PEOPLE'S REPUBLIC OF BANGLADESH

DEPARTMENT OF DISASTER MANAGEMENT (DDM)
MINISTRY OF DISASTER MANAGEMENT AND RELIEF (MoDMR)

THE PREPARATORY SURVEY ON THE CAPACITY ENHANCEMENT ON DISASTER RISK REDUCTION, EMERGENCY RESPONSE AND RECOVERY PROJECT IN THE PEOPLE'S REPUBLIC OF BANGLADESH

FINAL REPORT

VOLUME I

MAIN REPORT

JUNE 2016

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD.
INGEROSEC CORPORATION
ORIENTAL CONSULTANTS GLOBAL CO., LTD.

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THE CAPACITY ENHANCEMENT ON
DISASTER RISK REDUCTION,
EMERGENCY RESPONSE AND RECOVERY PROJECT

FINAL REPORT

List of Reports

Volume I	:	MainReport
Volume II	:	Appendices
Volume III-1	:	Guideline of Operation of Disaster Recovery Fund
Volume III-2	:	Manual of Operation of Disaster Recovery Fund

Exchange Rate

1 US$ = 77.8 BDT = 120.2 JPY

1 BDT = 1.55 JPY

November 2015

Summary

1. Introduction

1.1 Background

The People's Republic of Bangladesh (hereinafter referred to as "Bangladesh") is one of the most vulnerable countries to natural disasters. It is located in the world's largest delta, with 90% of land located in low lying area where the height above sea level is 10 meters or less. In 1998, about 70 % of the land area was inundated by flood. Cyclone occurs almost every year, with which more than 3 thousands people lost their lives by the Cyclone Sidr in 2007. In the last 30 years from 1985 to 2014, total number of deaths due to natural disaster is more than 170 thousands, cumulative total of affected people is more than 262 million, and the economic loss caused by these disasters is reported to be around 570 million U.S. Dollar each year, according to the international disaster database "EM-DAT" as of December 2015. This hinders the stable economic growth of the country. Also, there has been a growing concern on the risk of earthquake, even after the experience of Nepal Earthquake occurred in April 2015.

The Ministry of Disaster Management and Relief (hereinafter referred to as "MoDMR") is the responsible ministry to comprehensively implement the activities of disaster risk reduction and emergency response under the Disaster Management Act (2012). However, cross-sectoral cooperation setup is not sufficiently established at the implementation level, and disaster management plan and guidelines are not commonly available in the relevant agencies to disaster risk reduction. This circumstance often brings about the situation in which activities and budget investment by individual agency for disaster risk reduction actually do not reduce vulnerability of concerned community. This is a challenge of disaster management sector in Bangladesh to effectively and efficiently utilize limited budget by coordinating disaster recovery and rehabilitation activities implemented by individual agencies. In terms of disaster communication in Bangladesh, early warning system is greatly improved. However, the communication system during disaster to understand the affected people and damaged area could be improved for more efficient response and quick recovery afterwards. Furthermore, necessity of quick recovery and rehabilitation activities at post-disaster phase needs to be acknowledged and preparation of appropriate procedure and regulations are required.

The Government of Bangladesh (GOB) had developed the Seventh Five-Year Plan for FY2016-2020, in which disaster management is considered as one of the key sectors to address, besides climate change and environmental management. Bangladesh aims to be a middle income country by 2021, for which it must overcome vulnerability to natural disaster and make the society disaster-resilient. Based on this background, the Government of Bangladesh (herein after referred to "GOB") requested loan assistance from the Government of Japan (hereinafter referred to as "GOJ") for strengthening disaster risk management in Bangladesh by strengthening implementation of disaster risk reduction, emergency response, and quick and effective recovery and rehabilitation.

1.2 Project Objective and Study Area for the Survey

The Project Objectives and Study Area for the Survey are as discussed below.

Table 1 Project Outline

Items	Outline
Project Name	Disaster Risk Management Enhancement Project (The Project)
Project Objective	The objective of the P roject is to enhance comprehensive disaster risk management ofthe Government of Bangladesh by recovering and rehabilitating infrastructures at high riskf for natural disasters, providing equipment for emergency communication and relief, and establishing the scheme for quick and effective recovery and rehabilitation works and its implementation, thereby contributing to build Bangladesh society more disaster-resilient.
Survey Area	Areas highly vulnerable to floods, cyclone and storm surge.
Executing Agency	Major Executing Agencies 1) Ministry of Disaster Management and Relief (MoDMR) 2) Department of Disaster Management (DDM) Executing Agencies 3) Local Government Engineering Department (LGED) 4) Bangladesh Water Development Board (BWDB) 5) Fire Service and Civil Defence (FSCD)
Relevant main Japanese assistance activities	Loan Fund Cooperation 1) Emergency Disaster Damage Rehabilitation Project (2008, about 7 billion JPY) 2) Haor Flood Management and Livelihood Improvement Project (2014, about 15 billion JPY) 3) Inclusive City Governance Project (2014, about 30 billion JPY) 4) Small Scale Water Resources Development Project (2007, about 5 billion JPY) 5) Northern Bangladesh Integrated Development Project (2012, about 20 billion JPY) Grant Aid Cooperation 6) Projects for Construction of Cyclone Shelter (1st to 5th, and "The Programme for Construction of Multipurpose Cyclone Shelters in the Area Affected by the Cyclone Sidr") (1993-2008, about 4 billion JPY) 7) Projects for Improvement/Establishment of Meteorological Radar System (5 places, 1986-2007, about4.63 billion JPY) 8) Project for Improvement of Meteorological Radar System in Dhaka and Rangpur (2015, about 2.9 billion JPY) Technical Cooperation 9) Rural Infrastructure Development & Management Advisor (Sep.2014-Aug.2016) 10) Disaster Management Sector Coordination Advisor(Jul. 2015-Jun.2017) 11) Integrated Water Resources Management Adviser (Sep. 2014 - Sep. 2016) 12) The Project for Capacity Development of Management for Sustainable Water Related Infrastructure (Sep. 2013 – Sep. 2016) 13) Reserch Project on Disaster Prevention/Mitigation Measures against Floods and Storm Surges (Apr. 2014 - Mar. 2019) 14) Project for Capacity Development on Natural Disaster-Resistant Techniques of Construction and Retrofitting for Public Buildings (Mar. 2011 - Dec. 2015) 15) Capacity Development Project for Participatory Water Resources Management through Integrated Rural Development (Oct.2012-Oct.2017)

1.3 Objective of the Survey

The objective of the Preparatory Survey is to formulate the Project which may be financed by JICA, through examination of the necessity of the Project, project scope,, project cost, and environmental considerations.

2. Project Outline

Through the Project implementation, MoDMR and Department of Disaster Management (DDM) will strengthen their capability of comprehensive disaster risk management and promote mainstreaming disaster risk reduction in the government. This will be done by MoDMR and DDM participating in the sub-project selection, in cooperating the viewpoint of disaster risk reduction (i.e. beneficiaries viewpoint), and by ensuring efficient and effective utilization of the budget in terms of disaster risk reduction. Once the sub-projects are selected, executing agencies will carry out the rehabilitation work.

Component 1

Rehabilitation of flood countermeasure facilities, rural roads and bridges, those continue to be in a vulnerable state, and/or deemed to be in a state of high vulnerability and could be damaged by water induced disasters in near future, will be a scope of the Component. Executing agencies are BWDB and LGED.

Photo 1 Damage caused by water pounding

Photo 2 Erosion in line with scouring

Photo 3 Damage from footing

(1) Component 2

Procuring communication equipment and equipment for emergency rescue required for the case of water induced disasters will be a scope of the Component. Executing agencies are DDM and FSCD.

(2) Component 3

Establishing the Disaster Recovery Fund for quick and effective disaster recovery and rehabilitation, and utilizing the scheme for public infrastructures such as flood countermeasure facilities, rural roads and bridges will be a scope of the Component. Executing agencies are BWDB, LGED and DDM.

(3) Consulting Services

Detailed Design, Tender Assistance, Construction Supervision, Facilitation of Environmental and Social Consideration, Capacity Development and etc. for Disaster Risk Management Enhancement Project.

Component 1 covers activities of mitigation and preparedness during the pre-disaster period, Component 2 covers a relatively short period immediately before disaster and during the disaster period, and Component 3 covers activities of recovery and rehabilitation during the post-disaster period. The relationship among the components and the disaster management cycle are illustrated in Figure 1. The salient feature of this Project is to enhance the capacity of GOB to conduct Disaster Risk Reduction (DRR) activities in all stages of the disaster management cycle (i.e., pre-disaster, during disaster, post-disaster).

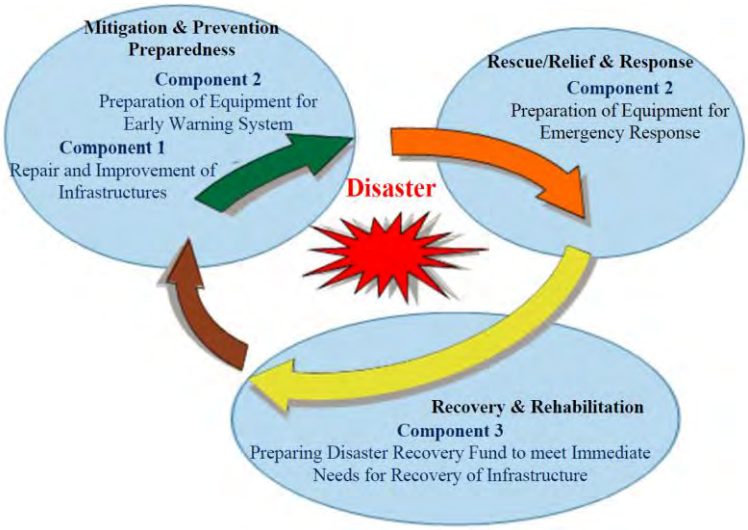


Figure 1 Project Components and Disaster Management Cycle

3. Project Management, Operation and Maintenance

At the national level, the MoDMR is the coordinating national agency for "Disaster Risk Management Enhancement Project". The DDM in the MoDMR, which was established in 2012 following the enactment of the Disaster Management Act of 2012, has the mandate to implement the objectives of the Act by reducing the overall vulnerability from different impacts of disaster.

To smoothly execute the Project, GOB will establish the Organization.

(1) Project Steering Committee (PSC)

The MoDMR shall be responsible for overall coordination and monitoring of the Project. In this connection, the Project Steering Committee (PSC) to be chaired by the Secretary of MoDMR shall provide overall guidance, policy advises and coordination of the Project, addressing inter-ministerial issues that may arise during project implementation.

(2) Project Coordination and Monitoring Unit (PCMU)

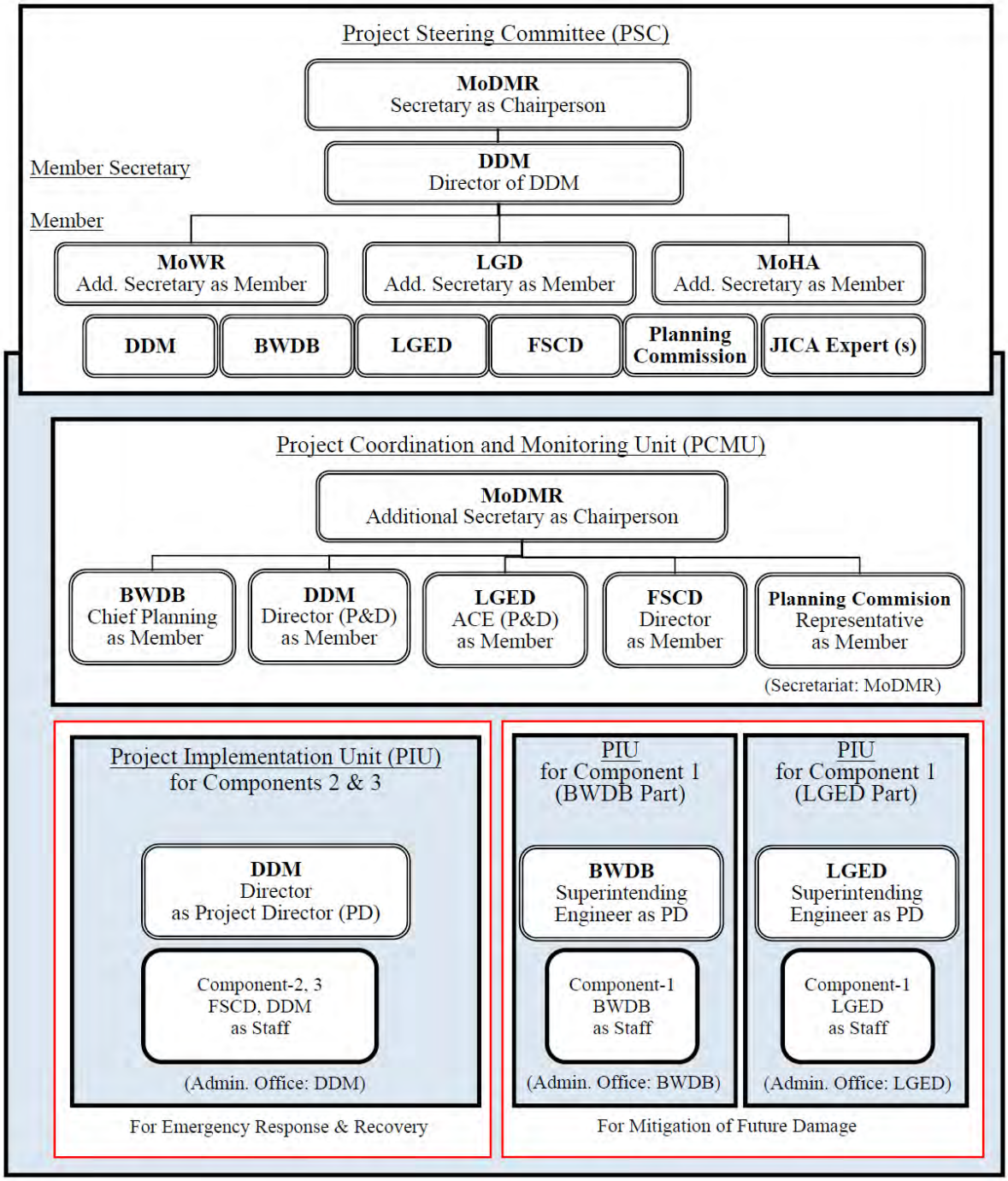
The Project Coordination and Monitoring Unit (PCMU) shall be created in the MoDMR to provide overall coordination, management and resource support in terms of technical and human resources for efficient implementation of this multi-ministerial project. The PCMU shall be headed by the Additional Secretary of MoDMR and provide secretariat services in the form of technical and administrative resources to the PSC. In addition, the PCMU shall collect progress reports timely at appropriate intervals including technical and financial matters from each of the three (3) PIUs and prepare consolidated progress reports for onward transmission to the PSC, ERD, JICA and other ministries/divisions concerned.

(3) Project Implementation Unit

Under the overall supervision of PCMU, three PIUs shall be established to be responsible for sub-projects in the component. In Component 1, two PIUs, i.e., BWDB-PIU and LGED-PIU, shall be

established for the implementation of sub-projects. In Components 2 and 3, DDM-PIU shall be established for the implementation of sub-projects. All the three PIU headquarters shall establish field offices after approval of DPPs submitted by each PIU. The PIUs shall be responsible for the overall management of sub-projects to achieve the outputs efficiently.

The overall management structure of the Project is illustrated in Figure 3.



Note: ▭ : DPP prepared by MoDMR for Components 2, 3 and 4, and LGED and BWDB for Component 1.
Source: Prepared by JICA Survey Team based on discussions with MoDMR, DDM, BWDB and LGED

Figure 2 Overall Management Structure of the Project (Draft)

The operation and maintenance of the Project will be the responsibility of the executing agencies. The Component 1 will be the responsibility of BWDB and LGED, the Component 2 is DDM and FSCD, and the Component 3 is BWDB, LGED and DDM.

4. Consulting Services

The objective of the consulting services is to achieve the efficient and proper preparation and implementation of the Project through the Detailed Design, Tender Assistance, Construction Supervision, Facilitation of Environmental and Social Consideration and Capacity Development.

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Table 2 Expected Time Schedule

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5. Implementing Schedule

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Table 3 Implementation Schedule

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6. Project Cost

The breakdown of project cost for equipment and infrastructure project is estimated considering 1) Equipment cost and construction cost, 2) Price escalation for equipment and construction cost, 3) Physical contingency on the main project cost, 4) Consulting service cost (including physical contingency), 5) Land acquisition cost (not included in equipment project), 6) VAT and Project administrative cost of the employer (project implementing body). Land acquisition cost, VAT and Project administrative cost are non-eligible for financing. The calculation conditions on equipment and construction cost depend on the implementation body as shown in the table below.

Table 4 Conditions applied to the Cost Estimate

Item	Condition	Remarks
Base year	November 2015	Refer to General Guidelines for FY2015Yen Loan Projects
Exchange rate	1USD = 120.2JPY, 1USD = 77.8BDT, 1BDT = 1.55JPY	ditto
Price escalation	FC 1.8%, LC 6.1%	ditto
Physical contingence	5% of project cost, 5% consultant service cost	ditto

Estimated project cost is tabulated in Table 5.

Table 5 Estimated Project Cost

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7. Operation and Effect Indicator

To evaluate the impacts from the subprojects in Component 1 and 2 in a quantitative way, the JICA Survey Team and local counterparts, BWDB, LGED, DDM and FSCD have agreed to utilize the evaluation indicators below. The methodology, baseline and target figure will be determined after the selection of subprojects, discussion among the stakeholders and baseline surveys.

Table 6 Operation and Effect Indicators

Component	Type of Project	Indicator (unit)
1. Repair and Improvement of Infrastructure	Embankment (BWDB)	Operation Indicator: 1. Maximum water level of observation point (m) Effect Indicator: 1. Decreasing frequency of inundation inside the subproject area caused by embankment breach (times/year)
	Revetment (BWDB)	Operation Indicator: Monitor eroded points of the revetments (Number) Effect Indicator: Decreasing distance in riverbank line shifting (m)
	Bridge and Road (LGED)	Operation Indicator: Annual average daily traffic (vehicle/day) Effect Indicator: 1. Decreasing impassable day caused by disasters (day/year) 2. Shortening of travel time (minutes) 3. Increasing annual average daily traffic (vehicle/day)
2. Procurement of Equipment for Emergency Rescue and Relief	Communication Network System (DDM)	Operation Indicator: 1. Maintenance report (times/year) 2. Training report (times/year) Effect Indicator: 1. Increasing number of equipped office (number) 2. Reduction of response time for emergency (hour)
	Equipment for Emergency Rescue (DDM)	Operation Indicator: 1. Maintenance report (times/year) 2. Operation report (times) 3. Training report (times/year) Effect Indicator: 1. Increasing number of equipped office (number) 2. Increasing number of people rescued by the equipment (number) 3. Reduction of response time for emergency (hour)
	Communication Network System (FSCD)	Operation Indicator: 1. Maintenance report (times/year) 2. Operation report (only for movable system) (times) 3. Training report (only for movable system) (times/year) Effect Indicator: 1. Increasing number of equipped Fire Station (own area basis number) 2. Reduction of response time for emergency (hour)
	Equipment for Emergency Rescue (FSCD)	Operation Indicator: 1. Maintenance report (times/year) 2. Operation report (times) 3. Training report (times/year) Effect Indicator: 1. Increasing of number of equipped Fire Station (own area basis number) 2. Reduction of response time for emergency response (hour) 3. Increasing of number of people rescued by the equipment (number)
3. Disaster Recovery Fund (DRF)	Strengthen Bangladesh government's capacity on comprehensive disaster risk reduction (DDM)	Operation Indicator: 2. Number of disaster recovery and reconstruction projects implemented through coordination between ministries under the scheme of DRF (Number)
	Early response and recovery (DDM)	Operation Indicator: 1. The number of disaster recovery and reconstruction projects that are completed within a year of disaster stricken under the scheme of DRF (number) 2. The number of days which are required a recovery and reconstruction project to be approved under the scheme of DRF (day)

Source : United Nations (http://www.un.org/Depts/Cartographic/english/htmain.htm)

● Soil investigation areas by JICA

Source : The Project for Capacity Development of Management for Sustainable Water Related Infrastructure (JICA)

LOCATION MAP

THE PREPARATORY SURVEY ON THE CAPACITY ENHANCEMENT ON DISASTER RISK REDUCTION, EMERGENCY RESPONSE AND RECOVERY PROJECT

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ACRONYMS AND ABBREVIATIONS

Abbreviations	Official Name
AADT	Annual Average Daily Traffic
ACE / ADCE	Additional Chief Engineer
ADB	Asian Development Bank
ADG	Additional Director General
ADP	Annual Development Programme
ADRA	Adventist Development and Relief Agency International
ADSL	Associates for Development Services Limited
AGO	Accounting General Office
APD	Assistant Project Director
ARAP	Abbreviated Resettlement Action Plan
AusAID	Australian Agency for International Development
BBS	Bureau of Statistics
BCCRF	Bangladesh Climate Change Resilience Fund
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCPR	Bureau for Crisis Prevention and Recovery (UNDP)
BCR	Benefit-Cost Ratio
BDP2100	Bangladesh Delta Plan 2100
BDT	Bangladesh Taka
BECA	Bangladesh Environmental Conservation Act
BMD	Bangladesh Meteorological Department
BPATC	Bangladesh Public Administration Training Centre
BRAC	Building Resources Across Communities
BWDB	Bangladesh Water Development Board
CAAB	Civil Aviation Authority of Bangladesh
CAT-DDO	Catastrophe Deferred Drawdown Option
CBC	Construction of Bridges & Culverts
CBN	Cost of Basic Needs
CC	Climate Change
CCA	Climate Change Agreement
CC-Block	Cement Concrete Block
CCC	Climate Change Cell
CCDMC	City Corporation Disaster Management Committee
CCKN	Climate Change Knowledge Network
CCTF	Climate Change Trust Fund
CDMP	Comprehensive Disaster Management Programme
CDSP-IV	Char Development and Settlement Project-IV
CE	Chief Engineer
CEGIS	Center for Environmental and Geographic Information Services
CEIP	Coastal Embankment Improvement Project
CHT	Chittagong Hill Tracts
CI	Corrugated Iron
CMCS	Construction of Multipurpose Cyclone Shelters
CMFS	Construction of Multipurpose Flood Shelters
CO	Computer Operator

Abbreviations	Official Name
CP	Contract Package
CPI	Consumer Price Index
CPP	Cyclone Preparedness Programme
CPPIB	Cyclone Preparedness Program Implementation Board
CPTU	Central Procurement Technical Unit
CSG	Cemented Sand and Gravel
CTII	CTI Engineering International Co., Ltd.
DAE	Department of Agriculture Extension
DC	Deputy Commissioner
DCF	Discounted Cash Flow
DDM	Department of Disaster Management
DDMC	District Disaster Management Committee
DEPC	Department of Environmental Pollution Control
DEX	Direct Execution
DFID	Department for International Development
DF/R	Draft Final Report
DG	Director General
DGHS	Directorate General of Health Services
DIDB	Disaster Incident Database
DLS	Department of Livestock Services
DMA	Disaster Management Act
DMB	Disaster Management Bureau
DMCs	Disaster Management Committees
DMIC	Disaster Management Information Center
DMIN	Disaster Management Information Network
DMRD	Disaster Management & Relief Division
DNA	Disaster Needs Assessment
DNCC	Dhaka North City Corporation
DSCC	Dhaka South City Corporation
DoE	Department of Environment
DoF	Department of Fisheries
DoF	Department of Forest
DPD	Deputy Project Director
DPHE	Department of Public Health Engineering
DPP	Development Project Proposal
DRR	Disaster Risk Reduction
DRF	Disaster Recovery Fund
DRMIS	Disaster Risk Management Information System
DRRO	District Relief and Rehabilitation Officer
EBBIP	Eastern Bangladesh Bridge Improvement Project
ECAs	Ecologically Critical Areas
ECC	Environmental Clearance Certificate
ECNEC	Executive Committee of National Economic Council
ECR	Environmental Conservation Rules
ECRRP	Emergency 2007 Cyclone Recovery and Restoration Project
EED	Education Engineering Department

Abbreviations	Official Name
EGPP	Employment Generation Program for the Poorest
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Monitoring Plan
E/N	Exchange of Notes
EOC	Emergency Operation Center
EPAC	Earthquake Preparedness and Awareness Committee
EPWAPDA	East Pakistan Water and Power Development Authority
EPZ	Export Processing Zone
ERD	Economic Relations Division
ERF	Early Recovery Facility
ESMS	Environmental and Social Management System
EU	European Union
FAO	Food and Agriculture Organization
FAP	Flood Action Plan
FD	Forest Department
FFW	Food for Work
FFWC	Flood Forecasting & Warning Center
FIDC	Forest Industries Development Corporation
FIDIC	International Federation of Consulting Engineers
FIRR	Financial Internal Rate of Return
F/R	Final Report
F/S	Feasibility Study
FSCD	Bangladesh Fire Service and Civil Defence
FY	Fiscal Year
FYP	Five Year Plan
GC	Governing Council
GDP	Gross Domestic Product
G.I.	Galvanized Iron
GIS	Geographic Information System
GOB	Government of Bangladesh
GOJ	Government of Japan
GLIDE	Global Disaster Identifier Number
GPS	Global Positioning System
GR	Gratuitous Relief
HAPIG	Humanitarian Assistance Programme Implementation Guideline
HBB	Harringbone Brick
HF	High Frequency
HFA	Hyogo Framework for Action
HIES	Household Income and Expenditure Survey
HP	Horse Power
HQ	Headquarter
IA	Implementing Agency
ICB	International Competitive Bidding
ICT	Information and Communication Technology
IDA	International Development Association

Abbreviations	Official Name
IEE	Initial Environmental Examination
IFAD	International Fund for Agricultural Development
IFRC	International Federation of Red Cross and ed Crescent Societies
IMD	Indian Meteorological Department
IMDMCC	Inter-Ministerial Disaster Management Coordination Committee
IMED	Implementation Monitoring and Evaluation Division
IMF	International Monetary Fund
INGO	International Non-governmental Organizations
IPCC	Intergovernmental Panel on Climate Change
IRI	International Roughness Index
IRR	Internal Rate of Return
ISEC	INGÉROSEC Corporation
ISF	Informal Settler Families
ISO	International Organization for Standardization
IT	Information Technology
IT/R	Interim Report
IUCN	International Union for Conservation of Nature and Natural Resources
IWM	Institute of Water Modelling
JICA	Japan International Cooperation Agency
JICE	Japan International Cooperation Center
JMREMP	Jamuna Meghna River Embankment Mitigation Project
JPY	Japanese Yen
JV	Joint Venture
L/A	Loan Agreement
LCB	Local Competitive Bidding
LCS	Labor Contracting Society
LGD	Local Government Division
LGED	Local Government Engineering Department
LGI	Local Government Institutions
M&E	Monitoring and Evaluation
MBA	Master of Business Administration
MC	Management Committee
ME&DD	Mechanical Equipment & Dredger Directorate
MDGs	Millennium Development Goals
MDRU	Movable and Deployable ICT Resource Unit
MFI	Microfinance Institutions
MIM	Monitoring and Information Management
MMT	Mobile Maintenance Team
MoDMR	Ministry of Disaster Management and Relief
MoEF	Ministry of Environment and Forest
MoF	Ministry of Finance
MoFDM	Ministry of Food and Disaster Management
MoFOOD	Ministry of Food
MoHA	Ministry of Home Affairs
MoH&FW	Ministry of Health and Family Welfare
MoHPW	Ministry of Housing and Public Works

Abbreviations	Official Name
MoL	Ministry of Land
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MoP	Ministry of Planning
MoWR	Ministry of Water Resources
MRA	Microcredit Regulatory Authority
MRFBERMP	Main River Flood and Bank Erosion Risk Management Program
MRVA	Multi-hazard Risk Vulnerability Assessment
MT	Metric Tonne
NCMCCR	National Crisis Management Center and Control Room
NDMC	National Disaster Management Council
NDMAC	National Disaster Management Advisory Committee
NDRCC	National Disaster Response Coordination Centre
NDRCG	National Disaster Response Coordination Group
NEMAP	National Environment Management Action Plan
NEP	National Environmental Policy
NES	National Environmental Strategy
NETIS	New Technology Information System
NEX	National Execution
NGO	Non-governmental Organizations
NHA	National Housing Authority
NPDM	National Plan for Disaster Management
NPDRR	National Platform for Disaster Risk Reduction
NPV	Net Present Value
NWMP	National Water Management Plan
NWPo	National Water Policy
O&M	Operation and Maintenance
OCG	Oriental Consultants Global Co., Ltd.
ODA	Official Development Assistance
OSS	Office Support Staff
P&D	Planning and Development
PAP	Project Affected People
PARISHAD	Parishad
PC	Pre-stressed Concrete
PCMU	Project Coordinating and Monitoring Unit
PD	Project Director
PDB	Power Development Board
PEC	Project Evaluation Committee
PESAROEAOD	Procurement of Equipment for Search & Rescue Operation for Earthquake & Other Disaster
PG/R	Progress Report
PIC	Project Implementation Committee
PIO	Project Implementation Officer
PIU	Project Implementation Unit
PKSF	Palli Karma-Sahayak Foundation
PO	Partner Organizations
PPR	Public Procurement Rules

Abbreviations	Official Name
PQ	Pre-Qualification
PRS	Poverty Reduction Strategies
PRSP	Poverty Reduction Strategy Paper
PSB	Portable Steel Bridge
PSC	Project Steering Committee
PSTN	Public Switched Telephone Network
PWD	Public Works Datum
RAC	Regional Accounting Center
RAJUK	Rajdhani Unnayan Kartripakka
RAMS	Road Asset Management System
RC	Reinforced Concrete
RDEC	Rural. Development Engineering Center
REB	Rural Electrification Board
RERMP	Rural Employment & Road Maintenance Programme
RHD	Road and Highway Department
RMB	Rénmínbì
RMF	Risk Management Framework
RMRSU	Road Maintenance and Road Safety Unit
RSDMS	Road & Structure Database Management System
SAARC	South Asian Association for Regional Cooperation
SAE	Senior Assistant Engineer:
SAIWRPMP	South-west Area Integrated Water Resource Planning and Management Project
SCC	Sylhet City Corporation
SE	Superintending Engineer
SFYP	Sixth (Seventh) Five Year Plan
SIDA	Swedish International Development Cooperation Agency
SI	Site Inspector
SIMS	Scheme Information Management System
SOD	Standing Orders on Disaster
SOP	Standard Operating Procedure
SPEC	Special Project Evaluation Committee
SPT	Standard Penetration Test
SSWR	Small Scaled Water Resource
STD	Standard Tendering Document
SWC	Storm Warning Centre
TK	Taka
TOR	Terms of Reference
TR	Test Relief
TTC	Travel Time Cost
TU	Training Unit
UBSP	Urban Building Safety Project
UDMC	Union Disaster Management Committee
UHF	Ultra High Frequency
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund

Abbreviations	Official Name
UNO	Upazila Nirbahi Officer
UNV	United Nations Volunteers
URP	Urban Resilience Project
US$ / USD	United States Dollar
UzDMC	Upazira Disaster Management Committee
VGF	Vulnerable Grain Facility
VOC	Vehicle Operating Cost
V-SAT	Very Small Aperture Terminal
WARPO	Water Resources Planning Organization
WB	The World Bank
WFP	World Food Programme
WMA	Water Management Association
WMCA	Water Management Cooperation Association
WMF	Water Management Federation
WMIP	Water Management Improvement Project
WMOs	Water Management Organizations
XEN	Executive Engineer

CHAPTER 1. PROJECT OUTLINE

1.1 Background

The People's Republic of Bangladesh (hereinafter referred to as "Bangladesh") is one of the most vulnerable countries to natural disasters. It is located in the world's largest delta, with 90% of land located in low lying area where the hight above sea level is 10 meters or less. In 1998, about 70 % of the land area was inundated by flood. Cyclone occurs almost every year, with which more than 3 thousands people lost their lives by the Cyclone Sidr in 2007. In the last 30 years from 1985 to 2014, total number of deaths due to natural disaster is more than 170 thousands, cumulative total of affected people is more than 262 million, and the economic loss caused by these disasters is reported to be around 570 million U.S. Dollar each year, according to the international disaster database "EM-DAT" as of December 2015. This hinders the stable economic growth of the country. Also, there has been a growing concern on the risk of earthquake, even after the experience of Nepal Earthquake occurred in April 2015.

The Ministry of Disaster Management and Relief (hereinafter referred to as "MoDMR") is the responsible ministry to comprehensively implement the activities of disaster risk reduction and emergency response under the Disaster Management Act (2012). However, cross-sectoral cooperation setup is not sufficiently established at the implementation level, and disaster management plan and guidelines are not commonly available in the relevant agencies to disaster risk reduction. This circumstance often brings about the situation in which activities and budget investment by individual agency for disaster risk reduction actually do not reduce vulnerability of concerned community. For example, while rehabilitation budget for embankment road is allocated, that for revetment is not, or a community supposed to be protected by a certain infrastructure is kept in danger because the recovery work of damaged infrastructure is not implemented in a timely manner. This is a challenge of disaster management sector in Bangladesh to effectively and efficiently utilize limited budget by coordinating disaster recovery and rehabilitation activities implemented by individual agencies. In terms of disaster communication in Bangladesh, early warning system is greatly improved. However, the communication system during disaster to understand the affected people and damaged area could be improved for more efficient response and quick recovery afterwards. Furthermore, necessity of quick recovery and rehabilitation activities at post-disaster phase needs to be acknowledged and preparation of appropriate procedure and regulations are required.

The Government of Bangladesh (GOB) had developed the Seventh Five-Year Plan for FY2016-2020, in which disaster management is considered as one of the key sectors to address, besides climate change and environmental management. Comprehensive policy formulation and planning in disaster management is in progress, and the policy papers such as the "Disaster Management Act (2012)", the "National Plan for Disaster Management (2010)", the "Bangladesh Climate Change Strategy and Action Plan (2009)", the "Flood Preparedness Plan of Bangladesh (2014)", the "Emergency Preparedness Plan for Cyclone (2013)", and the "Standing Order on Disaster (2010)", have been prepared. GOB recognizes that lack of understanding, lack of knowledge and skills to devise appropriate actions in anticipation of a hazard are the

limitations. SFYP incorporates priority areas agreed in the Sendai Framework[1] and aims at implementing its priorities. In the SFYP, development of the Disaster Risk Reduction (DRR) and requisition of knowledge, understanding and skills for DRR by GOB officials at all levels are proposed as prioritized actions.

Bangladesh aims to be a middle income country by 2021, for which it must overcome vulnerability to natural disaster and make the society disaster-resilient. Based on this background, the Government of Bangladesh (herein after referred to "GOB") requested loan assistance from the Government of Japan (hereinafter referred to as "GOJ") for strengthening disaster risk management in Bangladesh by strengthening implementation of disaster risk reduction, emergency response, and quick and effective recovery and rehabilitation.

The Japan International Cooperation Agency (JICA) has been supporting the GOB's efforts to reduce disaster risk through technical cooperation projects such as the dispatch of "Integrated Water Resource Management Advisor", "The Project for Capacity Development of Management for Sustainable Development of Water Related Infrastructure (The JICA Sustainable Water Related Infrastructure CDP)", the "Research Project on Disaster Prevention/Mitigation Measures against Floods and Storm Surges", the Grant Aid for "The Project for Improvement of Meteorological Radar Systems in Dhaka and Rangpur", and the ODA loan for the "Haor Flood Management and Livelihood Improvement Project". Since disaster management covers disaster risk reduction, emergency response and recovery, the ongoing "Preparatory Survey on Capacity Enhancement on Disaster Risk Reduction, Emergency Response and Recovery" (The Survey) will make use of any or all related information from these projects which have been supported by JICA, further collect necessary information from concerned agencies, and carry out cross sectional study to examine the feasibility of the Project.

1.2 Project Outline, Objective and Study Area for the Survey

The Project Outline, Objectives and Study Area for the Survey are as discussed below.

1.2.1 Project Outline

The Project outline is as summarised in Table 1.2.1 and Table 1.2.2.

[1] The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted at the Third UN World Conference in Sendai, Japan, on March 18, 2015. It is the outcome of stakeholder consultations initiated in March 2012 and inter-governmental negotiations from July 2014 to March 2015, supported by the United Nations Office for Disaster Risk Reduction at the request of the UN General Assembly.(www.preventionweb.net/go/sfdrr)

Table 1.2.1 Project Outline (1/2)

Items	Outline
Project Name	Disaster Risk Management Enhancement Project (The Project)
Project Objective	The objective of the P roject is to enhance comprehensive disaster risk management ofthe Government of Bangladesh by recovering and rehabilitating infrastructures at high riskf for natural disasters, providing equipment for emergency communication and relief, and establishing the scheme for quick and effective recovery and rehabilitation works and its implementation, thereby contributing to build Bangladesh society more disaster-resilient.
Project Outline	Through the Project implementation, MoDMRand Department of Disaster Management (DDM) will strengthen their capability of comprehensive disaster risk management and promote mainstreaming disaster risk reduction in the government. This will be done by MoDMR and DDM participating in the sub-project selection, in corporating the viewpoint of disaster risk reduction (i.e. beneficiaries viewpoint), and by ensuring efficient and effective utilization of the budget in terms of disaster risk reduction. Once the sub-proects are selected, executing agencies will carry out the rehabilitation work. Component 1 Rehabilitation of flood countermeasure facilities, rural roads and bridges, those continue to be in a vulnerable state, and/or deemed to be in a state of high vulnerability and could be damaged by water induced disasters in near future, wi1l be a scope of the Component. Component 2 Procuring information communication equipment and equipment for emergency rescue required for the case of water induced disasters will be a scope of the Component. Component 3 Establishing the Quick and Effective Recovery Scheme for quick and effective disaster recovery and rehabilitation, and utilizing the scheme for public infrastructures such as flood countermeasure facilities, rural roads and bridges will be a scope of the Component. Cosulting Services Detailed Design, Tender Assistance, Construction Supervision, Facilitation of Environmental and Social Consideration, Capacity Development and etc. for Disaster Risk Management Enhancement Project
Survey Area	Areas highly vulnerable to floods, cyclone and storm surge.
Executing Agency	Major Executing Agencies 1) Ministry of Disaster Management and Relief (MoDMR) 2) Department of Disaster Management (DDM) Related Agencies 3) Local Government Engineering Department (LGED) 4) Bangladesh Water Development Board (BWDB) 5) Fire Service and Civil Defence (FSCD)

Table 1.2.2 Project Outline (2/2)

Items	Outline
Relevant main Japanese assistance activities	Loan Fund Cooperation 1) Emergency Disaster Damage Rehabilitation Project(2008, about 7 billion JPY) 2) Haor Flood Management and Livelihood Improvement Project (2014, about 15 billion JPY) 3) Inclusive City Governance Project(2014, about 30 billion JPY) 4) Small Scale Water Resources Development Project(2007, 5 billion JPY) 5) Northern Bangladesh Integrated Development Project(2012, 20 billion JPY) Grant Aid Cooperation 6) Projects for Construction of Cyclone Shelter (1st to 5th, and "The Programme for Construction of Multiporpose Cyclone Shelters in the Area Affected by the Cyclone Sidr") (1993-2008, about 4 billion JPY) 7) Projects for Improvement/Establishment of Meteorological Radar System (5 places, 1986-2007, about4.63 billion JPY) 8) Project for Improvement of Meteorological Radar System in Dhaka and Rangpur (2015, about 2.9 biliion JPY) Technical Cooperation 9) Rural Infrastructure Development & Management Advisor (Sep.2014-Aug.2016) 10) Disaster Management Sector Coordination Advisor(Jul. 2015-Jun.2017) 11) Integrated Water Resources Management Adviser (Sep. 2014 - Sep. 2016) 12) The Project for Capacity Development of Management for Sustainable Water Related Infrastructure (Sep. 2013 – Sep. 2016) 13) Reserch Project on Disaster Prevention/Mitigation Measures against Floods and Storm Surges (Apr. 2014 - Mar. 2019) 14) Project for Capacity Development on Natural Disaster-Resistant Techniques of Construction and Retrofitting for Public Buildings (Mar. 2011 - Dec. 2015) 15) Capacity Development Project for Participatory Water Resources Management through Integrated Rural Development (Oct.2012-Oct.2017)

1.2.2 Objective of the Survey

The objective of the Preparatory Survey is to formulate the Project which may be financed by JICA, through examination of the necessity of the Project, project scope, project implementation arrangement, project cost, and environmental and social considerations.

1.2.3 Scope of the Survey

The survey was implemented based on the agreement executed in April, 2015 between the GOB and JICA. To achieve the above project objectives, the JICA Survey Team carried out the survey in accordance with "Basic Understanding", "Technical Basic Policy", and "Basic Policy on Project Administration". Various reports based on the Survey were prepared, and explanations as well as meetings with GOB on the reports were conducted.

CHAPTER 2. COLLECTION OF FUNDAMENTAL INFORMATION

2.1 Review and Confirmation of Background and Necessity of the Project

2.1.1 Confirmation of Laws/Acts and Plans related to Disaster Risk Reduction

Laws/Acts and Plans related to disaster risk reduction and management, as well as the activities and/or projects/programmes being implemented by other donors, have been reviewed and/or confirmed. Furthermore, data and information relevant to the Survey have been collected and reviewed based on the results of previous studies.

As a result, consistency of the objectives with upper level plans and implementing programmes, meaning or significance, needs or necessity, and relevance of the Project have been evaluated and clarified in terms of contribution to disaster risk reduction and promptness of recovery and rehabilitation implementations.

(1) Superior Plans, Legislations, etc.

The following Table 2.1.1 show the operational status and outline contents of the superior plans and legislations relevant to the Project that were or are being compiled in Bangladesh.

Table 2.1.1 Relevant Superior Plans, Legislation, etc.

Name of Legislation or Plan	Status
Superior Plans:	
Sixth 5-Year Plan (2011-2015)	Under implementation
Seventh 5-Year Plan (2016-2020)	Announcement of Final Version in December 2015
Relevant Plans:	
Delta Plan (2100)	Being compiled as of December 2015
Legislations:	
Disaster Management Act (2012)	Under implementation
Plans:	
National Disaster Policy(2015)	Announcement of Bengali version in September 2015
National Plan for Disaster Management (2010-2015)	Under implementation
National Plan for Disaster Management (2016-2020)	Being compiled as of December 2015
Standing Order on Disasters (2010)	Under implementation
Flood Response Preparedness Plan of Bangladesh (2014)	Under implementation
Emergency Preparedness Plan for Cyclones (2013)	Under implementation

(a) Superior Plan: Sixth Five-Year Plan (SFYP), 2011-2015

The Sixth 5-Year Plan defines the roles and activities of related agencies that build the infrastructure and provide the public services necessary for revitalizing the economy of Bangladesh. Priority fields are: (1) Income and poverty, (2) Human resources development, (3) Water and sanitation, (4) Energy and social infrastructure, (5) Gender equality and empowerment, (6) Environmental sustainability, and (7) Information transmission technology.

a) Water Resources

Goals and strategies for the management and development of water resources are as follows: (1) Management based on public participation, (2) Improvement of water flow capacity based on river dredging, (3) Prevention of river erosion, (4) Land reclamation, (5) Combined use of surface water and groundwater for sustainable irrigation, (6) Multipurpose utilization of river water, (7) Regional and international cooperation aimed at basin-wide management and development of water resources in international rivers, (8) Flood control/flood management, (9) Raising of coastal and flood embankments, (10) Realization of food security through security of year-round sustainable irrigation, (11) Water conservation for irrigation and other purposes, (12) Address and mitigation of climate change, (13) Environmental conservation, (14) Comprehensive coastal management, and (15) Capacity building of water resources-related agencies in areas of climate change, data management, river management, and IT technology, and (16) Survey and research on future water resources management.

b) Disaster Risk Management

Goals and strategies for the mitigation of disaster risks are as follows: (1) Mitigation of disaster risks and realization of a comprehensive approach to climate change in current or future development plans, programs and policies, (2) Improvement of specialist technologies and know-how on disaster risk mitigation and climate change countermeasures, disaster risk management, early warning systems, post-disaster activities, etc., (3) Strengthening of mechanisms for building capacity related to mitigating disaster risks and the impact of climate change on all levels from communities to public agencies, (4) Community-based programs aimed at mitigating disaster risks and climate change, (5) Promotion of effective livelihood improvement activities incorporating disaster risk mitigation and climate change countermeasures, (6) Disaster risk mitigation and climate change capacity building related to procedures for effective countermeasures and management for dealing with flooding, cyclones, river erosion, pest and disease damage, earthquakes, infectious disease epidemics, etc., and building reinforced systems, (7) Formation of legal and public frameworks concerning effective disaster risk mitigation and climate change countermeasures and management, (8) Capacity building of the state's emergency response and management activities with emphasis on community disaster risk management and disaster management support on the level of divisions, districts and unions, (9) Improvement of early warnings and community warning systems, (10) Capacity building for relief and damage survey by related agencies, (11) Introduction of systems for coordinating effective responses and management in emergencies including clerical management and relief between related persons at different levels, and (12) Building of information management systems based on telecommunications.

c) Climate Change

In water management and disaster risk management programs related to climate change, since it is forecast that the entire coastal area will be adversely affected by climate change, the repair and construction of embankments and seawalls in coastal parts that have been damaged by cyclones in recent years were identified as top priority.

(b) Superior Plan: Seventh Five-Year Plan (SFYP), 2016-2020

The Seventh Five-Year Plan (2016-2020) (hereinafter, referred to as SFYP 2016-2020) has been prepared and made available on the website of the Planning Commission. The SFYP 2016-2020 is categorized into 13 sectors and Disaster Management and/or DRR/DRM is mainly positioned as the 13rd sector together with Food Security, Gender Equality and Social Protection, and also described in the 8th Sector focusing on E nvironment and Climate Change (CC).

The outline of the Disaster Risk Management and related activites in the SFYP 2016-2020 is as follows:

a) Proposed Actions to be taken in Sector 8 "Environment and Climate Change"

The present Seventh Plans's articulation of a sustainable development strategies involves a large array of actions under three key themes: (i) Climate Change Management and Resilience (comprised of adaptatipon and mitigation); (ii) Environmental Management; and (iii) Disaster Management. These actions are aligned with the overall framework and strategies of NSDS, and are broadly consistent with the scope of the post-2015 SDGs.

In order to achieve the national vision and given the socio-economic diversification of Bangladesh, Delta Vision has been formulated. Along with providing a long term strategic planning, the Delta Plan also specifies short term (2015-2021) Programme with a portfolio of projects formulated in conjunction with the 7th FYP objectives as follow:

Indication	Sub-Indication	Quantity	Present	Target
Risk susceptible to natural hazard	Average flood extent	% of total area of Bangladesh	30	25
	Extreme flood extent		50	35
	Cycclone damage extent		10	4
	Average drought extent		9	9
	Extreme drought extent		47	25
	Dry season saltwater intrusions	% of total coastal area	40	35
	Water logging extent		2.5	0.5
	Length of bank line erosion	% of total river length	15	11

b) Proposed Actions to be taken in Sector 13 "Social Protection"

In Social Protection (Sector 13) in SFYP (2016-2020), "Disaster Management" is one of key issues, such as Food Security, Social Inclusion and Gender Equality. The outline of goal and target activities of Disaster Management in Sector 13 is summarized as follows:

Goal:

Overall goal is to reduce and mitigate the effects of the underlying risk

Overall targets:

1. Upgrade the disaster management regulative framework.
2. Risk reduction and climate change adaptation principles (with sustainability) are mainstreamed within all development programmes, plans and policies.
3. Create a national training capacity to sustain and progressively expand the training efforts.
4. Strengthen community and household level capacity to withstand the disastrous situation
5. Establishment of DM fund, the National Emergency Operations Centre (NEOC)
6. Strengthen national capacity for response management suppon to local governments
7. ICT based Multi-hazard EWS at community level
8. Establish Go- NGO and private sector coordination for disaster risk reduction
9. Establish multi sectoral coordination system
10. Reduce vulnerability of the communities through effective, targeted social safety nets
11. Establish & strengthen the regional networks
12. Strengthen the use of space based technology
13. Develop a monitoring and evaluation system

5 Prioritized Activities based on Basic DRM Policies of MoDMR:

1. Mainstreaming DRR and CCA:
2. Disaster Risk Reduction Strategies:
3. Disaster Preparedness, Warning and Response:
4. Post-disaster Recovery, Reconstruction and Rehabilitation

Cross-cutting issues:

a. Enable proactive communication to vulnerable communities.
b. Review and reform business processes within relevant ministries and departments.

Monitoring Mechanism and Financing systems:

- Consider developing a policy on DRR financing,
- Allocate sufficient national budget to initiate action whilst welcoming international contributions to deliver sustainable enhancement of disaster resilience.

(c) Relevant Plan: Delta Plan 2100 [Bangladesh Delta Plan of 2100 (BDT 2100)]

As requested by the GOB, the Government of the Netherlands (GON) is conducting a study to formulate both financial and technical assistance plans for the Bangladesh Delta Plan 2100 (BDT 2100). The BDT 2100 Formulation Project was started in April 2014 and will be completed by September 2016.

The Objective of BDT 2100 is to realize a sustainable and commonly agreed-upon vision and optimum strategy for Bangladesh, and a framework for its implementation. BDT 2100 is to contain all sectors related to "Delta" like SFYP 2016-2020 explained in the previous Subsection. In this connection, the ongoing BDT 2100 Formulation Project aims to add status and position of the BDT 2100 into SFYP 2016-2020 as one of the main objectives of the Project.

a) Thematic Areas in BDT 2100

As of May 2015, the BDT 2100 Formulation Project has conducted a number of basic studies in accordance with the twenty (20) thematic areas shown in the following table.

Table 2.1.2 Thematic Areas to be considered in BDT 2100

Thematic Areas		
River Systems Management and Morohological Dynamics	Sustainable Transportation and Infrastructure	Socio-Economic and Demographic Condition
Water Resources	Fisheries and Livelistock	Ecological Setting
Coast and Polder Issues	Disaster Management	Forest and Biodiversity
Public Health	Land Resources Management	Environmental Pollution
Water Supply and Sanitation	Urbanization and Settlement	Population Growth and Management
Climate Change Issues	Agriculture and Food Security	Regional Cooperation
Information and Knowledge Management	Institutional Framework/Arrangement	

b) Timeline for the Formulation of BDT 2100

The timeline for the formulation of BDT 2100 by the BDT 2100 formulation project is as shown in the table below.

Table 2.1.3 Timeline for the Formulation of BDT 2100

Schedule	Target
April 2014 to December 2015	Inception, Baseline studies and Governance and Delta Framework
January 2015 to March 2015	Input to Seventh Five-Year Plan
January 2015 to December 2015	Vision, Scenarios & Strategies, and Implementation Strategies
January 2016 to September 2016	BDP 2100 Documentation
May 2016 to September 2016	BDP 2100 Finalization

c) Hot Spots

The BDT 2100 formulation project focuses on six (6) designated areas called "Hot Spots" as significant areas to collect gaps and challenges related to water issues. (See the Table below.)

Table 2.1.4 Hot Spots of the BDT 2100 Formulation Project

Hot Spots
Coastal Zone, Barind Region, Haor Region, Chittagong Hill Tracts, Rivers and Estuary, and Urban Areas

d) Progress of the Formulation of BDT 2100

The BDT 2100 formulation project has been finalizing "Vision, Scenarios and Strategy of BDT 2100" as of May 2015. The Draft BDT 2100 has not been published yet but ideas of "vision" and "goal selection criteria" have been published and discussed as shown in the following table.

Table 2.1.5 Vision and Goals of BDT 2100 (Draft)

Item	Description
Delta Vision (Tentative)	Achieve long term economic growth and environmental sustainability while effectively coping with climate change, natural disasters and other delta issues through robust, adaptive and integrated strategies, and equitable water governance.
Goal Selection Criteria	Goal 1: Ensure safety against water and climate change related disasters Goal 2: Ensure water security and efficiency of water usages Goal 3: Ensure integrated river system and estuaries management Goal 4: Conserve and preserve wetlands and ecosystems and promote their wise use Goal 5: Develop effective institutions and equitable governance for intra and trans-boundary water resources management Goal 6: Achieve functional and optimal use of land and water

(d) Legislation: Disaster Management Act of 2012

a) Outline

The Disaster Management Act of 2012 which became effective in September 2012 establishes rules on the construction of effective disaster management infrastructures capable of responding to all kinds of disasters, in order to strengthen concerted disaster management activities. This legislation establishes rules for mitigating the overall impact of disasters, utilizing superior skills in order to implement post-disaster rescue and reconstruction programmes, providing emergency humanitarian assistance to disaster-prone areas through reducing the harmful impacts of disasters to acceptable levels based on adoption of disaster risk mitigation programmes, and building effective disaster management infrastructure for enabling concerted activities between related public agencies and private sector organizations to address disasters.

According to the Disaster Management Act, the National Disaster Management Council (NDMC), comprised of the Prime Minister as Chairperson, and the associated ministers, the ministry secretaries and the military (army, navy, air force) representatives as members, has been established as the agency with supreme responsibility for disaster risk management in Bangladesh.

The responsibilities and duties of the NDMC are as follows:

1. To provide policies and project-related strategic guidelines related to disaster management;
2. To provide necessary guidelines pertaining to all concerns regarding implementation of legislations, and policies and plans related to disaster management;
3. To provide strategic guidelines for confirming, modifying, correcting and conducting post-review revision of existing disaster risk mitigation and emergency response programs;
4. To evaluate disaster response programs and provide strategic consulting concerning this point to authorities, related committees and officials;
5. To provide strategic consulting to authorities, related committees and officials concerning the planning of post-disaster responses and relief activities and the methods and processes of such activities;
6. To confirm the implementation status of government projects and programs that are implemented in order to address disasters and reconstruction efforts;
7. To instruct offices and officials to organize seminars, workshops, etc., geared towards raising the awareness of all concerns, activities, orders, programs, laws, rules, policies, etc., related to disasters; and
8. To implement other related measures geared towards attaining the goals of the Disaster Management Act.

Moreover, the National Disaster Response Coordination Group (NDRCG) exists under the NDMC for the purpose of appropriately organizing and effectively implementing programs for addressing major disasters, and the Standard Operating Procedures (SOD) defines the respective responsibilities and division of duties concerning disaster risk management.

The responsibilities and duties of the National Disaster Response Coordination Group are as follows:

1. To evaluate disaster conditions and initiate methods and processes for responding to disasters and conducting prompt rescue;
2. To formulate a definite dispatch arrangement of resources for responding to disasters;
3. To formulate appropriate conveyance systems for warnings and notifications;
4. To coordinate responses and prompt rescue operations;
5. To manage post-disaster rescue and search operations;
6. To coordinate post-disaster relief activities;

7. To provide additional equipment and resources to areas where telecommunications have been severed;
8. To do decision-making and to issue instructions concerning the order of priority of relief supplies, funds and vehicles;
9. To coordinate the dispatch of additional personnel and provide telecommunications equipment to disaster-affected areas (including military dispatches);
10. To execute information management in emergency situations at times of disaster;
11. To execute committee decisions and reporting of disaster conditions to committees;
12. To provide instructions and updates for implementing the disaster management system across multiple agencies;
13. To recommend disaster countermeasures and risk mitigation procedures;
14. To issue orders concerning resources, services, buildings designated as emergency evacuation centres, vehicles and other necessary equipment; and
15. To provide advice to the government on requests for cooperation from the military.

In addition, at the regional level, the City Cooperation Disaster Management Committee/s, District Disaster Management Committee/s, Upazira Disaster Management Committee/s, Union Disaster Management Committee/s, etc., have been established to implement disaster management activities (disaster forecasting, disaster risk management and mitigation, advance preparations against disaster, and emergency response and relief at times of disaster).

b) Establishment of the Disaster Management Fund

In order to achieve the objectives of the Disaster Management Act 2012, the government had established two funds; namely, the National Disaster Management Fund and the District Disaster Management Fund. The National Disaster Management Fund is maintained under the supervision of the Disaster Management and Relief Division (DMRD), and the bank account for it is maintained under the joint signatures of the Secretary of the Ministry of Food and Disaster Management (MoFDM) and the Director of the DMRD.

On the other hand, the District Disaster Management Fund is maintained under the supervision of the District Disaster Management Committee, and its bank account is maintained under the joint signatures of the Deputy Commissioner and the District Relief and Rehabilitation Officer (DRRO). Execution of the National Disaster Management Fund and the District Disaster Management Fund is stipulated based on rules.

Provided that, until the rules are not formulated in this regards, execution of those funds and fund money may be spent according to government financial rules and regulations.

(e) DRR Plan: National Plan for Disaster Management of 2010

The National Plan for Disaster Management of 2010 is a comprehensive disaster management plan that stipulates medium to long-term disaster management (disaster risk mitigation and prevention, emergency response capacity building, improvement of disaster recovery and reconstruction activities) in Bangladesh. Its contents cover the following activities: (1) Analysis of threats of natural and human disasters to population, society, economy and infrastructure and confirmation of where and how frequently such threats are likely to occur; (2) Conduct of detailed analysis into who (what) is more vulnerable to such disasters and what kinds of impacts they will produce; (3) Examination of countermeasures for preventing such disasters (in particular human disasters and environmental destruction) and methods for mitigating impacts or preventing disasters in advance; (4) Clarification of the roles of government, NGOs and private sectors in compiling and implementing disaster risk management and risk mitigation plans; (5) Examination of the allocation of state budget to disaster risk mitigation activities and emergency disaster assistance; (6) Conduct of management and coordination of higher level institutions to ensure that there is no overlapping of activities by aid agencies, governments, international and domestic NGOs and private sectors; and (7) Establishment of an efficient system within government related agencies in order to realize sustainable development, environmental management and disaster risk mitigation.

Even though the unique topographical and natural conditions of Bangladesh is prone to flooding and cyclone damage, the effects of which have impeded social and economic development, the government has not compiled a comprehensive and specific plan of disaster countermeasures. Recently, the importance of disaster risk management was emphasized in the Millennium Development Goals (MDGs) and the Poverty Reduction Strategy Paper (PRSP). On the other hand, in line with the strengthening of disaster risk management initiatives both domestically and internationally in the Hyogo Framework for Action (HFA) 2005-2015, the United Nations Framework Convention on Climate Change (UNFCCC) 1994, the South Asian Association for Regional Cooperation (SAARC) Disaster Management Framework 2006-2015 and so forth, and the NPDM 2010-2015 were compiled in 2010 by the Ministry of Food and Disaster Management (MoFDM).

NPDM 2010-2015, which is particularly consistent with the SAARC Disaster Management Framework 2006-2015, comprises activity plans and strengthening framework geared to the achievement of the following seven strategic goals: (1) Specialization of disaster risk management systems, (2) Mainstreaming of disaster risk mitigation and climate change countermeasures, (3) Strengthening of disaster management-related systems and mechanisms, (4) Capacity building of communities for responding to risks, (5) Expansion of disaster risk forecasting and risk mitigation programmes across all related fields, (6) Strengthening of emergency support systems, and (7) Construction and strengthening of local and international networks.

(f) Standing Orders on Disaster, 2010

Standing Orders on Disaster (SOD) are prescribed for disaster risk management in Bangladesh.

Compiled by the Disaster Management Bureau (DMB) under the Disaster Management & Relief Division (DMRD) in the MOFDM in 1997, the SOD was revised in 2010. Reflecting disaster-related standards and regulations in Bangladesh [the Disaster Management Act, the National Disaster Management Policy, the National Plan for Disaster Management, the Guidelines for Government at all Levels (Best Practice Models, etc.)], the SOD stipulate the detailed roles and responsibilities concerning natural disasters that residents and the representatives of related government agencies, departments, bureaus, agencies, communities, and public institutions, etc., should take concerning disaster risk management (mitigation of disaster risk, emergency response, recovery and reconstruction in the event of disaster).

Guidelines for Government at all levels are developed as best practice models, and are used to assist Ministries, NGOs, disaster management committees and civil society in implementing disaster risk management. Guidelines will include among others:

- Disaster Impact and Risk Assessment Guideline
- Local Disaster Risk Reduction Fund Management Guidelines
- Emergency Fund Management Guidelines
- Indigenous Coping Mechanism Guidebook
- Community Risk Assessment Guidelines
- Damage and Needs Assessment Methodology
- Hazard Specific Risk Assessment Guidelines
- Emergency Response and Information Management Guideline
- Contingency Planning Template
- Sectoral Disaster Risk Reduction Planning Template
- Local Level Planning Template
- National Risk Reduction Fund Management Guideline
- National Disaster Reduction and Emergency Fund Management Guideline

According to the SOD, the National Disaster Management Council (NDMC), comprised of the Prime Minister as Chairperson, the associated ministers, the ministry secretaries and the military (army, navy, airforce) representatives as members, has been established as the agency with supreme responsibility for disaster risk management in Bangladesh. The responsibilities of the NDMC are stipulated as follows: (1) To provide and review policies, plans and guidelines related to disaster risk mitigation and response to emergencies; (2) To provide strategic advices; To coordinate the development plans and programmes of related agencies from the viewpoints of reviewing national disaster management systems and managing disaster risks; (3)To promote changed awareness of policy decision makers concerning disaster risk mitigation; (4) To provide evaluation and strategic advices concerning disaster

risk management measures; (5) To present directions for evaluating emergency response, recovery and reconstruction in the wake of major disasters, and for improving systems and procedures; and (6) To promote management and coordination of complex disasters and multiple fields, with a view to mitigating disaster risk and managing emergency responses.

Under the NDMC, the Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) is the state level agency with responsibility for compiling and implementing policies, plans and guidelines pertaining to the mitigation of disaster risks and management of responses to emergencies. The IMDMCC is comprised of the Minister of MOFDM as Chairperson, the Cabinet Secretary as the Vice Chairperson, and the secretaries of related government ministries as members, and it is responsible for disaster management.

In addition to the above, there are state-level committees, councils and groups such as the National Disaster Management Advisory Committee, the Earthquake Preparedness and Awareness Committee (EPAC), the National Platform for Disaster Risk Reduction (NPDRR), the National Disaster Response Coordination Group (NDRCG), the Cyclone Preparedness Programme (CPP) Policy Committee, CPP Implementation Board (CPPIB) and so on. The respective responsibilities and roles of such agencies are stipulated in the SOD. Moreover, detailed responsibilities and roles of ministries, departments and bureaus including the Ministry of Water Resources and the BWDB are prescribed for disaster risk mitigation and emergency responses (normal times, when warnings are issued, when disasters occur, during reconstruction).

On the other hand, on the regional level, the City Cooperation Disaster Management Committee/s (CCDMC) has been established to implement all activities concerning disaster management in cities (disaster forecasting, risk management, risk mitigation, advance preparations for disasters, emergency response and relief efforts). Moreover, the Disaster Management Committee/s (DMCs) were also established on the level of Districts, Upazila and Unions. The SOD also stipulates the detailed roles, responsibilities and contents of activities concerning disaster management of the CCDMC and DMCs.

(g) Flood Response Preparedness Plan of Bangladesh, 2014

The Flood Response Preparedness Plan of Bangladesh for 2014 was compiled by the MoDMR and its affiliated agency, the DDM. In this plan, flood risk analysis is implemented and vulnerability is evaluated in four stages for each district. Moreover, the Plan analysis damage and proposes the standard operating procedure (SOP) for the following two scenarios:

a) Scenario 1: Case where major flooding similar to that of 1998 occurs in 10 districts in the north of Bangladesh

(Projected disaster-affected population: 2,900,000)

Target districts: Jamapur, Tangail, Bogra, Lalmonirha, Kurigram, Rangpur, Gaibandha, Sirajganj, Syllet, Sunamganj

b) Scenario 2: Case where major flooding similar to that of 1998 occurs in the following 17 districts:

(Projected disaster-affected population: 3,500,000)

Target districts: Faridpur, Jamalpur, Manikganj, Munshiganj, Rajbari, Shariyatpur, Tangail, Chandpur, Laxmipur, Bogra, Lalmonirhat, Kurigram, Rangpur, Gaibandha, Sirajganj, Sylhet, Sunamganj

c) Actions Taken by SOP

Contents of the SOP are categorized according to the amount of time that elapses following the occurrence of flood.

24 hours: (1) Collection of SOS-Forms, (2) Reporting of damage by DDM, District Relief and Rehabilitation Officer (DRRO) and Project Implementation Officer (PIO) to the MoDMR, (3) Convening of emergency meeting by the District Disaster Management Committee (DDMC), (4) Provision of information on losses and damage, (5) Establishment of control rooms on the union and upazira levels, (6) Start of rescue operations, etc.

24~72 hours: (1) Provision of detailed information on losses and damage, (2) Collection of detailed information in D-Forms, (3) Assignment of emergency relief operations, (4) Management of rescue operations, (5) Coordination of related agencies in charge of medical affairs and civilian disaster risk management, etc., (6) Management of early rescue operations, etc.

1~4 weeks: (1) Collection and analysis of D-Forms, (2) Allocation of recovery programs, (3) Follow-up of activities on the regional level, (4) Coordination of relevant government ministries and agencies concerning relief, (5) Dispatch of monitoring teams by the DDM, (6) Coordination of national emergency meetings, (7) Provision of means of transport necessary for conducting emergency responses and monitoring, (8) Reporting of measures to the MoDMR, etc.

2~3 months: (1) Start of reconstruction activities, (2) Coordination of related agencies concerning reconstruction, (3) Coordination of meetings on the regional level, (4) Coordination of NPOs concerning reconstruction, (5) Reporting of reconstruction measures to the MoDMR, etc.

d) Advance Preparations for Flood Disasters

For the readiness to flood disasters, a budget of BDT 200,000,000 and a rice stockpile of 80,000MT were accumulated between June 2014 and May 2015 for use in providing emergency relief and evacuation in the event of flooding. Moreover, humanitarian aid agencies have prepared cash, food, evacuation shelters, supplies, education and medical supplies, etc., worth a total of BDT 37,016,377 for use in the event of emergencies.

(h) Emergency Preparedness Plan for Cyclone, 2013

The Emergency Preparedness Plan for Cyclone, 2013, was compiled by the MoDMR and its affiliated agency, the DDM. The Emergency Preparedness Plan for Cyclone, 2013 analysis damage and proposes a Standard Operating Procedure (SOP) for the following two scenarios:

a) Scenario 1: Case where a Category-2 cyclone hits five districts in the southeast of Bangladesh.

(Projected disaster-affected population: 2,930,000)

Target districts: Chittagong, Coxbazar, Feni, Laxmipur, Noakhali

(Category-2 cyclones have gusts of 125 - 164 km/h, causing significant damage to crops. Damage to buildings is minor).

b) Scenario 2: Case where a Category-4 cyclone hits seven districts in the southwest of Bangladesh.

(Projected disaster-affected population: 2,790,000)

Target districts: Barguna, Bhola, Patuakhali, Pirojpur, Bagerhat, Khulna, Satkhira

(Category-4 cyclones have gusts of 225 - 279 km/h, causing significant roofing loss and structural damage).

c) Actions Taken by SOP

Contents of the SOP are categorized according to the amount of time that elapses following the occurrence of floods.

24 hours: (1) Collection of SOS-Forms, (2) Reporting of damage by DDM, DRRO and PIO to the MoDMR, (3) Convening of emergency meeting by the DDMC, (4) Provision of information on losses and damage, (5) Establishment of control rooms on the union and upazira levels, (6) Start of rescue operations, etc.

24~72 hours: (1) Provision of detailed information on losses and damage, (2) Collection of detailed information in D-Forms, (3) Assignment of emergency relief operations, (4) Management of rescue operations, (5) Coordination of related agencies in charge of medical affairs and civilian disaster risk management, etc., (6) Management of early rescue operations, etc.

1~4 weeks: (1) Collection and analysis of D-Forms, (2) Allocation of recovery programmes, (3) Follow-up of activities on the regional level, (4) Coordination of relevant government ministries and agencies concerning relief, (5) Dispatch of monitoring teams by the DDM, (6) Coordination of national emergency meetings, (7) Provision of means of transport necessary for conducting emergency responses and monitoring, (8) Reporting of measures to the MoDMR, etc.

2~3 months: (1) Start of reconstruction activities, (2) Coordination of related agencies concerning reconstruction, (3) Coordination of meetings on the regional level, (4) Coordination of NPOs concerning reconstruction, (5) Reporting of reconstruction measures to the MoDMR, etc.

d) Advance Preparations against Cyclone Disasters

For the readiness to cyclone disasters, the budget of BDT 130,000,000, a rice stockpile of 80,000MT, 135,000,000 blankets, 85 rescue boats, and 3,751 cyclone shelters mainly in coastal areas were prepared between June 2012 and May 2013 for use in providing emergency relief and evacuation in the event of cyclones. Moreover, humanitarian aid agencies have provided cash of BDT 80,000,000 and 1,287MT of food.

(2) Outline of Assistance by Other Donors

In Bangladesh, the following projects have been or are being implemented by the World Bank, the Asian Development Bank, the Government of the Netherlands, the United Nations Development Programme, etc. Outlines of these projects are as shown in the following table.

Table 2.1.6 Projects being Implemented or Scheduled for Implementation by Other Donors

Implementation Agency	Project Title	Implementation Period
The World Bank (WB)	Water Management Improvement Project (WMIP)	September 2007 ~ June 2015 Project Cost : US$ 123.26 million
	Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)	November 2008 ~ June 2014 Project Cost : US$ 221 million
	Coastal Embankment Improvement Project (CEIP)	2013 ~ 2020 Project Cost : US$ 400 million
Asian Development Bank (ADB)	South-west Area Integrated Water Resource Planning and Management Project (SAIWRPMP)	August 2006 ~2013 Project Cost : US$ 43 million
	Main River Flood and Bank Erosion Risk Management Program (MRFBERMP)	2014 ~ 2023 Project Cost : US$ 405.4 million
Netherlands	Blue Gold Program	2013 ~ 2019 Project Cost : US$ 70.5 million
	Char Development and Settlement Project-IV (CDSP-IV)	2011 ~ 2017 Project Cost : US$ 89.2 million
United Nations Development Programme (UNDP)	Early Recovery Facility (ERF)	2011 ~ 2015 Project Cost : US$ 586 million
	Comprehensive Disaster Management Programme II (CDMP-II)	2010 ~ 2015 Project Cost : US$ 76.16 million
15 countries and International Aid Agencies including WB	Flood Action Plan (FAP)	1990 ~ 1995 Project Cost : 15 billion Yen

(a) Projects by the World Bank

a) Water Management Improvement Project (WMIP)

The WMIP primarily aims to incorporate and strengthen the public participatory approach to the operation and maintenance of water-related facilities constructed by the BWDB. Composed of the four components shown in the following table, it was scheduled to be implemented between September 2007 and June 2015. The main executing agencies are BWDB and WAPRO. The project cost is US$ 123.26 million.

Table 2.1.7 Outline of the WMIP Components

Component	Contents
1. System Improvement and Management Transfer	This aims to introduce and strengthen the public participatory process adopted by the government to operation and maintenance. It includes construction of a database and introduction of GIS and a numerical model.
2. O&M Performance Improvement	This entails introducing techniques aiming for the sustainable operation and maintenance of facilities based on public participation. This is conditional on the target areas not requiring large-scale rehabilitation works and there are already functioning WMOs or equivalent civilian organizations.
3. Institutional Improvement	This aims to conduct organizational strengthening of the BWDB and WARPO, which are the main agencies with control over water resources. This includes capacity building, training, monitoring and evaluation, and introduction of IT devices and equipment.
4. Flood Damage Rehabilitation	This entails implementing of rehabilitation works for infrastructure damaged in the floods of 2007 and by Cyclone Aila in 2009.

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

The ECRRP was implemented in over six years from November 2008 to June 2014 with the objectives of restoring and rebuilding structures and livelihoods destroyed by Cyclone Sidr, and building a setup for long-term disaster countermeasures and a management setup. The main executing agencies are LGED and BWDB. The project cost was US$ 221 million and the target areas were the coastal areas excluding the east of the country. Outlines of the ECRRP components are as shown in the following table.

Table 2.1.8 Outlines of ECRRP Components

Component	Contents
1. Agricultural Sector Recovery and Improvement Program	・Support for the agricultural products subsector ・Support for the fisheries subsector ・Support for the livestock subsector ・Promotion of community support and component management
2. Reconstruction and Improvement of Multipurpose Shelters	・Construction of new shelters ・Improvement of existing shelters ・Improvement of the shelter network ・Consulting services for the above
3. Rehabilitation of Coastal Embankments	・Rehabilitation of coastal embankments ・Consulting services for the above
4. Long-term Disaster Risk Mitigation Program	・Capacity building via multi-hazard modelling and evaluation activities ・Improvement of embankments on Brahmaputra River and in CEIP ・Preparations for construction of new shelters and improvement of existing local roads
5. Monitoring and Assessment of Project Effects	Compilation of the project inputs, outputs and numerical indicators of achievements by the consultants
6. Project Management, Technical Support, Strategic Review, Training, Emergency Support for Future Disasters	・Project Coordination and Monitoring Unit (PCMU) ・Consulting services regarding post-disaster reconstruction financing ・Strategic examination of re-insurance subscription, etc. ・Technical support and training concerning disaster management ・Emergency support in response to disasters that may occur during project implementation

c) Coastal Embankment Improvement Project (CEIP)

CEIP, which aims to strengthen the ability of coastal inhabitants to respond to natural disasters and climate change, has the following objectives: 1) To mitigate damage to life, property, farm products, and livestock due to natural disasters; 2) To reduce the time taken for recovery and reconstruction following cyclones and other natural disasters; and 3) To reduce inflows of saltwater to areas inside embankments due to climate change, to rehabilitate and improve the safety of coastal embankments, and to improve and restore the polder system in coastal areas. The executing agency is BWDB. The project costs of CEIP-1 are as shown in the following table.

Table 2.1.9 CEIP-1 Project Costs

Component	Cost
1. Polder rehabilitation cost	US$291 million
2. Environmental and social consideration costs	US$56 million
3. Execution supervision and monitoring costs	US$32 million
4. Project management and technical cooperation	US$21 million
Total project cost	US$400 million

The CEIP eventually targeted 17 polders selected from the 139 polders under the jurisdiction of the BWDB. Among these, it is planned to commence detailed design in the first year for five high priority polders, while the remaining 12 polders will undergo F/S in 2016 and 2017. As of June 2015, out of the five polders targeted in CEIP-I (Phase-I), detailed design was completed on four polders (Numbers 32, 33, 35/1, and 35/3).

Concerning the CEIP embankment height, upon implementation of the probability scale, separate simulations (10, 25, 50, 100 year probabilities) based on the assumption that global warming will cause the sea level to rise by 50 centimetres, tropical low pressure intensity to rise by 10%, air temperature to rise by 2 degrees and precipitation to rise by 20% by 2050, it was decided to adopt the 25-year probability. The CEIP polder categories are as shown in the table below.

Table 2.1.10 CEIP Polder Categories

Item	Detailed Design Targets	F/S Targets
Polder No.	32, 33, 35/1, 35/3, 39/2C	14/1, 15, 16, 17/1, 17/2, 23, 34/3, 40/2, 41/1, 43/2, 47/2, 48

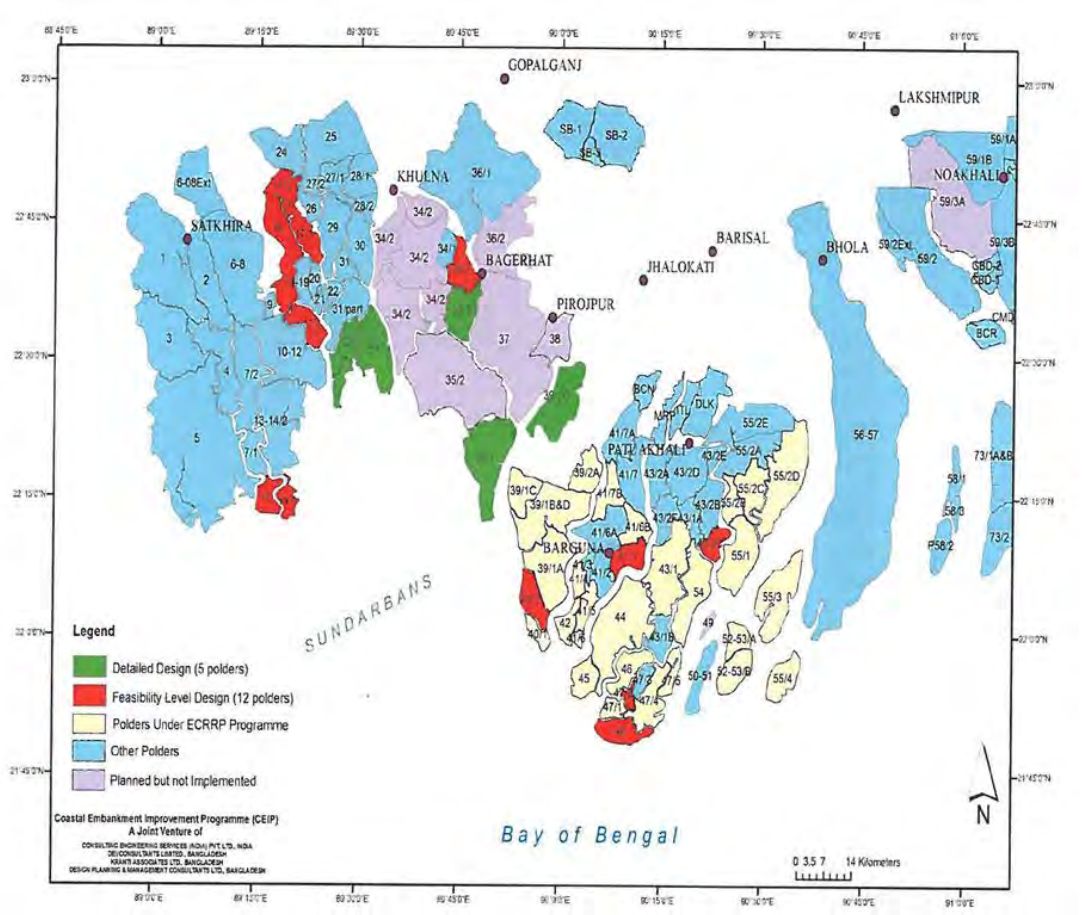


Figure: Selected 17 polders for the Study

Source: Coastal Embankment Improvement Project, Phase-1, Design Report, BWDB

Figure 2.1.1 Current Status of Polders with support from the World Bank (WB)

(b) Projects by the Asian Development Bank

a) South-West Area Integrated Water Resource Planning and Management Project (SAIWRPMP)

SAIWRPMP entailed compiling a comprehensive water management plan based on public participation and constructing a productive and sustainable water resources management system based on the plan. The main targets were the Chenchuri Beel Sub-project and the Narail Sub-project over an area straddling Jessore District and Narail District in the southwest, and the reconstruction of polders that were damaged by Cyclone Aila in Khulna District and Sathkira District. The project executing agency is BWDB. This project was implemented from August 2006 to 2013 at a cost of US$43 million.

SAIWRPMP was composed of the following components:

1. Compilation of a comprehensive water management plan based on public participation;
2. Construction of water management infrastructure;

3. Support for agriculture and fisheries development services and improvement of livelihoods;
4. Support for construction of sustainable maintenance system; and
5. Guidelines, framework and organizational capacity building geared to provision of effective services.

b) Main River Flood and Bank Erosion Risk Management Program (MRFBERMP)

MRFBERMP, which intends to mitigate risks of flooding and riverbank erosion through building a water disaster risk mitigation system based on sustainable structures and non-structural measures, is the successor project to the Jamuna Meghna River Embankment Mitigation Project. The project executing agency is BWDB. The project is scheduled for implementation from 2014 to 2023 at a cost of US$405.4 Million.

MRFBERMP is composed of the following components:

1. Measures to address land loss caused by long-term riverbank erosion. These entail utilizing a cost effective large-size sandbag method that can be adjusted according to the shape of riverbed and was developed in the Jamuna Meghna River Embankment Mitigation Project;
2. Improvement of income for local inhabitants who are dependent on agricultural revenue. This is aimed through combining embankment construction (hard measures) with flood control and water management techniques (soft measures); and
3. Construction of embankments and other structures that can greatly contribute to stable rivers.

(c) Projects by the Netherlands

a) Blue Gold Programme

The Blue Gold Programme, which will be conducted for six years from 2013, is comprised of activities aimed at improving livelihoods in order to effectively implement water management based on public participation. The project executing agency is BWDB.

The project targets ring polders in the three districts of Patuakhali, Khulna and Satkira, with the intent to benefit 150,000 households over an area of 160,000 hectares. The project cost is US$70.5 million.

The programme has the following four objectives:

1. Strengthening of the sustainability of polder development through effective public participation;

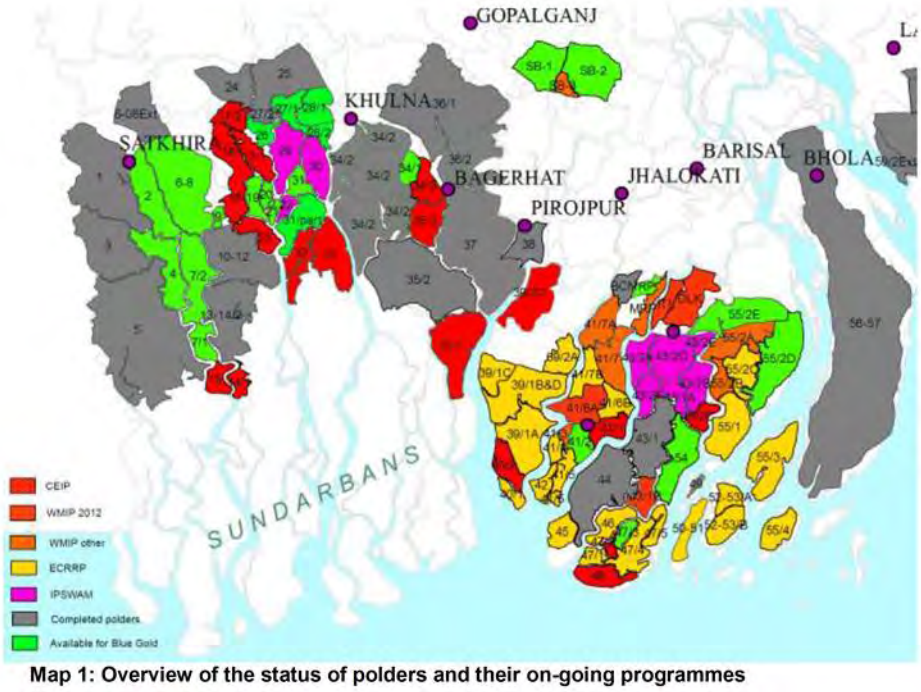
2. Repair of embankments and construction of water distribution systems based on public participation; and
3. Reinforcement of farmers' incomes through improvement of agricultural production capacity (improvement of production systems, harvests, processing, preservation and marketing).

In order to realize these objectives, it is intended to implement three components as shown in the following table.

Table 2.1.11 Implementation Items on the Three Components of the Blue Gold Programme

Item	Description
1. Water resources development based on community participation	Promotion of community participation and organizational strengthening
	Sustainable integrated water resources development
2. Securing of food safety and business deployment	Securing of food safety and agricultural development
	Business development and involvement of the private sector
3. Livelihood improvement and measures to tackle issues that cross multiple fields	Education concerning water and public hygiene
	Issues that cross multiple fields (organizational operation, gender, etc.)

Source: Blue Gold Programme for Integrated Sustainable Economic Development by improving the Water and Productive Sectors in selected Polders Program Document (August, 2012)



Map 1: Overview of the status of polders and their on-going programmes

Source: Blue Gold Programme Report

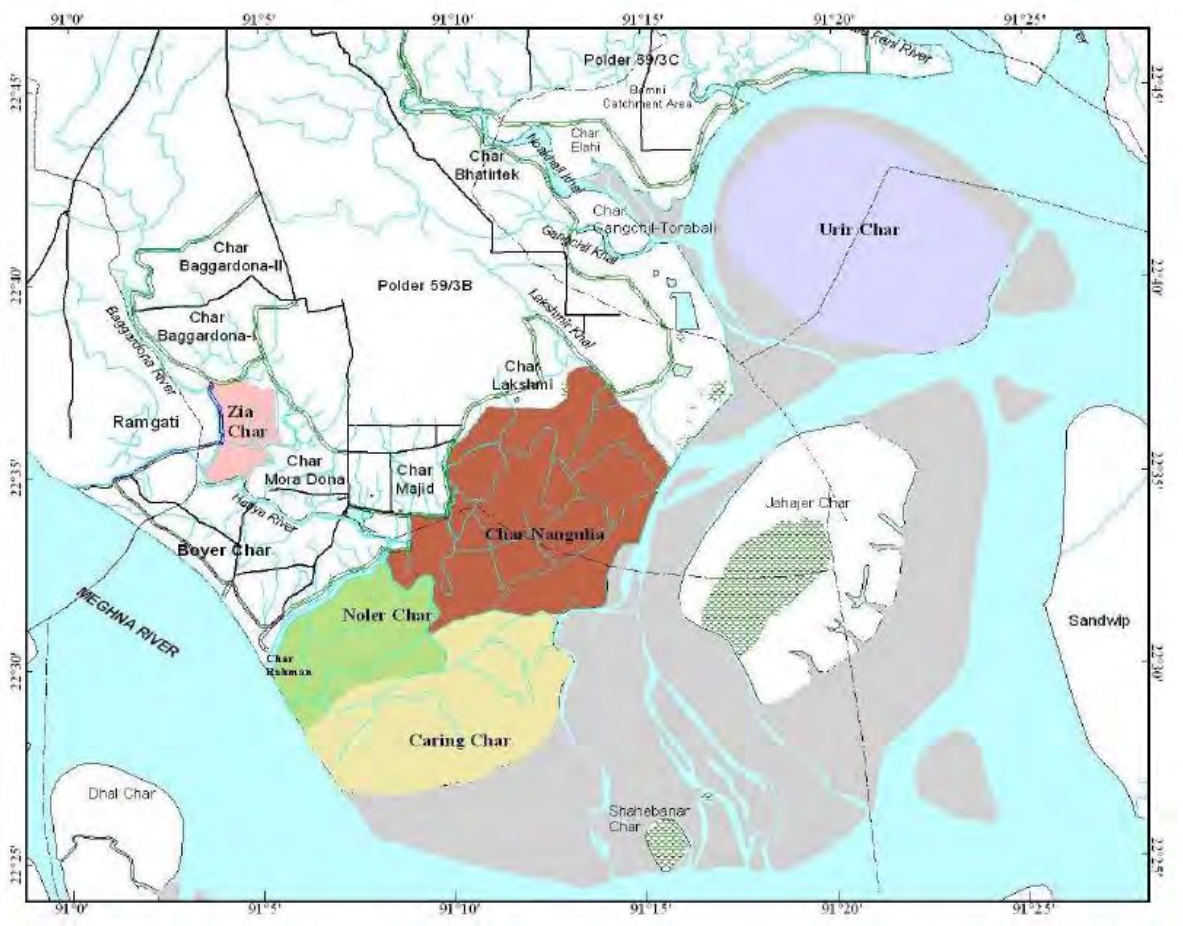
Figure 2.1.2 Location of Target Polders (Green) in the Blue Gold Program

b) Char Development and Settlement Project-IV (CDSP-IV)

The overall objective of the project is to reduce poverty and hunger for poor people living on newly accreted coastal chars, which will be achieved via improved and more secure livelihoods. The purpose is therefore to improve and enhance the security of the livelihoods of the settlers in the project areas. The project executing agency is BWDB. The following six project components are implemented in these areas.

