to 4.5 - 5 m, so that it can withstand storm surges of 3.3 to 4.3 m of one-in-50-year event with climate change scenario. If the Polder 32 is raised according to the proposed design, the adjacent polders (31, 23 and 10-12) might be overtopped in case of one in 50 year event with climate change scenario, as their existing crest level are lower than the extreme surge level (see **Tables 10.1, 10.2 and 10.3**). However, these polders are not likely to be affected by storm surges of one-in-25-year event.

Polder 34/2, which is under construction, is located on the eastern bank of Passur River, opposite the Polder 33 (see **Figure 10.1**). Although the existing crest level of Polder 34/2 is not known yet, the raising of embankment of Polder 33 might increase storm surge level in the area during extreme storm surge events. This needs to be investigated further.

Polder 39/1 is adjacent to the Polder 35/1 (see **Figure 10.2**). Polder 39/1C has existing crest level of 4 m, which would be sufficient to prevent storm surge event of one-in-25-years with climate change scenario. However, some part of the Polder 39/1 may be overtopped by extreme storm surge event of one-in-50 years with climate change scenario (comparison of crest level and storm surge level is given in **Tables 10.2 and 10.3**).

Polder 34/2 and Polder 37 are adjacent to the Polder 35/3 (**Figure 10.1, Table 10.2**). Storm surge level in all scenarios would be low as this place is far from the coast. Therefore, it is expected that there would not be any cumulative impact on the adjacent polders.

Polder 37 and 38 are adjacent to the Polder 39/2C, of which Polder 37 is under construction and Polder 38 is has not been implemented yet (**Figure 10.2, Table 10.2**). Raising of embankment of Polder 39/2C might have slight impact of the adjacent polder only in extreme storm surge level (**Tables 10.1, 10.2 and 10.3**).

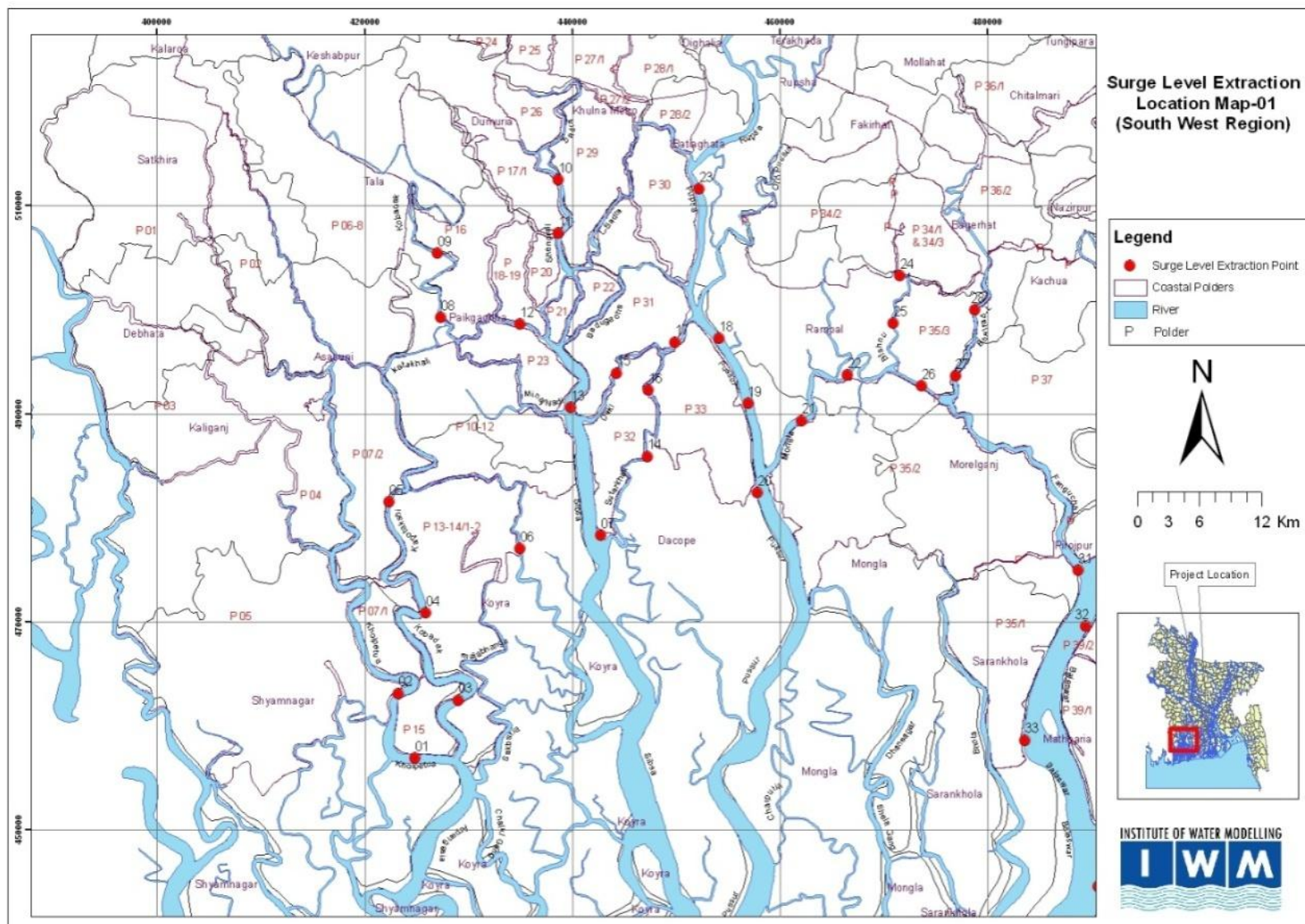


Figure 0.1: Location of Polders where Storm Surge Modeling was carried out

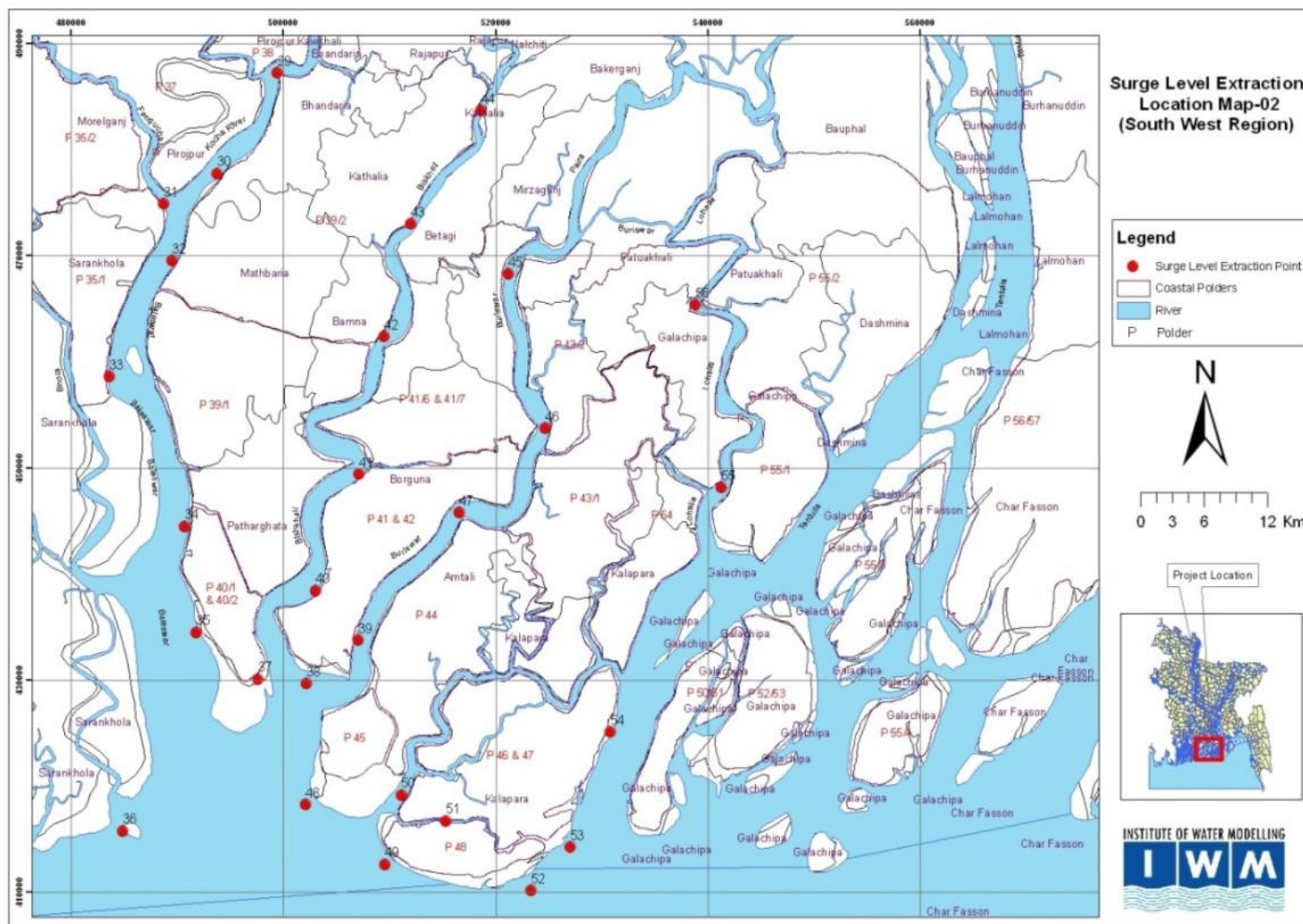


Figure 10.2: Location of Polders where Storm Surge Modeling was carried out

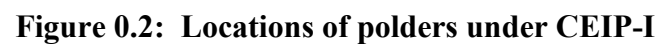


Table 0.1: Proposed design crest level of embankments of five polders

Polder Number	Design crest level (m)
32	4.5 - 5.0
33	4.5
35/1	6.0 - 6.5
35/3	4.5
39/2C	5.0 - 5.5

Source: Draft Detail Design Report for Flood Embankments, Drainage Canals, Protection works and Hydraulic Structures (Five Polders), Coastal Embankment Improvement Project, Phase-I (CEIP-I), BWDB, Dhaka, May, 2012.

Table 0.2: Existing average crest level of adjacent polders of five polders

Polder Number	Adjacent Polders	Existing average crest level (m)*
32	10-12	3.45
	23	3.45
	31	3.66
33	34/2	On going
35/1	39/1	4.0
35/3	34/2	On going
	37	On going
39/2C	37	On going
	38	Not implemented

**Source: Data collected by CEIP*

Table 0.3: Computed Storm Surge Levels Adjacent to Five Selected Polders

Point No	Adjacent Polder Number	River Name	Maximum Surge Level without Climate Change (m)		Maximum Surge Level with Climate Change (m)	
			1: 25 yr	1: 50 yr	1: 25 yr	1: 50 yr
07	32	Sibsa	3.419	3.984	3.606	4.021
104	32	Sibsa	3.492	4.059	3.681	4.111
13	32/31/23	Sibsa	3.510	4.070	3.845	4.316
14	32/33	Sutarkhali	2.899	3.284	3.845	4.316
16	32/33	Sutarkhali	2.945	3.341	3.073	3.346
15	32	Dhaki	3.059	3.489	3.396	3.767
17	33	Dhaki	2.882	3.258	2.983	3.239
18	33	Pussur	2.765	3.096	2.853	3.078
19	33	Pussur	2.917	3.322	2.993	3.249
20	33	Pussur	3.113	3.570	3.238	3.565
24	35/3	Bishnu	2.574	2.880	2.596	2.778
25	35/3	Bishnu	2.574	2.880	2.623	2.817
26	35/3	Kata Khali	2.595	2.923	2.730	2.979
28	35/3	Poylahara	2.669	3.028	2.755	2.99
29	39/2C	Kocha	3.240	3.767	3.355	3.732

Point No	Adjacent Polder Number	River Name	Maximum Surge Level without Climate Change (m)		Maximum Surge Level with Climate Change (m)	
			1: 25 yr	1: 50 yr	1: 25 yr	1: 50 yr
30	39/2C	Kocha	3.235	3.781	3.441	3.854
31	35/1	Baleswar	3.338	3.904	3.583	4.038
101	35/1	Bhola	2.929	3.360	3.180	3.546
33	35/1	Baleswar	3.308	3.903	3.782	4.340
32	35/1	Baleswar	3.288	3.861	3.577	4.045
102	35/1	Bhola	3.324	3.913	3.708	4.244
103	35/1	Baleswar	3.336	3.917	3.668	4.178

Source: Draft Detail Design Report for Flood Embankments, Drainage Canals, Protection works and Hydraulic Structures (Five Polders), Coastal Embankment Improvement Project, Phase-I (CEIP-I), BWDB, Dhaka, May, 2012.