1. Effective management of water resources, protection against tidal and storm surges, improved drainage
2. Climate resilient internal infrastructure for communication, markets, cyclone shelters, provision of potable water and hygienic sanitation
3. Provision to the settlers of a legal title to land
4. Improved livelihoods and household resilience
5. Institutional development in order to create an enabling institutional environment
6. Knowledge management through undertaking and disseminating surveys and studies and by learning from and contributing to Integrated Coastal Zone Management (ICZM) efforts. The purpose of the ICZM is to improve and enhance the security of the livelihoods of the settlers in the coastal areas.

CDSP IV is the fourth phase in a series of projects that have been developing newly accreted land (chars) in Bangladesh (Phase 1 started in 1994). CDSP IV started back in March 2011. The focus of the activities of CDSP IV is on the development of five new chars: Char Nangulia, Noler Char and Caring Char (these three chars are contiguous to each other); Urir Char and Char Ziauddin. The total extent of these chars is around 30,000 ha, with an estimated population of 155,000 in 28,000 households. The project is co-financed by the Government of Bangladesh, the Government of the Netherlands, and the International Fund for Agricultural Development (IFAD). BWDB is the lead agency for CDSP IV and is responsible for the coordination at project level among the implementing agencies as LGED, DPHE, DAE, MOL and FD.



Source：CDSP-IV (http://www.cdsp.org.bd)

Figure 2.1.3 Location of Target Chars in CDSP-IV

(d) Projects by the United Nations Development Programme

The two UNDP projects described below ere implemented almost simultaneously. Whereas the ERF focused on improving emergency response to natural disasters and disaster prevention, CDMP entailed mitigation of disaster risks and infrastructure development. In both projects, joint training for disaster risk management was implemented.

a) Early Recovery Facility (ERF)

The ERF was implemented between 2011 and 2015 and was completed in December 2015 with the Government of Bangladesh, UNDP, and other NGOs acting as implementing partners. With a budget of US$586 million, it entailed making improvements to livelihood and implementing a shelter program based on the long-term point of view. The main execeuting agencies were the MoDMR and DDM.

The primary objective of the ERF is to strengthen autonomous and sustainable disaster risk management capacity on the nationwide level geared to reconstruction.

The ERF comprises activities in the following five priority areas:

1. Provision of policy and programme support geared to reconstruction on the regional and national levels;
2. Promotion of implementation of post-disaster projects that are fair, transparent and have social unity;
3. Flexibility of state activities when responding to emergencies through linking state and regional authority in the planning, implementation and evaluation of reconstruction activities;
4. Reinforcement of support through developing policies and plans for safe reconstruction, identifying the physical supplies that are needed for reconstruction, coordinating with various related agencies, preparing early reconstruction plans, and providing human resources; and
5. Support to research agencies investigating climate changes that hinder sustainable disaster responses, early reconstruction efforts and disaster patterns.

b) Comprehensive Disaster Management Programme II (CDMP-II)

The CDMP was consist CDMP-I and CDMP-II, CDMP-I was implemented between 2004~2009. The main activities of CDMP-I were: implementation of disaster management training; earthquake risk assessment in three cities; establishment of a climate change database; and construction of the legal framework starting with the Disaster Management Act concerning disaster management in Bangladesh.

Donors were the the UNDP, United Kingdom Department for International Development (DFID), European Union (EU), Norwegian Agency for Development Cooperation (NADC), Swedish International Development Cooperation Agency (SIDA), Australian Agency for International Development (AusAID). CDMP-II was implemented between 2010 and December 2015, and the executing agencies in Bangladesh were MoDMR and DDM. The project cost is US$ 76.16 million. The CDMP-II aims to reduce the vulnerability for natural disaster and human disaster includes the influence of climate change through technical support about risk reduction and comprehensive disaster management.

The program has the following five objectives:

1. Strong, well-managed and professional institutions capable of implementing a comprehensive range of risk reduction interventions;
2. Reduced risks to rural and urban populations through raising awareness and empowering communities;
3. Improved overall effectiveness and timeliness of disaster preparedness;

4. Improved and broadened measures to ensure government ministries' budget include disaster provisions;
5. Implemented community-level interventions to be best prepared from disaster risks from a changing climate.

The CDMP comprised activities in the following

1. The disaster and climate change vulnerability of over 3 million people under 40 most disaster vulnerable districts have been reduced by risk reduction schemes. These are selected from local Risk Reduction Action Plan (RRAP). These schemes are funded through Local Disaster Risk Reduction Fund modalities of CDMP and mostly implemented by Union/Upazila Disaster Management Committees.
2. CDMP financed ground breaking work to map the seismic vulnerability of nine of Bangladesh's biggest cities using the latest remote sensing and statistical analyses techniques.
3. CDMP in partnership with Bangladesh Teleltalk Ltd. (state-owned mobile phone company), Bangladesh Meteorological Department (BMD) and Flood Forecasting and Warning Centre (FFWC) introduced Interactive Voice Response based early warning system. CDMP in partnership with FFWC has extended flood forecast lead time from 3 to 5 days, potentially saving the lives, livelihoods and assets of 88 million people living in four river basin areas.
4. 17 universities comprises of both public and private and 11 training institutes including Bangladesh Public Administration Training Centre (BPATC) introduced certificate, diploma, honors and masters course in disaster management with support from CDMP. Establishment and operation support of Disaster Mangement Information Center (DMIC).
5. CDMP has financed pieces of research, operational guidelines, training manuals and related knowledge products.
6. CDMP supported Bangladesh Fire Service and Civil Defence in training and development urban community volunteers. These volunteers have successfully took part in search and rescue operation of fire, landslide and building collapse incidents. CDMP also supported Cyclone Preparedness Programme (CPP) to expand their operation in South-West coast of Bangladesh through training and development of volunteers.

Table 2.1.12 Contents of Each Donor Expense

Donor	US$ million
United Kingdom Department for International Development	$ 20
European Union	$ 17
Norwegian Agency for Development Cooperation	$ 16.88

Australian Agency for International Development	$ 8.32
Swedish International Development Cooperation Agency	$ 7.00
UNDP	$ 6.00
Government of Bangladesh	$ 0.96
Total	$76.16

(e) Other Projects

a) Flood Action Plan (FAP)

The FAP, a comprehensive program of flood countermeasures targeting a total of 26 components comprising 11 Main Components (countermeasure works plans) and 15 Supporting Studies, was implemented between 1990~1995 at a cost of approximately 15 billion yen by 15 countries and international aid agencies.

The Main Components comprised five basic studies (Regional Studies) aimed at flood prevention and water resources management planning in respective districts, and studies related to embankments and revetments on major rivers, flood prevention in major cities, cyclone protection based on coastal levees, flood warning systems, assistance for restoration activities, etc.

Concerning the Supporting Studies, the following activities were implemented: operation and land expropriation for existing flood control, irrigation and drainage works, investigation of impacts on environment and fisheries, investigation of local flood responses and strengthening of flood resistance, quantity surveying of major rivers, preparation of topographical maps and geographical information systems, mathematical modeling of flooding, development of model concepts for flood management, investigation of required institutional conditions, a pilot project on compartmentalization (fine zoning of drainage districts), management of variable flood plains, pilot project on river course stabilization and so on.

Targeting a wide range of activities from large-scale embankment construction planning to surveys of public awareness regarding floods, the FAP marked a shift away from flood protection towards Living with Floods. Nevertheless, the FAP was criticized by international NGOs for relying too much on structural measures for flood protection and so on.

Building on the achievements of the FAP, the Government of Bangladesh compiled national plans such as the National Water Policy (NWP) and National Water Management Plan (NWMP), and these have marked an ongoing transition of flood countermeasures in Bangladesh towards "Living with Floods."

Table 2.1.13 FAP Components

FAP No.	Program	Donor
1	Strengthening of the Brahmaputra Right Bank Embankment (BRE)	*WB*
2	Planning Study for Flood Protection and Drainage in the Northwest Area	*England, Japan*

3	Planning Study for Flood Protection and Drainage in the North-Central Area	*EU, French*
4	Water Management Project in the Southwest Area	*ADB,UNDP*
5	Planning Study for Flood Protection and Drainage in the Southeast Area	*WB,UNDP*
6	Planning Study for Flood Protection and Drainage in the Northeast Area	*Canada*
7	Planning Study for Cyclone Protection	*EU,IDA*
8A	Flood Protection Plan for Greater Dhaka	*ADB, Finland*
8B	Dhaka City Comprehensive Flood Protection Plan	ADB, Finland
9A	Protection Plan for 5 Regional Cities	*ADB*
9B	Strengthening of Meghna River Left Bank Embankments	*ADB, Finland*
10	Flood Prediction and Early Warning	*UNDP, Japan, Denmark*
11	United Nations Development Program for Establishment of a Disaster Risk Management System	*UNDP*
12	Agricultural Assessment of Flood Protection, Drainage and Irrigation Plans	*England, Japan*
13	Study of operation and management conditions	*England, Japan*
14	Study of flood response conditions by inhabitants in areas inundated by flooding	*USA*
15	Land acquisition and relocation study	*Sweden*
16	Environmental study	*USA, Netherlands*
17	Fisheries study and pilot project	*England*
18	Topographical maps	*French, Germany, Finland, Switzerland*
19	Geographical information system	*USA*
20	Compartmentalization pilot project	*Germany, Netherlands*
21/22	Embankment protection and river course shaping pilot project	*Germany, France*
23	Living with Floods (strengthening of flood resistance)	*USA*
24	River surveying	*EU*
25	Flood analysis model verification and operation	*England, France, Denmark*
26	Flood policy and organization building	*UNDP, France*

Reference Literature: Flood Action Plan

Reference Literature: Asian Development Bank Institute, Development Aid and Bangladesh, Haruo Uchida

(3) Relevance of this Project

Bangladesh is one of the most vulnerable countries to the natural disaster, located in the largest delta area in the world, with 90% of the land is located in the low lying area where the height above sea level is 10 meters or less. In 1998, about 70 % of the land area is inundated by flood. Cyclone occurs almost every year, with which more than 3 thousands people lost their lives by the cyclone Sidr in 2007. The last half of the 20th century, total number of deaths due to natural disaster is more than 700 thousands, and the cumulative total of affected people in the last 10 years is more than 75 million. The economic loss caused by these disasters is huge, reported to be somewhere between 50 and 60 billion yen each year, and this hinders the stable economic growth of the country.

In the Sixth Five-Year Plan, the primary objectives are economic growth and mitigation of poverty; however, in order to realize a stable economic growth, it is necessary to mitigate damage, reduce poverty and achieve rapid post-disaster recovery and reconstruction based on the construction of an

effective disaster risk management setup. Accordingly, it is necessary to build a comprehensive disaster risk management setup for responding to disasters.

In terms of goals and strategies concerning disaster mitigation, the Sixth 5-year Plan identifies disaster risk mitigation, climate change countermeasures, and disaster risk management measures, and it especially makes the repair and construction of embankments and tide embankments in coastal areas that have been damaged by cyclones in recent years the top priority, however, budget shortages have made it difficult to implement prompt disaster recovery. In the districts where prompt disaster recovery has not been implemented, scouring and erosion caused by natural disasters such as repeated flooding and storm surge from cyclones have grown and led to the loss of land and colony.

In the Seventh Five-Year Plan, the priority activities concerning disaster risk management are the strengthening of disaster preparedness, warnings and response capability, and strengthening of post-disaster recovery and reconstruction.

Furthermore, in the National Plan for Disaster Management, 2010, the project geared to medium and long-term disaster management (disaster risk mitigation and prevention, strengthening of emergency response capacity, improvement of disaster recovery and reconstruction activities) was implemented.

On the other hand, other donors primarily comprised of the World Bank, Asian Development Bank and the Government of the Netherlands have implemented assistance aimed at mitigating disaster risks through constructing infrastructures (riverbank erosion countermeasures and rehabilitation of embankments in coastal areas, etc.), conducting water management and maintenance programs based on public participation, strengthening organizational capacity and so on; however, support concerning disaster management in Bangladesh has so far been limited to two projects (ERF and CDMP) implemented by the UNDP that were completed in December 2015. Accordingly, since financial and system building assistance for disaster management activities are currently stagnant, there is concern that future disaster management activities will be impeded.

They have not so far offered support for building of the comprehensive disaster risk management setup in Bangladesh.

In view of these points, this project, which aims to mitigate disaster risks based on preparedness for disasters (construction of embankments, provision of equipment and materials, establishment of a disaster relief and recovery fund, etc.), strengthening of emergency response capacity, building of a mechanism for improving disaster recovery and reconstruction activities, and construction of a comprehensive disaster risk management setup for strengthening disaster responses and recovery, is consistent with higher level plans in Bangladesh. Moreover, because the project has high relevance and contributes to the stable economic development of Bangladesh, it is deemed to be highly necessary.

2.1.2 Capacity of Organizations related to DRR Operations

The roles and responsibilities of agencies/organizations related to DRR are to be confirmed. In particular, capacities of MoDMR/DDM to coordinate whole DRR activities in Bangladesh, BWDB and LGED for infrastructure development as well as FSCD as first responder agency for disaster operation are to be confirmed since these agencies are candidate agencies for the implementation of the Project.

(1) Ministry of Disaster Management and Relief (MoDMR)

(a) Outline of Roles and Responsibilities, and Organizational Structure

In accordance with the dynamic revision of the Disaster Management Act of Bangladesh of 2012, the Ministry of Food and Disaster Management (MoFDM) was divided into two (2) ministries; namely, the Ministry of Food (MoFOOD) and the Ministry of Disaster Management Relief (MoDMR). Most of the roles and responsibilities related to disaster management activities of the MoDMR were taken from MoFDM. In addition, the former Disaster Management Bureau (DMB) under MoFDM was reorganized as the Department of Disaster Management (DDM) under MoDMR in September 2012. Therefore, MoDMR and DDM are the leading agencies for national disaster management activities in Bangladesh.

Aside from the DDM, the MoDMR has another subsidiary organization managed and supported by Bangladesh Red Crescent Societies; namely, the Cyclone Preparedness Programme (CPP) established in 1980 after a huge cyclone with more than 300 thousand people dead.

The mission and functions of the MoDMR are as follows.

a) Mission

The mission is to mitigate the risks to the people, especially, the poor and vulnerable during disasters by strengthening the overall capacity for disaster management and to establish an efficient and capable emergency disaster response system to face large scale disasters.

b) Major Function

The major functions of the MoDMR are as follows:

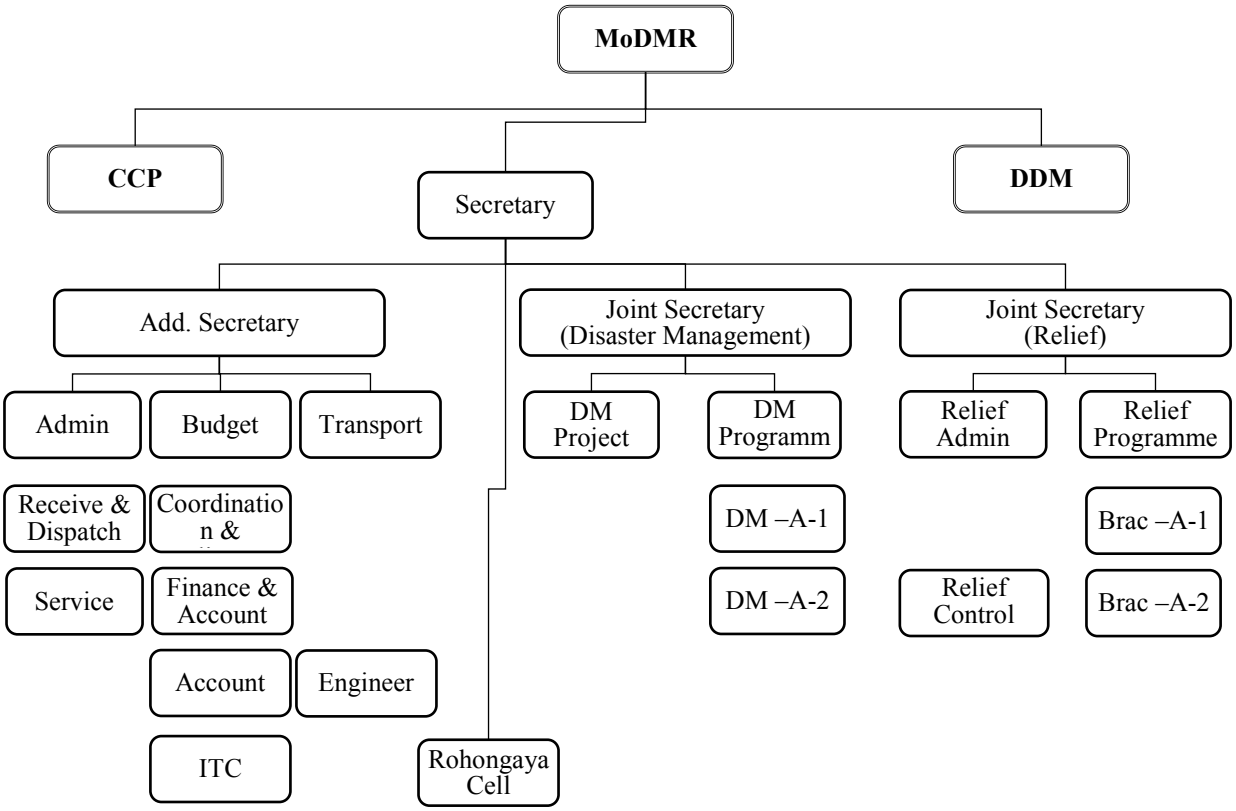
1. To formulate and implement laws, policies and action plans for disaster risk reduction, emergency response and disaster management;
2. To prepare policies and plans for providing urgent humanitarian assistance and rehabilitation programmes and to prepare and preserve the database of all social safety net programmes implemented by the ministry;

To prepare disaster risk reduction plans, taking up activities for training and research, as well as the coordination, monitoring and evaluation among local, regional and international development partners;

3. To implement humanitarian assistance so as to ensure food security through the implementation of Food for Work (Rural Infrastructure Development); Rural Infrastructure Maintenance (Test Relief), VGF, GR, and other programmes;
4. To ensure employment for the ultra-poor during lean periods of the year to reduce risks;
5. To coordinate the use and distribution of emergency food aid and other humanitarian assistance received from other countries; and
6. To implement programmes related to refugee affairs and to coordinate with the relevant national and international agencies.

c) Organization Chart

As of May 2015, the organization of the MoDMR is led by a Secretary and Additional/Joint Secretaries as well as the Minister and composed of about 10 sections headed by the Deputy and Additional Secretaries as shown in Figure 2.1.4. The total number of officers and staff members of the MoDMR is 173.



Original Source: MoDMR (Arranged by the JICA Survey Team)

Figure 2.1.4 Organizational Chart of MoDMR

Table 2.1.14 Staff/Personnel Assignment for MoDMR

Sl. No.	Designation	Quantity
1st Class		39
1	Secretary	1
2	Additional Secretary	1
3	Joint Secretary	2
4	Deputy Secretary	6
5	Deputy Chief	1
6	Senior Assistant Secretary	11
7	Senior Assistant Chief	3
8	Others	14
2nd Class		36
3rd Class		68
4th Class		30
Grand Total		173

Source: MoDMR

(b) Budget

Budget and expenditures of the MoDMR in recent years are as summarized in Table 2.1.15.

Table 2.1.15 Budget and Expenditures of MoDMR

Unit: Thousand BDT

Category	Item	Actual	Assumed	Budget	Projection	
		2013-14	2014-15	2015-16	2016-17	2017-18
Summary	Non-Development	41,163,377	49,073,848	51,098,514	55,478,555	60,470,638
	Development	10,776,435	19,503,445	23,306,518	27,200,345	30,476,162
	Total	51,939,812	68,577,293	74,405,032	82,678,900	90,946,800
Agency-wise	Secretariat	N/I	31,371,384	33,328,077	42,488,736	45,41,148
	R&R Programmes	N/I	30,420,190	33,727,664	37,146,045	40,994,890
	I-Organizations	N/I	492	550	600	700
	DDM	N/I	6,207,069	6,696,690	2,354,723	5,673,991
	District	N/I	150,877	159,777	169,491	178,592
	Upazila	N/I	378,616	431,233	458,319	486,232
	CPP	N/I	48,665	61,041	60,986	71,347
	Total	N/I	68,577,293	74,405,032	82,678,900	90,946,800
Individ-uals	CDMP-II	1,096,125	1,518,200	913,900	0	0
	Relief Operation-1 (GRs)	15,278,881	15,985,003	18,386,062	20,821,245	23,106,990
	Relief Operation-2	37,627	1,000,000	1,000,000	1,000,000	1,000,000
	EGPP	13,839,357	15,000,000	15,000,000	16,000,000	17,000,000
	Cyclone Shelter	19	55	7	45	66
	Flood Shelter	0	30	143.35	-	-
	Bridge & Culvert	14	13	13	14	15
	FFW-I	13,867	103,648	115,000	126,000	137,000
	FFW-II	5,548,355	10,112,705	13,102,818	15,160,980	16,943,260

Source: MoDMR and Ministry of Finance (49_Ministry of Disaster Management & Relief English(1).pdf) (Arranged by the JICA Survey Team)

N/I : Not informed

It is noted in the budgeting system of the MoDMR is that most of the disaster relief activities for disaster affected people are included in the non-development budget as "Grants-in-Aid". In addition,

the activities of Social Safety Net programmes are included in the non-development budget as "Grants-in-Aid" except the following:

- Additional Costs for Food for Work (Food for Work –II (FFW-II)); and
- Activities not approved by the Ministry of Finance as regular budget.

In addition, the budget for CDMP-II being supported by the UNDP is also under the "Development Budget".

"Relief Operation-2" mentioned in Table 2.1.15 above is "Budget for Contingency" to be utilized in emergency cases, such as disaster operations and relief activities not covered by the regular budget. This budget has been secured at BDT 100 Crore (BDT 1 Billion) every year.

The actual performances of Safety Net activities conducted by the MoDMR/DDM are as summarized in Table 2.1.16.

Table 2.1.16 Actual Performances of Safety Net Activities by MoDMR/DDM

Item	Achievement
Term	2011-12 to 2013-14 (3 years in the past)
Total Project Number	117,767 Projects
FFW Programme	986 thousand MT for Food Grains or 6,044 thousand poor people
TR Programme	593,609 schemes with 1,130 thousand MT of food grains or 9,271 thousand poor people
VGF Programme	760 thousand MT of food grains or 99,300 thousand ultra-poor people
GR Programme	112 thousand MT of rice and BDT 17.64 Crore of cash with additional BDT 7.02 Crore for house building grants for affected destitute people as well as 1 lakh bundles of CI sheets and 9 lakh pieces of blankets
Bridge & Culverts Pprogramme (under 12m long)	BDT 729.22 Crore for 3,546 bridges (for 3.5 Crore people)
Flood Shelter	156 in 154 upazillas of 43 districts
Cyclone Shelter	100 multi-purpose cyclone shelters
EGPP Programme	for people in poverty stricken areas
Cyclone-resistant homes	3,913 in Aila affected area

Source: MoDMR and Ministry of Finance (49_Ministry of Disaster & Relief_English(1).pdf)

(c) Gaps and Challenges on Organization of the MoDMR

Gaps and challenges on the organization of MoDMR were reviewed in the Survey through KIIs and the actual data mentioned above. As a result, the following two (2) bottlenecks/gaps with challenges shown in Table 2.1.17 below are detected.

Table 2.1.17 Two Bottlenecks of Disaster Management in Bangladesh

Bottleneck of DRR	Specific Gaps/Challenges
Short Rotation of position shift for the officialdom systems in Bangladesh	● This system is one of the bottlenecks to develop and enhance the capacity of a ministry since improvement activities that take a long term and step-by-step may not be sustained.
Insufficient Coordination	● Residents and Media have not attached importance to

Bottleneck of DRR	Specific Gaps/Challenges
Works of DRR activities between ministries	inter-agency coordination works by the MoDMR. ● The implementation of inter-ministry coordination work for DRR has not started yet since MoDMR/DDM has never had experience on this matter.

The two (2) bottle-necks/gaps with challenges on the MoDMR are described below in detail.

a) Short Rotation of Position Shift for the Officialdom Systems in Bangladesh

As one of the official systems in Bangladesh, all public officials have to change duties/designations in every 3-4 years including transfer from ministry to other ministry, from ministry to deputy commissioner of district or head of upazila, or vice-versa. This system has an advantage in that every government official could acquire a stronger personality as secretary of the national government. On the other hand, this system is one of the bottlenecks to develop and enhance the capacity of a ministry since improvement activities that take a long term and step-by-step may not be sustained or maintained due to the changes of instructions by different officials.

This situation may be a fatal factor for the MoDMR as well as DDM of which mandates has been shifted to pro-active disaster risk reduction including increasing investment and capacity development activities for pre-disaster phase and under the condition of paradigm shift of DRR worldwide.

b) Insufficient Coordination Works of DRR Activities between Ministries

It is required that the MoDMR should enhance knowledge, understanding and requisite skills for DRR developed by officials and staff members at all levels, and conduct development and implementation with focus on financial performance, monitoring and evaluation, technical assistance for DRR mainstreaming in Bangladesh. However, the MoDMR and DDM have never conducted activities for DRR mainstreaming involving other sectors in a pro-active manner due not to insufficient human capacity but insufficient experience.

(2) Department of Disaster Management (DDM)

(a) Outline of Roles and Responsibilities, and Organizational Structure

The Department of Disaster Management (DDM) under the Ministry of Disaster Management and Relief was set up in November 2012 following the enactment of the Disaster Management Act of 2012. The Department has the mandate to implement the objectives of the Disaster Management Act by reducing the overall vulnerability from different impacts of disaster by undertaking risk reduction activities; conducting humanitarian assistance programs efficiently to enhance the capacity of poor and disadvantaged as well as strengthening and coordinating programmes undertaken by various government and non-government organizations related to disaster risk reduction and emergency response. DDM is responsible for the execution of directives, and recommendations by the

Government in connection with disaster management, as well as the national disaster management principles and planning.

The vision and mission of DDM are as follows:

a) Vision

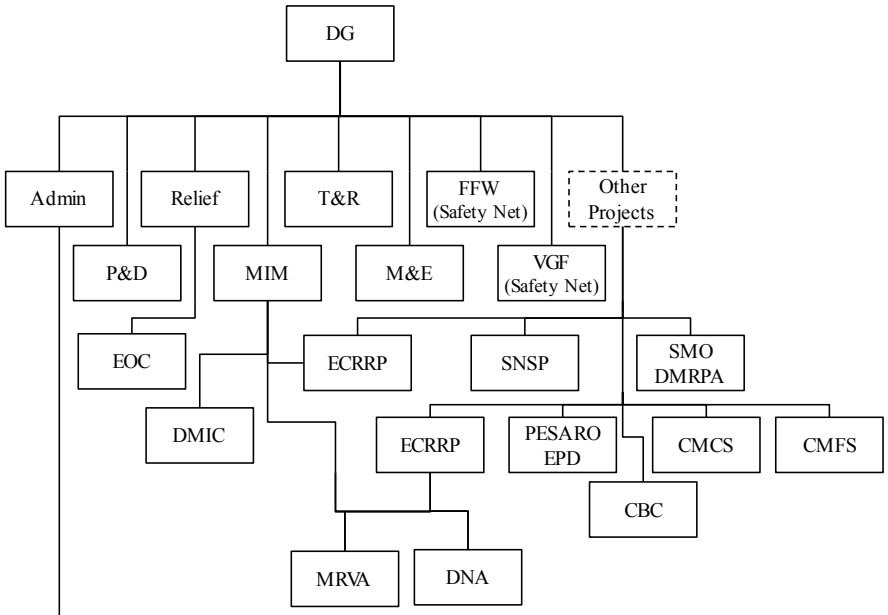
The Department of Disaster Management (DDM) would be a vibrant department of excellence for Disaster Risk Reduction (DRR) mainstreaming into Disaster Management Programme; vulnerability reduction of people, especially the poor and disadvantaged, from the different impacts of disaster, knowledge, research and capacity building on the whole cycle of disaster management in the light of the Disaster Management Act of 2012.

b) Mission

The Department of Disaster Management (DDM) will act under the Ministry of Disaster Management and Relief in implementing the objectives of the Disaster Management Act of 2012 by undertaking risk reduction activities;.responding to disaster events efficiently, as well as strengthening and coordinating programs undertaken by different stakeholders related to DRR and DRM.

c) Organizational Chart

As of May 2015, the organization of the DDM is headed by a Director General holding the rank of Additional Secretary to the Government of Bangladesh and functioning as its Chief Executive Officer. The organogram of DDM has a total of 2710 employees, 254 of which are at the head office. The DDM organizational chart is as shown in Figure 2.1.5.

Level	Organizational Chart	No. of Staff
H.Q. Top		DG: 1
Wing		Dir: 8 Dep.Dir:19 (77 Officers in Total)
Project Cell		Other Staff: 177 **254 in Total**
District		DRRO: 1 in 64 Districts with 5~6 Staff
Upazila		PIO: 1 in 488 Upazilas with 3~4 Staff
Total Number of Staff in DDM (as of June 2015)		**2,710**

Legend:

DG	:	Director General	EOC	:	Emergency Operation Center
Admin	:	Administration	ECRRP	:	Emergency Cyclone Recovery and Restoration Project
P&D	:	Planning and Development			
FFW	:	Food for Work	VGF	:	Vulnerable Group Feeding
MIM	:	Monitoring and Information Management	MRVA	:	Multi-hazard Risk Vulnerability Assessment
T&R	:	Training and Research	DNA	:	Damage Needs Assessment
M&E	:	Monitoring and Evaluation	PESAROEAOD	:	Procurement of Equipment for Search & Rescue Operation for Earthquake & Other Disaster
DMIC	:	Disaster Management Information Centre			
CBC	:	Construction of Bridges & Culverts	CMCS	:	Construction of Multipurpose Cyclone Shelters
CMFS	:	Construction of Multipurpose Flood Shelters			

Original Source: DDM (arranged and illustrated by JICA Survey Team)

Figure 2.1.5 Organizational Chart of DDM

(b) Budget

Budget and expenditures of the DDM in recent years are as summarized in Table 2.1.18.

Table 2.1.18 Budget and Expenditures of DDM

Unit: Thousand BDT

Organization	Budget	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14	FY 2014/15
DDM	Revenue	87,133	88,680	113,022	120,433	127,659
	Expenditure	85,245	85,789	106,062	107,684	-
District Offices	Revenue	107,749	121,329	123,306	144,225	150,877
	Expenditure	102,469	115,909	117,846	137,514	
Upazilla Offices	Revenue	233,367	259,388	264,989	313,912	378,616
	Expenditure	219,250	258,658	260,308	302,129	-

Source: DDM

(c) System of Disaster Information Transmission and Action for Disaster

The information transmission flow based on information on SWC and FFWC was given status as Preparedness activity before the disaster occurs. There are two early warning and disaster information communication systems in Bangladesh: the system implemented by DDM, and the CPP system implemented by the Bangladesh Red Crescent Society. In addition, numerous media outlets exist for warning and disaster information to the regions such as TV, radio, etc, which also receive cyclone warnings from the SWC (Storm Warning Centre) and water level warnings from the FFWCs (Flood Forecasting and Warning Centres).

The BMD (Bangladesh Meteorological Department) is tasked with weather observation and weather forecasting in Bangladesh. It conducts weather forecasting based on observations such as weather ballon observation and weather satellite observation.

The DDM headquarters mainly receives information on heavy rainfall and approaching tropical depression and cyclones from the SWC by facsimile. However, since the DDM side does not have a system for receiving information on holidays and at night time, the SWC telephones the DDM DG at such times.

The FFWC, which was established as a department of the BWDB, mainly collects hydrological data including water level data, etc. from a nationwide network of water observation and flood forecasts and warnings. It uses facsimile and email to send observation data, forecasts and warnings to the media and related agencies.

According to the hearing survey with DDM, it does not have direct communication with the FFWC except in emergency situations, but checks information on hazardous water levels on the FFWC website (http://www.ffwc.gov.bd/).

The following page shows a conceptual diagram of the early warning and disaster information communication system.

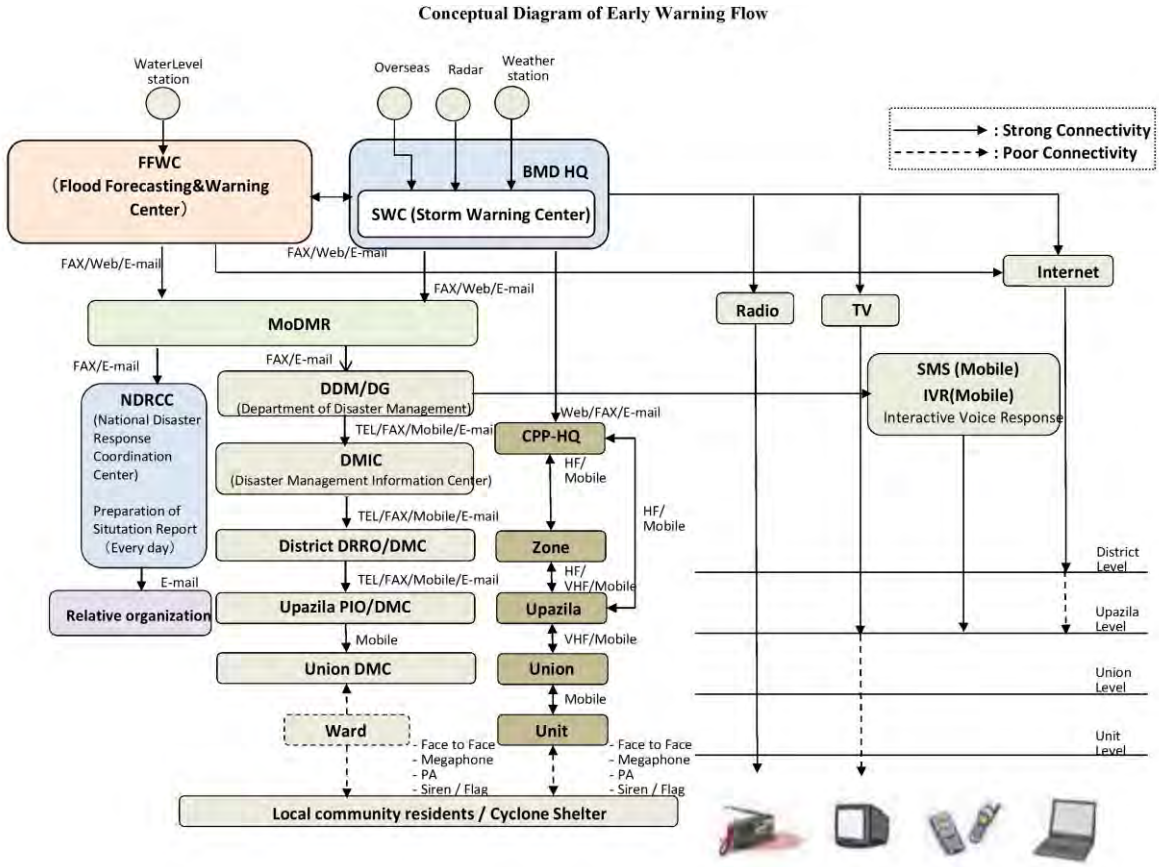


Figure 2.1.6 Conceptual Diagram of Early Warning and Disaster Information Systems in Bangladesh

In Bangladesh, the SWC issues cyclone warnings. According to SOD 1997, there are 10 stages of cyclone warning signals with different responses. The warning signals are classified according to wind velocity. At signal stage 4, the chairperson convenes emergency meetings of local governments (UzDMC, UDMC) in order to discuss countermeasures when a cyclone approaches. Evacuations begin in earnest when a stage 6 signal is issued.

Moreover, according to SOD 2010, the signals were revised to a 6-stage system however; the conventional 10-stage signals continue to be used.

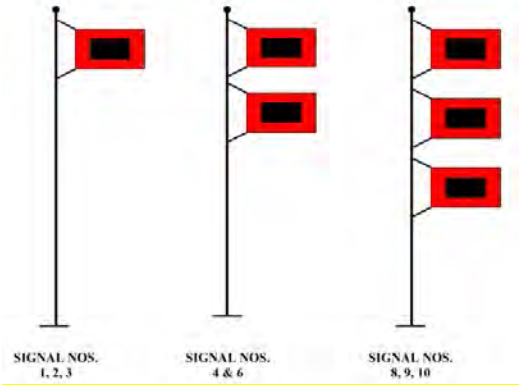


Figure 2.1.7 Signal-separate Flags (SOD, 2010)

Following the occurrence of Cyclone Sidr in 2007, the DDM started collection of disaster information based on SOS-Forms for supply of food and blankets, and time-based designation of relief activities, etc. according to the 2010 disaster risk management guidelines of the SOD.

Table 2.1.19 Time Response Before and After Cyclones

Wind velocity (km/h)	Impact	Weather information (SWC)		DDM	BWDB,LGED	Local governments	Residents
51-61	○ Storm in remote sea	Warning to remote areas No. I	Signal 1 issue	○ Grasping of information from SWC (Fax/Web) ○ Provision of information to local governments (Email/Tel)		○ Grasping of disaster information via TV, radio, SMS, etc. ○ Receipt of disaster information from DDM	○ Grasping of cyclone information via TV, radio,etc.
62-88	○ Possibility of shipwreck in remote sea	Warning to remote areas No. II	Signal 2 issue				
40-50	○ Cyclone storm area ○ Damage to crops	Regional warning No. III	Signal 3 issue				
51-61	○ Extensive damage to farmland ○ Damage to houses ○ Small and medium-scale damage caused by high tides on low land	Regional warning No. IV	Signal 4 issue	○ Start of preparations for emergency relief ○ Grasping of information from SWC (Fax/Web) ○ Provision of information to local governments (Email/Tel)	○Warning to the people for flood ○Inspection of facilities ○Grasping of information from SWC ○ Attendance in emergency meetings ○ Participation in emergency meeting (sharing of disaster information) ○Support to resure,technical issue	○ Alerting of residents ○ Convening of emergency meeting (UzDMC, UDMC)	○ Outdoor ban on children ○ Grasping of cyclone information via TV, radio,etc.
62-88		Hazard warning No. V	Signal 5 issue				
	○ Cutting of power supply and communications ○ Damage to houses	Hazard warning No. VI	Signal 6 issue			○ Evacuation advisory to residents ○ Convening of emergency meeting (UzDMC, UDMC)	○ Start of evacuation to evacuation centers ○ Grasping of cyclone information via TV, radio, SMS, etc.
89-117	○ Flooding of low land due to high tides ○ Cutting of power supply and communications ○ Extensive damage to houses ○ Flooding of low land due to high tides	Hazard warning No. VII	Signal 7 issue				
		Grave hazard warning No. VIII	Signal 8 issue	○ Grasping of information from SWC (Fax/Web) ○ Provision of information to local governments (Email/Tel) ○ Completion of preparations for emergency relief		○ Evacuation order to residents ○ Convening of emergency meeting (UzDMC, UDMC)	○ Standby of evacuation centers
118-170	○ Cutting of power supply and communications ○ Extensive damage to houses ○ Flooding of low land due to high tides	Grave hazard warning No. IX	Signal 9 issue				
≥170	○ Cutting of power supply and communications ○ Extensive damage to houses ○ Flooding of low land due to	Grave hazard warning No. X	Signal 10 issue				
0～24 hours after disaster occurrence				① Collection of SOS-Forms ② Reporting of damage to MoDMR ③ Convening of emergency meeting by DDMC ④ Provision of information on losses and damage ⑤ Establishment of control rooms in unions and upazillas ⑥ Start of relief and rescue activities, etc.	○ Grasping of damage conditions ○ Inspection of facilities ○Participation in emergency meeting	○ Request for support ○ Attendance in emergency meetings	Request for support
24～72 hours after disaster occurrence				① Provision of detailed information on losses and damage ② Collection of detailed information in D-Forms ③ Allocation of emergency relief activities ④ Control of rescue activities ⑤ Coordination of medical care, civic disaster management agencies, etc. ⑥ Control of initial rescue activities, etc.	○ Grasping of damage conditions ○ Inspection of facilities ○ Provision of infrastructure damage information to PIO	○ Request for support	Request for support
1～4 weeks after disaster occurrence				① Collection and analysis of D－forms ② Allocation of recovery programs ③ Follow-up of activities on the regional level ④ Coordination of related agencies and ministries in the relief effort ⑤ Dispatch of monitoring team from DDM ⑦ Provision of necessary means of transport for emergency response and monitoring ⑧ Reporting of activities, etc. to MoDMR	○ Grasping of damage conditions ○ Inspection of facilities ○ Application for emergency works to headquarters ○ Emergency works headquarters approval, contract, construction	○ Request for support	Request for support
2～3 months after disaster occurrence				① Start of recovery activities ② Coordination of related agencies in the recovery effort ③ Coordination of meetings on the regional level ④ Coordination of non-profit organizations in the recovery effort ⑤ Reporting of recovery activities, etc. to MoDMR	○ Completion of emergency works ○ Application to headquarters for the rehabilitation project	○ Request for support and rehabilitation	○ Request for support and rehabilitation

(d) DDM Collection of Disaster Damage Information

DDM information on damage caused by natural disasters is first transmitted from the Union Parishads. Information is communicated by mobile phone and orally to PIO (Project Implementation Officers) on the Upazila level. After that, the UNO uses the SOS Form to communicate through UNO→DRRO→DC→DMIC. The information is conveyed in a day using SOS forms to the DMIC (Disaster Management Information Centre), which conducts the final aggregation of damage information.

An example of an SOS form (August 19, 2015, flood damage in DDM Upazilla Dohar) is shown below.

Table 2.1.20 Table SOS Form

Estimated losses and Emergency needs (SOS) Determination Form

Date :	19/8/2015
Upazilla Name :	Dohar
Hazard Type :	Flood
1.Number Of Affected Union :	3
1. Affected Union (Name) :	Kushumhati, Moksedpur, Nayabari,
1. Affected Pourashava (Name) :	
2.Number of Sever Union :	1
2. Sever Union (Name) :	Narisha,
2. Sever Pourashava(Name) :	
3. Affected People :	1000
4. Devastated Total Home :	500
5. Fully Devastated :	200
6. Partially Devastated :	300
7. Dead :	12
8. Missing :	5
9. Need Rescue :	Need
10. Rescue :	Boat, Lifejaket
11. Need Health :	Need
12. Health :	doctor, emargency medicine etc.
13. Need Water :	Need
14. Water :	Pure drinkable water, ors, jarikan.
15. Need Food :	Need
16. Food :	Rice, Wheat, Dry food etc.
16. A. Need Cloth :	Need
16. B. Cloth Type :	Blanket,Shari,
17. Need Shelter :	Need
18. Shelter :	Tent, Flood shelter etc.
19. Emergency Others :	Baby Cloth etc.
20. Remarks	Need Security

Delowar Hossen
UPIO, Dohar, Dhaka

19/8/2015
Date

Signature

The D-Form, which shows more detailed information than the SOS form, is transmitted to the DMIC approximately three weeks after the damage is caused by a natural disaster.

The D-form used on the occasion of Cyclone Komen is shown on the following page. It shows the number of fatalities, number of damaged homes, information on damage to infrastructure such as roads, embankments and so on.

The information on damage to infrastructure is obtained by PIO from the BWDB and LGED field offices and is shared by both organizations.

The NDRCC (National Disaster Response Coordination Centre), which is under the MoDMR, sorts through situation reports approximately one month following the disaster, submits reports to DC, DRRO and MoDMR and also displays them on the website.

Table 2.1.21 Losses and Damages (D-Form) caused by Heavy Rainfall and Cyclone KOMEN (June to July, 2015)

Losses and damages form (D-FORM) due to Flood caused by Heavy Rainfall and Cyclone " KOMEN"

Sl. No	Name of District	Number of Damaged Upazila	Number of Damaged Union/Paurashava	Damaged Area (square kilometers)	The number of Affected People		The number of dead	The number of injured	Affected Families		Homes damaged		Affected Cattle	
					More affected	Partially affected			More affected	Partially affected	Totally affected	Partially affected	Number	Price
01	*02*	*03*	*04*	*05*	*06*	*06 (a)*	*07*	*08*	*09*	*9(a)*	*10*	*10(a)*	*11*	*11(a)*
01	Chittagong	12	139	1141.28	217066	323577	01	-	42913	106453	1289	19345	05	8000/-
02	Cox'sbazar	08	66	1256.30	459720	359155	18	904	70500	87812	25622	84500	3082	39065000/-
03	Noakhali	09	79	2294.48	-	212890	02	-	-	84960	765	2990	1561	9586200/-
04	Feni	03	10	54.60	9100	20910	-	-	4100	2482	402	1308	-	-
05	Comilla	08	62	341.0	62000	284990	-	-	13450	47461	-	23275	-	-
06	Bandarban	07	33	-	-	156655	-	-	-	-	-	-	-	-
07	Khulna	04	30	206.0	-	71740	-	-	9550	19384	1250	25524	-	-
08	Satkhira	05	47	339.35	66755	120548	-	-	7686	20044	260	4426	04	50000/-
09	Kurigram	09	63	507.0	168088	300000	-	-	42000	75000	-	-	-	-
10	Gaibandha	06	52	242.0	58000	100902	01	-	14500	25200	-	-	05	100000/-
11	Naogaon	03	16	105.0	32780	60000	01	-	8995	15000	-	-	-	-
	Total	**70**	**597**	**6487.01**	**1073509**	**2311367**	**23**	**904**	**213694**	**483796**	**29580**	**161368**	**4657**	**48981200/-**

Sl.No	Name of District	Damaged Duck Chicken		Damaged Crops		Loss of Salt		Homes Damaged		The number of affected Educational Institutions		Affected of Religious Organizations	
		Number	Price	Hector	Price	Hector	Price	Hector	Price	Totally affected	Partially affected	Totally affected	Partially affected
01(a)	*02(a)*	*12*	*12(a)*	*13*	*13(a)*	*14*	*14(a)*	*15*	*15(a)*	*16*	*16(a)*	*17*	*17(a)*
01	Chittagong	3850	4370000	17378	1394785000/-	-	-	1692	19000000/-	03	205	-	50
02	Cox'sbazar	78200	20860000	8151	111119100/-	56.0	112000/-	53640	2742568000/-	108	250	-	490
03	Noakhali	800	151386	4438	547805805/-	-	-	1178	352345820/-	10	346	-	15
04	Feni	-	-	-	-	-	-	-	-	-	02	-	01
05	Comilla	-	-	18026	340000000/-	-	-	-	-	40	102	-	-
06	Bandarban	-	-	-	-	-	-	-	-	-	-	-	-
07	Khulna	24916	-	2775	-	-	-	-	-	-	64	05	83
08	Satkhira	1575	236000	7587	125452000	-	-	3517	64422000/-	-	60	-	30
09	Kurigram	-	-	-	-	-	-	-	-	-	-	-	-
10	Gaibandha	252	25000	35049	-	-	-	-	-	-	-	-	-
11	Naogaon	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**109593**	**25642386/-**	**93404**	**2519161905/-**	**56.0**	**112000/-**	**60027**	**3178335820/-**	**161**	**1054**	**05**	**669**

Sl.No	Name of District	Damaged roads (km)		Damaged Embankment (km)		Damaged forest (hector)		Electricity damaged (km)		Damaged Tele-communications (km)		Damaged industries		Damaged fishery	
		unpaved	paved	Totally	Partially	How many hectares	Price	How many km	Price	How many km	Price	Quantity	Price	Quantity	Price
01(b)	*02(b)*	*18*	*18(a)*	*19*	*19(a)*	*20*	*20(a)*	*21*	*21(a)*	*22*	*22(a)*	*23*	*23(a)*	*24*	*24(a)*
01	Chittagong	281.65	889.00	19.5	51.5	-	3830000/-	-	8050000/-	-	-	-	-	3523	107312000/-
02	Cox'sbazar	352.20	1090.00	89.50	158.50	-	69500000/-	-	870000/-	-	1800000	10	10300000/-	888	211670000/-
03	Noakhali	634.0	2268.00	07.00	31.00	72	4734000/-	11.9	-	-	-	-	-	-	-
04	Feni	-	-	0.195	o.090	-	-	-	-	-	-	-	-	-	-
05	Comilla	155.00	1202.00	25.0	20.0	-	-	-	-	-	-	-	-	317	1450000/-
06	Bandarban	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07	Khulna	377.2	512.12	-	4.00	220	-	-	-	-	-	-	-	15700	-
08	Satkhira	185.80	205.70	7.70	61.50	-	500000/-	-	-	-	-	-	-	79	95000000/-
09	Kurigram	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Gaibandha	-	74.0	-	-	-	-	-	-	-	-	-	-	1455	-
11	Naogaon	-	40.0	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**1985.85**	**6280.82**	**148.896**	**326.59**	**292**	**785640000/-**	**11.9**	**8920000/-**	**-**	**1800000/-**	**10**	**10300000/-**	**21962**	**415432000/-**

Sl.No.	Name of District	Damaged Tube wells)			Number of Ponds	Damaged Boat/Trawler		Fishing Net		Damaged hand-loom		Damaged Bridges and Culverts
		Deep	shallow	Hand pumps		Quantity	Price	Quantity	Price	Quantity	Price	
01(c)	*02(c)*	*25*	*25(a)*	*25(b)*	*26*	*27*	*27(a)*	*28*	*28(a)*	*29*	*29(a)*	*30*
01	Chittagong	20	753	30	5869	284	46400000/-	-	22550000/-	-	-	-
02	Cox'sbazar	2436	4225	2230	18249	144	10145000/-	1105	1900000/-	-	-	-
03	Noakhali	1638	1589	16	4073	-	-	392	-	-	-	15
04	Feni	-	-	95	770	-	-	-	-	-	-	-
05	Comilla	-	-	-	3207	-	-	-	-	-	-	-
06	Bandarban	-	-	-	-	-	-	-	-	-	-	-
07	Khulna	01	85	05	563	-	-	-	-	-	-	-
08	Satkhira	67	109	595	274	-	-	-	-	-	-	-
09	Kurigram	-	-	-	-	-	-	-	-	-	-	-
10	Gaibandha	-	-	-	-	-	-	-	-	-	-	-
11	Naogaon	-	-	-	-	-	-	-	-	-	-	-
	Total	**4162**	**6761**	**2971**	**326.59**	**428**	**56545000/-**	**1497**	**24450000/-**	**-**	**-**	**15**

The following figure shows the flow of disaster information transmission to the DDM headquarters.

At normal times, the UzDMC holds monthly meetings chaired by the Upazila Nirbah Officer, while the DDMC holds meetings chaired by the Deputy Commissioner once in every two months. When a Stage 4 warning signal is issued by the SWC, the chairperson convenes an emergency meeting of members to decide on the disaster response.

After reporting the information to MoDMR and the request for urgent rescue from the local region through the SOS Form, the Director of Relief (DDM) makes a decision on the supply of food and money for affected residents.

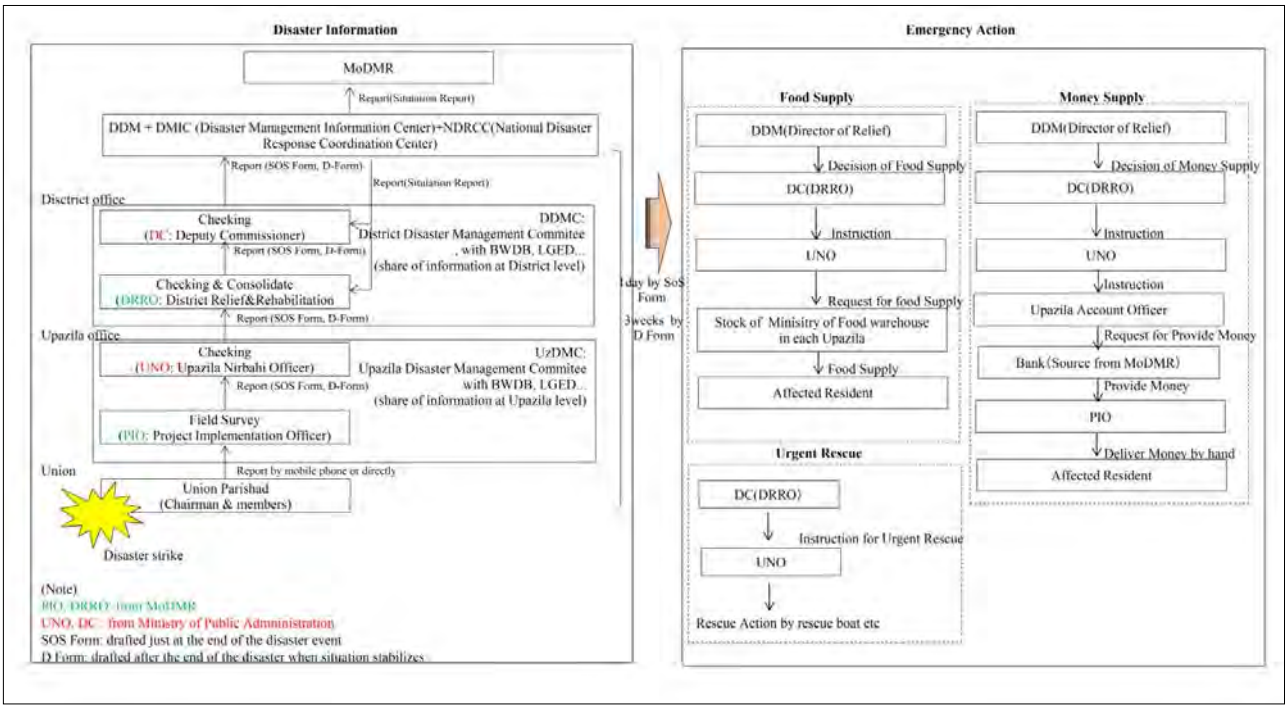


Figure 2.1.8 DDM Damage Information and Emergency Response Flow

Table 2.1.22 Main Members of UzDMC

(i)	Upazila Nirbahi Officer	1	Chairperson
(ii)	Mayor of Pourashava located in the Upazila (in appropriate case)	1	Member
(iii)	Chairman of Union Parishad(s)	----	Member(s)
(iv)	Government Officers at Upazila Parishad (Upazila Agriculture Officer, Upazila Fisheries Officer, Upazila Livestock Officer, Upazila Education Officer, Upazila Project officer (*Upobritti)*, Upazila Women Affairs Officer, Upazila Food Controller, Assistant Commissioner (Land), Upazila Health and Family Planning Officer, Officer-in-Charge (Police), Upazila Engineer, Sub-Assistant Engineer (Public Health), Upazila Social Welfare officer, Upazila Youth Development Officer, Upazila Cooperative Officer, Upazila Ansar-VDP Officer, Representative Upazila FSCD, Assistant Director, CPP (in appropriate case)	16	Member
(v)	Representatives of Women (Co-opted members in Upazila Parishad)	3	Member
(vi)	President of BRDB/Central Cooperatives Samity	1	Member
(vii)	Assistant Director, CPP (in appropriate case)	1	Member
(viii)	Representative of Bangladesh Red Crescent Society (in appropriate case)	1	Member
(ix)	Representatives of NGOs (one representative each from Local, National and International NGOs nominated by the UNO)	3	Member
(x)	Socially Reputed Persons or Civil Society Representatives (President of Press Club, President of Traders Association and Principal of a College or Madrasha, nominated by the UNO)	3	Member
(xi)	Upazila Commander of Freedom Fighter Command Council	1	Member
(xii)	Upazila Project Implementation Officer (PIO)	1	Member Secretary

Source : Standing Orders on Disaster, 2010

Table 2.1.23 Main Members of DDMC

(i)	Deputy Commissioner	1	Chairperson
(ii)	Chief Executive Officer of Zila Parishad	1	Member
(iii)	Heads of all concerned departments at district level [Superintendent of Police, Civil surgeon, Deputy Director (Department of Agricultural Extension), District Fisheries Officer, District Livestock Officer, District Primary Education Officer, District Education Officer, District Women Affairs Officer, District Food Controller, Executive Engineer (Public Health), Executive Engineer (LGED), Deputy Director (Social Welfare), Deputy Director (Youth Development), District Cooperative Officer, District Ansar VDP Adjutant, District Information Officer, Executive Engineer (Water Development Board), Executive Engineer (PWD), Executive Engineer (R &H), Assistant Director/Deputy Assistant Director (FSCD), District in- Charge BISIC, Senior Official of a Nationalized Bank nominated by the DC	22	Member
(iv)	Mayor of District Headquarter Pourashava	1	Member
(v)	All Upazila Nirbahi Officers (UNO)	--	Member
(vi)	Women representatives (Nominated by the DC)	2	Member
(vii)	District Representative of Red Crescent Society (in appropriate case)	1	Member
(viii)	Representative of Cyclone Preparedness Programme (in appropriate case)	1	Member
(ix)	Representatives of NGOs (one representative each from Local, National and International NGOs selected by the DC)	3	Member
(x)	Socially Reputed Persons or Civil Society Representatives (President of the Press Club, President of the Lawyers Association, President of the Chambers or Business Society, Principal of College/Madrasha- nominated by the Chair of DDMC)	4	Member
(xi)	District Commander of District Muktijhodha Sangsad	1	Member
(xii)	President of the District Scout	1	Member
(xiii)	President of the District Committee, Union Parishad Forum	1	Member
(xiv)	Representative of the Armed Forces Division (during disaster)	1	Member
(xv)	District Relief and Rehabilitation Officer (DRRO)	1	Member Secretary

Source : Standing Orders on Disaster, 2010

(e) Gaps and Challenges

a) Gaps and Challenges on the Organization of DDM

It is natural that the Gaps and Challenges on the Organization of DDM should be the same as those of the MODMR, such as the "Short rotation of positions of officials in Bangladesh" and the

"Insufficient Coordination Works of DRR activities among the-ministries". In addition, the following issue was detected through the survey.

- Work demarcation between MoDMR and DDM is not clearly defined. For example, with respect to disaster information, the National Disaster Response Coordination Centre (NDRCC) belonging to the MoDMR collects and transmits it, and the Disaster Management Information Centre belonging to the DDM collects and manages it. It is desirable that bothe organizations are coordinated.

b) Problem when Disaster Occurs

It is said that communication through the DDM line takes longer than that of the CPP line for warnings to be received from the SWC and issued in the Unions. Reasons given are that the internal processing time within the DDM, districts and upazilas is long and difficult for dealing with SWC warnings outside of working hours. Other problems are as follows:

- Disasters do not necessarily occur every time cyclone and flood warnings are issued by the SWC (BMD) and FFWC (BWDB). In fact, since disasters occur less frequently than before, there is hesitation about using such warnings to trigger the evacuation of residents.
- When cyclones attack, the radio is the main equipment for communication, however, radio equipment is not usually properly maintained and becomes unusable when the power source breaks down.
- Since 11 districts are required as the minimum unit for issuing cyclone warnings, the warning signals and actual weather differ based on the features of the district.
- Since the water level observation dates in the Bangladesh southern area is few, flood forecasting is difficult.
- SOS-Form and D-Form are used as the method of communication of disaster information, however, electricity supply is cut at a large-scale disaster and delay of data transmission is probable.

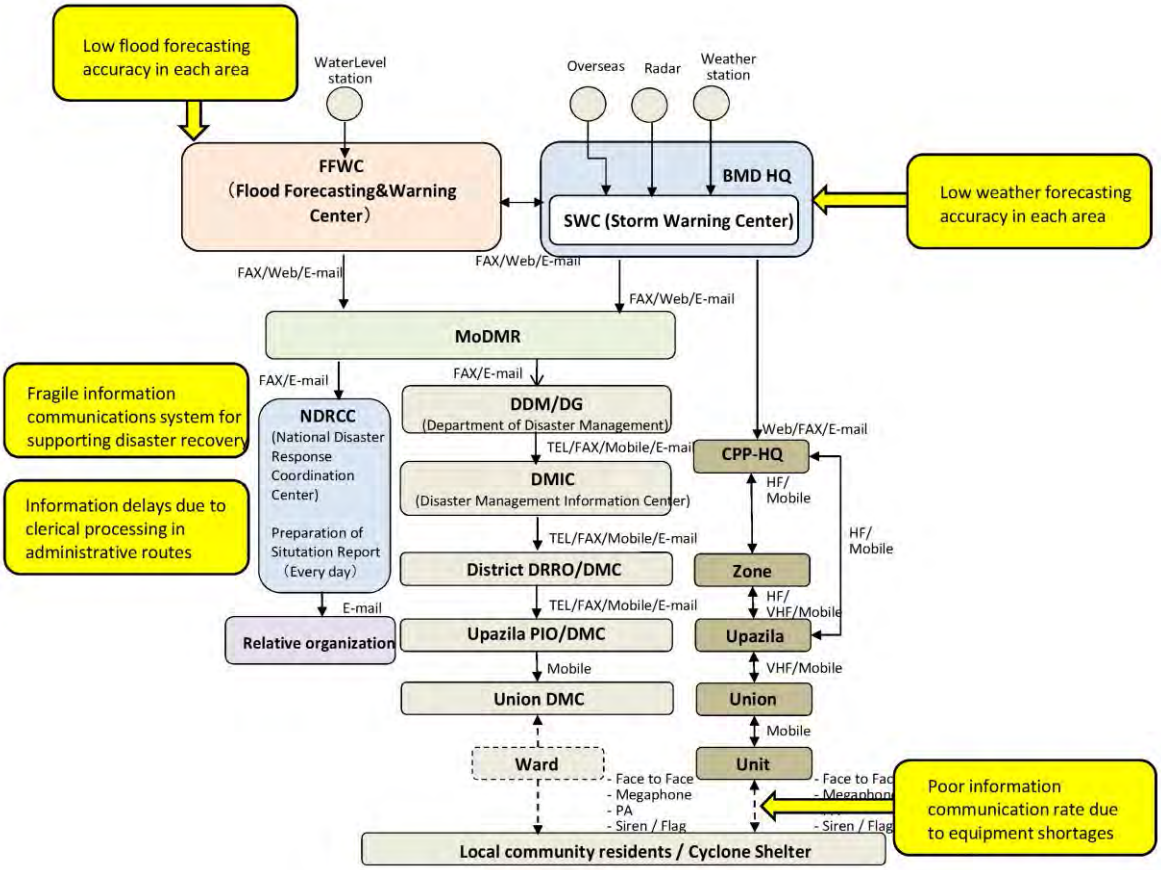


Figure 2.1.9 Issues on the Information Transmission System

The following table shows the probable countermeasure to the issues mentioned above.

Table 2.1.24 Problem and Countermeasure in Information System

Task	countermeasure
Weakness of transmission system of information on disaster recovery support	Paperless disaster information. Unification of disaster information by introduction of disaster information system that can confirm it even at the centre and the related organizations.
Information transmission is delayed outside working hours.	Establishment of a 24-hour communication setup between responsible personnel in central and regional offices and agencies, and construction of an SMS communications system for emergency communications between said personnel
Flood forecasting and warning	Introduction of flood forecasting system with temporary water gauge and alarm
Low weather forecasting accuracy in each area	Technical cooperation in weather forecasting and introduction of raingauge and radar
Low flood forecasting accuracy in each area	Technical cooperation in flood forecasting and installation of water level stations
Poor information communication due to equipment shortages	Supply equipment

(3) Bangladesh Water Development Board (BWDB)

The Bangladesh Water Development Board (BWDB) is the main agency of the government under the Ministry of Water Resources (MoWR) for managing water resources of the country. Additionally, it was given the responsibility of accomplishing the tasks of executing flood control, drainage and irrigation projects to increase productivity in agriculture and fisheries. The outlines of the BWDB are described below in detail based on the study report prepared by JICA expert in BWDB (2010-2014).

(a) Outline of Roles and Responsibilities, and Organizational Structure

After the independence of Bangladesh, the authority was restructured in 1972 into two different organizations to deal with water and power separately. The BWDB was created under the Bangladesh Water and Power Development Board Order 1972 (P.O. No. 59 of 1972) as a fully autonomous organization. The reform program and the structural adjustment process were undertaken by the GOB for transformation of BWDB through the enactment of the BWDB Act of 2000 that requires the BWDB's functions to be guided by the National Water Policy (NWPo) of 1999 and the National Water Management Plan (NWMP) of 2004 as summarized in the following table.

Table 2.1.25 Duties and Roles of the BWDB

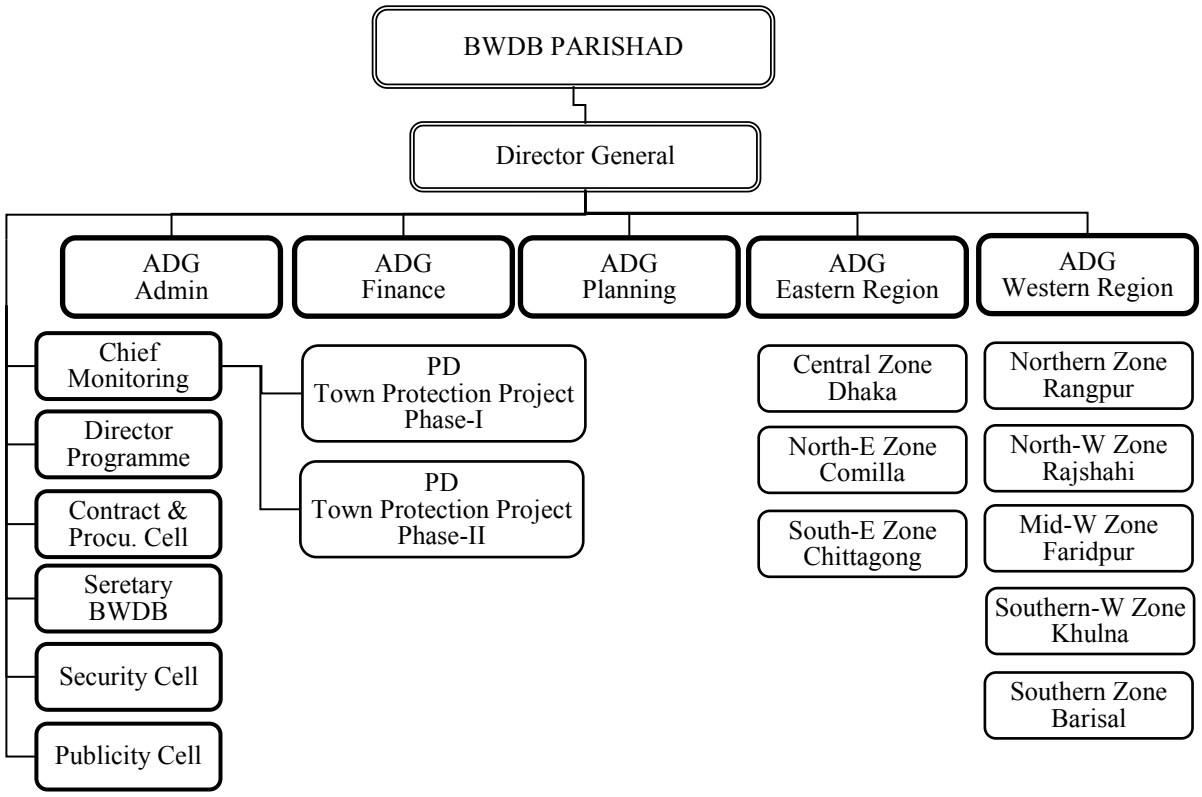
Hard Component	Soft Component
1. River training, flood control, drainage improvement, irrigation and drought mitigation by construction of dams, barrages, reservoirs, dikes, water-level regulation facilities, etc.	1. Flood and Drought Early Warning and Prediction
2. Promotion of surface water utilization for Fishery, navigation, forest management and water logging mitigation works, such as river mouth and canal dredging for water distribution.	2. Monitor water levels of all major river systems, Collect weather forecasts and hydrological data. Strengthen the Flood Forecasting and Warning centre with improved technology.
3. Works for Soil conservation and land accretion by sand deposit phenomena and river mouth control	3. Dike crown road management, Forest management and Fishery support under BWDB properties for Environmental Preservation and Improvement and poverty reduction Activities
4. River Control and river diking system preservation works to protect City core areas, markets, and historical and public infrastructures.	
5. Construction and Management works for sea or coastal dikes.	4. Formulation of organization for water users and stakeholders with water management plan, implementation monitoring and evaluation as well as maintenance works and education and training activities for sustainable development and collection of water utilization fees
6. Prevention works for salinity intrusion and desertification.	
7. Securement of Water for Irrigation and Environmental Preservation.	

Source: Final Report by Michio Ota, Ex-JICA Long Term Expert of BWDB

BWDB is governed by the PARISHAD (Policy-making and Control Council) chaired by the Minister of MoWR and composed of thirteen (13) members including the four (4) secretaries of ministries related to water management; namely, MoWR, LGD, MoF (Economic Division) and MoEF, one Water Resource Engineer and one Water Resource Specialist nominated by the GOB, two

representatives of beneficiaries of completed/implemented project of BWDB, one NGO representative, one representative of the Bangladesh Institute of Chartered Accountants nominated by the GOB, and the DGs of BWDB and WARPO.

The works are implemented individually by wing, section and local level branch offices as shown in the organizational chart in Figure 2.1.10.



Source: BWDB : http://www.bwdb.gov.bd/index.php?option=com_content&view=article&id=119&Itemid=189 (Accessed on 2015/07/03)

Figure 2.1.10 Organization Chart of BWDB

BWDB is not responsible for the issuance of permission for water use and river channel utilization. With regard to water use, the Water Resources Planning Organization (WARPO) is presently drafting the water use policy through the National Water Act in association with ADB. Regarding river channel management, no agency has the authority to manage rivers complehensively and there is no plan to establish any guideline yet.

BWDB is headed by the Director General (DG) and composed of five (5) wings; namely, the Administration Wing, the Finance Wing, the Planning Wing, and the O&M Wing divided into Eastern and Western regions as shown in Figure 2.1.10. Each wing is managed by an Additional Director General (ADG) supporting the DG and is composed of several circles for its work areas.

The wings related to the Project are as follows.

- Planning Wing: For formulating the national perspective of BWDB achievements, review of BWDB projects in terms of technical issues and monitoring toward the formulation of the Five-Year Development Plan; and
- O&M Wings (Eastern Region & Western Region): For conducting prevention and mitigation works against natural disasters for water-related facilities with implementation of early recovery and rehabilitation works as well as evaluation of damaged infrastructures.
- Local offices of district level belong to the O&M Wing.

The number of officers/staff members of BWDB has been declining since the 1990's based on the restructuring under the leadership of WB. As a result, the 8,935 staff members in 1998 decreased to approximately 7,000 staff members in 2013.

(b) Budget

Budget and expenditures of the BWDB in recent years are as summarized in Table 2.1.26.

Table 2.1.26 Budget and Expenditure of BWDB

Unit: Thousand BDT

Item	2013-13	2014-15		Budget	Projection	
	Actual	Budget	Revised	2015-16	2016-17	2017-18
Operational Units (Non-Development)	7,137,222	7,514,741	7,478,699	7,900,523	8,361,400	8,821,300
Development	19,628,997	26,859,800	21,409,800	29,686,700	30,874,168	34,270,326
Total	26,766,219	34,374,541	28,888,499	37,587,223	39,235,568	43,091,626

Source: Ministry of Finance

(c) Gaps and Challenges on the Organization of BWDB

Gaps and Challenges on the Organization of BWDB are essential for project implementation since BWDB may be one of core project implementing agencies.

The gaps and challenges grasped through interview surveys from May to July 2015 are as follows:

a) Deteriorating Conditions due to River Erosion Disasters

River erosion disasters have taken place everywhere along the major river courses. The impacts have not been controlled yet due mainly to the high cost of prevention works, although the riverine fertilized areas along Jamuna and Brahmaputra are protected by revetment, spur dikes and other erosion control facilities with financial and technical support from international donors and development banks.

According to the "World Disaster Report" published annually by IFRCS, in 2001, about 1,000,000 people were affected by river erosion and 9,000 hectares of cultivable lands were lost. Only a few affected people were able to find new shelters while the others became homeless for uncertain periods [Cited from the National Disaster Plan (2010-2015)].

b) Insufficient Maintenance and Recovery Costs

Through the KIIs and the site investigations by the JICA Survey Team with BWDB officials and affected sites in the target areas, one of the significant issues on the DRR system in Bangladesh is the insufficient allocation of funds for maintenance and recovery costs. The requests for funds based on the estimated costs to maintain or reconstruct infrastructures damaged by natural disasters are submitted by the district offices to the BWDB Head Office. However, the funds actually disbursed accounts for only 10% of the requested funds on average. (Refer to Subsection 2.4.2.)

It is imperative and important to maintain constructed infrastructures in order to ensure the function of structures although new development projects are also essential.

Table 2.1.27 Funds Requested and Allocated for Damaged Infrastructures of BWDB

Unit: Thousand BDT

District	Requested	Actual Allocation	Ratio
Cox's Bazar	2,000,000	50,000~70,000	2~3%

Source: Interview Survey Results, JICA Survey Team

c) Construction Material

Based on the visual observation during the site investigation at the coastal area, it is concluded that there is no issue on the existing dike material. Judging from the condition of cross-section of dikes broken or eroded in many places, the dike materials are well compacted. The main cause of collapse of dike in a coastal area is the collapse of riverside and the dike itself due to the scoring of riverbed in a river exceeding 10m in depth. Another main cause is the ocean waves that directly hit a dike without revetment which is generally eroded and finally collapses.

It is necessary to protect the entire length of dike affected by ocean waves in a coastal area by revetment; currently however, the installation of revetment is considerably insufficient. Furthermore, the dike in a coastal area is constructed of soil taken from the neighbouring area and characteristics of the soil was confirmed as silty cohesion material in all survey points.

Precast concrete blocks are generally used as the material for revetment. However, it is very difficult to obtain rock materials in Bangladesh because of the topographical characteristics where most parts of country is composed of delta area. It is most common to procure the coarse aggregate for ready mixed concrete from the Sylhet region located at the North-East part of Bangladesh.

In recent years, the use of cheap aggregate coming from India has been increasing. Due to the limited area for gathering aggregates as stated above, the situation easily falls into the lack of aggregates depending on the condition of award of new projects. In addition to the said condition where demand-and supply balance is easily collapsed, it is generally necessary to procure the materials by long distance transportation so that the unit costof aggregates becomes very high. Since the cost of precast concrete blocks for revetment is very high, the installation of revetment will be insufficient in case of lack of funds.

(4) Local Government Engineering Department (LGED)

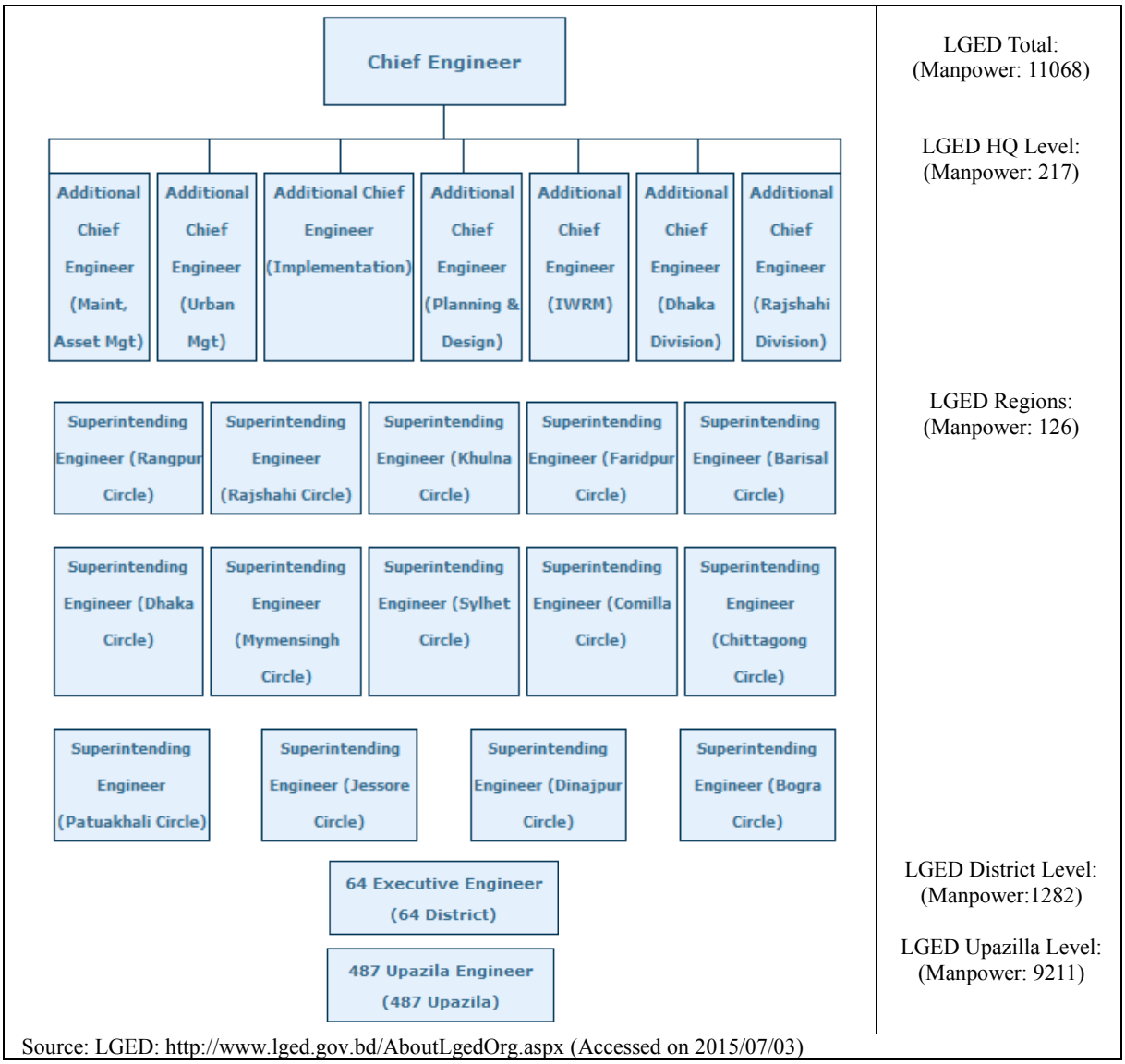
(a) Outline of Roles and Responsibilities, and Organizational Structure

The Local Government Engineering Department (LGED) is one of the largest public sector organizations in Bangladesh entrusted with the planning and implementation of local level rural urban and small scale water resources infrastructure development programs under the Ministry of Local Government, Rural Development and Cooperatives (MoLGRDC). The LGED works closely with the local stakeholders to ensure people's participation and bottoms–up planning in all stages of the project implementation cycle. The broad objectives of LGED's development activities are to improve the socio-economic condition of the country through the provision of local infrastructures and capacity building of the stakeholders. The LGED works in a wide range of diversified programs like construction of roads, bridges/culverts and markets to social mobilization, empowerment and environmental protection.

The roles and functions of LGED are as follows:

- Construction of local level infrastructures including small scale water resources facilities (in case irrigated area is 1,000 hectares or less);
- Maintenance of local level infrastructures including small scale water resources facilities;
- Technical assistance to Pourashaba (Municipal Council) and City Cooporation;
- Technical asisstance to Zila (District Council);
- Technical assistance to Upazila (Sub-district Council) and Union Council;
- Technical assistance to other ministries;
- Preparation of development plan, database, technical specification and manual; and
- Human resources development and capacity building of LGED, local government and other stakeholders.

The LGED, with 11,068 staff members, is a highly decentralized organization where ninety-eight percent of the total manpower works at the District and Upazila (Sub-District) level (total number of staff members in the Head Office is only 217). The organizational chart of LGED is as given in the following figure based on the interviews and web information.



Source: LGED: http://www.lged.gov.bd/AboutLgedOrg.aspx (Accessed on 2015/07/03)

Figure 2.1.11 Organizational Chart of LGED

(b) Budget

Budget and Expenditures of the LGED in the recent 5 years are summarized in Table 2.1.28.

Table 2.1.28 Budget and Expenditures of BWDB

Unit: Thousand BDT

Organization	Budget	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14	FY 2014/15
LGED	Revenue	7,683,803	9,365,619	10,770,239	11,965,504	13,694,603
	Expenditure	7,242,946	9,077,046	10,498,614	11,906,143	13,338,029
	Development	38,830,500	43,508,200	57,381,800	61,071,100	79,671,700
	Expenditure	38,534,900	42,129,000	56,699,200	60,461,400	67,052,100

Source: LGED

(c) Gaps and Challenges on the Organization of LGED

LGED's current issues, which is the same as that of BWDB but less serious than BWDB, is the lack of budget for the rehabilitation of infrastructure after the occurrence of disaster. In addition, as stated in the issue of BWDB, the issues on construction material is common in Bangladesh.

(5) Fire Service and Civil Defence (FSCD)

(a) Outline of Roles and Responsibilities, and Organizational Structure

The Fire Service and Civil Defence (FSCD) is a first responder service oriented government organization under the Ministry of Home Affairs (MoHA) and remain alert 24 hours a day for the management of any disaster. This is the only mandated organization of the Bangladesh government which remains ready to face any call of incident and responds within a maximum of 30 seconds. Although the dedicated operational fire fighters of this department devote themselves to the effective operation of any incident/disaster, the professional capability of FSCD needs to be more modernized and enhanced to face the present and future challenges.

The mandate, vision, mission and task of FSCD are as follows.

a) Mandate

FSCD is a service oriented government organization under the MoHA and mandated to be the first respondent in all types of disaster and remains alert round the clock to face any disaster under the "Fire Prevention and Extinction Act of 2003" and the "Civil Defence Act of 1952"

b) Vision

The vision is to acquire competency as one of the leading fire-fighting and disaster management organizations in Asia

c) Mission

The mission is to protect and save lives and property for a safe and secured Bangladesh

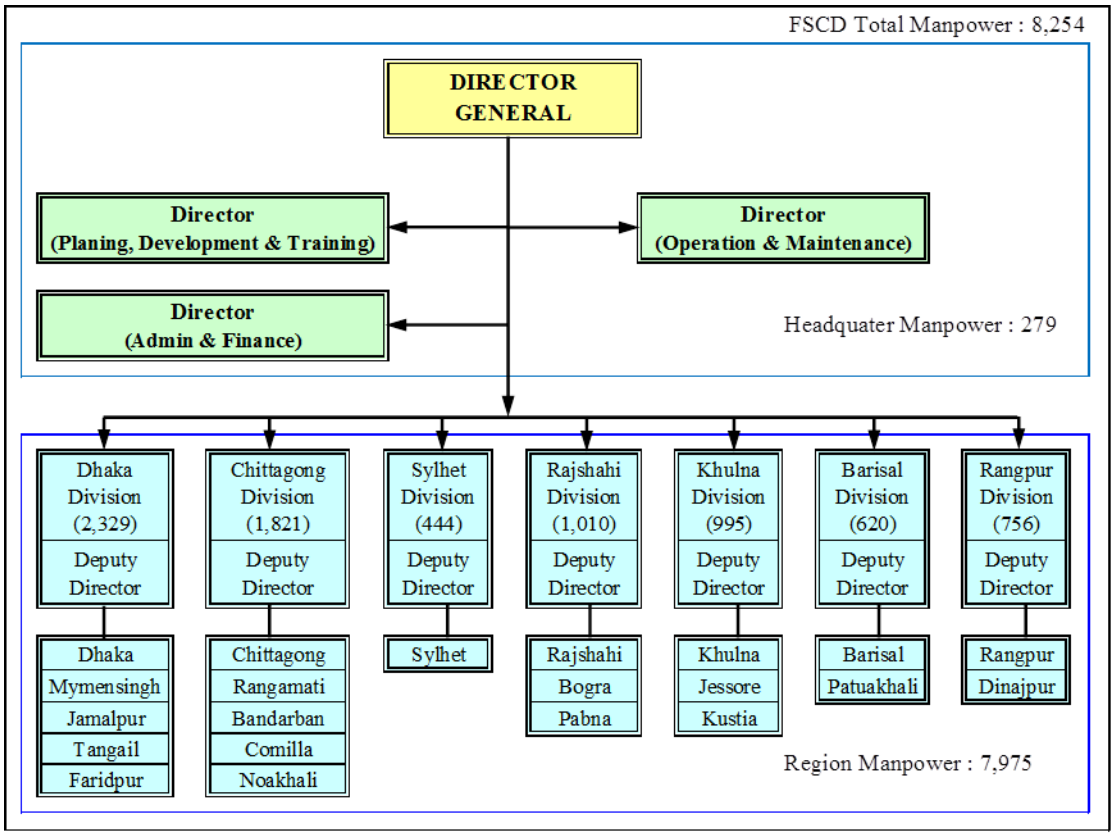
d) Tasks

- To fight all types of fire breaking out at any time of day and night;
- To provide advice on fire prevention and fire protection measures for buildings, industrial and commercial installations, etc.;
- To effect rescue from burning buildings, underneath collapsed structure, wrecked ship, launches and boats in water and all other situations;
- To arrange transportation of casualties and sick people to hospital by ambulance;
- To carry sick persons from the town/hospital to desired destination through the Ambulance of the Department on payment of requisite charges;
- To render first aid to casualties due to accidents;

- To levy and collect license fees from owners of Warehouse/Workshop in accordance with the Warehouse Ordinance;
- To train service personnel in fire-fighting, first aid and rescue techniques;
- To train employees of government departments, national institutions, autonomous bodies and members of the public on fire-fighting, civil defence and self-protective measures against peace time and war time hazards at the Departmental Training Complex and in the Divisional/District and Sub-Divisional Town/Upazila;
- To advice government offices, private institutions and premises on protective measures against air raids during war;
- To carry out fire risk assessment of existing infrastructure and provide advice;
- To render technical advises to Government as and when required;
- To maintain liaison with the International Fire Fighting/Civil Defence organizations and to represent Bangladesh in International Conferences in the field of fire-fighting and civil defence;
- To determine requirement, standardize and arrange procurement of equipment locally and from abroad;
- To plan and execute development of the department;
- To carry out research work on fire-fighting and civil defence methodology; and
- To arrange repair and maintenance of general and operational vehicles as well as specialized equipment of the department.

e) Organizational Chart

As of July 2014, the organization of the FSCD is headed by a Director-General. The organogram of FSCD has a total of 8,254 employees including officers and staff members whosepositions are classified into Class-I (Personnel: 47), Class-II (Personnel: 155), Class-III (Personnel: 7,709) and Class-IV (Personnel: 343). The FSCD organizational chart is as shown in Figure 2.1.12.



Source : FSCD, July 2014

Figure 2.1.12 Organizational Chart of FSCD

(b) Budget

Budget and expenditures of the FSCD in recent years are as summarized in Table 2.1.29.