1.47 Other Projects around Polder 35/1

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 35/1. The activities of these projects may generate cumulative impacts on the polder. Tables 10.4 and 10.5 show lists of various projects undertaken by the GoB and NGOs in the districts of Bagerhat and Khulna.

Table 0.4: 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
	Biodiversity Conservation in Sundarban Reserve Forest.	1999-2005	Satkhira, Khulna, 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 0.5: 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

1.48 Cumulative Impacts of Other Projects in the Area

Some cumulative impacts are likely to be generated in polder 35/1, due to the implementation of various large or small scale projects. These impacts may be direct or indirect, major or minor in context of polder 35/1, but the consequences of such impacts need to be investigated. The cumulative impacts found in polder 35/1 for different projects are discussed below.

a) Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)

In order to facilitate 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.

A major component of the overall activities of this project is rehabilitation of coastal embankments in five upazilas of Barguna district (Amtali, Bamna, Betagi, Barguna sadar, Patharghata), two upazillas of Pirojpur district (Bhandaria, Mathbaria), and three upazillas of Patuakhali district (Dashmina, Galachipa, Kalapara). Among the 35 polders considered for rehabilitation under the project, polder 39/1C is located near the left bank of Baleswar river, at the opposite side of polder 35/1. The design height of embankments in Polder 39/1 is 4m (from mean sea level) and this polder will tend to divert the flow of Baleswar River further downstream. Consequently, the lake in the southern periphery of polder 35/1 (Bogi lake) will be subjected to inflow of huge amount of silts and will be reduced in depth in future. Due to the reduced depth of Bogi lake, existence of mangrove flora may be expanded towards the polder in future. Places near Bogi lake may undergo the diversion of new mangrove species because of the chances of expansion of saline habitats in the polder. Meanwhile, easy access from Sundarbans to polder 35/1 through Bogi lake would lead to frequent migration of animals from the Sunderbans. The fish species sustainable in brackish water would also migrate into the polder. This may result in more frequent migration of flora-fauna in polder 35/1 from Sundarbans.

Also due to development of polder 39/1 under ECRRP, the Baleswar River may undergo waste pollution, siltation, and the consequent shallow depth of this river will affect polder 35/1 in a number of aspects. The wave action of Baleswar River may cause significant damage to polder 35/1 and river water may overtop the embankment of the polder due to rise in cyclonic surges beyond the design level.

ECRRP also covers reconstruction and improvement of multipurpose shelters in all upazilas of Bagerhat district. Material and labor procurement for the construction of such shelters may influence the implementation of proposed interventions under CEIP in polder 35/1. The transportation of heavy materials would deteriorate the road surface quality; noise level will also rise due to construction of shelters. Local labors (from Bagerhat) would be involved in the construction of shelters and this may lead to a socially conflicting scenario in the implementation of interventions suggested in polder 35/1 under CEIP.

b) Other GoB Projects

Apart from ECRRP and CEIP there are other projects undertaken by the GoB at or near the study area. The GoB projects have mostly been completed a few years ago. But still there are foreseeable pre-project impacts generated by such projects into polder 35/1.

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 35/1. The consultations made with local people revealed that the flow of Bhola River is marginally influenced (in terms of flow velocity and other flow parameters) due to the salinity protection project implemented in Nazirpur. Due to the upstream river dredging under the project, the flows in Baleswari and Bhola rivers have increased in recent times.

There is a flood rehabilitation project implemented by Local Government Engineering Department (LGED), at local level in Khulna, Satkhira, Bagerhat districts. The project improved the status of local people with a few social impacts in polder 35/1. Due to agricultural development caused by the flood rehabilitation project, food security has been developed for polder 35/1. The effective implementation of the project ensured growth in development, and hence many people from polder 35/1 preferred such developed places of Khulna, Satkhira, 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. There had been biodiversity conservation plans on smaller scale in the districts of Bagerhat, Khulna and Satkhira. Such biodiversity conservation plans in Sundarbans have eventually led to improvement of habitats, people, water quality etc. in Polder 35/1.

In the year 1998, Department of Forest (DoF) extended the culture technology of marine shrimp on macro scale in Khulna, Bagerhat, Satkhira and Cox’s bazaar. The project continued upto 2004, discovering the consequences of virus attacks (of white spot syndrome virus, taura syndrome virus, and infectious hypodermal and haematopoietic necrosis virus) on shrimps during the later stages of the project implementation. However, the popularity of shrimp culture spread in regional level and shrimp culture in polder 35/1 during dry season is a very common practice. The culture of shrimp is not a labor intensive practice, thus shrimp culture in polder 35/1 created more unemployment among the people. During the dry season, a number of places in the embankment were cut down to facilitate the entry of saline water; this practice created weak points in the embankment and reduced the strength of the embankment. One notable positive impact of shrimp culture in polder 35/1 is that it ensured overall socio-economic development of the area. Due to frequent shrimp culture practice in the polder area, agricultural practice is being hampered, which eventually is affecting the asset level of poor farmers in Polder 35/1.

Another project that affects the polder is the “Development of Signboard-Rayenda-Sharankhola road”, a project implemented by the Roads and Highways Division (RHD). The road enters into polder 35/1 from Signboard (Bagerhat) and its good surface quality ensures improved transportation inside the polder. As a result, socio-economic status of the people living in Polder 35/1 has been 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 Sundarban as the way it used to do before. The quality and navigability of Bogi lake have further been improved due to the implementation of the project by KCC. Therefore, the environment of Polder 35/1 is being improved.

c) NGO Projects

In recent times, there are number of 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 fattening, and floating garden). These non structural projects have mostly been able to spread awareness against climate change, and biodiversity conservation. People in polder 35/1 consider floating garden as a very useful practice in response to climate change effects. Such adaptable measures adopted by the people of Polder 35/1 may help their economic status on crisis situations.

1.49 Induced Impacts Caused by CEIP

Induced impacts are the effects on environmental resources which occur as a result of the project's influence on land use, water quality, salinity, cropping pattern, irrigated area, fish and other habitats, migration, employment opportunities, poverty. This is the impact that generates over a period of time or in locations outside the immediate project area.

In Polder 35/1, implementation of interventions may cause some 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 CEIP works in Polder 35/1.

a) Sedimentation

The proposed interventions will guard 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 Baleswar and Bhola rivers and new morphological changes may be established outside the polder (i.e. new lands may be formed inside the rivers through accretion). There are some areas having no embankments protection near Polder 35/1. These areas may suffer the consequences of sedimentation in Baleswar River. Telikhali, Tushkhali, Atarkhali, and Saula are some of the locations under Pirojpur district which are not under polder coverage (Figure 10.1). These areas are under the inundation risk during monsoon through the implementation of interventions in Polder 35/1 under CEIP-I. In addition, sedimentation in smaller water bodies namely Bogi lake, Bhola river may cause regular drainage congestion problems in its downstream. The navigability of rivers may deteriorate over the years. A number of smaller water bodies may be permanently silted up. The satellite image (Figure 10.4) shows the locations of Polder 35/1 in the district of Bagerhat and Telikhali, Tushkhali, Atarkhali, Saula unions under Pirojpur district.

The effects of project implementation in Polder 35/1 are likely to be significant in the nearby areas. The Polders situated farther beyond the discussed areas will bear negligible effects of the interventions in Polder 35/1.



Figure 0.3: Satellite Image polder 35/1

b) Erosion

The blockage of tidal flow into the polder will result the flow of the peripheral rivers (Bhola and Baleswar) to be diverted further downstream and upstream. This may lead to erosion on the river banks of the unprotected areas (Parts of Pirjoppur district, Sundarban). 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 i.e. Bhola river, Bogi lakes etc. would undergo frequent congestion. Especially during low tides, Bogi lake in the south will gradually become more shallow. In the next few years, there is possibility of the Bogi lake (on the south, connected to the Sundarban) to be filled up permanently due to accumulation of silts, lower velocity of flow etc. The effects of congestion in the surrounding rivers would directly affect the nearby areas (Sundarban, 39/1, places of Pirojpur district). The polders beyond these locations may undergo some congestion affects but these are negligible in the context of Polder 35/1.

Due to the congestion in the rivers, the upstream areas would be subjected to greater surge heights. This may cause damage to embankments of the Polders located upstream of Baleswar river (Polders 35/2 and 37)

d) Flooding

Tidal water would not be able to enter polder 35/1 during monsoon, as a result the nearby areas which are not protected will face higher risk of inundation. Loss of assets of the people living in Atarkhali,

Telikhali, Saola unions, in Pirojpur district may take place due to flood. The nearby areas with no or insufficient polder protection will also be affected to cyclones and other hazards in future.

Table 10.6 shows the design crest levels of embankments in polder 35/1 and 39/1. The crest level of 39/1 is low compared to that of Polder 35/1. Therefore river water diverted from polder 35/1 may overtop the embankments of polder 39/1 during monsoon.

Table 0.6: Crest level of embankments of two polders

Polder Number	Design crest level (m)
35/1	6.0 - 6.5
39/1	4.0

Source: Data collected by CEIP

In the upstream, Polder 35/2 and Polder 37 will be under greater threat of being inundated during storm surge events mentioned above.

e) Water Quality

The implementation of interventions would lead to infrastructural developments, increased labor sheds, and hence population increase. This 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 of Baleswar River and Bogi Lake.). 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 35/1 (polder 39/1, 35/2 and 37) as well as the unprotected areas (Telikhali, Atarkhali, Tushkhali, Saola, Dhanisafa etc. unions under Pirojpur district) will be more exposed to saline water intrusion. 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) Land Use

The implementation of proposed interventions may indirectly affect the land use of nearby areas. Due to increased surge created in Baleswar River, polder 39/1 and a few other unions of Pirojpur districts 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 would be affected due to flood and other disasters. More erosion may take place in the river banks causing significant reduction of lands. The rivers in the periphery of Polder 35/1 would cause erosion in the adjacent areas, but for areas beyond the adjacent polders such affects would be negligible.

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. 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. There would be increased salinity intrusion on areas downstream of the Baleswar River. However in areas in the upstream of the

river (Polders 35/2 and 37), salinity intrusion would be limited and boro cropping may still be practiced during dry seasons.

h) Habitat

Depth of smaller water bodies outside the polder i.e. Bogi lake, Bhola 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 i.e. mangrove flora may be increased where as the aquatic flora and fauna may be decreased significantly.

In the next few years, some part of the flood plain area in the upstream of the polder (some part of Morrelganj upazila) may gradually be converted into high land through siltation. The fisheries from tidal flood plain may eventually decrease while fish culture practices might increase.

For improvement of the polder, the risk of inundation might be transferred to nearby unprotected areas (particularly in the downstream of the peripheral rivers). 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) Fish Migration and Biodiversity

The siltation in peripheral rivers and canals of polder 35/1 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, water will move towards the upstream and downstream of Baleswar River during high tide. This increased volume of water will enhance fish migration in that water body. 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 Baleswar River. The longitudinal migration of Hilsha fish to upstream may also decrease due to increased sedimentation in the river.