Table 2.1.29 Budget and Expenditures of FSCD

Unit: Thousand BDT

Description	2013-14	2014-15		Budget	Projection	
	Actual	Budget	Revised	2015-16	2016-17	2017-18
Non-Development	1,834,478	1,969,611	2,572,973	2,247,076	2,325,744	2,432,571
Development	797,462	1,580,000	1,705,000	1,141,300	844,562	1,283,734
Total	2,631,940	3,549,611	4,277,973	3,388,376	3,170,306	3,716,305

Source: Ministry of Finance

(c) Gaps and Challenges on the Organization of FSCD

Gaps and challenges on the organization and tasks of FSCD that are related to the Project are as follows.

- Inadequate Operation Equipment;
- Unregulated Construction of Buildings and Mushrooming Growth of High-rise Buildings (not following the building code);
- Inadequate Awareness about Various Aspects of Disaster;

- Emergency response capability of Staff during a disaster (lifesaving, rescue, first aid);
- Delay of arrival during an emergency due to traffic Jam; and
- Compliance with the law at the time of emergency activities as FSCD institutions, and its execution capability.

Details are discussed in "Chapter 4".

2.1.3 Confirmation of Disaster Response and Disaster Risk Management Programs

In light of the results discussed in Subsections 2.1.1 and 2.2.2, outlines and summaries of the current disaster response and recovery systems in Bangladesh with expected programmes/projects in relation to improvement of recovery and relief systems in Bangladesh are as described below.

(1) Current Disaster Response and Recovery Activities of MoDMR and DDM

As described in Subsection 2.1.1 (1) (g) and (h), related organizations at all levels shall activate their disaster response operations mainly in accordance with the Standard Operating Procedures (SOPs) set under the Flood Response Preparedness Plan of Bangladesh for 2014 and the Emergency Preparedness Plan for Cyclone, 2013.

On the other hand, MoDMR and DDM shall also activate Safety Net operations in parallel with the disaster response operations. These safety net activities shall be conducted to support poor and disadvantaged from disasters in accordance with the Humanitarian Assistance Programme Implementation Guideline 2012-2013 (HAPIG 2012-2013).

(a) Disaster Response Operations based on the Flood Response Preparedness Plan

As shown in Subsection 2.1.1 (1) (g) and (h), the agencies and organizations related to disaster response operations will take actions in accordance with the SOPs in the Flood Response Preparedness Plan of Bangladesh, 2014, and the Emergency Preparedness Plan for Cyclone, 2013, as described in Table 2.1.30.

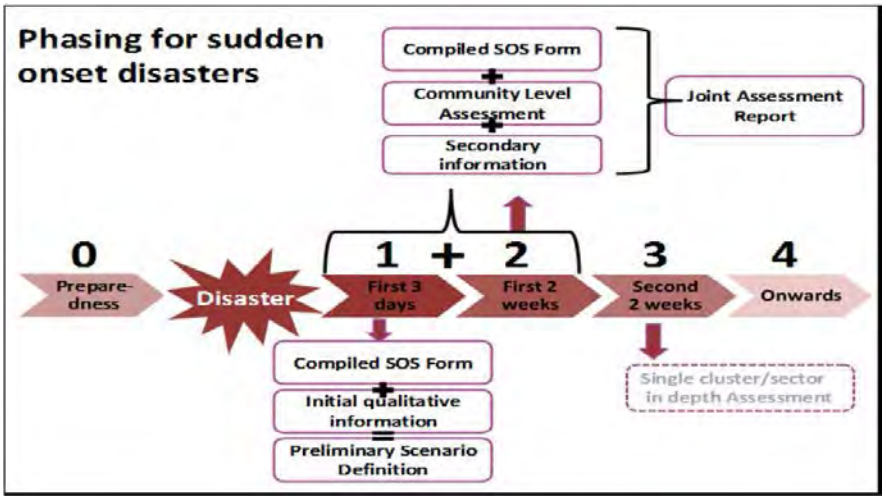
Table 2.1.30 Disaster Response Operations by Related Agencies in accordance with SOPs

Timeline	Actions	Responsible
0-24 hours	• Initial data collection through SOS-form • Reporting to the MoDMR through DDM, DRRO, PIO • As per SOD, DDMC calls emergency meeting where responsibilities of relevant district level officials are defined in responding to disaster emergency. Similarly, UzDMC and UDMC meetings convene. • Provision of initial first-hand information on loss and damage to the NDRCC/DMIC • Set up of control room at district, upazila and union levels. • Step towards allocation of immediate life-saving relief items. • Initiation of search and rescue operations.	• PIO • UNO • DRRO • DC • DDM • MoDMR •Relevant Departments at district and upazila level

Timeline	Actions	Responsible
24-72 hours	• Undertaking of detailed loss and damage assessment through D-form • Reporting to MoDMR through DDM-DRRO-PIO • Emergency relief allocation (GR Rice, GR Cash, Emergency shelter materials) upon receipt of demand from the concerned DC and distribution • Monitoring of the relief distribution • Coordination with relevant officials on the deployment of medical team and fire service and civil defence • Supervision of first aid, search and rescue operations	• PIO • UNO • DRRO • DC • DDM • MoDMR •Relevant Departments at district and upazila level
1 – 4 weeks	• Analysis and authentication of findings in the D-form • Completion of the D-form and determination of allocation of resourses towards working out rehabilitation programme • Follow-up of implementation of decisions taken in the DMCs at local level • Coordination of relief and recovery by engaging relevant ministries and departments • Coordination at the local level to ensure proper distribution avoiding duplication of efforts • Dispatch of monitoring team from DDM to oversee the response work on the ground • If external assistance is required, arranging of meetings at the national level (Headed by Prime Minister or headed by the Minister of Disaster Management and Relief as per SOD) • Provision of vehicle support to the DC, UNO for proper monitoring of emergency response • Preparation of response report to the MoDMR	• PIO • UNO • DRRO • DC • DDM • MoDMR •Relevant Departments at district and upazila level
2 – 3 months	• Rehabilitation activities (livelihood, housing and others) • Coordination with other relevant departments (livestock, health, DPHE, Education, Agriculture and so on) for joint efforts in rehabilitation • Arrangement of DMCs meetings at district, upazila and union level • Monitoring inspection • Coordination with non-government organizations working on response and recovery • Preparation of response and recovery report to MoDMR	• PIO • UNO • DRRO • DC • DDM • MoDMR •Relevant Departments at district and upazila level

Source: Flood Response Preparedness Plan of Bangladesh, 2014 and Emergency Preparedness Plan for Cyclone, 2013

In the actual disaster response operations described in Table 2.1.30, actions to be taken in each timeline (phase) will be evaluated and monitored by the assessment results or confirmed from the SOS-Forms and D-Forms submitted from actual disaster affected sites. The relationship between disaster operations and assessments of responses is as illustrated in Figure 2.1.13



Source: Flood Response Preparedness Plan of Bangladesh, 2014

Figure 2.1.13 Relationship between Disaster Response Phase and Process of Submission of Assessment

However, it has been confirmed through the interview surveys and site inspections that few reports in SOS-Forms and D-Forms from the ground level have been properly and timely prepared and submitted. Therefore, damage amounts and values in the initial situation reports published by the NDRCC have contained some errors because these were not precisely accumulated from the ground level.

Currently, upper level offices (DRROs or DDM Head Office) require lower levels (upazila PIOs or unions) to submit SOS-Forms/D-Forms or to report disaster damages through the phone.

In this connection, precise damage data have been confirmed after a couple of weeks. These situations should be improved to take appropriate response operations matched with actual needs based on the SOS-Forms and D-Forms. As example of the current status, the differences of flooding situations by reports from various sources occurred on June 25~28, 2015 at Cox's Bazar and Chittagong areas as shown in Table 2.1.31.

Table 2.1.31 Differences of Disaster Situations between Various Sources

Source	District	Affected Family/person	Dead/Missing	Date of Update
EOC, DDM	Cox's Bazar	15,900families	10	2015.06.28
	Bandarban	29,676 families	2	
	Ragamati	700 families	0	
Total		**46,276 families**	12	
NDRCC	Chittagong	229,250persons	0	2015.06.28
	Cox's Bazar	25,000person	17	
	Bandarban	22,198 families		
Total		-		
NCMCCR*1	Cox's Bazar	-	17	2015.06.28
	Bandarban	-	2	
Total		-	19	

*1: NCMCCR: National Crisis Management Centre and Control Room, DGHS
Source: Situation Report 20150628 by DMIC

As described in Table 2.1.31, differences of disaster situation would result in unsuitable disaster response operations due to the following facts:

- Disaster damage reporting system by SoS-Forms and D-Forms based on the Flood Response Preparedness Plan of Bangladesh for 2014 and the Emergency Preparedness Plan for Cyclone, 2013 has not become widespread or widely disseminated in Bangladesh; and
- Communication Systems on the local level are still scarce.

These situations have caused conflicting reports. The mechanism and system for disaster reporting standard procedures including timely and proper submission of SoS-Forms and D-Forms shall be observed by all levels.

(b) Disaster Response by Safety Net Activities based on the Humanitarian Assistance Programme Implementation Guideline 2012-2013 (HAPIG 2012-2013)

Disaster response operations through Safety Net Activities based on the Humanitarian Assistance Programme Implementation Guideline 2012-2013 (HAPIG 2012-2013) have also been conducted by MoDMR/DDM. These safety net activities have been more promptly or quickly commenced compared with other disaster response operations by reporting system. The results from those safety net activities have been activated since pre-disaster phase and situations under disasters can be easily assumed

The safety net system of HAPIG 2012-2013 is as explained below.

a) Outline of Safety Net Activities and Targets

The details of safety net activities are described in Subsection 2.3.4 of this report. In this subsection, "Gratuitous Relief" activities of MoDMR and DDM during and after a disaster are explained in detail.

As "Gratuitous Relief" which can be applied for disaster affected people or organizations, MoDMR/DDM has prepared the following programmes:

A) Vulnerable's Grain Facility (VGF);

B) Gratuitous Relief Cash (GR Cash);

C) Gratuitous Relief Rice (GR Rice);

D) Gratuitous Relief Cloth (GR Cloth);

E) Gratuitous Relief CI Sheet (GR CI Sheet);

F) Gratuitous Relief House (GR House);

The eligible persons or organizations for these "Gratuitous Reliefs" are as follows:

a. Usually vulnerable and poorest persons/families;

b. Disaster affected people/families/organizations in disaster period and after disaster;

c. Poor community engaged in various professions suffering for food crisis;

d. Primary level students under the risks of malnutrition;

e. Foods for the poor & people observing religious festivals; and

f. Other people/families/groups/communities in special consideration & requirement by government decision.

In addition, 12 standard criteria to become eligible persons or organizations have been prepared in HAPIG 2012-2013 and people/families or organizations are certified if they are applicable for fulfilling at least 4 conditions out of 12 conditions to be counted as vulnerable/poorest person/family.

The criterion regarding natural disasters is only one: "The family extremely suffering from food crisis due to natural disaster" among the 12 criteria. It supposes that these programmes are meant mainly for poverty programmes as well as safety net programmes for natural disaster affected people.

Table 2.1.32 Twelve Criteria for the Eligibility to "Gratuitous Relief"

No.	Criteria
1.	The family which does not own land or have no land other than homestead.
2.	The family which depends only on daily labour.
3.	The family which depends on income of female worker or begging.
4.	The family that has no income generating male member & the family is insolvent.
5.	The family which school going member have to work for food.
6.	The family which have no income generating asset.
7.	The family which head is left by husband, isolated or divorcee woman & the family is insolvent.
8.	The family which head is insolvent freedom fighter.
9.	The family which head is insolvent & physically disabled.
10.	The family which receives no micro credit.
11.	The family which suffers from extreme food crisis due to natural disaster.
12.	The family which members cannot manage foods for two times in a day for maximum time of a year.

Source: Humanitarian Assistance Programme Implementation Guideline 2012-2013 (MoDMR/DDM)

b) Releasing Criteria for "Gratuitous Relief"

"Gratuitous Reliefs" have been released based on the six (6) conditions listed in Table 2.1.33.

Table 2.1.33 Releasing Criteria of "Gratuitous Relief" by MoDMR/DDM

Condition / Criteria		VGF	GR-Cash	GR-Rice	GR-Cloth	GR-C.I.S.	GR-House
Pre-Disaster	For Poverty Disaster Risk Reduction	+					
	For Disaster Risk Reduction to very poor people	+					
	Reducing disaster risk to children and vulnerable peoples.	+					
	Contribution in poverty alleviation and climate change	+					
Immediate after Disaster	Peoples/families damaged massively by natural disaster	+		+		+	+
	Insolvent families of wounded/dead peopledamaged in any disaster or accident.		+	+			
	Repair/reform aid to structures damaged by natural disaster. Save very poor peoples from winter/terrible winter effects		+		+		
Others	Periodical Distribution		+ *1			+	+
	Religious Activities			+			

*1: once in every 10 years; +: to be distributed

These "Gratuitous Relief" distributions are executed based on the approval of the steering committees or programme implementing committees established permanently in national, district,

upazila/ctity, union and work levels. Lower level committees can request the allocation of "Gratuitous Relief" as needed.

Disaster response operations by MoDMR/DDM generally mean or refer to these "Gratuitous Relief" activities.

(2) BWDB

(a) BWDB Disaster Setup

The Standing Order on Disasters (SOD) which were compiled in 1997 and revised in 2010 stipulate the responsibilities and roles of government ministries and related agencies concerning disaster risk management.

The disaster response duties and roles of the BWDB including its regional operation and maintenance offices are as shown in the following table.

Table 2.1.34 Disaster Response Duties and Roles of the BWDB

Office	Response Duties and Roles
BWDB Headquarters	● 24-hour operation of the disaster response units and information transmission units ● Transmission of disaster cautionary information to all related agencies ● Dispatch of contact personnel to the MOFDM's Emergency Operation Centre (EOC) ● Reporting of emergency situations to the Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) and ECO ● Identification and securing of human resources and materials necessary for the emergency recovery of disaster-affected facilities, etc. ● Requesting of necessary assistance for emergency recovery to the MOFDM ● Implementation of emergency activities for the protection and evacuation of human lives and property ● Support for the evacuation and rescue operations of local authorities through utilizing the BWDB organizational setup on the ground level ● Appointment of supervisors who will make frequent visits to disaster-affected areas ● Requesting intervention by the MOFDM in cases where assistance by the IMDMCC / National Disaster Management Council (NDMC) is required or according to necessity ● Appropriate responses for protecting human lives and property in emergency situations
BWDB O&M local offices (Chief Engineer/ Superintending Engineer/ Executive Engineer/ Assistant Engineer)	● 24-hour operation of flood information centres, and dispatch of contact persons to local disaster response units ● Reporting to BWDB disaster response units and local disaster response units in emergencies ● Support for the evacuation and rescue operations of local government organizations ● Recovery of disaster-affected facilities while managing engineers and materials ● Survey of damage immediately after flooding, and planning and design of emergency recovery and reconstruction based on short-term and long-term plans ● Appointment of work supervisors and emergency prevention measures, and budget planning and execution in disaster-affected areas ● Requesting the IMDMCC to provide assistance via local government organizations as needed ● Appropriate responses for protecting human lives and property under emergency conditions

(b) BWDB Disaster Risk Management Projects

Table 2.1.35summarizes the representative disaster risk management projects implemented by the BWDB. Depending on the case, some projects are major donor undertakings ranging from a few to more than 10 years.

As a major future undertaking, there are plans to implement the Feasibility Study (F/S) on 12 coastal polders based on the assistance from the World Bank in 2016~2017.

The 12 target polders are as follows: (14/1, 15, 16, 17/1, 17/2, 23, 34/3, 40/2, 41/1, 43/2, 47/2, 48)

Table 2.1.35 BWDB Disaster Risk Management Projects

Sl. No.	Name of Project	Start Year/ End Year	Project Cost (Lakh taka)
01	South–West area integrated water resources management project (Revised)	Apr-2005 Dec-2015	30,503.51 26,951.56
02	Tarail pachuria inaugurated water resource project	Mar-2010 Jun-2014	28,144.57 10,625.07
03	Right bank of Surma flood control, irrigation & drainage project	Jul-2011 Jun-2015	68,494.10 5,630.47
04	Ganga-Kopatakkha irrigation Rehabilitation Project	Sep-2012 Jun-2016	18,815.00 6,347.00
05	Bhutiabeel &Barnal salim pur kolabashu khali flood control & Irrigation project Khulna	Oct-2012 Jun-2018	28,190.15 599.40
06	Right bank of Koratoa inaugurated Flood control, irrigation & Drainage Project	Jul-2013 Jun-2015	2,554.91 700.00
07	Old & New Dakatia small Feni river basin development Project 3rd (Revised)	July-2003 Jun-2015	14,409.23 7,018.80
08	Water Management Improve project WMIP 2nd (Revised)	July-2004 Dec-2015	98,227.56 52,420.56
09	Emergency 2007Cyclone Recovery & Restoration project (ECRRP)	Jul-2008 Dec-2017	70,310,.00 18,648.00
10	Coastal area Cyclone Aila destroyed BWDB infrastructure Rehabilitation Project	Jul-2010 Jun-2015	37,754.61 30,401.08
11	Strengthening embankments on both banks of the Gomati river rehabilitation projects	Jul-2010 Jun-2015	6,780.52 4,391.52
12	The Kalni Kushiara river management project	Apr-2011 Jun-2014	60,983.31 2,502.71
13	Dariyapara Amatmarpara para and adjacent areas created along the right bank of the Jamuna River flood control dam project, Bogra	Jan-2012 Jun-2016	21,446.34 6,200.00
14	Haor advance in the prevention flood and drainage development projects	Jul-2011 Jun-2015	68,494.00 5,630.00
15	Bagerhat district, 34/2 polders integrated water management project	Jul-2012 Jun-2015	16,726.00 995.00
16	Blue - Gold program (BWDB component)	Jan-2013 Jun-2018	56,349.00 5,106.20
17	Coastal project (1st stage)	Jul-2012 Jun-2020	328,000.00 371.10
18	Charfashion Monpura conservation projects in the city	Jul-2009 Jun-2016	16,804.59 4,234.21
19	Meghna river erosion at Burhanuddin Shahbazpur gas field in Bhola district, to protect the project (phase II)	Mar-2010 Jun-2014	13,410.25 8,486.94
20	Jamuna river erosion and Islampur upazila of Jamalpur district dewanganj bahadurabada phutani market to be in the dock and sarishabari pinna market area and Islampur Upazila of the district haragila harinadhara arrow to save the project	Jul-2009 Jun-2014	41,700.71 17,688.23

Source: http://www.bwdb.gov.bd

(3) Programmes or Projects related to Disaster Recovery and Rehabilitation Operations by Donors

Supporting systems utilizing Programmes or Projects related to Disaster Recovery and Rehabilitation Operations by Donors are as summarized below. The outlines of these Programmes or Projects are explained in detail in Subsection 2.4.1. Regarding emergency support for disaster response and early recovery support by donors, the summaries are given in Subsection 2.3.4.

Table 2.1.36 Disaster Recovery and Rehabilitation Programmes and Projects by Donors

Donor	Programme / Project	Amount	Brief Outline
World Bank (WB)	Bangladesh Climate Change Resilience Fund (BCCRF))	USD 188Mil. (Grant)	Provision of Funds for Comprehensive Disaster Risk Reduction measures and investments for infrastructures
WB, International Development Association (IDA)	Urban Resilience Project (URP)	USD 173Mil. (Loan)	Building Risk Assessment Improvement including construction certifications and establishment of approval process for inspection rule after construction of buildings in Dhaka, Sylhet, etc.
JICA	Urban Building Safety Project (UBSP)	JPY 12Bil. (Loan)	Building Retrofitting Improvement for Earthquakes
UNDP	Early Recovery Facility: ERF	USD 65.8Mil. (Grant)	Programme for supporting recovery operations by national governments

2.2 Review of Historical Disaster Records and Needs for Support in Each Phase

2.2.1 Historical Disaster Records and Identification of High Disaster Risk Areas

Disaster-related data and disaster historical databases available in Bangladesh are collected and summarized in this section in terms of conditions and tendency of disasters in the past. The results are as follows:

(1) Disaster-Related Data and Disaster Historical Databases Available

As of June 2015, the available historical disaster databases in Bangladesh are as listed in Table 2.2.1 below.

Table 2.2.1 Historical Disaster Databases in Bangladesh

Organization / Agency	Disaster-Related Data / Materials to be Reviewed in the Survey	Results of Data Availability
MoDMR / DDM	Disaster-related Data in the Past accumulated in the Disaster Management Information Centre (DMIC)	Disaster Incident Database (DIDB) releases the list of disasters in Bangladesh since 1970. In addition, DMIC have also provided all of the "Disaster Situation Reports" since 2007.
LGED	Damaged Historical Regional Infrastructure Database	LGED has prepared road infrastructure database in which damaged road records can be input for budget allocation of urgent recovery and rehabilitation. However, all databases have been revised annually and from time to time.
BWDB	Historical Disaster Database being managed by Monitoring Section	Damaged infrastructures by huge floods and cyclones are summarized. However, the records are not summarized and organized as historical disaster records.
Others (Related Agencies)	Other Disaster-related Data and Materials, if any; Recovery and Rehabilitation Activities executed by related agencies in the Past	In order to know disaster situations in Bangladesh, world-wide disaster databases, such as "EM-DAT" and "GLIDE", are also available.

As explained in Table 2.2.1 above, statistically-meaningful databases in Bangladesh from the viewpoint of disaster risk assessment for nationwide scale are EM-DAT and GLIDE or Disaster Incident Database (DIDB) prepared by DMIC in DDM. Therefore, DIDB since 1970 and records of situation reports since 2007 are reviewed in this section.

(a) Disaster Record by DIDB in DMIC

DMIC which created DIDB has been established under the Comprehensive Disaster Management Programme Phase-II (CDMP-II) of UNDP supported by EC, UK-AID, AUS-AID. DMIC has played as the role of "E-Library" and managed by the Programme Team of UNDP and DDM. As an achievement by DMIC, DIDB has been operated with list of disaster incidents and outline of disaster from 1970 Data. Original list of disaster incidents can be accessed from the website of DMIC (http://www.dmic.org.bd/).

As also explained above, disaster situation reports which are originally published in Bangla Language by the National Disaster Response Coordination Centre (NDRCC) located in the MoDMR based on the preparedness, warning and disaster response information from available source agencies, such as Bangladesh Meteorological Department (BMD) for weather warning and BWDB for water level warning as well as damage reports (SOS-Forms and D-Forms) from local governments, have been collected and recorded (in English) by the DMIC since 2007.

Based on these two (2) available databases or raw information, the characteristics and features of disasters in Bangladesh were reviewed.

a) Summary of Disaster Trend by DIDB

DIDB of DMIC refers to a list of individual disaster information including the date of incident, type of disaster, duration of disaster and rough disaster damage information since 1970.

DIDB has defined disasters into 15 types due to effect and causes of hazard as shown in Table 2.2.2 below.

Table 2.2.2 Types of Disaster in the DIDB

No.	Types of Disaster
1	Cold Wave
2	Earthquake
3	Fire
4	Flash Flood
5	Flood
6	Hail Storm
7	Heat Wave
8	Landslide
9	NorWester
10	River Erosion
11	Soil Loss
12	Thunderstorm
13	Tornado
14	Tropical Cyclone
15	Water Logging
16	Others

The number of total disasters/incidents listed in the DIDB is 118. These disasters can be re-categorized into 10 types in terms of effect and damage by hazard as shown in Table 2.2.3 and Figure 2.2.1.

Table 2.2.3 Reclassification of Disasters in the DIDB

Type of Disaster	No. of Events
Cold Wave / Heat Wave	4
Tornadoes/Nor'Wester	33
Flood / Flash Flood / Water Logging	11
Tropical Cyclone	22
Thunderstorm / Hail Storm	11
River Erosion / Soil Loss	10
Landslide	3
Earthquake	10
Fire	6
Others	8
Total	118

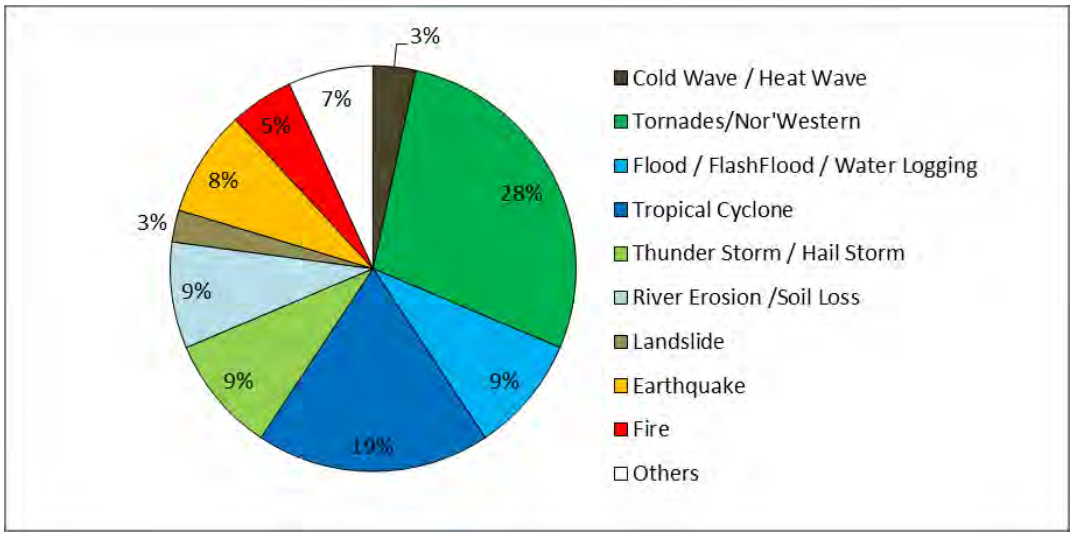


Figure 2.2.1 Percentage/Share of Each Disaster Type in the DIDB

As shown in Figure 2.2.1 above, the number of occurrences of hydro-meteorological disasters have accounted for 80%, or water-related disasters such as Flood/Flash Flood/ Water Logging, Tropical Cyclone, Thunderstorm / Hail storm, and River Erosion / Soil Loss have accounted for 46%. Therefore, hydro-meteorological disasters should first be considered in disaster management activities in Bangladesh.

However, it should be noted that the findings from the DIDB have included the following remarks (See Table 2.2.4).

Table 2.2.4 Remarks about DIDB

Consideration	Specific Issues	Specific Examples
Category of Disaster Type	Categorization of Disasters is vague.	Examples of "Vague" : In case a disaster by Tornado occurs due to NorWester, the type of disaster is categorized into Tornado or NorWester? In case a disaster by heavy rainfall occurs due to cyclone, this type of disaster is "Cyclone" or "Flood"? Recommendation: The classification criteria shall be determined and published.
"Will or Choice" of Disaster Record	Criteria for record / preservation of phenomena are certain.	Examples of "Uncertainty" : Criteria of Record and/or Non-Record are uncertain. In DIDB, there are 40 Events in year 2009 only which accounts for more than 30% of all events. The kind of events to be recorded shall be determined.
Consideration of Intensity of Disaster, such as the number of affected people	Evaluation and/or assessment of hazards and risks cannot be done if only the number of events of disasters are available.	Difficulty of Hazard/Risk Assessment ● DIDB only indicates the number of disasters although damage amount/scale depends on the intensity and vulnerability of hazard.

b) Summary of Situation Reports by DIDB

As described above, DMIC has recorded all of Situation Reports published in English since 2007. DMIC has been updated daily during disasters and/or during conducting disaster relief activities. Hence, DMIC has accumulated and published more than 260 Situation Reports in total. In the Survey, these Situation Reports are also re-organized and summarized as shown in Table 2.2.5. According to records of Situation Reports by DMIC, 29 disasters have occurred in 8 years since 2007.

Table 2.2.5 Summary of Disasters since 2007 by DMIC

No.	Name of Event	Type of Disaster	Month/Year
1	Akash	Cyclone	May 2007
2	2007 Earthquake	Earthquake	Nov. 2007
3	Sidr	Cyclone	Dec. 2007
4	Aila	Cyclone	Jun. 2009
5	Heavy Rain	Landslide	Jun. 2010
6	2010 Monsoon-1	Flood	Jul. 2010
7	2010 Monsoon-2	Thunder/Flash Flood	Jul. 2010
8	2010 Monsoon-3	Flood	Aug.-Sep. 2010
9	2010 Monsoon-4	Flood	Sep. 2010
10	2011 Earthquke	Earthquake	Sep. 2011
11	2011 Deep Depression	Gusty Wind	Oct. 2011
12	2012 Heavy Rain-1	Landslide	Jun. 2012
13	2012 Heavy Rain-2	Landslide	Jun. 2012
14	2012 Monsoon-1	Flood Landslide	Jun.-Aug.2012
15	NorWester	Tornado	Jun. 2012
16	2012 Monsoon-2	Flood	Sep. 2010
17	2012 Monsoon Depression	Rain / Flood	Oct. 2012
18	2012-13 Cold Wave	Cold Wave	Jan. 2013
19	Brahmanbaria NorWester	Tornado	Mar. 2013
20	Brahmanbaria NorWester	Tornado	Apr. 2013
21	Dhaka Building Collapse	Building Collapse	May 2013
22	2013 Nor Wester	Tornado	May 2013
23	Mahasen	Cyclone	May 2013
24	2013 Monsoon	Flood/Erosion/Flash Flood	Sep. 2013
25	2013-14 Cold Wave	Cold Wave	Dec. 2013
26	Rain	Waterlogged	Jan. 2014
27	2014 Monsoon	Inudation	Aug.-Sep. 2014
28	Nepal Earthquake	Nepal Earthquake	Apr. 2015
29	2015 Flash Flood	Flood	Jun. 2015

Original Source: Situation Report in DMIC (http://www.cdmp.org.bd/modules.php?name=Situation, Accessed on June 30, 2015 and arranged by JICA Survey Team

As explained in Table 2.2.4 in the preceding Subsection, the assessment of hazard and/or risk due to disasters should be conducted by taking into account not only "the number of events" but also "intensity of effects" and/or "vulnerability". In the Survey, "the number of affected family/household" indicated in the situation reports for each disaster is paid attention to as intensity of effects of which the number can identify the most affected area/districts by disasters for certain

scale and extents of effect by each disaster. As a result, the ranking of Districts based on the number of affected families/households is shown in Table 2.2.6 below.

Table 2.2.6 Summary of Intensity of Disasters and Affected District Rank based on the Number of Affected Families/Households (Top 20 Districts)

Order	Name of District (Zila)	Location	No. of Affected Families	No. of Dead/Missing
1	Gaibandha	Along Jamna River	445,321	3
2	Bagerhat	Coastal Area	433,526	817
3	Chittagong	Coastal Area	425,132	161
4	Satkhira	Coastal Area	424,325	85
5	Patuakhali	Coastal Area	417,425	694
6	Barguna	Coastal Area	346,392	1,324
7	Barisal	Coastal Area	298,488	106
8	Bhola	Coastal Area	287,098	103
9	Kurigram	Along Jamna River	281,948	1
10	Pirojpur	Coastal Area	265,472	919
11	Jamalpur	Along Jamna River	250,113	3
12	Cox's Bazar	Coastal Area	242,447	144
13	Khulna	Coastal Area	235,953	69
14	Bogra	Along Jamna River	227,321	2
15	Sirajganj	Along Jamna River	208,729	1
16	Jhalokati	Coastal Area	151,191	47
17	Sylhet	North-east Area	148,366	3
18	Shariatpur	Along Padoma River	102,617	17
19	Jessore	South-west Area	97,050	4
20	Madaripur	Near Padoma River	93,707	41

Original Source: Situation Report in DMIC (http://www.cdmp.org.bd/modules.php?name=Situation (Accessed on June 30, 2015 and arranged by JICA Survey Team)

As the first screening to select areas to be considered in the Project, 20 districts as listed in Table 2.2.6 were considered. (See also Figure 2.2.2.)

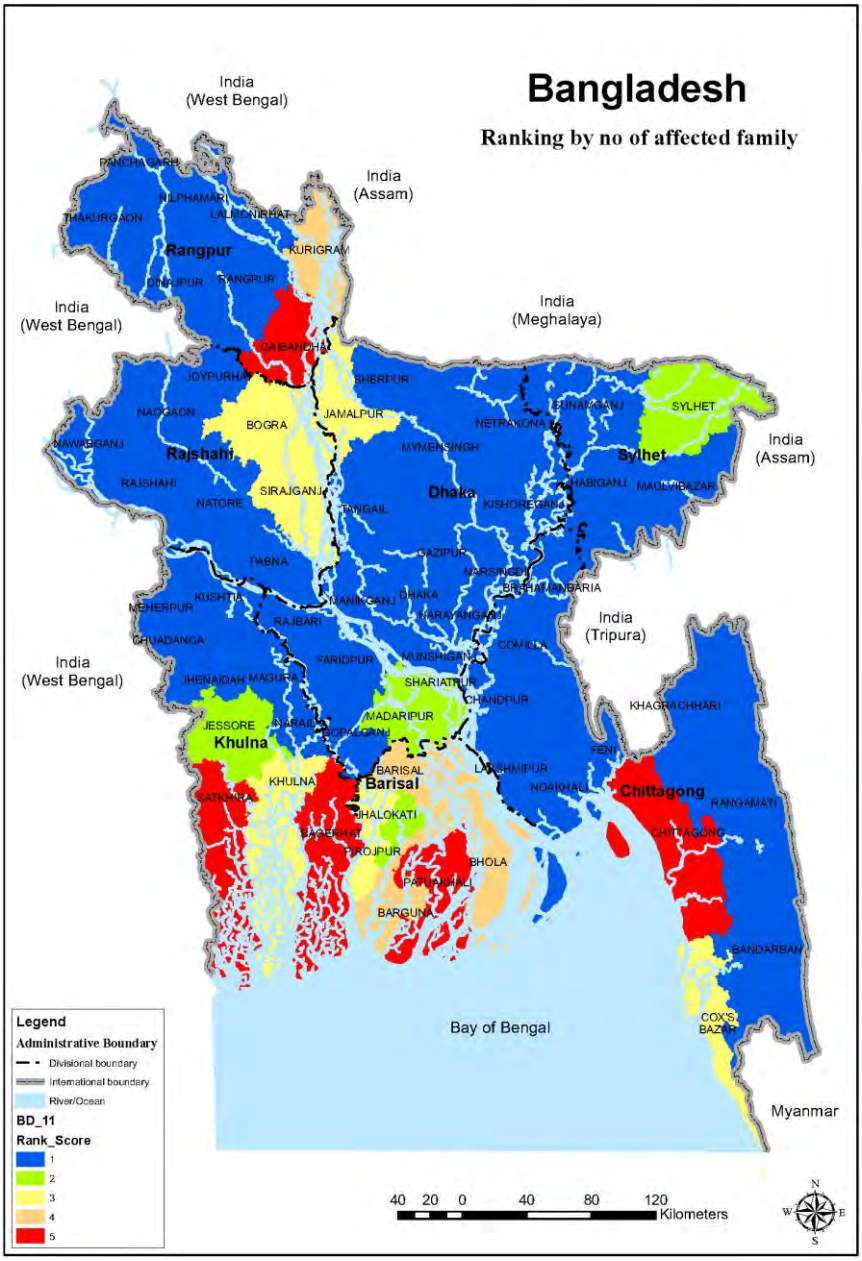


Figure 2.2.2 District Classified according to the Number of Affected Families/Households (5-Point Scale)

Furthermore, the ratio of the total number of affected families/households by type of disaster is as shown in the following table.

Table 2.2.7 Reclassification of the Number of Affected Family/Household by Type of Disasters

Type of Disaster	Affected Family/Household		Dead / Missing	
	Number	Share (%)	Number	Share (%)
Cyclone	3,061,864	49.4	4,458	74.8
Floods and Sediment Disaster due to Rain (Landslides, Slope Failure)	3,122,357	50.4	226	3.8
Others	14,348	0.2	1,274	21.4
Total	6,198,565	100.0	5,958	100.0

Original Source: Situation Report in DMIC (http://www.cdmp.org.bd/modules.php?name=Situation (Accessed on June 30, 2015 and arranged by JICA Survey Team)

The number of dead and missing has been dominated by "Cyclone" (74.8%) due to the huge cyclone disasters by Sidr (2007) and Aila (2009). Subsequently, "Others" followed (21.4%) due to death of more than 1,100 people due to the tragic garment plant building collapse in Dhaka in 2013.

On the other hand, the number of dead and missing people by floods or other disasters due to rain mainly caused by flash flood with high velocity and/or sediment from hilly and steep ground slope is not so high compared to Cyclone although the record of disasters is only 8 years between 2007 and 2015. This reason has also resulted from the characteristics of river flood of which speed of water rising is slow and gradual. The residents along the riverine areas, such as those along the Jamuna and Brahmaputra rivers, were able to evacuate without loss of life even though their livelihood and damages are catastrophic and devastating.

(b) Cyclones in Bangladesh in the Past

According to the reclassification of records of situation reports by DMIC, the characteristics and features of disasters in Bangladesh are as summarized below:

- The dead/missing by disasters have mainly resulted from flash flood or sediment disasters by heavy rain and cyclones including building collapse. In the recent 8 years, cyclone disasters are dominant as the causes of dead and missing; and
- From the viewpoint of the number of affected people, cyclones and floods also account for 99% of the residents and these two types of disasters still have affected the people of Bangladesh.

In this Subsection, the characteristics of Cyclones affecting the people of Bangladesh in terms of both considerations such as threat to lives and livelihoods are described in detail as follows:

a) Damages by Cyclones in the Past

The Indian Ocean regions is one of the major cyclone prone regions of the world. Cyclones are formed and generated every year near the Bengal Bay and storm surge, wind and waterborne disasters frequently affect the coastal areas of Bangladesh. Therefore, lots of affected families/households and dead/missing have been reported.

The number of dead as well as the maximum wind speeds and height of storm surges by each cyclone that hit Bangladesh in the second half of the twentieth century has been reported by the Bangladesh Meteorological Department (BMD), as shown in Table 2.2.8 below.

The recent cyclones that hit Bangladesh (Cyclone Sidr in 2007) has also affected people in 30 districts and severely deteriorated 12 districts as described in the explanation of re-organization of Situation Reports by DMIC. The number of dead and missing due to Cyclone Sidr were 3,363 and 871, respectively, with 55,282 injured. Cyclones are still among the most devastating disasters in Bangladesh.

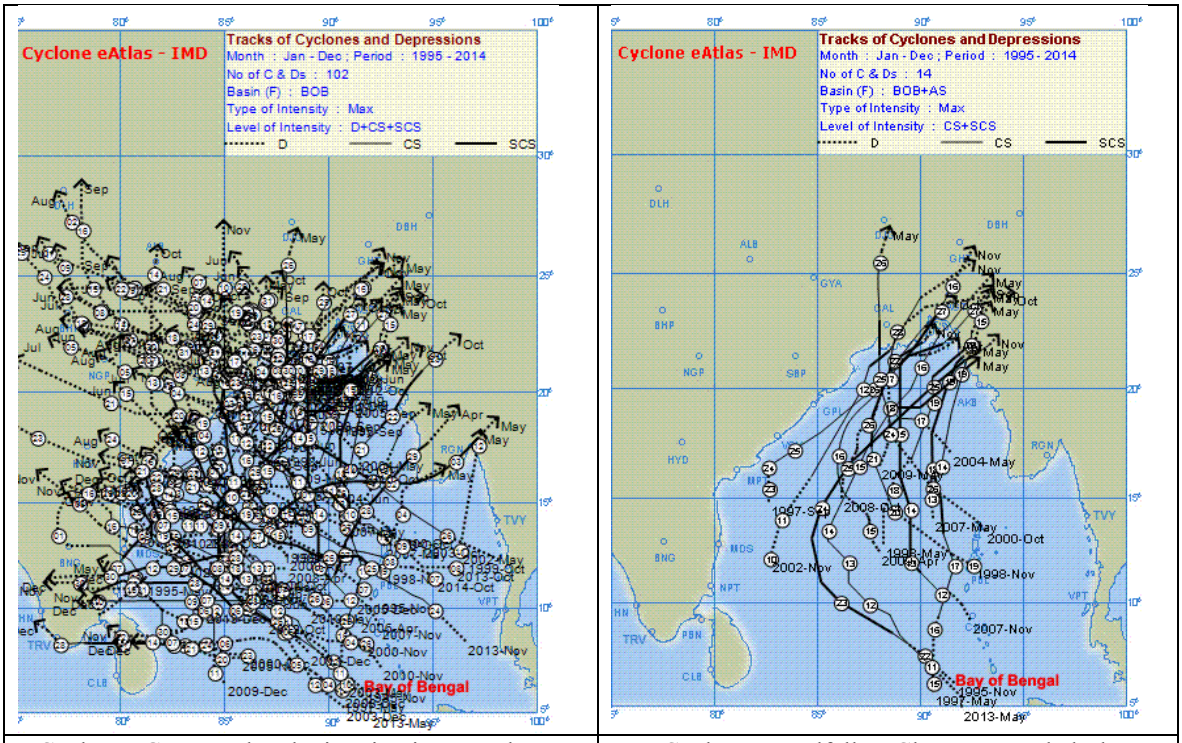
Table 2.2.8 Cyclones the Hit in Bangladesh in the Second Half of the 20th Century

Date of Landfall	Max. Wind (km/hr)	Height of Surge (m)	Dead
1965/5/11	161	3.7-7.6	19,279
1965/12/15	217	2.4-3.6	873
1966/10/1	139	6.0-6.7	850
1970/11/12	224	6.0-10.0	300,000
1985/5/25	154	3.0-4.6	11,069
1991/4/29	225	6.0-7.6	138,882
1997/5/19	232	3.1-4.6	155
2007/11/15	223	6.1-9.1	3,363

Original Source: BMD and arranged by JICA Report (Preparatory Survey (Programme Formulation), March 2010)

b) Frequency of Cyclones

The frequency of cyclones in Bengal Bay has been confirmed from the database service provided by the Indian Meteorological Department (IMD). Cyclones of typical tracks that hit Bangladesh have been generated near low latitudes towards the north-west direction at first, then shifts from north-west to north-east, as shown in Figure 2.2.3.



Cyclones Generated and Direction in Bengal Bay (102 Generated)

Cyclones Landfall or Close to Bangladesh (14 Landfalls)

Source: Cyclone E-Atlas (IMD)

Figure 2.2.3 Cyclones Generated in Bengal Bay during Recent 20 Years (1995 – 2014)

On an average, about 5-6 tropical cyclones are formed in the Bay of Bengal every year, out of which 0.7 may be landfall in or near Bangladesh with huge damages.

2.2.2 Identification of Prioritized Areas and Specific Needs supported by the Project

Through the interviews, analyses, survey and identification of high risk area(s) of disaster damage in Subsection 2.2.1 above, specific needs to be supported under the Project and prioritized areas to be rehabilitated or strengthened in the Project by the GOB side are discussed and reviewed.

(1) Methods for Identifying Prioritized Area(s) through the Survey

Based on the results of understanding under Subsection 2.2.1, methods of identifying prioritized areas(s) are envisioned as shown in the following Figure 2.2.4.

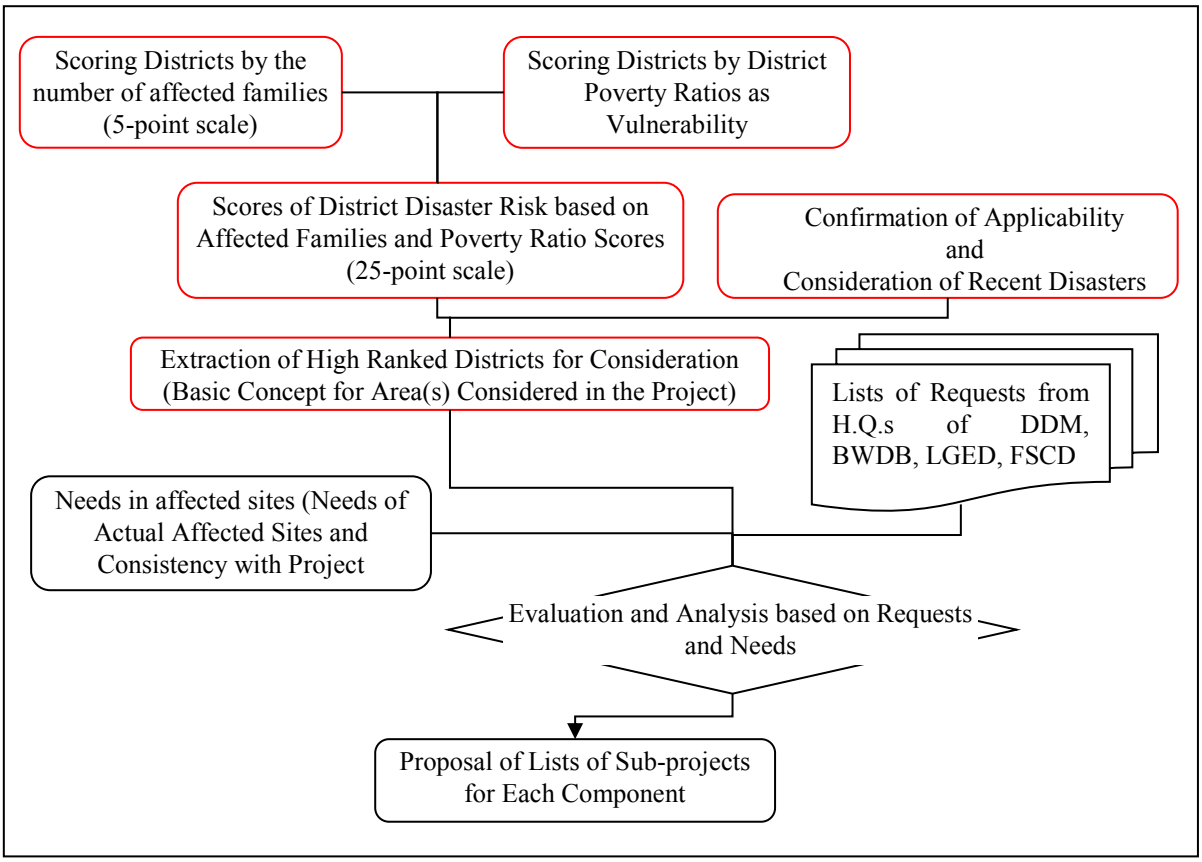


Figure 2.2.4 Method of Identifying Prioritized Areas for the Project

As a basic concept for the selection of prioritized areas for the Project, calculation method of risk index from the number of affected families/households as "Hazard Exposure" and the district poverty ratio as "Vulnerability" of each district is adopted by the reference to world disaster risk index described in annual World Risk Reports published by UNs.

(2) Prioritized Areas (Districts)

(a) High Ranked Districts

In Subsection 2.2.1, all districts have been scored based on the number of affected family/household by the record of situation reports of the DMIC. (5-point score)

On the other hand, all districts are also scored (5-point score) based on poverty ratios [Upper Poverty Line) (Refer to Sibsection 2.3.1 (4)] as shown in Table 2.2.9.

Table 2.2.9 Scoring of Districts for Affected Families by Disaster and Poverty Ratio

Score	Threshold	
	Affected Family/Household	Upper Poverty Line
5	360,000~	51.7 %~
4	270,001~36,000	39.7 ~ 51.6%
3	180,001~270,000	27.7 ~ 39.6%
2	90,001~180,000	15.7 ~ 27.6%
1	0~90,000	3.6 ~ 15.6%

As a result, high ranking disaster risk districts are as given in Table 2.2.10 and indicated in Figure 2.2.5.

Table 2.2.10 Base of Selecting Target Areas/Districts for the Project

Rank	Name of District (Zila)	RiskScore
1	Barisal	20
1	Bagerhat	20
1	Satkhira	20
1	Gaibandha	20
1	Kurigram	20
6	Bhola	12
6	Pirojpur	12
6	Jamalpur	12
9	Patuakhali	10
9	Shariatpur	10
11	Cox's Bazar	9
11	Khulna	9
11	Sirajganj	9
14	Barguna	8
14	Jhalokati	8
16	Madaripur	6
16	Jessore	6
16	Bogra	6
19	Chittagong	5

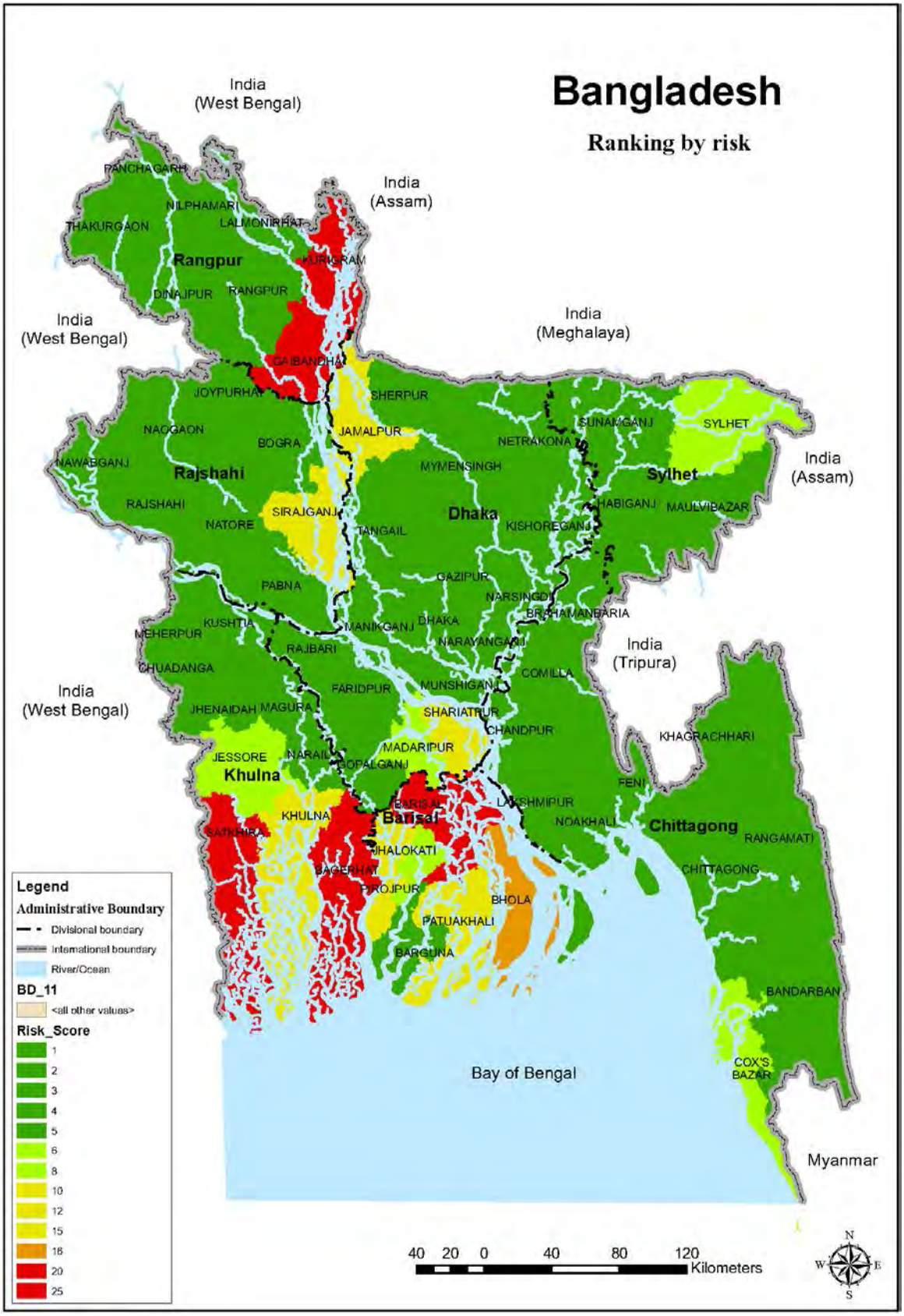


Figure 2.2.5 Districts Highly Ranked by Risk Analysis and to be considered for Selecting Target Areas/Districts for the Project

(b) Target Areas/Districts

Target Areas/Districts mentioned in Table 2.2.10 for selecting sub-projects in each component are more screened or extracted based on the applicability of the Project as follows.

a) Type of Disaster

Taking into account both the intensity of damage or disaster effects; namely, "the number of affected families/households" and "the number of dead/missing", the target areas in the Project may focus on flash flood affected areas or cyclone affected areas as shown in Table 2.2.7 in Subsection 2.2.1.

b) Consideration of Recent Disasters

The deteriorated infrastructures damaged by recent disasters should be considered in consistency with the objectives of the Project. In this connection, situation reports published in DMIC in 2015 should be considered. According to DMIC, disasters are two (2) disasters in 2015; namely, the "Nepal Earthquake" and the "Flash Flood in Chittagong, Bandarban and Cox's Bazar".

c) Final Selection of Target Areas/Districts for the Project

Large-scale scouring of large rivers and massive flooding are excluded from the project target, because the other donors such as ADB and World Bank have the projects to treat these types of disasters. . Final target areas/districts taking into account the type of disaster and affected areas by the recent disaster in 2015. Finally, twelve (12) target areas/districts are selected as shown in Table 2.2.11 and Table 2.2.12.

Table 2.2.11 Final Screening for Target Areas/Districts

Rank	Name of District (Zila)	Risk Score	Type of Disaster		Affected by Recent Disaster	Selection
			Flash Flood	Cyclone		
1	Barisal	20		Y		Selected
1	Bagerhat	20		Y		Selected
1	Satkhira	20		Y		Selected
1	Gaibandha	20				
1	Kurigram	20				
6	Bhola	12		Y		Selected
6	Pirojpur	12		Y		Selected
6	Jamalpur	12				
9	Patuakhali	10		Y		Selected
9	Shariatpur	10				
11	Cox's Bazar	9	Y	Y	Y	Selected
11	Khulna	9		Y		Selected
11	Sirajganj	9				
14	Barguna	8		Y		Selected
14	Jhalokati	8		Y		Selected
16	Madaripur	6				
16	Jessore	6				
16	Bogra	6				
19	Chittagong	5	Y	Y	Y	Selected

Table 2.2.12 Selected Target Areas/Districts

Name of District (Zila)	
Barisal	Cox's Bazar
Bagerhat	Khulna
Satkhira	Barguna
Bhola	Jhalokati
Pirojpur	Chittagong
Patuakhali	Noakhali[2]

2.3 Social and Economic Survey in the Target Area

2.3.1 Social and Economic Condition of the Survey Area

Based on the survey area map (Location Map), the JICA Survey Team conducted a survey in the assumed project area (about ten districts in the Brahmaputra River coastal area and the southern Bangladesh coastal area) based on the existing data and information. Additional study may be conducted when the project area is added or changed.

(1) Population

Table 2.3.1 shows the population, land area and population density of all districts in Bangladesh.

[2] Requested by GOB

Table 2.3.1 Population, Land Area and Population Density of All Districts

Zila	Population (2011)			Area		Population density	
	Total	Share (%)	Population Change 2001-2011(%)	(km2)	Share (%)	(per km2)	Rank
Barisal Division	8,325,666	5.7	1.9	13,297	9	613	
Barguna	892,781	0.6	5.2	1,831	1.2	481	59
Barisal	2,324,310	1.6	-1.3	2,785	1.9	823	45
Bhola	1,776,795	1.2	4.3	3,403	2.3	517	57
Jhalokati	682,669	0.4	-1.7	749	0.5	795	46
Patuakhali	1,535,854	1.1	5.1	3,221	2.2	471	60
Pirojpur	1,113,257	0.8	0.2	1,308	0.9	844	44
Chittagong Division	28,423,019	19.7	17.0	33,771	22.9	831	
Bandarban	388,335	0.3	30.3	4,479	3	86	64
Brahmanbaria	2,840,498	2	18.4	1,927	1.3	1,457	8
Chandpur	2,416,018	1.7	6.4	1,704	1.2	1,404	10
Chittagong	7,616,352	5.3	15.2	5,283	3.6	1,421	9
Comilla	5,387,288	3.7	17.2	3,085	2.1	1,719	5
Cox's Bazar	2,289,990	1.6	29.1	2,492	1.7	913	35
Feni	1,437,371	1	15.9	928	0.6	1,530	6
Khagrachhari	613,917	0.4	16.8	2,700	1.8	225	62
Lakshmipur	1,729,188	1.2	16.1	1,456	1	1,175	14
Noakhali	3,108,083	2.2	20.6	3,601	2.4	853	43
Rangamati	595,979	0.4	17.3	6,116	4.1	97	63
Dhaka Division	47,424,418	32.8	21.5	31,120	21.1	1,502	
Dhaka	12,043,977	8.3	41.5	1,464	1	8,111	1
Faridpur	1,912,969	1.3	8.9	2,073	1.4	901	37
Gazipur	3,403,912	2.3	67.5	1,800	1.2	1,852	4
Gopalganj	1,172,415	0.8	0.6	1,490	1	771	49
Jamalpur	2,292,674	1.6	8.8	2,032	1.4	1,115	18
Kishoregonj	2,911,907	2	12.2	2,689	1.8	1,061	22
Madaripur	1,165,952	0.8	1.7	1,145	0.8	1,004	26
Manikganj	1,392,867	1	8.4	1,379	0.9	1,000	27
Munshiganj	1,445,660	1	11.7	955	0.6	1,487	7
Mymensingh	5,110,272	3.5	13.8	4,363	3	1,156	15
Narayanganj	2,948,217	2	35.6	700	0.5	4,139	2
Narsingdi	2,224,944	1.5	17.4	1,141	0.8	1,930	3
Netrokona	2,229,642	1.6	12.1	2,810	1.9	786	47
Rajbari	1,049,778	0.7	10.3	1,119	0.8	929	34
Shariatpur	1,155,824	0.8	6.8	1,182	0.8	970	30
Sherpur	1,358,325	0.9	6.2	1,364	0.9	978	28
Tangail	3,605,083	2.5	9.6	3,414	2.3	1,046	24
Khulna Division	15,687,759	10.9	6.7	22,272	15.1	699	
Bagerhat	1,476,090	1	-4.7	3,959	2.7	369	61
Chuadanga	1,129,015	0.8	12.1	1,177	0.8	954	32
Jessore	2,764,547	1.9	11.9	2,567	1.7	1,068	21
Jhenaidah	1,771,304	1.2	12.1	1,961	1.3	895	38
Khulna	2,318,527	1.6	-2.5	4,394	3	522	56
Kushtia	1,946,838	1.4	11.9	1,601	1.1	1,207	13
Magura	918,419	0.6	11.4	1,049	0.7	871	41
Meherpur	655,392	0.5	10.8	716	0.5	910	36
Narail	721,668	0.5	3.3	990	0.7	722	52
Satkhira	1,985,959	1.4	6.5	3,858	2.6	511	58
Rajshahi Division	18,484,858	12.9	13.0	18,197	12.3	1,007	
Bogra	3,400,874	2.4	12.9	2,920	2	1,154	16
Joypurhat	913,768	0.6	7.9	965	0.7	942	33
Naogaon	2,600,157	1.8	8.7	3,436	2.3	750	51
Natore	1,706,673	1.2	12.2	1,896	1.3	894	39
Chapai Nawabganj	1,647,521	1.1	15.6	1,703	1.2	960	31
Pabna	2,523,179	1.8	15.9	2,372	1.6	1,053	23
Rajshahi	2,595,197	1.8	13.5	2,407	1.6	1,069	20
Sirajganj	3,097,489	2.2	15.0	2,498	1.7	1,230	11
Rangpur Division	15,787,758	11	14.0	16,317	11.1	960	
Dinajpur	2,990,128	2.1	13.1	3,438	2.3	864	42
Gaibandha	2,379,255	1.7	11.3	2,179	1.5	1,078	19
Kurigram	2,069,273	1.4	15.5	2,296	1.6	893	40
Lalmonirhat	1,256,099	0.9	13.2	1,241	0.8	1,006	25
Nilphamari	1,834,231	1.3	16.7	1,580	1.1	1,152	17
Panchagarh	987,644	0.7	18.1	1,405	1	698	53
Rangpur	2,881,086	2	13.3	2,368	1.6	1,210	12
Thakurgaon	1,390,042	1	14.5	1,810	1.2	762	50
Sylhet Division	9,910,219	6.9	24.8	12,596	8.5	779	
Habiganj	2,089,001	1.4	18.9	2,637	1.8	781	48
Maulvibazar	1,919,062	1.3	19.0	2,799	1.9	679	54
Sunamganj	2,467,968	1.7	22.6	3,670	2.5	666	55
Sylhet	3,434,188	2.4	34.4	3,490	2.4	975	29
Bangladesh	144,043,697	100	15.8	147,570	100	964	

Source: Population Census 2001, 2011 Edited by JICA Study Team

The population shares of the Dhaka and Chittagong divisions are 32.8% and 19.7% respectively, which are higher than the population shares of Barisal and Sylhet divisions which are 5.7% and 6.9 %.

Dhaka Division has the highest population density of 1,502 persons/km^2, while the nationwide average is 964 persons/km^2. Following this, the north-west regions such as Rajshahi and Rangpur divisions have a relatively higher population density. The five districts with the top ten largest population densities belong to Chittagon Division; however, the average population density, which is 831 persons/km^2, is lower than the nationwide average. Barisal Division and Sylhet Division have 613 and 779 persons/km^2, respectively, which are relatively low. (See Table 2.3.1)

Comparing the population of 2011 with that of 2001, the nationwide population growth during this decade is 15.8%. However, it can be seen that there are regional disparities in the growth rates. The population in the Dhaka and Sylhet divisions has highly increased during this decade, it has not increased in the Barisal and Khulna divisions. The population growth of Barisal division, especially, is a very low at the rate of 1.9% in the same period. Figure 2.3.2 shows that upazila wise population change in the Barisal and Khulna divisions has the same tendency. Population has even decreased in many districts in the coastal area (blue/green colored upazilas in the map).

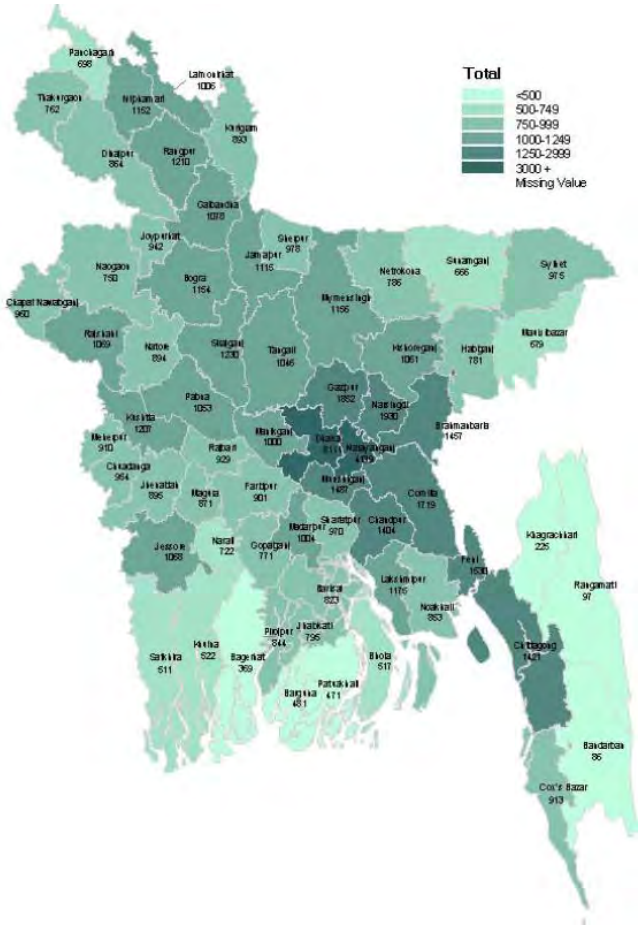
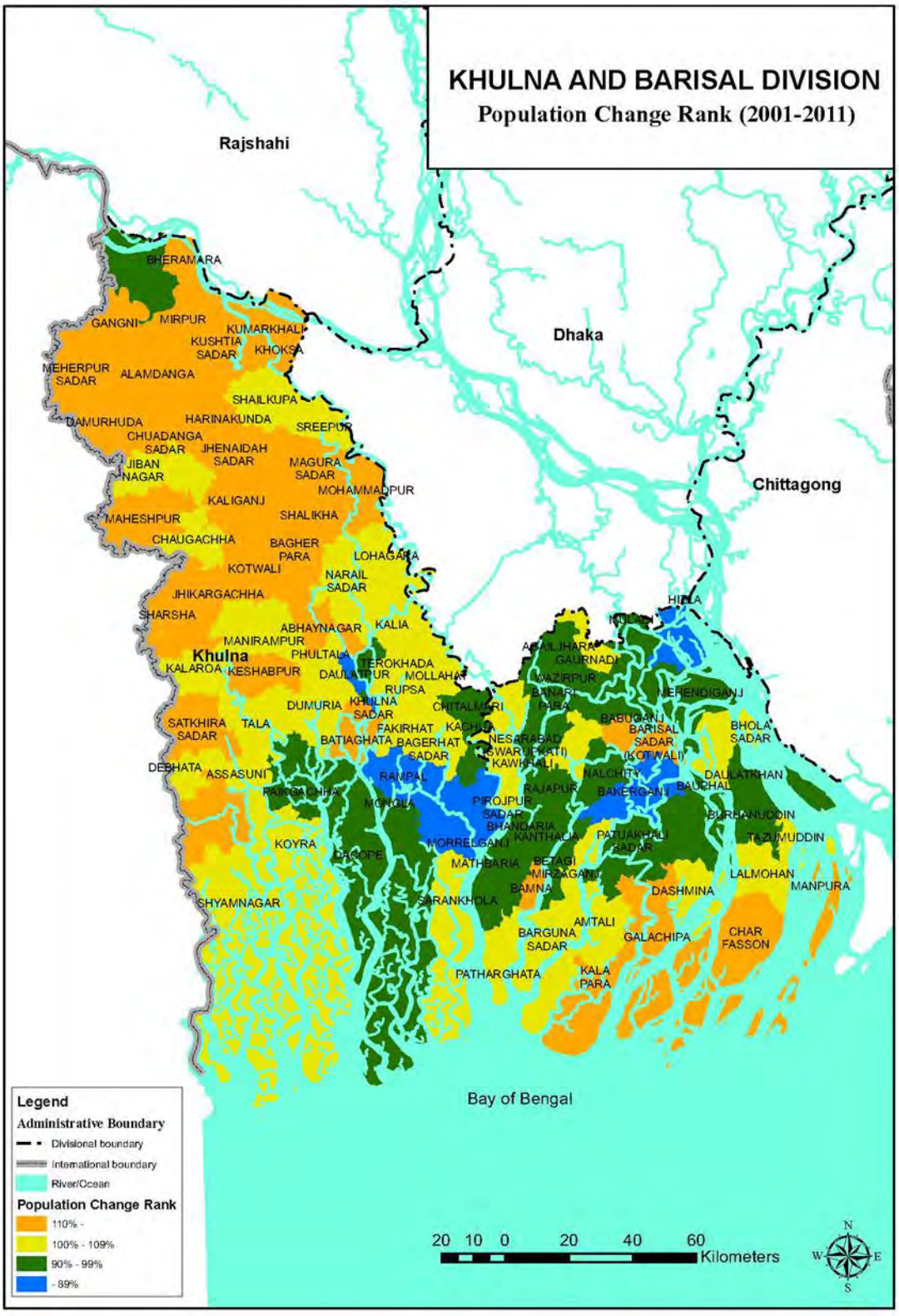


Figure 2.3.1 Bangladesh Population Density Map District-wise (2011)



Source：JICA Survey Team based on Population & Housing Census 2001, 2011 BBS 2013

Figure 2.3.2 Population Change in Khulna and Barisal Division Upazila-wise from 2001 to 2011

(2) Economy and Industries

Table 2.3.2 shows main economic indicators of Bangladesh.

Table 2.3.2 Bangladesh Main Economic Indicator

Major Economic Indicators	2009-10	2010-11	2011-12	2012-13	2013-14(p)
GDP at Current Price (Mill.Tk.)	7,975,387	9,158,288	10,552,040	11,989,232	13,509,204
GDP at Constant Price (Mill.Tk.)	6,070,972	6,463,423	6,884,932	7,298,965	7,745,385
GDP Growth Rate at Constant Price (%)	5.57	6.46	6.52	6.01	6.12
Per capita GDP (In Tk.)	53,961	61,198	69,614	78,009	86,731
Per capita GDP (In US $)	780	860	880	976	1,115
Population (Mill.No.)	147.8	149.7	151.6	153.7	155.8

Note :p denotes provisional Base:2005-06
Source:BBS

The economic status of Bangladesh is summarized as follows:

- Bangladesh economy has developed at a very high growth rate of 5 to 6% every year since 2009.
- GDP at current price is predicted to be 13,509 billion TK and per capita GDP has reached more than US$1,000 in 2013.

Table 2.3.3 shows industrial sector-wise GDP and its growth rate at current prices.

Table 2.3.3 Industrial Sector-wise GDP and Growth Rate at Current Prices

Industrial Origin Sector	Growth Rate (%)					Price (Billion Taka)
	2009-10	2010-11	2011-12	2012-13	2013-14(p)	2013-14(p)
1. Agricuture						
1) AGRICULTURE AND FORESTRY	6.55	3.89	2.41	1.47	2.46	939
a) Crops & horticulture	7.57	3.85	1.75	0.59	1.91	677
b) Animal Farmings	2.51	2.59	2.68	2.74	2.83	133
c) Forest and related services	5.34	5.56	5.96	5.04	5.05	130
2) FISHING	4.6	6.69	5.32	6.18	6.49	275
2. Industry						
3) MINING AND QUARRYING	8.15	3.62	6.93	9.35	5.22	122
a) Natural gas and crude petroleum	8.52	0.68	3.78	7.55	1.74	72
b) Other mining & coal	7.43	9.34	12.58	12.34	10.72	50
4) MANUFACTURING	6.65	10.01	9.96	10.31	8.68	1,445
a) Large & medium scale	6.27	11.11	10.76	10.65	9.16	1,184
b) Small scale	8.17	5.67	6.58	8.81	6.6	262
5) ELECTRICITY, GAS AND WATER SUPPLY	9.97	13.36	10.58	8.99	7.4	109
a) Electricity	10.5	15.82	10.97	9.69	8.16	92
b) Gas	8.78	0.07	7.45	5.91	1.71	11
c) Water	5.79	8.23	10.91	4.75	6.62	6
6) CONSTRUCTION	7.21	6.95	8.42	8.04	8.56	524
3.Service						
7) WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR	5.85	6.69	6.7	6.18	6.57	1,046
8) HOTEL AND RESTAURANTS	6.01	6.2	6.39	6.49	6.7	56
9) TRANSPORT, STORAGE & COMMUNICATION	7.55	8.44	9.15	6.27	6.47	857
a) Land Transport	7.31	7.18	6.83	5.91	6.19	543
b) Water transport	3.19	2.92	3.1	3.21	3.22	60
c) Air transport	18.19	15.23	5.76	-1.64	3.36	9
d) Support transport services, storage	10.33	11.97	17.6	3.36	3.44	49
e) Post and Tele communications	9.02	13.77	16.92	9.67	9.3	196
10) FINANCIAL INTERMEDIATIONS	6.25	10.44	14.76	9.11	9.12	252
a) Monetary intermediation (Banks)	3.15	12.98	17.61	10.87	10.53	211
b) Insurance	19.08	3.69	4.41	0.61	1.79	28
c) Other financial auxilliaries	17.71	-2.54	2.33	3.14	3.5	13
11) REAL ESTATE, RENTING AND BUSINESS ACTIVITIES	3.85	3.88	3.92	4.04	4.24	516
12) PUBLIC ADMINISTRATION AND DEFENCE	8.23	8.84	7.53	6.53	7.06	252
13) EDUCATION	5.18	5.63	7.75	6.3	8.22	169
14) HEALTH AND SOCIAL WORKS	6.83	6.34	3.81	4.76	5.02	138
15) COMMUNITY, SOCIAL AND PERSONAL SERVICES	3.21	3.23	3.25	3.25	3.27	730

Note :p denotes provisional Base:2005-06
Source: BBS

The industrial condition in Bangladesh is summarized as follows:

- As to the industrial sector share of Bangladesh, "Service" comprises 54% of the GDP, followed by "Industry" and "Agriculture (including Forestry and Fishery) with approximate shares of 30% and 16%, respectively.
- The shares of the three industrial sectors have stayed almost at the same level since 2009.
- Regarding the GDP growth rate of each sector, "Industry" has sustained a high growth rate of approximately 9% in recent years. On the other hand, "Agriculture" has been in a downward trend at the rate of about 3% since 2010, although it was more than 6% in 2009. "Service" has sustained approximately 6% every year since 2009.

For the details of each industrial sector, they are as follows:

- The breakdown of "Agriculture" sector reveals that "Crops & Horticulture" comprise the highest share of approximately 56%, followed by "Fishery" with 23% ,"Animal Farming" and "Forest and related services" with 10% each in 2013.
- In the breakdown of the "Industry" sector, the share of "Manufacturing" is the highest of about 66%, followed by "Construction" with about 24%, "Mining and Quarrying", "Electricity, Gas and Water supply" with about 5%, respectively. "Manufacturing" has gradually increased its share of approximately 16% in 2013 from 14% in 2009. Besides that, the share of each industry in the "Industry" sector has been stable at generally the same level. As for the growth rate of each industry "Mining and Quarrying" has increased from 8.15% in 2009 to 10.72% in 2013, which is the highest growth rate in all industrial categories in the year. "Manufacturing" has been continuing its high growth rate in the range of about 7-10%. "Construction" also has been developing highly increasing its growth rate from about 7% in 2009 to 9% in 2013.
- As to the breakdown of the "Service" sector, the share of "Wholesale and Retail Trade" is the highest at about 26% (including car repairs), followed by "Transport, Storage and Communication" with about 21%, "Community, Social and Professional Service" with about 18% and "Real estate, Renting and Business Activities" with 13% and so on. "Financial Intermediation" has been continuing with a high growth rate: for instance, in 2011 when it reached about 15%, and increased its share a bit.

(3) Household Income

Division wise average household income was surveyed in the "Households Income & Expenditure Survey 2010". Table 2.3.4 shows the average household income and its ranking.

Table 2.3.4 Division-wise Average Nominal Household Income (Monthly)

Division	Income (TK)	Rank
Barishal Division	9,158	7
Chittagong Division	14,092	1
Dhaka Division	13,226	2
Khulna Division	9,569	5
Rajshahi Division	9,342	6
Rangpur Division	8,359	8
Sylhet Division	11,629	3
Total (National)	11,479	4

Source:HIES2010

As the above table shows, Chittagong has the highest income of 14,092 TK, the second highest division is Dhaka with 13,226 TK. On the other hand, Rangpur has the lowest income of 8,359 TK, and Barisal has the second lowest at 9,158 TK.

(4) Poverty Ratio

In Bangladesh, the poverty ratio is the head count rate (HCR) of poverty measured by using two different standards which are "Upper Poverty Line" and "Lower Poverty Line". Those two standards are calculated based on the Cost of Basic Need (CBN) method, which defines a level of expenditures necessary cost as a poverty line for covering basic needs such as food (non-food items also included) equivalent to the caloric requirement of a family member of a household. Table 2.3.5 shows the division-wise poverty ratio in 2005 and 2010. A division is divided into two areas which are urban and rural area. The poverty ratio is shown in each area. Changes of poverty ratio from 2005 to 2010 are also noted in brackets in the table.

Table 2.3.5 Incidence of Poverty by Divisions (2005 and 2010)

Lower Poverty Line

Division	2010			2005		
	National	Rural	Urban	National	Rural	Urban
Barisal	26.7 (−8.9)	27.3 (−9.9)	24.2 (−2.2)	35.6	37.2	26.4
Chittagong	13.1 (−3.0)	16.2 (−2.5)	4.0 (−4.1)	16.1	18.7	8.1
Dhaka	15.6 (−4.3)	23.5 (−2.6)	3.8 (−5.8)	19.9	26.1	9.6
Khulna	15.4 (−16.2)	15.2 (−17.5)	16.4 (−11.4)	31.6	32.7	27.8
Rajshahi (Former)	21.6 (−12.9)	22.7 (−12.9)	15.6 (−12.8)	34.5	35.6	28.4
Rajshahi (New)	16.8	17.7	13.2	−	−	−
Rangpur	30.1	30.8	24.0	−	−	−
Sylhet	20.7 (−0.1)	23.5 (1.2	5.5 (−5.5)	20.8	22.3	11.0
National	17.6 (−7.5)	21.1 (−7.5)	7.7 (−6.9)	25.1	28.6	14.6

Upper Poverty Line

Division	2010			2005		
	National	Rural	Urban	National	Rural	Urban
Barisal	39.4 (−12.6)	39.2 (−14.9)	39.9 (−0.5)	52.0	54.1	40.4
Chittagong	26.2 (−7.8)	31.0 (−5.0)	11.8 (−16.0)	34.0	36.0	27.8
Dhaka	30.5 (−1.5)	38.8 (−0.2)	18.0 (−2.2)	32.0	39.0	20.2
Khulna	32.1 (−13.6)	31.0 (−15.5)	35.8 (−7.4)	45.7	46.5	43.2
Rajshahi (Former)	35.7 (−15.5)	36.6 (−15.7)	30.7 (−14.5)	51.2	52.3	45.2
Rajshahi (New)	29.8	30.0	29.0	−	−	−
Rangpur	46.2	47.2	37.0	−	−	−
Sylhet	28.1 (−5.7)	30.5 (−5.6)	15.0 (−3.6)	33.8	36.1	18.6
National	31.5 (−8.5)	35.2 (−8.6)	21.3 (−7.1)	40.0	43.8	28.4

HIES2010 BBS

The table above reveals the following points:

- Poverty ratios are estimated at 17.6% using the Lower Poverty Line, and 31.5% in the Upper Poverty Line at the national level in 2010.
- The poverty ratio in urban areas is generally lower than that of rural areas.
- In the case of the Lower Poverty Line, the poverty ratio in Rangpur is 30.1% which is the highest among all divisions, while the second highest is 26.7% in Barisal, followed by Sylhet with 20.7%.
- The poverty ratio by Lower Poverty Line at the national level has decreased by about 7-8% compared to that of 2005. However, the proportion of reduction varies by division. There have been relatively large reductions in Khulna, Rajshahi and Barisal with the rates of -16.2%, -12.9% and -8.9%, respectively.
- In Barisal and Khulna, the poverty ratio of urban areas is higher than that of rural area.

Poverty ratio at district/upazila level are shown in the following poverty maps (Figure 2.3.3 and Figure 2.3.4) and Table 2.3.6 prepared by the World Bank, BBS and WFP.

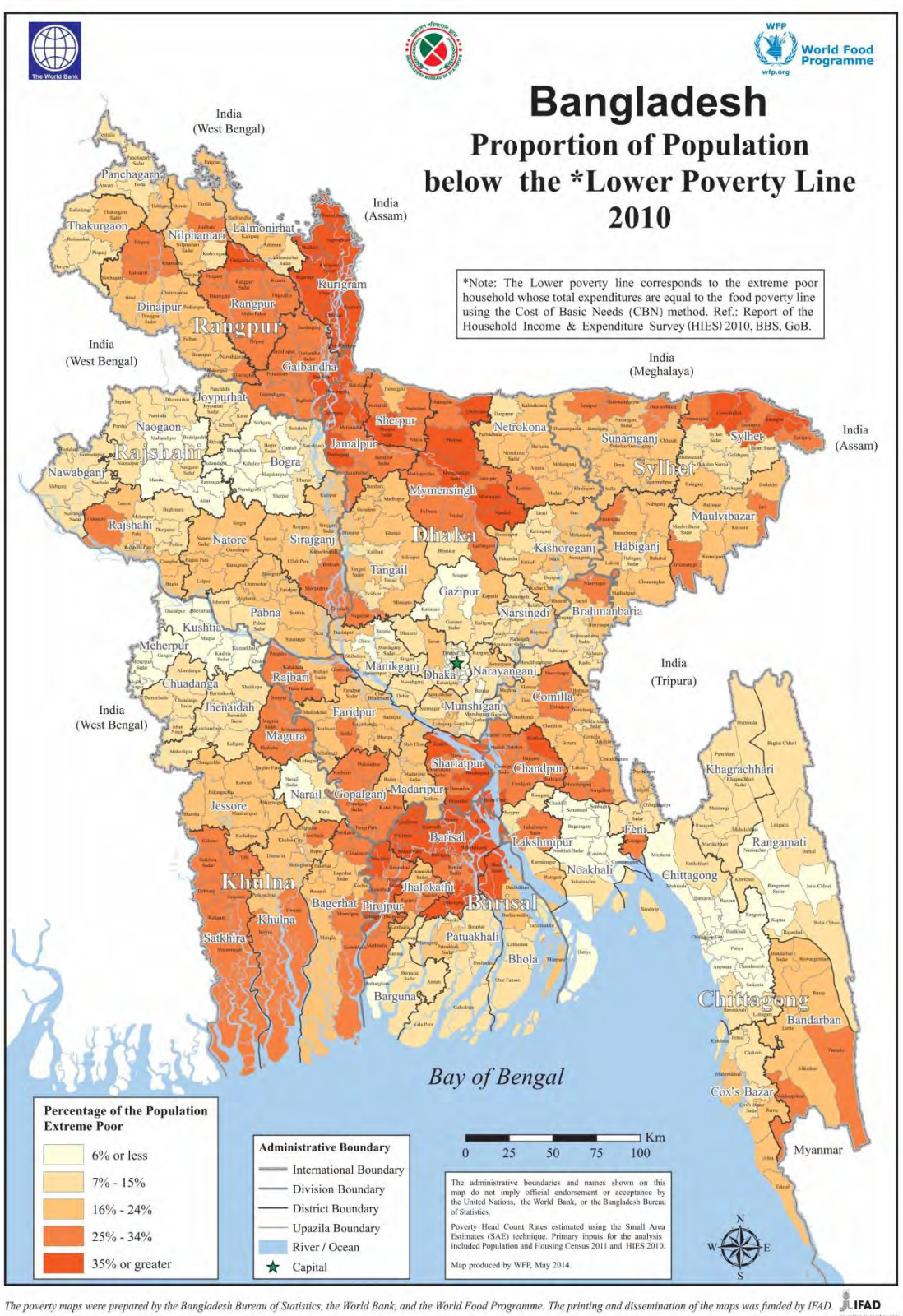


Figure 2.3.3 Proportion of Population below the Lower Poverty Line, 2010

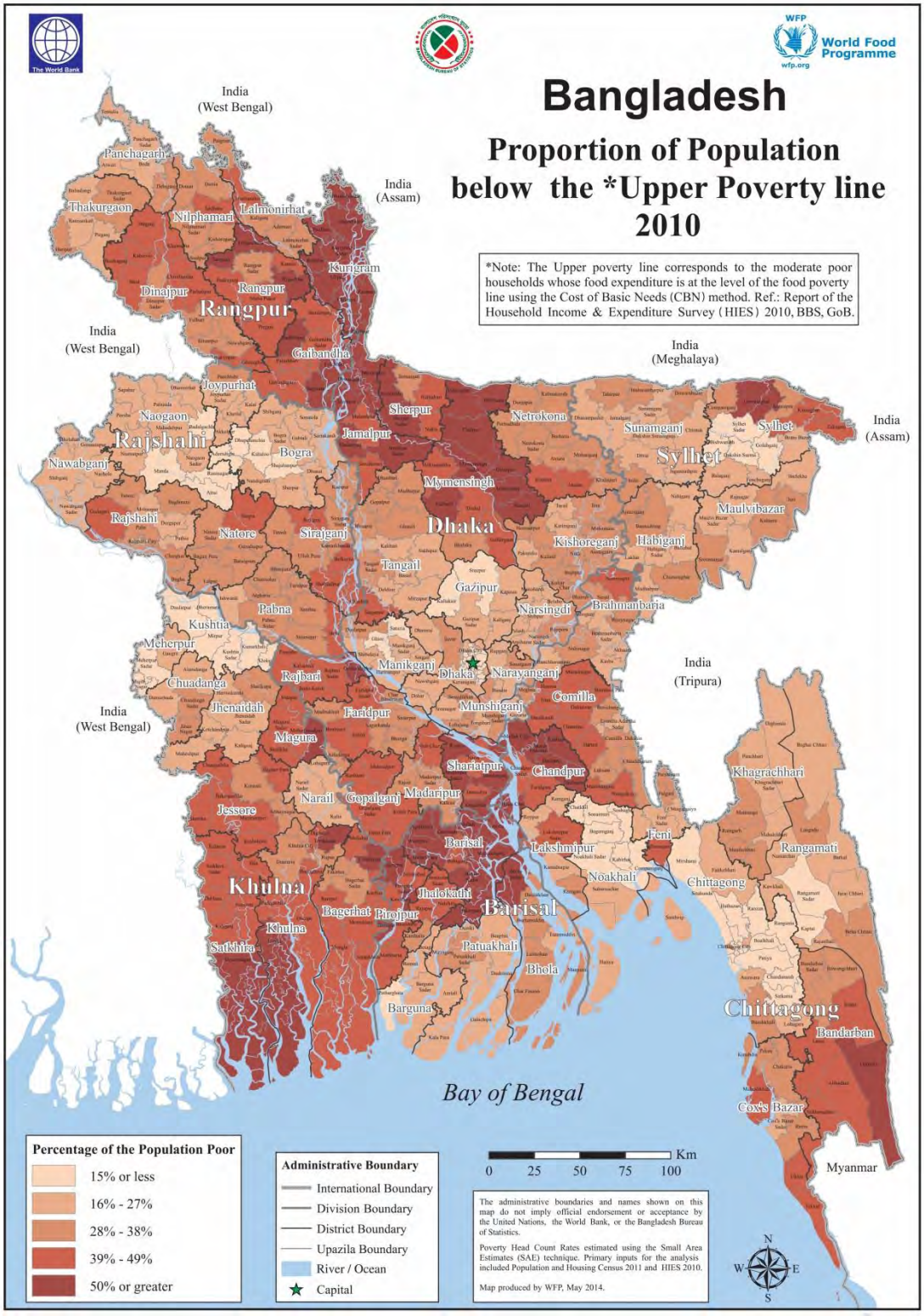


Figure 2.3.4 Proportion of Population below the Upper Poverty Line, 2010

Table 2.3.6 Poverty Ratio Zila and Upazila-wise (2010)

Upazila	No. of Union	Population (2011)	Extream poor (lower povety line)%	Poor (Upper poverty line)%
Bagerhat	75	1,476,000	24.0	42.8
Bagerhat Sadar	10	266,000	18.6	35.9
Kachua	7	97,000	23.6	42.5
Rampal	10	155,000	22.5	41.1
Sarankhola	4	119,000	28.2	48.0
Chitalmari	7	139,000	30.0	50.0
Morrelgonj	16	295,000	27.0	46.5
Mongla	6	137,000	22.7	41.9
Mollahat	7	131,000	26.7	46.1
Fakirhat	8	138,000	19.2	36.4

(5) Poverty and Slow Development Factor

Table 2.3.7 shows a summary of the results of analyses conducted in the "Household Income and Expenditure Survey Report 2010 (HIES2010)" by BBS. Various analyses of poverty were made in the report and they show the characteristics of poverty in Bangladesh.

Table 2.3.7 Summary of Poverty Factors in HIES2010

Factor	Summary of Analysis Results
Household Composition	・HCR of incidence of poverty tends to increase with the increase of household size (number of members in a household) ・HCR of incidence of poverty tends to increase for households whose heads are lower age. ・HCR of incidence of poverty in widowed/divorced households is likely to be very high
Employment	・HCR of incidence of poverty in households whose heads' occupations are "Service" is the highest among the other occupations in 2010. ・The second highest is "Agriculture" with almost the same level as "Service" in 2010,although "Agriculture" was the highest in 2005
Land Ownership	・Land owning households tend to have lower poverty ratio ・However landless households tend to have lower poverty ratio than households which own lands but a little bit.
Education	・HCR of incidence of poverty in households falls in inverse proportion to the education level of those households.

Source: JICA Study Team based on HIES2010

In the same way, according to the report "Bangladesh Poverty Assessment: Assessing a Decade of Progress in Reducing Poverty 2000-2010" prepared by the World Bank in 2013, poverty analysis in terms of demographic characteristics and educational attainment shows the standard correlations; namely, households that are poor tend to: (1) be larger in size; (2) have higher dependency ratios; (3) have a greater number of children; (4) be headed by individuals who are nearly three years younger than non-poor households; and (5) be headed by individuals with no education.

On the other hand, in the same report, the factors of high poverty ratio are mentioned, especially in Rangpur Division. The poverty ratio in Rangpur in 2010 is higher than the nation's average in 2005, suggesting that Rangpur is at least five years behind in terms of poverty reduction relative to the rest of the country. This is because there is seasonal poverty and hunger, or Monga, observed in Rangpur. Due

to its severity, this seasonal phenomenon which lasts about three months, from September to November, has important consequences for livelihoods and well-being. Some of the major reasons for Rangpur's comparative disadvantages are:

- Inadequate investment in infrastructure, including electricity, resulting in a non-diversified rural economy and limited opportunities for off-farm employment.
- Low crop yields due to poor soil quality (for example, soil salinity).
- A high proportion of landless households that depend on wage-labor income.
- Low wage rates for both male and female agricultural day labourers.
- Risk of floods and river erosion.
- Livelihood vulnerability of people living in char areas, consisting of reclaimed land from rivers and including tiny island-like fragments.
- Poor inflows of remittances from migrant family members working in the country or abroad.

2.3.2 Features of Disaster and Emergency Response

(1) Past Disaster Cases

Table 2.3.8 shows past major cyclonic storms and brief description about damages and losses caused by the cyclonic storms in Bangladesh, while Table 2.3.9 shows the year-wise percentage of area inundated by floods in Bangladesh against the total national land area.

Table 2.3.8 Disaster-Related Data and Materials to be reviewed in the Survey

Date of occurrence	Landfall Area	Maximum Wind Speed in kph.	Tidal Surge Height in ft	Central Pressure (mbs)	Loss/ Damage
1960/10/11	Chittagong	160	15	-	People Killed = 3000
1960/10/31	Chittagong	193	20	-	People Killed = 5149
1961/5/9	Chittagong	160	8-10	-	People Killed = 11468
1961/5/30	Chittagong (NearFeni)	160	6-15	-	Damage report not available.
1963/5/28	Chittagong-Cox's Bazar	209	8-12	-	People Killed = 11520 Home stead lost = 1000000
1965/5/11	Chittagong-Barisal Coast	160	12	-	People Killed = 17279
1965/11/5	Chittagong	160	8-12	-	People Killed = 873
1965/12/15	Cox's Bazar	210	8-10	-	Great loss of lives Fishermen missing = 1000
1966/11/1	Chittagong	120	20-22	-	People Killed = 850
1970/10/23	Khulna-Barisal	163	Maderate	-	No heavy damage report received.
1970/11/12	Chittagong	224	10-33	-	People Killed= 200000(officially)
1974/11/28	Cox's Bazar	163	9-17	-	People Killed = 20, People wounded = 50 People missing = 280
1981/12/10	Khulna	120	7-15	989	People Killed = 72
1983/10/15	Chittagong	93	-	995	People Killed = 43 Fishermen missing = 100
1983/11/9	Cox's Bazar	136	5	986	Fishermen missing = 300
1985/5/24	Chittagong	154	15	982	People Killed = 4264, People missing = 6805, Affected area = 1906 sq.miles People affected = 1310935, Damaged to crops in acres = 132860 House damaged fully = 90915, House damaged partly = 34611 Livestock lost = 135033, Road damaged = 40 miles Embankment damaged fully = 53 miles, Embankment damaged partly = 189 miles
1988/11/29	Khulna	160	2-14.5	983	People Killed = 6133 (Bangladesh & India) People missing = 6000, Crops damaged = 940 crores(Taka)
1990/12/18	Cox's Bazar Coast	115	5-7	995	Damage report not available.
1991/4/29	Chittagong	225	12-22	940	People Killed = 138882, People wounded = 1390540 No. of affected Population = 10798275 Damage to crops fully = 133272 acres Damage to crops partly = 882705 " No.of house destroyed fully = 819608, partly =882705
1994/5/2	Cox's BazarTeknaf Coast	278	5-6	948	People Killed = 188, Affected people = 416000 Totally damaged dwelling houses = 45000, Partially " = 62677 Cattle & livestock = 7890, Crops lost (totally) = 21167 acres Crops lost (partially) = 33862 acres Barrage damaged = 126kms , Roads & Highways damaged= 350kms
1995/11/25	Cox's Bazar	140	10	998	Damage report not available.
1997/5/19	Sitakundu	232	15	965	People Killed = 155, People wounded = 9663, People affected = 2835472 Livestock killed = 3118, Houses damaged (fully) = 112160 Houses damaged(partly) = 99557, Crops damaged(fully) = 19173 acres Crops damaged(partly) = 78160 acres, Roads damaged (fully) = 53 kms Roads damaged (partly) = 162kms, Embankment damaged = 6km Bridge & Culverts damaged = 165
1997/9/27	Sitakundu	150	10-15	-	People Killed =78, People missing = 222, People affected =2015669 People wounded = 2396, Houses damaged (fully) = 51435, Houses damaged(partly) =163352, Crops damaged(fully) =16537 acres Crops damaged(partly) =72662 acres, Bridge & Culverts damaged =85 Roads damaged (fully) =218 kms, Roads damaged (partly) =2379ms Embankment damaged=280km
1998/5/20	Chittagong Coast near Sitakundu	173	3	-	People Killed = 14, People wounded = 100, Fishermen missing = 100 Houses damaged = 10000
1999/10/17	Orissa Coast	-	-	-	No causalities was reported in Bangladesh
1999/10/25	Orissa Coast	-	-	-	No causalities was reported in Bangladesh
2000/10/28	Sundarban coast near Mongla	50 - 60 kph	2-4 ft	-	People killed =3, Fishermen reported missing =Abot 250 Houses reported damage = 3,000
2001/10/16	Andhra coast	65-85 kph	-	996 hpa	-
2002/11/12	Sundarban coast near Raimangal river	65-85 kph	5-7 ft	998 hpa	People killed =2, Fishermen reported missing = About180 Houses reported damage = 1,000
2003/5/20	Myanmar coast	65-85 kph	3-5 ft	-	No causalities was reported
2003/12/16	Andhra coast	98-115 kph	-	992 hpa	No causalities was reported
2004/5/19	Cox's Bazar - Akyab Coast	65-90 kph	2-4 ft	990 hpa	26 small boats with fishermen were reported missing
2007/11/15	Khulna-Barisal Coast near Baleshwar River	223	15 ft	942 hpa	People Killed = 3363, People wounded = 55282, Missing People = 871 People affected = 8923259, Families affected = 2064026 Livestock killed = 1778507, Houses damaged (fully) = 564967 Houses damaged(partly) = 957110 ,Crops damaged(fully) =743321acres Crops damaged(partly) = 1730316 acres, Roads damaged (fully) = 1714 kms Roads damaged (partly) = 6361 kms, Embankment damaged = 1875 kms Bridge & Culverts damaged = 1687
2009/5/25	West Bengal-Khulna Coaast near Sagar Island	70-90	4-6	987	-

Source: Bangladesh Meteorological Department

Table 2.3.9 Year-wise Percentage of Area Inundated by Flood in Bangladesh

Year	Flood Affected area		Year	Flood Affected area		Year	Flood Affected area	
	Square KM	% of area inundated		Square KM	% of area inundated		Square KM	% of area inundated
1954	36,800	25	1975	16,600	11	1995	32,000	22
1955	50,500	34	1976	28,300	19	1996	35,800	24
1956	35,400	24	1977	12,500	8	1998	1,00,250	68
1960	28,400	19	1978	10,800	7	1999	32,000	22
1961	28,800	20	1980	33,000	22	2000	35,700	24
1962	37,200	25	1982	3,140	2	2001	4,000	2.8
1963	43,100	29	1983	11,100	7.5	2002	15,000	10
1964	31,000	21	1984	28,200	19	2003	21,500	14
1965	28,400	19	1985	11,400	8	2004	55,000	38
1966	33,400	23	1986	6,600	4	2005	17,850	12
1967	25,700	17	1987	57,300	39	2006	16,175	11
1968	37,200	25	1988	89,970	61	2007	62,300	42.21
1969	41,400	28	1989	6,100	4	2008	33,655	22.80
1970	42,400	29	1990	3,500	2.4	2009	28,593	19
1971	36,300	25	1991	28,600	19	2010	26,530	18
1972	20,800	14	1992	2,000	1.4	2011	29,800	20
1973	29,800	20	1993	28,742	20	2012	17,700	12
1974	52,600	36	1994	419	0.2	2013	15,650	10.6

Source: Flood Response Preparedness Plan of Bangladesh, June 2014, DDM, MoDMR

As for the upazila-wise status of flood occurrences, the Bangladesh Meteorological Department provides information about the occurrences of storm and river erosion for every upazila. Table 2.3.10 shows the occurrences in Kurigram district as an example.

Table 2.3.10 Upazila-wise Occurrence of Storm and River Erosion

Zila	Upazila	No. of Union	Storm				River Erosion				Area (km2)
			2008	2009	2010	2011	2008	2009	2010	2011	
Kurigram	Bhurungamari	10	○	○	○	○	○	○	○	○	236.26
	Char Rajibpur	3	○	○	○	○	○	○	○	○	111.03
	Chilmari	6	×	○	○	○	○	○	○	○	224.96
	Phulbari	6	○	○	○	○	○	○	○	○	156.61
	Kurigram Sadar	8	×	×	×	×	○	○	○	○	276.43
	Nageshwari	14	×	×	×	×	○	○	○	○	417.56
	Rajarhat	7	○	○	×	×	○	○	×	×	166.64
	Raumari	5	×	×	×	×	○	○	○	○	197.03
	Ulipur	13	○	×	×	×	○	○	○	○	458.48

Source: District Statistic Book, 2013

(2) Emergency Response

As regards emergency response to damage caused by past disasters, it can be confirmed from the assessment reports for large scale cyclones in recent years.

According to the assessment report "Cyclone AILA Joint UN Multisector Assessment & Response Framework" prepared by the UN, the emergency response of the Bangladesh Government to Cyclone Aila was a predominantly resourced relief effort. Apart from that, the Government also undertook some emergency repair of embankments to stop seawater inundation, particularly, during high tide as a safety net program of "Cash for Work". Meanwhile, in the agriculture sector, the Department of Agriculture Extension (DAE) provided several kinds of cereal seed and fertilizer to affected farmers. On the other hand, the Government has not provided any support to the fisheries or livestock sectors.

Following Cyclone Aila, the Government of Bangladesh did not make an international appeal, or any formal request for external assistance; the emergency response was initiated predominantly by the government. However, although there was an absence of a formal appeal, the international community provided assistance to a number of international and national organizations and government agencies working in the most affected areas. Table 2.3.11 shows a summary of the government assistance and Table 2.3.12 shows a summary of international donor assistance.

Table 2.3.11 Summary of Government of Bangladesh Assistance

Item	Amount	Status
Gratuitous Rice	36,500 MT	Completed
Cash Grants	1,288 Lakh	Completed
Shelter Grants (cash)	3,002 Lakh	Completed
Food Assistance (VGF)	7,649.6 MT	Ongoing
Agriculture Spport (crop)	3,497 Households	Completed

Souce: Bangladesh Poverty Assessment 2013, WB
Original Souce: Relief Division DMB, 21 April 2010 & DAE Upazila Officers, 26 May 2010

Table 2.3.12 Summary of International Donor Assistance

Donor	Amount (USD)	Sector(s)/Activity(ies)
ECHO	11.93 million	Food Assistance, Health & WASH Shelters
EU	6.63 million	NFIs, Settlement Support (through IOM)
DFID	1.58 million	Livelihoods & WASH
Government of Spain	0.66 million	Food Assistance (through WFP)
WFP	18.5 million	Food Assistance
UNICEF	1.5 million / 0.54 million / 0.75 million	WASH/Education/Health/Nutrition
FAO	0.5 million	Agriculture
UNDP	0.25 million	Livelihoods
WHO	0.1 million	Emergency Meidcine & WASH
TOTAL	44.25 million	

Date: 26 May 2010

According to the assessment report, families affected by flood inundation took refuge at the top of relatively high land such as dikes and roads, and lived in a situation like slum. Some displaced families moved to rural or urban areas to avoid unstable refuge life. Families displaced by Cyclone Aila counted 76,278, and 25,928 families were forced to take such refuge life in uncomfortable surroundings. At Koyra Upazila, Khulna District, about 40,000 people moved. At Koyra Upazila and Dacope Upazila, Khulna District, and Shyamnager Upazila and Assuasuni Upazila, Satkhira District, it was reported that 14,000 families were forced to take such refuge life during monsoon season.

Table 2.3.13 Number of Families lived on Embankments after Cyclone Aila in Khulna and Satkhira

District	Upazila	Union	No. of Families on Embankments
Khulna	Koyra	Dakkin Bedkhashi	893
		Koyra Sadar	315
		Maheshwaripur	820
		Uttar Bedkhashi	179
		Bagali	132
		Moharapur	470
	Dacope	Kamarkhola	2,865
		Sutarkhali	4,840
		Sub-Total	**10,514**
Satkhira	Shyamnagar	Gabura	1,000
		Padmapulur	1,200
	Assasuni	Protapnagar	600
		Assasuni Sadar	400
		Siruil	200
		Sub-Total	**3,400**
		TOTAL	**13,914**

Source: Bangladesh Poverty Assessment 2013 WB

(3) Land Use Control in the Area Affected by Natural Disaster

The Land Use Plan is to be stipulated as a chapter in the Master Plan of the City Cooperation and Pourshava based on the Pourshava Act, 2009. The current Master Plan indicates goals and objectives at the year 2030, optimizing the existing land use to make a balanced development between existing and future needs without disturbing the natural environment. The activities of building and land development are to be controlled by the Land Use Plan. (Refer to Figure 2.3.5 for the Actual Land Use Plan.)

The area of river have been designated as open space that were restricted to use as embankment, river bank, ecological park and the installation of monument while there is no land use classification being equivalent to the river zone and the coastal zone in Japan. The construction of buildings is supposed to not allowed in the open space.

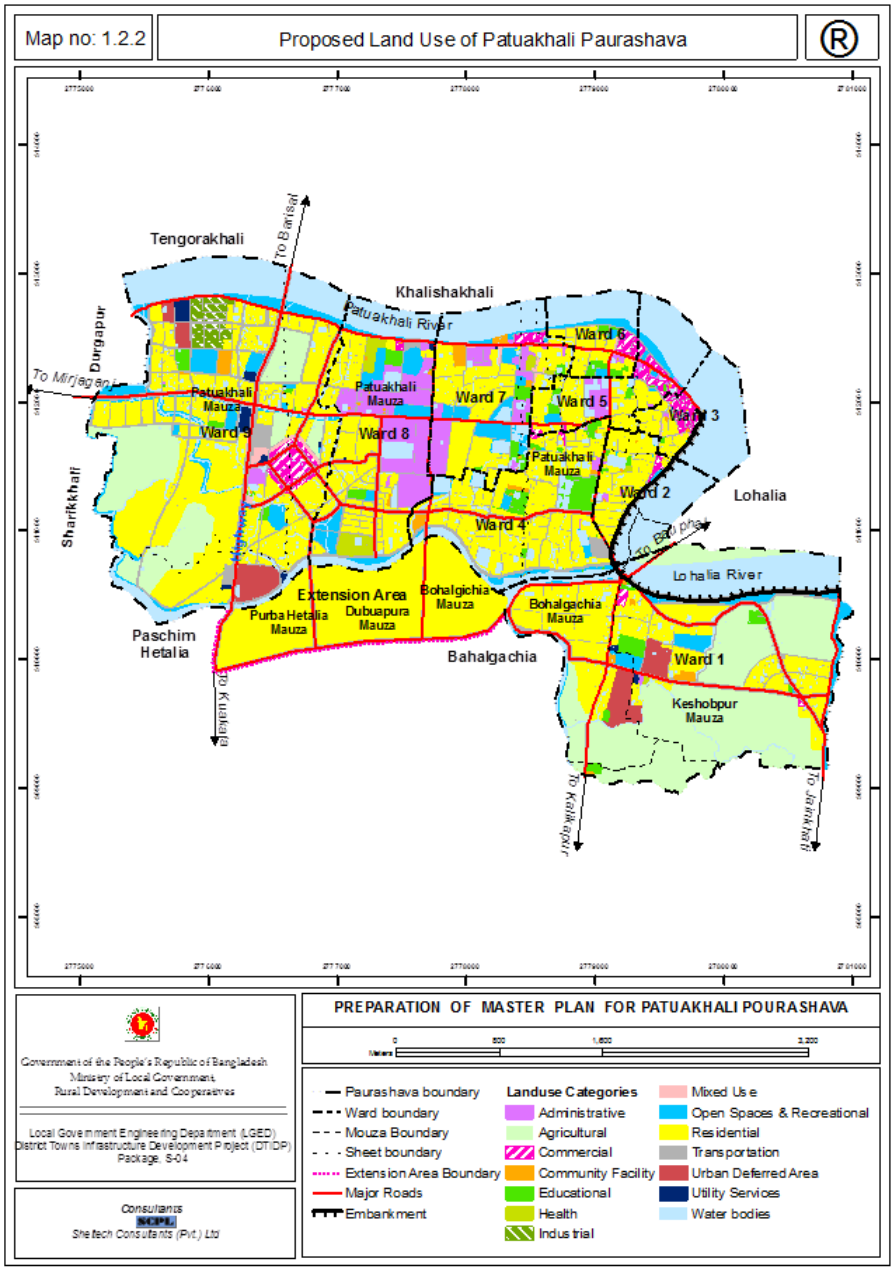


Figure 2.3.5 An Example of Land Use Plan: Patuakhali Paurshava (Under Process)

CHAPTER 3. COMPONENT 1: CIVIL WORKS AS DISASTER RISK REDUCTION

3.1 Technical Assessment of Existing Damaged Infrastructure and Operation and Maintenance

Embankment (dikes), roads, and bridges in the coastal area are very important basic infrastructure in view of disaster risk management cycle. Embankments are disaster prevention facilities to protect the coastal area from high tides. Roads and bridges play an important role for quick and smooth emergency rescue and relief. In case these structures are damaged by natural disaster, recovery and rehabilitation shall be implemented as soon as possible.

Technical specifications of these structures for construction are set by each implementing agency, taking into account the disaster-prone characteristics of Bangladesh. However, there exist many infrastructures damaged by natural disaster in the past. Therefore, in order to formulate an appropriate project facility planning, the JICA Survey Team conducted site surveys to identify and evaluate the damage conditions of existing infrastructures including sorting and analysing important technical points to be taken into consideration during rehabilitation or reconstruction works aimed at mitigating disaster risks and addressing disasters. Site surveys have been conducted several times at the 11 districts (Sathkhira, Khulna, Bagerhat, Pirojpur, Jhalokati, Patuakhali, Barguna, Bhola, Barisal, Chittagong, and Cox's Bazar) except Noakhali among the 19 target districts between June and July 2015. Regarding the target districts, considering the necessity of recovery and rehabilitation of infrastructure damages by past natural disasters, location is set to 19 districts.

In addition, it is important that operation and maintenance be carried out adequately and timely to ensure sustainable use of the facilities after implementation of the Project. However, in many cases, substantial backlog of maintenance exists due to budgetary, staffing and equipment constraints. Therefore, the JICA Survey Team investigated the appropriate operation and maintenance methods, analyse current conditions, and propose effective trainings, capacity building, etc., to be conducted within the Project as the need dictates.

3.1.1 Bridges

(1) Target Bridges

The southern coastal zone of Bangladesh suffers from floods almost every year causing immense damage to bridge infrastructure, often making it impassable to traffics. This is one of the reasons causing delay in the development of bridges in these areas.

The Government of Bangladesh has put effort in the development of bridges in accordance with the priority set in the "Master Plan Study for Portable Steel Bridge Construction on Feeder and Rural Roads". As a part of such effort, 76 bridges were constructed on rural roads from the superstructure material provided under the Grant Aid assistance of Japan through, "The Project for Provision of Portable Steel Bridges on Upazila and Union Roads".

Similarly, bridges and box culvert spanning 1,200m have been constructed in nine (9) areas (excluding Chittagong, Cox's Bazar and Noakhali Districts)of the objective coastal area, under the World Bank assistance (Emergency 2007 Cyclone Recovery and Restoration Project, ECRRP). Furthermore, about 8,300m in total length has been provided in the same nine (9) areas through the" Southwest Rural Development Project" in ECRRP under Japanese ODA loan.

Nevertheless, significant numbers of bridges, including replacement of heavily damaged bridges is still required to be provided in these areas. According to LGED, the number of locations where a bridge/culvert is required reaches to more than four hundred (400).

This project aims to undertake rehabilitation orreconstruction of damaged bridges in these areas. Survey has been conducted of such bridges. The bridges selected for the survey were those that were recommended by the LGED and were not undertaken in other projects mentioned above. These bridges were selected from those that were damaged in the past water-induced disasters and need urgent rehabilitation or those that are vulnerable to such disasters in future and need urgent rehabilitation.

(2) Survey Method and Items

Site survey was conducted on the 13 identified existing bridges and their conditions were checked using the inspection sheet shown in Figure 3.1.1. Items such as bridge type, construction year, dimensions, pavement type/condition, materials used (re-bars, concrete, aggregates, etc.) including the condition, scale and causes of the damage were examined.

BRIDGE INSPECTION SHEET June 15, 2015 Weather: Rain Sheet No: BR-1

1. District: Bagerhat		**2. Upazila:** Morrelgonj		**3. Location (GPS):**	N 22d 38m 22s E 89d 48m 48s
4. Road Name or Code: Patuakhali- Aila Upazila Road				**5. Classification:** Upazila Road	
6. Bridge Name: N/A		**7. Bridge Type:**	Superstructure: RC, Metal, Wooden, Bricks, Bamboo Substructure : RC, Metal, Wooden, Brick, Bamboo		
8. Dimension:	Length= 36 (m) , Span = 9 (span length= 4 m) , Width = 2.0 (m)				
9. Pavement:	Wooden Plank (Bridge surface), Brick HBB (Road)				

10. Damages/Condition		**NO**	**LITTLE**	**MEDIUM**	**HIGH**	**EXTREME**
Metal	Corrosion					YES
	Cracks				YES	
	Deflection			YES		
	Detachment					
	Broken		YES			
Concrete	Cracks		YES			
	Abrasion			YES		
	Missing Parts		YES			
Others	Surface Distress			YES		
	Hand rails broken		YES			
	Joints	YES				
	Shoe condition	YES				
	Vibration					YES
	Erosion			YES		
	Scouring		YES			
	Inclination	YES				
	Others if any	• Portion of RC slab washed away during cyclone • Joins Union Councils and is important for access of locals to shelters.				
EVALUATION		Replacement recommended at early stage				

Sketch, Location or Pictures

Source: JICA Survey Team

Figure 3.1.1 Example of Inspection Sheet

(3) Identification of Surveyed Bridges

Site survey has been conducted in eleven (11) out of nineteen (19) target districts. Figure 3.1.2 indicates the locations/sites. The candidate sites were those listed by the LGED-District offices or LGED-Upazila offices. Thirteen (13) bridges recommended by LGED-District offices or LGED-Upazila offices were surveyed. These bridges, which LGED says are either damaged by past disaster(s) and had undergone temporary rehabilitation but still continue to be in a vulnerable state, and/or those that are deemed to be in a state of high vulnerability and could be damaged by water induced disasters in the near future. It is to be noted that one of the bridges among the thirteen (13) surveyed is a causeway in Cox's Bazar District

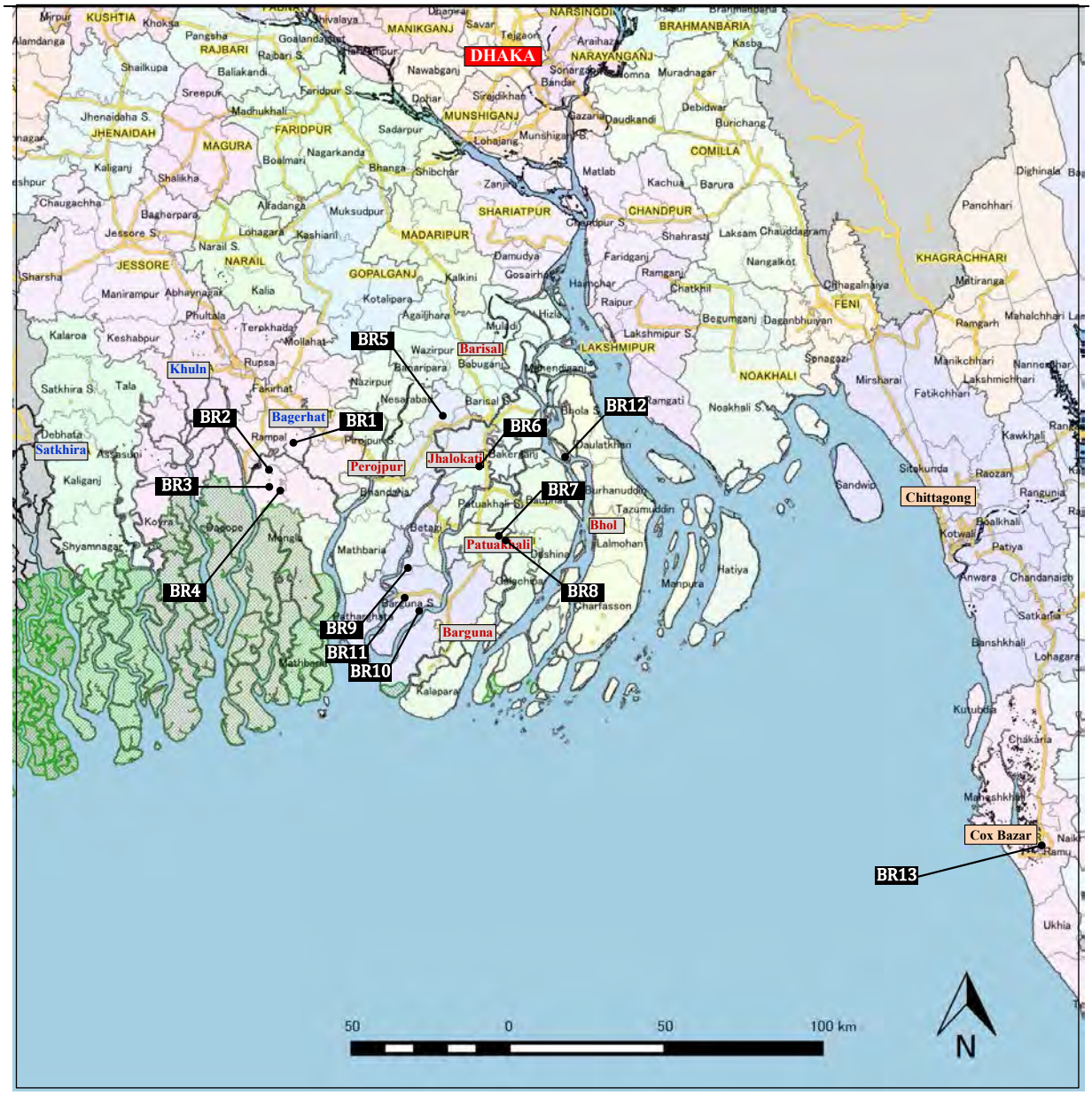


Figure 3.1.2 Location Map of Survey Sites (Bridges)

(4) Outline of Surveyed Bridges

Outlines of the twelve (12) bridges and a causeway are summarized in Table 3.1.1 and Table 3.1.2 . The surveyed bridges mostly had a similarity in that the superstructure is made of reinforced concrete supported by metal beam(s) substructure. Also, most of the bridges were constructed prior to the establishment of the present design standard and are considered to be more than 20 years old. There was only one concrete bridge (BR1) with both superstructure (RC deck) and substructures (abutments) made of concrete.

All bridges are in a state of high vulnerability. BR5 in Jhalokati District and BR12 in Bhola District have completely collapsed and are out of use. BR11 in Barguna which serves as an access to Barguna central market has no concrete-slab and instead plywood is placed and used by pedestrians. Vehicles

are restricteds from using this bridge. BR3 is a bamboo bridge constructed based on the accumulated experience of the locals from the past. No damage was confirmed on this bridge. Vehicles are restricted and only pedestrians and motorbikes are allowed, and as such it could be obstructive for smooth evacuation during disaster period. All other bridges are also severely damaged and could collapse by further disasters.

On the other hand, BR13 is a causeway that was recently constructed. Completion ceremony was held in April, 2015. The embankment of a nearby river was breached by the torrential rain at the end of June causing flash flood and severly damaging the causeway.

Table 3.1.1 Outline of Surveyed Bridges (1/2)

No.	Location (District Upazila) Bridge Dimension	Dist. Pop. ('000)	Structure Type (Damage extent/degree and cause)	Expected Outcome	Expected Benefit to Community	Site Photos
BR1	Bagerhat/ Sadar VillageRoad L=14m, W=3.7m	266	Super: RC slab Sub: Concrete abutment (Abutment inclination by riverbed scouring, severe spalling of handrail concrete by salt damage)	Enhancement of traffic safety, improvement of evacuation access	Safe and smooth evacuation during disaster, vitalization of community due to enhanced connectivity	
BR2	Bagerhat/ Mongla Union Road L=13m(27m), W=2.0m	137	Super: Wooden plank Sub: Metal beams/piles (Metal beams severely corroded, deformed by fatigue, salt damage)	Enhancement of traffic safety & connectivity, improvement of evacuation access	Safe, smooth evacuation during disaster, smooth transportation of prawn products, vitalization of community	
BR3	Bagerhat/ Mongla VillageRoad L=48m, W=1.9m	137	Super: Wooden Plank Sub: Bamboo (Wooden planks unstable due to loosening of nails)	Enhancement of traffic safety & connectivity, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	
BR4	Bagerhat/ Mongla Union Union Road L=20m, W=2.5m	137	Super: Wooden plank (RC Slab prior damage) Sub: Metal beams/piles (Deck unstable, handrail concreteless, beams corroded deformed due to fatigue, salt damage)	Enhancement of traffic safety connectivity, improvement of evacuation access	Improved access to markets, schools, public facilities shelters, safe and smooth evacuation during disaster	

Table 3.1.2 Outline of Surveyed Bridges (2/2)

No.	Location (District Upazila) Bridge Dimension	Dist. Pop. ('000)	Structure Type (Damage extent/degree and cause)	Expected Outcome	Expected Benefit to Community	Site Photos
BR5	Jhalokati/ Sadar Upazila Road L=30m, W=3.5m	216	Super: RC Slab Sub: Metal beams/piles (Collapsed due to fatigue, overflow during flood and riverbed scouring)	Enhancement of traffic safety & connectivity, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	

No.	Location (District Upazila) Bridge Dimension	Dist. Pop. ('000)	Structure Type (Damage extent/degree and cause)	Expected Outcome	Expected Benefit to Community	Site Photos
BR6	Jhalokati/ Nalchity Upazila Road L=20m, W=3.0m	194	Super: RC Slab Sub: Metal beams/piles (Beams severely corroded, deformed, superstructure unstable and damaged by fatigue and salt damage)	Enhancement of traffic safety& connectivity, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	
BR7	Patuakhali/ Sadar Union Road L=40m, W=2.5m	317	Super: RC Slab Sub: Metal beams/piles Superstructure partly damaged due to fatigue and salt damage	Enhancement of traffic safety, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	
BR8	Patuakhali/ Sadar VillageRoad L=36m, W=1.9m	317	Super: Wooden plank Sub: Metal beams/piles (Beams severely corroded, deformed, superstructure unstable and damaged by fatigue and salt damage)	Enhancement of traffic safety& connectivity, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	
BR9	Barguna/ Betagi UpazilaRoad L=45m, W=3.7m	117	Super: RC Slab Sub: Metal beams/piles (Metal beams corroded by fatigue and salt damage)	Enhancement of traffic safety& connectivity, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	
BR10	Barguna/ Sadar VillageRoad L=40m, W=2.5m	261	Super: RC Slab Sub: Metal beams/piles (Settlement due to riverbed scouring. Beams corroded and deformed by salt damage)	Enhancement of traffic safety & connectivity, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	
BR11	Barguna/ Sadar UpazilaRoad L=65m, W=3.7m	261	Super: RC Slab Sub: Metal beams (RC slab fallen off, metal corroded and deformed due to fatigue and salt damage)	Enhancement of traffic safety & connectivity, improvement of evacuation access	Improved access to central market and safe/smooth evacuation during disaster	
BR12	Bhola/ Sadar VillageRoad L=95m, W=3.7m	431	Super: RC Slab Sub: Metal beams/piles (Collapsed due to fatigue, overflow during flood and riverbed scouring))	Enhancement of traffic safety & connectivity, improvement of evacuation access	Safe and smooth evacuation during disaster, communal vitalization	
BR13	Cox's Bazar/ Ramu UpazilaRoad L=160m, W=5.5m	267	Concrete Causeway (Completely destroyed due to wash out by flood in June, 2015)	Enhancement of traffic safety & connectivity, improvement of evacuation access	Improved access and communal vitalization	

(5) Technical Evaluation of Damaged Bridges

Major damages observed on the surveyed bridges are due to fatigue, salt damage, scouring of riverbed, collision, and human error. Although some of the bridges were directly damaged due to overflow

during Cyclones Sidr and Aila, most of other damages are the effect offloods and tidal waves and, occasionally, human causes.

(a) Fatigue

This is a damage caused by repeated application of external force such as vehicular load. The most common damage is the generation of cracks in concrete and fissure in metals. The surveyed bridges are mostly 20 years or older. Although cracks in concrete were not significant, fissure in metal beams were observed in almost all the bridges. In most of the displaced member of the metal beams the nuts and bolts that hold the members of metal beams together were either missing or cracked and not working properly.

(b) Salt Damage

Salt damage is a phenomenon where the chloride ions penetrate the concrete and generate cracks, spalling of concrete and thinning (reduction of surface area) of re-bars. Damage is mainly caused by salt in the ambient, which causes corrosion of re-bars resulting in cracks in concrete due to expansion of the bars. Salt damage was prominent on handrails rather than on RC deck and on both the concrete and metal handrails of all the bridges surveyed.

Salt damage on substructure was more significant. Ten out of 12 bridges, except BR1 and BR3 have piers made of metal beams. Severe corrugation, cracks and degradation caused by salt damage were confirmed on these structures. These bridges are located in coastal area, where they are readily and highly exposed to saline water. Also, most of these bridges were constructed more than 20 years ago. Some were rehabilitated after cyclones (Sidr and Aila) using the then readily available material and during the period, the abutment and piers were damaged due to severe corrugation.

(c) Settlement

An abutment of BR1 in Bagerhat District and a pier of BR10 in Barguna District have settled causing the bridge to incline. This is assumed to be caused by scouring of riverbed at the abutment and the piers.

(d) Collision

The span of all bridges that have metal beams as piers are only about 6 meters wide. This makes the piers susceptible to collision by logs, timber and other debris transported during flood and results in the deformation and displacement of the members. Damage of handrails of most of the bridges can also be attributed to impact by vehicles. As can be understood from the table above, the widest carriageway of a bridge among the surveyed bridges is only 3.7m wide. Most of the other bridges could hardly pass a vehicle. The handrails are damaged or displaced as vehicles repeatedly collide with them.

(e) Overflow and Scouring

All bridges were affected by overflow and river bed scouring during cyclones (Sidr and Aila) and some floods. BR5 and BR12 have been completely damaged. This is assumed to be caused by high water level smashing the RC decks with the transported debris combined with the weight of the piled up debris and force of the flowing water, which results in the collapse of the superstructure. The top of the causeway, BR13, has been partially collapsed due to overflow caused by flooding of the nearby river.

(f) Design, Construction Defect and Lack of Maintenance

BR3 is a concrete bridge constructed in 1993. Although it looks normal, one of the abutments has settled causing the bridge to incline. The soil in the area is clayey where uneven settlement can easily occur. Regardless of such condition, no pile foundation has been provided to support the bridge, which can be considered as one of the major reasons for the settlement of the bridge. On the other hand, the length of the bridge is shorter than the width of the river (the abutment lies within the river section) and the approach road, which is constructed inside the river has constrained the river width at the bridge. As a result, the approach road section was washed away during the flood. Furthermore, there is no protection work applied at the river bed or at the slopes as a measure to prevent scouring and erosion around the abutment.

Another cause of damage is lack of proper and timely maintenance. According to LGED, maintenance work has been rarely carried out on the surveyed bridges.

Photo 3.1.1 Fatigue
BR11 Barguna, Sadar

Photo 3.1.2 Salt Damage
BR6 Jhalokati, Nalchity

Photo 3.1.3 Salt Damage
BR1 Bagerhat, Sadar

Photo 3.1.4 Settlement
BR10 Barguna, Sadar

Photo 3.1.5 Collision
BR6 Jhalokati, Nalchity

Photo 3.1.6 Collapsed Bridge
BR12 Bhola, Sadar

Figure 3.1.3 Photos of Damaged Bridges

(6) Points to be considered during Detailed Design

Recently, bridges longer than 600 meters have been successfully constructed under the design and supervision of the Planning Unit of LGED. This is evident that LGED is capable of design and construction supervision of such bridges. However, this can not be said for construction of small bridges in rural areas that are undertaken by middle-lower class local contractors. Therefore, following technical points are desirable to be considered during the detailed design.

- The width of bridges surveyed is less than 3.7m, which is very narrow. Even the width of the 120m long Botnikhali Bridge in Betagi Upazila in Barguna District which is under construction has a carriageway width of 5.5m, which is just sufficient for an auto-rickshaw and a car or a truck to pass under reduced speed. The width will not suffice in the future if there is a rapid rise in traffic. Therefore, the width of the bridge should be determined taking into consideration the traffic volume as well as future traffic demand of the road.
- Most of the bridges surveyed have metal beams. In Japan, metal beams are used on temporary bridges/landing stages only. In Bangladesh, they are used probably because concrete or reinforced bars are not easily available or metal beams are easier to construct (without use of heavy equipment). Currently, concrete is abundantly available. However, since the survey area lies in a coastal area, sufficient covering should be provided to prevent salt damage. The aggregates should also be properly washed or use of fly-ash need to be considered for measures against alkali-silica reaction.
- Water in the coastal area is highly saline and areharmful to concrete. Therefore, stringent supervision is required during construction of concrete bridges in these areas and procurement of water should be properly planned.
- Protective measures on riverbed should be taken necessarily at the abutment and piers including protection of slopes near the abutment to prevent from scouring and erosion.
- Approach slab should be provided necessarily to prevent settlement at the ends.

3.1.2 Roads

(1) Target Roads

The road network in the target coastal areas is relatively established. However, most of the roads are in a damaged condition. The reason can partly be attributed to the cyclones and floods that occcur almost every year in this region.

Recently, The government of Bangladesh had rehabilitated an approximate 360km of damaged roads in nine (9) out of the twelve (12) target coastal areas (excluding Chittagong, Cox's Bazar and Noakhali Districts) under the World Bank project named as "Emergency 2007 Cyclone Recovery and Restoration Project ECRRP". An additional of 1,100km were also rehabilitated or improved in the same area with Japanese loan throguh the "Southwest Rural Development Project"

Under the circumstances, it can be said that the Government of Bangladesh is putting effort on rehabilitation and improvement of damaged roads. However, there is a huge backlog. According to LGED, as of August 2015, there is about 1,800km of roads in the target area that need to be improved.

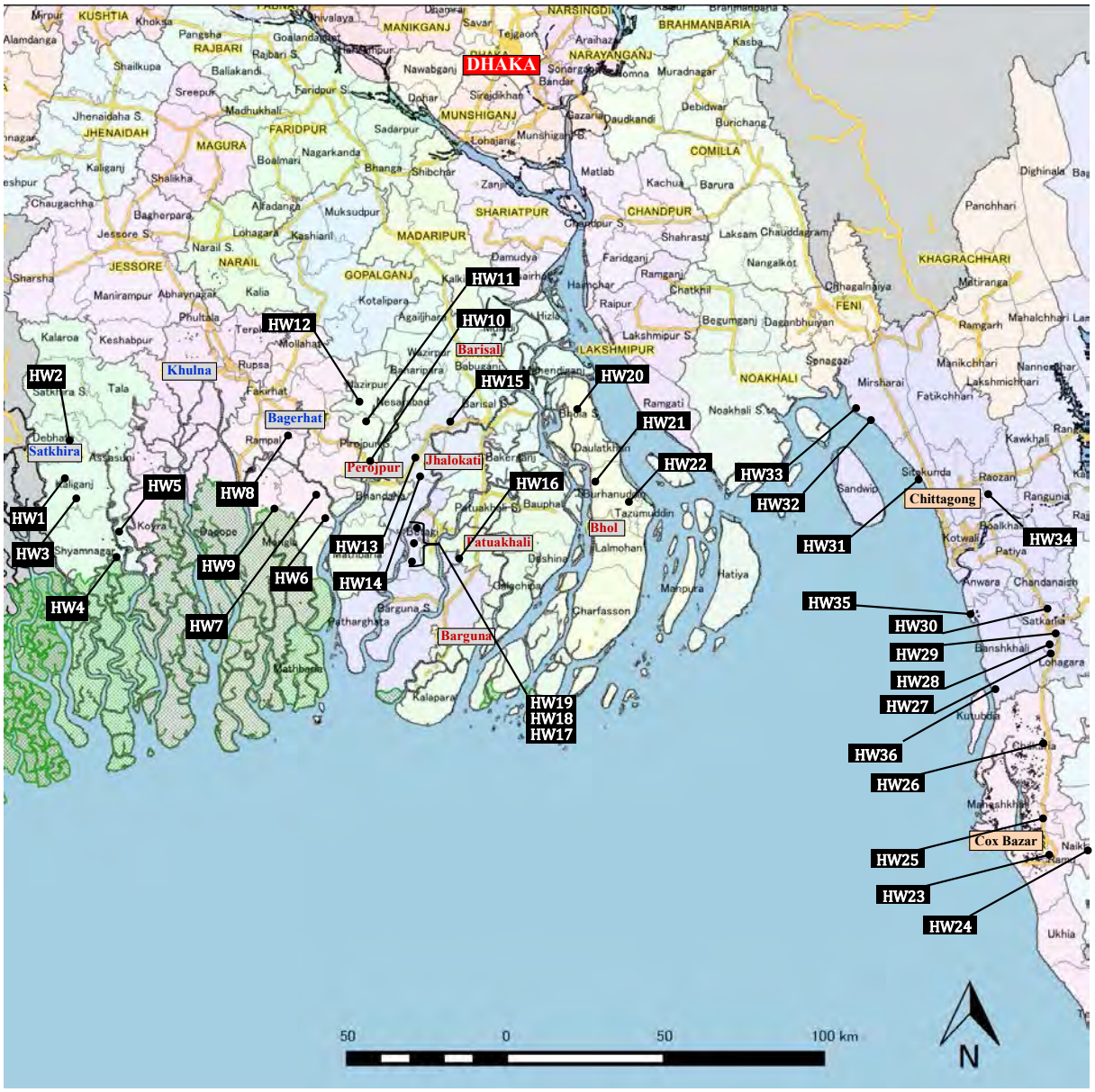
This project aims to undertake the rehabilitation or restoration of damaged roads in these areas. A survey has been conducted on such roads and the roads selected for the survey were those recommended by the LGED and not undertaken under the projects mentioned above. These roads were selected from those that were damaged in the past water-induced disasters and need urgent rehabilitation, or those that are considered vulnerable to such disasters in future.

(2) Survey Method and Items

Site reconnaissance has been carried out for the five (5) identified roads and their present condition as well as type, scale and causes of damages were checked by visual inspection.

(3) Identification of Survey Sites

Altogether, thirty-six (36) roads in eleven (11) districts have been identified. Roads in Noakhali District are not included. Their surveyed sites are as indicated in Figure 3.1.4.



Source: JICA Survey Team

Figure 3.1.4 Location Map of Survey Sites (Roads)

(4) Outline of Surveyed Roads

Outlines of the surveyed roads are given in Table 3.1.3 . Out of the 36 surveyed, six (6) roads (HW2, HW4, HW5, HW7, HW8, and HW16) are embankment roads. BWDB is responsible for maintaining the embankment (earthen portion), while LGED is responsible for maintaining the road/pavement (the portion above embankment). The others are roads that belong to LGED and consist of upazila roads, union roads and village roads inside of polders.

Table 3.1.3 Outline of Surveyed Roads

No.	District/Upazila Damaged Length/Width	Dist. Pop. ('000)	Pavement Type (Damage/Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
HW1	Satkhira/ Kaliganj Upazila road L=18km, W=7.3m	275	Asphalt pavement (Scouring/ erosion of slope, settlement, surface distress/ washout due to overflow during flood)	Travel time reduction, safe and smooth traffic flow/mobility	Transportation of relief supply enabled during disaster; Smooth transportation of prawn products; Vitalization of community	
HW2	Satkhira/ Kaliganj Upazila road* L=15.2km, W=5.5m	275	Asphalt pavement (Scouring/erosion of slope, surface distress/ washout due to overflow during flood)	Travel time reduction, safe and smooth traffic flow/mobility	Houses and farmlands protected from inundation; Enhanced transportation of prawn products	
HW3	Satkhira/ Kaliganj Upazilaroad L=4.2km, W=5.5m	275	Brick pavement (Erosion of slope, surface distress/washout due to overflow during flood)	Safe and smooth traffic flow/mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW4	Satkhira/ Syamnagar Union road* L=4.8km, W=3.7m	318	Brick pavement (Scouring/ erosion of slope, surface distress/washout due to storm surge)	Travel time reduction, safe and smooth traffic flow/mobility	Houses and farmlands protected from inundation; Enhanced transportation of prawn products	
HW5	Satkhira/ Syamnagar Upazila road* L=3.7km, W=3.0m	318	Brick pavement (Scouring/erosion of slope, surface distress/washout due to storm surge)	Travel time reduction; safe and smooth traffic flow/ mobility	Houses and farmlands protected from inundation; Enhanced transportation of prawn products	
HW6	Bagerhat/ Morelgonj Upazila road L=1.0km, W=7.3m	295	Asphalt pavement (Complete washout due to high tide)	Strengthen connectivity, Travel time reduction; safe and smooth traffic flow/ mobility	Severed communities connected and vitalized; Improved accessibility and trafficability	
HW7	Bagerhat/ Morelgonj Upazila road* L=5.0km, W=7.3m	295	Brick pavement (Scouring/erosion of slope, surface distress/washout due to storm surge)	Travel time reduction; safe and smooth traffic flow/ mobility	Houses and farmlands protected from inundation; Improved access to markets, schools, shelters, etc.	
HW8	Bagerhat/ Sader Union road* L=3.5km, W=5.5m	266	Brick pavement (Erosion of slope, surface distress/ washout due to overflow during flood)	Safe and smooth traffic flow/ mobility	Farmlands protected from inundation	

No.	District/Upazila Damaged Length/Width	Dist. Pop. ('000)	Pavement Type (Damage/Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
HW9	Bagerhat/ Mongla Union road L=17.5km, W=5.5m	137	Concrete pavement (Surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	N/A
HW10	Perojpur/ Nazirpur Union road L=1.0km, W=3.3m	181	Brick pavement (Erosion of slope, surface distress/washout due to overflow during flood)	Safe and smooth traffic flow/ mobility	Enhanced traffic safety (safe and smooth mobility of locals)	
HW11	Perojpur/ Nazirpur Union road L=12.7km, W=3.5m	181	Brick pavement (Erosion of slope, surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW12	Perojpur/ Nazirpur Upazila road L=0.4km, W=7.3m	181	Asphalt pavement (Erosion of slope, surface distress/washout due to overflow during flood)	Safe and smooth traffic flow/ mobility	Houses and farmlands protected from flood	
HW13	Jhalokati/ Sadar Upazila road L=3.0km, W=5.3m	216	Asphalt pavement (Erosion of slope, surface distress/washout due to overflow during flood)	Safe and smooth traffic flow/ mobility	Houses and nearby school protected from flood; Enhanced traffic safety (safe and smooth mobility of locals)	
HW14	Jhalokati/ Rajapur Upazila road L=11.2km, W=3.7m	149	Asphalt pavement (Erosion of slope, surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW15	Jhalokati/ Rajapur Village road L=17.5km, W=3.0m	149	Asphalt pavement (Surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW16	Patuakhali/ Sadar Upazila road* L=12.0km, W=7.3m	317	Asphalt pavement (Scouring/erosion of slope and surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Houses and nearby school protected from flood; Improved access to markets, schools and shelters	
HW17	Barguna/ Betagi Union road L=1.9km, W=5.3m	117	Asphalt pavement (Surface distress/washout due to overflow during flood)	Safe and smooth traffic flow/ mobility	Enhanced traffic safety (safe and smooth mobility of locals)	

No.	District/Upazila Damaged Length/Width	Dist. Pop. ('000)	Pavement Type (Damage/Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
HW18	Barguna/ Betagi Village road L=2.4km, W=5.5m	117	Asphalt pavement (Surface distress/washout due to overflow during flood)	Safe and smooth traffic flow/ mobility	Enhanced traffic safety (safe and smooth mobility of locals)	
HW19	Barguna/ Sadar Upazila road L=4.5km, W=5.5m	261	Asphalt pavement (Surface distress/washout due to overflow during flood)	Safe and smooth traffic flow/ mobility	Enhanced traffic safety (safe and smooth mobility of locals)	
HW20	Bhola/ Sadar Upazila road L=12.0km, W=5.5m	431	Asphalt pavement (Surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW21	Bhola/ Sadar Upazila road L=15.0km, W=5.5m	431	Asphalt pavement (Surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW22	Bhola/ Borhanudin Upazila road L=8.5km, W=5.5m	234	Asphalt pavement (Surface distress/washout due to overflow during flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW23	Cox Bazar/ Ramu Upazila road L=2.5km, W=5.5m	267	Asphalt pavement (Severe damage, surface distress/washout due to flood in June, 2015)	Strengthen connectivity; Travel time reduction; safe and smooth traffic flow/mobility	Severed communities connected and vitalized; Improved access provided	
HW24	Cox Bazar/ Ramu Union road L=0.1km W=5.5m	267	Asphalt pavement (Severe damage, surface distress/washout due to flood in June, 2015)	Strengthen connectivity; Travel time reduction; safe and smooth traffic flow/mobility	Severed communities connected and vitalized; Improved access provided	
HW25	Cox Bazar/ Sadar Union road L=1.0km, W=5.5m	459	Asphalt pavement (Severe damage, surface distress/washout due to flood in June, 2015)	Strengthened connectivity; Travel time reduction; safe and smooth traffic flow/ mobility	Severed communities connected and vitalized; Improved access provided	
HW26	Cox Bazar/ Chakoria Union road L=2.0km, W=5.5m	475	Asphalt pavement (1m inundation by flood in June, 2015)	Strengthened connectivity, Travel time reduction, safe and smooth traffic flow/mobility	Severed communities connected and vitalized; Improved access provided	

No.	District/Upazila Damaged Length/Width	Dist. Pop. ('000)	Pavement Type (Damage/Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
HW27	Chittagong/ Lohagara Upazila road L=5.0km, W=5.5m	280	Asphalt pavement (Surface distress/washout due to flood in 2013 and 2015)	Travel time reduction, safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW28	Chittagong/ Lohagara Upazila road L=4.0km, W=5.5m	280	Asphalt pavement ((Surface distress/washout due to flood in 2013 and 2015)	Safe and smooth traffic flow/ mobility	Improved access and enhanced traffic safety (safe and smooth mobility of locals)	
HW29	Chittagong/ Satkania Upazila road L=7.0km, W=5.5m	385	Asphalt pavement (Surface distress/washout due to flood in 2013 and 2015)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW30	Chittagong/ Satkania Upazila road L=21.0km, W=5.5m	385	Asphalt pavement (Surface distress/washout due to flood in 2013 and 2015)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	
HW31	Chittagong/ Sitakundi Upazila road L=0.3km, W=3.7m	389	Brick pavement (Scouring/erosionof slope, displacement of retaining wall due to flash flood from hill and storm surge)	Safe and smooth traffic flow/ mobility	Severed communities connected and vitalized; Improved access provided	
HW32	Chittagong/ Sitakundi Upazila road L=1.5km, W=5.5m	389	Asphalt pavement (Scouring of slope, surface distress/washout due to flash flood from hill side)	Safe and smooth traffic flow/ mobility	Enhanced traffic safety (safe and smooth mobility of locals)	
HW33	Chittagong/ Sitakundi Union road L=4.2km, W=5.5m	389	Asphalt pavement (Scouring of slope, surface distress/washout due to flash flood from hill side)	Safe and smooth traffic flow/ mobility	Enhanced traffic safety (safe and smooth mobility of locals)	
HW34	Chittagong/ Hathazari Union road L=5.0km, W=3.7m	462	Brick pavement (Scouring/erosion of slope, surface distress/washout due to flood)	Travel time reduction; safe and smooth traffic flow/ mobility	Enhanced traffic safety (safe and smooth mobility of locals)	
HW35	Chittagong/ Banskali Village road L=0.5km, W=3.7m	431	Brick pavement (Surface distress/washout due to overflow during flood)	Strengthened connectivity; Travel time reduction; safe and smooth traffic flow/ mobility	Severed communities connected and vitalized; Improved access provided	

No.	District/Upazila Damaged Length/Width	Dist. Pop. ('000)	Pavement Type (Damage/Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
HW36	Chittagong/ Banskali Union road L=6.0km, W=3.7m	431	Asphalt pavement (Scouring of slope, surface distress/washout due to flash flood from hill side)	Travel time reduction; safe and smooth traffic flow/ mobility	Improved access to markets, schools and shelters; Enhanced traffic safety (safe and smooth mobility of locals)	

(5) Technical Evaluation of Damaged Roads

Erosion/scouring of river banks and embankment slopes, washout due to overflow, and settlement due to seepage are the major damages observed on the roads. Most of these damages are attributed to cyclones Sidr and Aila in addition to recurrent tidal wave action or flood and heavy rainfall during the monsoon.

(a) Erosion and Failure of Road Slopes

This type of damage is peculiar on embankment roads or roads that run along a river or canal. The damage is most prominent along the concave portion of the embankment/bank (water colliding front). The slopes are collapsed due to repeated scouring of the riverbed and by erosion of slope due to tidal change and wind waves. Most of these roads are said to have been constructed more than 10 years ago. Non-provision of slope protective works and lack of adequate and timely maintenance are the main causes of acceleration of the damage.

On the other hand, in HW12 and HW13 in Perojpur and Jhalokati districts, respectively, concrete piles and walls have been provided to stabilize the lateral displacement of slope. However, these have inclined possibly due to riverbank scouring or lateral earth pressure on the road. In the case of HW13, the concrete blocks are tied, pulled and fixed on the other side of the road by means of a metal rod as a temporary measure to stop the lateral movement.

(b) Washout

This damage is also observed on almost all roads. The roads are submerged during flood and high tide and a part of the road is carried away by water. HW-3 is an embankment road in Morrelgonj Upazila, Bagerhat District and runs along the Poylahar River, a large river. At this section, 1 km of the road has been completely washed out due to overflow during high tide, which might have been encouraged also by the scouring and erosion of the road slopes due to wave action prior to overflow. Other roads are mostly partially washed out, causing surface distress such as upheaval/swell, loss of pavement, generation of huge pot holes, etc. Surface distress is more significant in areas with dense vegetation, since vegetation blocks the sunlight, allowing the surface to be wet for a longer period.

(c) Settlement

Severe surface distress of roads due to settlement was observed in road HW1 in Satkhira. This road is approx. 1m higher than the adjacent ground elevation. The surrounding ground were originally paddy fields, but now a shrimp farm. It was learned that for good production of shrimps, the water level is required to be maintained to a height of 1m, which is almost the same as the road level, making the road susceptible to submergence during heavy rainfall and thus allowing water to infiltrate the pavement. This infiltration has contributed to the transport of lower pavement level material (base, sub-base course) causing settlement of the road and resulting in severe heaving/swelling and surface distress. In addition, the bottom part of the road slope has been excavated to almost the vertical state (intentionally for increasing the shrimp farm area) causing slope failure and lateral displacement of slope accelerating the settlement of the road.

Photo 3.1.2.1 Erosion

Photo 3.1.2.2 Washout

Photo 3.1.2.3 Settlement

Figure 3.1.5 Photos of Damaged Roads

(6) Points to be considered during Detailed Design

The site survey observations that should be considered during the detailed design stage are as follows:

- In general, there is no major issue related to the design and construction of roads. Damage to the roads are attributed partly to unpredictable level of disasters and partly to lack of proper and timely maintenance.
- Close coordination between BWDB and LGED is required regarding the maintenance of embankment roads since BWDB is responsible for only the maintenance of embankment while LGED is responsible for the road (pavement).
- Digging the road side slopes of fill section to increase land/pond area of shrimp farm is considered to be one of the causes of settlement. In such area, it is desirable to provide structures to support the slopes and prevent lateral movement/settlement of the roads.
- Consideration for application of concrete pavement should be taken on roads in dense vegetation areas and where the road has high chances of being affected by water.

(7) Maintenance of Infrastructures

Road infrastructures under the responsibility of the regional offices of LGED in the two districts are as shown in the table below.

Table 3.1.4 Roads under Regional Offices of LGED in Surveyed Districts

(Unit: km)

Region*	District**	Upazila Road Length		Union Road Length		Village Road Length
		Paved	Unpaved	Paved	Unpaved	
Barisal	Patuakhali	471	111	598	725	7983
Khulna	Bagerhat	470	132	321	142	4457

*Division (Bengali: Bibhag); ** District Source: LGED Regional Offices

The present maintenance condition of existing roads and bridges of LGED is generally good even if under budgetary constraint, except structures along the rivers.

3.1.3 Embankments and Hysraulic Structures

(1) Coastal Embankments and Target Embankments of the Study

Tidal rivers form an intricate network in the coastal areas located in the southern part of Bangladesh that were targeted for survey. The coastal zone spans over 580 km of coastline. The coastal zone constitutes 32% of the land area (47,200 km^2) and hosts nearly 28% of the population[4] (42 million). Sixty-two percent (62%) of the coastal land has an elevation of up to 3 m and 83% up to 5 m above mean sea level. It can be said that the average elevation of the coastal area is below the high tide level.

Since 1961 the GOB had started constructing 139 polders and 6,000 km long embankment under the Coastal Embankment Project to protect approximately 1.5 million ha residents and agriculture in the area from flooding, saltwater infiltration and so on. . However, since these polders were designed under the conventional maximum hightide, they are unable to cope with the very high waves during cyclones and other stormy weather conditions.

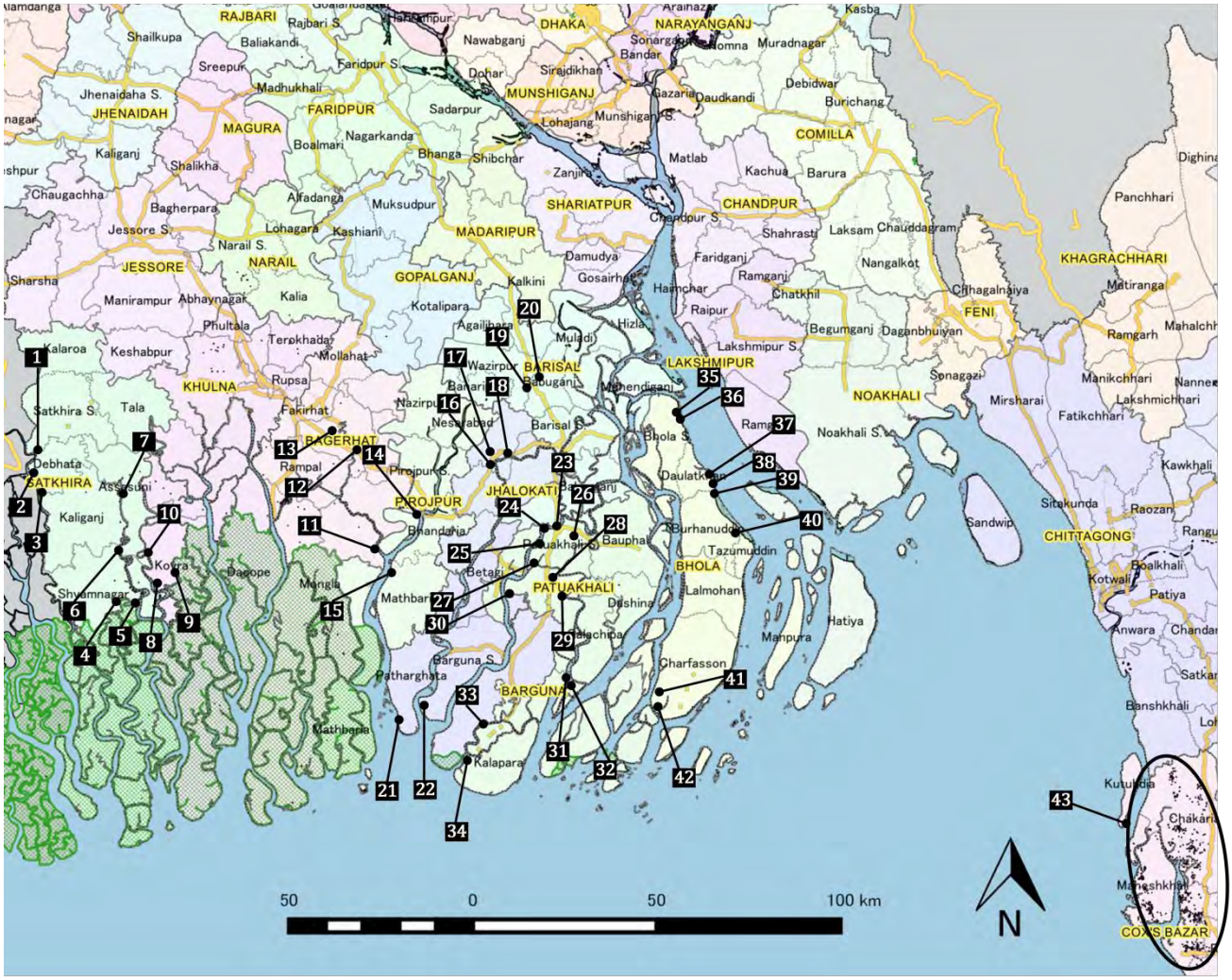
After the cyclones in 1991 and 1997, BWDB implemented the Coastal Embankment Rehabilitation Project. In November 2007, many polders were breached and 1,875 km long embankment were damaged by the high waves caused by Cyclone Sidr and the reconstruction work following this disaster is still being continued with support from the WB (ECRRP; Credit Agreement signed in December 2008). Moreover, 1,742 km long embankments were damaged by the Cyclone Aila in 2009.

In the circumstances, BWDB commenced a WB-funded project to improve the performance of coastal embankments in consideration of future climate change as a long-terme phased programme. The project is scheduled to select five (5) out of the intial 17 polders for implementation of works (CEIP - Phase I, Credit Agreement signed in October 2013). These works will entail embankment heightening, bank/embankment slope protection, reconstruction of hydraulic structures, and improvement of drainage systems.

This present site survey targetted the polders that do not overlap with the projects mentioned above and selected by BWDB as vulnerable to damage.

(2) Identification of Survey Sites

The site survey was carried out at 46 locations in 11 out of the targetted 12 districts shown in Figure 3.1.6).



Source: Prepared by the JICA Survey Team

Figure 3.1.6 Survey Sites of Embankments and Hydraulic Structures

(3) Survey Method and Items

A visual inspection sheet was prepared by referring to the Procedure for Evaluating Results of Embankment and Revetment Inspection (draft) (hereafter referred to as the Embankment Evaluation Procedure), March 2015, MLIT, that is used in Japan. This visual inspection sheet was used to conduct the technical evaluation of existing embankments.

The embankment evaluation procedure classifies the required functions of embankments into (a) overflow prevention function, (b) seepage prevention function, and (c) erosion resistance function, and it configures 13 types of deformation as indicators for determining that functions have declined.

In this study, visual inspections were carried out upon setting the seven (7) indicators shown in Table 3.1.4 while referring to the above 13 indicators. Indicator "Slope failure", "Bulging" and "Steepening" among 13 indicators were unified in "Slope failure" and indicator "Deformation of foot protection works", "Tree erosion" and "Abnormal vegetation" were excluded from this survey's indicators because there were no functions of the foot protection and sodding at the site embankment. Furthermore indicator "Poor drainage" was also excluded because private houses are adjacent to the embankment, so it could't be identified weather the cause of the puddle was poor drainage of embankment or artificial pond for residential purpose. Evaluation of inspection results according to each type of embankment deformation was conducted according to the three stages of "None," "Some damage" and "Intensive damage" and the final comprehensive evaluation was conducted according to the four ranks of "None," "Minor damage," "Some damage" and "Intensive damage". Figure 3.1.7 shows an example of the visual inspection sheet.

Table 3.1.5 General Types of Embankment Deformation and Indicators in this Study

<table>
<tr><th>Functions</th><th>State of Functional Decline</th><th colspan="2">Deformation</th><th>Indicators in this Study</th></tr>
<tr><td rowspan="11">Overflow Prevention Function

Seepage Prevention Function

Erosion Resistance Function</td><td rowspan="11">Settlement
Slippage
Piping
Erosion</td><td rowspan="6">Deformation</td><td>Cracking</td><td rowspan="11">(a) Cracking
(b) Settlement and irregularity
(c) Slope failure
(d) Bank/ Embankment erosion
(e) Riverbed scouring
(f) Animal holes
(g) Water seepage and sand jets</td></tr>
<tr><td>Caving and irregularity</td></tr>
<tr><td>Slope failure</td></tr>
<tr><td>Settlement</td></tr>
<tr><td>Deformation of foot protection works *</td></tr>
<tr><td>Bulging</td></tr>
<tr><td>Steepening</td></tr>
<tr><td colspan="2">Animal holes</td></tr>
<tr><td colspan="2">Tree erosion *</td></tr>
<tr><td colspan="2">Erosion</td></tr>
<tr><td colspan="2">Water seepage and sand jets</td></tr>
<tr><td colspan="2">Abnormal vegetation*</td></tr>
<tr><td colspan="2">Poor drainage*</td></tr>
</table>

Source: Procedure for Evaluating Results of Embankment and Revetment Inspection (draft), March 2015, MLIT, with modifications by the JICA Survey Team.

* marked deformations are excluded from this survey indicators.

INSPECTION SHEET OF EMBANKMENT (EBK-9)

District	Bagerhat	Date & Time	2015/6/18 10:00
Upazilla	Bagerhat Sadar	GPS Location : Latitude	22° 38′ 25.21″ N
Polder Number	37	Longitude	89° 48′ 8.53″ E
River Name	Daratana River	Construction Year	2010
Km Post	9.00km	Rehabilitation Record	
Design Condition	Crest width: (4.30)m , Crest level: (4.30)m , H.W.L.: ( )m		
	Free boad: (1.00)m, Side slope: R/S (1:3) C/S (1.2)		
Existing Condition	Crest width: (3.5-4.0)m , Tidal difference: ( )m		
	Material (Embankment): (clay) , Material (Ground): (clay)		
	Crest use	: None / (Road) / House / Other ( )	
	Slope protection	: None / CC block / (Vegetation) / Other ( )	
Existing Damage by Inspection	Crack	: (None) / Some damage / Intensive damage	
	Sinking / Irregularity	: None / Some damage / (Intensive damage)	
	Slope failure	: (None) / Some damage / Intensive damage	
	Bank erosion	: (None) / Some damage / Intensive damage	
	Riverbed scouring	: (None) / Some damage / Intensive damage	
	Animal hole (tunnel)	: None / (Some damage) / Intensive damage	
	Water seepage	: (None) / Some damage / Intensive damage	
Damage level	Sound condition / (Minor damage) / Some damage / Intensive damage		

Plan Sketch

Attached Photo

1	2	3	4
			
5	6	7	8

Note: Prepared by the JICA Survey Team

Figure 3.1.7 Example of Visual Inspection Sheet

(4) Outline of the Survey

The following table shows the survey findings at each survey site.

Table 3.1.6 Outline of Surveyed Embankments and Hydraulic Structures

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
1	District: Satkhira Upazila: Debha Polder No.3 (Dike=64km Area=22,267ha)	Embankment with Slope Protection (L=1.5km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of floods into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
2	District: Satkhira Upazila: Debha Polder No.3 (Dike=64km Area=22,267ha)	Embankment (L=0.8km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of floods into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
3	District::Satkhira Upazila: Kaliganj Polder No.3 (Dike=64km Area=22,267ha)	Embankment (L=1.0km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
4	District:Satkhira Upazila: Shyamnagar Polder No.5 (Dike=190km Area=55,466ha)	Embankment (L=1.7km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
5	District:Satkhira Upazila: Shyamnagar Polder No.5 (Dike=190km Area=55,466ha)	Embankment (L=0.6km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
6	District:Satkhira Upazila:Assasuni Polder No.4 (Dike=80km Area=10,500ha)	Embankment (L=1.0km/ Intensive damage/ Bank-Embankment erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
7	District:Satkhira Upazila: Assasuni Polder No.4 (Dike=80km Area=10,500ha)	Embankment (L=1.5km/ Intensive damage/ Embankment erosion caused by waves)	Prevention against Flood into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
8	District: Khulna Upazila: Koira Polder No.13-14/2 (Dike=93km Area=17,854ha)	Embankment (L=2.2km/ Intensive damage/ Embankment erosion caused by waves)	Prevention of flood into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
9	District:Khulna Upazila: Koira Polder No.13-14/2 (Dike=93km Area=17,854ha)	Drainage Sluice (3 places/ Intensive damage - Concrete crack; No steel gates/ Deterioration)	Prevention of flood into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
10	District: Khulna Upazila: Koira Polder No.13-14/2 (Dike=93km Area=17,854ha)	Embankment (L=0.9km/ Intensive damage/ Embankment erosion caused by waves)	Prevention of flood into Polder	Protection of residents, agricultural land, aquacultural land, infrastructure, etc., from disaster damage	
11	District:Bargerhat Upazila: Morrelganj Polder No.35/3 (Dike=40km Area=6,790ha)	Embankment with Slope Protection (L=1.05km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
12	District:Bargerhat Upazila: Bargerhat Sadar Polder No.34/1 (Dike=10km Area=2,212ha)	Flood overflow (L=6.0km/ due to no embankment)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
13	District:Bargerhat Upazila: Bargerhat Sadar Polder No.34/2 (Dike=70km Area=47,394ha)	Embankment Road (L=1.5km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
14	District:Pirojpur Upazila: Pirojpur Sadar Polder No.38	Embankment (L=1.0km/ Some damage/ Bank erosion caused by waves)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
15	District:Pirojpur Upazila: Mothbaria Polder No.39/D	Embankment (L=0.5km/ Some damage/ Bank erosion caused by waves)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
16	District:Jhalokathi Upazila: Jhalokathi Sadar Polder BIP 13	Embankment (L=4.5km/ Some damage/ Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
17	District:Jhalokathi Upazila: Nalchity Polder BIP 14	Embankment (L=2.0km/ Some damage/ Bank erosion caused by boat waves)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
18	District: Jhalokathi Upazila: Jhalokathi Sadar	Embankment (L=2.0km/ Some damage/ Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
19	District: Barisal Upazila:Babuganj	Bank Protection for Airport (L=2.3km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of residents, agricultural land, air route, etc., from disaster damage	
20	District: Barisal Upazila:Babuganj	Bank Protection for Bridge (L=0.4km/ Intensive damage/ Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Flood into Polder	Protection of bridge abutment and approach road of the most important regional transportation network	
21	District:Barguna Upazila: Patharghata Polder No.40/1 (Dike=22km Area=2,105ha)	Embankment (L=1.0km/ Intensive damage/ Bank erosion caused by waves)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
22	District: Barguna Upazila: Barguna Sadar Polder No.42	Embankment (L=5.0km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
23	District: Patuakhali Upazila: Dumki	Embankment with Slope Protection (L=0.4km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
24	District: Patuakhali Upazila: Dumki	Embankment with Slope Protection (L=2.0km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of ferry station, roads, residents, agriculture land, industrial area, etc. from disaster damage	
25	District: Patuakhali Upazila: Dumki	Embankment Road (L=0.2km/ Intensive damage/) Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank eosion and flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
26	District: Patuakhali Upazila: Dumki	Embankment (L=1.2km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
27	District: Patuakhali Upazila: Dumki	Embankment (L=0.2km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
28	District: Patuakhali Upazila: Patuakhali Sadar	Bank Erosion (L=0.3km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of a part of the district center from disaster damage and promotion of regional economical development	
29	District: Patuakhali Upazila: Patuakhali Sadar Polder No.43/2E (Dike=20km Area=1,650ha)	Embankment Road (L=1.1km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
30	District:: Patuakhali Upazila: Patuakhali Sadar Polder No.43/2C (Dike=26km Area=2,753ha)	Embankment Road (L=0.4km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damages	
31	District: Patuakhali Upazila: Galachipa Polder No.55/1 (Dike=46km Area=10,325ha)	Drainage Sluice (1 place/ Intensive damage - Concrete crack; No steel gates/ Deterioration)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
32	District: Patuakhali Upazila: Galachipa Polder No.55/1 (Dike=46km Area=10,325ha)	Embankment Road (L=0.1km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of bank erosion and flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
33	District: Patuakhali Upazila: Kalapara Polder No.46 (Dike=40km Area=5,635ha)	Drainage Sluice (1 place/ Intensive damage - Concrete crack; No steel gates/ Deterioration)	Prevention of flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
34	District: Patuakhali Upazila: Kalapara Polder No.47/1 (Dike=22km Area=2,478ha)	Embankment with Slope Protection (L=2.75km/ Intensive damage/ Bank erosion caused by waves)	Prevention of Tidal Wave/ Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
35	District: Bhola Upazila: Bhola Sadar Polder No.56-57	Embankment (L=1.5km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Tidal Wave/Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
36	District: Bhola Upazila: Bhola Sadar Polder No.56-57	Embankment (L=1.7km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Tidal Wave/Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
37	District: Bhola Upazila: Daulatkhan Polder No.56-57	Embankment (L=1.3km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Tidal Wave/Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
38	District:Bhola Upazila: Daulatkhan Polder No.56-57	Embankment (L=4.0km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Tidal Wave/Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
39	District: Bhola Upazila: Daulatkhan Polder No.56-57	Embankment (L=4.2km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Tidal Wave/Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
40	District: Bhola Upazila: Tazumuddin Polder No.56-57	Embankment with Slope Protection (L=6.0km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Tidal Wave/Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
41	District: Bhola Upazila: Charfassion Polder No.56-57	Embankment (L=3.0km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Prevention of Bank Erosion and Tidal Wave/Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
42	District:Bhola Upazila: Charfassion Polder No.56-57	Drainage Sluice (3 places/ Intensive damage - Concrete crack; No steel gate/ Deterioration)	Prevention of Tidal Wave into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
43	District: Cox's Bazar Upazila: all	Embankment/ Revetment/ Sluices (L=56km, L=8.5km, 51 places/ Intensive damage/ Heavy rain caused by monsoon)	Prevention of Flood	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	

No.	Location	Damaged Structure (Damage Ext.ent/ Degree/ Cause)	Expected Outcome	Expected Benefit to Community	Site Photo
44	District: Chittagong Upazila: Raujan Kamafuli Irrigation	Bank Erosion (L=0.5km/ Intensive damage/ Bank erosion caused by waves & Bank erosion in line with riverbed scouring)	Protection of land from bank erosion	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
45	District: Chittagong Upazila:Hathazari	Drainage Sluice (1 place/ Intensive damage/ piping due to riverbed scouring)	Prevention of Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	
46	District: Chittagong Upazila: Banshkhali Polder No.64/1A (Dike=58km Area=5,750ha)	Embankment (L=7.0km/ Intensive damage/ Embankment erosion caused by waves)	Prevention of Tidal Wave into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damage	

(5) Technical Evaluation of Damaged Embankments

As shown in the table above, almost all of the surveyed locations are in the state of "Intensive damage" where the embankment has already collapsed or where failure to act could lead to breach of the embankment road and subsequent massive damage to the local economies.

Based on on-site observations, the two primary causes of embankment damage are thought to be "bank erosion in line with riverbed scouring" and "bank erosion caused by waves".

Judging from the cross sections of the damaged embankments that were visually observed, the embankment bodies are made of clayey soil that has been manually excavated and banked from adjoining land. These clay material embankments are firmly compacted, and no sections of loose breakup were observed.

However, at some embankments, voids in embankment were observed. These voids may be caused by lack of compaction in construction, animal holes and penetration of rainfall water.

(a) Bank erosion in line with riverbed scouring

This is a common cause of damage in small and medium river embankments in Bangladesh. The riverbed in front of the embankment footing becomes locally scoured, causing the embankment slope on the river side to gradually crumble from the toe and eventually leading to collapse of the embankment. This type of damage is conspicuous on the so-called water pounding parts of river bends, and it has also been confirmed on relatively small rivers of around 100 meters in width. There are also cases of concrete block (CC block) revetments being damaged in this way. The causes are thought to

be as follows: (a) damage from footingcaused by scouring of the revetment foundations; and (b) damage from the ends of revetments because they have not been properly finished with stoppers and so on.

Photo 3.1.3.1 Damage caused by water pounding

Photo 3.1.3.2 Erosion in line with scouring

Photo 3.1.3.3 Damage from footing

Figure 3.1.8 Photos of Damaged Embankment

(b) Bank erosion caused by waves

Damage caused by waves is especially prominent in southern coastal areas that are directly exposed to waves from the Bay of Bengal. Also, even on rivers in inland areas that do not face onto the ocean, erosion damage has been confirmed in places where the river width is large and fetch is long. Even on continuous embankment sections, disparities can be seen between parts that are totally destroyed and parts that are not. Such differences are thought to be explained by differences in wind direction and riverbed terrain (existence of sandbars and water-route).

Photo 3.1.3.4 Section of total embankment destruction

Photo 3.1.3.5 Damage to sea dike revetment

Photo 3.1.3.6 Sea dike revetment slope

Figure 3.1.9 Photos of Damaged Coastal Dike

(6) Conditions of Hydraulic Structures

Water inside polders is drained into rivers via traversal channels. Sluice gates and sluice pipes are installed in the sections where the drainage channels traverse the polders. These structures are also used for acquiring river water during the dry season. The sluice pipes are fitted with flap gates on the river side to stop river water from flowing backwards when the river water level is high. Moreover, manually operated winch gates are installed on the landside. Since these gates are manually operated, they measure roughly 1 meter in height and breadth. Some of the existing facilities that were surveyed are

more than 50 years old and are in a state of severe deterioration. In some cases, structures have become broken and embankments have partially eroded due to this deterioration. It is urgently necessary to build new embankments in such cases.

		
Photo 3.1.3.7 Deteriorated Hydraulic Structures	Photo 3.1.3.8 Partialy eroded embankment	Photo 3.1.3.9 Newly constructed sluice gate

Figure 3.1.10 Photos of Damaged Hydraulic Structures

(7) Technical Points to Consider in Implementing Rehabilitation in the Project

The following paragraphs describe the technical points that need to be considered when conducting rehabilitation aimed at mitigating disaster risks and addressing disasters in the Project.

(a) Riverbed scouring countermeasures

As a method for addressing bank erosion in line with riverbed scouring, measures to strengthen embankment slope toes and revetment foundations are effective. Generally, foot protection works using geo-bags, C.C. block and riprap which can be adjusted in line with riverbed fluctuations are effective methods. However, because it is hard to acquire stone materials due to limited rock quarry and a large amount of stones are needed in Bangladesh river, it is better to examine foundation reinforcement measures using C.C. block and geo-bags.

(b) Wave countermeasures

As a method for addressing sections impacted by waves, it is effective to cover embankment slopes with concrete blocks and also to install wave dissipating works comprising tetrapod, etc. on the front of embankments. Wave dissipating works are expected to gradually sink over time; however, they can still be expected to have a certain wave dissipating effect even if they do. Even the conventional approach of covering embankment slopes with CC blocks of differing sizes exhibits a certain degree of effectiveness in preventing erosion; however, there have been cases where wave uplift pressure lifted and scattered the blocks. Accordingly, when covering with concrete blocks, it is better to counter uplift pressure through adopting perforated blocks and so on.

(c) Securing of setback and planting of trees

Rivers in Bangladesh are deep and have large fluctuations in riverbed and banks. Therefore, the embankment design standard (Standard Design Manual) of Bangladesh stipulates that setback be secured as follows upon considering the need to secure a borrow pit and width for erosion. However, if

the prescribed width cannot be secured, it is necessary to take bank erosion countermeasures upon securing a minimum setback of 6 meters.

Necessary setback = Minimum necessary width 6m + Erosion width in past 10 years

According to the engineer of BWDB Bagerhat O&M office, a setback of roughly between 50 to 100 meters should be secured. Considering that the soil of setbacks is clayey and prone to erosion, it is desirable to also plant trees like mangrove etc. to enhance the resistance to erosion.

(8) Operation and Maintenance Conditions

The following table shows the infrastructure that is managed by the BWDB local offices in the two coastal districts that were surveyed.

Table 3.1.7 Infrastructure Managed by BWDB Local Offices in the Two Coastal Districts

Zone	Circle	Division	Number of Polders	Length of Ring Polders (km)	Structures* (Quantity)	Area inside Ring Polders (ha)
South (Barisal)	Patuakhali	Kalapara	16	516.873	279	75,860
		Patuakhali	18	922.605	323	107,742
Southwest (Khulna)	Bagerhat		11	389.04	178	124,801

*Sluice gates, sluice pipes Source: BWDB local offices

The maintenance activities of local offices mainly comprise emergency works (recovery of broken embankment parts) and maintenance of hydraulic structures; however, due to lack of budget, understaffing and shortage of equipment, routine inspections are hardly implemented at all.

Incidentally, operation of sluice gates is consigned by the BWDB to Water Management Organizations (WMOs).

3.2 Screening of Sub-projects Candidate

3.2.1 Screening Criteria

Criteria for screening infrastructure to be rehabilitated are described as follows:

- Facilities contributing to "Rapid Rehabilitation" in disaster management cycle. Enhance the functionality of primary facilities which supporting early response in disaster. Facilities are also included which protect the key facilities for certain area like airport, ferry pier, etc.
- Facilities contributing to "Mitigation" in disaster management cycle. Strengthen vulnerable infrastructure against disaster.
- Facilities with great urgency of repair for large damage.
- Facilities having an overall large scale but partly damaged, it is possible to significantly reduce disaster damage by repairing the locally damaged part.
- Safety degree against flood, storm surge, etc. shall meet the design guideline.
- Sites are excluded from the project target where it is difficult to economically correspond with large-scale scouring of large rivers and difficult maintenance.

- Whether it is necessary treat as a new project considering a site condition.
- Whether there is an overlap with other agencies (donor) in project scope.

3.2.2 Screening of Sub-projects

Based on the criteria mentioned above, a) Rapid Rehabilitation, b) Mitigation, c) Urgency, d) Benefit, e) Maintenance, f) New Project, and g) Other Donors are considered for screening.

Table 3.2.1 Screening of Embankment Sub-projects to be Rehabilitated (BWDB)

No	District	Upazilla	Type of Structure	Rapid Rehabil-itation	Mitiga-tion	Urgen-cy	Benefit	Main-tenance	New Project	Other Donors	Total
1	Satkhira	Debha	Embankment with Slope Protection		5	3	5	1	5	5	24
2		Debha	Embankment		5	3	5	1	5	5	24
3	"	Kaliganj	Embankment		5	3	5	1	5	5	24
4	"	Shyamnagar	Embankment		5	5	5	1	5	5	26
5		Shyamnagar	Embankment		5	5	5	5	5	5	30
6		Assa Suni	Embankment		5	5	5	5	5	5	30
7		Assa Suni	Embankment		5	5	5	5	5	5	30
8	Khulna	Koyra	Embankment		5	5	5	1	5	5	26
9		Koyra	Drainage Sluice Gate		5	3	3	5	5	5	26
10		Koyra	Embankment		5	5	5	5	5	5	30
11	Bargerhat	Morrelganj	Embankment with Slope Protection		5	5	5	1	5	5	26
12		Bargerhat Sadar	No Embankment		5	5	5	5	1	5	26
13		Bargerhat Sadar	Embankment Road		5	1	5	5	5	5	26
14	Pirojpur	Pirojpur Sadar	Embankment		5	1	5	5	5	5	26
15		Mothbaria	Embankment		5	1	5	5	5	5	26
16	Jhalokathi	Jhalokathi Sadar	Embankment		5	1	5	5	5	5	26
17		Nalchity	Embankment		5	1	5	5	5	5	26
18		Jhalokathi Sadar	Embankment		5	1	3	5	5	5	24
19	Barisal	Babuganj	Bank Protection for Airport	5		5	5	5	5	5	30
20		Babuganj	Bank Protection for Bridge	5		5	5	5	5	5	30
21	Barguna	Patharghata	Embankment		5	5	5	5	5	5	30
22		Barguna Sadar	Embankment		5	5	5	1	5	5	26
23	Patuakhali	Dumki	Embankment with Slope Protection		5	1	3	5	5	5	24

No	District	Upazilla	Type of Structure	Rapid Rehabil-itation	Mitiga-tion	Urgen-cy	Benefit	Main-tenance	New Project	Other Donors	Total
24		Dumki	Embankment with Slope Protection	5		3	5	5	5	5	28
25		Dumki	Embankment Road		5	1	3	5	5	5	24
26		Dumki	Embankment		5	1	3	5	5	5	24
27		Dumki	Embankment		5	1	3	5	5	5	24
28		Patuakhali Sadar	Bank Erosion		5	1	5	5	5	5	26
29		Patuakhali Sadar	Embankment Road		5	5	5	1	5	5	26
30		Patuakhali Sadar	Embankment Road		5	1	5	5	5	5	26
31		Galachipa	Drainage Sluice Gate		5	3	5	5	5	5	28
32		Galachipa	Embankment Road		5	3	5	5	5	5	28
33		Kalapara	Drainage Sluice Gate		5	5	5	5	5	5	30
34		Kalapara	Embankment with Slope Protection		5	5	5	1	5	5	26
35	Bhola	Bhola Sadar	Embankment		5	5	5	1	5	5	26
36		Bhola Sadar	Embankment		5	5	5	1	5	5	26
37		Daulatkhan	Embankment		5	5	5	1	5	5	26
38		Daulatkhan	Embankment		5	5	5	1	5	5	26
39		Daulatkhan	Embankment		5	5	5	1	5	5	26
40		Tazumuddin	Embankment with Slope Protection		5	5	5	1	5	5	26
41		Charfassion	Embankment		5	5	5	1	5	5	26
42		Charfassion	Drainage Sluice Gate		5	5	3	5	5	5	28
43	Cox's Bazar	(Wide Area)	Embankment Slope/Bank Protection								

Note: Blue-shaded cells have been screened as promising candidate of Sub-project.