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 (Polder 39/1C, Polder 35/2, and the areas near the left bank of Baleswar River.)

k) 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 35/1, 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.

l) 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 35/1 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 areas (Polders 39/1, Polder 35/2, and parts of Pirojpur district).

Environmental Management Plan

This Chapter presents the Environmental Management Plan (EMP) for the CEIP-I activities in the Polder 35/1. The EMP essentially provides the implementation mechanism for the environmental and social mitigation measures discussed in **Chapter 9**.

1.50 Objectives of EMP

The basic objective of the EMP is to manage, prevent, and mitigate potentially adverse impacts of Project interventions in the Polder 35/1. 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 35/1 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.

1.51 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.

1.52 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 35/1 are described below.

1.52.1 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.

1.52.2 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.

1.52.3 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.

1.52.4 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***.

1.52.5 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

1.53 Mitigation Measures and 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 11.1 below 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.

Table 0.1: 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	<ul style="list-style-type: none"> • During design the segment wise soil requirement and location of the sources of soil for earthwork for each polder construction/rehabilitation will be identified. • Selection of Borrow Areas for earthen material collection. • No objection from land owner/Revenue authorities as applicable • Contractor shall ensure that borrow materials used for embankment filling is free of pollutants • Disposal of excess soil will be done at site with no objection from DoE and local authority

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Borrowing of Earth	<p>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:</p> <ul style="list-style-type: none"> • Lands close to toe line and within 0.5 km from toeline. • 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 will 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. <p>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.</p> <ul style="list-style-type: none"> • 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 Management of Excavated Material	<p>To minimize the adverse impact during excavation of material following measures are need to be undertaken:</p> <ul style="list-style-type: none"> • Adequate drainage system shall be provided to the excavated area • At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff. <p>The followings precautions shall be undertaken during quarry operations.</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Deposition of dredged material will be away from the channel edge to limit damage to streamside habitats. This also allows a degree of flooding to occur on the floodplain, thereby creating opportunities for wet grassland, scrub/wet woodland, wetlands and seasonally grazed rough grass. • Where possible biotechnical engineering, for example geo textiles, may be used to help stabilize the material and aid re-colonization. • Other possibilities include: drying and spreading the spoil over adjacent land, which can

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	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	<ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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) will be reinstated to its initial conditions (relief, topsoil, vegetation cover). Ensure that roads used by construction vehicles are swept regularly to remove sediment
Dredging	<ul style="list-style-type: none"> 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 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	<ul style="list-style-type: none"> 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	<p>The Contractor will</p> <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Construction worker's camp shall be located at least 500 m away from the nearest habitation. The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odor is generated.
ECOP 3: Agriculture Management	
Loss of Top Soil	<ul style="list-style-type: none"> Soil from fallow lands/ non-agricultural lands will be used in earthwork in embankments Collect/strip top soil before earth filling and store and reuse it for final surfacing of embankment top and tree plantation/afforestation. Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m Remove unwanted materials from top soil like grass, roots of trees and similar others The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil 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: <ul style="list-style-type: none"> Anaerobic conditions-turning the stockpile or creating ventilation holes through the stockpile; Erosion – temporary protective silt fencing will be erected;
Soil salinity	<ul style="list-style-type: none"> 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 will be avoided.
ECOP 4: Noise Management	
Construction vehicular traffic	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
ECoP 5: Ecology Management	
Flora	
Vegetation Clearance	<ul style="list-style-type: none"> • Tree felling will 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 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 lands	<ul style="list-style-type: none"> • Critical breeding areas of major fish species will be identified and declared as sanctuaries. • Creation of small lagoons and pools that may trap the fishes will be avoided. • 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	<ul style="list-style-type: none"> • Sufficient free flow will be guaranteed in the design and construction work to ensure free pass of migrating fishes.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	<ul style="list-style-type: none"> Hydraulic structure will be operated considering fish migration and spawning time A guideline for area specific hydraulic structure operation guideline will be developed
Dredging	<ul style="list-style-type: none"> 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	
<p>Siting and Location of construction Camps (MRDI, 2011)</p>	<ul style="list-style-type: none"> 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 will endorse detailed layout plan for the development of the construction camp submitted by the contractor. The plan will 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	<p>The following facilities will be provided by the contractor</p> <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.
Health and Hygiene	<ul style="list-style-type: none"> 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 repellent sprays during monsoon. Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	<ul style="list-style-type: none"> Place display boards at strategic locations within the camps containing messages on best hygienic practices
Payment of Wages	<ul style="list-style-type: none"> The payment of wages will be as per the Minimum Wages Act, Department of Labor, and Government of Bangladesh for both male and female workers. Display of the minimum wages board at camps and major construction sites will be done in local languages at the construction and labor camp sites. Wages will be paid to the laborers only in the presence of BWDB staff; Contractor is required to maintain register for payment of labor wages with entry of every labor working for him. Also, he has to produce it for verification if and when asked by the Engineer, EMU and/or the concerned BWDB staff/Engineer's representative
Rehabilitation of Labor and Construction Camp	<p>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.</p> <p>Various activities to be carried out for site rehabilitation include:</p> <ul style="list-style-type: none"> 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) will 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. <p>This shall include the following:</p> <ul style="list-style-type: none"> Photograph of rehabilitated site; Land owner consent letter for satisfaction in measures taken for rehabilitation of site; and Undertaking from contractor; <p>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 will be include in the agreement with the landowner by the contractor. Also, he would have to obtain a certificate for satisfaction from the landowner.</p>
Damage and Loss of Cultural Properties	
Conservation of Religious Structures and Shrines	<ul style="list-style-type: none"> 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.
	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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,

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	excavations, trenches and safe means of entry and outlet.
Risk from Electrical Equipment	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.
Traffic Management	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

1.54 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).

1.55 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 will be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive **database of the polder specific Environmental Impact and Monitoring information** will be created, which will help to evaluate the impacts easily.

The Monitoring 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. The monitoring is a daily process, which ensures that departures from the EMP and RAP 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 basis. 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.

Table0.2: 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	Visual inspection of	monthly	Contractor	CS, M&E

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
borrow site	pit/site	borrow site and ensuring operational health and safety			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 of the embankments and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	At the end of filling activity	Contractor	CS, M&E 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	Monthly	Contractor	CS

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		implemented			
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, pH, DO, BOD, COD etc)	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Half Yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB
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

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
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 site	24 hours Air quality monitoring	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
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 0.3: 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	Before plantation	Contractor	CS, BWDB, M&E Consultant

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		foreshore			
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 prevent water pollution caused by run-off from harvesting areas	Beginning of work	Contractor	CS, BWDB, M&E Consultant
Nursery Embankment Management	Nursery	Visual inspection of height of embankment, possibility of water logging and connection to the waterbodies	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

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 0.4: 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			

Parameter	Visual Judgment		
	Poor	Moderate	Satisfactory
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.

1.56 Documentation, Record keeping and Reporting

1.56.1 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.

1.56.2 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 report will include a section on Emergency Action Plan and polder safety surveillance.

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.

1.56.3 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.

1.56.4 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.

1.56.5 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.

1.56.6 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.

1.56.7 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.

1.57 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.

1.57.1 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.

1.58 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 handles by the Grievance Redress Committee.

In addition to the compensation, water management projects will 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.

1.59 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 0.5: Tentative Cost Estimates for Environmental Management and Monitoring*

	Description	Cost Million BDT	Cost Million US\$
1	Crop compensation for land owner/share croppers	1	0.012
2	Awareness program on plant and wildlife conservation	1	0.012
3	Social forestry program along both sides of the embankment and other khas areas	Included in afforestation budget	
	Waste management	0.5	0.006
4	Emergency budget allocation for closing breach points of the embankments and repairing the damage of structure	10	0.122
5	Water quality monitoring	1	0.012
6	Air and noise quality monitoring analysis	1	0.012
7	Soil and water salinity monitoring	0.5	0.006
8	Land acquisition and compensation cost	Budget included in RAP report	
10	Capacity building and training	4.0	0.049
11	Consultancy services cost for supervision and monitoring	6	0.073
Total Cost of EMP		25.0	0.304

1.60 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.

1.60.1 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
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.

1.60.2 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.

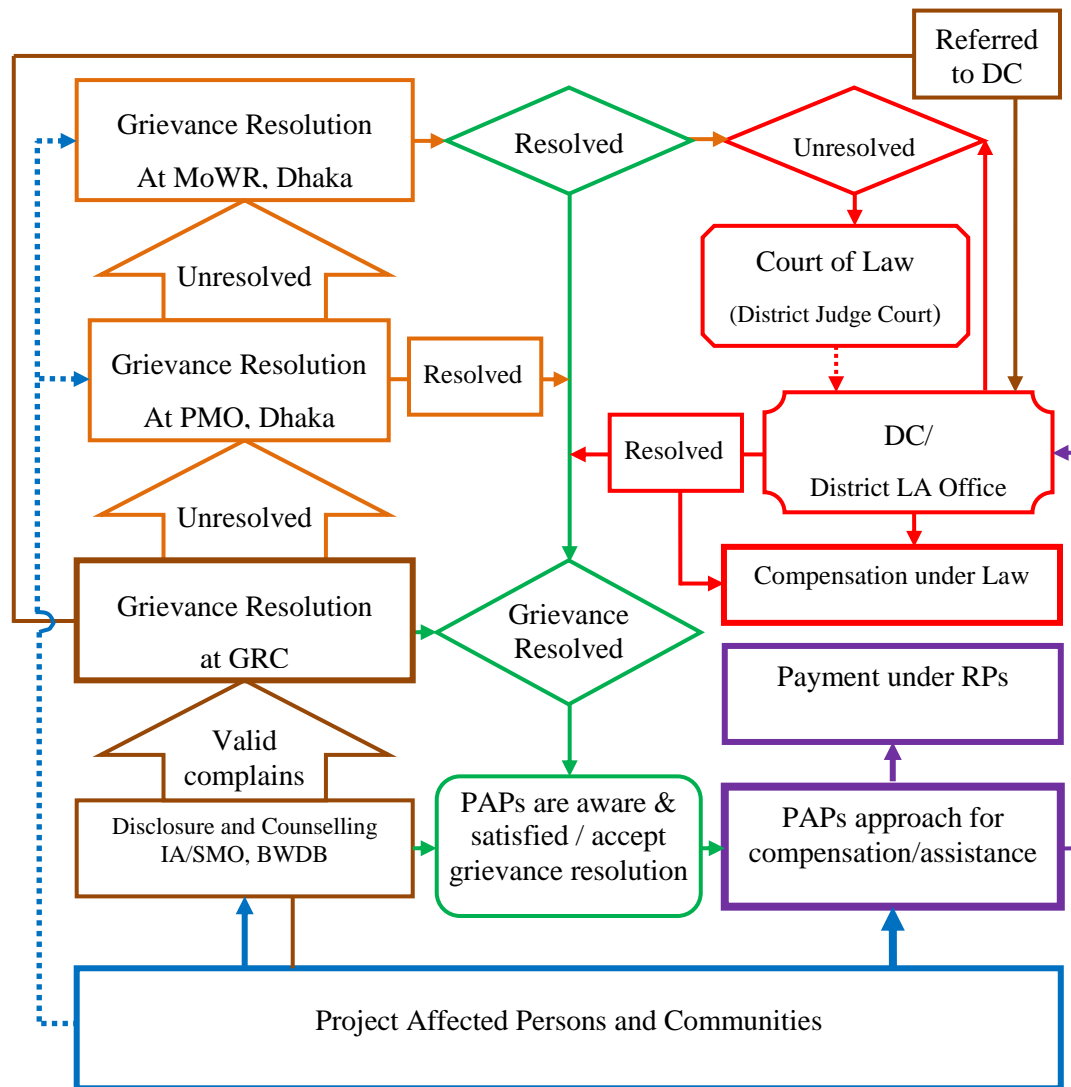


Figure 0.1: GRM Process Flow Chart

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.