Table 3.2.2 Screening of Road Sub-project to be Rehabilitated (LGED)

Code	District/ Upazila	Road Type	Rapid Rehabili-tation	Mitigation	Urgen-cy	Benefit	Main-tenance	New Project	Other Donors	Total
HW1	Satkhira/ Kaliganj	Upazila	5		5	5	5	5	5	30
HW2	Satkhira/ Kaliganj	Upazila *	5		1	3	5	1	5	20
HW3	Satkhira/ Kaliganj	Upazila	5		1	3	5	5	5	24
HW4	Satkhira/ Shyamnagar	Union*	5		3	3	5	5	5	26
HW5	Satkhira/ Shyamnagar	Upazila *	5		3	5	5	5	5	28
HW6	Bagerhat/ Morrelgonj	Upazila	5		3	5	5	5	5	28

Code	District/ Upazila	Road Type	Rapid Rehabili -tation	Mitigation	Urgen -cy	Benefit	Main -tenance	New Project	Other Donors	Total
HW7	Bagerhat/ Morrelgonj	Union*	5		3	3	5	5	5	26
HW8	Bagerhat/ Bagerhat Sadar	Union*	5		1	1	5	5	5	22
HW9	Bagerhat/Mongla	Union	5		1	1	5	5	5	22
HW10	Perojpur/Nazirpur	Union	5		1	1	5	5	5	22
HW11	Perojpur/Nazirpur	Union	5		1	1	5	5	5	22
HW12	Perojpur/Nazirpur	Upazila	5		1	1	5	5	5	22
HW13	Jhalokati/ Jhalokati Sadar	Upazila	5		5	5	5	5	5	30
HW14	Jhalokati/ Rajapur	Upazila	5		1	1	5	5	5	22
HW15	Jhalokati/ Rajapur	Village	5		1	1	5	5	5	22
HW16	Patuakhali / Patuakhali Sadar	Upazila *	5		5	5	5	5	5	30
HW17	Barguna/ Betagi	Union	5		1	1	5	5	5	22
HW18	Barguna/ Betagi	Village	5		1	1	5	5	5	22
HW19	Barguna/Barguna Sadar	Upazila	5		1	1	5	5	5	22
HW20	Bhola/Bhola Sadar	Upazila	5		1	1	5	5	5	22
HW21	Bhola/Bhola Sadar	Upazila	5		1	1	5	5	5	22
HW22	Bhola/ Borhanuddin	Upazila	5		1	1	5	5	5	22
HW23	Cox Bazar/Sadar, Ramu, Chakoria and Pekua	Various								

Note: Blue-shaded cells have been screened as promising candidate of Sub-project.

Table 3.2.3 Screening of Bridge Sub-projects to be Rehabilitated (LGED)

Code	District/ Upazila	Road Type	Rapid Rehabili -tation	Mitigation	Urgency	Benefit	Main -tenance	New Project	Other Donors	Total
BR1	Bagerhat/ Bagerhat Sadar	Union	5		5	5	5	5	5	30
BR2	Bagerhat/Mongla	Village	5		5	5	5	5	5	30
BR3	Bagerhat/Mongla	Village	5		5	5	5	5	5	30
BR4	Bagerhat/Mongla	Union	5		5	5	5	5	5	30
BR5	Jhalokati / Jhalokati Sadar	Upazila	5		1	1	5	5	5	22
BR6	Jhalokati/Nalcity	Upazila	5		5	5	5	5	5	30
BR7	Patuakhali / Patuakhali Sadar	Union	5		1	1	5	5	5	22
BR8	Patuakhali/ Patuakhali Sadar	Village	5		1	1	5	5	5	22
BR9	Barguna/ Betagi	Upazila	5		3	3	5	5	5	26
BR10	Barguna/ Barguna Sadar	Village	5		5	1	5	5	5	26
BR11	Barguna/ Barguna Sadar	Upazila	5		5	5	5	5	5	30
BR12	Bhola/Bhola Sadar	Upazila	5		5	5	5	5	5	30

Note: Blue-shaded cells have been screened as promising candidate of Sub-project1.

As shown in the tables above, 18 sub-projects have been selected as promising canditate for Component 1.

Table 3.2.4 Eight (8) Sub-projects Selected forBWDB as Promising Candidate

No.	District	Upazilla	Type of Structure	Main Damage and Process on Structure	Time of Disaster	Causes of Damage
5	Satkhira	Shyamnagar	Embankment	L=0.6km, (d)(e) Intensive damage	On-going damage	Bank erosion in line with riverbed scouring
6	Satkhira	Assa Suni	Embankment	L=1.0km, (d)(e) Intensive damage	On-going damage	Bank erosion in line with riverbed scouring
7	Satkhira	Assa Suni	Embankment	L=1.5km, (d) Intensive damage	On-going damage	Bank erosion caused by waves
10	Khulna	Koyra	Embankment	L=0.9km, (d) Intensive damage	On-going damage	Bank erosion caused by waves
19	Barisal	Babuganj	Bank Protection for Airport	L=2.3km, (d)(e) Intensive damage	On-going damage	Bank erosion in line with riverbed scouring
20	Barisal	Babuganj	Bank Protection for Bridge	L=0.4km, (d)(e) Intensive damage	On-going damage	Bank erosion in line with riverbed scouring
21	Barguna	Patharghata	Embankment	L=1.0km, (d) Intensive damage	Cyclone Sidr (2007), Aila (2009), Monsoon in June 2015	Bank erosion caused by waves
33	Patuakhali	Kalapara	Drainage Sluice Gate	1 place, Concrete crack; No steel gates; Intensive damage	-	Deterioration

Table 3.2.5 Ten (10) Sub-projects Selected for LGED as Promising Candidate

Code	District/ Upazila	Type	Road Length/ Width	Time of Disaster	Causes of Damage
HW1	Satkhira/ Kaliganj	Upazila road	L=18.0km, W=5.5m	2008 flood and 2009 Aila	Slope scouring/erosion, settlement, wash out
HW13	Jhalokati/ Jhalokati Sadar	Upazila road	L=3.0km, W=5.3m	2012 flood	Washout (0.5km)
HW16	Patuakhali / Patuakhali Sadar	Upazila road	L= 12.0km, W=5.5m	2007 Sidr	Slope erosion and failure (Embankment road)
BR1	Bagerhat/ Bagerhat Sadar	Bridge Super: RC Slab Sub: Concrete	L=40m, W=5.35m	2007 Sidr、2009 Aila	Salt damage, settlement
BR2	Bagerhat/Mongla	Bridge Super: wooden planks Sub: Metal beams	L=30m, W=5.35m	2007 Sidr	Fatigue, Salt damage
BR3	Bagerhat/Mongla	Bridge Super: Bamboo Sub: Bamboo	L=51m, W=5.35m	2007 Sidr	No damage but substandard
BR4	Bagerhat/Mongla	Bridge Super: Wooden planks Sub: Metal beams	L=20m,W=5.35m	2007 Sidr	Fatigue, salt damage, collision
BR6	Jhalokati/Nalcity	Bridge Super: RC Slab Sub: Metal beams	L=20m,W=7.3m	2007 Sidr, 2009 Aila	Fatigue, salt damage, collision
BR11	Barguna/ Barguna Sadar	Bridge Super: Wooden planks Sub: Metal beams	L=66m,W=7.3m	2007 Sidr	Fatigue, salt damage, collision
BR12	Bhola/Bhola Sadar	Bridge Super.: RC Slab Sub: Metal beams	L=96m,W=5.35m	2009 Aila	Collapsed (Not in use) due to flood

3.3 Preliminary Design of Sub-projects

3.3.1 Bridges

(1) Status of Bridge Sites Selected

The present status of seven (7) bridge sub-projects is summarized in Table 3.3.1. The status of the existing bridges described here is based on the survey conducted including the information obtained from hearings with the LGED person in-charge and local residents.

Table 3.3.1 Status of Selected Bridge Sub-projects

Bridge	Location (District/ Upazila)	Outline of Existing Bridge	Overview	Site Photos
BR1	Bagerhat/ Sadar Located on the road connecting Kashimpur Bazar in Dema Unionand Abdul RasulpurMarket	<Road Type> Village Road 【Dimension】 L=14 m、W=3.7m 【Structure type】 Super: RC Slan Sub: Metal beams/piles	• Constructed in year1993. • Bridge length is 14m and river width is about 30m. Thereby the abutments and approach road lies inside river section. • Approach roads were damaged during Sidr and/or Aila. Abutment inclined due to riverbed scouring. • Significant damage of handrail due to salinity. • Approach road slopes have no protective measures, making it vulnerable to upcoming disasters. • Assumed (from hearings) depth of riverbed 3.5m from surface.	 
BR2	Bagerhat/ Mongla Located in Suniltala Union on the road connecting the union with the neighboring upazila.	<Road Type> Union Road <Dimension> L=13 m、W=2.0m (Prior to damage, L=27m, W=2.1m) <Structure> Super: Wooden Plank (Prior disaster: RC Slab) Sub: Metal beams/piles	• Temporarily rehabilitated following washout of the deck during Sidr (2007) • Wooden planks are unstable. Substructure is in critical condition as the metal beams are severely corroded, thinned and deformed. • It was used to transport agro-products from farms nearby until the slab of the bridge was damaged by Sidr in 2007. • It is used by about 3,000 local residents for access to the market, school, town hall and cyclone shelter. • Assumed (from hearings) depth of riverbed 3.5m from surface.	 
BR3	Bagerhat/ Mongla Located on the road that connects Sundarban Union HQ and Madurpalta Bazar	<Road Type> Village Road <Dimension> L=48m、W=1.9m <Structure> Super: Wooden Plank Sub: Bamboo	• Reconstructed at same location and same type as the original on damaged during Sidr (2007) • The fixed points of wooden planks are loose making it unstable. • The width is narrow and only enough for autobikes and pedestrians. Rickshaws and vehiles can not pass. • If damaged, it will create difficulty for about 16,800 village people in accessing to markets, town halls and cyclone centers. • Assumed (from hearings) depth of riverbed 3.5m from surface.	 

Bridge	Location (District/ Upazila)	Outline of Existing Bridge	Overview	Site Photos
BR4	Bagerhat/ Mongla Located over Khanjahan Ali Canal near Khanjahan Ali Market	<Road Type> Union Road <Dimension> L=20m、W=2.5m <Structure> Super: Wooden Plank (Prior disaster: RC Slab) Sub: Metal beams/piles	• Constructed in 2006 • Severely damaged during Sidr and Aila • Rehabilitated after disaster but the damage is still progressing. Metal beams are corroded, deformed, displaced due to loss of bolts and handrail spalled due to salt damage. • Very important route for the village people in terms of access to Khanjahan Ali Market, town hall, school and evacuation route to cyclone shelter • Assumed (from hearings) depth of riverbed 3.5m from surface.	 
BR6	Jhalokati/ Nalchity Spans over Manpasa Canal on the road that connects Taltala and Manpasa Market	<Road Type> Upazila Road <Dimension> L=20 m、W=3.0m <Structure> Super: RC Slab Sub: Metal beams/piles	• Constructed in the '80-'90s (assumed) • Severely damaged during Sidr (2007). • Presently, in very critical state. Large area of the deck is missing, which is covered with a metal plate. Metal beams are corroded, thinned, deformed and members displaced. Handrails have also broken and fallen down. • More than 1,000 people per day use the bridge to access the markets located on both sides of the bridge. • Assumed (from hearings) depth of riverbed 3.5m from surface.	 
BR11	Barguna/ Sadar Spans over Khadkon River on the road connecting Barguna District HQ and Kakshira growth center	<Road Type> Upazila Road <Dimension> L=65m、W=3.0m <Structure> Super: RC Slab Sub: Metal beams/piles	• Constructed in the '80-'90s (assumed) • Significantly damaged during Sidr (2007) • RC deck is almost without concrete and only the reinforcement remains. • Being used using wooden planks in replacement of concrete deck. • Damage is still progressing due to salinity. Currently, the metal beams are severely corroded, deformed, and broken and is in extreme condition. • Restriction is being imposed for vehicular use. About 15,000 people per day use to go to the market • Assumed (from hearings) depth of riverbed 8.5m from surface.	 
BR12	Bhola/ Sadar Located on a village road that foes to Hazir Market in the southwest of the Upazila.	<Road Type> Village Road <Dimension> L=95m、W=3.7m <Structure> Super: RC Slab Sub: Metal beams/piles	• Constructed in 1995 • The decks in the middle were washed away by Aila (2009) severing access to three unions with 30,000 people on the other side. • Roads on the isolated unions are well maintained but inconvenient to move for not having a bridge. • Evacuation to nearby shelters during large scale disasters is not possible. • Assumed (from hearings) depth of riverbed 8.5m from surface.	 

(2) Design

(a) Applicable Design Standards

The "Road Structures Manual for Single Lane Bridges, Feb. 2011, Volume I. Reinforced Concrete Brudge" that was prepared under the JICA-assisted project named as "The Strengthening of Activities in RDEC Project" is applied for the preliminary design of bridges.

This manual provides standard designs of reinforced concrete girders connected with RC deck of span range 12 to 24m and abutment bridges varying between 3m and 7m. However, this manual is also applied to multispan bridges.

(b) Survey Drawings

The existing condition of the bridge sites is prepared based on the inventory of existing bridges carried out during site survey and the information obtained from hearings conducted with the District and Upazila office staff members of LGED including the local residents.

(c) Applicable Load

The objective bridges are located along Upazila roads, Union roads and Village roads that are under the responsibility of LGED. Therefore, the load to be applied is HS-20, which is referred from the design standard of LGED mentioned above.

(d) Location

The bridges are planned at the location of the existing bridges. Whether or not it will affect the river section will be studied. Where embankents exist, the location of the abutment, as a general principle, is taken such that it lies behind the cross point with the design high water level.

(e) Superstructure

Simple RC deck is considered for the superstructure. The width, length of bridge and span numbers and lengths are discussed hereunder.

a) Bridge Width

The width to be applied depends on the class of the road. The dimensions of the bridges for each class are determined based on the design manual in a manner indicated below.

Bridge Width of Upazila Road

Bridges on Upazila road are planned to have a total width of 7.3m, with 5.5m wide carriageway and 0.65m wide footwalk on either side. The footwalk is raised to a height of 0.25m from the deck using a curb stone. Handrails are provided as a preventive measure agains skidding off. Two percent (2%) crossfall is provided for the surface to facilitate surface drainage.

Bridge Width of Union and Village Road

Bridges on Union and Village road are planned to have a total width of 5.35m, with 3.7m wide carriageway and 0.6m wide footwalk on either side. The footwalk is raised to a height of 0.25m from the deck using a curb stone. Handrails are provided as a preventive measure agains skidding off. Two percent (2%) crossfall is provided for the surface to facilitate surface drainage.

b) Bridge Length and Composition of Spans

- The longest length applicable as stipulated in the standard drawings of RC bridges prepared by LGED is 24m.
- The spans applied are 15m, 17m, 20m, 22m, and 24m
- The rivers are used by local water transportation (small boats) only and therefore no particular consideration is taken in determining the span lengths.
- Number of spans is minimized to reduce the number of piers.

f) Freeboard

Freeboard is defined here as the height between the soffit of the girder to the high water level of past disasters. It was learnt from hearings with local residents at the sites that the past high water level in average is about 1.5m above the ground surface. A clearance of 1.0m is added to this high water level for freeboard. Therefore the freeboard is 1.5m. Freeboard is a clearance for boat navigation and flowing debris during flooding. The freeboard of 1.0 m applied for preliminary design of bridges is based on the past bridge construction projects such as the Project for Provision of Portable Steel Bridges on Upozila and Union Roads under Japanese grant aid for Bangladesh (basic design studies conducted in 1993, 2001 and 2005).

(f) Substructure

a) Abutment and Pier

Abutment and pier to be applied for the bridges is planned in accordance with the standard design manual of LGED. Full depth retuen type abutment and wing wall is applied for abutment and a pile bent type for pier(s).

b) Foundation

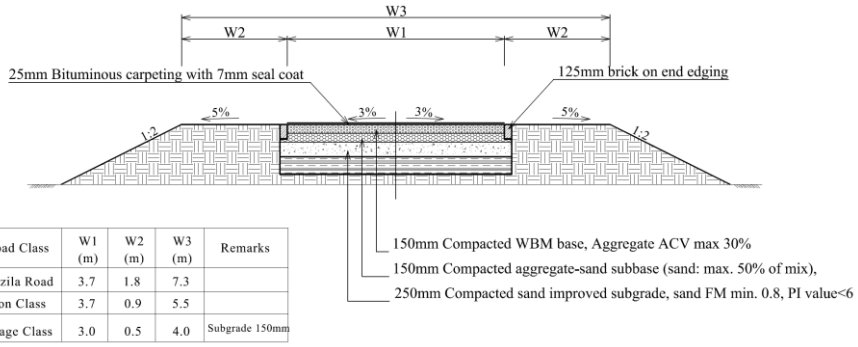
The soil condition of the coastal area according to a report prepared based on the drilling investigation results indicate that the upper layer is a distribution of 4m to 12m thick silty clay layer, where the N-value varies from 1 to 12. The layer beneath is formed from sandy or silty soil which varies in thickness from 2m to 13m and where the N-value is between 8 and 30. Therefore, a foundation pile is planned to support the abutment and piers.

According to the local contractors, RCC cast-in-situ bored piles of diameter 0.5m to 0.9m are commonly used in the country. Therefore, similar piles are provided for foundation.

(g) Ancillaries

a) Approach Road

The cross section and pavement structure of the approach road is planned based on the standard design manual of LGED. The width of the approach road will follow those accordingly for Upazila, Union and Village roads as stipulated in the manual and will be transitioned to the width of the existing road. Approach roads will have asphalt pavement. The maximum grade applied is 6% and the fill section will have a slope of 1:2. The cross section of each road class is illustrated in Figure 3.3.1.



Road Class	W1 (m)	W2 (m)	W3 (m)	Remarks
Upazila Road	3.7	1.8	7.3	
Union Class	3.7	0.9	5.5	
Village Class	3.0	0.5	4.0	Subgrade 150mm

Figure 3.3.1 Typical Cross Section of Approach Roads

b) Slope Protection

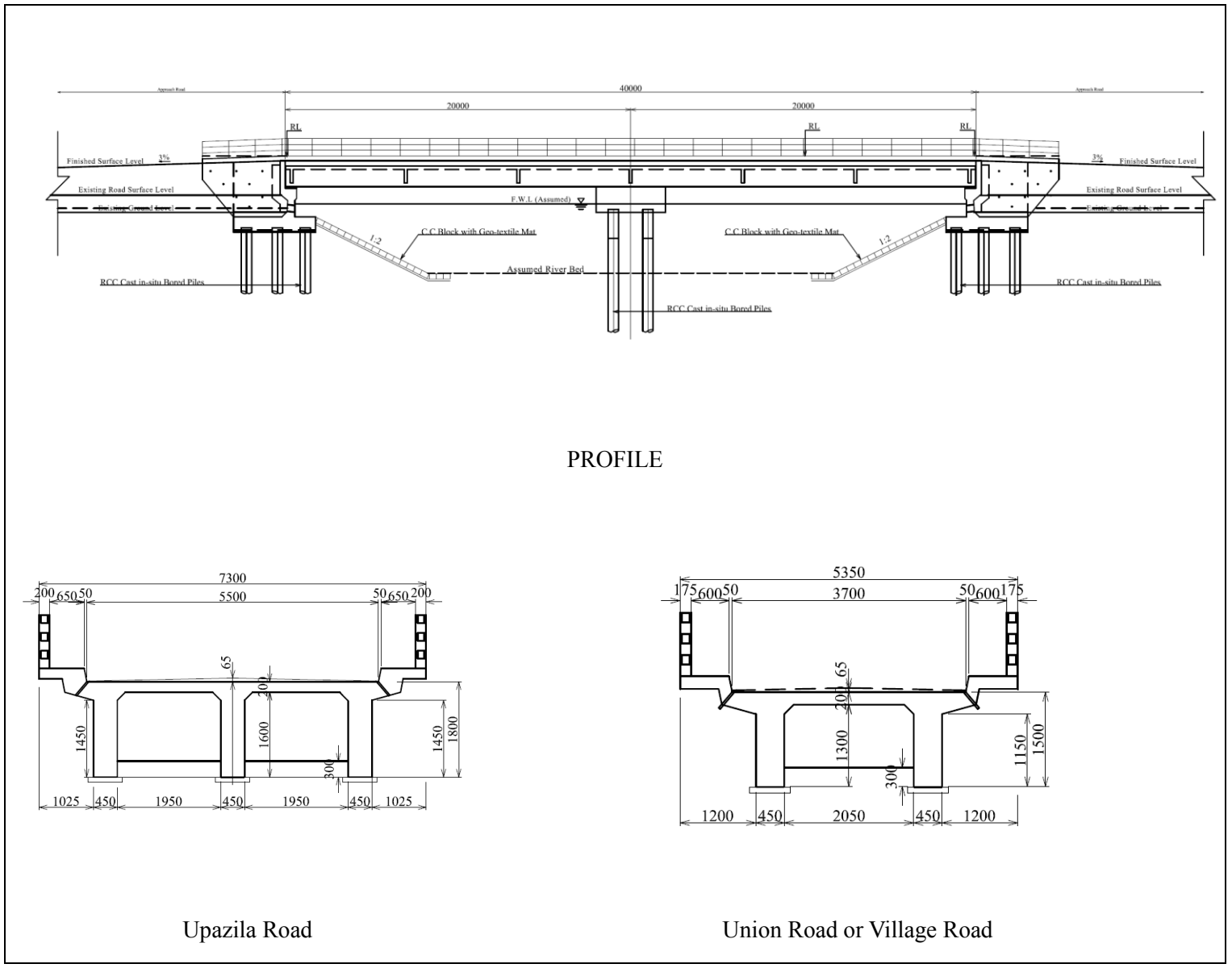
Concrete pre-cast blocks are used 10m at both sides of the abutments to protect its surrounding from erosion.

(h) Preliminary Desgin

The result of the preliminary design of each bridge is summarized in Table 3.3.2. A sample drawing is illustrated and the drawings are compiled in Appendix 3 (Preliminary Design Drawings)

Table 3.3.2 Preliminary Design Results of Objective Bridges

Bridge No.	BR-1	BR-2	BR-3	BR-4	BR-6	BR-11	BR-12
Road Type	Village	Union	Village	Union	Upazila	Upazila	Village
Bridge Type	Reinforced Concrete Girder Bridge						
Length (m)	40	30	51	20	20	66	96
Span (m)	20m x 2	15m x 2	17m x 3	20m x 1	20m x 1	22m x 3	24m x 4
No. of Pier(s)	1	1	2	-	-	2	3
Width (m)	5.35	5.35	5.35	5.35	7.30	7.30	5.35



Source: Survey Team

Figure 3.3.2 Sample Drawing of Preliminary Design of Bridge

3.3.2 Road

(1) Status of Selected Road Sites

The present status of three (3) objective roads is summarized in Table 3.3.3 . The status of the existing bridges described here is based on the survey conducted including the information obtained from hearings with the LGED person in-charge and local residents.

Table 3.3.3 Present Status of Selected Road Sub-projects

Road	Location (District/ Upazila)	Basic Information of Existing Road	Overview	Site Photo
HW1	Satkhira/ Kaligonj Road that connects Bastala, eastern town, Kaligonj	<Road Class> Upazila Road <Damage Range> L=18km、 W=7.3m <Pavement> Width: 3.7m Type: Asphalt	• Constructed by RHD in 2001-2002 and handed over to LGED and now LGED is looking after its operation and maintenance • Many markets and settlements are scatterd alongside. • 4 km passes through prawn farms • Trunk road ofter used to transpot commodities and plays a vital role in the socio-economical activities of the people living alongside. • Repeatedly inundated during Aila(2009) and other floods, resulting to severe surface distress. Undulation due to transportation of base material and uneven irregular subsidence.	 
HW13	Jhalokati/ Sadar The beginning point starts from the RHD road R870, which runs East-West and is about 1km north from the District HQ.	<Road Class> Upazila Road <Damage Range> L=3.0km、 W=5.5m <Pavement> Width:3.7m Type: Asphalt	• Important road since it begins and end at Regional Road (RHD) • 500m of the segment is in concave front of River Basand and a section of 2.5km up and down from this front has been damaged by Aila and daily current effect, causing scoring and erosion of slopes. • Rehabilitation was done by shifting the alignment away from the water front but was damaged again by flood in 2014/2015 • Commuting road for about 5,000 students of a religious school nearby. • Used for evacuation and transporting supplies.	 
HW16	Patuakhali/ Sadar The road that connects the Patuakhali District HQ and Ayla Upazila HQ in Barguna District	<Road Class> Upazila Road <Damage Range> L=12km、 W=3.7m <Pavement> Width: 3.7m Type: Asphalt (partially brick)	• Constructed in 2003, damaged by Aila (2009) • A section of 0.5km which lies in the concave front of the river flowing almost parallel to the road was washed away due to riverbed scouring and slope erosion. • Rehabilitated temporarily but the erosion and overflow has not stopped and can be destroyed by floods in the future. • A 12km segment before and after the above spot has surface washout due to overflow during flood. • Access to two growth centers and 4 markets and is used by locals for accessing to markets, for evacuation and for carrying supplies during disaster.	 

(2) Design

The design is conducted for the purpose of rehabilitation or function restoration of the damaged objective roads sub-projects. The design guidelines and/or construction specification of LGED is referred for the design. The contents of the design are discussed below.

(a) Applicable Design Standards

The design and maintenance work of rural roads is undertaken by LGED and it is mandatory to use the LGED's design manual, "Road Design Standard Rural Roads, 2005", for the design of rural roads. Therefore, the same design manual is applied for the preliminary design of objective roads.

(b) Survey Drawings

According to LGED Upazila office, the preliminary design is often carried out using the Upazila Road Map and the design manual only. Therefore, this preliminary design is also conducted in the same manner. However, the existing condition such as the damaged range of the roads, road width, pavement type, cross section etc. are determined based on the inventory of objective roads carried out during the site survey and the information collected from hearings conducted with the District and Upazila office staff members of LGED including the local residents.

(c) Horizontal Alignment

In principal, the horizontal alignment of the existing road is maintained. However, the alignment of HW13 and HW16, where heavy revetment or slope protection will be required, is slightly shifted away from the water front toward the country side.

(d) Vertical Alignment

The vertical alignment of the road will follow that of the existing road. The finished level is however planned to be 0.2m higher that the high water level measured in the past flood. The hearings with the locals indicates that the past high water level is just on top of the existing roads (incase of embankment road, the crest level). However, a segment of HW1 and HW16 will be raised 0.5m from the existing road surface taking into consideration that the sections were overflowed upto 0.3m in the past.

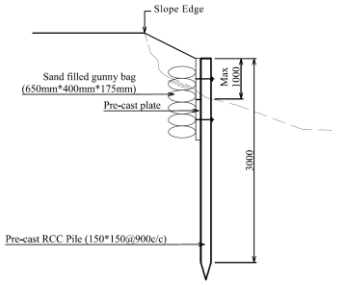
(e) Cross Section

This project aims to rehabilitate the damaged section of a road to restore its functions. Therefore, the cross section to be applied is referred from the design manual of LGED in association with the inventory data provided along with the dimensions of the existing road and the site conditions. The result is that that all three roads will have a road width of 7.3m where the pavement width is 3.7m and shoulders 1.8m. The carriageway is provided with a crossfall of 3% and the shoulder with 5% for facilitating durface drainage.

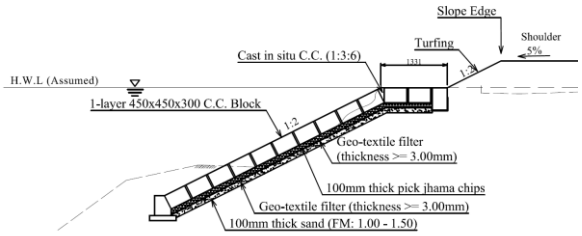
(f) Fill Slopes

The sides of fill section are provided with a slope of 1:2 (vertical: horizontal). Turfs such as 'Dhurba' or 'Hikar' that are commonly used in rural roads in Bangladesh are provided for protection. Sections along a river or where the slopes are exposed to water for relatively long time (for example section passing between prawn farm), concrete palisading as shown in Figure 3.3.3(a), and is widely used in Bangladesh is applied. This structure is also applied on sections where standard slope can not be applied due to certain constraints.

A section of HW16 is an embankment road and protection of slopes is responsibility of BWDB. Therefore, C.C Blocks as shown in Figure 3.3.3(b) that is commonly used for BWDB slope protection works is applied.



a) Concrete Palisading



b) C. C. Block

Source: JICA Survey Team

Figure 3.3.3 Slope Protection Measures

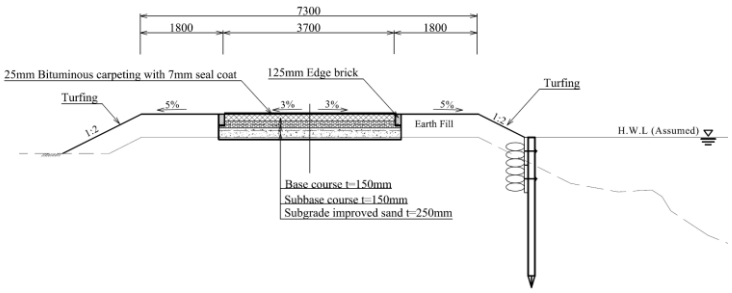
(g) Pavement

Asphalt pavement, which is widely used in Bangladesh and the objective areas are planned. It will have 32mm surface course, 150mm each for base and subbase course and 250mm of subgrade. 125mm wide bricks are provided at both ends of the pavement.

Lately, application of concrete pavement is under consideration by LGED in coastal areas, which experiences heavy rainfall and is highly saline. Therefore, it is recommendable that application of concrete pavement be considered during the detailed design stage.

(h) Typical Cross Section

A representative cross section is shown in Figure 3.3.4. The result of the preliminary design is summarized in Table 3.3.4 and the drawings are provided in Appendix 3 (Preliminary Design Drawings)



Source: Survey Team

Figure 3.3.4 Representative Cross Section of Objecteve Roads

Table 3.3.4 Preliminary Design Results of Objective Roads

Code	Road Class	Design Length (km)	Total Width(m) (Carriageway+Shoulder)	Elevation to be Raised (m)	Slope Protection Measures
HW1	Upazila Road	18.0	7.3 (3.7+1.8)	0.2 (partially 0.5)	Turfing, Concrete Palisading
HW13		3.0		0.2	Turfing, Concrete Palisading
HW16		12.0		0.2 (partially 0.5)	Turfing, Concrete Palisading、C.C block

3.3.3 Embankment

(1) Status of Embankment Sites Selected

Present status of selected 7 embankment sub-projects is summarized in Table 3.3.5 below.

Table 3.3.5 Present Staus of Embankment Sub-projects Selected

No	Location	Structure to be Rehabilitated	Overview	Site Photo
5	(1)District Satkhira (1.99 million population) (2)Upazilla Shyamnagar (0.32 million population)	(Type) Polder Embankment (Feature of Structure) Width of Embankment 4.3m, Top level +4.3mPWD, River-side Slope 1:3, Country-side Slope 1:2 (Damage Situation) 0.6km long embankment has been eroded and sectional 40% of embankment body was lost. To protect embankment from erosion caused by wave action, concrete blocks are to be provided for river side slope of embankment.	Polder No. 5 has 190 km long embankment, 55,466 ha and 0.44 million population. A part of embankment of Polder No. 5 which is located at the concave of river channel has been eroded by wave action. Once, big waves by cyclone, etc., occures, this portion will easily collapse and river water will enter the polder.	 

No	Location	Structure to be Rehabilitated	Overview	Site Photo
6	(1)District Satkhira (1.99 million population) (2) Upazilla Assasuni (0.27 million population)	(Type) Polder Embankment (Feature of Structure) Width of Embankment 4.3m, Top level +4.3mPWD, River-side Slope 1:3, Country-side Slope 1:2 (Damage Situation) 1.0km long embankment has been eroded and sectional 50% of embankment body was lost. To protect embankment from erosion caused by wave action, concrete blocks are to be provided for river side slope of embankment.	Polder No. 4 has 80 km long embankment, 10,500 ha and 0.09 million population. A part of embankment of Polder No. 4 which is located at the concave of river channel has been eroded by wave action. Once, big wave by cyclone, etc., occures, this portion will easily collapse and river water will enter the polder.	 
7	(1)District Satkhira (1.99 million population) (2)Upazilla Assasuni (0.27 million population)	(Type) Polder Embankment (Feature of Structure) Width of Embankment 4.3m, Top level +4.3mPWD, River-side Slope 1:3, Country-side Slope 1:2 (Damage Situation) 1.5km long embankment has been eroded and sectional 50% of embankment body was lost. To protect embankment from erosion caused by wave action, concrete blocks are to be provided for river side slope of embankment.	Polder No. 4 has 80 km long embankment, 10,500 ha and 0.09 million population. A part of embankment of Polder No. 4 which is located at the concave of river channel has been eroded by wave action. Once, big wave by cyclone, etc., occures, this portion will easily collapse and river water will enter the polder.	 

No	Location	Structure to be Rehabilitated	Overview	Site Photo
10	(1)District Khulna (2.32 million population) (2)Upazilla Koira (0.19 million population)	(Type) Polder Embankment (Feature of Structure) Width of Embankment 4.3m, Top level +4.3mPWD, River-side Slope 1:3, Country-side Slope 1:2 (Damage Situation) 0.9km long embankment has been eroded and sectional 40% of embankment body was lost. To protect embankment from erosion caused by wave action, concrete blocks are to be provided for river side slope of embankment.	Polder No. 13-14/2 has 93 km long embankment, 17,854 ha and 0.14 million population. A part of embankment of Polder No. 4 which is located at the concave of river channel has been eroded by wave action. Once, big wave by cyclone, etc., occures, this portion will easily collapse and river water will enter the polder.	 
19	(1)District Barisal (2.32 million population) (2)Upazilla Babuganj (0.14 million population)	(Type) Bank Erosion Protection (Feature of Structure) CC Block Revetment for river bank and Bamboo Groynes (about 100m long) under construction Since the existing river channel meanders and its 2.3 km long river bank concave is seriously eroded, huge amount of concrete blocks are to be provided for erosion protection.	River channel located north of Barisal Airport meanders. According to record of Google Earth (2006 and 2015), progress of bank erosion ranges from 150 m 200 m at concave, which is 20 m to 25 m per year. Without any countermeasure, erosion will reach to the airport area in 20 years. This river is located 120km far from the Bay of Bengal and still within tidal-river. Movement of water level is big and bank erosion is serious. (Project Effects) To secure the air-route between Dahka of national center and Barisal of reginal center. The air-route is very important for disaster relief activities and rehabilitation works when disaters occure.	 

No	Location	Structure to be Rehabilitated	Overview	Site Photo
20	(1)District Barisal (2.32 million population) (2)Upazilla Babuganj (0.14 million population)	(Type) Embankment and Revetment (Feature of Structure) Width of Embankment 4m, Slope 1:2, CC Block Revetment provided. (Damage Situation) About 100m long reveted Embankment has been damaged and a part was washed out completely. Huge amount of concrete blocks are to be provided for erosion protection.	This bridge is a very important one, a part of National Road No. 8 (Dahka - Barisal). Reveted embankment for protection of bridge abutment has been eroded and a part of embankment was washed out totally. Without any countermeasure, erosion will reach the approach road in 5 years estimated on the record of Google Earth. (Project Effects) To secure the main national road between Dakha of national center and Barisal of regional center. This road is a very important for relief activities, recovery and rehabilitation works.	 
21	(1)District Barguna (0.89 million population) (2) Upazilla Patharghata (0.14 million population)	(Type) Polder Embankment (Feature of Structure) Width of Embankment 4.3m, River-side Slope 1:7, Country-side Slope 1:2 Top Level +5.1mPWD. C.C Blocks for slope protection are not provided. (Damage Situation) A length of 1.0km embankment has been washed out due to high wave action in monsoon in June 2015. As known from satellite photo, breeched embankment and river is very close compared with other portion of polder. This section need strong embankment with concrete blocks.	in this section, embankment of Polder 41/1 (22 km long embankment, 2,105 ha within polder and 0.04 million population), was damaged by wave action several time in the past and cyclone Sidr. This section has no trees in front of embankment and space between river and embankment is narrow.	 

(2) Applicable Design Standard

Embankment design as a rule is implemented according to the BWDB Standard Design Manual of 1995 that is widely used in Bangladesh, while Japanese standards are referred to concerning items not covered by this.

(3) Design Flood Frequency

In the BWDB's Standard Design Manual, it is stipulated that the following flood frequencies be adopted for river embankments in Bangladesh according to the importance of the river and the situation regarding property in the protected land:

(1) 1:20 year water level, where agricultural damage is predominant.

(2) 1:100 year water level, where human lives, properties and installation are predominant.

Generally, along Jamuna River, Padma River, Meghna River and also in city and urban areas, this water level (1:100 year water level) is used.

This Project is intended to implement the rehabilitation of existing embankments that have been damaged by water-related disasters. Basically, therefore, the design flood frequency shall be the same as in the existing embankments or in cases where the height of the existing embankment is lower than adjacent embankments, height shall be aligned with the adjacent structures. The study targets full flood embankments and sea dykes in southern coastal areas. Therefore, according to the Standard Design Manual, the design flood frequency shall be based on the 20-year probability. However, in cases of protection for important infrastructure such as bridges, the design flood frequency shall be set according to the design criteria for the target infrastructure.

(4) Alignment of Embankment

In the Standard Design Manual, it is stipulated that the alignment of embankment should be planned upon taking the technical, economical and morphological aspects into account. Concerning the set back distance, it is stipulated that enough space for the borrow pit and erosion rate should be ensured, or if this is not possible, river training works and slope protection works should be considered.

This Project is intended to implement therehabilitation of existing embankments that have been damaged by water related disasters. Therefore, it is necessary to give priority to speed by keeping the area of land acquisition to a minimum and, accordingly the alignment of rehabilitated embankments shall be planned in accordance to the existing alignment.

(5) Embakment Crest Level

On river embankments in Bangladesh, the crest level of embankment is set upon considering the following elements.

$$\text{Crest Level} = \underset{\text{(i)}}{\underline{\text{D.H.W.L.}}} + \underset{\text{(ii)}}{\underline{\text{Free board}}} + \underset{\text{(iii)}}{\underline{\text{Confinement Effect}}} + \underset{\text{(iv)}}{\underline{\text{Climate Change Effect}}}$$

In the Study, the design crest level was set as follows, in consideration of the results of discussions with the BWDB Design Circle:

(i)	Design High Water Level (D.H.W.L.)	Generally, D.H.W.L. is set upon conducting frequency analysis of the observed water level. The method of assessment differs depending on whether the embankment is on one side or both sides of the river. Concerning areas where a runoff analysis model and flood analysis model aren constructed, D.H.W.L. is set based on the calculated water level. ---> In the target area of the Study, since D.H.W.L. is set based on the observed water level, this rule shall be strictly observed. If calculated water level by CEIP is available nearby, it shall also be used as deemed appropriate. In some non-polder areas, the bank full level shall sometimes be set as D.H.W.L.
(ii)	Free Board	Free board is set upon considering wind set-up, height of wave run-up and safety margin. Generally, following heights are adopted. ・For full flood embankment, minimum free board is 0.9 m ・For submersible embankment, free board is 0.3 m ---> In the Project, since submersible embankments are not targeted, 0.9 m shall be adopted.
(iii)	Confinement Effect	This should be considered in applicable cases. ---> It is not considered in this study.
(iv)	Climate Change Effect	This should be considered in applicable cases. ---> In the Study, it was not considered in line with (2) above. It shalll be considered if it becomes necessary to include the sea level rise at the detailed design stage.
(v)	Other	Subsidence allowance are considered in some pojects. CEIP applies 0.3 m. ---> It is not considered in this Study. Geological survey shall be conducted at the detailed design stage and it shall be considered if deemed necessary.

(6) Embankment Crest Width

Crest width of embankment is stipulated in the Standard Design Manual as follows:.

- Crest width should not be less than 2.50 m.
- If the embankment is used as inspection road, minimum crest width should be 4.30 m.
- If the embankment is used as road, width shall be selected based on the type of road structure + 1.00 m shoulder on both sides.
- In the case of a submersible embankment, the crest width shall be 3.60 m.

The crest width is sometimes prescribed as 6.00 m in the case of sea dyke. However it may be adjusted appropriately according to land use condition of country side.

This Project is intended to implement rehabilitation of existing embankments that have been damaged by water related disasters. Therefore, crest width shall be set according to the above standard applied to existing embankments.

(7) Side Slope

In the Standard Design Manual, it is stipulated that the embankment side slope should be determined based on stability analysis (slope stability analysis, seepage analysis). Generally, the following cross sections are adopted on full flood embankments:

- Side slope on country side: 1:2
- Side slope on river side: 1:2~1:3
- In case of sea dyke, side slope on the ocean side is stipulated as 1:5 or 1:7.

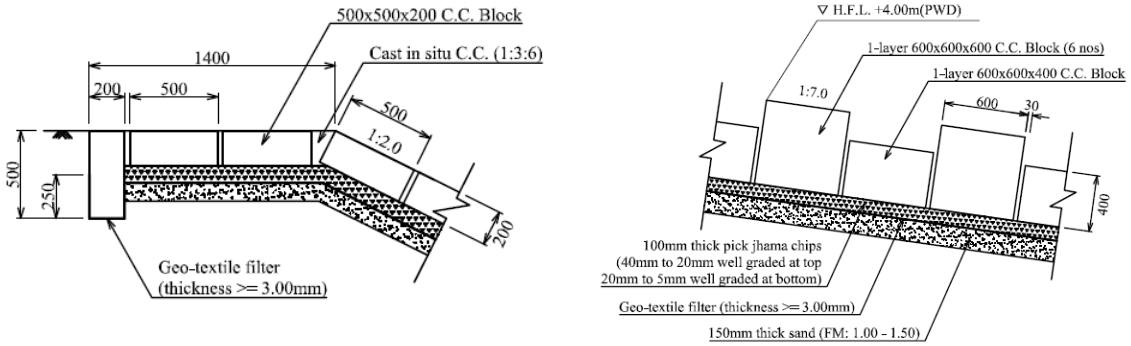
In the Study, side slope that is based on the above standard will be adopted following discussions with the BWDB Design Circle. However, it will be necessary to conduct geological survey and determine side slope based on the results of stability analysis in the detailed design.

(8) Slope Protection

This Project is intended to implement rehabilitation of existing embankments that have been damaged by water related disasters, and the sites selected in the Study are parts that are vulnerable to damage as typified by river bends. Accordingly, slope protection works shall be provided in order to stop them being damaged again in future. Slope protection works shall be installed using C.C. blocks and geo-bags, which are widely used in Bangladesh. Basically, the shape of slope protection works shall be designed according to the Standard Design Manual upon holding discussions with the BWDB Design Circle. The basic approach to slope protection works will be as follows:

- In areas that are higher than the working low water level (working L.W.L.), C.C. block lining revetments will be adopted.
- Block lined revetments will be back filled with bick chip and sand, and lining that consists of geo-textile sheet will be placed (see Figure 3.3.5 (1)).
- On sea dykes, dissipater blocks will be placed on lined revetments over limited sections (see Figure 3.3.5 (2)).
- In areas that are lower than the working L.W.L., revetments will be built through dumping C.C. blocks or geo-bags.
- The average covering thickness of dumped revetments will be 1.0 m.

In implementing the Project, it will be necessary to review the shape of slope protection works upon conducting natural condition survey (such as river survey, geological survey, current observation) in the detailed design.



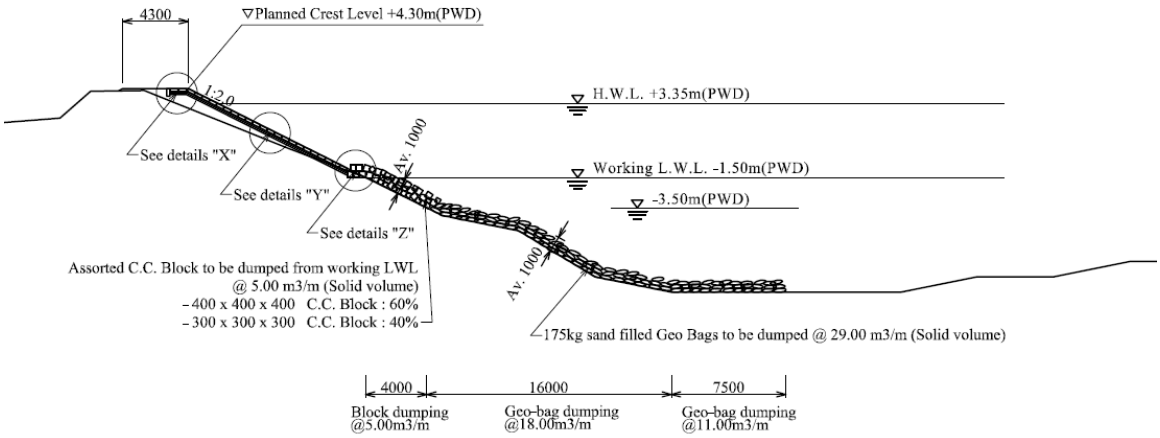
(1) Structure of block-lined revetment (2) Structure of dissipater blocks

Source: JICA Survey Team

Figure 3.3.5 Examples of C.C. Block Lined Revetment

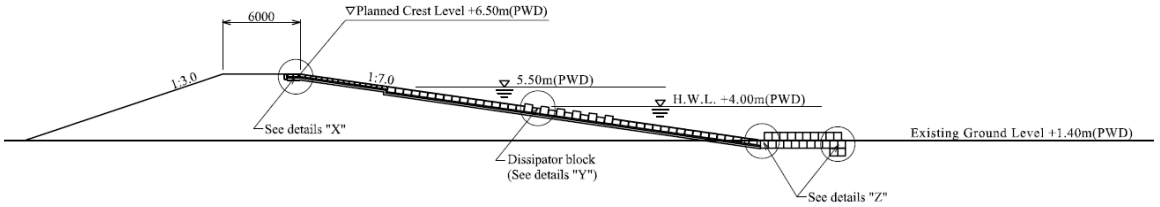
(9) Preliminary Design

Figure 3.3.6 shows the standard cross-sections of river embankment and sea dyke. Preliminary design is shown in Appendix 3 (Preliminary Design Drawings)



Source: JICA Survey Team

Standard Cross Section of River Embankment (BWDB Sub-project No. 7)



Source: JICA Survey Team

Standard Cross Section of Sea Dyke (BWDB Sub-project No. 21)

Figure 3.3.6 Standard Cross Section of River Revetment

3.3.4 Drainage Sluice Gate

(1) Status of Selected Drainage Sluice Site

Present status of selected drainage sluice site is shown in the following table.

Table 3.3.6 Present Status of Sub-project (Drainage Sluice)

No	Location	Structure to be Rehabilitated	Overview	Site Photo
33	(1)District Patuakhali (1.54 million population) (2)Upazilla Kalapara (0.24 million population)	(Type) Drainage Sluice (Feature of Structure) 0.8m diameter x 8 vents with flapgates at river-side. (Damage Situation) This structure was constructed in 1960's/70's, more than 50 years ago. Crushed bricks were used for concrete aggregate. Structure is already deteriorated and partly severely damaged resulting in holes in embankment. Urgent rehabilitation work is needed. It is desirable that location of reconstruction be at the same location to avoid social problems.	This structure is a part of Polder 46 which has 40 km long embankment and 5,635 ha area for residents and paddy field. Within polder about 29 thousand population. This sluice is an important one for a major drainage canal flowing into river.	  

(2) Applicable Design Standard

Preliminary design of drainage sluice is conducted in accordance with BWDB Standard Design Manual, 1995.

(3) Proposed Vent Dimension

BWDB applies 1.5 m width by 1.8 m height for 1 vent size of sluice. Since width of drainage channel is about 20 m, dimension of 8 vents x 1.5 m x 1.8 m is proposed for rehabilitation of drainage sluice. Invert elevation of sluice is based on existing sluices, (-) 0.6 mPWD.

Embankment is re-constructed on the rehabilitated sluice in accordance with existing dimensions (+4.3 mPDW crown elevation and 4.3 m width). However, loads considering embankment heightening in the future should be used for the structural calculation in the next detailed design of sluice.

(4) Auxiliary Structures

Reinforced cement concrete apron and stabilization for riverbed/slope with C.C. Blocks at both country and river sides are to be provided for protection from scouring by flowing water. In addition, 10 m long river side slope protection with C.C. Block for both sides of sluice gate are proposed for protection from river bank/embankment erosion.

(5) Preliminary Design

Preliminary design is shown in Appendix 3 (Preliminary Design Drawings). New sluice is proposed to be constructed at the same location to avoid the relocation of houses and additional land acquisition. During construction, other connecting drainage channels shall be used for temporary drainage.

3.4 Selection Creiteria for Sub-project of Component 1

Considering results of site investigation of damaged structures and design data of preliminary design, Criteria for selecting infrastructure to be rehabilitated is described as follows:

(1) Target Districts of Component 1

Considering the necessity of recovery and rehabilitation of infrastructure damages by past natural disasters, location of Component 1 is set as table below:

Table 3.4.1 Target Districts of Component 1

Division	District	Number
Khulna	Satkhira, Khulna, Bagerhat	3 Districts
Barisal	Barisal, Pirojpur, Jhalokati, Barguna, Patuakhali, Bhola,	6 Districts
Dhaka	Gopalganj, Madaripur, Shariatpur, Faridpur	4 Districts
Chittagong	Chandpur, Lakshmipur, Noakhali, Feni, Chittagong, Cox's Bazar,	6 Districts
Total	-	19 Districts

The target areas are identified as the 19 districts stated above, where unexpected disasters like cyclone and flash flood occur frequently. Hence, improvement of facilities can minimize loss of life and protect more people.

(2) Selection Criteria

Facilities contribute to "Rapid Rehabilitation" in disaster management cycle and enhance the functionality of primary facilities which supporting early response in disaster. Sub-projects for the Component 1 will be selected by considering following issues:

Table 3.4.2 Selection Criteria of Component 1

● Extent of Assumed Damage
- Expected number of affected people
- Expected amount of economic loss
- Expected damage of socioeconomic infrastructure (port, airport, regional road, etc.)
● Damage Degree of the Infrastructure
- Degree of physical damage
- Time elapsed after the damage
● Vulnerabilities of Target Upazila
- Population below the Upper Poverty Line (BBS 2010)
● Duplication with major Development Partners' Assistance

(3) Score and Evaluation

Each of the applicable infrastructures above will be prioritized by following scores:

Table 3.4.3 Score and Evaluation (Extent of Assumed Damage)

Criteria		Score	What will happen without Immediate Recovery Works	
			Evaluation	Examples
Extent of Assumed Damage	Expected number of affected people	10	Exceptionally Large number of affected people will be expected	More than 100,000 people in a target Upazila will be affected.
		8	Very Large number of affected people will be expected.	More than 50,000 people in a target Upazila will be affected.
		6	Large number of affected people will be expected	More than 25,000 people in a target Upazila will be affected.
		4	Medium Number of affected will be expected.	More than 10,000 people in a target Upazila will be affected.
		2	Low Number of affected will be expected.	Less than 10,000 people in a Upazila will be affected.
	Expected amount of economic loss	5	Exceptionally Huge economic loss will be expected.	Most of agricultural products in a union will be affected.
		4	Very Huge amount of economic loss will be expected.	The central market in target Upazila will totally be flushed out.
		3	Large amount of economic loss will be expected.	The biggest industry factory in target Upazila will stop operation for more than 1 month.
		2	Medium amount of economic loss will be expected.	More than 30% of agricultural lands in a union are inundated.
		1	Low amount of economic loss will be expected.	Some farmer's lands are washed out.
	Expected damage of socioeconomic infrastructure	5	The most important socioeconomic infrastructure in the division will be damaged in case recovery work cannot be implemented.	Further damage of the embankment will affect the operation of airport/port.

Criteria		Score	What will happen without Immediate Recovery Works	
			Evaluation	Examples
		4	Small-scaled disaster will affect socioeconomic infrastructure.	The important bridge in region will collapse.
		3	Medium-scaled disaster will affect socioeconomic infrastructure.	The important community road will become impassable during heavy rain.
		2	Large-scaled disaster will affect socioeconomic infrastructure.	Damaged bridge will completely collapse by large-scaled disaster. Damaged revetment affect stability of the important bridge.
		1	Damaged portions are still durable compared to other ordinary portion.	Damaged bridge and road will still function. Damaged portions of river bank repaired by Temporary works will function.

Table 3.4.4 Score and Evaluation (Damaged Degree of the Infrastructure)

Criteria		Score	Current Condition	
			Evaluation	Examples
Damaged Degree of the Infrastructure	Degree of physical damage	5	Completely damaged / Loss	Almost completely disappearance of a series of embankment (more than 100 meter wide) or totally collapse of a bridge, ...
		4	Severely damaged	Some portions of embankment with revetments are flushed out (less than 100 meter wide) A bridge abutment tilts to the side. A bridge girder gets broken.
		3	Moderately damaged	Several sections of revetments of embankment are flushed out. Footing of a pier of bridge is eroded.
		2	Partially damaged	Some portions of embankment are eroded. Handrails of Bridges are damaged.
		1	Less/Minor Damaged	Minor repair works are needed.
	Time elapsed after the damage	5	Infrastructures damaged by Sidr (2007) or Aila (2009)	Target bridge was destroyed in Aila.
		3	Infrastructures damaged during 2000 – 2007 (before Sidr)	Target polder was washed out in 2005.
		2	Infrastructures damaged during 2010 – 2015	Target road network was damaged by Flash Flood in 2015.

Criteria		Score	Current Condition	
			Evaluation	Examples
		1	Infrastructures damaged in 1999 or earlier	Target revetment was flushed out in 1991 Cyclone.

Table 3.4.5 Score and Evaluation (Vulnerabilities of Target Upazila)

Criteria		Score	Consideration of Vulnerability to Disasters	
			Evaluation	Examples
Vulnerabilities of Target Upazila	Percentage of Population below the Upper Poverty Line (BBS 2010)	5	Target Upazila with very high poverty line	More than or equal to 55.0 %
		4	Target Upazila with high poverty line	40.0% ~ 54.9%
		3	Target Upazila with medium poverty line	28.0% ~ 39.9%
		2	Target Upazila with low poverty line	14.0% ~ 27.9%
		1	Target Upazila with very low poverty line	Lower than or equal to 13.9%

Table 3.4.6 Score and Evaluation (Duplication with major Development Partners' Assistance)

Criteria	Score	Consideration of Investment Equality (Civil Work)	
		Evaluation	Examples
Duplication with major Development Partners' Assistance	No 5	No similar projects in target Upazila have been implemented or planned under other development partners' assistance.	No Project in Target Upazila
	Yes 1	Similar projects in target Upazila have been implemented or planned under other development partners' assistance.	A WB project (polder construction) has been undertaken in same Upazila.

(4) Selection of Sub-project at the Beginning of Project Implementation

The selection method and criteria shall be used at the beginning of project implementation to select the sub-projects, considering the latest priority of infrastructure improvement.

3.5 Climate Change Adaptation (CCA) of Projects

The increment of risks by climate change shall be taken into consideration for the infrastructures to be improved or rehabilitated in the Project (mainly, activities in Component 1 and 3). Equipment and facilities to be procured in the Project (Component 2) may also contribute to the climate change adaptation in Bangladesh. In this section, the latest statutes and achievements of measures for climate change adaptation in line with the Sixth Five-Year Plan (SFYP 2011-2015) and the updated plan are confirmed, and the contribution of the Project to the climate change adaptation by the Government of Bangladesh (GOB) are also specifically identified.

3.5.1 Recognition of Achievements of the SFYP 2011-2015 in Terms of CCA

The GOB's CCA achievements until 2015 based on the SFYP 2011-2015 are acknowledged in the draft of the Seventh Five-Year Plan 2016-2020 (Draft SFYP 2016-2020) issued in November 2015, as follows (refer to Table 2.1.2 in Chapter 2):

(1) Outline of Achievements of CCA under SFYP 2011-2015

The Intergovernmental Panel on Climate Change (IPCC) has noted that Bangladesh will be among the worst victims of climate change. A rise in both sea level and frequency of cyclone-storms due to the escalating atmospheric temperature is likely to have grave food and energy security consequences, which will also facilitate different types of diseases and frequency of other natural calamities. Needless to say, the prevailing high density of population will only make it difficult to identify effective coping strategies.

Under such circumstances, in the area of climate change, there is a large unfinished agenda. The M&E effort under the SFYP 2011-2015 is weak, which makes it much more difficult to assess progress adequately.

Long-term planning and substantial public investment will be necessary. The formulation of the Bangladesh Delta Plan-2100 and its timely implementation during the SFYP 2016-2020 will be a major long-term policy and institutional initiative for building resilience and reducing the effects of disaster.

(2) Current Status and Situation of each Individual Effort of Climate Change Consideration

As described above, Bangladesh is one of the countries in the world that are most vulnerable to the impacts of climate change. To address this challenge, the present Government of Bangladesh launched its first Climate Change Strategy and Action Plan (BCCSAP) in 2008 and revised it in 2009. The plan seeks to build a medium to long term program for enhancing resilience to climate shocks and facilitating low-carbon, sustainable growth. To implement the 44 programs specified under the six thematic areas of BCCSAP 2009, the Climate Change Trust Fund (CCTF) was created in the fiscal year 2009-10. Subsequently, Climate Change Trust Act 2010 was enacted, and in accordance with the Act, the Bangladesh Climate Change Trust (BCCT) was established in 2013. Since inception of the Fund, the government allocated 3,000 crore taka in CCTF until FY2015. The Government of Bangladesh established the Bangladesh Climate Change Resilience Fund (BCCRF) to support the implementation of the BCCSAP in 2010 with several development partners (DPs). The total amount pledged under BCCRF as of the end of 2014 was approximately US$187 million. The BCCRF is managed by the Ministry of Environment and Forests (MoEF) on behalf of the GOB.

Under the Sixth Plan, GOB have developed and implemented various policies and strategy instruments to address the fallout of climate change. For example, a pro-poor Climate Change Management strategy has been adopted, which prioritizes adaptation and disaster risk reduction and also addresses low carbon development, mitigation, technology transfer and mobilization and international provision

of adequate finance. In addition, the Department of Environment (DoE) has taken a number of initiatives to address climate change. Through the Climate Change Cell, DoE has already developed the DPP based Climate Proofing guideline (final draft) for the fisheries and livestock sectors, and developed a comprehensive training manual on climate change. Sea level rise and risk analysis have been assessed. DoE has also established a Climate Change Knowledge Network (CCKN) including forty Departmental Focal Points (mainly government departments and research institutes) and established a rich web-based Climate Change Database. DoE is acting as Secretariat of the Bilateral Offset Credit Mechanism (BOCM), a joint initiative of the Government of Bangladesh and Japan, to facilitate transfer of world leading low carbon energy efficient technologies, products, services and infrastructure to Bangladesh.

3.5.2 Outline of Climate Change Management in Draft SFYP 2016-2020

In November 2015, the GOB issued the draft SFYP 2016-2020 based on the recognition and evaluation of the SFYP 2011-2015. The contents of Climate Change Management in the draft SFYP 2016-2020 are summarized below. In addition, the contributions and relevances of the activities of the Project to the climate change adaptation of the GOB are also identified.

(1) Issues on Climate Change Adaptation in Bangladesh

As in the SFYP 2011-2015, Climate Change Management under the SFYP 2016-2020 will be addressed on two fronts: Adaptation and Mitigation. The adaptation strategy will encompass various measures that can be taken to adequately prepare for the inevitable consequences of climate change, whereas mitigation efforts will cover activities aimed at reducing the carbon footprint. There are a number of limitations faced by GOB institutions regarding implementation of CCA as follows:

- Weak capacity;
- Limited Understanding, Knowledge and Capacity;
- Priorities are not set;
- Weakness in implementation, monitoring and shared learning;
- Lack of Financing;
- Inadequate Institutional Coordination; and
- Expenditure Management.

(2) Activities of Climate Change Adaptation in the Draft SFYP 2016-2020

"Activities in draft SFYP 2016-2020" in Table 3.5.1 are for climate change adaptation quoted from draft SFYP. On the other hand, "Activities in the Project" are outputs or expected activities to be executed under the Project. Hence, Table 3.5.1 shows that the Project will make a big contribution to the CCA in Bangladesh.

Table 3.5.1 Activities of CCA mentioned in Draft SFYP 2016-2020 and Contributions/Relevances of the Project

Activities for CCA in Draft SFYP 2016-2020 *1	Relevant and/or Contribution Activities in the Project
Promote a whole-of government approach for climate change readiness	Coordination mechanism and function of PCMU among DDM-BWDB-LGED to be established in the Project will effectively be utilized in the selection of prioritized programmes and activities for CCA in Bangladesh.
Enhance understanding, knowledge, capacity and coordination	
Prioritize programmes and projects	
Improved implementation, monitoring and shared learning	The lessons learnt through the M&E activities in the Project shall refer to the activities of CCA.
Enhance CCA financing	The mechanism and system of Disaster Recovery Fund in Component 3 may be referred and/or utilized for the financial system of CCA activities.
Managing hazards and disasters	Equipment and facilities to be procured in Component-2 will strengthen and enhance disaster response and mitigate damages by disasters. Infrastructures repaired and recovered under Component 1 and/or 3 will mitigate disaster damage by adverse climate change conditions.
Infrastructural functioning and maintenance	
Integrate Gender Sensitivity in project design	The target areas of the Project are mainly coastal areas of Bangladesh and almost the same areas where the conditions become worse by climate change. The project activities shall support food security and social protection in the areas where the poverty level is high.
Food security, social protection and health	
Curbing internal migration and displacement	

Source: *1: Draft Seventh Five Year Plan 2016-2020, Planning Commission (P-461 ~ 462)

(3) Similarity of Target Areas between the Climate Vulnerable Zones of BCCRF and the Project

The table below shows the three most climate-vulnerable zones in Bangladesh identified by the Bangladesh Climate Change Resilience Fund (BCCRF) and mentioned in the draft SFYP 2016-2020. In addition, The table also shows target districts of the Project. Target/prioritized areas of climate change management are quite similar or almost the same as those of the Project.

Table 3.5.2 Most Climate-Vulnerable Zones and Target Districts of the Project

Type of Zone	Main Target Districts of BCCRF	Target Districts of the Project
Saline-affected coastal zones	Satkhira, Khulna, Jessore, Bagerhat, Patuakhali, Barguna	Component 1: Barisal, Bagerhat, Satkhira, Bhola, Pirojpur, Patuakhali, Cox Bazar, Khulna, Barguna, Jhalokati, Chittagong, Noakhali, Feni, Lakshmipur, Chandpur, Shariatpur, Madaripur, Gopalganj, and "19th district" (MoDMR to confirm)
Flood-affected areas and charlands	Barisal, Cox's Bazar, Jamalpur, Mymensingh, Bagerhat, Jessore, Khulna, Kurigram, Nilphamari	
Drought-affected or rain-scarce areas in north western Bangladesh	Chuadanga, Jessore, Naogaon, Rajshahi, Satkhira, Natore	

Source: BCCRF Annual Report 2013 (SFYP (P-459))

3.5.3 Consideration of Climate Change Adaptation in Component 1 of the Project

As described in Subsection 3.4.2, it has been confirmed that the Project will contribute to the proposed CCA activities in Bangladesh. In this sub-section, adaptation measures in the sub-projects of Component 1 in terms of design and construction to be taken into consideration are discussed (refer to Section 3.3 in this Chapter).

(1) Latest Study on the Impacts of Climate Change in Bangladesh and their Adaptation Measures

In the detailed design stage of the Project, target infrastructures in Component 1, such as dike (embankment), road and bridge shall be designed taking into consideration the adverse effects of climate change.

According to the embankment design standard of Bangladesh, the design level is determined to be 20-year return period for embankments to protect agricultural production, and 100-year return period for embankments to protect human lives and assets as shown in Section 3.3. With the support from the World Bank, BWDB is implementing the Coastal Embankment Improvement Project, Phase 1 (hereinafter referred to as CEIP-1) targeting the coastal areas of Bangladesh (refer to Figure 3.5.1).

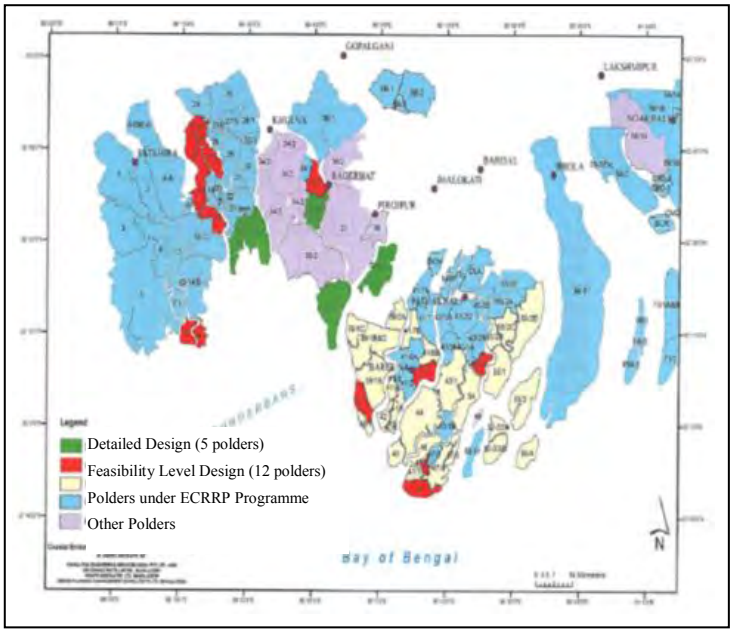


Figure 3.5.1 Project Area of CEIP-1

With the target year of 2050, CEIP-1 calculates deflection by storm surge by return period with and without the impact of climate change (1: 0.5 mm increase of sea level, and 2: 10% increase of wind speed of cyclones). Based on the calculation results, BWDB determines the height of levee crown of coastal embankments (refer to Table 3.5.3).

Table 3.5.3 Deflection by Storm Surge in Return Period (With and Without Climate Change)

Location No	Adjacent Polder	River	Without Climate Change				With Climate Change			
			Max Surge Height (New mPWD)				Max Surge Height (New mPWD)			
			10yr Ret. Period	25yr Ret. Period	50yr Ret. Period	100yr Ret. Period	10yr Ret. Period	25yr Ret. Period	50yr Ret. Period	100yr Ret. Period
7	32	Sibsa	2.659	3.419	3.984	4.544	2.836	3.35	3.731	4.11
104	32	Sibsa	2.742	3.492	4.059	4.626	3.038	3.879	4.503	5.122
13	32/33/23	Sibsa	2.764	3.51	4.07	4.631	3.202	3.831	4.298	4.762
14	32/33	Sutarkhali	2.391	2.899	3.284	3.669	2.705	3.093	3.381	3.666
16	32/33	Sutarkhali	2.422	2.945	3.341	3.736	2.706	3.073	3.346	3.616
17	33	Dhaki	2.384	2.882	3.258	3.634	2.638	2.983	3.239	3.494

Location No	Adjacent Polder	River	Without Climate Change				With Climate Change			
			Max Surge Height (New mPWD)				Max Surge Height (New mPWD)			
			10yr Ret. Period	25yr Ret. Period	50yr Ret. Period	100yr Ret. Period	10yr Ret. Period	25yr Ret. Period	50yr Ret. Period	100yr Ret. Period
18	33	Pussur	2.328	2.765	3.096	3.427	2.55	2.853	3.078	3.301
19	33	Pussur	2.37	2.917	3.322	3.725	2.647	2.993	3.249	3.503
20	33	Pussur	2.51	3.113	3.57	4.027	2.797	3.238	3.565	3.89
24	35/3	Bishnu	2.17	2.574	2.88	3.186	2.351	2.596	2.778	2.958
25	35/3	Bishnu	2.17	2.574	2.88	3.186	2.363	2.623	2.817	3.008
26	35/3	Katakhali	2.161	2.595	2.923	3.251	2.394	2.73	2.979	3.227
28	35/3	Poylahara	2.185	2.669	3.028	3.385	2.438	2.755	2.99	3.223
29	39/2C	Kocha	2.544	3.24	3.767	4.293	2.847	3.355	3.732	4.106
30	39/2C	Kocha	2.497	3.235	3.781	4.324	2.884	3.441	3.854	4.264
31	35/1	Baleswar	2.59	3.338	3.904	4.469	2.97	3.583	4.038	4.489
101	35/1	Bhola	2.36	2.929	3.36	3.791	2.687	3.18	3.546	3.909
32	35/1	Baleswar	2.515	3.288	3.861	4.43	2.945	3.577	4.045	4.51
33	35/1	Baleswar	2.505	3.308	3.903	4.494	3.029	3.782	4.34	4.895
102	35/1	Bhola	2.545	3.324	3.913	4.502	2.987	3.708	4.244	4.776
103	35/1	Baleswar	2.569	3.336	3.917	4.498	2.98	3.668	4.178	6.685

Source: BWDB

However, according to the study result of CEIP-1, the project is extremely expensive if the embankment design level is designed at 100-year with consideration on the aforementioned climate change impacts. In conclusion, CEIP-1 plans tidal embankments to meet the design level of 100-year without climate change as well as the design level of 25-year even with consideration of climate change.

(2) CCA Measures to be considered in Component 1

(a) BWDB Embankment and LGED Road

In the Project, the measures for CCA shall be taken into consideration for the design of embankment in Component 1 as described in Sub-section 3.3.3. As a result, the design and construction of embankment shall be conducted as follows in terms of CCA

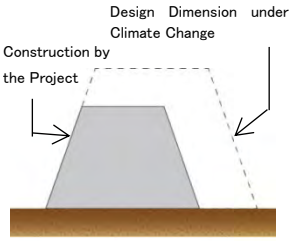
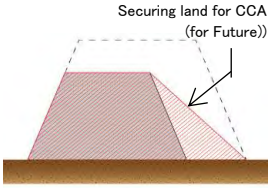
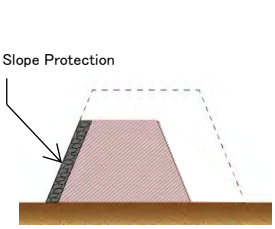
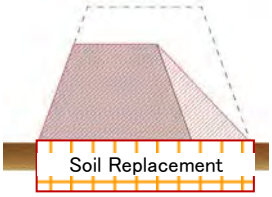
- The design and construction of embankment under Component 1 shall be complied with BWDB and/or LGED design standard. The elevation of crown of embankment is set at the design dike elevation fixed by BWDB. As explained in Sub-section 3.3.3, the design of dike elevation will basically not consider climate change effect. The water level rise by climate change will be considered, if it becomes necessary to include the sea level rise at the detailed design stage;
    - As a Japanese Yen Loan Project, the newly revised standards by JICA Technical Assistant Project(s) related to the Project shall be applied for the design;
    - The Project is intended to implement rehabilitation of existing embankments that have been damaged by water related disasters, and the sites selected in the Study are parts that are vulnerable to damage as typified by river bends. Accordingly, slope protection works will be provided in order to stop them being damaged again in future (refer to

Sub-section 3.3.3). This consideration contributes to the raising of stability of embankment against climate change effects. It is expected that the embankment due to slope protection will be irrefrangible structures against extremely high water level; and

- Taking into account the design and construction of the embankment explained above, the dike or road shall be constructed not by concrete parapet wall, but soil embakment up to the design crest.

Other alternatives being discussed with BWDB are explained in the following table.

Table 3.5.4 Other Climate Change Adaptation Measures to be considered in Detailed Design Stage of the Project

	Alternative Measures			
	No Consideration for CCA	Securing Land for Future	Strengthened Resilience	Soil Improvement for Future
Cross Section				
Concept	Reconstruction based on Original Design	For heightening the Dike for CCA in the future, the land is secured in the Project.	Revetmemt / Slope Protection will be put on the dike for strengthening of stabilities against increased water and wave pressure.	For heightening the Dike for CCA in the future, the foundation is strengthened and improved in the Project.
Evaluation	Portions to be repaired by the Project are vulnerable to disaster and it is highly likely that repaired portions are damaged again.	It is expected that land acquisition time will be long (more than 1.5 years). It will be considerable in case land acquisition is smoothly finished.	The project cost will increase compared to Option of "No Consideration". However, embankment is strengthened and high resilience against climate change effect.	Necessity shall be analysed and evaluated in Detailed Design Stage. The cost is more expensive than Option Securing Land.
	N/A	ICA	AM	ICA

Legend: N/A: Not applied for the Project; ICA: To be considered in Detailed Design Stage, if applicable.
AM: Minimum Requirement of CCA in the Project

Erosion/scouring of river banks and embankment slopes, washout due to overflow and settlement due to seepage are major damages observed on the damaged roads. Most of these damages are attributed to cyclones Sidr and Aila, in addition to recurrent tidal wave action or flood and heavy rainfall during the monsoon. In this connection, the foundation of LGED roads along river banks to be reconstructed under Component 1 shall also be considered in accordance with BWDB standard (such as construction of slope protection) as mentioned above.

(b) BWDB: Drainage Sluice

As one of the target infrastructures of subprojects in Component 1, structures for flood mitigation being maintained by BWDB, such as drainage sluice gates, are also considered. In the detailed design stage of the Project, the adaptation measures for climate change as shown below shall be taken into account.

Table 3.5.5 Climate Change Adaptation Measures to be taken for Drainage Sluice Gate and Other Flood Mitigation Structures in Component 1

Items to be Considered	Effects by Climate Change	Counter measures to be taken as adaptation in the Project
Dimension of Structures	Precipitation augmentation and increment of run-off	Dimension of Structure shall be upgraded based on increments of design discharge and other criteria for structure design.
Member of Structures (Loads for Design)	Rising Design Water Level and increment of loads due to heightening of embankment	Thickness and length of members of structures shall be strengthened based on increments of loads and stresses.

According to the studies and/or reports for climate change effects in Bangladesh, such as South Asia: Shared Views on Development and Climate Change by WB and F/S of Padma Bridge by JICA, annual mean precipitation is expected to increase by 5~10% in the middle of the 21st century, with increment by 10~20% of run-off of river discharge, leading to more flooding. In this connection, the dimension and length of target structures shall be designed taking into consideration increments of design loads and flood discharges when concrete structures are selected as one of the sub-projects in Component 1. This consideration will increase the construction costs by 10~20% of the cost without consideration of climate change. On the other hand, concrete structures without climate change adaptation will be reconstructed again for adaptation to climate change later. It will double in cost compared with the cost of construction with climate change adaptation from the beginning.

As explained above, concrete structures selected as sub-projects in Component 1 shall be designed taking into account climate change. Detailed analysis and design criteria for climate change adaptation shall be determined with BWDB and other related organizations.

(c) LGED: Bridge

As described in Sub-section 3.3.1, freeboard of superstructure of bridges is set as follows:

- Freeboard is defined here as the height between the soffit of the girder to the high water level of past disasters. It was learnt from hearings with local residents at the sites that the past high water level in average is about 1.5m above the surface ground. A clearance of 1.0m is added to this high water level for freeboard. Therefore, the freeboard is 1.5m (see Sub-section 3.3.1).

It is expected that durable/useful life of the bridges to be constructed in the Project is more than 50 years. Therefore, the function of bridges constructed in the Project would be hampered by climate change effects for 20~30 years if the design of bridges have not taken climate change into

consideration. In addition, the retrofitting and CCA cost of the bridge is quite expensive compared with strengthening works for soil embankment.

Hence, the climate change effects shall be considered for the design elevation of superstructure as shown in Figure 3.5.2.

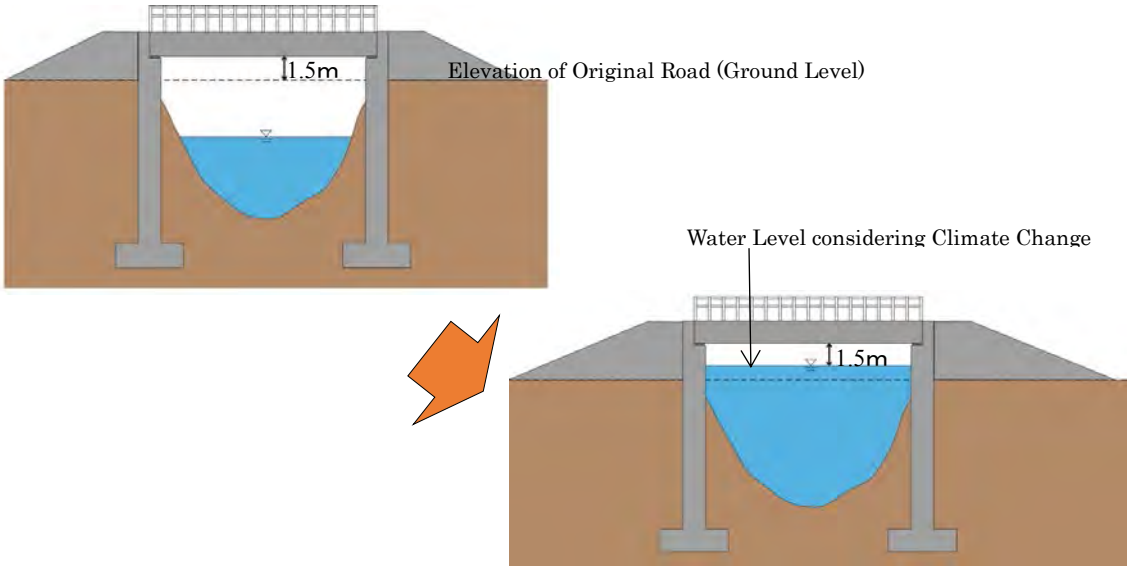


Figure 3.5.2 CCA Measures for Construction of Bridges under the Project

CHAPTER 4. COMPONENT 2：EQUIPMENT FOR EMERGENCY RESPONSE

4.1 General

The equipment needed for emergency disaster response, rescue, and relief (Component 2) were confirmed from: (1) the information obtained from the results of the past study reports on water-related disaster projects; (2) the results of the field survey conducted by the JICA Study Team in the coastal area in Bangladesh; and (3) the problems and issues from the past JICA grant aid project on the supply of equipment and materials for emergency disaster response and rescue against the 1998 flood.

With regard to the applicability of Japanese technology in solving water-related disasters in Bangladesh, the necessary information was also collected and studied through the interviews with the agency officers in charge of equipment, as well as the responses to questionnaires of the four (4) related agencies; namely, the Department of Disaster Management (DDM), the Bangladesh Water Development Board (BWDB), the Local Government Engineering Department (LGED), and the Bangladesh Fire Service and Civil Defence (FSCD).

These are summarized as follows:

- Introduction of foreign products of equipment which are applicable for the emergency disaster response and rescue in Bangladesh;
- Problems and issues of the field survey results conducted by the JICA Survey Team in the coastal area of Bangladesh;
- Clarification of applicable materials and equipment which Japanese companies possess and predominantly used internationally; and
- Confirmation of the list of materials and equipment requested by the offices of DDM, BWDB, LGED, and FSCD.

4.1.1 Confirmation of Equipment Needed for Emergency Response

(1) Introduction of Foreign Products of Equipment for the Emergency Response

Table 4.1.1 shows the results of the survey on water-related disaster grant or loan projects in Bangladesh by international donors in recent years to the DDM, BWDB, LGED and Bangladesh FSCD.

Table 4.1.1 Introduction of Foreign Products of Equipment for Disaster Response and Rescue into Bangladesh

Implementing Agencies	Year	Project/ Florien Goods	Aid Amount (BDT million) / (million Yen)	Doner
DDM	2008 to 2015	Emergency 2007- cyclone (Sidr) recovery ad restoration project (ECRRP), sub-component D1: Disaster mitigation & reduction	780 million BDT	Funded by WB

Implementing Agencies	Year	Project/ Florien Goods	Aid Amount (BDT million) / (million Yen)	Doner
	2008 to 2012	Project for procurement of equipment for search and rescue operation (phase-1) to FSCD, Army Forces Division and City Cooperation, 2008-2012	620 million BDT	Funded by WB
	2012 to 2016	Project for procurement of equipment for search and rescue operation (phase-2) to FSCD, Army Forces Division and City Cooperation, 2012-2016	-	Funded by WB
BWDB	2000	Equipment supplied for the 1998-Flood Disaster Relief Project	/1,633 million Yen	Japan Grant For RHD, LGED, BWDB
LGED	1993-95	Multipurpose Cyclone Shelter Construction Project	/1,771 million Yen	Japan Grant
	1994-96	Local Road-Bridges Construction Project	/1,513 million Yen	Japan Grant
	2000	Equipment supplied for the 1998-Flood Disaster Relief Project	/1,633 million Yen	Japan Grant For RHD, LGED, BWDB
FSCD	2014	Ambulance supply (50 cars)	18 million RMB	China Grant
	2015	Calamity Rescue Equipment donated by the Government of China Double cabin 4WD (150 vehicles) Motor bike 275 cc (100 nos.) and others	37 million RMB	China Grant

Source: DDM, BWDB HQ, LGED HQ, FSCD HQ、Dhaka

According to DDM, the support needs for the ECRRP (Emergency 2007-Cyclone Recovery and Restoration Project) in Sub-Component D-1, Disaster Mitigation & Reduction, requires training for the volunteers and the local government officers of 35 Upazila for emergency disaster response and rescue in the coastal areas in Bangladesh. For emergency response and rescue, 35 megaphone sirens, 12 pick-up type four-wheel vehicles, and 12 small life-boats for rescue are available. Furthermore, the consignee prepares four (4) boats for emergency disaster rescue and first aid during rough seas.

At the time of cyclone, the people should have first aid equipment, generator, ship transportation, materials, as well as megaphone, siren and radio sets for disaster emergency communication of early warning and urgent response.

Also in the "Project for Procurement of Equipment for Search and Rescue Operation (Phase-1) to FSCD、 the Armed Forces Division and City Cooperation, 2008-2012", 4-wheel dozers, 4 pilot trucks, 4 excavators (heavy type), 4 excavators (light type), 4 cranes (light type), 8 forklifts, and other materials and equipment have been provided. In Phase 2 (2012 to 2016), the project is now in process.

In the Equipment Supplied for the 1998-Cyclone Flood Disaster Relief Project funded by JICA, the materials and equipment as listed in Table 4.1.4 were provided to RHD, LGED and BWDB through the Government of Japan. The details are described in (3) (a).

(2) Results and Issues of the Field Survey in the Project Target Candidate Areas

(a) Results of Information experienced in Past Disasters in Coastal Area

A field survey of the Coastal Area in Bangladesh as the project target candidate area was carried out from June 12 to 18, 2015. The survey areas were Barisal District and Patuakhali District in Barisal Division, and Bagerhat District in Khulna Division. The field survey results and issues are given in Table 4.1.2. The field survey notes together with the site photos are given in Appendix A4.1.

Table 4.1.2 Results and Issues of Field Survey in the Coastal Area of Bangladesh

Division/District	Contact Persons	Survey Results and Issues
Barisal/ Barisal	FSCD, Barisal River Fire Station	● The River Fire Station is mandated as **first responder** during emergency water-related disasters by cyclone, flood and storm surge for emergency disaster management response and rescue of people in the country. ● The major control rivers are 7: Megna, Shahbazpur Channel, Tentulia, Kazal, Rabnabad, Burishwar, and Bishkhali.
	FSCD Office, Barisal River Fire Station	● Barisal FSCD owns two (2) boats; one rescue fire float (about 16m long, 5m wide, year 1993 domestic manufacture) and one speed boat (about 5m long, 1.5m wide). ● There is **no wireless communication system**. The available communication tool is the private mobile phone only. ● Whirlpool can be seen on the Barishwar River in Baguna District (having a river width of several km). Fatalities by accident of a boat occurred on the river during flood.
/Patuakhali	DC Officer	● Traces of enormous damages by 2007-Cyclone "Sidr" and 2009-Cyclone "Aila" are seen in Patuakhali District. ● It was gathered that the most serious issues during the cyclone disasters above were **lack of emergency rescue and relief daily necessities** such as drinking water, dry foods, blankets, etc., and **the blockage of access of local relief to villages and lack of means of communication** to the communities. ● Based on the experiences learnt from the damages by the previous cyclones, the DC officer strongly desires that disaster information and communication technology (ICT) system by satellite shall be applied to the cyclone prone areas in the Coastal Area, and rescue boats with/without engines are also necessary. ● The coastal area including Patuakhali District is low-lying area and consists of many islands enclosed by wide rivers with big tidal river influence which may results in the erosion of river banks or sedimentation by river flow. During the monsoon seasons, the land which consists of silty clayed soils is affected by storm surges and the shape of the land can be changeable every day and vulnerable. The only means of access of residents who live in low-lying islands are the **water related transportation system and communication method** by any means.

Division/District	Contact Persons	Survey Results and Issues
/Patuakhali	DC Officer, Bangladesh Red Crescent Society/Youth Association, Patuakhali Unit	● It is noted that **lack of ICT (Information & Communication Technology)** and local relief supplement are the serious problems, and **neither fixed telephone lines nor cell phones** are used at the time of cyclones. ● Lack of tools for **early warning communication system t**o communities is also a serious issue. ● Every time it rains, the residents have to walk along the roads submerged in floodwater and **move to evacuation centres** or to safe housing and building for shelter (0.5 km - 1 km distance). ● The availability of sewage facilities and drinking water supply are also difficult. Inundations by flood last for several days. ● More systematic activity of PIO (Project Implementation Officer) and volunteers of CPP (Cyclone Preparedness Programme) are **required for leading the residents to evacuation centres**. ● Since the roads are damaged by the disasters and people suffer from the floods, **water boats** (speed boats, engine boats, etc., are needed.
/Patuakhali	FSCD office, Patuakhali	● The Patuakhali River Fire Station has one speed boat. Since 2013, the speed boat has been used for resident's emergency medical care at the opposite river shore. The condition of engines is erratic so that the boats are not in full operation. ● Training for capacity building of rescue members is required.
Barisal/Barisal	CPP (Cyclone Preparedness Programme) Office, Barisal	● The CPP acts only for the coastal area in the country. ● CPP's activity network area consists of 7 Zonal areas, 37 Upazila offices, 322 Union offices, 3,291 Unit offices, and has volunteers of 49,365 people (Males: 32,910; Females: 16,455) in the Coastal Area. ● In the communication network for CPP, there are the HF (High Frequency) & mobile phone between CPP HQ in Dhaka and Barisal City, HF wireless apparatus between Barisal and 4 Upazila （Galachipa, Dashmina, Mathbaria, Saronkhola, and VHF wireless apparatus between Upazila and Union, and partially VHF wireless apparatus & mainly mobile phone between Union and Unit Office. ● **It is possible to establish contact within 24 hours** by changing the fixed time of communication, i.e., the fixed time could be 19:00. In April-May, contact was made 3 times a day and in October-November, it was twice a day (9:30-10:30 and 14:30-15:30). During the cyclones in December-March and June-September, contacts were made during the fixed time contact. ● The volunteers of the Office, Union Office, and Unit Office used handy microphones/loudspeakers as information and communication tools. The loudspeakers are old (made in 1993 in Japan) but **they are still working well** and the volunteers **admire the excellence and quality of the Japanese product**. Some communication tools made in another country broke down after a few years. ● It was observed that people living in coastal areas are very poor and paddy/rice as the main crop has a low yield. Houses are also structurally fragile, and roads are not paved. **Protection works against cyclones are very fragile**. ● The present HF/VHF wireless radios are also made of used parts so that replacements are very necessary. Since 2011, equipment consisting of 32HF and 96VHF second-hand ones are used. ● Electricity is interrupted at the time of cyclone, and a **solar system is effective after cyclone passage**. ● The CPP team leaders of Upazila, Union and Unit hands information down to residents by the handy microphone o loudspeaker or by going around using a motorcycle or a bicycle as the means of disaster information management communication system. However, there are a lot of people who do not have a motorcycle or a car so that problems occur. For mobility in the communication of warning, **machinery and materials are also required**.

Division/District	Contact Persons	Survey Results and Issues
Khulna/ Bagerhat	Interview with residents, Union Sadar, Upazila Morrelganj	● Information on the occurrence of cyclones are conveyed by the **fixed telephone or mobile phone as urgent cyclone disaster information**, and information from the Upazila and Union offices of lower level are communicated to the Unit office through the Bagerhat District office. ● In Sidr, information on the cyclone was disseminated as mentioned above. Time of communication is unclear. ● The information was first communicated to the Chairman and the Union Parishad members (9 members of committee) and the security and advisability of evacuation were disseminated to the Union residents. ● The communication means is the fixed telephone or mobile phone, and a PIO with a motorbike hands the information down to residents using a loudspeaker at the possible area of disaster.
Khulna/ Bagerhat	DRR Officer Office, Bagerhat District	● The Bagerhat DRR Office has one officer and two staff. ● The Upazila Bagerhat PIO also has two staff at the office of Upazila. One staff is temporary employment under annual contract. There are five-day workers a week. ● Bagerhat District has 9 Upazila: Bagerhat, Mullahas, Fakirhat, Rampal, Mongla, Chitalmari, Kachua, Morrelganj, and Saranhola. ● Four out of the 9 districts and their Upazilas are vulnerable. These are the Bagerhat District (Upazila of Sarankhola, Mongla, Morrelganj), Pirojpur District (Upazila of Mathbaria, Zianagor, Bhandaria), Patuakhali District (Upazila of Kalapara, Glachipa, Rangabali, Dashimina), Barguna District (Upazila of Pathrghata). ● Since 2012, DMIC Bagerhat has an emergency warning system at the office of DRR. According to the DRRO, however, a panel of the warning system has not been opened yet and the system is not functioning at all. ● At present the ICT system depends on the mobile phone correspondence only. ● This office has a speed boat donated by Holland in 2014 and is moored at the Vayrab River. The maintenance and fuel cost is paid by the district. ● One of the two engines of the boat is out of order at present. ● The roles of PIO are development management of each upazila, disaster warning management, and evacuation of people.

Source: JICA Study Team
Notes: DC (Deputy Commissioner), FSCD (Fire Service & Civil Defence). Bold fonts in the table mean key words for emergency disaster response and rescue.

The various problems regarding the emergency disaster response were raised by the residents as well as the officers of the local government offices and related agencies concerned as shown in the survey results (indicated in bold fonts in the table above). They define the respective roles of the persons/entities concerned, the implementation of communication, and confirmation of the means of information and communication to the residents before the occurrence of disasters/cyclones and after evacuation to the cyclone shelters is announced. The issues are the lack of daily necessities which are emergency disaster relief to the residents such as drinking water, food, blanket, etc., and the blockage of access of local relief as well as the means of information and communication during the disasters. According to the information from DDM and FSCD, comparing the two times of the cyclone disasters of Aila in 2007/Sidr in 2009 and the recent times, it is said with possibility in the district in late years the drinking water of the plastic bottle largely spreads in the country and a plastic bottle drinking water factory opens in the district city/town in the coastal region of Bangladesh. In addition, it is noted that a supply of the drinking water of the relief material in the emergency seems to include distribution

support by NGOs (for examples, Action Aid Bangladesh, Oxfam, Oxfam GB, Islamic Relief, World Vision, NGO Forum for Public Health, DSK, PSTC, Handicap International, etc.).

(b) Report on Early warning and Disaster Information System in Coastal Area

Based on the results of the report on "Data Collection Survey on Early Warning and Disaster Information System in Coastal Area (2013)", the following disaster information are compiled as mentioned in Table 4.1.3**.**

Table 4.1.3 Disaster Information from Data Collection Survey on Early Warning and Disaster Information System in Coastal Area (2013)

Past Disasters	Items	Results of Experience Information at the Time of Past Disasters
Cyclone Mahasen 2013	Status during Cyclone Mahasen	Due to unexpected time for internal processing, a DDM line needed to take more time than that of a CPP line. The average time from the waring bulletin issued from SWC to the warning was announced was 2 hours and 15 minutes by CPP and 6 hours and 01 minute by DDM.
	Community Based Disaster Risk Management	Awareness raising, disaster education, and training/drill are hardly carried out well, and almost half of residents reply that **there is no evacuation drill** by local community. **Awareness and capacity development on disaster education are crucial for residents**.
	Ensuring Transportation Means	There is severe scarcity of transportation means for rescue activities at district, upazila, union and unit level. Therefore there is high demand for ensuring transportation means such as motorcycles and motorboats. They will also be useful for delivery of relief supplies and as a communication means for isolated areas. Especially, **lack of rescue boats affects in the current condition badly because the number of people who can be saved is limited without rescue boats**. If there re rescue boats, they could be used for rescue activities of fishermen as well. **For this reason, demand for rescue boats is especially high**.
	Establishment of Early Warning System/ Disaster Information Dissemination System	Construction of the early warning system / disaster communication system is needed for local community. Among a disaster prevention-related organization, a speaker siren system, a mobile speaker, satellite-based mobile phone is necessary for DDM, District, Upazila, and Union. As for t**he cell-phone/mobile phone in particular, the spread advances in the country,** and it is thought that it will become **main means of the transmission in near future**.
Cyclone Aila 2009	Rehabilitation and Reconstruction after Disasters	Polders were completely destroyed by Cyclone Aila (May 2009) in some area. Some of the area are inundated with salted water even now (as of 2013) because of no operations have been taken. Rehabilitation and reconstruction after disasters should be addressed with the reconstruction of the local government system as soon as possible.

Source: Data Collection Survey on Early Warning and Disaster Information System in Coastal Area, Final Report、JICA, July 2013

4.1.2 Specific Work for Emergency Disaster Response and Rescue Equipment

(1) Cooperation Results of the Past Japanese Grant Aid for Equipment

(a) Equipment producted by Japanese Company

In the devastating flood in July to September 1998, it was noted that among the roads of 29,155 km under the jurisdiction of LGED's consisting of 6,565 km of paved roads and 22,590 km of non-paved

roads, 2,243 km were damaged. Structures under the control of BWDB such as embankments, suspension bridges, culverts, etc., also suffered from great damage. Based on the request from the Government of Bangladesh, the Government of Japan provided Grant Aid to Bangladesh for equipment such as construction machinery, vehicles and materials for the 1998-flood Disaster Relief Project as shown in Table 4.1.4 below.

Table 4.1.4 List of Equipment supplied for the 1998-Flood Disaster Relief Project*

Implementing Agency	Equipment	Specification	Quantity		Present Condition			Remarks
					Runn -ing	Need repair	Out of order	
RHD	1.Bulldozer	12ton, 90-120HP	unit	4	0	4	0	All the equip-ment is still in operational or need repair.
	2.Moter Grader	135HP	unit	2	2	0	0	
	3.Wheel Loader	130HP	unit	4	3	1	0	
	4.Excavater	0.5~0.8m3	unit	4	2	2	0	
	5.Hydraulic Crane	20-25ton-carry	unit	3	2	1	0	
	6.Truck crane	8-10ton-carry	unit	2	2	0	0	
	7.Truck	5-7ton-180HP	unit	36	28	8	0	
	8.Truck trailer	20-30ton	unit	4	2	2	0	
	9.Wrecker truck	25-25ton-carry	unit	2	2	0	0	
	Total			61	43	18	0	
LGED	1.Bulldozer	Komatsu,D41E-6, 12ton, 90-120HP	unit	4	1	3	0	
	2.Moter Grader	Komatsu,GD-511A-1 ,Blade:3.7m3,135HP	unit	4	2	2	0	
	3.Wheel Loader	Komatsu,WA250-3A, Blade:2.0m3,130HP	unit	4	1	3	0	
	4.Vibrating Roller	Sakai, SW230, 1.5ton, 20HP	unit	24	6	3	15	
	5.Road Roller	Sakai, R2, 8-10ton	unit	28	25	3	0	
	6.Tire (wheel) Roller	Sakai, TS200, 130HP	unit	4	3	0	1	
	7.Truck	Mitsubishi, 3ton	unit	40	36	4	0	
	Total			108	74	18	16	
BWDB	1.Bulldozer	90HP	unit	4	1	2	1	
	2.Excavater	0.5~0.8m3	unit	10	4	6	0	
	3.Hydraulic Crane	20, 30, 50ton	unit	3	3	0	0	
	4.Steel sheet-pile	SY295 12m	ton	1000	-	-	-	
	Total (equipment only)			17	8	8	1	

Source: RHD, LGED, RWDB, * the Project for Supply of Equipment and Martials for Flood Disaster Relief, 1999 JICA

Notes: The equipment listed in the above table shows the equipment supplied for 1998-flood disaster relief project under the E/N signed on June 20, 1999, Grant amount of 1,633 million Yen.

As shown in the table above, the current situation of the listed equipment has been surveyed by the JICA Survey Team through information provided by the three (3) related government agencies (RHD, LGED and BWDB). The following facts were revealed.

a) RHD

(The interview results with RHD, the Planning & Maintenance Wing Zone Officer, Dhaka)

- All units of equipment supplied by JICA are still operational, but some need repair.

- The average number of depreciation years of construction equipment and materials is 6 to 8 years in Japan. Although the supplied units of Japanese equipment are more than 16 years after manufacture in Japan, about 70% are currently working and operational.
- Although about 30% (18 units) of equipment need repair, there is no difficulty in the acquisition of spare parts of the same brand from the manufacturers in Japan through the agencies and suppliers in Dhaka City.
- The bulldozers frequently need repair work, but there is no problem in the acquisition of spare parts.
- About 78% of the trucks are running at present and the remaining are repairable.
- The survey results reveal the superior quality and usability of equipment manufactured in Japan.

b) LGED

(The interview results with Executive Mechanical Engineer, LGED HQ)

- Although the supplied Japanese equipment has more than 16 years after manufacture in Japan, about 69% are still currently functional and operational.
- Compared to the new equipment made in India or China, the durable period is 3 to 4 years, i.e., less life and costlier maintenance.
- Out of 108 units, 16 units are already out of order (about 15%) and 18 units are under repair (16%).
- Out of 2 kinds of rollers (vibratory roller, 1.5 ton; road roller, 8-10 ton), about 89% of roads rollers are still running, while 62% small scaled vibratory roller are already out of order. With regard to rollers, it is said that rollers beyond the middle type may be tolerable and easier to use.
- It has been revealed in the survey that equipment made in Japan have high quality and easier to use.

c) BWDB

- All equipment (bulldozers, excavators, hydraulic cranes) granted to BWDB in Dhaka has been used for over 16 years. Out of 17 units of equipment, 47% is still functional and operational
- All the cranes (100%) are still functional and operational
- About 47% of the total number of equipment need repair and only one unit is out of order (5%).

- According to the database of equipment owned by BWDB, except the equipment made in Japan, 21 units out of 24 units are out of order (88%).
- BWDB states that the equipment made in Japan are really of high quality and durability.

(b) Equipment for Emergency Response and Predominance over which Japan Possesses

As to the applicability of Japanese technology to Component 2, some items are considered; namely, the purpose of the project, topographic and geological features, advantage of Japanese technology for information-communication technology and mobile phone system, and acquisition of spare parts as follows.

Table 4.1.5 Applicability of Japanese Technology to Component 2

Item	Applicability of Japanese Technology	Remarks
Purpose of Applicability of Japanese Technology	• Advantages of equipment and communication system with Japanese technology for emergency disaster response and rescue. • International cooperation that understands the Japanese name with the national flag of Japan is promoted.	
Outline of the Project Area; Topography and geology; Improvement of present people's living condition; Needs for inhabitants leant from the past disaster experiences.	• The coastal area as target candidate site for the field study on the Project consists of topographically flat and low-lying islands. The neighborhood of the island is easy to be influenced by the tide level in a wide river, and the water edge of the island is subject to repetitive erosion and accumulation of debris/sediment. • In the coastal area, the islands are easily affected by high tide at the time of monsoon and the topography is fragile with silty-clayey geology resulting in the change of shape of the island. At the time of Cyclone, local residents who live in fragile structured houses are forced to evacuate to the cyclone shelters or elevated grounds or safer buildings on time. • Water connectivity and transportation, and means of communication are needed to tie up with the local residents who live in the low-lying islands.	JICA field survey results (2015)
Advantages of Japanese technology, materials and equipment	• It is possible to utilize and promote similar equipment supplied for the 1998-Flood Disaster Relief Project. The planning for equipment shall consider the use of excellent Japanese equipment technology, and Japanese equipment is to be used greatly. • For example, about 70% of the Japanese Grant Aid equipment is still running and playing an active role on time for the past 16 years since 2000 (refer to Table 4.1.4). If the average durable years of an equipment is 6-8 years, it means that Japanese equipment have been used and this is more than double the durable years of new equipment made in China and India (the durable period is 3-4 years). • Based on the JICA field survey observation and results on the equipment granted for the JICA 1998-Flood Disaster Relief Project, they are being used properly and effectively.	Refer to Table 4.1.4, Equipment supplied for the 1998-Flood Disaster Relief Project.

Item	Applicability of Japanese Technology	Remarks
Advantages of Japanese technology on information and communication-cellular phone system.	• Based on the experience during "the Great East Japan Earthquake" in 2011, the cellular phone networks were not severed but the lines were busy during the disaster. Due to this experience, it is recommended that servicing of cellular phone networks is needed in case of emergency disaster response of first responders (emergency response personnel), coordinator (adjustment personnel) and servicing of internet (disaster data information sharing). • It is to be noted that only a Japanese company has offered such a cellular phone network and internet service during disaster response and rescue operations, showing the advantage of Japanese technology and that it is already readily available. Recently, the introduction of Japanese disaster ICT system begun in the Philippines and Indonesia as examples of the best practices of sophisticated Japanese protection technology against disasters to the ICT system. • It is crucial that several measures for plural choices as a disaster prevention communication system should be prepared and secured at the time of the disaster as much as possible or restored immediately. In a communication system of DDM and SFCD, it is more desirable and functionable for ①the wireless communication (HF) net between the central government/the headquarters and the local government, ②the enlargement of the function of the wireless communication net (VHF) between the local governments/communication posts of DDM/FSCD in a district/upazila leveled communication system, and ③ the placement of facilities (mobile communication cars) to find the communication with the stricken area at the time of a disaster as soon as possible.	The Booklet of Best Practices of Resilient ICT Systems in Japan, Ministry of Internal Affairs and Communications
Acquisition of spare parts	• Spare parts required for repairing equipment of Japanese manufacture can be purchased from dealers at an open market in Dhaka City. • There are no Japanese factories in Bangladesh, but dealers/agencies of Japanese manufacturers (Komatsu, Kawasaki, Kobelco, Sakai, Hino/Toyota, Takeuchi, etc.) have been available since the 1970's in Dhaka City. • There is also an agent of a European mechanical manufacturer in Dhaka City.	Interviews with the dealers and suppliers for spare parts in Dhaka City.

Source: JICA Survey Team

(c) Capacity for Equipment Required for Bangladesh

a) Maintenance Capability

LGED

LGED deploys all the equipment at the district level workshops under the supervision of a mechanical engineer. LGED has 64 workshops all over the 64 districts in Bangladesh; i.e., one workshop in each district. There are 22 workshops existing in the 22 districts under the supervision of the mechanical engineer who graduated from a university, while there are newly established 42 workshops in 42 districts under the supervision of a diploma level mechanical engineer. LGED has a workshop programme to enhance the capacity of the workshops in the country.

BWDB

BWDB has the Maintenance Department with a chief mechanical engineer in district level offices in the country. In the department, however, there is no maintenance work for equipment, but repair work for automobiles only. There are 5 major mechanical workshops in the country; namely, Dhaka, Chittagong, Khulna, Bheramara, and Borga. These workshops do not have enough manpower and are now limited to BWDB's own repairing works for equipment only. Regarding spare parts for the equipment, they are available at the local markets in major cities in the country.

DDM

DDM implements the O&M of its equipment by the DRRO, through the District Commissioner Office (DC Office) of the project area. Concerning boat maintenance, boat engines are operated and checked each morning. Moreover, because DDM has no directly managed repair workshops, repairs are entrusted to private workshops whenever breakdown occur.

FSCD

FSCD has 5 workshops in the major cities in the country; namely, Dhaka, Chittagong, Khulna, Rajshahi, and Rangpur. In Dhaka City, the FSCD Head Office has a workshop for maintenance and repair works and there are 65 staff members (1 chief mechanical engineer, 1 engineer, and 63 technicians and staff). One new workshop is planned to be open in Barisal District and it becomes the sixth newly opened workshop in the country. It is possible to purchase spare parts for the equipment through the agencies of a dealer/supplier in Dhaka City. In case that a major repair work for rescue fire floats is required, a shipyard or dockyard for the floats is to be used such as the Khulna Shipyard Company as a commercial enterprise in the Khulna Port and the Narayanjonj Dockyard Company in the Mongla Port.

d) Budget in the Past

LGED

Annual budget and maintenance budget results for LGED in 5 fiscal years (FY2010 to FY2014) are as tabulated below

Table 4.1.6 Annual Budget for LGED in 5 Fiscal Years (2010-2014)

Fiscal Year	2010	2011	2012	2013	2014
Total Budget (million BDT)*1	56,790	61,390	83,770	82,960	86,700*
Maintenance Budget (million BDT)*2	6,058	6,387	7,740	8,158	9,000
Ratio (*1/*2) (%)	10.7	10.4	9.2	9.8	10.4

Source: LGED
*Annual development budget allocation to LGED in FY2014 to FY2015 is US$1,112 million.

The above maintenance allocations are for road and road structure maintenance works and do not include staff salaries and other costs such as fuels, office stationaries, travel allowances, and miscellaneous expenses.

BWDB

All budgets and maintenance budget for BWDB in the 5 fiscal years (FY2010 to FY2014) are as tabulated below

Table 4.1.7 Annual Budget for BWDB in 5 Fiscal Years (2010-2014)

Fiscal Year	2010	2011	2012	2013	2014
Total Budget (million BDT)*1	-	-	-	-	18,720.0
Maintenance Budget (million BDT)*2	3,051.0	3,178.1	3,678.1	3,550.0	3,710.0
Ratio (*1/*2) (%)					19.8%

Source: BWDB HQ, Dhaka

DDM

All budgets and maintenance budget for DDM in the 5 fiscal years (FY2010 to FY2014) are as tabulated below

Table 4.1.8 Annual Budget for DDM in 5 Fiscal Years (2010-2014)

Unit: Thousand BDT

Organization	Budget	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14	FY 2014/15
DDM	Revenue	87,133	88,680	113,022	120,433	127,659
	Expenditure	85,245	85,789	106,062	107,684	-

FSCD

All budgets and maintenance budget for FSCD in the 5 fiscal years (FY2010 to FY2014) are as tabulated below.

Table 4.1.9 Annual Budget for FSCD in 5 Fiscal Years (2010-2014)

Fiscal Year	2010	2011	2012	2013	2014
Total Budget (million BDT) *1	1,223	1,346	1,473	2,029	2,573
Maintenance Budget (million BDT)*2 (Maintenance cost of equipment only)	15	20	20	48	50
Ratio (*1/*2) (%)	1.2	1.5	1.4	2.4	1.9

Source: FSCD HQ, Dhaka

e) Spareparts

New spare parts of Japanese brand of machinery, equipment and materials are available in Dhaka City through an agent and a supplier of the brand manufacturers of materials and equipment in

Japan. With regard to the agencies of manufacturers in India and China, as well as the manufacturers of European countries and the USA, it is also possible to get spare parts of those brands. Delivery takes 1 to 2 months by surface transportation and about 2 weeks by air based on the interview with a supplier and agency (established in 1972 and 2000) in Dhaka.

(d) Existing Equipment and Materials owned by LGED, BWDB and FSCD

Table 4.1.10 to Table 4.1.12 show the lists of equipment and facilities that are currently owned by LGED, BWDB and FSCD. According to DDM, there is no equipment owned by DDM.

Table 4.1.10 Existing Equipment owned by LGED

Division	District	Number of Existing Major Equipment for Water Related Disasters						
		Excavator	Wheel Loader	Crane (Truck Mounted)	Truck/ Dump Truck	Trailer	Porta-ble steel bridge	Vibratory Road Roller
Dhaka	17 districts including Dhaka	0	2	0	17	0	0	2
Chittagong	11 districts including Chittagong	0	3	0	11	0	0	2
Khulna	10 districts including Khulna	0	0	0	10	0	0	0
Rajshahi	10 districts including Rajshahi	0	0	0	8	0	0	0
Sylhet	4 districts including Sylhet	0	0	0	4	0	0	0
Barisal	6 districts including Barisal	0	0	0	6	0	0	0
Rangpur	8 districts including Dinajpur	0	0	0	8	0	0	0
Total (64 districts)		**0**	**5**	**0**	**64**	**0**	**0**	**4**

Source: LGED Head Office, Dhaka

LGED possess equipment and machinery in 2 divisions: Dhaka and Chittagong. Major machinery and equipment such as wheel loaders and vibratory road rollers can be managed at 2 districts only: Dhaka and Gazipur. As shown in the following table, trucks and dump trucks are owned and managed by the LGED at each district

Table 4.1.11 Existing Equipment owned by BWDB

Division	District	Number of Existing Major Equipment for Water Related Disasters							
		Exca-vator	Crane (crawler crane)	Crane (wheel type)	Dump Truck	Pay Loader	Bull-dozer	Barge	Low Bed Trailer
Dhaka	17 districts including Dhaka	37	3	8	10*	8*	24*	11	6
Chittagong	11 districts including Chittagong	0	0	0	0	0	0	0	0
Khulna	10 districts including Khulna	0	0	0	0	0	0	0	0
Rajshahi	10 districts including Rajshahi	0	0	0	0	0	0	0	0
Sylhet	4 districts including Sylhet	0	0	0	0	0	0	0	0
Barisal	6 districts including Barisal	0	0	0	0	0	0	0	0
Rangpur	8 districts including Dinajpur	0	0	0	0	0	0	0	0
Total(64 districts)		**37**	**3**	**8**	**10**	**8**	**24**	**11**	**6**

Source: BWDB HQ Dhaka

Notes: In the above table, 10 dump trucks should be 2 because 8 are out of order. Similarly, 8 pay loaders and 24 bulldozers should be as follows: 2 need repair and 6 out of order, and 1 operational, 2 need repair, 21 out of order, respectively. At the BWDB Head Office, equipment is not Japanese brand or manufacture, but from other countries.

The major machinery/equipment owned by BWDB is playing an active role in Dhaka District only, and there is no major machinery/equipment in the other districts. In the local districts, the equipment working at site is owned by the contractors under the contract.

Table 4.1.12 Existing Equipment and Materials owned by FSCD

Division	District	Equipment and Materials deployed by FSCD in Bangladesh				
		Rescue Fire Float	Rescue Speed Boat	Jiminy Boat	Life Jacket/ Life Buoy	ICT System
Dhaka	17 districts including Dhaka	2	1	0	30	0
Chittagong	11 districts including Chittagong	1	0	0	10	0
Khulna	10 districts including Khulna	0	1	0	20	0
Rajshahi	10 districts including Rajshahi	0	0	0	0	0
Sylhet	4 districts including Sylhet	0	0	0	0	0
Barisal	6 districts including Barisal	1	2	0	30	0
Rangpur	8 districts including Dinajpur	0	0	0	0	0
Total(64 Districts)		**4**	**4**	**0**	**90**	**0**

Source: FSCD Head Office, Dhaka

The major equipment and materials owned by FSCD are deployed in four (4) divisions of Bangladesh only (Dhaka, Chittagong, Khulna, Barisal), while there is none in the other three (3) divisions (Rajshahi, Sylet, Rangpur). In terms of district having major equipment and materials, there are 2

districts in Dhaka Division (Dhaka and Kishoreganj), the Chandpur District in Chittagong Division, the Khulna District in Khulna Division, and 2 districts in Barisal Division (Barisal and Patuakhali).

(2) List of Equipment Newly Required for the Related Agencies

Three (3) items have been described above concerning the confirmation of support needs of materials and equipment and the introduction of materials and equipment for which Japanese technology was used at the time of emergency response, rescue, and relief in Bangladesh. These are: a) the result of the Project for Supply of Equipment and Materials for Flood Disaster Relief, 1999 JICA; b) the results of the field investigation survey conducted by the JICA Survey Team in the Barisal Division and Kulna Division in June 2015; and c) the study results of the selection of equipment for the emergency response, rescue, and relief which are internationally predominant in the field of Japanese industrial technology.

The list of materials and equipment prepared and requested by the Department of Disaster Management (DDM), the Bangladesh Water Development Board (BWDB), the Local Government Engineering Department (LGED), and the Bangladesh Fire Service and Civil Defence (FSCD) are as shown in Table 4.1.13 to Table 4.1.16.

The selection criteria for the 12 target districts are described in Section 4.2.1 and the location of the 12 target districts comprising the Project Area are as indicated in Figure 4.2.1.

After the discussion between the Government of Bangladesh including DDM, BWDB, LGED and FSCD, and the JICA Head Office and the JICA Study Team, the contents, quantities and cost estimates of the materials and equipment to be selected are as mentioned in Section 4.2.2.

Table 4.1.13 Equipment Requested by DDM

No.	Equipment	Specification	Purpose	Unit	Quantity
1	HF base set	-	Essential communication among 12 districts, 35 upazila, 2 DDM HQ, and 2 MoDMR.	set	51
2	Antenna tower (40 ft.) for HF fixed radio	-	Essential communication among 12 districts, 35 upazila, 2 DDM HQ, and 2 MoDMR.	set	51
3	Solar panel	-	Power backup for communication among 12 districts, 35 upazila, 2 DDM HQ, and 2 MoDMR	set	49
4	Rescue speedboat	-	Search and rescue	set	12
5	Portable generator	-	Emergency power backup	set	12
6	Megaphone siren	-	Cyclone response recovery	set	175
7	Siren	-	Cyclone response recovery	set	175
8	First aid kit	-	Cyclone response recovery	set	175
9	Life jacket	-	Cyclone response recovery	set	175
10	Stretcher	-	Cyclone response recovery	set	175
11	Radio set	-	Cyclone response recovery	set	175

Source: DDM- HQ, Dhaka

Table 4.1.14 Equipment Requested by BWDB

No.	Equipment	Specification	Purpose	Unit	Quantity
1	Excavator (long boom)	65'-00'' long	Emergency disaster response & rescue, Crushing and strip-off, loading and moving of excavated materials	unit	12
2	Excavator	Standard	Emergency disaster response & rescue, Crushing and strip-off, loading and moving of excavated materials	unit	12
3	Bulldozer	D-6	Emergency disaster response & rescue, moving of excavated materials	unit	5
4	Dump truck	10 m3	Emergency disaster response & rescue, transport of construction materials	unit	12
5	Crane	70 ton, 43m long	Emergency disaster response & rescue, hang-up and moving of heavy articles	unit	1
6	Crane	30 ton, 35m long	Emergency disaster response & rescue, hang-up and moving of heavy articles	unit	2
7	Crane	16 ton	Emergency disaster response & rescue, hang-up and move heavy articles	unit	4
8	Tug	1000 HP	Emergency disaster response & rescue, transport of peoples, goods, supplies	unit	2
9	Barge	300 ton	Emergency disaster response & rescue, transport of goods, supplies	unit	5
10	Barge	200 ton	Emergency disaster response & rescue, transport of goods, supplies	unit	5
11	Jeep car	-	Emergency disaster response & rescue, transport of peoples, goods, supplies	unit	12
12	Speed boat	-	Emergency disaster response & rescue, transport of peoples, goods, supplies	unit	12

Source: BWDB Head Office, Dhaka

Table 4.1.15 Equipment Requested by LGED

No.	Equipment	Specifications	Purpose	Unit	Quantity
1	Excavator	12-15 ton, 2.5 m^3, fixed boom type, bucket capacity (0.5-1.0 m3) with hammer (1 ton)	Emergency disaster response and rescue, crushing and strip-off, loading and moving of excavated materials	set	12
2	Pay loader/Wheel loader	Wheel loader, hydrostatic trans-mission, bucket capacity (2-3 m^3), operating weight (11.5-12.5 ton)	Emergency disaster response and rescue, transport and moving of construction earth and crushed materials	set	12
3	Crane (truck mounted)	Telescopic boom truck crane, total rated lifting load (25-30 ton), dead weight in travel state (30-32 ton), engine rated output (200-230 kw)	Emergency disaster response and rescue, hang-up and move a very heavy articles	set	12
4	Truck/Dump truck	Capacity (5 ton)	Emergency disaster response and rescue, transport of construction materials	set	24
5	Trailer	Capable to carry equipment of having minimum weight 15 ton to the site.	Emergency disaster response and rescue, transport of construction equipment	set	12
6	Generator	Alternator: rated output (50-60 kva) diesel engine: 4 cylinders, direct injection, rated output (55-60 kw)	Emergency disaster response and rescue, power generation at site	set	12

No.	Equipment	Specifications	Purpose	Unit	Quantity
7	Portable steel bridge	Single lane type with steel decking, 100m long bridge	Emergency disaster response and rescue, urgent construction of the road bridge making potable steels	set	12
8	Vibratory road roller	Operating weight (8-10 ton), engine power (60-90 kv)	Emergency disaster response and rescue, compaction of road base	set	12
Total				set	108

Source: LGED HQ Dhaka
Notes: Training on risk reduction such as quality assurance and awareness is required for 1 to 3 months.

Table 4.1.16 Equipment Requested by FSCD

No.	Equipment and Materials	Specification	Purpose	Unit	Quantity
1	Rescue fire float	40 ft. long (min.)-300HPx2, fire pump with rescue equipment	Emergency disaster response, rescue, and relief, especially patrolling/providing river transit waterways to surrounding islands in their own division.	Float	6
2	Rescue speed boat	7m long (min.)-120HPx2 outboard engines with rescue equipment	Emergency disaster response, rescue, and relief	Boat	12
3	Inflatable boat (jiminy boat)	Rubber body, length 16 ft. (min.) -	Emergency disaster response, rescue, and relief	boat	12
4	Diving apparatus	Twin cylinders with accessories -	Emergency disaster response, rescue, and relief	set	448
5	Air compressor	Heavy duty type, for air delivery, 300 litre/m(min.)-	Emergency disaster response, rescue, and relief	set	112
6	Life jacket	Standard type-	Emergency disaster response, rescue, and relief	set	208
7	Life buoy	Standard type-	Emergency disaster response, rescue, and relief	set	208
8	Operation field communication vehicle	Vehicle equipped with various types of communication equipment ICT-car	Emergency disaster response, rescue, and relief, District Fire Station (12)	car	12
9	VHF repeater	Frequency range 136-174 MHz (min.)	Emergency disaster response, rescue, and relief, District Fire Station (12), Fire Station (24)	set	36
10	VHF base set	Frequency range 136-174 MHz (min.), TX:11A, 6A RX:2.5A	Emergency disaster response, rescue, and relief, District Fire Station (12), Fire Station (100)	set	112
11	HF base set	Frequency range RX:30 kHz – 30 MHz; TX: 1.6-30 MHz	Emergency disaster response, rescue, and relief, District Fire Station (12)	set	12
12	VHF car mobile set	Frequency Range 134-174MHz(minimum),	Emergency disaster response, rescue, and relief, District Fire Station (51), Fire Station (188)	set	239

13	VHF walkie talkie	Frequency Range 134-174MHz(minimum),	Emergency disaster response, rescue, and relief, District Fire Station (125), Fire Station (102)	set	227
14	Tower antenna (200 ft.) for VHF repeater	3 legged triangle self-supported angular tower made of high quality mid steel, height-60m,	Antenna for ICT system (VHF repeater), District Fire Station (12)	set	12
15	Tower antenna (60 ft.) for VHF base set/ repeater	GI pipe for VHF fixed radio	Antenna for ICT system (VHF base set/ repeater), Fire Station (100)	set	100
16	Tower antenna (40 ft.) for HF base set	GI pipe for HF base station	Antenna for ICT system (HF base set), District Fire Station (12)	set	12

Source: FSCD HQ Dhaka

4.2 Selection of Equipment

4.2.1 Policy on Selection of Equipment

(1) Criteria for Emergency Disaster Response Equipment

(a) Target Districts

In order to identify the disaster prone areas during cyclones and flash floods, as well as high storm risk areas through the past disaster records, the target area of the Project as set as the 12 districts located in the 3 divisions of Barisal, Khulna and Chittagong, people and families that would be possibly affected in these areas can be effectively reduced and more lives saved with the provision of warning, information and telecommunication system, as well as rescue equipment. Table 4.2.1 and Figure 4.2.1 show selected 12 districts for the disaster emergency response.

Table 4.2.1 Project Target Districts for Component 2

Division	District	Number
Khulna	Satkhira, Khulna, Bagerhat	3 Districts
Barisal	Barisal, Pirojpur, Jhalokati, Barguna, Patuakhali, Bhola,	6 Districts
Chittagong	Noakhali, Chittagong, Cox's Bazar,	3 Districts
Total	-	12 Districts

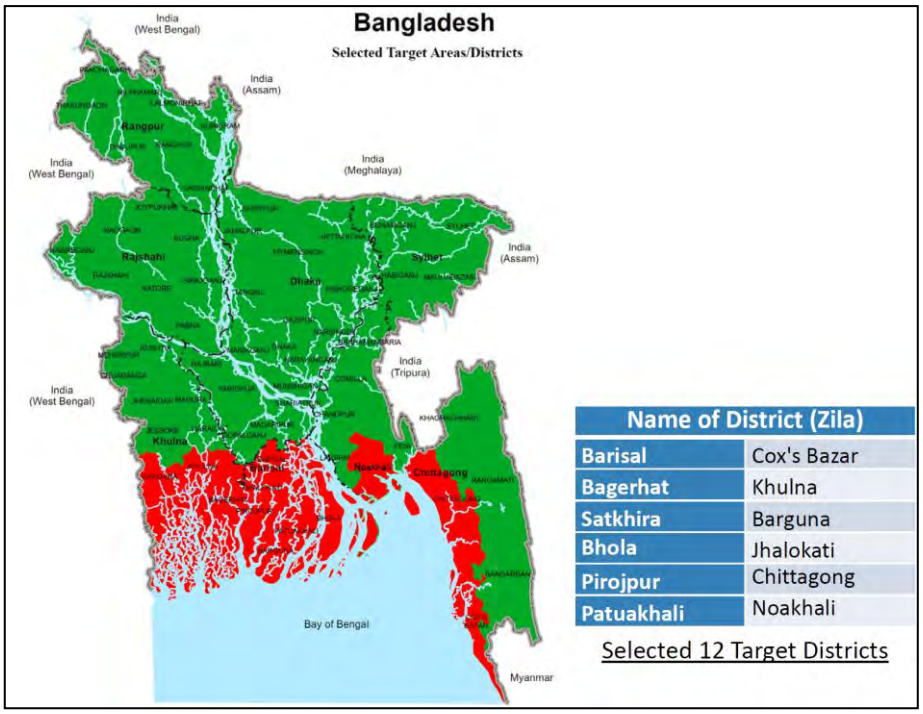


Figure 4.2.1 Project Target Districts for Component 2

(b) Criteria of Identification for Emergency Response Equipment

- Equipment is to be under the control of the requesting agency.
- If there were hindrances or deficiency of certain equipment in past evacuation and relief activities, the equipment has a higher priority on the assumption that loss will be reduced if the equipment is in place.
- Equipment which will contribute to "mitigation" and "emergency response" in disaster management recycle.
- Equipment that will facilitate early-warning (Preparedness) before disaster.
- Equipment is to be used for facilitating Search, Rescue and Emergency Response.
- The requesting agency has enough equipment maintenance capability.

(2) Existing Tendering System for Disaster-related Equipment in Bangladesh

The results of the interview survey with four concerned authorities, i.e., DDM, BWDB, LGED and FSCD concerning the equipment is described below.

The Central Procurement Technical Unit (CPTU) under the Ministry of Planning has prepared the Public Procurement Rule (PPR) which describes the principle, methods and processes of public procurement such as the selection of Consultant, selection of Contractor and also the procurement of Equipment, etc., in Bangladesh. It has also prepared the standard Pre-Qualification (PQ) documents and tender documents. These documents have been made public through the CPTU's website. The

procurement rule including standard documents have been formulated with reference to standard documents of the World Bank and also FIDIC under the support of the World Bank.

There are several types of tender documents based on the condition of tender such as Local Competitive Bidding (LCB) or International Competitive Bidding (ICB), Civil Works or Procurement of Equipment, with PQ or without PQ and also upper limit tender price, etc. Compliance with the PPR is mandatory in self-funded projects of the Bangladesh Government; whereas, the Donor's procurement rule prevails in loan projects. In general, in case of LCB of loan project, PPR is applied. On the other hand, in case of ICB, either Donor's own procurement rule or partially adjusted PPR based on the Donor's requirement is used.

In the procurement example related to disaster risk reduction in a previous project, DDM had procured Megaphone Siren, Small Marine Rescue Boat, Disruption-free telecom equipment (Satellite Phone), etc. The project was implemented through ICB based on the procurement rule of the World Bank. Besides, the electronic tender system which complies with the PPR was started in Bangladesh in 2014 to improve fairness and transparency

(3) Procurement Methods for Japanese Equipment

In order to start the study on the procurement of Japan made equipment, first of all, it is necessary to study and select the equipment which is superior in a specific point related to technology compared to the product of other countries. Then, the intention of the concerned authority as to whether or not it really prioritises any specific point needs to be confirmed.

Considering high standard and technically unique nature of the component, during the bidding, it shall be evaluated that the bidders have appropriate ability and resources to cope with the technical requirement.

4.2.2 Selection and Needs of Equipment

Based on the Selection Criteria mentioned in Section 4.2.1 (1) and the results of the studies and field survey, the selection and necessity of the Equipment (Component 2) are as summarized in Table 4.2.2.

Table 4.2.2 Issue, Cause and Action on Emergency Disaster Response

Emergency Response for Equipment	Related Government Agencies	Issue	Cause	Action
Machinery Equipment	BWMB/ LGED	• BWMB and LGED have requested construction equipment for the first time (refer to the lists of existing construction and requested equipment in Tables 4.1.6 to 4.1.12) • If no equipment is requested, emergency response equipment could not be made in advance.	• The introduction possibility of equipment concerned is considered when the availabilities are determined such as the maintenance management capability for equipment, the budget in the present situation on the district level, the spare parts, etc. • Public works such as roads, bridges and embankment dyke in the district are carried out through the contract basis with private construction companies. Therefore, it is assumed that BWDB and LGED do not have the system to perform operation and maintenance of the machinery equipment.	• It is emphasized to push forward the ability for maintenance improvement (staff, budget, etc.) of equipment in the local district, and it is better at first to hang time and to give priority to the improvement of maintenance ability of the organization. • Therefore, it will be decided in the present stage to shelve the request for equipment concerned.
Communication and Warning System	DDM/ FSCD	• Communication from the head office in Dhaka to the districts is late, so that transmission of disaster information on the district level and the evacuation of inhabitants is also delayed. • In the district and upazila level, the equipment requested are totally insufficient at present.	• Electrical/communication facilities suffer from disaster, and the mobile network and Internet, as well as the telephone lines are cut down. • Disaster information dissemination system takes time when communication is made from the headquarter level to the district level. • Information is not transmitted quickly at the headquarter level.	• It is necessary to prepare plural choices as a disaster information communication system and maintain the system facilities becoming the substitute of electricity, the communication facilities which are apt to suffer. • It is crucial to plan the efficiency of dissemination formalities that the communication to the district level requires. Review of the current procedure is required. • The existing system of disaster risk management should be reviewed and the information sharing system maintained at the time of emergency disaster.

Emergency Response for Equipment	Related Government Agencies	Issue	Cause	Action
Emergency Lifesaving apparatus	DDM/ FSCD	• Assistance to disaster victims is late since the equipment concerned is not insufficent.	• The complete amount of response equipment for the disaster suffering area and number of required operators are short. • Nobody can provide rescue without the required information to the rescuer. The rescue operation does not function well (non-efficiency).	• It is required that the information of the rescuer should be effectively grasped, and the rescue system also efficiently arranged (the choice of equipment deployment plan, the help destination, the appropriate place/location of refuge and the route). • Equipment and security of the rescue staff required for maintaining the rescue system to save effectively mentioned above are required and a system against any disaster arranged.

Thus, the government agencies targeted for the Component 2 (Equipment) procurement plan the DDM and FSCD. Equipment choices and needs are as shown in Table 4.2.3.

Table 4.2.3 Selected Equipment for the Project (DDM)

No.	Selected Equipment			Required Quantity	Justification for Selection
	Name of Equipment	Unit	Quantity		
1	Rescue speed boat	boat	12	for 12 districts (1 boat/district)	Search and rescue purpose for each district in cyclone disasters.
2	HF base set	set	51	51 sets for 12 districts, 35 Upazila, and 2 DDM HQ, and 2 MoDMR.	HF communication among MoDMR, DDM HQ, Districts, Upazila is essential in cyclone disasters.
3	40ft tower for HF fixed radio	set	51	51 sets for 12 districts, 35 Upazila, and 2 DDM HQ, and 2 MoDMR.	This is an antenna for HF communication among MoDMR, DDM HQ, Districts, and Upazila in cyclone disasters.
4	Megaphone	set	175	for 35 Upazila (35 x 5sets)	Cyclone response recovery
5	Siren	set	175	for 35 Upazila (35 x 5sets)	Cyclone response recovery
6	First aid kit	set	175	for 35 Upazila (35 x 5sets)	Cyclone response recovery
7	Life jacket	set	175	for 35 Upazila (35 x 5sets)	Cyclone response recovery
8	Stretcher	set	175	for 35 Upazila (35 x 5sets)	Cyclone response recovery
9	Radio set	set	175	for 35 Upazila (35 x 5sets)	Cyclone response recovery

Source: DDM

The breakdown of 12 target districts and 35 Upazila in Table 4.2.3 is shown in Table 4.2.4 together with jurisdiction areas and population.

Table 4.2.4 Selected Target Area for the Project (DDM)
(A Support Data of Table 4.2.3)

Division		District		Upazila damaged by disaster s of cyclone*/flood/storm surge		Area (km2)	Population (person) (2011)
1	Khulna	1	Khulna	1	Dacope	992	152,316
				2	Koira	1,775	193,931
		2	Satkhira	3	Shyamnagar	1,968	318,254
				4	Ashasiun	375	318,254
2	Barisal	3	Bagerhat	5	Sharonkhola	757	119,084
				6	Mongla	1,461	136,588
		4	Barguna	7	Sadar	454	261,343
				8	Patharghata	387	163,927
				9	Amtali	721	270,802
				10	Betagi	168	117,145
				11	Bamna	101	79,564
		5	Patuakhali	12	Bauphal	487	304,284
				13	Galachipa	1,268	361,518
				14	Dasmina	352	123,388
				15	Kalapara	492	237,831
		6	Pirojpur	16	Mathbaria	344	262,841
		7	Jhalokati	17	Kathalia	151	124,271
		8	Bhola	18	Sadar	413	430,520
				19	Borhanuddin	285	233,860
				20	Lalmohan	396	283,889
				21	Char Fession	1,106	456,437
				22	Manpura	373	76,582
				23	Tajumuddin	513	126,940
				24	Daulathan	317	168,567
		9	Barisal	25	Bakerganj	411	313,845
3	Chittagong	10	Noakhali	26	Subarna Char	575	289,514
				27	Hatiya	1,507	452,463
				28	Companiganj	381	250,570
		11	Chittagong	29	Sandweep	764	278,605
				30	Sitakunda	484	387,832
				31	Anowara	164	259,022
				32	Banshkhali	377	431,162
		12	Cox's Bazar	33	Sadar	228	459,082
				34	Mohishkhali	362	321,218
				35	Tekrat	389	264,389
3 divisions		**12 districts**		**35 Upazila**		***21,298***	**9,029,838**

Source: DDM,
Notes: * Cyclone 2007 (Sidr), ECRRP (Emergency Cyclone Recovery & Restoration Project) in 2015.

Table 4.2.5 Selected Equipment for the Project (FSCD)

No.	Selected Equipment			Required Quantity	Justification for Selection Reasons of Selection and Necessity
	Name of Equipment	Unit	Quantity		
1	Rescue fire float	float	6	For 6 districts; namely, Barisal, Pirojpur, Bhola, Barguna, Patuakhali, and Khulna.	An existing float is very old (Producted in 1993). Search and rescue purpose by medium-float for each district.
2	Rescue speed boat	boat	12	for 12 districts	Search and rescue purpose by small boat for each divisions of Khulna, Barisal and Chittagong.
3	Inflatable boat (jiminy boat) with air gun	boat	12	for 12 districts	Search and rescue purpose for each district in cyclone disasters.
4	Operation field communication vehicle ICT-car	set	12	for 12 districts.	Essential communication for 12 districts when public communication network is disrupted due to some damage in cyclone disasters.
5	VHF repeater	set	36	in 12 districts	Essential communication for each district in cyclone disasters.
6	VHF base set	set	112	for 112 fire stations in 12 districts	Essential communication for fire stations in 12 districts in cyclone disasters.
7	VHF car mobile set	set	239	for 112 fire stations in 12 districts	Essential communication for 112 fire stations in 12 districts in cyclone disasters.
8	VHF walkie talkie	set	227	for 112 fire stations in 12 districts	Essential communication for 112 fire stations in 12 districts in cyclone disasters.
9	HF base set	set	12	for 12 main fire stations in 12 districts	Essential communication for main fire stations in 12 districts and FSCD HQ in cyclone disasters.
10	200ft tower for VHF Repeater	set	12	for 12 main fire stations in 12 districts	Essential VHF antenna among 12 main fire stations in 12 districts.
11	60ft tower for VHF Base set/repeater	set	100	for 100 fire stations in 12 districts	Essential VHF antenna for 100 fire stations in 12 districts.
12	40ft tower for HF base set	set	12	for 12 main fire stations in 12 districts	Essential HF antenna between Dhaka HQ and 12 main fire stations in 12 districts.

Source: FSCD

4.3 Basic Technical Specification of Equipment

The basic technical specification of the Equipment for DDM and FSCD to be procured for the Project are compiled in Appendix 4.2.

CHAPTER 5. COMPONENT 3 : DISASTER RECOVERY FUND FOR QUICK AND EFFECTIVE RECOVERY

5.1 Basic Concept of Disaster Recovery Fund for Quick and Effective Recovery and Rehabilitation

5.1.1 Objectives of the Disaster Recovery Fund

The "Disaster Recovery Fund for Quick and Effective Recovery and Rehabilitation" (Component 3 of the Project) aims to strengthen the country's capacity on disaster risk reduction and management by responding to temporary financial needs when disasters occur and by supporting immediate post-disaster recovery and rehabilitation activities.

A similar scheme to this fund is the so-called "Post Disaster Stand-by Loan" funded by JICA ODA loan. JICA signed a Loan Agreement with the Government of Philippines to provide the Post-Disaster Stand-by Loan of JPY 50 billion in March 2014, and with the Government of Peru to provide the Post Disaster Stand-by Loan of JPY 10 billion in April 2014. The Government of Bangladesh is now not eligible for the Post Disaster Stand-by Loan, because the country's economic indicator that allows providing Post-Disaster Stand-by Loan is below the JICA standard. However, the increasing frequency of natural disasters in Bangladesh and the resulting human and economic losses have led to a need for emergency recovery of damaged infrastructure and reconstruction of livelihood.

In the post disaster stand-by loans in Philippines and Peru, the funds become available for disbursement after the "declaration of a state of emergency" due to a natural disaster. The declaration of a state of emergency in Bangladesh can be requested from any disaster management committees at local level to National Disaster Response Coordination Group (NDRCG) through Deputy Commissioner at a District[3]. After evaluation of disaster situation, the NDRCG chaired by Minister for Disaster Management and Relief will submit recommendation to the President to declare the concern region as distressed zone. This process, however, has no clear criteria and it depends on an arbitrary decision. It is important to provide a scientific criteria in declaration of disaster and distress zone. In this regards, NDRCG should be responsible for establishing a criteria in declaration of disaster and distress zone.

The objectives of the Fund is to support quick response and post-disaster recovery and reconstruction. The target activities supported by the Fund shall be basic infrastructure, such as roads, bridges and embankment, to ensure quick recovery of life line. Furthermore, activities supported by the Fund shall be decided in terms of effectiveness of investment to achieve a long term goal of reconstruction. MoDMR and DDM should prepare a guideline for the Fund.

[3] According to Disaster Management Act 2012, City Corporation Disaster Management Committee; District Disaster Management Committee; Upazilla Disaster Management Committee; Pourashava Disaster Management Committee; Union Disaster Management Committee are described as local disaster management organization.

5.1.2 Tentative Criteria for Application to Avail of the Disaster Recovery Fund

The target infrastructure supported by the Disaster Recovery Fund are embankment and water related facilities under the management of BWDB and rural roads and bridges under the management of LGED, other infrastructure including cyclone/flood shelters under management of local government. There are two lines of application to request for the utilization of Disaster Recovery Fund for recovery and reconstruction of these infrastructure. One is an application requested from local governments through the Deputy Commissioner, and the other is an application requested directly from implementation agencies, such as LGED and BWDB. In both cases, the application shall be submitted to the PIU, an organization managing the Disaster Recovery Fund, with supporting documents. The applications shall be examined by PIU based on the guideline of the Fund. Then, PIU selects candidate projects for implementation and submit the list to PCMU for approval and to PSC for endorsement.

Criteria for application to Disaster Recovery Fund include: (i) geographical area(s); (ii) types of disaster; (iii) intensity of disasters; (iv) degree of damages; (v) number of beneficiaries; (vi) cost estimate and technical information to be needed; and (vii) environmental and social considerations.

(1) Geographical Area(s)

The Disaster Recovery Fund shall basically be applicable to disasters occurred in any location over the country. There is no limitation of geographical areas of applicability of the Fund.

(2) Types of Disaster

According to the disaster situation report prepared by DMIC, Bangladesh has experienced nearly 30 disasters since 2007. Major disasters are cyclones, tornadoes, floods and landslides caused by heavy rainfall or monsoon, and these disasters are generally called as "hydro-meteorological disasters".

In addition to hydro-meteorological disasters, Bangladesh is vulnerable to geological disasters, which include earthquake, tsunami and landslides. Recently, the northern region of Bangladesh has experienced some by the Nepal Earthquake in April 2015.

Accordingly, both hydro-meteorological disasters and geological disasters are eligible to apply to the Disaster Recovery Fund. However, man-made disasters, such as fires, building or infrastructure collations and arsenic contamination, are not eligible to apply to the Fund.

Applicability of the Disaster Recovery Fund is based on intensity of disasters. In hydro-meteorological disasters, rainfall and wind speed are widely used as criteria to measure the intensity of disasters. For example, if rainfall is over 80 mm per day, it would be classified into an intensive disaster applicable for Disaster Recovery Fund. By the same token, if wind speed is over 25 meters per second, it will be classified into an intensive disaster that is applicable for Disaster Recovery Fund. The tentative criteria of applicability to the Disaster Recovery Fund in hydro-meteorological disasters and geological disasters are shown in Table 5.1.1.

Table 5.1.1 Tentative Criteria (Hazard Index) for Applicability to Disaster Recovery Fund

Type of Disaster	Items to be considered	Tentative Criteria / Applicable Index	Reference
Hydro-meteorological disasters (cyclone, flood, storm surge, landslide, tornado)	Rainfall measured at the nearest station authorized by BMD or BWDB	Rainfall is over 50 mm/day	A recovery Fund in Japan has adopted more than 80mm/24hours. In Bangladesh, daily precipitation record is only available.
	Water level measured at the nearest station authorized by BWDB	Water level is over the danger level set by BWDB Overtopping of water from dike	Average water level set by FFWC, BWDB.
	Wind speed measured at the nearest station authorized by BMD or BWDB	Wind speed is more than 20 m/s (70 km/h)	classified as "Cyclone" in Bangladesh.
Geological disasters (earthquake, landslide)	Earthquake intensity measured at the nearest station by BGS	Earthquake intensity is over "IV" in Modified Marcelli Intensity	Classified as "Light". Felt indoors by many, outdoors by few during the day.

Note: Applicable Index is at a lower setting in order to smoothly execute sub-project of Component 3.
Source: Prepared by JICA Survey Team

(3) Agencies Eligible to Apply for the Disaster Recovery Fund

The application to avail of the Disaster Recovery Fund for recovery and reconstruction shall be requested from the expected execution agenciy such as LGED, BWDB, DDM and others. The application must be endorsed by the local government, such as the Deputy Commissioner (DC) at the district level and/or the Upazila Nirbah Officer (UNO) at the sub-district level where damage has been encountered from a disaster. The application shall be submitted from the execution agenciy to the Project Implementation Unit (PIU), an organization managing the Disaster Recovery Fund, with supporting documents, such as SOS-Form and D-Form prepared by DDM and/or damage assessment report prepared by the execution agency. These documents shall indicate detailed information of damages caused by the disaster.

(4) Importance of Infrastructure to be recovered

The application for the Disaster Recovery Fund must indicate the importance and urgency of recovery and/or reconstruction of a particular infrastructure damaged by a disaster. The importance and urgency of recovery and/or reconstruction, in a sense, might be measured by the number of beneficiaries. If the recovery of damaged infrastructure would create a large number of beneficiaries, there might be a high priority of utilization of the Fund. The number of beneficiaries shall be described in the application form.

(5) Degree of Damage

To the application for utilization of the Disaster Recovery Fund shall provide detailed information on the damage caused by a specific disaster, including: (a) date and time of disaster; (b) type of disaster (e.g., cyclone, flood, storm surge, landslide, tornado, earthquake, or tsunami); (c) location of infrastructure damaged by the disaster; and (d) number of human loss and/or damaged properties.

Applicability of the Fund is based on the degree of damage caused by the disaster. For example, number of damaged houses or buildings indicates the degree of damage. In this connection, damage with more than 10 totally damaged houses and/or more than 50 partially damaged houses is classified into an intensive disaster to be eligible for the Fund. By the same token, damage with more than 100 hectares of crop land and/or more than BDT 10 crore of agricultural products is classified into an intensive disaster to be applicable for the Fund. The tentative criteria of degree of damages to be eligible to the Fund are shown in Table 5.1.2.

Table 5.1.2 Tentative Criteria (Damage Index) for Applicability of Disaster Recovery Fund

Index	Criteria	Remarks
Number of affected families	More than 1,000 families (Upazila)	These damages can be confirmed by SOS-Form and/or D-Form prepared by the local DDM office.

Source: JICA Survey Team

(6) Preliminary Cost Estimate and Technical Information

Implementation agencies, such as BWDB, LGED and DDM, shall request for recovery and reconstruction of damaged infrastructure by using the Fund. The application to the Fund must include the following technical information:

Table 5.1.3 Technical Information Needed for Application to Disaster Recovery Fund

Types of Maps and Information	Remarks
Location Map	scale: 1 to 50,000
Ground Plan	scale: 1 to 10,000
Cross Section	scale: 1 to 1,000
Horizontal Section	scale: 1 to 10,000
Longitudinal Section	scale: 1 to 1,000
Photos	Show damages of facilities

Source: JICA Survey Team

In addition, preliminary cost estimates for recovery of damaged infrastructure shall be attached to the application form. After receiving all the documents for the application to the Fund, PIU lead by MoDMR will review them based on the following technical considerations:

- Utilization of design standard prepared by BWDB or LGED
- Method of cost estimate

(7) Social and Environmental Considerations

Under the JICA Guidelines for Environmental and Social Considerations (April 2010), any project financed under the Disaster Recovery Fund is categorized as FI in social and environmental considerations at the moment, because the sub-projects are not identifled prior to the project implementation. Environmental Social Management System (ESMS) of BWDB and LGED was examined in this survey to see whether appropriate environmental and social considerations as stated in the JICA Guidelines are ensured for projects, and to see their institutional capacity to confirm environmental and social considerations of BWDB and LGED.

As soon the sub-projects are decided, BWDB and LGED will confirm the necessity of Environmental and Social Consideration. When necessary, they will prepare and submit required documents of the applicable sub-projects to Department of Environment (DoE) to obtain or renew an environmental clearance certificate (ECC) according to the ECR'97. BWDB and LGED will confirm the ECC when necessary to commence the sub-project.

The social and environmental considerations of sub-projects including ESMS of BWDB and LGED are discussed in Chapter 12 of this report.

5.2 Activities and Facilities supported by the Disaster Recovery Fund

5.2.1 Major Issues after Disaster

A wide range of issues appear after a disaster and each issue needs to be solved as early as possible. Table 5.2.1 summarizes the major issues after a disaster, which can be classified into seven (7) sectors: Housing, Water/Sanitation, Electricity/Communication, Drainage, Transportation, Livelihood and Social Services. Among the 7 sectors, the first priority for recovery effort is restoration of life-line, i.e., basic infrastructure to deliver foods, drinking water, medical goods, etc. In other words, recovery of basic infrastructure is the most essential and urgent issues in post-disaster period.

Table 5.2.1 Major Issues by Sector after Disaster

Sector	Main Issue after Disaster	Countermeasure against Issue*1	Responsible Agencies to cope with the Issue*2
House / Private Buildings	Losses of Habitants	Reconstruction of Residential Houses	NHA, RAJUK, etc
Water, Sanitation, Hygiene	Lack of Clean Water	Recovery of Damaged Infrastructure	WASA
Electricity / Communication	Losses of Electrical and Communication Services	Recovery of Damaged Infrastructure	PSTN Companies / Private Sector / PDB/ REB
River / Drainage	Decrease of Stability / Safety Level Increase of Flood Risk	Recovery of Damaged Infrastructure	BWDB / WASA / DDM
Transportation (Roads, Ports and Airports)	Disruption of traffic	Recovery of Damaged Infrastructure	RHD / LGED Port Authorities CAAB
Agricultural and	Decrease of Product Yield	Recovery of Farmland/	DLS / DoF /DAE

Fishery Products		Fishery Pond Procurement of Damaged Equipment	MoDMR/DDM
Education and Health Facilities	Securing Evacuation Places Losses of Access to Education / Health Facilities	Recovery of Damaged Infrastructure	EED DGHS / MoH&FW

*1: Relief and Rescue Activities are not included as countermeasures.

*2: CAAB : Civil Aviation Authority, Bangladesh, DLS: Department of Livestock Services, DoF: Department of Fisheries DAE: Department of Agricultural Extension, RAJUK: Rajdhani Unnayan Kartripakkha, NHA: National Housing Authority, EED: Education Engineering Department, DGHS: Directorate General of Health Services, REB: Rural Electrification Board, MoH&FW: Ministry of Health and Family Welfare, PSTN: Public Switched Telephone Network, PDB: Power Development Board

The primary target of support by the Disaster Recovery Fund is the sector which the GOB is not able to support recovery and reconstruction due to lack of budget. Table 5.2.2 shows the amounts of damages by sector in the Cyclone Sidr in 2007.

Table 5.2.2 Damages caused by Cyclone Sidr in 2007

Sector	Sub-Sector	Disaster Effect (USD (million))		
		Damage	Losses	Total
Social Sector		65.0	21.1	86.0
	Health and Nutrition	2.4	15.0	17.5
	Education	62.5	6.0	68.5
Infrastructure		1,029.9	30.9	1,060.8
	Housing	839.3	-	839.3
	Transport	116.0	25.0	141.0
	Electricity	8.3	5.2	13.6
	Water and Sanitation	2.3	0.7	2.9
	Urban and Municipal	24.6	-	24.6
	Water Resource Control	71.3	-	71.3
Productive Sectors		25.1	465.0	490.1
	Agriculture	21.3	416.3	437.6
	Industry	3.8	29.5	33.3
	Commerce	-	18.2	18.2
	Tourism	-	0.9	0.9
Cross-Cutting Issues		6.1	0.0	6.1
	Environment	6.1	-	6.1
Total		1,158.0	516.9	1,674.9

Source: Cyclone Sidr in Bangladesh Damage, Loss, and Needs Assessment for Disaster Recovery and Reconstruction, Draft Executive Summary, A Report Prepared by the Government of Bangladesh Assisted by the International Development Community with Financial Support from the European Commission, March 2008

In Cyclone Sidr, damages to infrastructure occupied more than 60% of the total amount, especially the housing sub-sector (USD 839.3 million), followed by the transport sub-sector (USD 141.0 million) and the water resource control sub-sector (USD 71.3 million). In the productive sector, the agriculture sub-sector had the highest amounts of damage (USD 437.6 million). Accordingly, the priority areas to be supported by the Disaster Recovery Fund are considered to be infrastructure and productive sectors in terms of the amount of disaster damage in the past.

5.2.2 Activities Supported by Early Recovery Facility

The Early Recovery Facility (ERF) program is currently ongoing in Bangladesh under the supervision of UNDP. The ERF established a fund for emergency response and recovery of USD 60 million. Although the details of the fund are not available, the fund focuses on supporting recovery of small-scale infrastructure, and the reconstruction of housing and livelihood for affected people.

The purpose of the Disaster Recovery Fund prepared under the JICA Loan is similar to the fund prepared under the ERF. Both funds are used for quick response and recovery from disasters in Bangladesh. In this connection, it is useful to coordinate these two funds and set up a line of demarcation of target sectors to be supported by each fund.

5.2.3 Target Sectors Supported by Disaster Recovery Fund

The main target sectors to be supported by the JICA Disaster Recovery Fund are summarized in Table 5.2.3. The target sectors are: (I) Water Resource Control; (ii) Transport and (iii) Agriculture and Fishery. The Water Resource Control sector includes recovery and reconstruction of damaged embankment, which will be mainly implemented by BWDB. The transport sector focuses on the recovery and reconstruction of damaged rural roads and bridges, which will be implemented by LGED.

Table 5.2.3 Target Sectors to be supported by JICA Disaster Recovery Fund

Sector	Major sectors damaged by Cyclone Sidr	Major sectors supported by UNDP ERF	Target sectors supported by JICA Disaster Recovery Fund
Housing	○	✔	
Water			
Electricity /Communication			
Water Resource Control	○	✔	◎
Transport	○	✔	◎
Agriculture /Fishery	○	✔	△
Social Sector		✔	

Source: JICA Survey Team

The Social sector including education and health facilities is not covered by the Disaster Recovery Fund, because damages are comparatively low. The Agriculture/Fishery sector is a support for livelihood recovery of affected people implemented by DDM. This sector is not covered by the Disaster Recovery Fund. Detail investigations need to be conducted with MoDMR and DDM.

Damages of the Housing sector are very high. However, tThe JICA Disaster Recovery Fund is not used to support the housing sector due to the following reasons:

- The support for post-disaster housing reconstruction is a financial support to affected people. The management mechanism of the Fund would be complex.
- It is not appropriate to support the reconstruction of houses where will be reconstructed in an area vulnerable to natural disasters.

- Post-disaster housing reconstruction is mainly supported by the UNDP ERF.

5.3 Selection Criteria for Sub-project of Component 3

Considering results of site investigation and study mentioned above, and discussion with GOB, Criteria for selecting infrastructure for "Quick and Effective Recovery and Rehabilitation" is described as follows:

(1) Target Area of Component 3

The Disaster Recovery Fund shall basically be applicable to disasters including earthquake occurred in any location over the country. There is no limitation of geographical areas of applicability of the Fund.

(2) Declaration for Heavy Disaster

For application for using the Disaster Recovery Fund, "Declaration for Heavy Disaster", which is issued by Project Steering Committee (PSC), is required. PSC will declare "Declaration for Heavy Disaster" by referring following information:

Table 5.3.1 Referring Information of Declaration for Heavy Disaster

References		
Intensity of Hazard	Precipitation	More than 50 mm/day
	Water level	Above "Danger Level"
	Wind speed	More than 20 m/s (70 km/h)
	Earthquake intensity	More than "IV"
Extent of Damage	Number of Affected Families (Upazila)	More than 1,000 families

(3) Public Infrastructures to be Considered

Table 5.3.2 Public Infrastructures to be Considered

Target Infrastructures
1. Flood Countermeasure Facilities
2. Rural Roads
3. Rural Bridges
4. Village Roads
5. Bridges/Culverts below 15m
6. Cyclone / Flood Shelters

(4) Selection Criteria

Sub-projects for the Component 3 will be selected by considering following issues:

Table 5.3.3 Selection Criteria of Component 3

● Extent of Damage
- Number of affected people
- Amount of economic loss
● Extent of Assumed Damage in Future
- Expected damage of socioeconomic infrastructure (port, airport, regional road, etc.)

● Damaged Degree of the Infrastructure
● Vulnerabilities of Target Upazila (Poverty Level)
- Population below the Upper Poverty Line (BBS 2010)

(5) Score and Evaluation

Each of the applicable infrastructures above will be prioritized by following scores:

Table 5.3.4 Score and Evaluation (Extent of Damage)

Criteria		Score	What happened in Disaster	
			Evaluation	Examples
Extent of Damage	Number of affected people	10	Exceptionally Large number of people were affected	More than 100,000 people in a target Upazila were affected.
		8	Very Large number of people were affected.	More than 50,000 people in a target Upazila were affected.
		6	Large number of people were affected	More than 25,000 people in a target Upazila were affected.
		4	Medium Number of people were affected.	More than 10,000 people in a target Upazila were affected.
		2	Low Number of people were affected.	Less than 10,000 people in a Upazila were affected.
	Amount of economic loss	5	Exceptionally Huge economic loss was experienced.	Most of agricultural products in a union were affected.
		4	Very Huge number of economic loss was experienced.	The central market in target Upazila was totally flushed out.
		3	Large number of economic loss was experienced.	The biggest industry factory in target Upazila stopped operation for more than 1 month.
		2	Medium Number of economic loss was experienced.	More than 30% of agricultural lands in a union were inundated.
		1	Low Number of economic loss was experienced.	Some farmer's lands were washed out.

Table 5.3.5 Score and Evaluation (Extent of Assumed Damage in the Future)

Criteria		Score	What will happen without immediate recovery work	
			Evaluation	Examples
Extent of Assumed Damage in the Future	Expected damage of socioeconomic infrastructure	5	The most important socioeconomic infrastructure in the division will be damaged in case recovery work cannot be implemented.	Further damage of the embankment will affect the operation of airport/port.
		4	Small-scaled disaster will affect socioeconomic infrastructure.	The important bridge in region will collapse.
		3	Medium-scaled disaster will affect socioeconomic infrastructure.	The important community road will become impassable during heavy rain.

Criteria		Score	What will happen without immediate recovery work	
			Evaluation	Examples
		2	Large-scaled disaster will affect socioeconomic infrastructure.	Damaged bridge will completely collapse by large-scaled disaster. Damaged revetment affect stability of the important bridge.
		1	Damaged portions are still durable compared to other ordinary portion.	Damaged bridge and road will still function. Damaged portions of river bank repaired by Temporary works will function.

Table 5.3.6 Score and Evaluation (Damaged Degree of the Infrastructure)

Criteria	Score	Current Condition	
		Evaluation	Examples
Damaged Degree of the Infrastructure	5	Completely Disappearance / Loss	Almost completely disappearance of a series of embankment (more than 100meter wide) or totally collapse of a bridge, ...
	4	Severely damaged	Some portions of embankment with revetments were flushed out (less than 100 meter wide) A bridge abutment tilts to the side. A bridge girder gets broken.
	3	Moderately damaged	Several sections of revetments of embankment were flushed out. Footing of a pier of bridge is eroded.
	2	Partially damaged	Some portions of embankment were eroded. Handrails of Bridges are damaged.
	1	Less/Minor Damaged	Minor repair works were needed.

Table 5.3.7 Score and Evaluation (Vulnerabilities of Target Upazila)

Criteria		Score	Consideration of Vulnerability to Disasters	
			Evaluation	Examples
Vulnerabilities of Target Upazila	Upper Poverty Line (BBS 2010)	5	Target Upazila with very high poverty line	More than or equal to 55.0 %
		4	Target Upazila with high poverty line	40.0% ~ 54.9%
		3	Target Upazila with medium poverty line	28.0% ~ 39.9%
		2	Target Upazila with low poverty line	14.0% ~ 27.9%
		1	Target Upazila with very low poverty line	Lower than or equal to 13.9%

5.4 Approval and Implementation Process of Recovery and Reconstruction Projects

5.4.1 Project Application and Appraisal Process

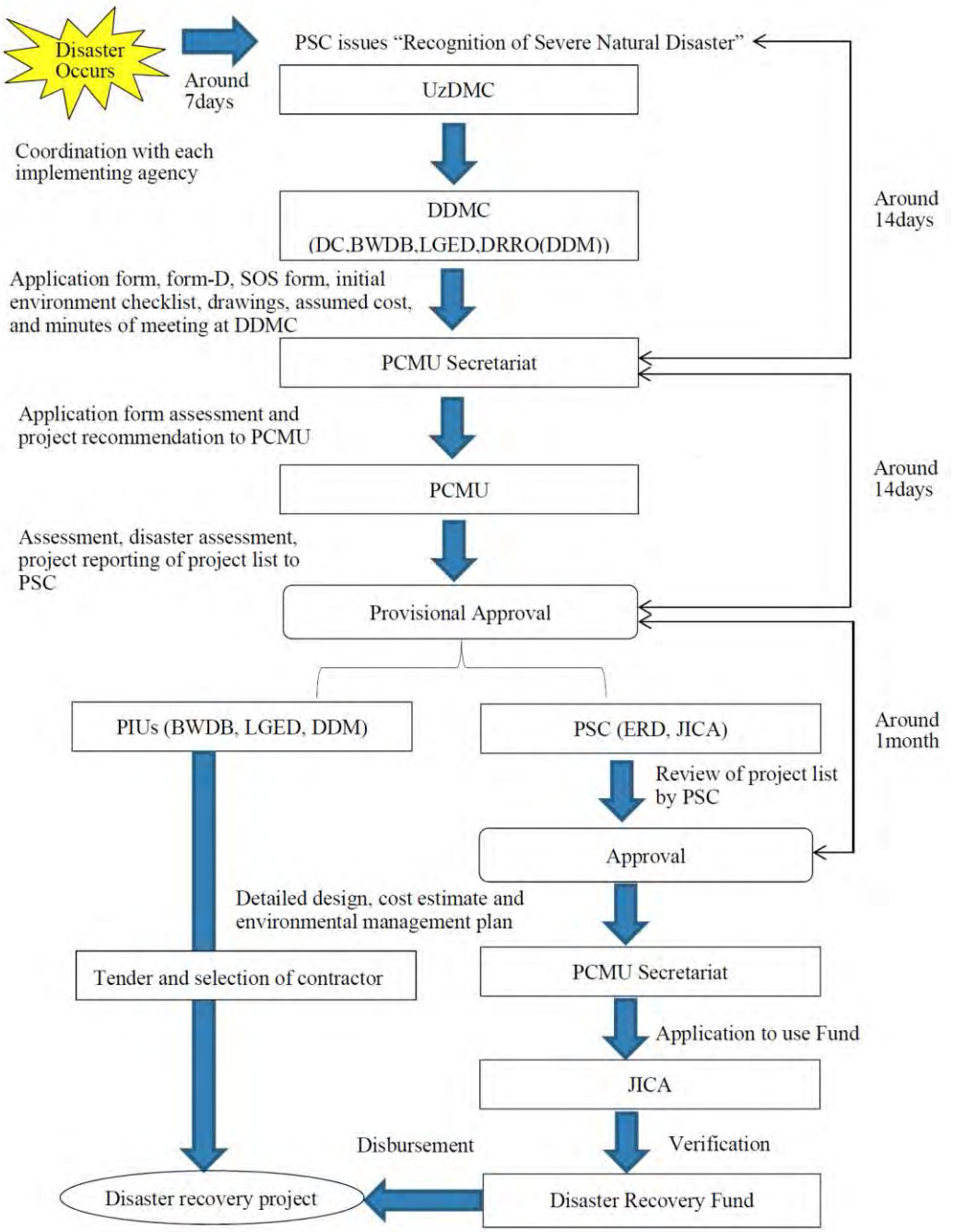
There are two lines of application for utilization of the Disaster Recovery Fund. One is an application requested from local governments, such as Deputy Commissioner (DC) at district level and/or Upazila Nirbah Officer (UNO) at sub-district level. The application from local government needs a support from the local DDM officers; namely District Relief and Rehabilitation Officer (DRRO) and the Project Implementation Officer (PIO). The other one is an application requested directly from implementation agencies, such as LGED, BWDB, DDM and others. In both cases, the application shall be submitted to Project Implementation Unit (PIU), an organization managing the Disaster Recovery Fund, together with supporting documents, such as SOS-Form and D-Form prepared by DDM or damage assessment prepared by the implementation agency. These documents shall provide detailed information of damages caused by the disaster.

Along with the application form, implementation agencies must prepare and submit D/D and cost estimates to PIU. All the documents will be examined by PIU based upon the guideline of the Fund. Then, PIU shall select candidate projects to be implemented with the Fund and make a recommendation of projects to PCMU. An appraisal Mission constituting officers appointed by the head of PCMU shall make a field survey to evaluate and confirm the projects. After confirmation of the projects by the Appraisal Mission, they shall be pre-approved by PCMU. The process of project application and appraisal is illustrated in Figure 5.3.1.

5.4.2 Project Implementation and Monitoring Process

PCMU shall submit a summary report of the pre-approved projects to PSC, ERD and JICA. Then, the pre-approved projects shall officially approved and the Disaster Recovery Fund would then be available for implementation of the projects. Following the approval of the projects, implementation agencies, such as BWDB, LGED, DDM and others, shall carry out the prequalification process to select the contractor and the bidding of the works for implementation of the project. The bidding process and selection of contractor need approval by PIU.

PIU shall periodically monitor the progress of the project during the implementation. After completion of the project, PIU shall dispatch a post evaluation mission and prepare a report showing the achievement of the project and the beneficiary. The post evaluation shall be continued for 1 year after completion of the project. The post evaluation report shall be submitted to PCMU. The processes of project implementation and monitoring is illustrated in Figure 5.3.1. The detailed processes are explained in the Guideline and Manual (Volime III).



Source: JICA Survey Team

Figure 5.4.1 Flowchart of Approval and Implementation Process of Project supported by JICA Disaster Recovery Fund (Component 3)

CHAPTER 6. IMPLEMENTATION AND MANAGEMENT STRUCTURE OF THE PROJECT

6.1 Implementation Structure of the Project

This section discusses the approval and implementation process of the recovery and rehabilitation projects conducted by DDM, BWDB and LGED.

6.1.1 Recovery and Rehabilitation Projects Implemented by Existing Agencies

(1) Recovery and Rehabilitation Projects Implemented by DDM

Recovery and rehabilitation projects have been requested by the local governments through the Deputy Commissioner (DC) at the district level and the the Upazila Nirbah Officer (UNO) at the sub-district level, with support from the local DDM officers. The application for the recovery project is submitted by the local governments to the DDM Headquarter, together with the duly accomplished SOS-Form and D-Form which indicate details of damages caused by the disaster. After receiving the application from the local government, the DDM Headquarter selects the priority projects for implementation. The recovery projects implemented by DDM include improvements of village roads, culverts and small bridges with approx. 15 meters in length. After completion of the projects, DDM hands over the improved facilities to the concerned villages.

Figure 6.1.1 shows the application and approval process of recovery and reconstruction projects implemented by DDM. The project scale that needs DPP is more than BDT 20 million, according to information from DDM. However, it is not decided by the regulation. Generally, it takes more than 1 year to get approval of implementation after receiving the application from the local governments.

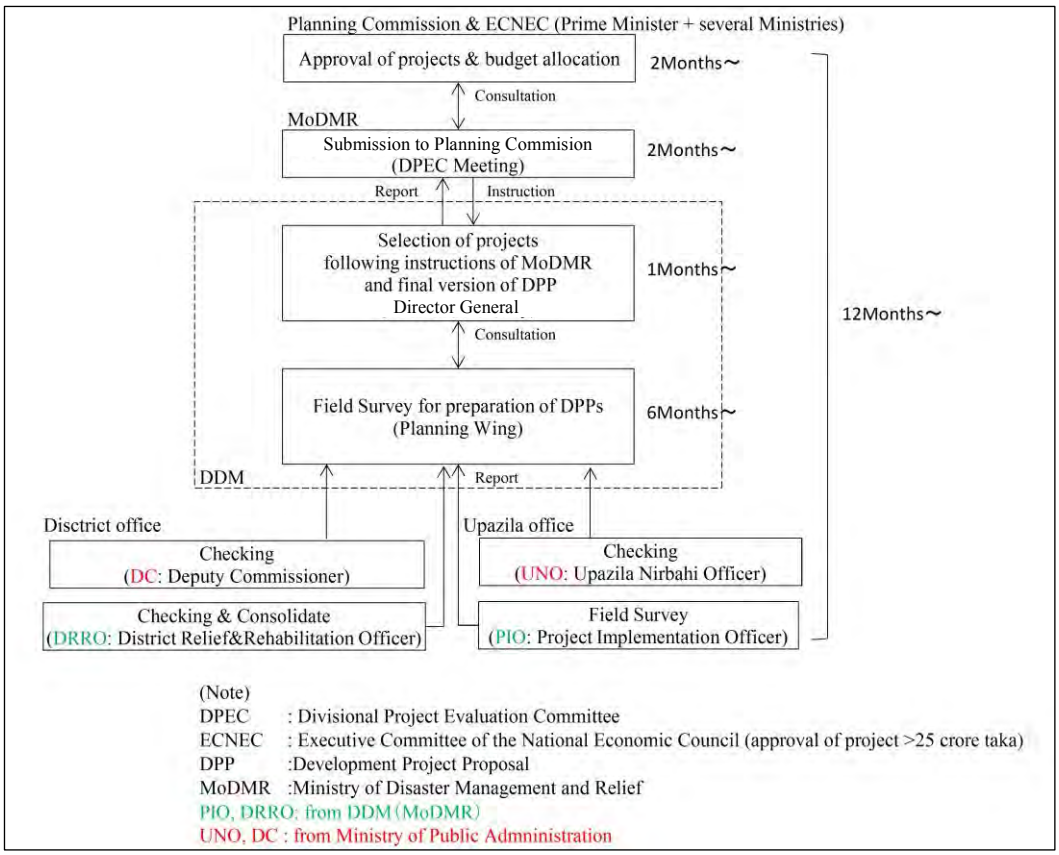


Figure 6.1.1 Approval Process of Recovery and Rehabilitation Projects by DDM

DDM also gives post-disaster recovery and reconstruction support to affected people and educational and religious facilities. This support is mainly food and cash (GR-Cash).

(2) Recovery and Rehabilitation Projects Implemented by BWDB

Projects implemented by BWDB are classified into four (4) types in terms of emergency of operation and maintenance. They are: (1) emergency maintenance project; (2) rehabilitation maintenance project; (3) routine maintenance project; and (4) annual development program project.

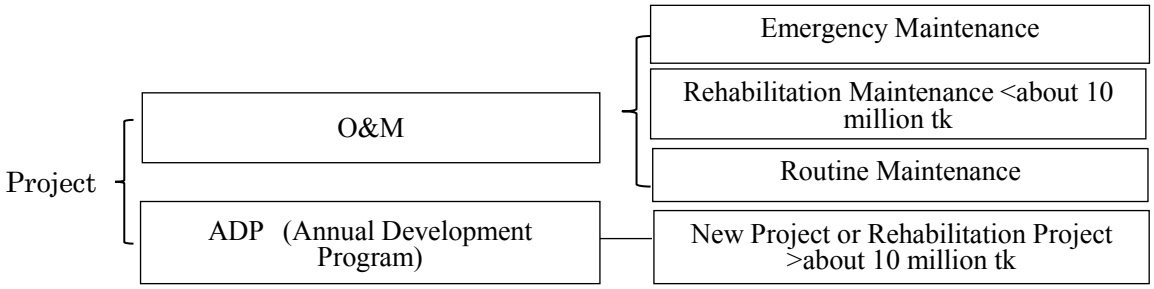


Figure 6.1.2 Recovery and Reconstruction Projects by BWDB

An emergency maintenance project has been conducted, when an embankment was damaged and houses located behind the embankment were at risk to be washed away. In this case, BWDB took a

simple construction for emergency, such as compilation of sandbags at the damaged section of embankment. The financial resource for the emergency maintenance project is 10% of the annual operation and maintenance budget of BWDB, which is approved in advance by the Ministry of Finance.

Due to the urgency of an emergency maintenance project, the ordinary bidding process is not taken. The Superintending Engineer in the BWDB field office can decide on the contractor for implementation of the project. An emergency maintenance project can be completed in about 2 months after it is requested from field office. The application and approval process of an emergency maintenance project is shown in Figure 6.1.3.

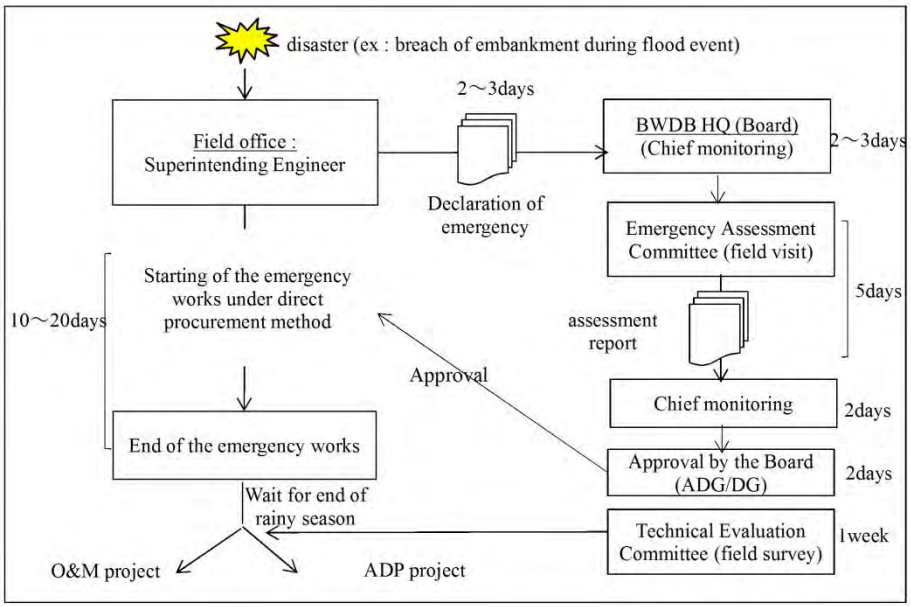


Figure 6.1.3 Approval Process of Emergency Maintenance Project by BWDB

A rehabilitation maintenance project is a full-scale work for improvement of damaged embankment after completion of the emergency maintenance. The operation cost of the rehabilitation maintenance project is less than BDT 10 million, according to information from BWDB. The rehabilitation maintenance project is usually carried out during dry season, because earthwork and CC blocks are included in the maintenance work. The approval of rehabilitation maintenance project needs at least 4 months after submission of application from the BWDB field office or DC. The application and approval process of rehabilitation maintenance project is shown in Figure 6.1.4.

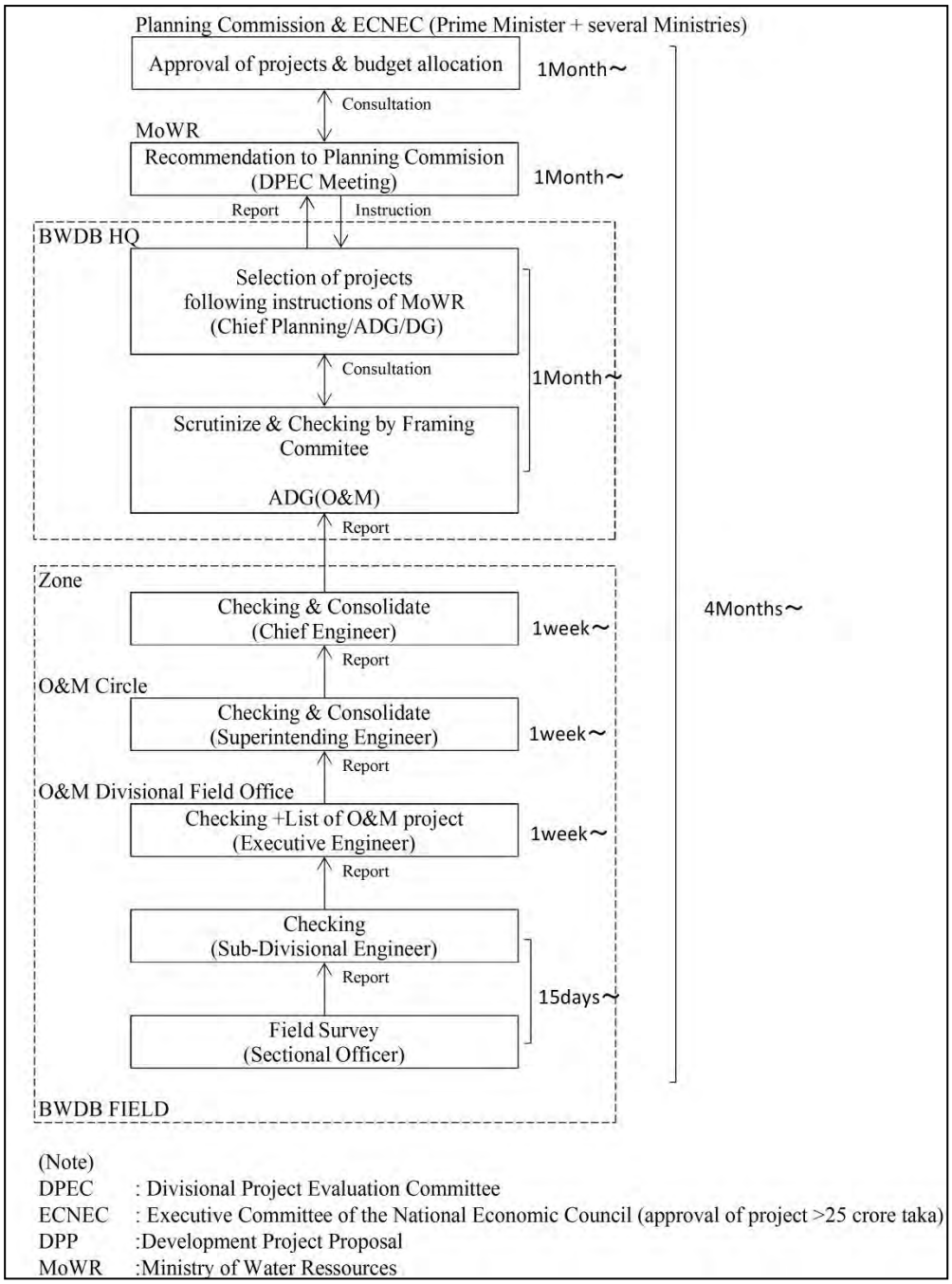


Figure 6.1.4 Approval Process of Rehabilitation Maintenance Project by BWDB

The annual development program (ADP) project is a new project aiming at flood mitigation at the cost of more than BDT 10 million, according to information from BWDB. Approval of an annual development project takes at least 1 year, which includes 6 months of DPP approval process, after submission of the application from the BWDB field office. Figure 6.1.5 shows the application and approval process of an annual development project of BWDB.