1.60.3 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. The format in Annex 3 of SMF may be used for periodic grievance reporting.

1.61 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 0.6: 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:

- | | |
|---|----------------------------|
| 6. Water Resources Engineer/ Team Leader: | 7. Md. Waji Ullah |
| 8. Water Resource Expert: | 9. Md. Sarfaraz Wahed |
| 10. River Morphologist: | 11. Nazneen Aktar |
| 12. Socio-Economists: | 13. Dr. Dilruba Ahmed |
| | 14. Subrata Kumar Mondal |
| 15. Soil and Agriculture Specialist: | 16. Mujibul Huq |
| 17. Agronomist | 18. Dr. Anil Chandra Aich |
| 19. Fishery Specialists: | 20. Mohammed Mukteruzzaman |
| | 21. Ashraful Alam |
| 22. Ecologist/Junior Ecologists: | 23. Ashoke Kumar Das |
| | 24. Mohammed Amanat Ullah |
| | 25. Mohammad Kamruzzaman |
| 26. Environmentalist: | 27. Dr. Ashraful Alam |
| 28. Geographical Information System (GIS)/Remote sensing (RS) specialist: | 29. Kazi Kamrull Hassan |
| 30. GIS/RS Analysts: | 31. Mohammed Saidur Rahman |
| | 32. Hasan Tawfique Imam |
| 33. Junior Engineers/Junior environmental Engineers: | 34. Syed Ahsanul Haque, |
| | 35. Mohammed Shibly Shadik |
| | 36. Mohammed Shakil Ahmed |
| | 37. Mohammed Jafrul Alom |
| | 38. 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 International Independent Environment Specialist, Mr. Mohammad Omar Khalid reviewed the document.

Annex A: Checklist

EIA of Coastal Polders under CEIP
Checklist for Water Resources Information Collection
Center for Environmental and Geographic Information Services (CEGIS)

A. Administrative Information

Name of Polder:	BWDB Zone:	Hydrological Zone:
BWDB Circle name:	BWDB O & M Division:	
District (s):	Upazila (s):	
Union (s):	Mouza (s):	

B. Project Description

General Information	
a. Type of project:	b. Area of polder (Ha):
c. Objectives of the scheme:	
d. New problems (if any) created by the project activities:	
e. Year of Starting:	f. Year of completion:
g. Name of surrounding polder	
h. Name of the projects hydro-morphologically dependent on the polder	
i. Cumulative hydraulic and morphological impacts as anticipated by local people	

Data Collected by:	Date:
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From	To	Length	Height	Actual reasons							
Regulators											
Location of Structure	GPS ID	Type	Vent Size	No of Vent	Service Condition (V/G/G/M/B/VB) ¹²	Present Condition (Partial/full)	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											

¹² VG – Very Good, G – Good, M – Moderate, B – Bad, VB – Very Bad

Irrigation Inlets										
Bridge/Culverts										
Others										
Drainage Channels										
Name	Length	Flow Direction	Flow (%)	Present Service Condition \ Problems	Reasons of Problem	Re-excavation Need (Y/N)	Proposed Re-excavation Mode (Manual/ Mechanical)	From – To (Approx. length)	GPS ID (Structure)	
Irrigation Canals										
Name	Length	Problems			Reasons	Re-sectioning (Y/N)	From – To (Approx. length)			
Protective Works										

Location Name	Type (Temporary/Permanent)	Length	Present Condition (G/ MD/ CD) ¹³	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			

¹³ 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)			Peak:
F1 (30-90 cm)			
F2 (90 – 180 cm)			
F3 (180 – 360 cm)			Recession:
F4 (> 360 cm)			
E. River Erosion			
River/Khal name	Area (ha)	Length (m)	Reasons
F. Accretion			
River/Khal name	Area (ha)	Reasons	
G. Water Quality (Peoples perception)			
1. Ground water (Presence of pollutant)			
Arsenic (Yes/No)	Location:		
Iron (Yes/No)	Location:		
2. Surface water			
River/Khal name	Quality of water (Good/Bad/Avg.)	Type of Pollutant	Sources of pollutant

H. Historical severe flood:

Recent flood	Extent (Days)	Flood level (cm)	Damage of resources	
1988				
1994				
1998				
2004				
2007				
Last five years	Flood year			Flooding areas:
	Non flood year			

I. Participatory Social Mapping by stakeholders (Name of regulators, name of public cuts points, Name of breaching points, location of water logged area, identification of encroached canal with name and their location on map)

J. Peoples opinion of the project

Pre-project condition:

Period of project benefits:

Present condition and Present problems:

Causes of problems:

Probable Solution/Improvement:

EIA of Coastal Polders under CEIP

Checklist for Land Resources, Agriculture and Livestock Information Collection Center for Environmental and Geographic Information Services (CEGIS)

Land Resources:

Land degradation

Factors	Year from starting LD	Result of LD
Soil erosion		
Sand carpeting		
Salinisation		
Acidification		
Nutrient deficiency		
Farming practices		
Water logging		
Others		

Agriculture Resources: (For small project information collection from filed. For large project both primary and secondary information collection from field and DAE office)

Cropping Pattern by land type

Land Type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-February)	% of area

Crop calendar

Crop name	Seedling		Transplanting/Sowing		Harvesting	
	Start	End	Start	End	Start	End

Crop yield

Crop Name	Damage free Yield (ton/ha)	Damage area (%)	Damage Yield (ton/ha)

*Damage area and yield loss calculation: Last 3 years average value

Crop damage

Name of hazard	Ranked	Timing	Causes
Flood			
Drought			
Pest infestation*			
Others:			
*List name of pest and pesticide by crop			

Fertilizer and pesticide application

Crop Name	Seed (Kg/ha)	Fertilizer (Kg/ha)				Pesticide		
		Urea	TSP	MP	Other	No of Appli.	Liq. (ml/ha)	Gran. (Kg/ha)

Irrigation, Land preparation and Labour

Crop Name	Irrigation			Land preparation			Labour	
	Mode	% of Area	Charge (Tk/ha)	Power (% of Area)	Animal (% of Area)	Tk/ha	Nos./ha	Tk/ labour

Note: Support Services of the project areas

Livestock Resources: Primary and Secondary Information collection from field and DLS offices

Livestock and poultry production

Name of Livestock/poultry	% of HH having Livestock/Poultry	No. of Livestock/poultry per HH
Cow/Bullock		
Buffalo		
Goat		
Sheep		
Duck		
Chicken		

Feed and Fodder

Name of Livestock/poultry	Feed/Fodder (Timing)	Scarcity	Causes	Remarks
Cow/Bullock				
Buffalo				
Goat				
Sheep				
Duck				
Chicken				

Diseases

Name of Livestock/poultry	Name of Disease	Disease (Timing)	Causes	Remarks
Cow/Bullock				
Buffalo				
Goat				
Sheep				
Duck				
Chicken				

Note: Support Services-

Where, when, how much and causes of Crop Damage.

Fisheries Baseline Checklist
EIA of Coastal Polders under CEIP

Village: Mouza: Union: Upazila: District: BWDB Circle: BWDB
Division:

Background Water bodies: Name: Alphabetic, Area: in Ha/% of area/Ana, Length: in km, Depth/Inundation depth: in Meter, Flood Duration: in Months, Production: metric ton

Problem/Issue	Fishing Effort	Habitat Type	Water Quality	Avg. Production	Production Trend (+/-) and Reason	List of Gears	% of gears	List of Habitat Name	Present					Past (15-20 yrs back)				
									Area	Length	Width	Depth	Duration	Area	Length	Width	Depth	Duration
Capture Fisheries:	a. Total No. of fisher HHs:	River																
	b. %/No. of CFHHs:																	
Culture Fisheries:	c. %/No. of SFHHS:	Beel (Leased/non leased)																

Indiscriminate Fishing Activities:	d. No. of Days spend annually in fishing by CFHHs:	Khal																
	SFHHs:	Floodplain																
		Swamp Forest																
		Fish pond																
		Baor																
	e. Hrs/Day spend in fishing by CFHHs:	Other																
	SFHHs:																	

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:				Reasons of increase or decrease	1.						Live fish						
											Other fish						
						2.					Prawn						
											Hilsa						
Important breeding, feeding and over wintering ground					3.												
						4.											
							5.						Rui				
										Catla							
Horizontal Migration pattern	Species: 1. 2. 3. 4. 5.	Season (Months):	Routes:		Significant areas	1.						Mrigel					
											Koi						
				2.								Sarpunti					
							3.						Large prawn				
													Small Pprawn				

Vertical Migration Pattern	Species: 1. 2. 3. 4. 5.	Season (Months):	Habitats:	Species of Conservation Significance	Rare:						Silver carp				
											Carp				
											Grass carp				
											Tengra				
					Unavailable:						Chapila				
											Others				

Post Harvest Activities		Fishermen Lifestyle	
Fish edible quality:		Socio-economic Status of subsistence level fishermen:	
Source of pollution in each habitat:		Socio-economic Status of Commercial fishermen:	
Seasonal vulnerability:		Other conflict (with muscle men/ agriculture/ other sector/laws):	
Ice factory (Number, location and name):		Fishermen community structure (Traditional/Caste/Religion)	
Landing center, whole sale market, other district markets, etc.:		Traditional fishermen vulnerability (Occupation change/others):	
Storage facility (number, location and name):		Existing Fisheries Management	
Fish market (Number, location and name):		Fishermen Community Based Organizations (FCBOs):	
Marketing problems:		WMOs activity:	

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 Carp (*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 molitrix*), Grass Carp (*Ctenopharyngodon idellus*), Mirror Carp (*Cyprinus carpio* var. *specularis*), Tilapia (*Oreochromis mossambicus* / *O. niloticus*), Shrimp, Aor (*Mystus aor* / *Mystus seenghala*), Boal (*Wallago attu*), Shol/Gazar & Taki (*Channa spp.*), Chital/Phali (*Notopterus chitala* / *N. notopterus*), Koi (*Anabas testudineus*), Singi/Magur (*Heteropneustes fossilis* / *Clarias batrachus*), Sarpunti (*Puntius sarana*), Thai Sarpunti (*Puntius gonionotus*), Punti (*Puntius spp.*), Others.

EIA of Coastal Polders under CEIP
Checklist for Ecological Information Collection
Center for Environmental and Geographic Information Services (CEGIS)

Basic Information

Date		Prepared by	
Name of the Polder			
BWDB Circle Name			
District/s		Upazila/s	
Location of the FGD			

Habitat Information/Ecosystem Types (Please put tick where is applicable)

Agriculture land		Forest patches including social forestry	
Settlement/Homesteads		Canal and ponds	
Orchard		Grasslands	
Fallow		Reserve forest	
Ridges		Others	

Terrestrial Vegetation Checklist (List of Major Plant Species)

Species Name	Status	Utilization
Homestead Vegetation		

Species Name	Status	Utilization
Mangrove Vegetation		
Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare		
Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others		

Terrestrial Wildlife Check List

Species Name	Habitat	Status	Migration Status
Mammals			
Amphibians			

Species Name	Habitat	Status	Migration Status
Reptiles			
Birds			
Habitat: 1= Homestead forest, 2= Floodplains, 3= Wetlands, 4= River, 5= Pond, 6=Forest Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare Migration Status: 1= Local, 2= Local Migratory, 3= Migratory			

Aquatic Wildlife Checklist

Species Name	Habitat	Status	Migration Status
Mammals			
Amphibians			
Reptiles			
Birds			

Species Name	Habitat	Status	Migration Status
Habitat: 1= Homestead forest, 2= Floodplains, 3= Wetlands, 4= River, 5= Pond, 6=Forest Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare Migration Status: 1= Local, 2= Local Migratory, 3= Migratory			

Foreshore vegetation/Mangrove vegetation

Name of the forest patches location (s)	Species Name	Abundance	Utilization
Abundance 1= High, 2=Moderate, 3=Low Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others			

Major Wetland information

Name of wetland	Type of Wetland	Area in Acre	Connectivity		Importance
			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			

Forest Information (Surrounding/nearer the polder)

Forest Name with Range/Beet office	Type	Location	Area in Acre	Major Plant Species
Type 1=Swamp Forest, 2=Reserve Forest, 3=Vested Forest, 4=Reed forest, 5=Other (specify)				

(9) Anticipated Impacts due to proposed interventions on particular Ecosystems

(Impact from changed land use, noise, human presence etc.)