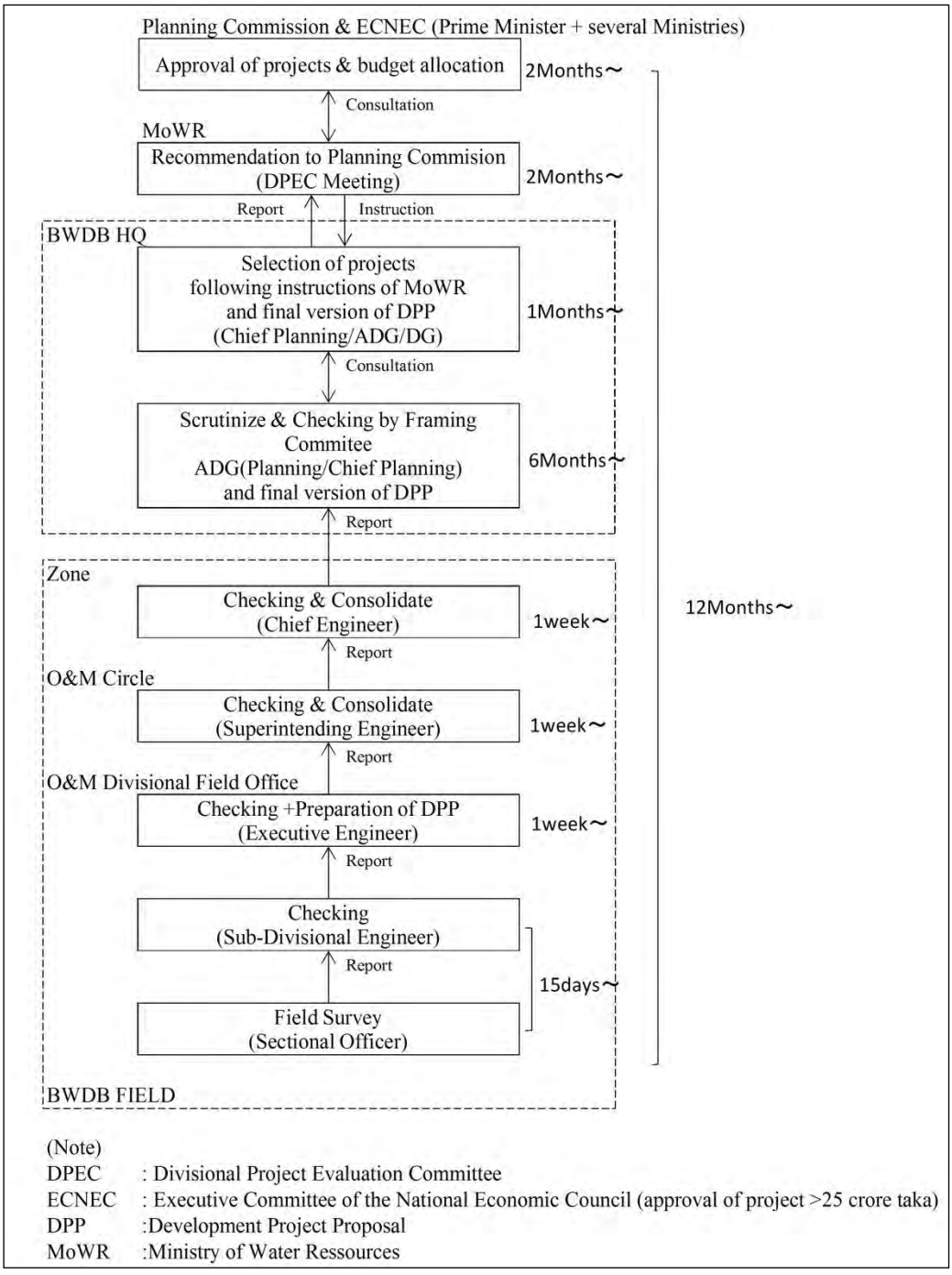


Figure 6.1.5 Approval Process of ADP Projects of BWDB

(3) Recovery and Rehabilitation Projects Implemented by LGED

Projects implemented by LGED are classified into 4 types in terms of emergency of operation and maintenance: (1) emergency maintenance project; (2) periodic maintenance project; (3) routine maintenance project; and (4) annual development project.

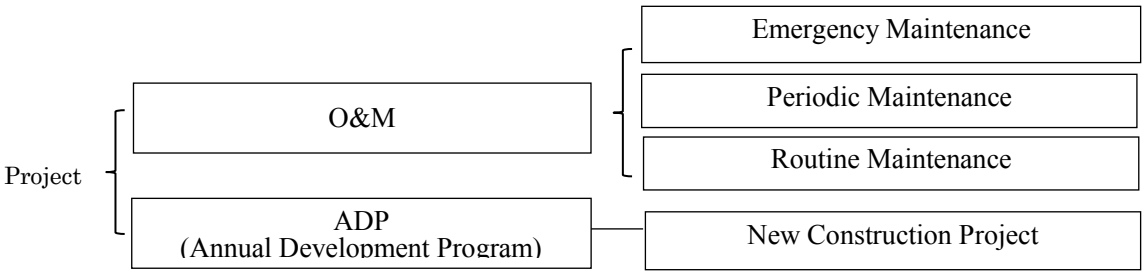


Figure 6.1.6 Recovery and Reconstruction Projects of LGED

The emergency maintenance project is conducted when roads, bridges or culverts are damaged due to heavy rainfall, flood or other hazards. The emergency maintenance project is limited to simple maintenance work, such as compiling sandbags at damaged locations and making brick pavement of damaged roads. Emergency maintenance does not include asphalt pavement. The financial resource of the emergency maintenance project is 10% of the annual operation and maintenance budget of LGED, which is approved in advance by the Ministry of Finance.

Due to urgency of the emergency maintenance project, the ordinary bidding process is not taken. The Executive Engineer in LGED district office can decide on the contractor for implementation of the project. An emergency maintenance project can be completed within 1 month after receiving the request from the field office. The application and approval process of an emergency maintenance project implemented by LGED is shown in Figure 6.1.7.

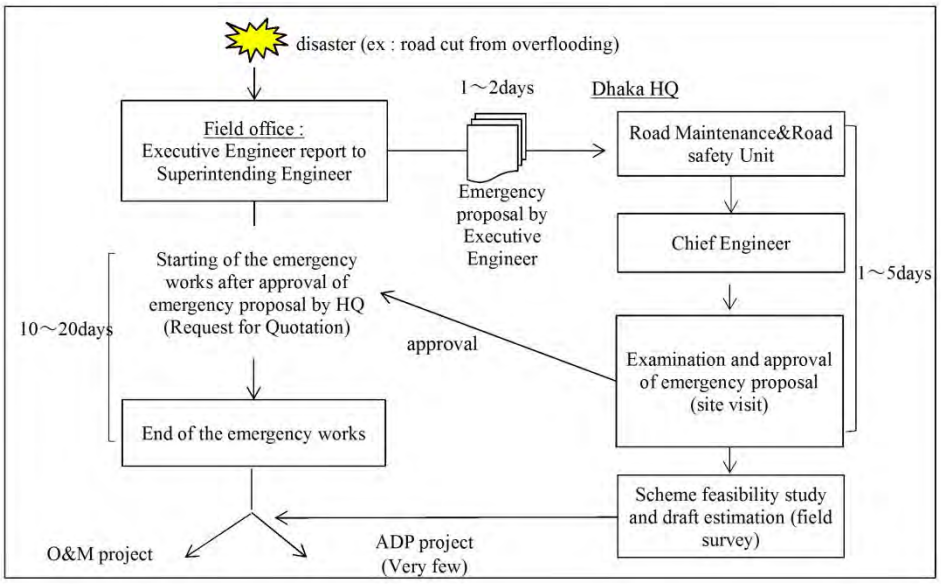


Figure 6.1.7 Approval Process of Emergency Maintenance Project of LGED

The periodic maintenance project is full-scale work, including asphalt pavement and compaction by heavy machinery, after completion of the emergency maintenance. Periodic maintenance work is carried out during the dry season to complete compaction and asphalt pavement. The approval of

periodic maintenance work needs at least 4 months after submission of the application from the LGED district office. The application and approval process of periodic maintenance project is shown in Figure 6.1.8.

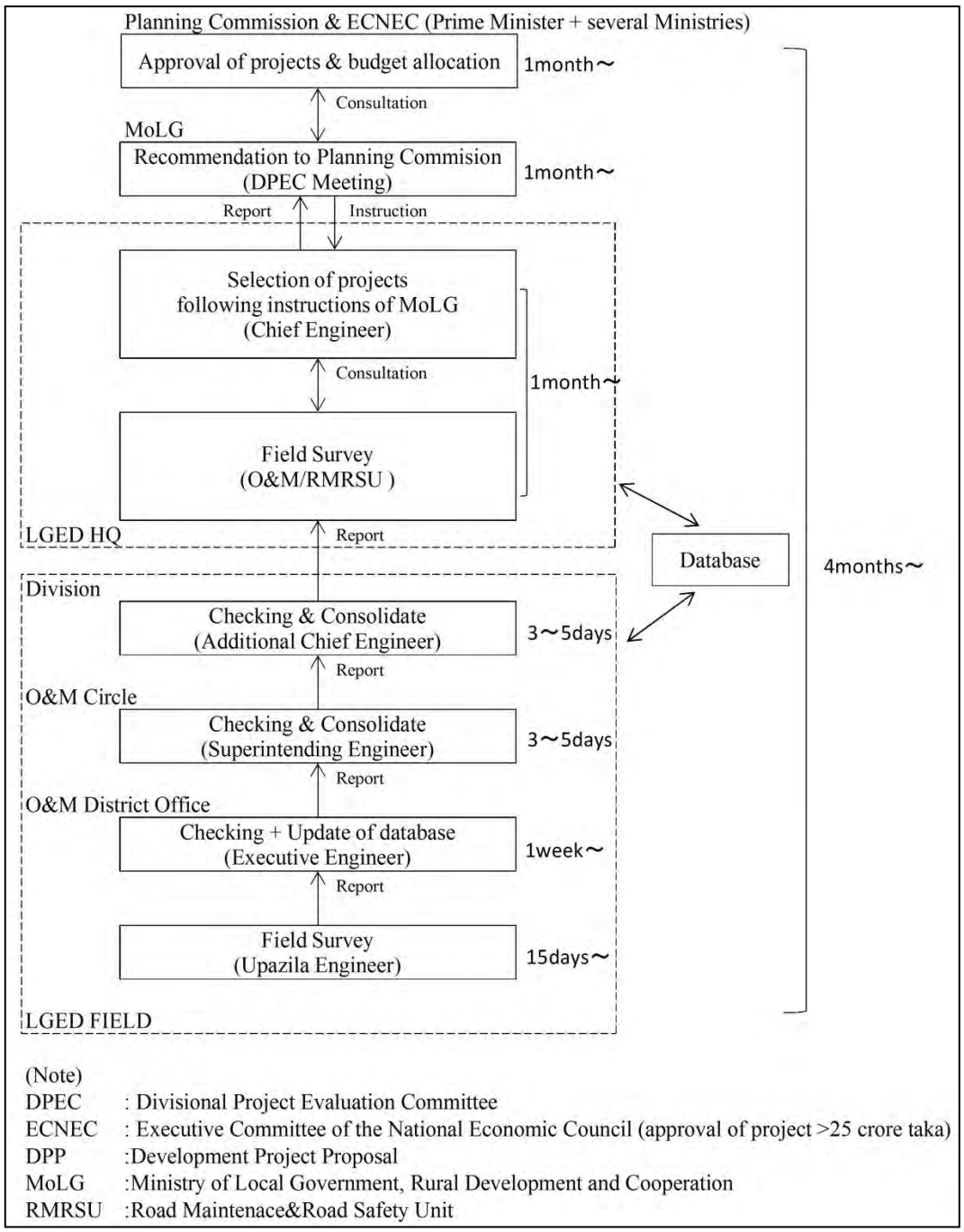


Figure 6.1.8 Approval Process of Periodic Maintenance Projects of LGED

The objective of the annual development program project is to construct new roads and bridges. The approval process of the ADP project is similar to that of the periodic maintenance project. It takes at least 10 months for approval, which includes 4-6 months of approval of DPP in the Planning Commission. The application and approval process of an ADP project is shown in Figure 6.1.9.

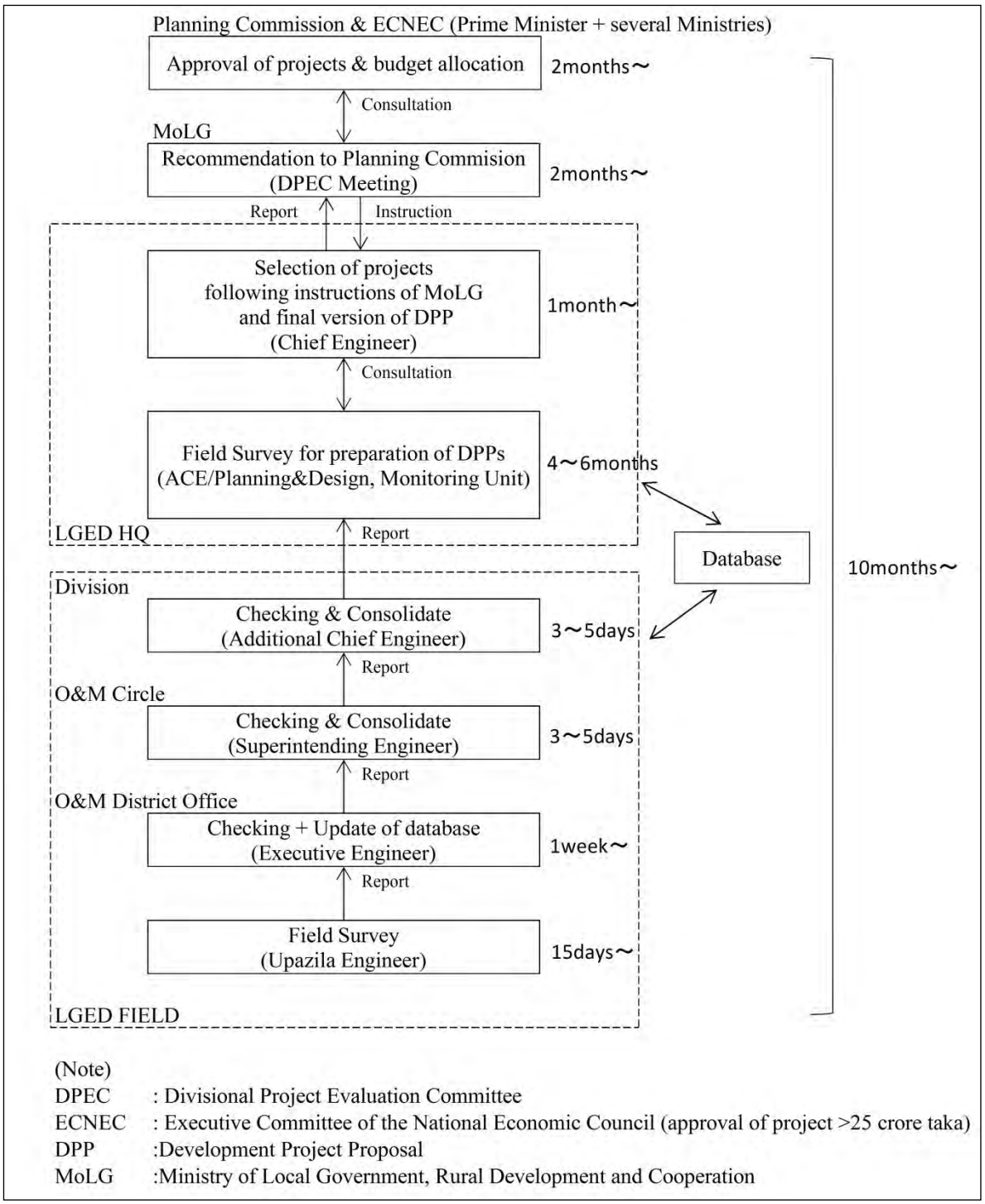


Figure 6.1.9 Approval Process of ADP Project of LGED

6.1.2 Implementation Structure of Similar Projects conducted by Donors

This section aims to review the administrative implementation mechanism of similar projects related to disaster risk reduction conducted recently in Bangladesh. The projects reviewed are: the Bangladesh Climate Change Resilience Fund (BCCRF), the Early Recovery Facility (ERF), and the Urban Resilience Project (URP)

(1) Bangladesh Climate Change Resilience Fund (BCCRF)

The Bangladesh Climate Change Resilience Fund (BCCRF) [4] is a coordinated financing mechanism by the Government of Bangladesh (GOB), development partners and the World Bank to address the impacts of climate change. The fund was established in May 2010 with financial support from Denmark, the European Union, Sweden and the United Kingdom. Subsequently, Switzerland, Australia and the United States of America joined the fund. This mechanism enables the GOB to channel in over USD 125 million grant funds to build resilience to the effects of climate change. The GOB leads in the management and implementation of the BCCRF.

The objective of the BCCRF is to support the implementation of Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009[5]. The BCCSAP 2009 has six main pillars:

(i) Food security, social protection and health;
(ii) Comprehensive disaster management;
(iii) Infrastructure;
(iv) Research and knowledge management;
(v) Mitigation and low carbon development; and
(vi) Capacity building and institutional strengthening.

The BCCRF finances activities designed to achieve the BCCSAP's goals and support one or more of the BCCSAP's pillars.

The BCCRF has a 3-tier governance system: (i) the Governing Council (GC); (ii) the Management Committee (MC); and (iii) the Secretariat. The GC provides overall strategic direction and guidance to BCCRF and ensures its alignment with the BCCSAP. It is a high-level committee chaired by the Minister of Environment and Forests (MoEF) and with the ministers and other stakeholders as members as shown in Table 6.1.1.

[4] Bangladesh Climate Change Resilience Fund, Annual Report 2013, Prepared by Bangladesh Climate Change Resilience Fund and Ministry of Environment and Forest
[5] Bangladesh Climate Change Strategy and Action Plan (BCCSAP), September 2009, Ministry of Environment and Forest

Table 6.1.1 Governance System of Bangladesh Climate Change Resilience Fund

Governance System	Items	Remarks
Governing Council (GC)	Roles and Functions	(1) To provide overall strategic direction and guidance to BCCRF; (2) To ensure its alignment with the Bangladesh Climate Change Strategy and Action Plan (BCCSAP)
	Chair Person	Minister, Ministry of Environment and Forests (MoEF)
	Members	Minister, Ministry of Agriculture Minister, Ministry of Agriculture Minister, Ministry of Finance Minister, Ministry of Food and Disaster Management Minister, Ministry of Foreign Affairs Minister, Ministry of Water Resource Minister, Ministry of Women's and Children Affairs Secretary from the Prime Minister's Office Secretary from the MoEF Secretary from the ERD of the Ministry of Finance Secretary from the Ministry of Planning Two representatives from the contributing development partners Two representatives from civil society The country director of the World Bank Dhaka Office as an observer.
Management Committee (MC)	Roles and Functions	(1) To carry out detailed reviews of grant requests submitted from the relevant government agencies and NGOs; (2) To evaluate that grant requests submitted are in line with the purposes of BCCSAP; (3) To recommend projects to the GC
	Chair Person	Secretary from MoEF
	Members	Joint Secretary (Development) from MoEF; Deputy Secretary (Environment) from MoEF; Additional Secretary from Economic Relation Division (ERD); Representative (General Economic Division) from Planning Commission; Two representatives from the contributing development partners; One representative from the World Bank; and One representative from civil society
Secretariat		Ministry of Environment and Forest

Source: Bangladesh Climate Change Resilience Fund, Annual Report 2013

The MC is a technical committee chaired by the Secretary of the MoEF. The MC's primary responsibilities are to carry out reviews of grant requests submitted by the relevant government agencies and NGOs; evaluate the grant requests in terms of purposes of BCCSAP; and recommend projects to the GC.

On February 2011, the MC approved the establishment of a BCCRF Secretariat at the MoEF so that it may eventually administer BCCRF activities. A joint secretary of the MoEF was appointed as BCCRF project director (PD) as of July 2012. The BCCRF Secretariat's main functions include day-to-day support to the MC and GC, advocacy, communications, donor coordination, program-level monitoring and evaluation, and preparation and implementation of the eventual transfer of BCCRF Secretariat functions from the Bank to the MoEF. As a start, the World Bank has been providing support to the

day-to-day operations of the BCCRF. However, this responsibility is gradually undergoing transition to the Secretariat.

The governance structure of the BCCRF is illustrated in Figure 6.1.10 and the projects[6] approved by the MC as of December 2013 are shown in Table 6.1.2.

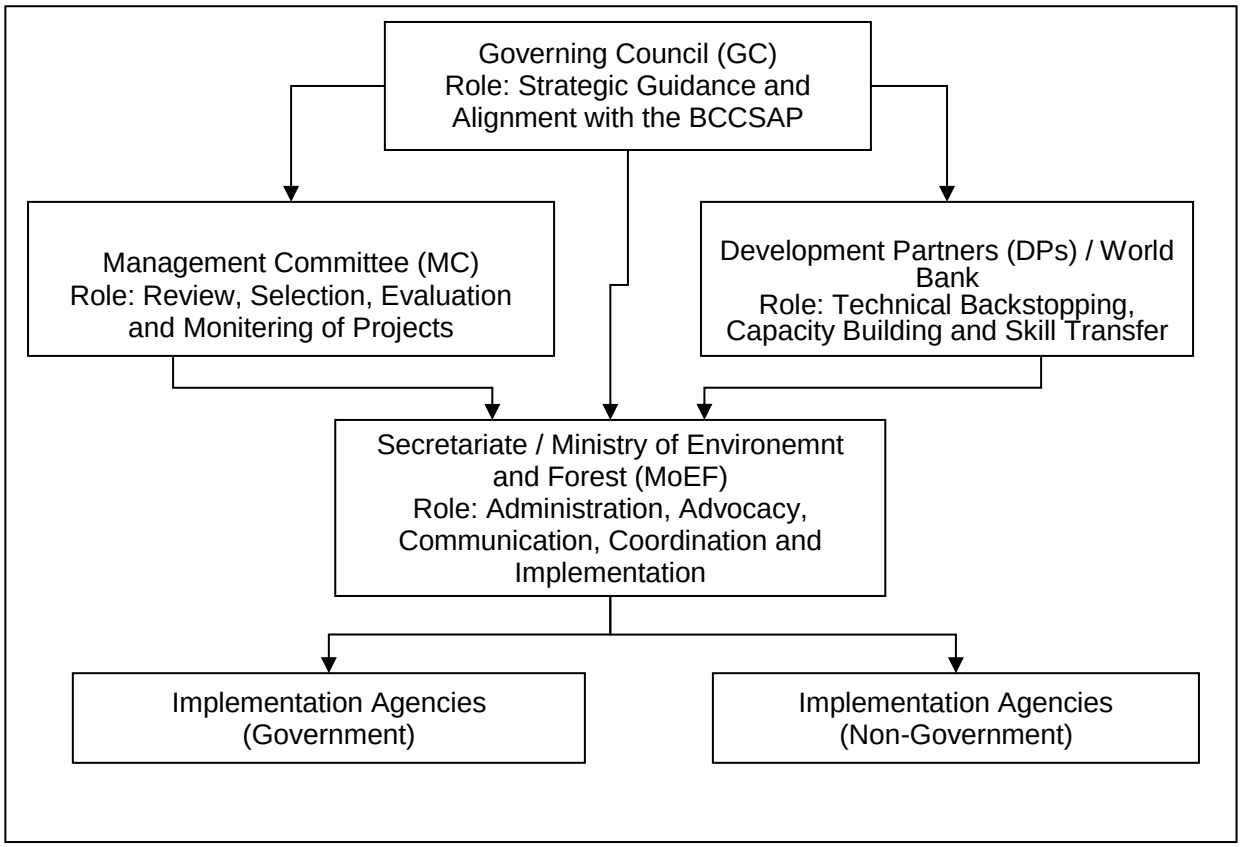


Figure 6.1.10 Governance Structures of the BCCRF

Table 6.1.2 Investment Projects Approved by MC of the BCCRF as of December 31, 2013

Investment Projects	Responsible Agencies	Amount (US$ Million)
Emergency 2007 Cyclone Recovery and Restoration Project (Multipurpose Cyclone Shelter Construction Project)	Local Government Engineering Department (LGED)	25.0
Secretariat for BCCRF Phase I (Capacity Building Project Phase I)	Ministry of Environment and Forest (MoEF)	0.2
Secretariat for BCCRF Phase II (Capacity Building Project Phase II)	Ministry of Environment and Forest (MoEF)	5.5
Community Climate Change Project (CCCP) (NGO Window)	Palli Karma-Sahayak Foundation (PKSF)	17.0
Supporting Agriculture Adaptation to Climate Change	Department of Agriculture Extension, Ministry of Agriculture	22.8

[6] Bangladesh Climate Change Resilience Fund, Annual Report 2013, Prepared by Bangladesh Climate Change Resilience Fund and Ministry of Environment and Forest.

Investment Projects	Responsible Agencies	Amount (US$ Million)
Climate-Resilient Participatory Forestation and Reforestation Project	Bangladesh Forest Department and Arannayk Foundation	33.8
Rural Electrification and Renewable Energy Development Project II (Solar Irrigation Project)	Infrastructure Development Company Limited	24.5
Modern Food Storage Facilities Project	Ministry of Food and Disaster Management	25.0

Source: Bangladesh Climate Change Resilience Fund, Annual Report 2013

According to the interview with the government agencies participating in the BCCRF, they pointed out that the approval process of projects is complicated and took a long time. It is also essential to strengthen the capacity of the Secretariat in the Ministry of Environment and Forest.

(2) Early Recovery Facility (ERF)

The increasing frequency of natural disasters in Bangladesh and the resulting human and economic losses have led to a high level of socio-economic vulnerability. This calls for more attention to be paid to the disaster recovery process. UNDP established the Early Recovery Facility (ERF) [7] as a way of financing and implementing emergency response and early recovery efforts to disasters in order to close the gap between the relief phase and long-term recovery. ERF provides support to the GOB for effective local and national level recovery implemented during the period from 2011 to 2015. ERF established a fund of US$ 60 million at its disposal and operated by UNDP, relevant government agencies and NGOs to be able to quickly respond to emergencies.

ERF pursues the following specific objectives in the context of Bangladesh:

- The ERF is aimed at promoting national ownership of the early recovery process through the fullest possible engagement of national and local authorities in the planning, execution and monitoring of recovery actions.
- Following the principle of "build back better", ERF aims to implement early recovery in a way that reduces damages and losses in case of a future disaster.
- The ERF through UNDP will support the national and local government in developing policies and plans for full recovery. Such a support will be provided through systematic assessment of recovery needs, coordination amongst various agencies, preparation of an early recovery plan/framework, and through provision of material, financial and human resource support wherever necessary.
- The ERF will promote equity, social inclusion, and transparency in promoting recovery policies and plans. It will advocate people's participation in recovery planning, and promote policies and programmes which do not discriminate on the basis of gender, ethnicity, religion, disability, etc.

[7] Government of The People's Republic Bangladesh and United Nations Development Programme Project Document, Early Recovery Facility, September 2011, signed by ERD and UNDP.

- The ERF will support and strengthen the Early Recovery Network and Early Recovery Cluster in Bangladesh, develop an overall recovery preparedness plan, and advocate for the allocation of resources in support of early recovery activities.
- The ERF will support "Research and Development (R&D)" to explore sustainable disaster response, early recovery and pilot demonstration to address critical challenges due to changing pattern of disasters under emerging climate change scenario.

ERF pursues an execution modality that is best suited in terms of speedy and flexible delivery and decision-making in recovery, and UNDP needs a strong leadership in the implementation of ERF. The approval process in the government and/or the management, procurement, financial and other procedures inherent to National Execution (NEX) modality is not supportive of rapid response in ERF. Thus, procedural flexibility is more compatible with Direct Execution (DEX) modality to respond quickly at the request of the government. UNDP provides overall supervision and management of the ERF and the technical and financial management of the ERF are undertaken by the UNDP project team.

In order to make strategic direction of the ERF and approval of the budget, the ERF Project Advisory Board was established. The Board meeting is held every 3 months and it is chaired by the Country Director of UNDP and co-chaired by representative from the Ministry of Food and Disaster Management (currently, it is the Ministry of Disaster Management and Relief). In disaster situations, the board can meet more frequently and appraise the situation. The members of the ERF Project Advisory Board are shown in Table 6.1.3 and overall management structure of Early Recovery Facility is shown in Figure 6.1.11.

Table 6.1.3 Members of ERF Project Advisory Board

Position	Designation
Chairman	Country Director, UNDP
Co-Chairman	Representative from DMRD, MoFDM
Members	Representative from ERD Representative, DRR Representative, DMB National Project Director, CDMP II Project Manager, CDMP II Representative, UNRCO Independent Technical Expert/Civil Society Representative Donor Representative(s) Assistant Country Director, UNDP (CCED) (Member Secretary)

Source: Early Recovery Facility, September 2011, signed by ERD and UNDP.

The ERF is supervised on a regular basis by the Assistant Country Director of UNDP, Climate Change, Environment and Disaster Cluster. The supervision involves the review of strategic directions, planned activities, resource availability, and overall implementation. The ERF team is led by the Project Manager, who is responsible for day-to-day operations and management of ERF's technical and financial resources.

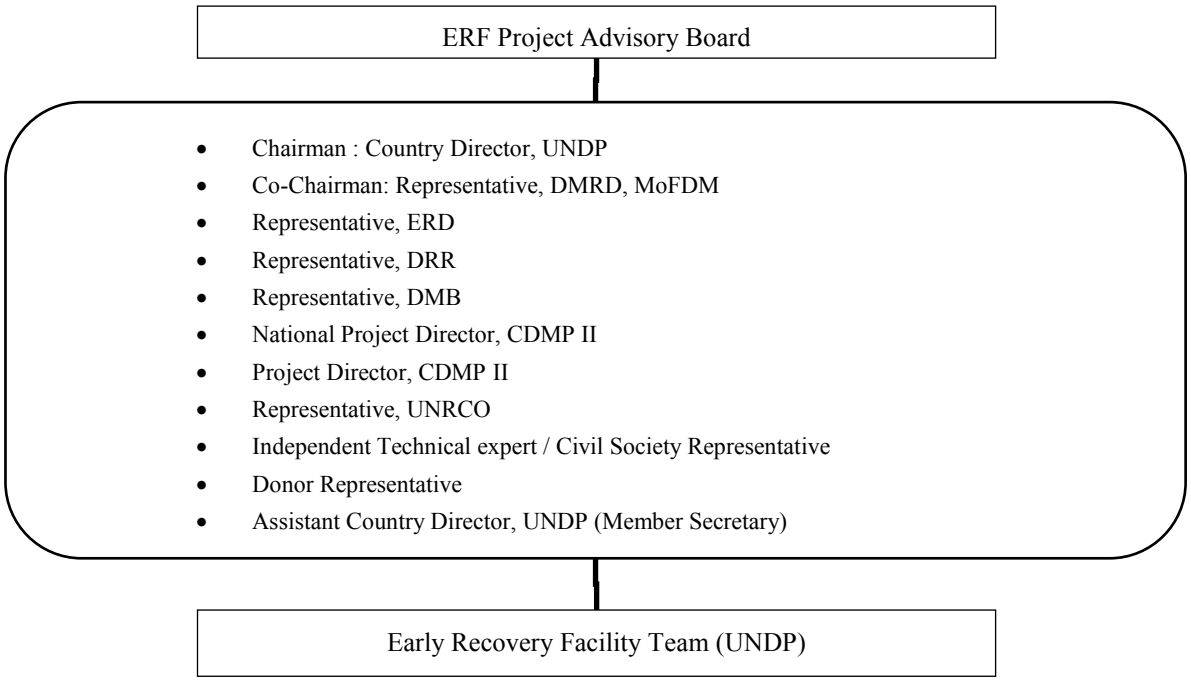


Figure 6.1.11 Management Structure of Early Recovery Facility

The ERF is operated by the fund provided by the development partners. All the projects under the ERF is led by UNDP and implemented by NGOs and Bangladesh government. The proposed JICA Loan Project is different from the management structure of ERF and it is expected that the government of Bangladesh needs to play leading roles in management and implementation of the Project.

Activities, responsible parties and volume of input under ERF are shown in Table 6.1.4.

Table 6.1.4 ERF Activities, Responsible Parties and Input

Intended Outputs	Activities	Responsible Parties	Input (US$)
1. A functional Early Recovery Facility	1.1 Recruitment of Staff 1.2 Orientation programme organized for ERF staff 1.3 Drill exercise organized aimed at managing ER	UNDP	1,500,000
	1.4 Setting up of Surge capacity 1.5 Establishment of an Early Recovery Network / Cluster	UNDP, ERF, BCPR	200,000
	1.6 Develop advocacy strategy 1.7 Plan trainings and workshops 1.8 Conduct periodic evaluation/s	UNDP, ERF, BCPR	350,000
2. Well-functioning, coordinated and equipped district and upazila level disaster management officials	2.1 Capacity building of DRROs and PIOs on disaster response, early recovery, recovery and coordination 2.2 Develop software to enhance the coordination and management DRROs and PIOs from the central level	UNDP, ERF, CDMP, BCPR	1,500,000

Intended Outputs	Activities	Responsible Parties	Input (US$)
3. Integrated and coordinated volunteer network ready to respond to local and national level disaster events	3.1 Develop a national Guideline/ SOP for disaster volunteers 3.2 Capacity building of nationalvolunteer organizations on disaster response, early recovery, recovery and coordination 3.3 Provide support to coordinate national volunteer organizations through network development 3.4 Training and equipment support for volunteers to service disaster response, early recovery and recovery interventions	UNDP, DRR, DMB, NGOs, UNV	750,000
4. Contribution to the development of innovative community-based solutions to disasters and climate change induced events	4.1 Support innovative and context specific disaster resilient/proof interventions 4.2 Develop community basedDisaster Risk Management Information System (DRMIS	UNDP, DRR, NGOs	1,000,000
5. Support to national level disasters in response to GOB appeal/request to extend complementary support	5.1 Emergency response carried out 5.2 Resource mobilized to meet Emergency needs 5.3 Relief distribution record is updated from time to time	UNDP, GOB Entities, NGOs	60,000,000
6. Support to emergency response coordination, through DER LCG and national cluster system	6.1 Emergency response coordination done regularly 6.2 Emergency response coordination done more efficiently 6.3 Support to establishment of national cluster system 6.4 South-South (South and South East Asia) solution exchange on emergency coordination	UNDP, CDMP, DMB	250,000
7. Support to Bangladesh to participate in regional and global DRM and CCA initiatives	7.1 Urban risk management programmes are implemented to supplement ongoing interventions 7.2 Climate risk management are carried out to supplement national effort	UNDP, BCPR, GOB Entities	266,000
TOTAL			65,816,000

Source: Early Recovery Facility, September 2011, signed by ERD and UNDP.

(3) Urban Resilience Project (URP)[8]

The overall objectives of the Urban Resilience Project (URP) are "to strengthen the capacity of agencies of the GOB to respond to emergency events and to strengthen systems to reduce the vulnerability of future building construction to disaster in Dhaka and Sylhet." The project is financed by the World Bank's International Development Association (IDA) loan amounting to US$ 173 million. The project will be implemented during the period from July 2015 to June 2020. URP comprises the following five components as shown in Table 6.1.5.

[8] International Development Association Project Appraisal Document on A Proposed Credit in The Amount of SDR 122.8 Million (US$ 173 Million) To Bangladesh for an Urban Resilience Project, February 25, 2015, The World Bank; Consolidated Development Project Proposal (DPP), Urban Resilience Project (URP), June3 2015, Programming Division, Planning Commission, Ministry of Planning

Table 6.1.5 Components of Urban Resilience Project

Component	Purpose	Implementation Agency
Component-A	Reinforcing the Country's Emergency Management Response Capacity	MoDMR、MoLGRDC、MoHA
Component-B	Vulnerability Assessment of Critical and Essential Facilities;	Ministry of Housing and Public Works (MoHPW)
Component-C	Improved Construction, Urban Planning and Development;	
Component-D	Project Implementation, Coordination, Monitoring and Evaluation	Programming Division, Planning Commission, Ministry of Planning
Component-E	Contingent Emergency Response.	

These components will be implemented by Implementation Agencies (IAs) across 5 ministries. Component A will be implemented by DDM within MoDMR, Dhaka North City Cooperation (DNCC)/ Dhaka South City Cooperation (DSCC)/ Sylhet City Cooperation (SCC) within MoLGRDC, and FSCD within MoHA. Components B and C will be implemented by RAJUK within MoHPW. Component D will be implemented by the Programming Division within the Ministry of Planning. Component E is a contingency fund which allows the Government to reallocate project funds to cover emergency response and recovery cost when a major disaster happens.

The implementation of the project will be guided by a Project Steering Committee (PSC), which provides overall guidance and policy advice for effective implementation of the project. The PSC will be chaired by the Secretary of Planning Division, Ministry of Planning. The roles of PSC are: (i) to oversee the implementation of the URP project; (ii) to review the project activities and reports regarding monitoring and evaluation; (iii) to provide overall policy and strategic guidelines for the Project; and (iv) to review the annual work plan. The PSC members are as follows:

Table 6.1.6 Project Steering Committee (PSC) Members of Urban Resilience Project

Member	
Chairperson：Secretariat, Programming Division, Ministry of Planning	Director General, PCMU, Programming Division, Planning Commission
Secretary, Planning Division, Ministry of Planning	Director General, Department of Disaster Management (DDM)
Secretary, Finance Division, Ministry of Finance	
Secretary, Economic Relations Division, Ministry of Finance	Chairman, Rajdhani Unnayan Kartripakka (RAJUK)
Secretary, Local Government Division, MoLGRDC	Chief Executive Officer, Dhaka North City Corporation (DNCC)
Secretary, Ministry of Disaster Management and Relief	
Secretary, Ministry of Home Affairs	Chief Executive Officer, Dhaka South City Corporation (DSCC)
Secretary, Ministry of Housing and Public Works	
Secretary, Implementation Monitoring and Evaluation Division	Chief Executive Officer, Sylhet City Corporation (SCC)
Chief, Programming Division, Planning Commission	Director General, Fire Service and Civil Defence Department

Member	
Chief, General Economics Division, Planning Commission	Joint Chief-2, Programming Division, Planning Commission
Chief, Physical Infrastructure Division, Planning Commission	Secretary : Director (Training, Coordination and Procurement), PCMU, Programming Division, Planning Commission

The Project Coordinating and Monitoring Unit (PCMU) will be established under PSC, which will be responsible for project coordination and management. The chief of the Programming Division, Ministry of Planning, is the Project Director (PD) of PCMU. The roles of PCMU are as follows:

- PCMU will provide secretariat services in the form of technical and administrative resources (preparing consolidated working paper for PSC meetings, writing minutes of meetings, finalize thereof for distribution, etc.).
- PCMU will collect progress / monitoring / financial reports from each PIU and prepare consolidated reports and submit them to Implementation Monitoring and Evaluation Division (IMED), External Resources Division (ERD) and World Bank (WB).
- PCMU will render top supervision / technical services to the PICs and PIUs.

Project Implementation Committee (PIC)[9] will be established in each component to supervise and coordinate all the activities of the PIU. PIC is headed by the Director General of each implementation agency. The roles of PIC are as follows:[10]

- Supervising the implementation team.
- Providing advice for timely implementation of schedule activities
- Monitoring and evaluating implementation progress.
- Reviewing the performance of project personnel and quality of deliverables.
- Resolving issues and conflicts that may emerge during implementation.
- Ensuring implementation follows both Government and World Bank rules and regulations.
- Facilitating coordination with other line ministries/divisions/agencies.

The Project Implementation Unit (PIU) will be responsible for efficient and effective implementation and regular monitoring of activities with respect to relevant components. PIU will function as the Secretariat of the PIC. Each PIU will be headed by a Project Director (PD), a mid- or senior-level official of the concerned implementation agencies. The institutional and implementation structure of the URP are illustrated in Figure 6.1.12.

[9] PIC is proposed by implementation agency, although the World Bank proposes governing structure without PIC.
[10] DPP for Urban Resilience Project prepared by DDM, May 2015

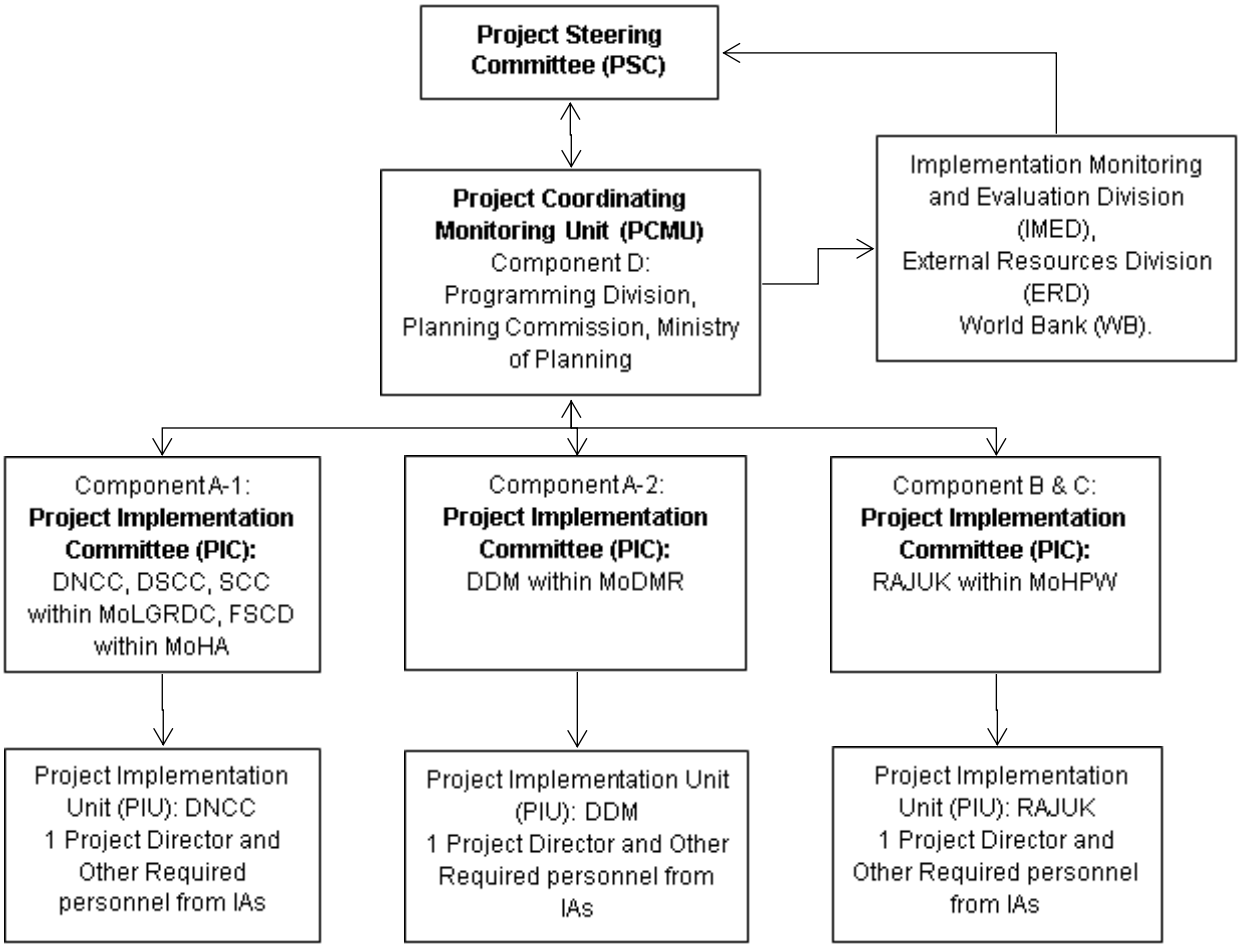


Figure 6.1.12 Governing Structure of Urban Resilience Project

The World Bank prepared the project appraisal document [11] in February 2015 and each implementation agency such as DNCC/DSCC/SCC, FSCD, DDM and RAJUK, prepared DPP of their own and submitted to the Planning Commission. The PCMU, Programming Division of the Ministry of Planning, prepared a consolidated DPP[12] and submitted it to Planning Commission. These DPPs were approved by ECNEC in June 2015. The loan agreement for the Urban Resilience Project was signed between World Bank and GOB on the 30th day of June 2015.

The implementation structure of URP is similar to the proposed project funded by the JICA ODA loan. According to a staff of the World Bank Dhaka Office, a comprehensive development project like URP needs a strong leadership and capacity of PSC which provides overall guidance and policy advice. In the implementation of URP, the World Bank identified the Programming Division as PCMU, which need strong capacity of coordination across different ministries and agencies. Component D was

[11] Internal Development Association Project Appraisal Document on a Proposed Credit in the Amount of SDR 122.8 Million to Bangladesh for an Urban Resilience Project, The World Bank, February, 25, 2015

[12] Consolidated Development Proposal (DPP) Urban Resilience Project, Programming Division, Planning Commission, June 2015.

created for the purpose of capacity enhancement of PCMU in project implementation, coordination, monitoring and evaluation.

(4) JICA Loan Projects

The objectives of this JICA project is to strengthen the capacity for disaster risk management in Bangladesh. The agencies t responsible for DRR in Bangladesh are MoDMR and DDM. These agencies are relatively new organizations and capacity of these agencies are limited. Accordingly, this section reviews the Japanese ODA loan projects in the field of disaster management as implemented in Bangladesh in the past to verify the capacity of GOB. The Japanese ODA loan projects studied were: 1) Emergency Disaster Damage Rehabilitation Project, implemented from 2008 to 2010; and 2) Haor Flood Management and Livelihood Improvement Project, on-going since 2014.

(a) Emergency Disaster Damage Rehabilitation Project, 2008-2010

The Emergency Disaster Damage Rehabilitation Project aimed to support quick restoration of economic and social activity in the flood and Cyclone in 2007 damaged area by providing import financing for essential commodities; and by rehabilitating and reconstructing damaged public infrastructure, thereby contributing to sustainable economic growth. The project was financed by Japanese ODA Loan (JBIC) with an amount of 6,960 million yen and implemented during the period from December 2008 to June 2010.

Table 6.1.7 Execution Agencies of Emergency Disaster Damage Rehabilitation Project

Executing Agency	Ministry of Finance (MoF)
	Local Government Engineering Department (LGED)
	Roads and Highways Department (RHD)
	Bangladesh Water Development Board (BWDB)

The GOB had four (4) executing Agencies for the project: the Ministry of Finance (MOF), the Local Government Engineering Department (LGED), the Roads and Highways Department (RHD) and the Bangladesh Water Development Board (BWDB). The Operation and Maintenance System of the project are undertaken by the same parties.

The project was in close cooperation with ADB, which implemented ex-post evaluations of flood damage rehabilitation projects in the past. The lessons learned from a similar project conducted by ADB show the importance of the following key issues:

- Preparations to provide support for dealing with disasters in an expeditious way;
- Infrastructure rehabilitation; and
- Rehabilitation work within 2 years to the greatest extent possible.

Based on these lessons learned, the project created an overall framework for rehabilitation of infrastructure within 2 years.

(b) Haor Flood Management and Livelihood Improvement Project

In the upper Meghna River basin in the northeast region, so-called "Haor areas", low wetlands between three and five meters above sea level are located and these areas are inundated during the monsoon period. At the start of the rainy season, flash floods occur by water flowing into the Meghna River from the mountainous regions in India, resulting in flood damage in the river basin. This area supports the country's economy, as a rice production base during the dry season and as a fishing ground during the rainy season. However, if the rice crop, which is a major source of income in the dry season, is damaged by the floods, the livelihoods of the people become significantly unstable.

Through flood management, rehabilitation and construction of rural infrastructure and agriculture and fishery promotion in the Haor region, this project will reduce the damage from floods, improve access to basic infrastructure, and improve agriculture and fishery productivity, thereby contributing to the improvement of living standard and to economic productivity in the area. The loan funds will be allocated to public works such as constructing embankments and rural roads, agriculture and fishery promotion activities and consulting services.

The Executing Agencies of the project were: Local Government Engineering Department (LGED), and Bangladesh Water Development Board (BWDB). The Operation and Maintenance System of the project is undertaken by the same.

Table 6.1.8 Execution Agencies of Haor Flood Management and Livelihood Improvement Project

Executing Agency	Local Government Engineering Department (LGED)
	Bangladesh Water Development Board (BWDB)

As mentioned above, the JICA loan funds in disaster management and rehabilitation were allocated mainly to public works such as constructing embankments and rural roads, agriculture and fishery promotion activities. The Ministry of Disaster Management and Relief (MoDMR) and the Department of Disaster Management (DDM), which are responsible for disaster management activities in Bangladesh, had no experience of implementation of JICA loan projects in the past. It is, therefore, necessary to enhance the capacity of the MoDMR and DDM in effective management of the Project.

6.1.3 Safety Measures in Existing Projects

Regarding the regulations for occupational health and safety in Bangladesh, employers' obligations to protect health, hygiene and safety of workers are stipulated in the Bangladesh Labour Act, 2006 (as amended in 2013). The Act stipulates safety of buildings, electric equipment and machines, but does not specify safety concerning construction. The reference to construction is limited to securing safety of a construction site by enclosing it with a fence, conducting regular inspections of machines such as lifts and cranes, etc.

On the other hand, the representative legislation for safety management in Japan includes the Industrial Safety and Health Act, the Order for Enforcement of the Industrial Safety and Health Act, and the Ordinance

on Industrial Safety and Health which specifies detailed regulations for enforcement of the act. Provisions of the Ordinance on Industrial Safety and Health include:

- Establishment of safety committee, health committee, etc.
- Construction, equipment and machines in which notification is required (excavating natural ground, makeshift passages, etc., with length of 10 meters or more).
- Works with which operations chief or operation leader should be appointed (excavating natural ground with length of 10 meters or more, earth retaining work, repair of construction machines, removal or assembly of attachments, etc.)
- Personnel who should be qualified (blasting expert, construction machine operator, etc.)
- Works requiring arrangement of a watcher or a guide (prevention of falling of or contacting with a construction machine, working close to overhead wires, open-cut excavating work, etc.)
- Prohibition of entry (within the operation radius of a construction machine, places where natural ground may collapse, places where dangerous substances are handled, etc.)
- Publicity (Work plan, signal, alarm, etc.)
- Obligation to wear personal protective equipment (safety helmet, safety belt, monitoring of wearing, etc.)
- Other compliance obligations and prohibited matters in execution of work (inclination of excavation surface, structure of earth retaining work, speed limit of construction machines, prevention of electricity shock, etc.)

Contents of the Bangladesh Labour Act

PART-I	Preliminary,
PART-II	Conditions of Service and Employment,
PART-III	Employment of Adolescent,
PART-IV	Maternity Benefit,
PART-V	Health and Hygiene,
PART-VI	Safety,
PART- VII	Special Provisions Relating to Health, Hygiene and Safety,
PART-VIII	Welfare,
PART-IX	Working Hours and Leave,
PART-X	Wages and Payment,
PART-XI	Wages Board,
PART-XII	Workers Compensation for Injury by Accident,
PART-XIII	Trade Union and Industrial Relations,
PART-XIV	Disputes, Labor Court, Labor Appellate Tribunal, Legal Proceedings, etc.,
PART-XV	Workers Participation in Companies Profits,
PART-XVI	Regulation of Employment and Safety of Dock Workers,
PART-XVII	Provident Funds,
PART-XVIII	Apprenticeship,
PART-XIX	Penalty and Procedure,
PART-XX	Administration, Inspection, etc.,
PART-XXI	Miscellaneous

6.1.4 Payment Procedure to Contractor

(1) Projects Implemented by GOB

(a) BWDB

Payment to the contractor is made by the RAC (Regional Accounting Center) of BWDB upon confirmation by the field officer of the volume of work at the site and approved.

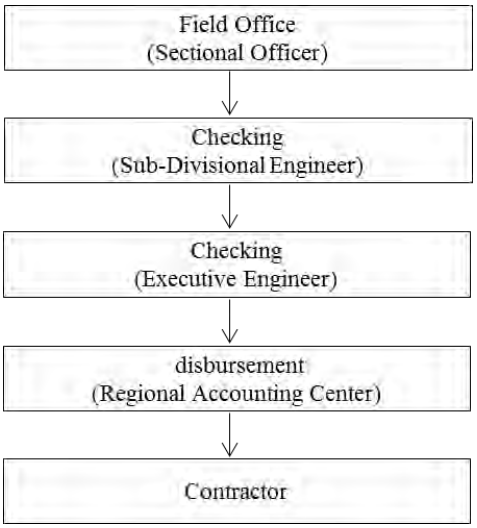


Figure 6.1.13 Payment Flow of the Project Implemented by BWDB

(b) LGED

After receiving the invoice from the contractor, the Payment to the contractor is made by the PIU Dhaka of LGED upon confirmation by the field officer of the volume of work at the site and approved.

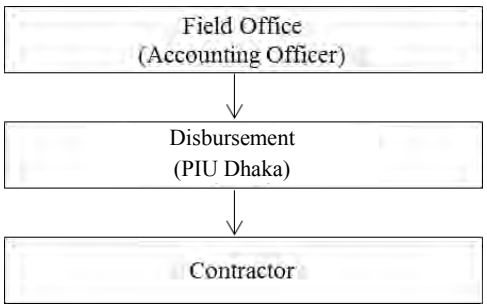


Figure 6.1.14 Payment Flow of the Project Implemented by LGED

(2) Projects Implemented by Donors

The payment flow of Haor Flood Management and Livelihood Improvement Project (JICA Loan Project signed in June, 2014.) is shown as follows.

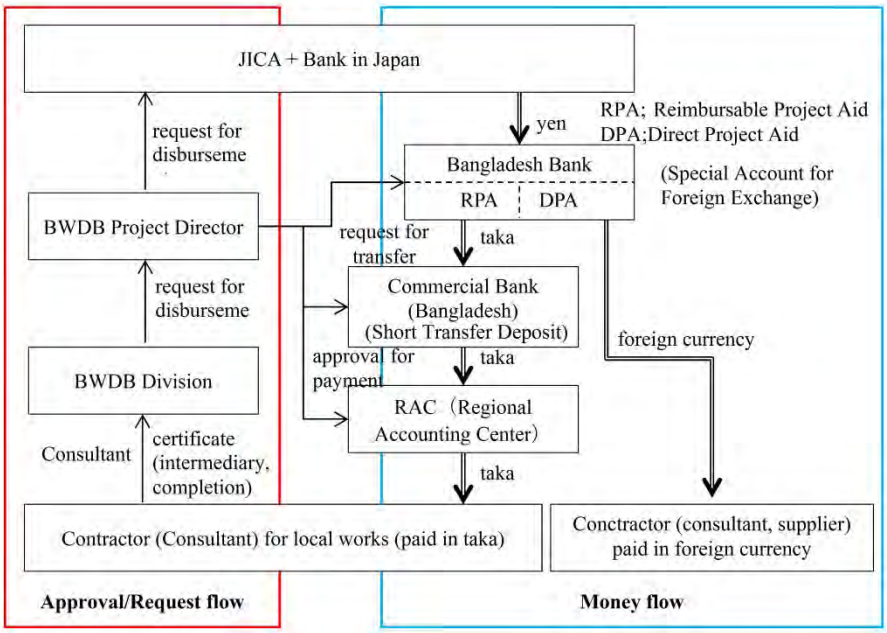


Figure 6.1.15 Payment Flow of Haor Flood Management and Livelihood Improvement Project (BWDB Portion)

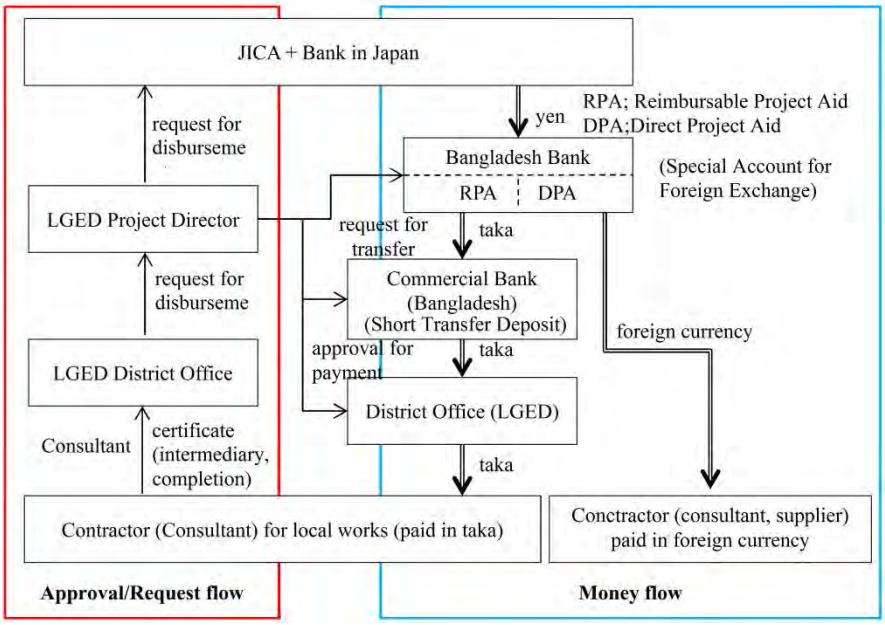


Figure 6.1.16 Payment Flow of Haor Flood Management and Livelihood Improvement Project (LGED Portion)

The documents needed for payment in the execution organization are as follows:

Table 6.1.9 Documents required for Payment

Required Documents	Remarks
1.Request for Disbursement	Disbursement request from Project Director to JICA
2.Summary Sheet of Payments	Attachment of 1. Request for Disbursement
3.Copy of Transfer Instruction	From Project Director to Agent Bank in Bangladesh
4.Claims for Payment	Attachment of 1. Request for Disbursement
5.Supporting documents evidencing	Attachment of 1. Request for Disbursement

6.1.5 Governance Structure of the JICA Project

The Project (Disaster Risk Management Enhancement Project) shall be implemented and managed by the GOB through the project execution and management organizations; namely, the Project Steering Committee (PSC), the Project Coordination and Monitoring Unit (PCMU) and the Project Implementation Units (PIUs). MoDMR will chair the PSC to coordinate, oversee and implement the Project. PCMU shall be established to operate and manage the Project under the PSC. PIUs are organized by several agencies across the ministries to be responsible for implementation of sub-projects in the Project.

(1) Project Components and Disaster Management Cycle

The salient feature of this Project is to enhance the capacity of GOB to conduct DRR activities in all stages of the disaster management cycle (i.e., pre-disaster, during disaster, post-disaster). The Project consists of the following three components:

- Component 1: Disaster Risk Reduction (Civil Works)
- Component 2: Emergency Response (Equipment)
- Component 3: Quick and Effective Recovery and Rehabilitation (Civil Works)

Component 1 covers activities of mitigation and preparedness during the pre-disaster period, Component 2 covers a relatively short period immediately before disaster and during the disaster period, and Component 3 covers activities of recovery and rehabilitation during the post-disaster period. The relationship among the components and the disaster management cycle are illustrated in Figure 6.1.17.

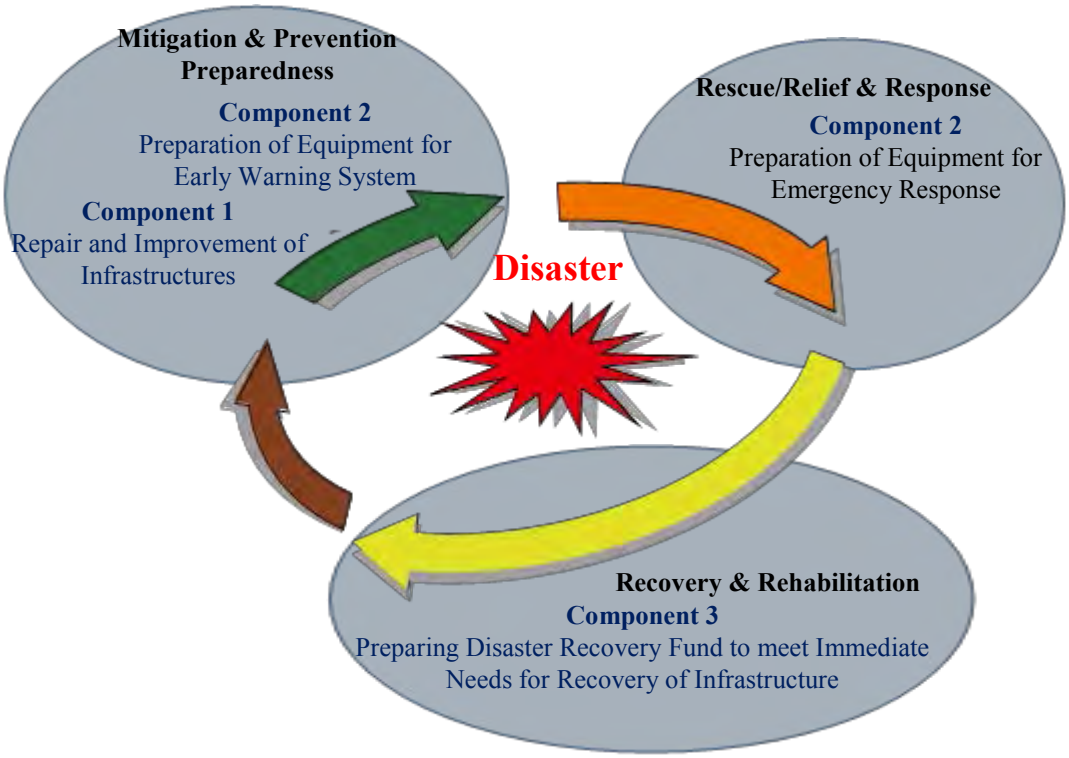


Figure 6.1.17 Project Components and Disaster Management Cycle

(2) Execution Agencies of the Project Components

At the national level, the MoDMR is the coordinating national agency for "Disaster Risk Management Enhancement Project". The DDM in the MoDMR, which was established in 2012 following the enactment of the Disaster Management Act of 2012, has the mandate to implement the objectives of the Act by reducing the overall vulnerability from different impacts of disaster, conducting humanitarian assistance programs, as well as strengthening and coordinating programs undertaken by various government and non-government organizations related to disaster risk reduction and emergency response. It is, however, said that the newly constituted department lacks the institutional foundation and staff training to effectively perform its roles and functions.

The Standing Order on Disaster (SOD)[13] formulated in 2010 gives the mandate to relevant agencies in disaster risk management and emergency response. Based on the mandates provided in the SOD, the following agencies are proposed to be execution agencies of each component in the Project.

[13] Standing Order on Disaster, Ministry of Food and Disaster Management, Disaster Management and Relief Division, Disaster Management Bureau, April 2010

Table 6.1.10 Proposed Execution Agencies of the Project

Component	Activities	Proposed Execution Agencies
Component 1	Improvement of Infrastructure (i.e., roads, embankments, bridges and culverts) for mitigation of damages from natural disaster	LGED, BWDB
Component 2	Procurement of Equipment for Early Warning, Emergency Rescue and Relief	DDM, FSCD
Component 3	Preparation of Disaster Recovery Fund for Recovery and Reconstruction to meet the needs for immediate recovery of damaged infrastructure and/or livelihood	LGED, BWDB, DDM

Source: JICA Survey Team based on discussions with MoDMR, DDM, BWDB and LGED

In Component 1, the Local Government Engineering Department (LGED) under the Ministry of Local Government, the Rural Development and Cooperatives (MoLGRDC), and the Bangladesh Water Development Board (BWDB) under the Ministry of Water Resource (MoWR) will be the execution agencies to conduct the following activities:

- During pre-disaster period, LGED will take the responsibility of repair/improvement of small roads, bridges and culverts to reduce disaster risk;
- During pre-disaster period, BWDB will take the responsibility of repair/improvement of breaches and weak points of embankment to reduce disaster risk; and
- LGED and BWDB will identify the locations of infrastructure necessary for repair and improvement during the pre-disaster period.

In Component 2, the Fire Service and Civil Defence (FSCD) under Ministry of Home Affairs (MoHA) and DDM under MoDMR will be the execution agencies to conduct the following activities during disaster:

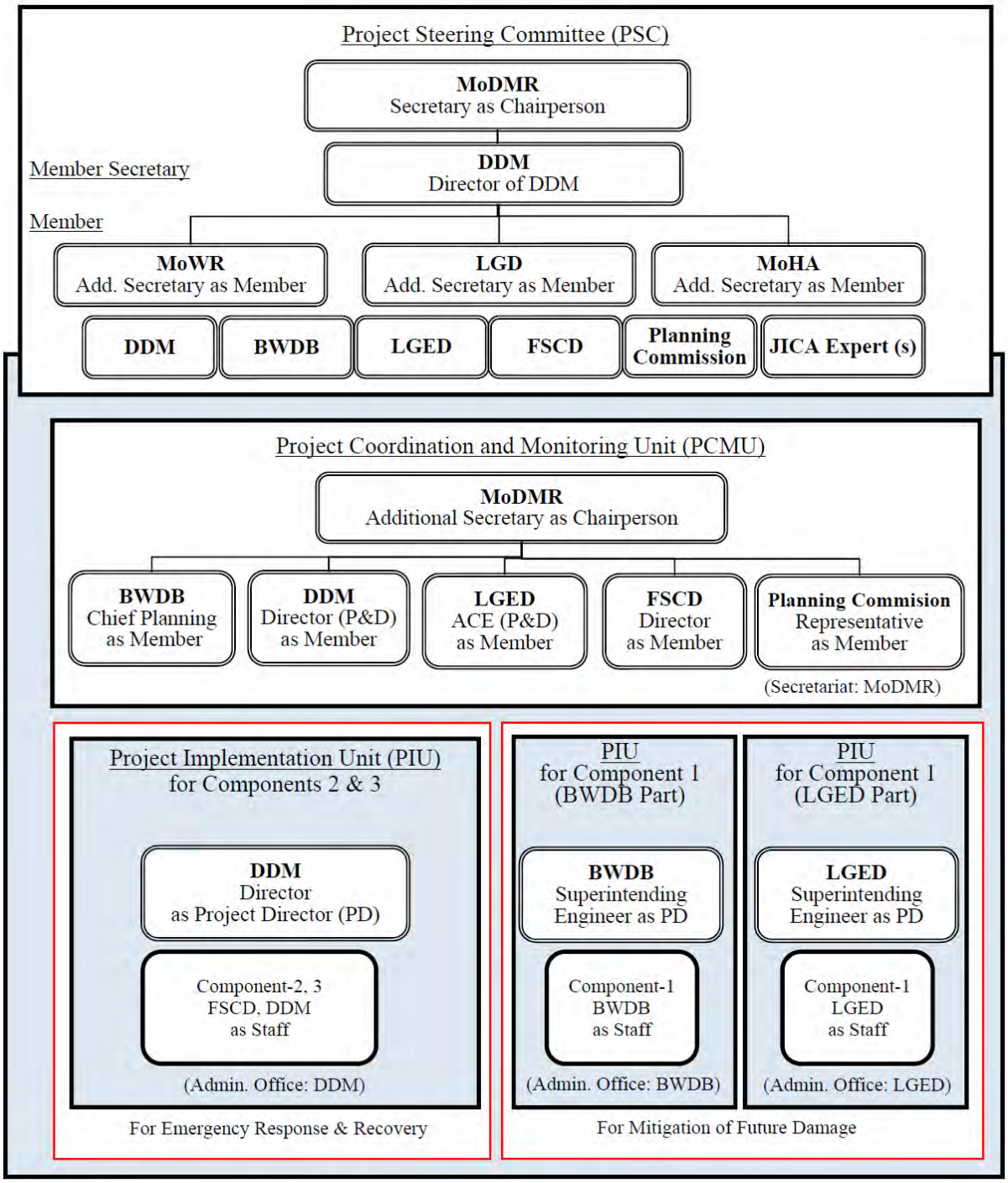
- When a disaster occurs, DDM shall immediately collect relevant information and deliver early warning from national to community level; and obtain information on disaster relief and recovery operations after disaster; and
- Search and rescue equipment shall be installed in FSCD which will perform the work of rescue, evacuation, transportation of injured people, pumping out water from food storage, etc., with assistance of the local authority during disaster.

In Component 3, the Department of Disaster Management (DDM) shall be the execution agency to conduct the following activities during post-disaster period:

- DDM shall prepare the development project proposal (DPP) in advance to make immediate response to disasters. The DPP includes projects supporting recovery of infrastructure and/or reconstruction of livelihood of affected people;
- DDM shall ensure quick allocation of financial support for recovery of damaged infrastructure and monitor compliance of policies and procedures for funding for repairs and recovery of infrastructure in distress areas; and

- Line agencies, such as LGED and BWDB, shall prepare the emergency recovery plan of damaged infrastructure with estimates of expenditures and request for allocation of funding to DDM.

The overall management structure of the Project is illustrated inFigure 6.1.18.



Note: ▭ : DPP prepared by MoDMR for Components 2, 3 and 4, and LGED and BWDB for Component 1.
Source: Prepared by JICA Survey Team based on discussions with MoDMR, DDM, BWDB and LGED

Figure 6.1.18 Overall Management Structure of the Project (Draft)

(3) Project Steering Committee (PSC)

The Government of Bangladesh (GOB) has the overall responsibility for implementing this multi-sectoral and multi-ministerial project which will contribute to the strengthening and enhancement of disaster risk management in Bangladesh. The GOB shall ensure proper planning, management, and coordination of the project mainly through three (3) of its ministries; namely, the Ministry of Disaster Management and Relief (MoDMR), the Ministry of Water Resources (MoWR), and the Ministry of Local Government, Rural Development and Co-operatives (MoLGRDC) in association with related ministries, such as the Ministry of Home Affairs (MoHA), the Ministry of Planning (MoP) and the other ministries concerned as needed. On behalf of the GOB, the three (3) ministries mentioned above shall oversee that each component of the Project is being implemented efficiently.

The MoDMR shall be responsible for overall coordination and monitoring of the Project. In this connection, the Project Steering Committee (PSC) to be chaired by the Secretary of MoDMR shall provide overall guidance, policy advises and coordination of the Project, addressing inter-ministerial issues that may arise during project implementation. The PSC shall be composed of the following members: representatives from MoWR, MoLGRDC, MoHA, DDM, Economic Relations Division (ERD), FSCD, LGED, BWDB, Planning Commission and Ministry of Environment and Forests (Table 6.1.11). Additional Secretary of MoDMR, head of PCMU, shall function as the member Secretariat of PSC. The PSC is expected to meet quarterly or at other times, if necessary. The JICA Bangladesh office shall be an observer of the PSC.

Table 6.1.11 Proposed Members of the PSC

Role in PSC	Description
Roles	The major responsibilities of PSC are coordination, monitoring and providing guidance ofthe Project. The specific roles and responsibilities are as listed below. ● Coordinate and monitor the Project ● Supervision of project implementation units (PIUs) ● Facilitation of coordination and convergence with other line ministries/divisions/agencies ● Address inter-ministerial issues and provide overall guidance ● Assurance of implementation following both governments of Bangladesh and Japan, as well as JICA rules and regulations ● Reflect outputs and outcomes of the Project on national DRR/DRM policies
Members:	
Chairperson	Secretary of Ministry of Disaster Management and Relief (MoDMR)
Member Secretary	Director of DDM
Member	Additional Secretary of MoWR Additional Secretary of LGD Additional Secretary of MoHA Director General of DDM Director General of BWDB Chief Engineer of LGED Director General of FSCD Representative of Planning Commission
Others	JICA Representative (s)

Source: JICA Survey Team

(4) Project Coordination and Monitoring Unit (PCMU)

The Project Coordination and Monitoring Unit (PCMU) shall be created in the MoDMR to provide overall coordination, management and resource support in terms of technical and human resources for efficient implementation of this multi-ministerial project. The PCMU shall be headed bythe Additional Secretary of MoDMR and provide secretariat services in the form of technical and administrative resources to the PSC. In addition, the PCMU shall collect progress reports timely at appropriate intervals including technical and financial matters from each of the three (3) PIUs and prepare consolidated progress reports for onward transmission to the PSC, ERD, JICA and other ministries/divisions concerned.

Table 6.1.12 Staff of PCMU and their Responsibilities

Title	Item	Details
Project Coordination and Monitoring Unit (PCMU)	Roles	The major respol1sibilities of PCMU are coordination and supervision of the overall activities to be implemented by PIUs. The specific roles and responsibilities are as listed below: ● Facilitate joint formulation ofthe sub-project ● Performance, Operation and Support to PSC activities as the Secretariat of PSC
	Chairperson	Additional Secretary of Ministry of Disaster Management and Relief (MoDMR)
	Member	Additional Sccrctary of MoDMR Director (Development & Planning)of DDM Chief Planning of BWDB Additional Chief Engineer (Planning & Design) of LGED Director of FSCD Representative of Planning Commission
	Secretariat	Additional Secretary of MoDMR
	Others	JICA Representative (s)

(5) Project Implementation Unit

Under the overall supervision of PCMU, three PICs shall be established to be responsible for sub-projects in the component. In Component 1, two PIUs, i.e., BWDB-PIU and LGED-PIU, shall be established for the implementation of sub-projects. In Components 2 and 3, DDM-PIU shall be established for the implementation of sub-projects. All the three PIU headquarters are located in Dhaka and shall establish field offices after approval of DPPs submitted by each PIU. The PIUs shall be responsible for the overall management of sub-projects to achieve the outputs efficiently. The basic roles and responsibilities of the PIU are shown in the Table below:

Table 6.1.13 Major Roles and Responsibilities of the PIUs

Term	Roles and Responsibilities
Before construction	Planning of overall implementation related to respective components
	Carrying out of surveys and investigations to be prepared with the hired Consultant
	Carrying out of land acquisition

Term	Roles and Responsibilities
	Conduct of detailed designs and/or determination of specifications of equipment to be procured with owner's estimate for responsible parts in collaboration with the Consultant
	Preparation of tender documents, calling of tenders and evaluation of contract in collaboration with the Consultant
During construction	Supervision of activities and monitoring of progress of component activities (Supervision of the construction of infrastructures and/or procurement of equipment)
	Checking/Certifying the Consultants' and Contractors' bills
	Implementation and supervision of the necessary activities related to the environmental permit, environmental management plan and monitoring plan
Throughout the project period	Coordination of respective District and Upazila officers and offices, such as DRROs, PIOs, XENs, and Superintending Engineers
	Coordination and support of activities in the Component 3
	Reporting necessary (Preparing progress reports) to the PCMU

Source: JICA Survey Team

(a) BWDB-Project Implementation Unit (PIU)

The BWDB-PIU for Component 1 shall perform the major roles and responsibilities shown in Table 6.1.13. In addition, BWDB-PIU shall perform the following specific roles and responsibilities:

- Calculation of work quantities based on detailed design and estimation of costs to countercheck the work volumes estimated by the contractors;
- Monitoring and supervision of the infrastructure development as sub-projects;
- Support on Component 3 (DDM) activities in terms of construction supervision and monitoring in case emergency recovery and rehabilitation works are selected and implemented in its jurisdiction area(s).

As of December 2015, eight sub-projects are proposed to be implemented by BWDB (Table 6.1.14). In order to implement and manage these sub-projects effectively, at least three (3) field offices are required: Satkhila, Khluna and Barisal.

Table 6.1.14 Proposed Sub-projects to be implemented by BWDB

No.	Facility	District/Upazila	Scope of Works	Remarks
1	Embankment/Revetment	Satkhila / Shyamnagar	L=0.6km	Polder 5
2	Embankment/Revetment	Satkhila / Assa Suni	L=1.0km	Polder 4
3	Embankment/Revetment	Satkhila / Assa Suni	L=1.5km	Polder 4
4	Embankment/Revetment	Khluna / Koira	L=0.9km	Polder 13-14/2
5	Embankment/Revetment Scouring Protection	Barisal / Babuganj	L=2.3km (Scouring L=1.0km)	For Bridge
6	Embankment/Revetment Scouring Protection	Barisal / Babuganj	L=0.4km (Scouring L=0.2km)	Barisal Airport
7	Embankment/Revetment	Barisal / Patharghata	L=1.0km	Polder 40/1
8	Drainage Sluice Gate	Patuakhali / Kalapara	0.8W x 0.8H x 8 Gates	Polder 46

Source: JICA Survey Team

The BWDB-PIU for Component-1 including head office and 5 field offices shall consist of 77 members in total and the roles and responsibilities of the officers and staff are shown in Table 6.1.15. The organizational chart of the BWDB-PIU is shown in Figure 6.1.19. The number of staff and the organizational chart are under discussion with GOB.

Table 6.1.15 Roles and Responsibilities of Staff Members in the BWDB-PIU

Sl No	Position in PIU	No. of person	Qualification/ Requirements	Roles and Responsibilities	Remarks
1	2	3	4	5	6
A	Dhaka Office: Project Implementation Unit (PIU), BWDB.				
1.	Project Director (Superintending Engineer/Director)	1	B.Sc Engg (Civil)	He will responsible for all planning, implementation and management for Component-1& 3 (BWDB Part).	Deputation from BWDB.
2.	Deputy Project Director (Executive Engineer)	1	B.Sc Engg (Civil)	Support to Project Director, especially in terms of engineering aspects for Component-1 & 3 (BWDB Part).	Deputation from BWDB.
3.	Deputy Chief (Soil)	1	Masters in Soil Science	Contribute to selection of crop pattern according to land pattern and other agriculture related work in project area.	Deputation from BWDB.
4.	Sub-Divisional Engineer/Assistant Engineer 1. Planning 2. Design	 1 1	B.Sc Engg (Civil)	Support to Project Director, especially in terms of engineering aspects for Component-1 & 3 (BWDB Part). Assist with the coordination of the different activities of the project.	Deputation from BWDB.
5.	Assistant Chief (Economics)	1	Masters in Economics.	DPP/RDPP/PDPP preparation, processing for approval and other planning related works. Contribute to analysis BCR, IRR, EIRR, FIRR etc. of the project.	Deputation from BWDB.
6.	Research Officer /Assistant Chief (Sociology)	1	Masters in Sociology.	Contribute to assess the socio-economic impact of the introduces interventions.	Deputation from BWDB.
7.	Research Officer / Assistant Chief (Environment & Fishery)	1 1	B. Sc. Engg (Civil/ Environment)	Supervision & monitoring regarding ESIA related activities such as RAP, LAP, EMP etc. of the project.	Deputation from BWDB. or Outsourcing
8.	Sub Assistant Engineer (Estimator)	1	Diploma in Civil Engg.	Support to Project Director, especially in terms of engineering for Component-1 & 3 (BWDB Part), and preparation of cost estimate & other works related to procurement.	Deputation from BWDB.
9.	Upper Divisional Assistant (UDA)	1	B.A or equivalent degree with computer skill (MS word and MS Excel).	Support in the preparation of reports, perform project related works and perform office related administrative works.	Outsourcing
10.	Senior Accounts Assistant	1	B.Com degree with computer skill (MS word and MS Excel).	Support in accounts related works regarding Component-1 & 3 (BWDB Part).	Deputation from BWDB.
11.	Data Entry Operator	1	H.S.C with computer skill (MS word and MS Excel).	Support in the preparation of reports, perform project related works and perform office related administrative works.	Deputation from BWDB.
12.	Driver	2	S.S.C	As directed by Project Director.	Deputation from BWDB
13.	Office Assistant (MLSS/Peon)	1	S.S.C	As directed by Project Director.	Outsourcing
14.	Cleaner	1	Class eight pass (J.S.C).	As directed by Project Director.	Outsourcing
Sub-Total		17			

B	Field Office: Project Implementation Unit (PIU), BWDB.				
1	Executive Engineer	5	B.Sc Engg. (Civil)	Contribution on procurement, implementation and management. Support to Project Director, especially in terms of administration/governance issues for Component-1 & 3 (BWDB Part) Supervise Sub-Project (s).	Additional Charge
2	Sub-Divisional Engineer	5	B.Sc Engg. (Civil)	Support to Executive Engineer, especially in terms of engineering for Component-1& 3 (BWDB Part).	Additional Charge
3.	Assistant Engineer	5	B.Sc Engg. (Civil)	Support to Executive Engineer, especially in terms of engineering for Component-1& 3 (BWDB Part).	Additional Charge
4.	Sub-Assistant Engineer	10	Diploma in Civil Engg.	Support to Executive Engineer, especially in terms of engineering for Component-1& 3 (BWDB Part).	Additional Charge
5.	Sub-Assistant Engineer (Estimator)	5	Diploma in Civil Engg.	Support to Executive Engineer, especially in terms of engineering for Component-1 & 3 (BWDB Part), and preparation of cost estimate & other works related to procurement.	Additional Charge
6.	Work Assistant	10	H.S.C with minimum 1 year experience in construction works.	Support Sub- Assistant Engineer in physical work and site supervision.	Additional Charge
7.	Accounts Assistant	5	B.Com degree with computer skill (MS word and MS Excel)	Support in accounts related works regarding Component-1 & 3 (BWDB Part).	Additional Charge
8.	Data Entry Operator	5	H.S.C with computer skill (MS word and MS Excel)	Support in the preparation of reports, perform project related works and perform office related administrative works.	Additional Charge
9	Driver	5	S.S.C	As directed by Executive Engineer.	Additional Charge
10.	Office Assistant (MLSS/Peon)	5	S.S.C	As directed by Executive Engineer.	Additional Charge
Sub-Total		60			
Total		77			

- Pay Scale indicated in the column 5 is old one. Salary amount will be almost double as per new Pay Scale declared by the Government of Bangladesh (GOB) which will be effective from July 2015.

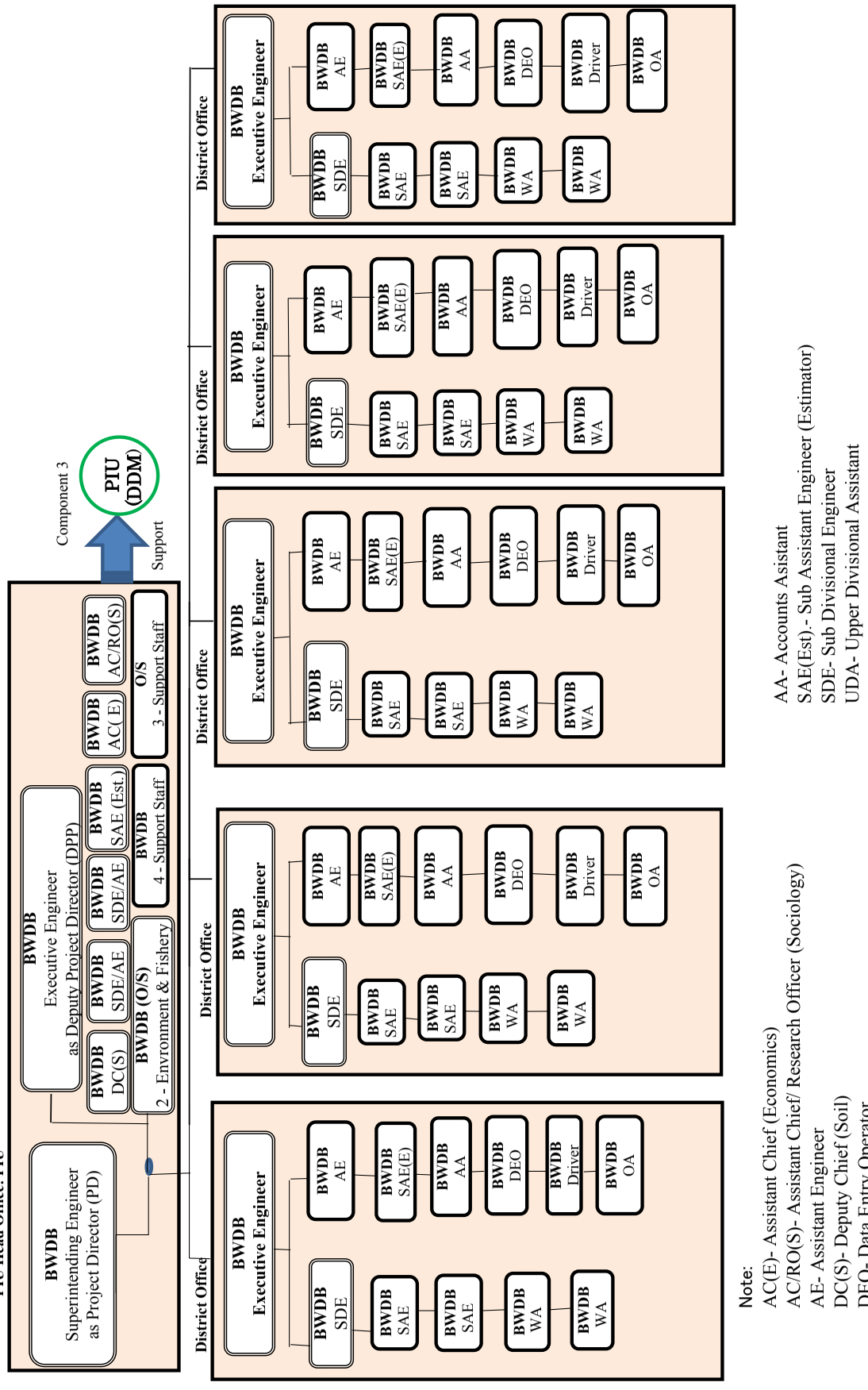


Figure 6.1.19 Tentative Organization Structure of BWED-PIU

(b) LGED-Project Implementation Unit (PIU)

In Component-1, another PIU (LGED portion) shall be established to be responsible for implementation of sub-projects of rural roads, bridges and culverts. The head office of the LGED-PIU shall be established in Dhaka and field offices shall be established in selected locations. The PIU shall be responsible for overall management of the sub-projects to achieve the outputs efficiently. The PIU shall perform the basic roles and responsibilities enumerated in Table 6.1.13.