Name of Intervention	Impacts
Embankment Re-sectioning	
Breach Closing	
Construction of Water control Structures	

(10) Comments (If any):

EIA of Coastal polders under CEIP
RRA/FGD Data Collection Format for Socio-economic Survey

Date of Survey:..... Name of Polder:

1. Place of Interview:

Name of Mouza(s).....

Union(s)/Ward(s).....

Municipality(s).if any

Upazila(s)/Thana(s).....

District(s)/.....

2. Characteristics of Population:

2.1 Total Households, Population (male, female, rural and urban) in Project area

Total Households	Population		
	Male	Female	Total

Source: BBS

2.2 Age distribution

Age range													
0-4 Years		5-9 Years		10-14 Years		15-17Years		18-34 Years		35-59 Years		60+Years	
M	F	M	F	M	F	M	F	M	F	M	F	M	F

Source: BBS

2.3 Literacy rate

% of Literacy (Over 7 years)		
Total	Male	Female

Source: BBS

2.4 Occupation and employment

Main occupation by population	% of population
Not working	
Looking for work	
Household work	
Agriculture	

Main occupation by population	% of population
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

- Labor (Male) for farming (High/Medium/Low), Av. Wage/Day (Tk.) Max:.....Min:
- Labor (M) for non-farming (High/ Medium/ Low), Av. Wage/Day (Tk.) Max:.....Min:
- Labor (Female) for farming (High/Medium/Low), Av. Wage/Day (Tk.) Max:.....Min:
- Labor (F) for non-farming (High/ Medium/ Low), Av. Wage/Day (Tk.) Max:.....Min:

2.6 Migration (seasonal/permanent)

a. Seasonal out migration from study area (% per year with location):

b. Seasonal in migration to study area (% per year with location):

c. Permanent out migration from study area (Number per 1/2 years with location):

d. Permanent in migration to study area (Number per 1/2 years with location):

2.7 Annual Expenditure and Income by range

a. Expenditure

Expenditure group (in taka)	Percentage of households
<=12,000	
12,000-24,000	
24,000-60,000	
60,000-1,08,000	
1,08,000-2,40,000	
>=2,40,000	

Sources: RRA

b. Income

Expenditure group (in taka)	Percentage of households
<=12,000	
12,000-24,000	
24,000-60,000	
60,000-1,08,000	
1,08,000-2,40,000	
>=2,40,000	

Sources: RRA

Self assessed poverty for year round

Sl. No.	Poverty status	Percentage of households
1	Deficit	
2	Balance/Breakeven	
3	Surplus	

Sources: RRA

Housing (photographs)

Sl. No.	Housing status	% of hhs having
1	Jhupri	
2	Kutcha	
3	Semi Pucka	
4	Pucca	

Source: RRA

Drinking water (photographs)

Sl. No.	Drinking water sources	Percentage of households use
1	Tap	
2	Tube well	
3	Well	
4	Pond	
5	Other.....	

Source: BBS

Sanitation (photographs)

Sl. No.	Toilet types	Percentage of households under each type
1	Water Sealed	
2	Ring Slub	
3	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	
3	Diarrhoea		11	Diabetes	
4	Dysentery		12	Hypertension	
5	Hepatitis		13	Asthma	
6	Malaria		14	T B	
7	Dengue fever		15	Gastric	
8	Typhoid		16	Arsenicosis	

Sources: RRA

b. Health facilities in study area (photographs)

Sl. No.	Type of facility	Number of facilities with name
1	Number of District level Hospitals	
2	Number of Upazila Health Complex	
3	Union Health Center	
4	Private Health Clinic/ Hospitals	

Sources: RRA

b.1 Status of peripheral health facilities used by the study area people:

Source of treatment facilities in study area

Sl. No.	Source of treatment facilities	% of hhs received
1	Trained Physician	
2	Paramedic/ Diploma Physician	
3	Quack Doctor and Informal Treatments	
4	No treatment facilities at all	

Sources: RRA

2.13 Electricity

Percentage of household having electricity facility:BBS

Percentage of household having electricity facility: (During Survey)

3. Social overhead capital (photographs)

3.1 Existing road networks in study area and it's level of benefit

a. National Road (km.)(GIS) Beneficial: Highly /Moderately / Poorly

b. Regional Road (km.) (GIS) Beneficial: Highly /Moderately / Poorly

c. Local Road Pucca (km.) (GIS) Beneficial: Highly /Moderately / Poorly

d. Local Road Kancha (km.) (GIS) Beneficial: Highly /Moderately / Poorly

3.1.1 Status of peripheral road networks (with name) used by the study area people:

3.2 Existing railway network in study area and it's level of benefit

a. Railway (km.)..... (GIS) Beneficial: Highly /Moderately / Poorly

3.2.1 Status of peripheral railway service used by the study area people:

3.3 Existing waterways in study area and it's level of benefit

a. National Route (km.) (GIS) Beneficial: Highly /Moderately / Poorly

b. Local Route (km.) (GIS) Beneficial: Highly /Moderately / Poorly

3.3.1 Status of peripheral water ways (with name) used by the study area people:

3.4 Status of the navigation route by season

a. National Route: Served Seasonally/Through out the year

b. Local Route: Served Seasonally/ Through out the year

3.5 Major waterways handicapped

a. by structures..... location

b. by siltation..... location

3.6 Nos. of major ghats/ports and name:

3.7 Academic Institution (school, colleges) (photographs)

Sl. No.	Type of facility	Nos. of Institution	Type of facility	Nos. of Institution
1	Primary School		Ebtedayee Madrasha	
2	High School		Dakhil Madrasha	
3	College		Alim/ Fazil Madrasha	

Sources: RRA

3.6.1 Status of peripheral academic institutions (with name) used by people of the study area:

3.8 Markets and GC (photographs)

Sl. No.	Type of facility	Nos. of markets	Comments with name
1	Major markets		
2	Minor markets		
3	Growth Centers		

Sources: RRA

3.8.1 Status of peripheral markets used by people of the study area:

4. Land holding categories

4.1 Percentage of HH who have owned agricultural land: (BBS)

Percentage of households with different land ownership category in the area:

Land ownership classes	Percentage of household
Land less/ No land (0 decimal)	
Land less (up to 49 decimal)	
Marginal (50-100 decimal)	
Small (101-249 decimal)	
Medium (250-749 decimal)	
Large (750 + decimal)	

Sources: RRA

5. Conflict between different land owner group and professional group

Reasons of Conflicts	Present status of problem	Solution they want with location
Water control infrastructures		

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					

Sl. No.	Major Disaster	Severely affected year	% of area affected	% of hhs affected	% of crop damage	Major crop damaged
4	Storm					
5	Cyclone					
6	Hail storm					
7	Salinity intrusion					
8	Water logging					
9	Erosion					

Sources: RRA

7. Safety Nets and Poverty Reduction Measures in the area:

7.1 Name and activity of GO/ NGOs working in this area

Name	Activity (Credit, Education, Health, Forestry, Fishery, Livestock Rearing, Women Empowerment, Human Rights, VGF, Boyosko bhata, etc.)	% of HHs coverage

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			

Sl	Issue/Question	Response/Suggestion		
	Fisher			
	Service holder			
	Others			
d)	No. of villages covered			
e)	Existence of fund			
f)	AGM			
g)	Election			
h)	EC meetings			
i)	Present water resources management activities			

8.2.2 Name of EC members with address/phone number:

Sl. No.	Name	Address	Phone Number
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Sl. No.	Name	Address	Phone Number
11			
12			
13			
14			
15			

If WMO does not exist, please state the reasons for

8.3 Are people willing to form WMO? Y/N

(If yes, give demonstrative proof of their capacity if any)

8.4 Is WMO willing to take up management responsibilities? Y/N

8.4.1 If yes, please give some idea about what to do on management

9. Some other Issues

9.1 Any land acquisition to be needed for the rehabilitation of the polder? Yes/No

9.1.1 If yes, size of the area? _____ (acre)

9.1.2 If yes, are they willing to provide land for acquisition? Yes/No

9.2 Any replacement of people to be needed for the rehabilitation of the scheme? Yes/No

9.2.1 If yes, how many? _____ (number of household)

9.3 Have any cultural heritage /archeological sites in the polder? Yes/No

Give some description

9.4 Have any vulnerable communities (e.g. landless, fishermen, boatmen, destitute women without food and/or shelter) in the scheme area? Yes/No

a. Give some description

a. Give some description

Name of the RRA/FGD Participants:

[illegible]

ॐ श्री गणेशाय नमः
 श्री गणेशाय नमः
 श्री गणेशाय नमः

বিস্মিল্লাহির রহমানির রাহিম

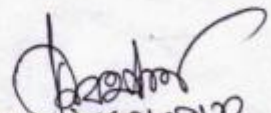
২নং খোস্তাকাটা ইউনিয়ন পরিষদ
চেয়ারম্যান : মোঃ মতিয়ার রহমান খান
ডাকঘর : রায়েন্দা বাজার, উপজেলা : শরণখোলা, জেলা : বাগেরহাট।

সূত্র : তারিখ : ২৪/০৭/১২

অনাপত্তি পত্র

এই ঘোষণা প্রত্যয়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্বব্যাংক কর্তৃক গৃহীত উপদ্রব্য বর্ধ উন্নয়ন কর্মসূচীর আওতাধীন (CEIP) বাংলাদেশ পারি উন্নয়ন বোর্ডের অধীন পোস্তা ৬৫/১ (মাড়িয়াঙ্গ ও শরণখোলা উপদ্রব্য) অনুগত প্রকল্পের জরাজিতি পুনঃনির্মাণ ও উন্নয়নের কাজ করলে এত প্রকার কর্মসূচীর কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম কর্মসূচীর অধীন অন্যান্য পরিচালিত হবে। তাছাড়াও বাংলাদেশ পারি উন্নয়ন বোর্ডের নির্দেশনা চমকসহিত সমস্ত এত ইতিমধ্যেই জমগন কর্তৃক প্রাপ্ত হয়েছে।


মোঃ মতিয়ার রহমান খান
চেয়ারম্যান
২নং খোস্তাকাটা ইউনিয়ন পরিষদ
শরণখোলা, বাগেরহাট

১৬নং খাউলিয়া ইউনিয়ন পরিষদ



চেয়ারম্যান : মোঃ আবুল খায়ের হাওলাদার

পোঃ সন্ন্যাসী বাজার, থানাঃ মোড়েলগঞ্জ,
জেলাঃ বাগেরহাট।

সূত্রঃ.....

তারিখঃ ২৪/০৮/১১

অনাপত্তি পত্র

এই মর্মে প্রত্যয়ন 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 পোস্তার ৩৫/১ প্রকল্পটির জরুরি ভিত্তিতে
পুনর্বাসন ও উন্নয়নের কাজে আমার ও অত্র এলাকার জনগণের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম জনগণের সক্রিয় অংশগ্রহণে 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 ইউনিয়ন পরিষদ
মোড়েলগঞ্জ, বাগেরহাট।



তারিখ : ১৪/০৭/২০২০

ବିଶି ଶାମ୍ବି ନାଗୋମ କଣା ଯାହା ଯେ, ଶାନ୍ତିକିଶୋର
ମାଧବୀ ଓ ନିଧିଶା ଶାନ୍ତି କଣ୍ଠେ ଶାନ୍ତି ଶାନ୍ତିକିଶୋର
ଆଦି ଶେଷର କମ୍ ଶାନ୍ତିକିଶୋର (EIP) ଶାନ୍ତିକିଶୋର
କାମର ଶେଷର (ଆଦିର ଆଦିର ଶାନ୍ତିକିଶୋର ଓ ଶାନ୍ତିକିଶୋର
ଓ ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର)
ନିଧିକିଶୋର ଶାନ୍ତିକିଶୋର ଓ ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର
ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର
ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର ଶାନ୍ତିକିଶୋର

(১) প্রধান উদ্দেশ্য হল, উক্ত প্রকল্পের অর্থিক প্রভাব
 সম্বন্ধে জানা যাতে কারিগরগণের মত। প্রত্যেক
 প্রকল্পের ক্ষেত্রে প্রধান প্রাথমিক নিয়মের অধীনে
 গণ্য করা হবে। প্রথম প্রকল্পের ক্ষেত্রে
 কারিগরগণের মত প্রকল্পের ক্ষেত্রে।

২৪/১/১২
মোঃ আসাদুজ্জামান (মিলন)
চেয়ারম্যান
৩নং বারেন্দা ইউনিয়ন পরিষদ
সকলখোলা, বাগেরহাট।

বিস্মিল্লাহির রহমানির রহিম
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

৪নং সাউথখালী ইউনিয়ন পরিষদ

শরণখোলা, বাগেরহাট।

স্মারক নং :

তারিখ : ২৪/০৫/১২

অনাপত্তি পত্র

এই মর্মে প্রত্যয়ন করাযাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্বব্যাংক কর্তৃক গৃহিত উপকূলীয় বাধ উন্নয়ন কর্মসূচীর আওতাধীন (CEIP) বাংলাদেশ পানি উন্নয়ন বোর্ডের অধীনে পোন্ডার ৩৫/১, মোড়েল গঙ্গা ও শরণখোলা উপজেলার অন্তর্গত প্রকল্পটির জরুরীভিত্তিতে পুনর্বাসন ও উন্নয়নের কাজ করলে অত্র এলাকার জনগণের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্প কার্যক্রম জনগণের সক্রিয় অংশগ্রহণে পরিচালিত হবে। তাছাড়া ও বাংলাদেশ পানি উন্নয়ন বোর্ড এর নির্মাণ কাজ চলকাকালীন সময় অত্র ইউনিয়নের জনগণ সার্বিকভাবে সহায়তা করবেন।



মোঃ মোজাম্মেল হোসেন
চেয়ারম্যান
৪ নং সাউথখালী ইউনিয়ন পরিষদ
শরণখোলা, বাগেরহাট।

Annex C: Tables

Table 1: Checklist of terrestrial and crop field plant species found within the study area

Scientific name	Family	Local name	Habit
<i>Acacia moniliformis</i>	Mimosaceae	Akashmoni	Tree
<i>Acalypha indica</i>	Euphorbiaceae	Muktajhuri	Herb
<i>Achyranthes aspera</i>	<i>Amaranthaceae</i>	Apang	<i>Herb</i>
<i>Aegle marmelos</i>	Rutaceae	Bel	Tree
<i>Albizia lebbeck</i>	Leguminosae	Sirish	Tree
<i>Albizia procera</i>	Leguminosae	Silkaroi	Tree
<i>Albizia richrdiana</i>	Leguminosae	Gogon Sirish	Tree
<i>Alstonia scholaris</i>	Apocynaceae	Chatim	Tree
<i>Amaranthus spinosus</i>	Amaranthaceae	Kata note	Herb
<i>Anthocephalus chinensis</i>	Rubiaceae	Kadom	Tree
<i>Areca catechu</i>	Palmae	Supari	Tree
<i>Artocarpus heterophyllus</i>	Moraceae	Kathal	Tree
<i>Averrhoa carambola</i>	Averrhoaceae	Kamranga	Tree
<i>Azadirachta indica</i>	Meliaceae	Nim	Tree
<i>Bambusa sp.</i>	Gramineae	Bans	Tree
<i>Barringtonia acutangula</i>	Barringtoniaceae	Hijal	Shrub
<i>Bombax ceiba</i>	Bombacaceae	Shimul	Tree
<i>Borassus flabelifer</i>	Palmae	Tal	Tree
<i>Calamus tenuis</i>	Palmae	Bet	Shrub
<i>Calotropis gigantea</i>	<i>Asclepiadaceae</i>	Akand	<i>Shrub</i>
<i>Calotropis procera</i>	<i>Asclepiadaceae</i>	Akand	<i>Shrub</i>
<i>Carica papaya</i>	Caricaceae	Papay	Shrub
<i>Carissa carandas</i>	<i>Apocynaceae</i>	Karamcha	<i>Shrub</i>
<i>Cassia alata</i>	Leguminosae	Dadmordon	Shrub
<i>Cassia fistula</i>	Leguminosae	Sonalu	Tree
<i>Cassia tora</i>	Leguminosae	Chakunda	Shrub
<i>Casuarina equisetifolia</i>	Casurianaceae	Jahu	Shrub
<i>Centella asiatica</i>	Umbelliferae	Thankuni	Herb
<i>Cestrum nocturnum</i>	Compositae	Hasnahena	Shrub

Scientific name	Family	Local name	Habit
<i>Chenopodium ambrosoides</i>	<i>Chenopodiaceae</i>	Chapali ghash	Herb
<i>Citrus grandis</i>	Rutaceae	Jambura	Tree
<i>Cleorodendrum viscosum</i>	Verbenaceae	Bhat	Shrub
<i>Clerodendrum inerme</i>	<i>Verbenaceae</i>	Bhant	Herb
<i>Cocos nucifera</i>	Palmae	Narikel	Tree
<i>Cotula hemispherica</i>	<i>Compositae</i>	Kancha ghash	Herb
<i>Crotolaria retusa</i>	<i>Gramineae</i>	Ban-san	Herb
<i>Croton bonplandianum</i>	<i>Euphorbiaceae</i>	Banjhal	Herb
<i>Cuscuta australis</i>	<i>Convolvulaceae</i>	Swarnalata	Herb
<i>Cynodon dactylon</i>	<i>Gramineae</i>	Durba	Herb
<i>Cyperus diformis</i>	<i>Cyperaceae</i>	-	Herb
<i>Dalbergia sissoo</i>	Fabaceae	Sisso	Tree
<i>Datura suaveolens</i>	Solanaceae	Dutura	Herb
<i>Dentella repens</i>	<i>Rubiaceae</i>	Hachuti	Herb
<i>Dillenia indica</i>	Dilleniaceae	Chalta	Tree
<i>Diospyros discolor</i>	Ebanaceae	Bilatigab	Tree
<i>Diospyros perigrina</i>	Ebanaceae	Deshigab	Tree
<i>Erythrina ovalifolia</i>	Leguminosae	Talimandar	Tree
<i>Euphorbia hirta</i>	<i>Euphorbiaceae</i>	Dudhia	Herb
<i>Ficus benghalensis</i>	Moraceae	Bot	Tree
<i>Ficus heterophylla</i>	Moraceae	Bhui Dumur	Herb
<i>Ficus hispida</i>	Moraceae	Dumur	Shrub
<i>Ficus religiosa</i>	Moraceae	Assawath	Tree
<i>Glycosmis pentaphylla</i>	Rutaceae	Daton	Shrub
<i>Lagerstromia speciosa</i>	Lythraceae	Jarul	Tree
<i>Leucauna laucocephalata</i>	Mimisaceae	Ipil ipil	Tree
<i>Litchi chinensis</i>	Sapindaceae	Lichu	Tree
<i>Mangifera indica</i>	Anacardiaceae	Aum	Tree
<i>Marsilea quadrifolia</i>	<i>Marciliaceae</i>	Susnishak	Herb
<i>Mikania scandens</i>	Compositae	Assamlata	Herb
<i>Moringa oleifera</i>	Moringaceae	Sajna	Tree
<i>Nicotiana plumbaginifolia</i>	<i>Solanaceae</i>	Bantamak	Herb

Scientific name	Family	Local name	Habit
<i>Nyctanthes arborescens</i>	<i>Solanaceae</i>	Sefali	Herb
<i>Ocimum americanum</i>	Labiatae	Tulshi	Herb
<i>Pandanus sp.</i>	Pandanaceae	Keya	Herb
<i>Phoenix sylvestris</i>	Palmae	Khejur	Tree
<i>Pongamia pinnata</i>	Fabaceae	Karoch	Tree
<i>Psidium guajava</i>	Myrtaceae	Peyara	Shrub
<i>Rhynchospora rufescens</i>	<i>Cyperaceae</i>	Shimbhatraji	Herb
<i>Ricinus communis</i>	Euphorbiaceae	Reri	Shrub
<i>Rorippa indica</i>	<i>Cruciferae</i>	Bansarisha	Herb
<i>Sacciolepis interrupta</i>	<i>Gramineae</i>	Nardulla	Herb
<i>Sesbania rostrata</i>	<i>Leguminosae</i>	Dhaincha	Herb
<i>Spondias dulcis</i>	Anacardiaceae	Amra	Tree
<i>Streblus asper</i>	Urticaceae	Sheora	Shrub
<i>Swietenia mahagoni</i>	Meliaceae	Mahogoni	Tree
<i>Syzygium cumini</i>	Myrtaceae	Kalojam	Tree
<i>Tamarindus indica</i>	Leguminosae	Tetul	Tree
<i>Tectona grandis</i>	Verbenaceae	Segun	Tree
<i>Terminalia arjuna</i>	Combretaceae	Arjun	Tree
<i>Terminalia catappa</i>	Combretaceae	Katbadam	Tree
<i>Trewia nudiflora</i>	Euphorbiaceae	Pitali/Latim	Tree
<i>Zizyphus mauritiana</i>	Rhamnaceae	Baroi	Tree

Source: Field survey, 2012

Table 2: Checklist of aquatic flora species found within the study area

Scientific name	Family	Local name	Habit
<i>Alternanthera philoxioides</i>	Amaranthaceae	Helencha	Herb
<i>Arundo donax</i>	Gramineae	Baranal	Herb
<i>Azolla pinnata</i>	Salviniaceae	Kutipana	Herb
<i>Ceratophyllum demersum</i>	Ceratophyllaceae	Jhangi	Herb
<i>Colocasia esculenta</i>	Araceae	Kachu	Herb
<i>Cyperus sp.</i>	Cyperaceae	Mutha	Herb

Scientific name	Family	Local name	Habit
<i>Eclipta alba</i>	Compositae	Kalokeshi	Herb
<i>Eichhornia crassipes</i>	Pontaderiaceae	Kochuripana	Herb
<i>Enhydra fluctuans</i>	Cyperaceae	Helencha	Herb
<i>Fimbristylis milliacea</i>	Cyperaceae	Joina	Herb
<i>Hygroryza aristata</i>	Gramineae	Putki	Herb
<i>Ipomoea aquatica</i>	Convolvulaceae	Kalmi sak	Herb
<i>Lemna perpusilla</i>	Lemnaceae	Khudipana	Herb
<i>Limnophila sessiliflora</i>	Scrophulariaceae	Bijatighas	Herb
<i>Ludwigia abscondens</i>	Onagraceae	Keshordam	Herb
<i>Ludwigia hyssopifolia</i>	Onagraceae	Keshordam	Herb
<i>Mersilea quadrifoliata</i>	Mersileaceae	Susnisak	Herb
<i>Monochoria hatata</i>	Pontaderiaceae	Kechur	Herb
<i>Nachamendra alternifolia</i>	Hydrocharitaceae	Kaisa	Herb
<i>Najas. sp</i>	Najadaceae	Goisa	Herb
<i>Nymphaea nouchali</i>	Nymphaeaceae	Shapla	Herb
<i>Nymphaea stellata</i>	Nymphaeaceae	Nilshapla	Herb
<i>Nymphoides indicum</i>	Menyanthaceae	Panchuli	Herb
<i>Phragmites karka</i>	Gramineae	Nol	Herb
<i>Pistia stratiotes</i>	Araceae	Topapana	Herb
<i>Polygonum barbatum</i>	Polygonaceae	Bishkatali	Herb
<i>Polygonum glabrum</i>	Polygonaceae	Bishkatali	Herb
<i>Polygonum lanatum</i>	Polygonaceae	Bishkatali	Herb
<i>Sagittaria sagittifolia</i>	Alismataceae	Chhotokul	Herb
<i>Salvina cucullata</i>	Salviniaceae	Kuripana	Herb
<i>Scirpus juncooides</i>	Cyperaceae	Chisra	Herb
<i>Spirodela polyrhiza</i>	Lemnaceae	Khudipana	Herb
<i>Trapa natans</i>	Trapaceae	Singra	Herb
<i>Vallisneria spiralis</i>	Hydrocharitaceae	Bicha	Herb
<i>Vetiveria zizanioides</i>	Gramineae	Binna	Herb
<i>Wolffia microscopica</i>	Lemnaceae	Guripana	Herb

Source: Field survey, 2012

Table 3: Checklist of mangrove species found within the study area

Scientific name	Local name	Type of plant
<i>Acanthus ilicifolius</i>	Hargoza	Scrambling, woody, thomy herb
<i>Acrostichum aureum</i>	Hodo, Tiger fern	Gregarious fern
<i>Bruguiera gymnorrhiza</i>	Kankra	Tree
<i>Clerodendrum inerme</i>	Sitka, Sitki	Scandent shrub
<i>Derris trifoliata</i>	Gila lota, Kali lota	climber
<i>Eriochloa procera</i>	Nol gash	Grass
<i>Excoecaria agallocha</i>	Gewa	Tree
<i>Herietira fomes</i>	Sundri	Tree
<i>Hibiscus tiliaceous</i>	Bhola	Shrub
<i>Myriostachya wightiana</i>	Dhanshi	Grass, common or new accretions
<i>Nypa fruticans</i>	Golpata	Palm with underground stem
<i>Sarcolobus globosus</i>	Bowali lota	climber
<i>Sonneratia caseolaris</i>	Choyla, ora, soyla	Small tree
<i>Sonneratia apetala</i>	Keora	Tree

Source: Field survey, 2012

Annex D: Figures

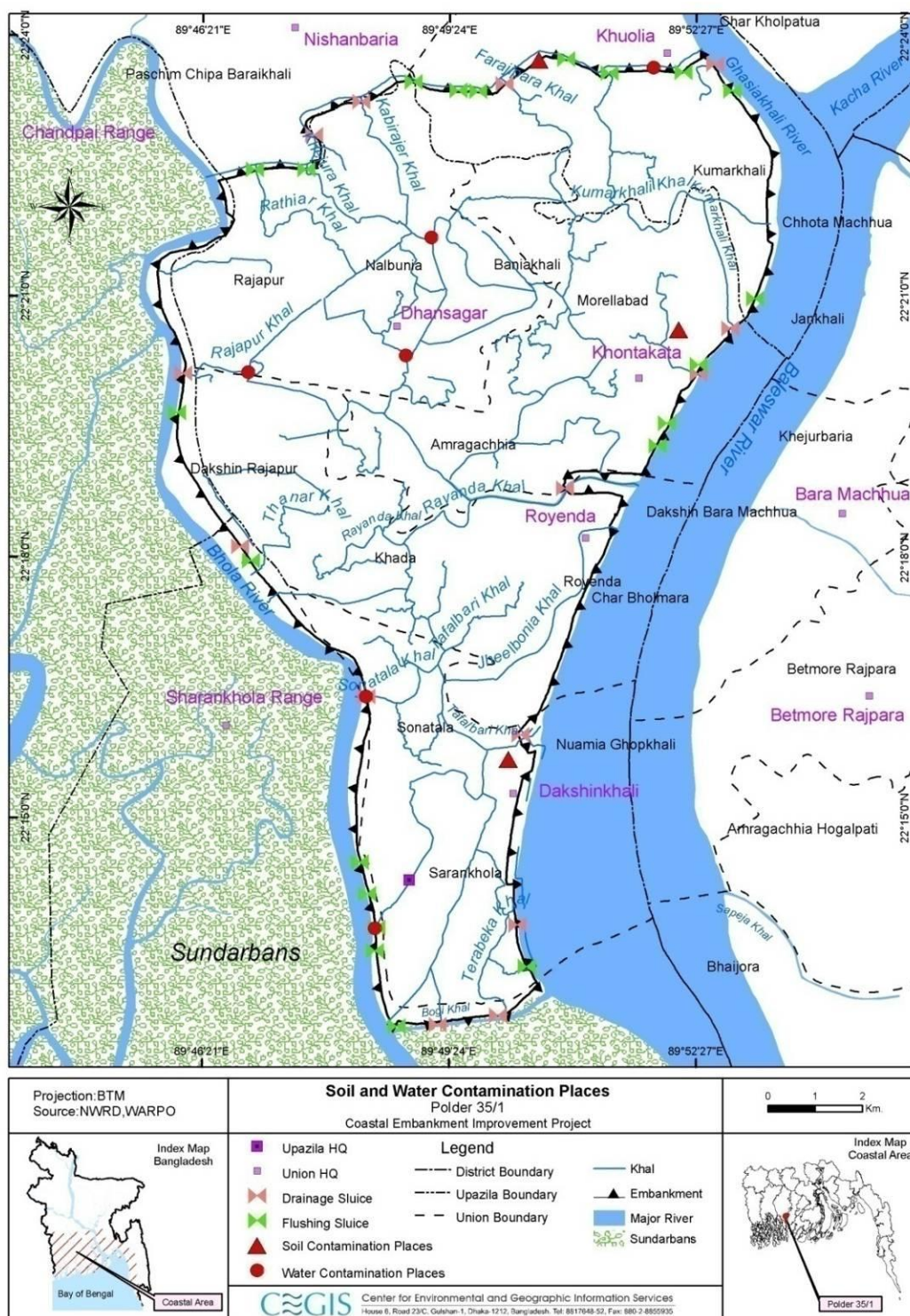


Figure 1: Soil and Water Contamination site of Polder 35/1

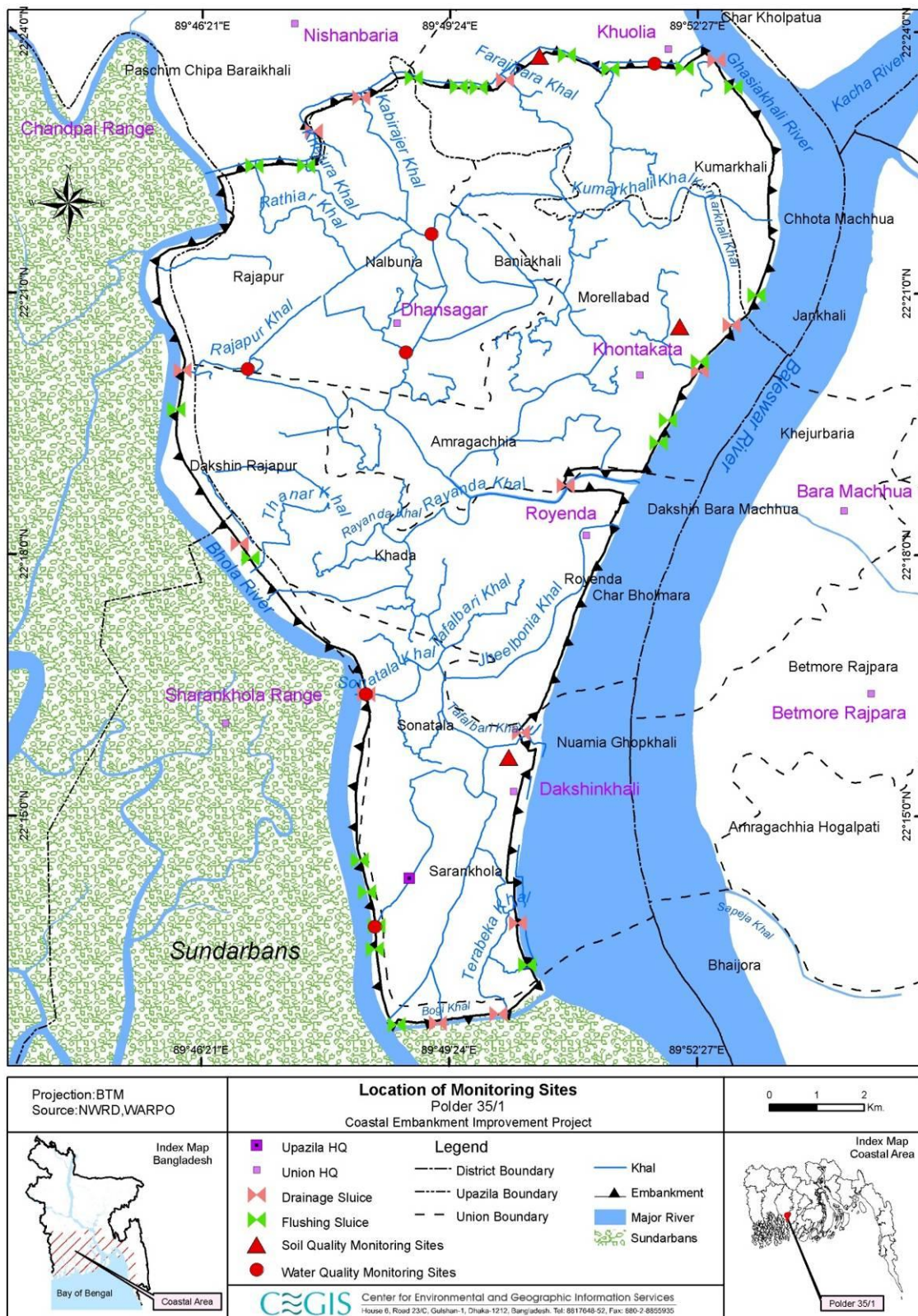


Figure 2: Monitoring sites of Polder 35/1

Annex E: List of Participants of PCM and FGD

List of PCM Participants

উপকূলীয় বান্ধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থান: **বায়ু-আগর ইউনিয়ন পরিষদ, সন্ন্যাসপাড়া** তারিখ: **২৪/০৩/১৮**

ক্রমিক সং.	অংশগ্রহণকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১	মো: আব্দুল হকিম	উপাচার্য	০১৭১৫৬৭০২৭	
২	মো: মোস্তাফিজ হোসেন	উপাচার্য	০১৭১৬৩৫২৩০৩	
৩	মো: মোস্তাফিজ	সদস্য	০১২২০৫২৫২১	
৪	মো: মোস্তাফিজ	সদস্য	০১৭১৭১২৫৪৫০	
৫	মো: মোস্তাফিজ	সদস্য	০১৭১৮০৬০৭১০	
৬	মো: মোস্তাফিজ	সদস্য	০১৭১৭৮১১০২৮	
৭	মো: মোস্তাফিজ	সদস্য	০১৭১৮৮৬২৭৭	
৮	মো: মোস্তাফিজ	সদস্য	০১৭১৮৬৫৬৭২০	
৯	মো: মোস্তাফিজ	সদস্য	০১৭২২৩৭৩৫৬	
১০	মো: মোস্তাফিজ	সদস্য	০১৭১৭-৩১৩৭৭২	
১১	মো: মোস্তাফিজ	সদস্য	০১৭১৭-৩৮৬২৩৫	
১২	মো: মোস্তাফিজ	সদস্য	০১৭৩১৩৫৩৩৫	
১৩	মো: মোস্তাফিজ	সদস্য	০১৭২০৩৬১২৫৩	
১৪	মো: মোস্তাফিজ	সদস্য	০১৭৩১৬৭০০৫৭	
১৫	মো: মোস্তাফিজ	সদস্য	০১৭১৭১৫১০৬	

જાન: - વાસ પ્રાજ્ઞાક હેલ્થકેર પ્રા.લિમિટેડ, તારિખ: 28/08/21

[illegible]

উপর্যুক্ত বঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থান: বান সাজাব ইউনিয়ন পরিষদ

তারিখ: ২৪/০৫/১২

ক্রমিক নং	আংশগ্রহণকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
৬৬	শ্রীঃ আশীষ কুমার	ইউ. এডভাইজার	০১৭১৩৭২৭৭৪৬	আশীষ কুমার
৬৮	শ্রীঃ মিলি কুমার	ইউ. এডভাইজার	০১৭২৭৪৮৭০৫৮	মিলি কুমার
৬৯	শ্রীঃ আদিত্য কুমার	ইউ. এডভাইজার	০১৭২৪৩৭৫৪৬	আদিত্য কুমার
৬৯	শ্রীঃ ইহসান আলী	সহকারী প্রকৌশল	০১৭৭৮২৭৫৭৭	ইহসান আলী
৭০	শ্রীঃ মিলি	সহকারী প্রকৌশল	০১৭৩৭২৭৮৭৮	মিলি
৬১	কমল কান্ত	সহকারী প্রকৌশল	০১৭৩৬৩৩০৩১৬	কমল কান্ত
৬২	শ্রীঃ আব্দুল হান্নান	সহকারী প্রকৌশল	০১৭১১২৭২৫৬	আব্দুল হান্নান
৮০	শ্রীঃ মিলি	সহকারী প্রকৌশল	০১৭৩৫৫৫৭০৮৭	মিলি
৮১	শ্রীঃ মিলি	সহকারী প্রকৌশল	০১৭২৫০৩৭৩০৭	মিলি
৮২	শ্রীঃ মিলি	সহকারী প্রকৌশল	০১৮১৮৭৭০৫৭৮	মিলি
৮৬				
৮৮				
৮৯				
৯০				
৯১				
৯২				
৯৩				
৯৪				
৯৫				

List of FGD participants

Sl. No.	Name of the participants	Age	Occupation	Address/Mobile Phone Number
1	Md. Ziaul Haque	28	Business	Sonnasy
2	Md. Mojibur Rahman	62	Service	01728212036
3	Md. Jobber Howlader	40	Farmer	Rayenda
4	Alomgir Howlader	42	Farmer	01740541415
5	Mofu Mridha	30	Business	01739966065
6	Hazi Habibur Rahman	65	Ex. Service	Rayenda
7	Md. Saleha Howlader	35	Business	01713926188
8	Md. Forid Bayati	38	Fisherman	01748939206
9	Md. Ishaq Ali	36	Farmer	01735686854
10	Md. Shahazan Mia	30	Farmer	01927728576
11	Md. Hemait Uddin	29	Fisherman	Bogi Bondor
12	Md. Raju Khan	19	Fisherman	Bogi Bondor
13	Abdur Rahman	22	Farmer	Bogi Bondor
14	Delwar Kholifa	32	Farmer	Bogi Bondor
15	Md. Ali Haider	35	Boatman	Bogi Bondor
16	Md. Sahajan Mirdha	32	Farmer	Choto Nolbunia
17	Md. Uniuse ali Howlader	51	Businessman	01746493017
18	Md. Aual Akon	72	Ex Farmer	01740621307
19	Md. Sohal Mirdha	32	Service	01914967828
20	Md. Mojibor Gazi	52	Farmer	01736330358
21	Md. Fool miea	42	Farmer	Choto Nolbunia
22	Md. Faruq vuhiean	31	Van puller	Choto Nolbunia
23	Md. Ismile Shake	40	Farmer	Choto Nolbunia
24	Md. Nasir ali	34	Businessman	Gazir brize
25	Md. Sarawar	33	Business	Dhansagar
26	Md. Mizanur Rahman	26	Business	01721347162
27	Md. Tobir Halader	37	Business	01732763935
28	Md. Sumon Halader	32	Fisherman	Pollemongol
29	Md. Abu salak Halder	36	Imam	Pollemongol
30	Md. Satter Talukder	20	Student	Dhansagar
31	Subol Dush	35	Fisherman	Dhansagar
32	Md. Somser ali	65	Farmer	Pollemongol
33	Md. Rajib Shake	25	Student	01722845182

Sl. No.	Name of the participants	Age	Occupation	Address/Mobile Phone Number
34	Md. Mobin Hossain	22	Student	Dhansagar
35	Md. Abdul Alim	33	Teacher	01913949666
36	Md. Touhidul Islam	35	Business	01913906834
37	Md. Asadul Islam	30	Business	01923875440
38	Md. Abdul Bari Khan	55	Teacher	01724115397
39	Md. Monerul Islam	28	Business	01919895399
40	Md. Nasir fokir	40	Farmer	Choto Pori
41	Md. Ismile Sikder	32	Van puller	Boro Pori
42	Md. Kamal Sikder	45	Farmer	BoroPori
43	Md. Salam Khan	50	Farmer	Choto Pori
44	Abdul Kuddus	37	Fisherman	Choto Pori
45	Md. Gieas Uddin Mirdha	55	UP Member	01722105655
46	Md. Moslam Ali	65	Farmer	Sarankhola
47	Md. Foule Miea	55	Business	01732017451
48	Md. Abdul Salam	45	Fisherman	Sarankhola
49	Md. Abul Hossain Foraji	42	Farmer	01720800771
50	Md. Zahangir Hossain	48	Ex UP Member	01719768758
51	Md. Anowar Hossain	42	Businessman	01733981631
52	Md. Sah Alom Gazi	50	Farmer	01731961432
53	Md. Ashraf Gazi	34	Service	01672626523
54	Md. Sumon Halder	30	Fisherman	Sarankhola
55	Md. Jakir Hossain	34		01823824281
56	Md. Salim Shikder	56		01760806491
57	Md. Alom Sarder	34		Bogi
58	Md. Monir Talukder	44		01735686882
59	Md. Solaiman Chaprasi	50		01946624259
60	Md. Panna Foraji	32		01714353783
61	Md. Solaiman Hossain	23		Kurikhali
62	Md. Akber Hossain	29	Farmer	Bogi
63	Md. Hafiz Mollah	43	Farmer	Bogi
64	Md. Babor ali	32	Fisherman	Kurikhali
65	Md. Samsul Haque	44	Day labour	Kurikhali
66	Md. Rasel Halder	22	Farmer	01725921046
67	Md. Hemait hossain	45	Business	01735021658
68	Md. Nasir Kazi	45	Farmer	01749801948

Sl. No.	Name of the participants	Age	Occupation	Address/Mobile Phone Number
69	Md. Kallu mullah	60	Farmer	01741538269
70	Md. Ali Hossain			01734367906
71	Md. Sahalam halder	48	Business	01733968834
72	Md. Allauddin talukder	54	Farmer	01933187354
73	Md. Munsur talukder	35	Business	01725033834
74	Md. Faruqe sawdagar	40	Farmer	Dhansagor
75	Md. Sahlam lom	37	Farmer	01911546508

Annex F: ToR for Environmental Impact Assessment (EIA) of CEIP-I/Polder 35/1

Background

Bangladesh Water Development Board (BWDB) requires to conduct Environmental Impact Assessment (EIA) study for Polder 35/1 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 qualitative 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, 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 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 discuss 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 discuss 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 G: Photo Album



Figure1: Sannashi 1 vent Drainage Sluice



Figure2: Tafalbari 2 vent Drainage Sluice



Figure3: Uttar Rajapur 2 vent Drainage Sluice



Figure4: Dakkhin Rajapur 2 vent Drainage Sluice



Figure5: Bogi bondar 4 vent Drainage Sluice



Figure6: Rayenda 4 vent Drainage Sluice



Figure7: Baleswer river at Sannashir lounch ghat



Figure8: Bogi khal at Bogibondar



Figure9: Bhola river at Sonatola



Figure10: Rayenda khal



Figure11: Water salinity testing in the polder



Figure12: Taking GPS reading in the Polder



Figure13: Erosion at Baleswar River



Figure14: Protective work in Polder area



Figure15: Protective work by CC block at Polder area



Figure16: Embankment used as rural road



Figure17: Navigation in Baleswar river



Figure18: Navigation at Rayenda Khal



Figure19: Small fishing boat in Baleswar river



Figure20: Fishing troller in Baleswar river



Figure21: Kutcha Road Network in the Polder



Figure22: Herringbone Road Network



Figure23: Pucca Road Network in the polder



Figure24: Soil sample Collection site



Figure25: Rice cum fish culture in the polder



Figure26: Aman rice harvesting in the Polder area
by harvester



Figure27: View of Boro rice seedlings



Figure28: Fishing boat inside the Polder area



Figure29: Going to PL collect in Boleswar River



Figure30: Repairing fishing gear inside the Polder



Figure31: PL collection inside the Polder



Figure32: PL collection by women



Figure33: Selling fish in the local market



Figure34: Mix catch fish



Figure35: Hilsha catch from Baleswar River



Figure36: Tafalbari Jam-e- Mosque



Figure37: Sarankhola Jam-e- Mosque



Figure38: Sarankhola Bazar in the polder area



Figure39: Chairman Bazar along the Embankment



Figure40: Sarankhola Degree College



Figure41: Forkania Hafize Madrassa, Rayenda



Figure42: Sonnyasi Girls' High School



Figure43: Kodomtola Govt. Primary School



Figure44: A.H.M Hatem Ali General Hospital



Figure45: Surjerhasi Clinic



Figure46: 50 Bed Upazila Health Complex



Figure47: Tafalbari Community Clinic



Figure48: School cum Cyclone Shelter at Sarankhola



Figure49: Destiny cyclone Shelter at Tafalbari



Figure50: School cum Cyclone Shelter



Figure51: School cum Cyclone Shelter



Figure52: Source of Drinking water



Figure53: PSF(Pond Sand Filter) inside the Polder



Figure54: Drinking water supply



Figure55: Drinking water supply inside Polder



Figure56: Semi puca house in the polder



Figure57: Semi puca house in the polder



Figure58: Kutch house in the polder



Figure59: Kutch house in the polder



Figure60: Pucca Toilet



Figure61: Ring slab Toilet



Figure62: Ring slab Toilet



Figure63: Kutcha Toilet



Figure64: FGD at Tafalbari launch ghat



Figure65: FGD at Pollimongal



Figure66: FGD at Chairman Bazar, Purbo Chipa Baraikhali



Figure67: FGD at Dokhinkhali



Figure68: FGD at Chaltiabunia



Figure69: FGD at Bandakata



Figure70:FGD Near at Gazir bridge



Figure71: FGD at Royenda



Figure72: International Consultant discuss with local stakeholders at Pollimongol



Figure73: International Consultant discuss with local stakeholders at south khali

PCM Pictures



Figure74: Discussion by CEGIS: professional



Figure75: Discussion by CEGIS professional



Figure76: PCM at Dhansagor UP



Figure77: Participants at PCM



Figure78: Discussion during PCM at Dhansagar UP



Figure79: Close discussion during PCM at
Dhansagar UP