In addition, the LGED-PIU shall perform the following specific roles and responsibilities:

- Calculation of work quantities based on detailed design and estimation of costs to countercheck the work volumes estimated by the contractors;
- Monitoring and supervision of the infrastructure development sub-projects; and
- Support to Component 3 (DDM) activities in terms of construction supervision and monitoring in case emergency recovery and rehabilitation works are selected and implemented in its jurisdiction area(s).

As of September 2015, the following 10 sub-projects are proposed to be implemented by LGED (Table 6.1.16). In order to implement and manage these sub-projects effectively, at least three (3) LGED-PIU field offices shall be established. The locations of the field offices are tentatively in Bagerhat, Jhalokati and Bhola.

Table 6.1.16 Proposed Sub-projects to be implemented by LGED

No.	Code	Facility (Road Class)	District/Upazila	Scope of Improvement Works (L: Length, W: width, Pv: pavement)
1	HW1	Road (Upazila)	Satkhila / Kaliganj	L=18.0km, W=5.5m, Pv=As
2	BR1	Bridge (Union)	Bagerhat/Sadar	L=40m, W=5.35m, Pv=Con. (RC Bridge)
3	BR2	Bridge (Union)	Bagerhat/Mongla	L=30m, W=5.35m, Pv=Con. (RC Bridge)
4	BR3	Bridge (Village)	Bagerhat/Mongla	L=51m, W=5.35m, Pv=Con. (RC Bridge)
5	BR4	Bridge (Union)	Bagerhat/Mongla	L=20m, W=5.35m, Pv=Con. (RC Bridge)
6	HW2	Road (Upazila)	Jhalokati/Sadar	L=3.0km, W=5.3m, Pv=As
7	BR5	Bridge (Upazila)	Jhalokati/Nalcity	L=20m, W=7.3m, Pv=Con. (RC Bridge)
8	HW3	Road (Upazila)	Patuakhali/Sadar	L=12.0km, W=5.5m, Pv=As (w/ Embankment Protection)
9	BR6	Bridge (Upazila)	Barguna/Sadar	L=66m, W=7.3m, Pv=Con. (RC Bridge)
10	BR7	Bridge (Upazila)	Bhola/Sadar	L=96m, W=5.35m, Pv=Con. (RC Bridge)

Source: JICA Survey Team

The LGED-PIU including the head office and 3 field offices shall consist of 43 members and the roles and responsibilities of the officers and staff are shown in Table 6.1.17. The organizational chart of the LGED-PIU is shown in Figure 6.1.20.

Table 6.1.17 Roles and Responsibilities of Staff Members in LGED-PIU

Sl. No	Name of the Post	Quantity	Qualifications	Responsibilities/ Accountabilities	Remarks
1	2	3	4	5	6
Project Implementation Unit (PIU), Dhaka					
1	Project Director (Superintending / Sr. Executive Engineer)	1	B.Sc. in Civil Engineering	To guide, coordinate, supervise, control and allocate tasks to the officers and staffs working for the project; Monitor and supervise the works and day to day activities including the performance of field level personnel involved in the project; Provide technical and other necessary support to the Executive Engineer and Upazila Engineer; Release of fund for the project activities; Review progress of the project. Liaison with the high officials of LGED, Ministry and other agencies related with the project, etc.	On Deputation
2	Deputy Project Director	1	B.Sc. in Civil Engineering	To assist PD in all relevant activities of the project including procurement, approval, supervision, monitoring & reporting; To visit the site regularly and provide necessary information to PD and other officials.	On Deputation
3	Assistant Engineer	1	B.Sc. in Civil Engineering	To assist PD and DPD in all relevant activities of the project including procurement, approval, supervision, monitoring & reporting; To visit the site regularly and provide necessary information to PD and other officials.	Outsourcing
4	Sub Assistant Engineer	1	Diploma in Civil Engineering	To assist the Assistant Engineer, DPD & PD in scheme approval, supervision, monitoring & reporting; To visit the site regularly and provide necessary information to PD and other officials.	Outsourcing
5	Accountant	1	M.Com/MBA	To assist PD in maintaining all accounts, preparing budget, auditing, allocating funds, reporting, etc.	On Deputation
6	Accountant Assistant	1	M.Com/MBA	To PD in maintaining all accounts, preparing budget, auditing, allocating funds, reporting, etc.	On Deputation
7	Computer Operator	1	Diploma in Computer/ B.A/B.Com/B.Sc	To assist PD, DPD and Assistant Angineer in the preparation of all types of reports, correspondence and other computer related programmes and documents; To maintain the computers.	Outsourcing
8	Driver	2	S.S.C./Class-VII	To operate and maintain the allocated project vehicles, including cleaning, renewal of registrtion, petty repair and maintenance, etc., & keeping and updating logbooks.	Outsourcing
9	Office Support	2	S.S.C./Class-VII	To assist officers & staff members in office business.	Outsourcing
Sub Total		**11**			
District Level Office (Six District)					
1	Project Manager (District Executive Engineer)	6	B.Sc. in Civil Engineering	He/She will supervise project activities in the field and ensure the quality of the works and provide necessary information/ report to PD	Additional duty
2	Assistant Engineer	6	B.Sc. in Civil Engineering	He/She will assist Project Manager in supervising the project activities in the field and ensuring the quality of the works and provide necessary information/report to District XEN and PD.	Outsourcing
3	Sub Assistant Engineer	6	Diploma in Civil Engineering	He/She will assist the Assistant Engineer (Project) and District XEN in supervising the project activities in the field and ensure quality of the works.	Outsourcing
4	Computer Operator	6	Diploma in Computer/ B.A/B.Com/B.Sc	He/She will assist District XEN and Assistant Engineer (Project) in preparation of all types of reports, letters and other Computer related programmes and documents. He/she will also maintain the computer.	Outsourcing
5	Office Support	6	S.S.C./Class-VII	Assisting officers & staffs in operation of office business.	Outsourcing
Sub Total		**30**			
Upazila level Office (Eight Upazila)					
1	Upazila Engineer)	8	B.Sc. in Civil Engineering	To supervise project activities in the field and ensure the quality of the works and provide necessary information/report to the District XEN.	Additional duty
Sub Total		**8**			
Grand Total :		**49**			

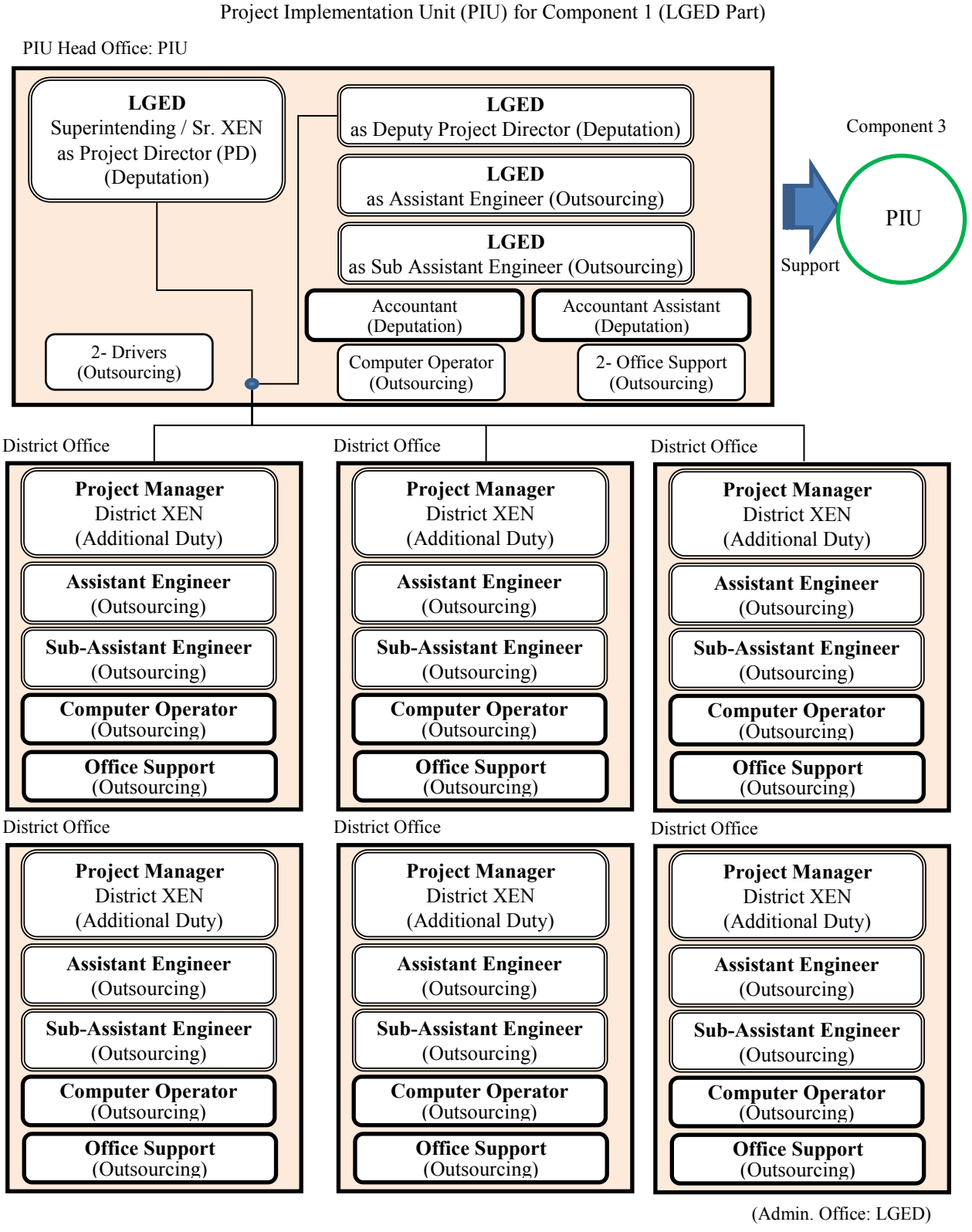


Figure 6.1.20 Tentative Organizational Structure of LGED-PIU

(c) DDM-Project Implementation Unit (PIU)

DDM-PIU shall be established to be responsible for implementation and management of Component-2: Procurement of equipment for disaster risk management, and Component-3: Establishment of Disaster Recovery fund for recovery and reconstruction which shall be established in the Department of Disaster Management (DDM). A head office of this DDM-PIU is located in Dhaka. The basic roles and responsibilities of the DDM-PIU are shown in Table 6.1.13.

In addition, the DDM-PIU shall perform the following specific roles and responsibilities for each component:

For Component 2, the specific roles and responsibilities of the DDM-PIU are:

- Final decision on facilities and equipment to be procured in the Project;
- Determination of Specification and Owner's Estimate for Facilities and Equipment to be procured in the Project in association with the Consultant;
- Monitoring and supervision of the procurement of facilities and equipment;
- Preparation of User's Manual and Guidelines for Facilities and Equipment with dry run;
- Monitoring and evaluation of actual operation and maintenance of facilities and equipment; and
- Reporting to PCMU of progress, monitoring and evaluation at periodical interval or as needed.

For Component 3, the specific roles and responsibilities of the DDM-PIU are:

- Collection of SOS-Forms and D-Form through focal section of DDM or DMIC in case a disaster happens;
- Acceptance of application forms for the utilization of Contingency Fund under the Project from any eligible government agency;
- Evaluation and selection of emergency works and/or activities to be implemented as Component 3 in the Project in accordance with the Guidelines and Criteria for the Utilization of Project Contingency Fund prepared by PCMU and approved by the PSC;
- Reporting of evaluation and selection results to PCMU in accordance with the Guidelines;
- Supervision and monitoring of emergency works and/or activities and reporting of the supervision and monitoring results to the PCMU; and
- Periodical evaluation of outputs and outcomes of emergency works/activities conducted in the Project.

The DDM-PIU shall be operated under the supervision of the Project Director, Director of the DDM. DRROs and PIOs nominated by DG of DDM and station officers selected by DG of FSCD shall fully support the activities of the DDM-PIU. The DDM-PIU shall consist of 18 officers/staff in total with specific roles and responsibilities as shown in Table 6.1.18. The organizational chart of the DDM-PIU is illustrated in Figure 6.1.21.

Table 6.1.18 Roles and Responsibilities of Staff Members in DDM-PIU

Position in PIU (Number of Personnel)	Required Ability	Roles and Responsibilities	Remarks
Officer in Dhaka (7 in Total)			
Project Director: PD (1)	Joint Secretary, MoDMR	• All Planning and Management for Component-2 and 3; • Procurement issues for Component-2	MoDMR Officers (Add'l. Duty)
Deputy Project Director-1: DPD-1 (1)	At least 10 years working experience in Disaster Management Field as senior officer in the Government	• Support to Project Director, especially in terms of administration/governance/ procurement issues for Component-2 and preparation of reports to be submitted by PCMU.	FSCD Officers (Addl. Duty)
Deputy Project Director-2: DPD-2 (1)	At least 10 years working experience in Design/Construction Supervision in Road/Bridge Field as senior officer in the Government.	• Support to Project Director, especially in terms of engineering for Component-2 and preparation of evaluation/ monitoring reports to be submitted by PCMU.	DDM Officer/Engineer (Outsourcing/Newly Hired)
Deputy Project Director-3: DPD-3 (1)	At least 10 years working experience in Design/Construction Supervision in Flood Protection Infrastructure Field as senior officer in the Government	• Support to Project Director, especially in terms of engineering for Component-3 and preparation of evaluation/ monitoring reports to be submitted by PCMU.	DDM Officer/Engineer (Outsourcing/Newly Hired)
Assistant Project Director: APD (3)	At least 10 years working experience as mid-class officer in the Government	• Support to DPD • Financial management/budgeting and accounting; • Procurement and contract management; • Monitoring in terms of Engineering	DDM Officer/Engineer (Outsourcing/Newly Hired)
Support Staff in Dhaka (11 in Total)			
Accountant (1)	Any Type of Bachelor's degree with Skill in Computer and Accounting (MS Word and MS Excel)	• Support in Accounting • Preparation of Accounting Report to PIU	DDM /FSCD Staff (Outsourcing/Newly Hired)
Office Assistant (3)	Any Type of Bachelor's degree with Computer Skill (MS Word and MS Excel)	• Support in the preparation of reports • Support in supervision and monitoring • Support to Accounting	DDM /FSCD Staff (Outsourcing/Newly Hired)
Computer Operator / Cad Operator (2)	College-educated with Skill of Cad Software as well as Computer Skill	• Support in Supervision and Monitoring	DDM Staff (Outsourcing/Newly Hired)
Site Inspector (3)	College-educated in Civil Engineering	• Conduct of site inspection, monitoring, and evaluation for Component-3	DDM Engineer (Outsourcing/Newly Hired)
Office Support Staff (2)	Experiences as Support Staff in the Past	• Support in Office Maintenance	DDM /FSCD Staff (Outsourcing/Newly Hired)
Total Number of Personnel in PIU (DDM-FSCD Part): 18 personnel			
Officers to Support PIU			
(DRO)	In case target facilities/infrastructures for Component 3 are located in its jurisdiction area, respective DRO shall fully support the project activities.	• Support in procurement and site inspection with supervision of works related to Components 2 and 3	(Add'l. Duty with his/her Staff)

Position in PIU (Number of Personnel)	Required Ability	Roles and Responsibilities	Remarks
(PIO)	In case target facilities/infrastructures for Component 3 are located in its jurisdiction area, respective PIO shall fully support the project activities.	• Support in procurement and site inspection with supervision of works related to Components 2 and 3	(Add'l. Duty with his/her Staff)
(Station Officer, FSCD)	In case facilities and equipment for Component 2 are installed in its jurisdiction area, focal Station Officer of FSCD shall fully support the project activities.	• Support in procurement and site inspection related to Components2 and 3	(Add'l. Duty with his/her Staff)

Source: JICA Survey Team based on discussions with MoDMR, DDM and FSCD

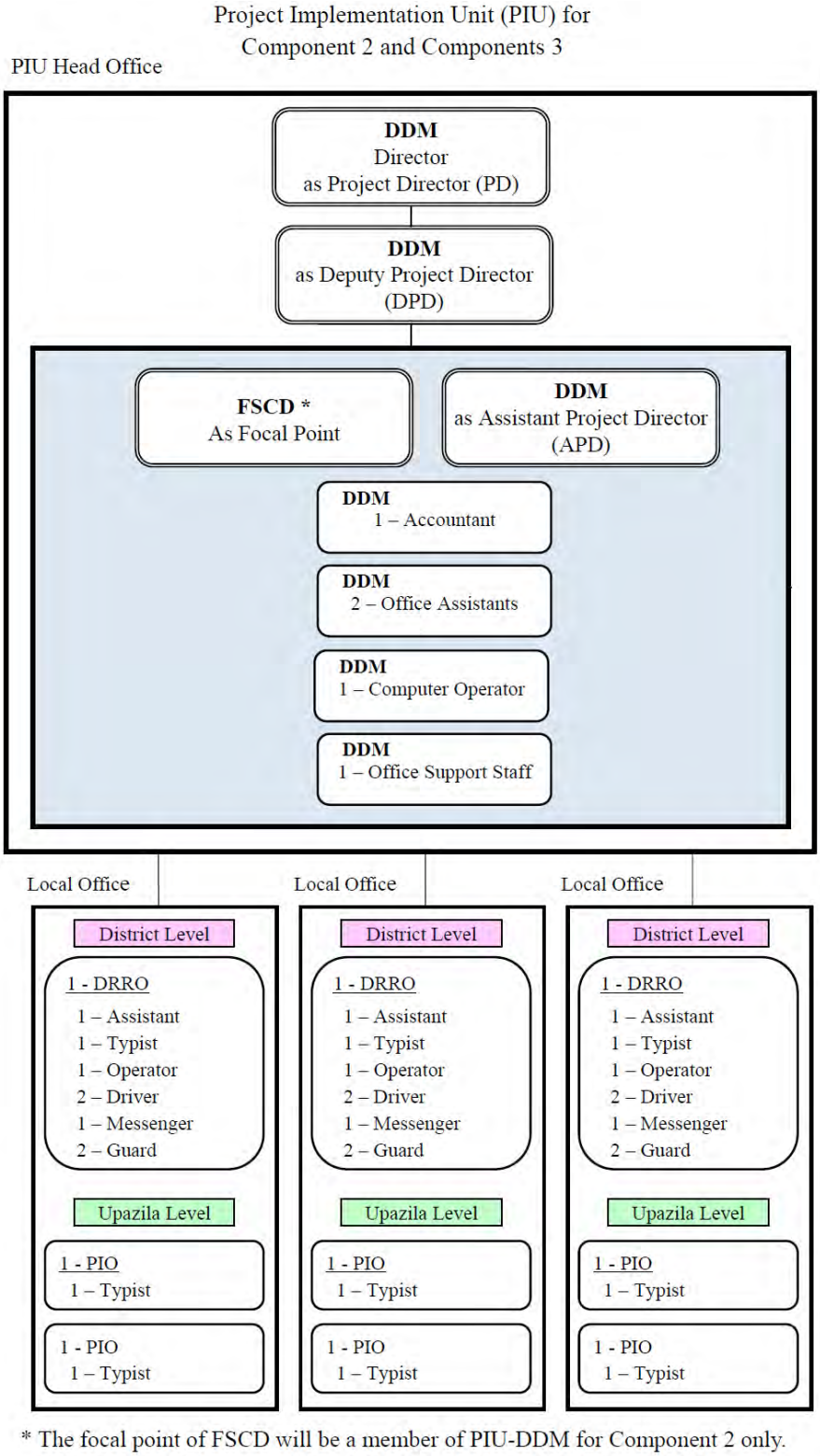


Figure 6.1.21 Tentative Organizational Structure of DDM-PIU

6.2 Organization for Operation and Maintenance

6.2.1 Organization of O&M for Component 1

In Bangladesh, the institutions in charge of operation and maintenance (O&M) of basic infrastructures targeted by Component 1 of this project, such as river embankments, roads and bridges, are shown in the following table along with the reference documents.

Table 6.2.1 Institutions in Charge of O&M of Infrastructures in Bangladesh

Infrastructure	Institution	Reference Document	Scope of this Project
River & coastal embankments*	Bangladesh Water Development Board (BWDB)	Bangladesh Water Development Board Act, 2000	○
Local roads & bridges (*upazila*, union & village roads)	Local Government Engineering Department (LGED)	GOB Notification PC/TS/Classification Committee/06, 2003/11/06	○
State roads & bridges (national, regional & *zila* roads)	Roads and Highways Department (RHD)		×
Urban roads & bridges	City Corporation	-	×

*For water resource units above 1000 ha, LGED; Otherwise: JICA Survey Team

The principal policies and regulations related to the O&M of embankments/bridges/roads are the following:

- The National Water Policy (NWPo, 1999), issued by the National Water Resources Council. The purpose of the NWPo is the comprehensive coordination of the water sector in Bangladesh. It establishes development principles aiming at the various institutions concerned, and promotes decentralization, stakeholder participation and information management, etc.
- The National Water Management Plan (NWMP, 2001) has been prepared by the Water Resources Planning Organization (WARPO) to implement the principles of the NWPo by coordinating the various actions of the concerned institutions.
- The Water Development Board Act of 2000, stipulates that the BWDB is in charge of the implementation and O&M of water resource units (flood protection, drainage and irrigation projects) above 1000 ha, and the LGED is in charge of units under 1000 ha.
- The "Guidelines for the Participatory Water Management" of 2000, prepared by the Ministry of Water Resources introduced the Water Management Organization (WMO) as a means to implement participatory management in water related projects with the objective to progressively hand-over the O&M of water related infrastructures from BWDB/LGED to beneficiaries.
- The Notification PC/TS/Classification Committee, 2003/11/06, specifies that the LGED implements the construction, operation and maintenance of local roads and bridges. Local roads include upazila (meaning 'sub-district') roads, union roads and village roads. Yet, village roads are managed jointly by LGED and the Local Government Institutions (LGIs) e.g Union Council (Union Parishad).

(1) Organization and Capacity for O&M at BWDB

(a) Organization and Staff

The organizational chart of BWDB is shown in Figure 6.2.1. The site offices (Divisions) in the target area of the project are coloured in red. Each Zone is managed by a Chief Engineer: Circle by Superintending Engineer and Division by an Executive Engineer. The actual number of BWDB personnel is 6,305 people (year 2015). However, the approved number is 8,935 people (6,305/8,935=approx.. 71%).

According to the Directorate of Staff Development of the BWDB, 1,340 personnel will be hired during FY2015/2016. Also, the approved number of personnel will soon be increased to 12,634 (under final approval) and 595 guards, or a total of 13,229 personnel. The personel of the O&M Division in the project target area are the following:

Table 6.2.2 Personnel of O&M Division of BWDB

Division	Approved Personnel	Actual No. Of Personnel	Cover Rate
Khulna O&M Division-1	84	56	67%
Khulna O&M Division-II	90	38	42%
Bagerhat O&M Division	90	40	44%
Satkhira O&M Division	93	41	44%
Satkhira O&M Division-II	83	41	49%
Barisal O&M Division	123	106	86%
Perojpur O&M Division	86	35	41%
Jhalokathi WD Division	76	12	16%
Barishal Mech.O&M Division(BIP)	78	66	85%
Patuakhali O&M Division	91	42	46%
Patuakhali (Kalapara) WD Division	76	17	22%
Barguna O&M Division	92	48	52%
Bhola O&M Division	89	44	49%
Bhola O&M Division-II	88	40	45%
Chittagonj O&M Division	94	63	67%
Chittagonj O&M Division-II	76	58	76%
Cox's bazaar O&M Division	103	56	54%
Noakhali O&M Division	79	58	73%
Total	1,595	861	54%

Source: BWDB, Directorate of Staff Development

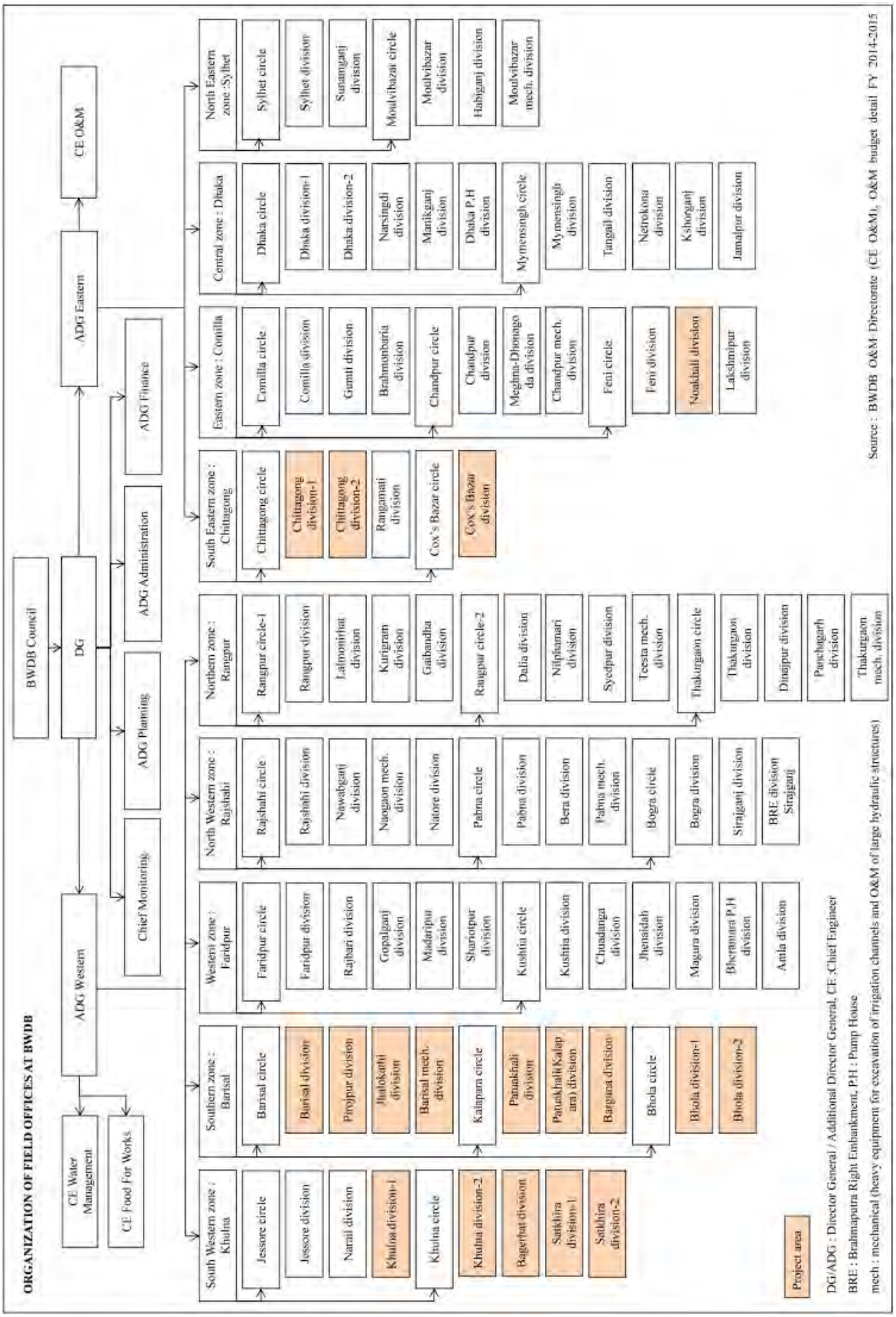
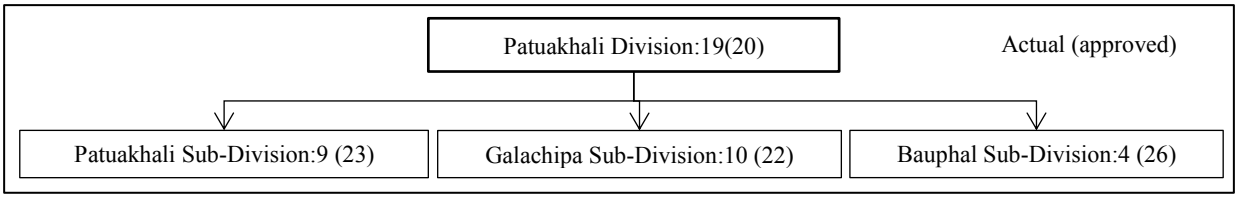


Figure 6.2.1 Organization of Field Offices at BWDB

The organization and staff of a typical O&M Division (ex: Patuakhali) are given on the figure below:



Source：BWDB, Patuakhali Executive Engineer

Figure 6.2.2 Organization and Staff of Typical O&M Division (e.g., Patuakhali)

The field offices are in charge of implementation of O&M works. The O&M Department is in charge of budget preparation and allocation, as shown in the figure below. The headquarters dispatches the available budget for O&M considering the requests of every division over the country.

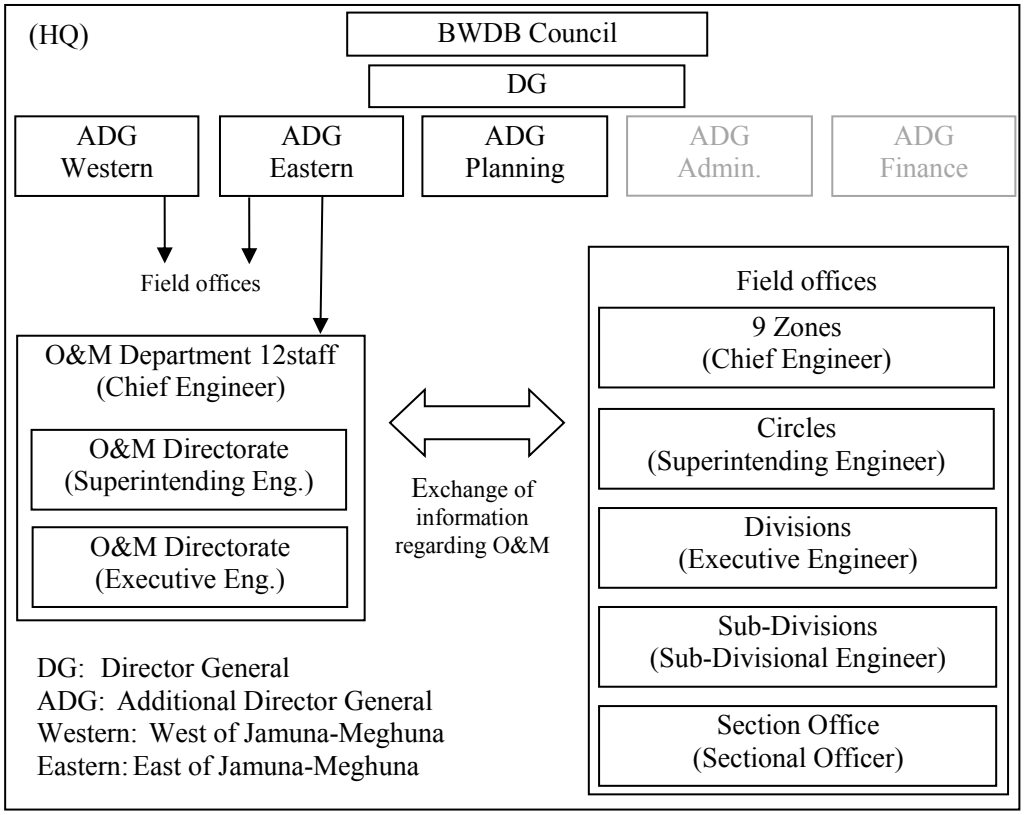


Figure 6.2.3 Organization for O&M at BWDB

The tasks of the O&M wing (ADG Western, ADG Eastern) are defined as follows:

(i) Preparing and updating of inventory of completed projects containing all basic project information.

(ii) Operation and maintenance of completed projects over 5000ha as outlined in the NWPO.

(iii) Providing management guidelines and necessary assistance to local and community organizations and the local governments for O&M of schemes with command area below 5000 ha.

(iv) Rehabilitation of projects under GOB funding and as directed by the Board from time to time.

(v) Transfer of rehabilitated/operating projects of 1000ha or below to the local governments.

(vi) Water management activities as indicated in the NWPO.

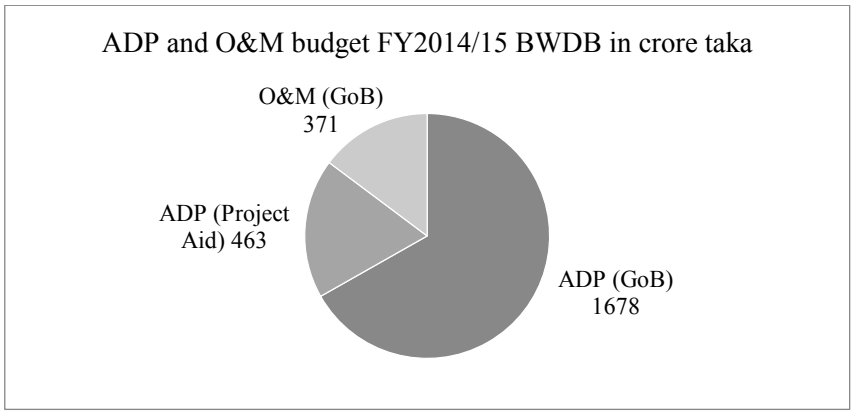
(vii) All activities under the Food for Works (FFW) programme.

(viii) Cost recovery, command area development and matters related to participatory water management.

(ix) Preventive work to foster all damage to water infrastructures due to natural disasters, damage assessment and emergency repairs following natural disasters.

(b) Budget

There are two main budgets for projects implementation at BWDB: i) the development budget which covers for the Annual Development Program (ADP); and ii) the O&M budget which covers for O&M works. The funding of projects from international cooperation (Project Aid) is managed through the development budget, even though components related to O&M works are included. For the financial year 2014/2015, the budget of BWDB is as shown in the figure below:



*the establishment budget (administration costs, wages, etc) is not included in the above
Source: BWDB Chief Monitoring, JICA Survey Team

Figure 6.2.4 Budget allocated to BWDB for FY2014/15 for Works

The budget for O&M in the 2014-15 fiscal year was 371 crore (meaning 'ten million') taka (5.9 billion yen) and used as follows:

(i)	Related to irrigation (routine):	43.86 crore taka	(12%)
(ii)	Related to rivers on international borders:	33.46 crore taka	(9%)
(iii)	Related to Haor area:	22.20 crore taka	(6%)
(iv)	Others (periodic maintenance):	234.47 crore taka	(63%)
(v)	Urgent recovery project	37.00 crore taka	(10%)

The beginning of the fiscal year from July to October is generally occupied by emergency works due to large floods coming from the upper basin of the main rivers and heavy rainfalls and cyclones. In November and December, the final program of periodic maintenance is established considering the pre-established program and also new priorities after the rainy season. The implementation of periodic

maintenance is done from January to June during the dry season and at the start of the rainy season before the water level in the rivers rises too much.

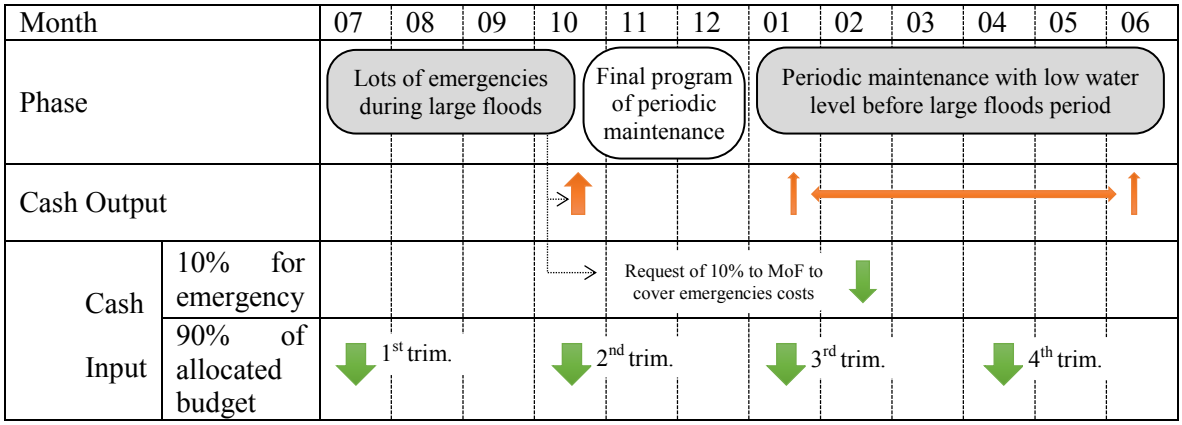
In order to provide financing for emergency maintenance works, 10% from the allocated O&M budget is kept by the Ministry of Finance as an emergency budget. The BWDB receives thus only 90% of the allocated O&M budget for the implementation of routine and periodic maintenance.

In order to apply for the use of the emergency budget, the BWDB shall produce necessary justifications of emergency works done within the year, the money is then transferred from Ministry of Finance to BWDB around March. Therefore, the emergency works often begin with the contactor's own fund and are later paid by BWDB after approval of these works and cash availability.

If the costs of the emergency works at national level go above the 10% reserve, the additional costs are either included in the revised budget (savings from actual tenders), exceptional re-allocation or programmed under the following fiscal year. Contractors may wait for several months before being fully paid for emergency works.

The embankment infrastructure of BWDB is generally weak regarding water disasters due to lack of maintenance; therefore, many damages occur during floods which leads to numerous emergency works. Consequently, the 10% reserve is generally fully used.

The cash flow of O&M activities around a typical year is summarized in the following figure.



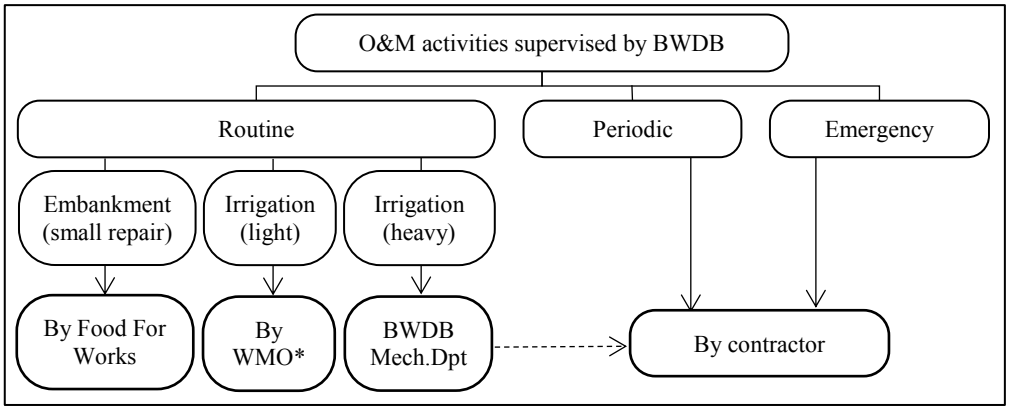
*routine maintenance is done all along the year with corresponding outputs

Figure 6.2.5 Cash Flow of O&M Works at BWDB

(c) Implementation of O&M

The O&M activities include routine maintenance, periodic maintenance and emergency maintenance. The routine maintenance is the day-to-day maintenance and operation of infrastructures (irrigation facilities and machinery, small repair of embankments, etc). The periodic maintenance is the heavy maintenance of a part of the infrastructure due to normal deterioration over time or due to unexpected deterioration by a natural disaster, for example. The emergency maintenance is a kind of maintenance

work aiming at avoiding the spread of damage due to an unexpected event like a flood or cyclone. The general categories of O&M activities are as shown in the following figure:



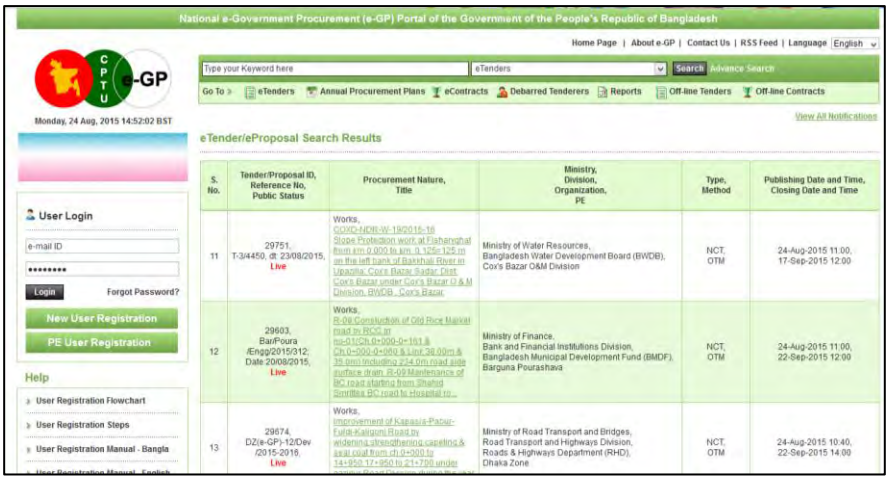
WMO: Water Management Organization (water and gate users group, etc.)

Source: BWDB Chief Monitoring, JICA Survey Team

Figure 6.2.6 Categories of O&M Activities at BWDB

The Food for Works programme was hiring local groups like Labor Contracting Society (women, landless people, etc.) to repair and maintain the surface of the embankments in exchange for food. However, the programme has not been working fully since 2006 and as a result, small repairs (surface repair, animal holes, etc.) are not done and the embankments are deteriorating at a faster rate.

The « Public Procurement Rules of 2008 » and related amendments (available at http://www.cptu.gov.bd/default.aspx) define procurement rules for public institutions in Bangladesh. The procurement of works at BWDB are implemented in accordance with these rules, mainly through the Open Tendering method for development projects and standard O&M projects. The Open Tendering method provides the highest degree of confidence with regard to compliance related risks by ensuring a high degree of transparency and competitiveness. Furthermore the tenders are implemented using the National e-Government Procurement (e-GP) Portal shown on the figure below, which improves further the quality of procedures .



Source: http://www.eprocure.gov.bd/aboutUs.jsp, accessed 15/08/24

Figure 6.2.7 Screenshot of e-GP Portal for Procurement of Works

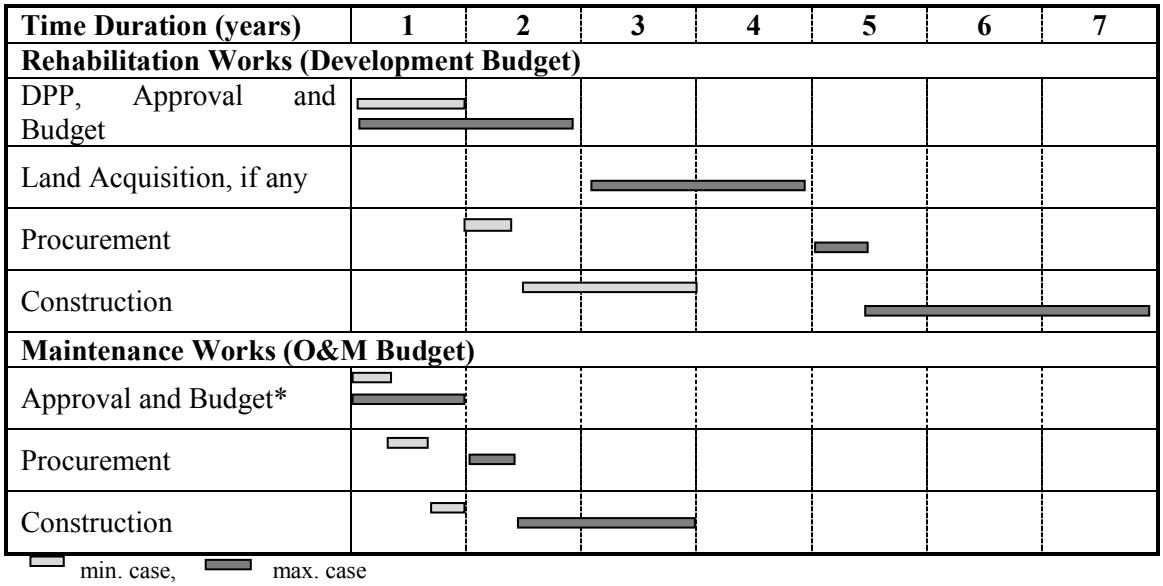
However, in order to quickly respond in case of emergency (e.g., breach of embankment during a flood event), the BWDB generally uses the Direct Procurement method, to eliminate the tendering period; so that the works can begin quicker. The maximum amount of a single contract under direct procurement is limited to 5 million taka (50 lacks) to reduce financial exposure linked to compliance risk.

These emergency works are centered on the reduction/mitigation of hazard. For example, in the case of an embankment breach, the emergency works consist of closing the breach (dumping of sandbags, etc.). The full repair of the breach and re-shaping of the embankment to its original state, is implemented later, as a complementary O&M project or development project. The planning of these complementary works begins after the end of the flood event.

At the BWDB, when an existing infrastructure (embankment, sluicegate, etc.) needs to be repaired, the corresponding works are either implemented under periodic maintenance (O&M budget) or as rehabilitation works under a development project (Annual Development Program budget). The choice between the two is made by considering the financial amount of the project as well as the importance of the needs (or risks associated with time).

Generally, a small financial amount (less than 10 million taka) with acute needs will tend to be implemented under an O&M project, whereas a large financial amount will be implemented as a development project. Indeed, an O&M project has a simpler and quicker assessment procedure and can thus be implemented faster. For a project with a large financial amount (over 10 million taka), the establishment of a DPP (Development Project Proposal) is preferred, together with in-depth studies to optimize the works. In that case, the works are implemented as a development project.

The time schedule associated with each type of project is summarized in the following figure, including the preparation phase (DPP, approval and budget allocation), land acquisition if necessary, procurement and construction:



*Depending on the date of project start within the financial year.

Source: BWDB Chief Monitoring, JICA Survey Team

Figure 6.2.8 Schedule of Maintenance/Rehabilitation Works at BWDB

According to the figure above, the implementation time for a rehabilitation project is from 3 to 7 years; whereas, the implementation time for a maintenance project is from 1 to 3 years. Emergency projects are generally implemented over several weeks.

(d) Participatory Water Management

Pertaining to the Bangladesh Water Development Board Act of 2000, the BWDB is in charge of the implementation and O&M of water resource units (flood protection, drainage and irrigation projects) above 1000 ha, and the LGED is in charge of units under 1000 ha. The participatory management of these units is defined by the Guidelines for Participatory Water Management, 2000. These guidelines introduce the Water Management Organization (WMO) as a means to implement participatory management with the objectives and organization defined in the following table. However, the implementation progress of the WMO varies by locality.

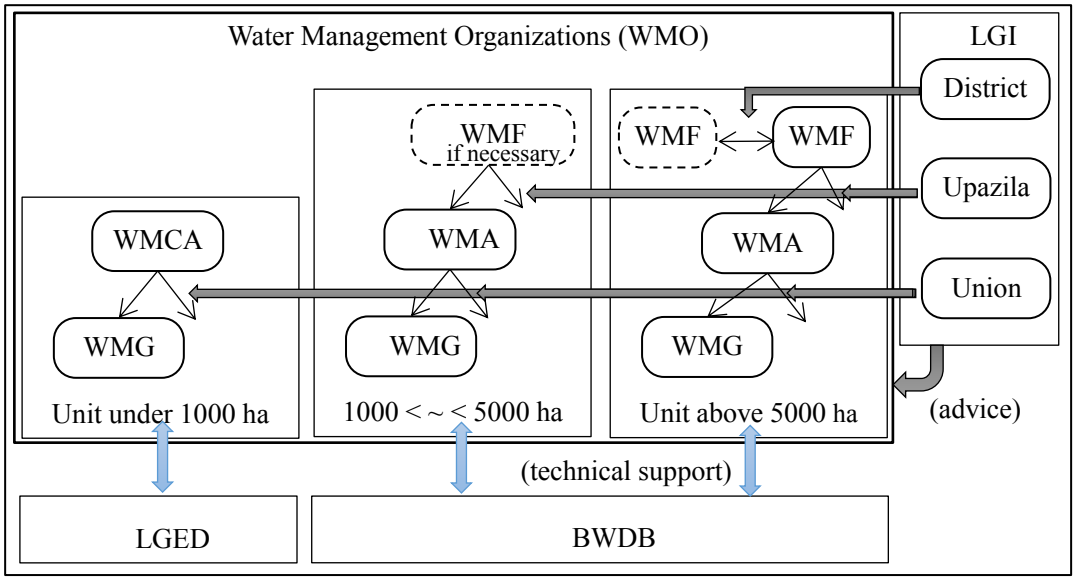
Table 6.2.3 Objectives and Organization of Participatory Water Management

Unit	Present organization	Objectives
Water Resource Units* under 1000ha	Property: LGED O&M: LGED+beneficiaries	Property: LGI (local institutions) O&M: WMO (beneficiaries)
Water Resource Units from 1000ha to 5000ha	Property: BWDB O&M: BWDB+beneficiaries	Property: BWDB O&M: LGI (local institutions) + WMO (beneficiaries)
Water Resource Units above 5000ha		Property: BWDB O&M: [BWDB + LGI (local institutions) + WMO(beneficiaries)] or private sector

*embankments, hydraulic structures, etc.

Source: Guidelines for Participatory Water Management, 2000

A WMO includes the Water Management Group (WMG), the Water Management Association (WMA, or WMCA for Water Management Cooperative Association), and the Water Management Federation (WMF). The members of the WMO are the women and men belonging to the households of farmers, fishermen, small traders, craftsmen, boatmen, landless people, destitute women, and PAPs (project affected persons). WMO members are advised by representatives of the corresponding LGI, and they are working with the corresponding implementation agency. The organization of these groups depends on the size of the unit as shown on the figure below.



Source: Guidelines for Participatory Water Management, 2000

Figure 6.2.9 Organogram of Water Management Organizations

WMOs participate actively in the operation and maintenance of units, with the technical support of the LGED and BWDB. The main activities performed are:

- To prepare overall management, operation and maintenance plan of the unit;
- To prepare plan for routine and periodic maintenance of infrastructural facilities;
- To comprehend the O&M costs for the project;
- To implement production plans on agriculture, fishery, livestock, forestry, etc;
- To implement the environmental management plan; and
- To receive training from the implementing agency (LGED or BWDB) or NGO.

The WMOs contribute to O&M costs either in cash or in work to the projects. The progress of implementation of WMO throughout Bangladesh vary. In 2007, LGED had implemented 580 Small Scale Water Resource (SSWR = Unit under 1000 ha) and has received support from JICA to develop 215 more SSWR through the yen loan project "Small-Scale Water Resource Development Project". However, financing of WMO is still not clearly established and some implementation problems occur. In 2014 a complementary project was launched by JICA; namely, "Capacity Development Project for

Participatory Water Resources Management through Integrated Rural Development". At the BWDB, WMOs were implemented, mainly, in the area of major irrigation project areas (e.g., Teesta River Project, Ganges-Kobadak Project in Kushtia), and they seldom exist in coastal areas.

(e) Technical Level, Support Requirements

Pertaining to the Bangladesh Water Development Board Act, 2000, the BWDB is in charge of the implementation and O&M of water resource units (flood protection, drainage and irrigation projects) above 1000 ha. According to the BWDB annual report for 2013/2014, the infrastructures under its responsibility is as follows.

Table 6.2.4 List of Infrastructures under BWDB

Infrastructure	Quantity
Completed schemes (projects)	776
Surface areas protected by embankments	6.2 million ha
Irrigated surface areas	1.572 million ha
Large scale water gates	4 units
Surface areas reclaimed from rivers	0.102 million ha
Urban flood protection projects	22
Embankments	11,283 km
Irrigation channels	5,325 km
Hydraulic structures	14,597 units
Pumping stations	20 units
Closure dams	1,379 units
Bridges & Sluice gates	5,641 units
Rubber dams	5 units
Dredgers	34 units
Dredged rivers	167 km
Roads (paved & unpaved)	1,041 km

Source: BWDB Annual Report 2013/2014

BWDB has an extensive experience on projects with funding from internantional donors. For example, the BWDB is implementing the following projects with funds from JICA:

- Haor Flood Management and Livelihood Improvement Project; and
- The Project for Capacity Development of Management for Sustainable Water Related Infrastructure.

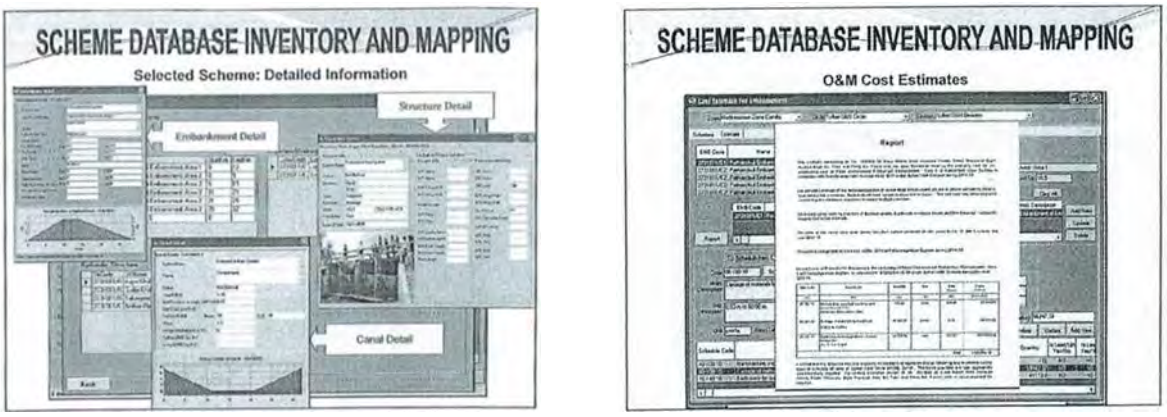
The guidelines related to O&M are the Guidelines for Operation and Maintenance of Permanent Structures under BWDB, 2010. These guidelines group the O&M works under 4 categories: (1) routine maintenance; (2) emergency maintenance; (3) periodic maintenance; and (4) flood related repair work, and give indications about maintenance plans and budgeting of projects.

There are also O&M manuals for use on particular projects financed by international donors (for example, WMIP). "The Project for Capacity Development of Management for Sustainable Water Related Infrastructure", which is financed by JICA, plans to prepare a maintenance manual for river structures based on these guidelines and previous manuals.

The procedure of selecting projects for maintenance activities is of particular importance because of the recurrent budget scarcity over recent years. For example, when prioritizing maintenance projects, the following items are taken into consideration:

1. Breach of embankment;
2. Hydraulic structures within embankments (gates and sluice gates); and
3. Maintenance of embankment (crest elevation, shape and slope protection).

However, the procedure above is implemented through paper-based application and the budgetary allocation is managed by the person in charge with the objective of keeping a balance among field offices. To ensure appropriate budget allocation and fairness, the Chief Monitoring Department of the BWDB has plans to develop a Scheme Information Management System (SIMS) based on the database of the Water Management Improvement Project (WMIP) financed by the World Bank.



Source: WMIP-IWM

Figure 6.2.10 Screenshot of SIMS under Development (WMIP)

The Training and Staff Development Department of BWDB is in charge of establishing the training program for all technicians and engineers. There are three main facilities in Bangladesh used by BWDB for the training of staff: the Kaptai Engineering Academy (Rangamati District), the Bhagakul Training Institute (Munshiganj District), and the Baradi Training Institute (Kushtia District).

These trainings aim at executive engineers, sub-divisional engineers, assistant engineers, etc.; and WMO or water users as well. These trainings occur all over the year and mobilize a large part of BWDB staff; for example, the Kaptai training program of 2015 include 16 sessions of 9 to 37 days, with an average of 20 persons per session (4008 trainee-days over the year). There are also cross-trainings with the Power Development Board for superintending engineers as well as trainings organized by the Central Procurement Unit or by the Planning Commission in Dhaka. Finally, several training programs are undertaken within donor projects (ECCRP, CEIP, WMIP, etc.).

Considering "The Project for Capacity Development of Management for Sustainable Water Related Infrastructure" and the on-going Water Management Improvement Project Database Development Project at BWDB, it is understood that additional support in the frame of this project is not required.

(2) Organization and Capacity for O&M at LGED

(a) Organization and Staff

According to the annual report of the LGED for the 2013/2014 fiscal year, the number of employees is 11,068, including 217 in the headquarters, 126 in 14 circles, 1,282 in districts, 9,211 in upazilas and the remaining 449 in other offices.

The unit managing the O&M activities within the LGED is the Road Maintenance and Road Safety Unit (RMRSU). The organization of the RMRSU is shown in the following Figure 6.2.11. Through the use of the Road and Structure Database Management System (RSDMS), the RMRSU gathers and evaluates the needs of O&M and allocates the available budget to the district offices.

The main missions of the RMRSU are as follows:

a. To attain higher economic growth, increase productivity, poverty reduction and social development through proper and timely maintenance of rural road and road structures that reduces the rate of deterioration, lowering vehicle operating costs;
b. To keep the road open continuously;
c. To improve the road safety concerns; and
d. To mitigate environmental and social aspect, etc.

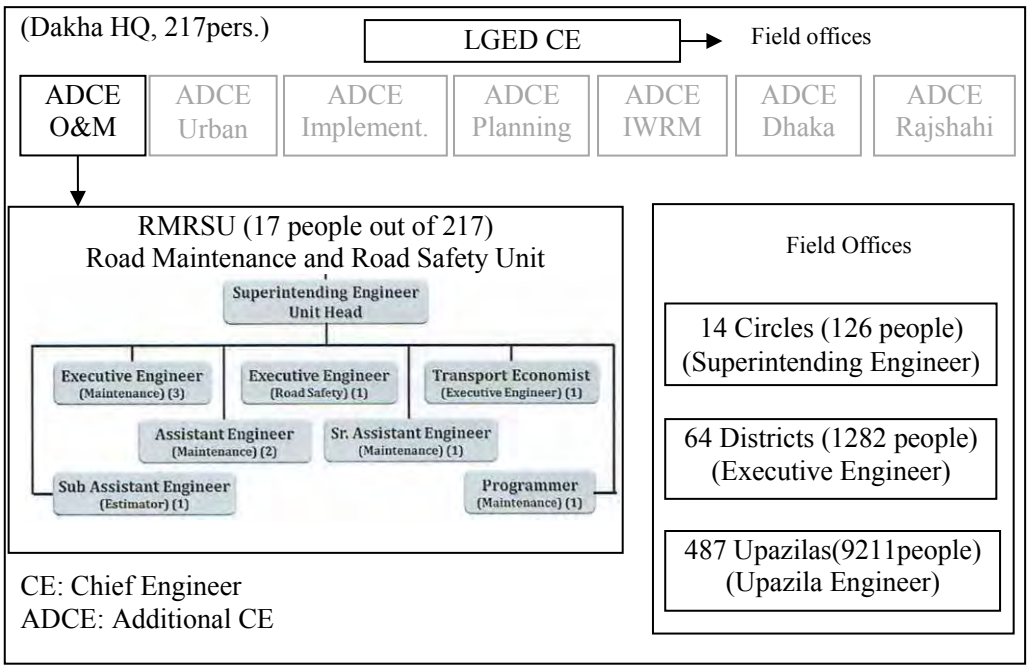


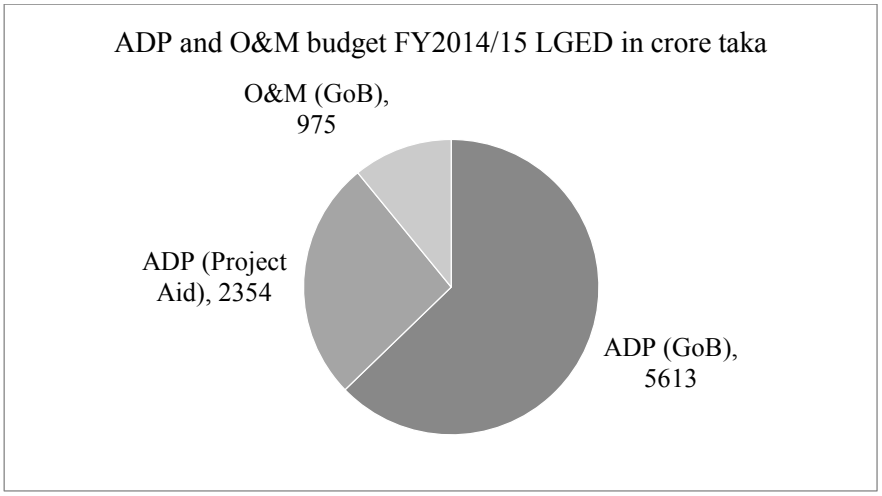
Figure 6.2.11 Organization for O&M in LGED

(b) Budget

Similar to the BWDB, there are two main budgets for project implementation at LGED: 1) the development budget for the Annual Development Program (ADP); and 2) the O&M budget for the O&M works. The funding of projects from international cooperation (Project Aid) is managed through the development budget, even though components related to O&M works are included. The

development budget covers activities of rural roads and bridges development and rural infrastructure development (market, school, cyclone shelters, town office, small irrigation projects, etc.).

For the fiscal year 2014/2015, the budget of LGED is as shown in the figure below:



*The establishment budget (administration costs, wages, etc.) is not included in the above

Source: LGED Monitoring Unit, JICA Survey Team

Figure 6.2.12 Budget allocated to LGED for FY2014/15 for Works

The O&M budget used in LGED is for four work categories: (1) routine (off-pavement) maintenance; (2) routine (on-pavement) maintenance; (3) periodic maintenance; and (4) emergency maintenance.

For the 2014-15 fiscal year, the O&M budget was raised to 975 crore taka (15.5 billion yen) and used as follows:

(1) Routine (off-pavement): 25 crore taka (2.6%)

(2) Routine (on-pavement): 4 crore taka (0.4%)

(3) Periodic maintenance: 938 crore taka (96.2%)

(4) Emergency maintenance: 8 crore taka (0.8%)

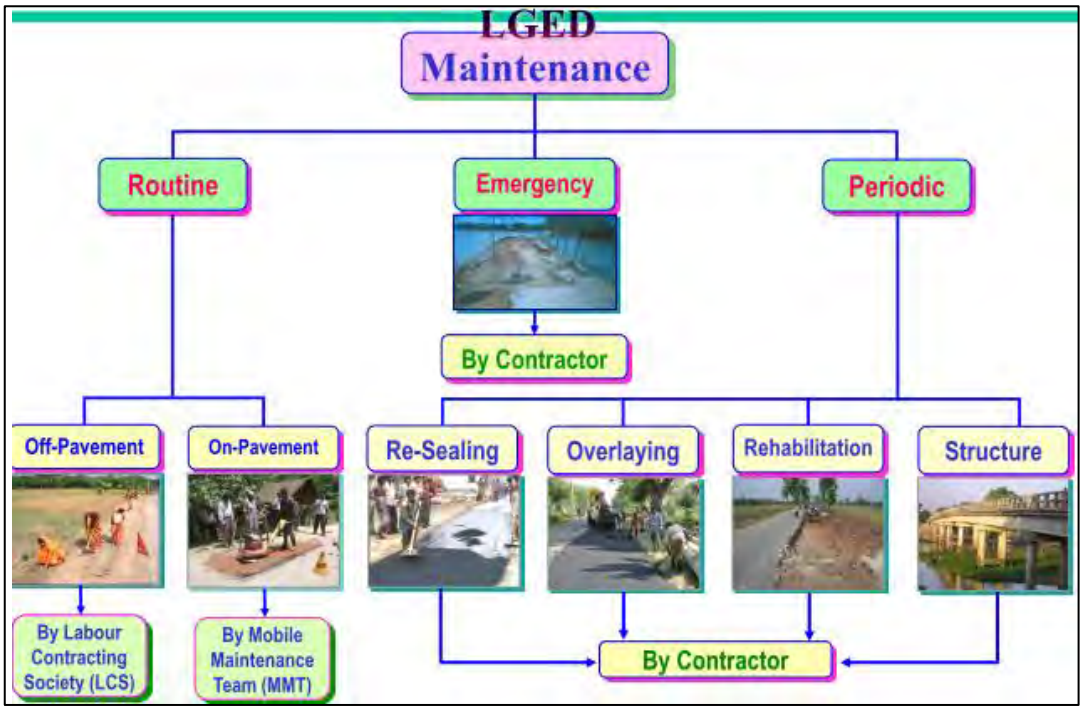
The cash flow of LGED is similar to the cash flow of BWDB, since most of the emergencies occur at the beginning of the fiscal year due to the large scale floods from July to September causing water to flow over roads which leads to road disconnection by embankment erosion (road disconnection is also caused by other reasons like landslides in Chittagong hills due to heavy rainfalls, etc.). Then the periodic maintenance is implemented during the dry season to facilitate the earth works and the access of construction equipment.

Like BWDB, 10% of the O&M budget of LGED is secured by the Ministry of Finance. This 10% reserve is generally fully used due to the sensitivity of infrastructures to disasters. In FY2014/15 emergency maintenance has been recorded as 0.8% of the budget, but the 10% reserve has been fully

used. Since the RMRSU records only the temporary works as emergency maintenance (sand bag dumping, etc) to re-establish the road connection. The complementary works to rehabilitate the corresponding road portion at its original state are recorded as periodic maintenance, but the costs of these works are financed from the 10% reserve for emergency maintenance.

(c) Implementation of O&M

The O&M activities at LGED include routine maintenance, periodic maintenance and emergency maintenance. The routine maintenance is about the maintenance of road (off-pavement) and the patch maintenance of road pavement (on-pavement). The off-pavement maintenance is done by the Labour Contracting Society (LCS) generally formed by a group of local women, and consists of cutting grass or light repairs like animal holes. The on-pavement maintenance is done by LGED's own Mobile Maintenance Team (MTT) and consists of light repair of pavement like filling pot-holes or cracks. Emergency maintenance and periodic maintenance (re-sealing, overlaying, rehabilitation, structure) are done by contractors. The general categories of O&M activities are as shown in the following figure:



Source: LGED, RMRSU

Figure 6.2.13 Categories of Road and Structure O&M Activities at LGED

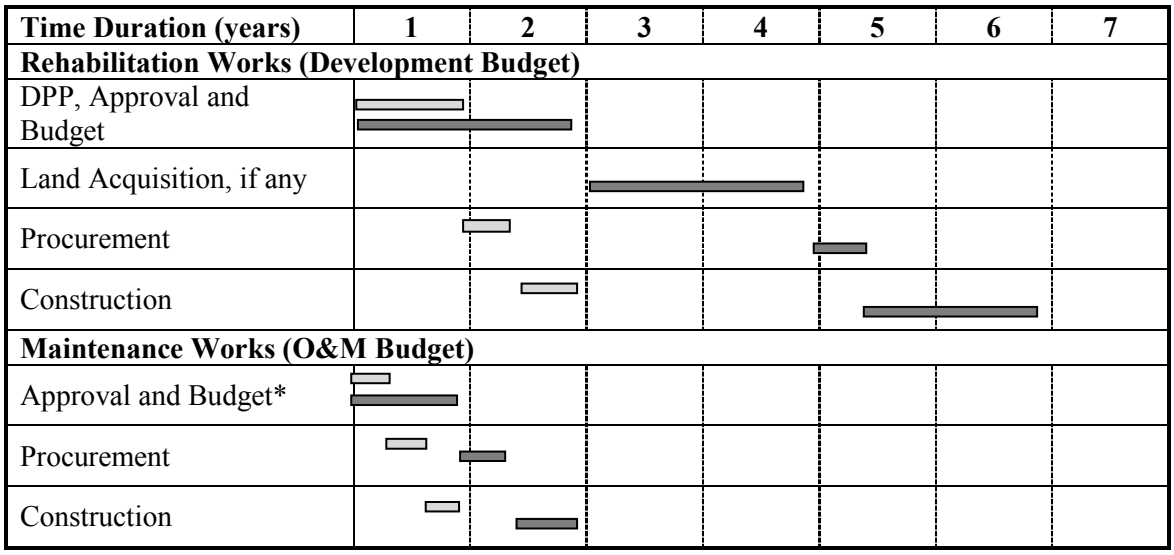
As in BWDB, the procurement of works at LGED occurs in accordance with the Public Procurement Rules, 2008 (PPR), mainly through the Open Tendering method for development projects and periodic maintenance projects. The off-pavement routine maintenance is implemented by LCS under the Direct Procurement Method. The on-pavement routine maintenance is done by LGED's own MMT (no need of procurement).

Emergency works are either implemented under the Open Tendering method using a reduced tendering time as allowed by the PPR, or if the costs are estimated to be less than 0.5 million taka, under Standard Request for Quotation to accelerate even more the start of the works. Unlike BWDB, LGED does not use Direct Procurement for emergency maintenance. One reason is that the damages can be surveyed only at the end of the disaster (for example in case of road submergence during flood), which gives enough time to avoid the need for Direct Procurement.

At LGED, the repair of existing infrastructures (road, culvert, bridge, etc.) is done under periodic maintenance in most of the cases, unless the specifications are changed (road widening, bridge type/length, etc.) in which case the works are implemented under the development budget as an ADP project.

In Bangladesh, there are cases where the crest of an embankment built by BWDB is used as a road built by LGED. Therefore, when these embankment roads suffer a disaster, the LGED is not able to rehabilitate the road until the BWDB has rehabilitated the concerned embankment section. This problem is recurrent, because of the budget insufficiencies of the BWDB.

The time schedule associated with each type of project is summarized in the figure below including the preparation phase (DPP, approval and budget allocation), land acquisition if necessary, procurement and construction:



*Depending on the date of project formulation within the financial year.

Source: LGED RMRSU, JICA Survey Team

Figure 6.2.14 Schedule of Maintenance/Rehabilitation Work at LGED

According to the figure above, the implementation time for a rehabilitation project is from 2 to 6 years; whereas, the implementation time for a maintenance project is from 1 to 2 years depending on the date of formulation within the financial year. Emergency projects are generally implemented over several weeks to a few months.

(d) Technical Level, Support Requirements

According to the Notification PC/TS/Classification Committee/06, 2003/11/06, the LGED implements the construction, operation and maintenance of local roads and bridges. Local roads include upazila (sub-district) roads, union roads and village roads. Yet, village roads are managed jointly by LGED and the Local Government Institutions (LGIs). The infrastructure (including road length and pavement ratio) under the responsibility of LGED is detailed in the following table.

Table 6.2.5 Road Infrastructure under LGED

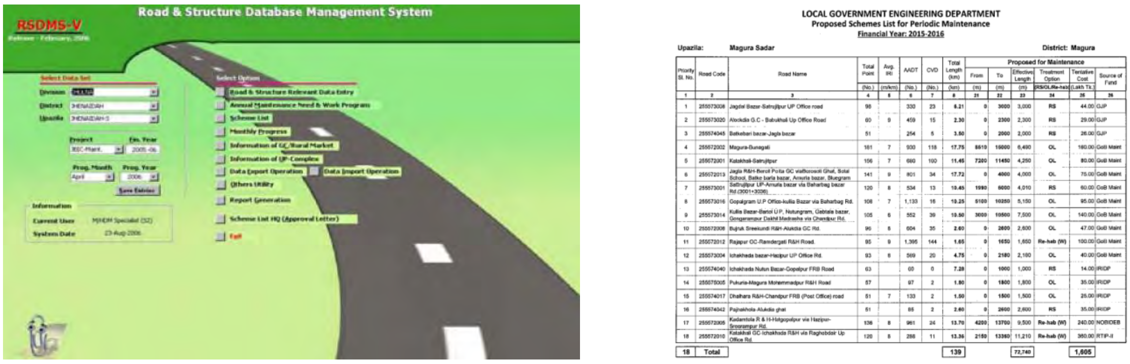
Road type	Cumulative Length	Proportion of Roads Paved	Length of structures (bridges & culverts)
Upazila road	37,334.86 km	80%	491,231m
Union road	44,202.03 km	51%	451,389m
Village road type A	111,340.87 km	8%	596,784m
Village road type B	111,501.55 km	20%	388,371m
Total	304,379.31 km	27%	1,927,775m

Source: LGED Website (www.lged.gov.bd)

LGED has an extensive experience on projects with funding from internantional donors. For example, the LGED is implementing the following projects with JICA funds:

- South-Western Bangladesh Rural Development Project
- Northern Bangladesh Integrated Development Project
- Haor Flood Management and Livelihood Improvement Project
- Inclusive City Governance Project
- Capacity Development Project for Participatory Water Resources Management through Integrated Rural Development

The guidelines related to the O&M activity of LGED is the "Guidelines for Implementation of Rural Roads and Culverts Maintenance Program, JICA-LGED 2010". The LGED has developed a comprehensive Road and Structure Database Management System (RSDMS) and uses it to establish maintenance plans and budget allocation. At the district level, the selection of maintenance projects for budget allocation is done by the District Disaster Management Committee (DDMC), considering the road category, the type of pavement, the traffic count and the maintenance record.



Source: LGED-RMRSU

Figure 6.2.15 Menu and Output Screen of RSDMS

In order to update the RSDMS database, several surveys are conducted as shown in the following table. The results of these surveys are entered into the database and updated maintenance plans are automatically established.

Table 6.2.6 O&M Site Surveys for Upazila and Union Roads

Survey	Frequency
Traffic count	Once in 2 years
International Roughness Index (IRI)	Once a year
Road conditions	Once a year
Structure conditions (bridges, culverts, etc.)	Once a year

Source: LGED－RMRSU

The training program at LGED is established every year by the Training Unit (TU). The trainings aim at LGED officers, staff including project staff, LGI representatives and other concerned stakeholders or beneficiaries for the smooth implementation of activities. The facilities are the Central Training Unit (CTU) in Dhaka and 14 decentralized Regional Training Centres. For example, in FY2014/15 the CTU has provided 47 training sessions for a total of 1,149 participants and 5,106 trainee-days. In addition to training courses conducted by the TU, donor development projects also implement courses and provide support to the TU.

Considering the above, it is understood that additional support in the frame of this project is not required.

(3) O&M Capacity Assessment

(a) O&M Cost

The annual O&M costs for the sub-projects of Component 1 are BDT 23,787,000 (BWDB: BDT 15,646,000; LGED: BDT 8,141,000)[14]. The details by sub-project are as follows:

[14] Resulting from cost data analysis of the past infrastructure projects, O & M cost is approx. 0.5 % of construction cost of embankment, 0.2 % of that of sluice gate, 1.2 % of that of road and 0.1 % of that of bridge.

Table 6.2.7 O&M Cost Summary for Component 1

Confidential

Table 6.2.8 O&M Cost Details for Component 1

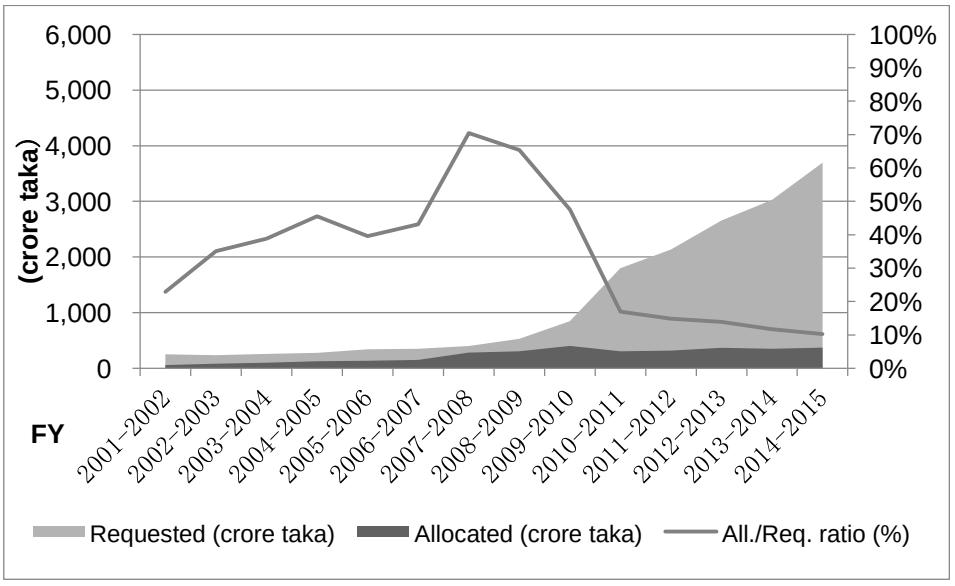
Confidential

Confidential

(b) O&M Capacity Assessment

a) BWDB

The budget allocated by the GOB for O&M activities of BWDB is far less than the requested budget, as shown in the following Figure 6.2.16 (about 10.24% for the current financial year). However, some of the O&M projects are implemented by international donors (CEIP, ECRRP, BlueGold, etc.), and some others are implemented under the development budget of the BWDB.



Source: BWDB O&M Directorate, JICA Survey Team

Figure 6.2.16 Annual O&M Budget of BWDB for 2001/02 to 2014/15 Financial Years (FY)

The national O&M budget is as per the above Figure 6.2.16. The Division of Patuakhali, for example, has requested a budget of 13.26 crore taka for the 2014/2015 financial year and has been allocated 4.13 crore taka (about 31%).

The O&M costs of the BWDB sub-project of Component 1 represents no more than 15,646,000/3,710,000,000=0.4% of the annual O&M budget of the BWDB. Taking into account of the annual growth rate of Bangladesh (>5%), it is estimated that a 0.4% increase of budget is

possible. The O&M fund of BWDB is very limited; hence, BWDB aims at developing a new source of O&M funds within GOB or with the assistance of international donors and through the participation of project beneficiaries with the development of WMO (Water Management Organization) and private sector initiative, following the Guidelines for Participatory Water Management, 2000.

b) LGED

As shown in the Figure 6.2.17 below, the O&M budget requested by LGED for the 2014-15 financial year was 4,826 crore taka (76.6 billion yen) and the allocated budget was approximately 20% of this amount (975 crore taka: 15.5 billion yen). However, similar to the BWDB, a large amount of O&M activities are undertaken through projects with funding by international donors (ECCRP, SRIIP, etc.) or as development project under ADP budget of the GOB.

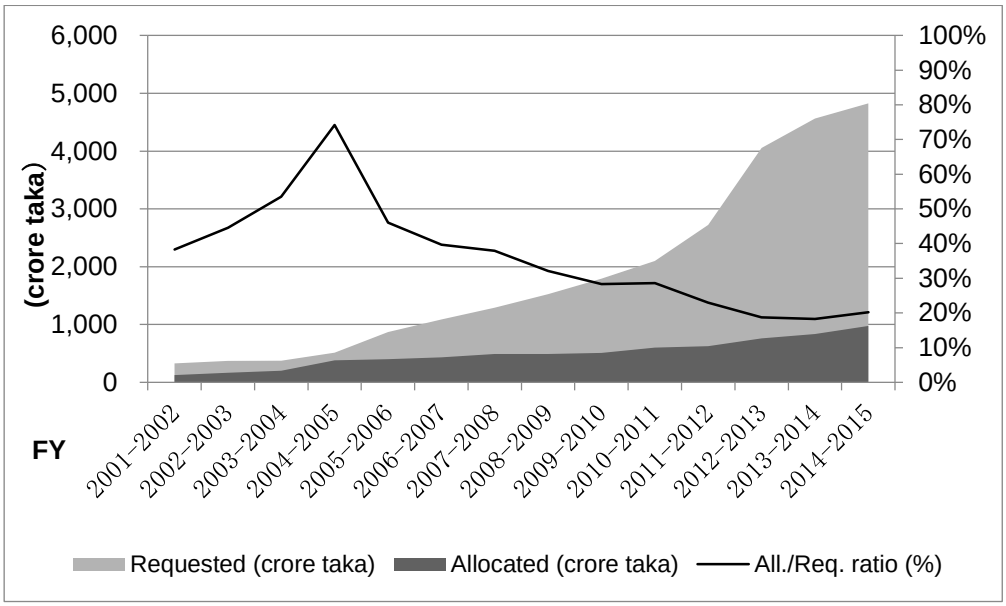


Figure 6.2.17 Annual O&M Budget of LGED for 2001/02 to 2014/15 Financial Years (FY)

The national O&M budget is as per the Figure 6.2.17 above. The District of Patuakhali, for example, was requested a budget of about 100 crore taka for the 2014/2015 fiscal year and was allocated 17.2 crore taka (about 17% of the requested amount).

The O&M costs of the LGED sub-project of the component 1 represents no more than 8,141,000/9,750,000,000=0.1% of the annual O&M budget of the BWDB. Taking into account of the annual growth rate of Bangladesh (>5%), it is estimated that a 0.1% increase of budget is possible. The O&M fund at LGED is not sufficient, however LGED aims at developing new resource of O&M fund within GOB, with the assistance of international donors or with the participation of beneficiaries through financing by Local Government Institutions (Union Parishad, Upazila Parishad, District Office).

6.2.2 Organization of O&M for Component 2

The O&M of equipment will be the responsability of the Department of Disaster Management (DDM) of the Ministry of Disaster Management and Relief and the Fire Service and Civil Defence (FSCD) of the Ministry of Home Affairs.

The plan and regulations related to the O&M of equipment under the management of DDM/FSCD are:

- DDM: Disaster Management Act of 2012. The Disaster Management Act establishes the DDM on its current organization under the MoDMR (previously, the Directrorate General of Relief and Rehabilitation under the Ministry of Food). Among its missions, the DDM shall organize the relief operations and distribution, the rehabilitation activities and support to vulnerable groups.
- FSCD: The Fire Act of 2003. The Fire Act defines the roles and responsabilities of the FSCD Directorate. The operational activities include: fire prevention and fighting, rescue activities, management of the ambulance service, repair and maintenance of equipment and tools, investigation, inspection, monitoring, and reporting to media.

(1) Organization and O&M Capacity of DDM

(a) Budget

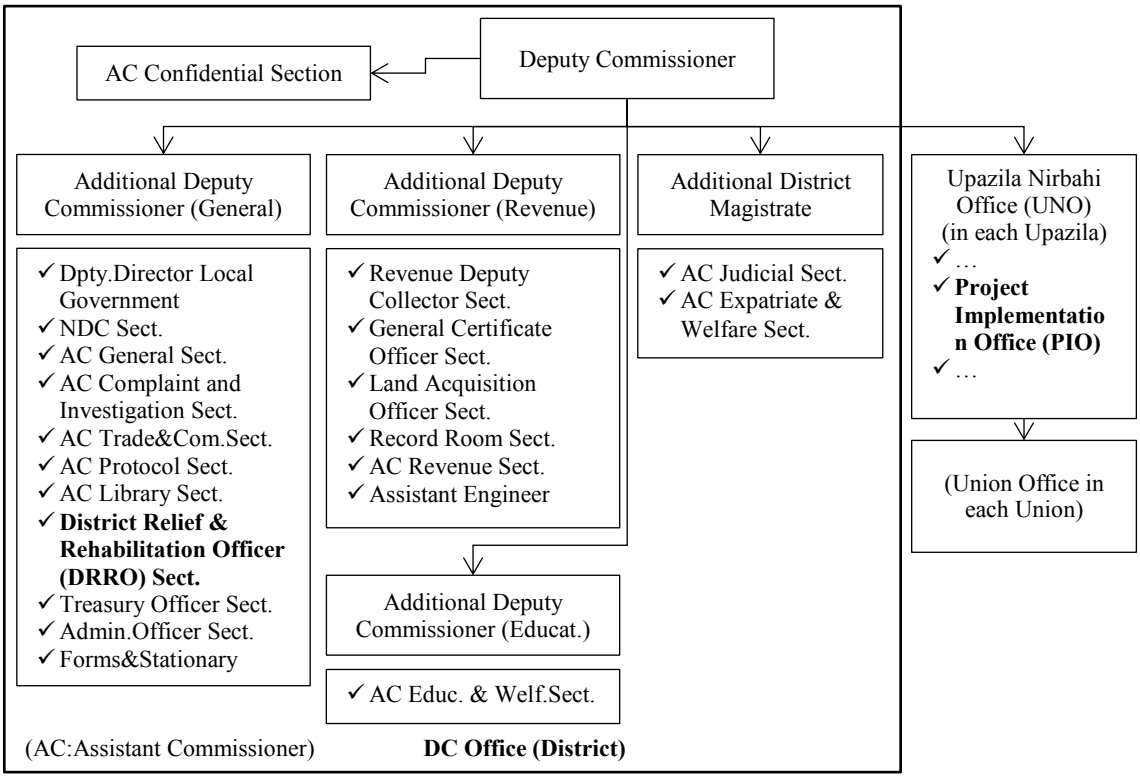
The organizational chart of the DDM is given in Section 5.2. The revenue budget of the DDM and actual expenditures in recent years are as follows:

Table 6.2.9 Revenue Budget of DDM and Actual Expenditures in Recent Years

Unit: Thousand BDT

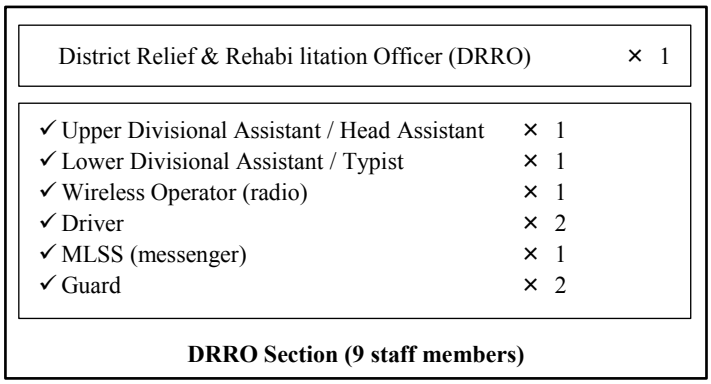
Organization	Budget	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14	FY 2014/15
DDM	Revenue	87,133	88,680	113,022	120,433	127,659
	Expenditure	85,245	85,789	106,062	107,684	-
District Offices	Revenue	107,749	121,329	123,306	144,225	150,877
	Expenditure	102,469	115,909	117,846	137,514	
Upazilla Offices	Revenue	233,367	259,388	264,989	313,912	378,616
	Expenditure	219,250	258,658	260,308	302,129	-

The equipment planned to be procured for DDM are mainly water disaster rescue boats and emergency communication systems (HF wireless). DDM implements the O&M of its equipment by the DRRO, through the District Commissioner Office (DC Office) of the project area (12 districts). The small-scale equipment (Megaphon, first aid kit, etc.) are used at District and Upazila levels by the DRRO and the PIO (Project Implementation Officer). Among the activities of the DRRO and the PIO, there is the support to the volonteers of the CPP (Cyclone Prepardness Program).



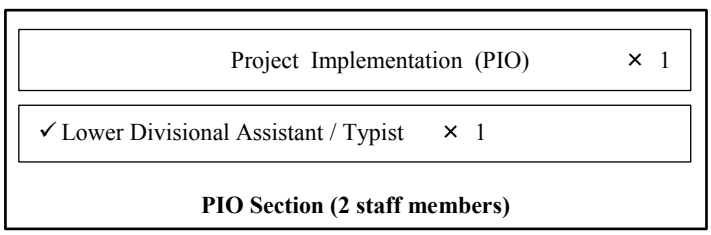
Source: Patuakhali District DC Office (http://www.patuakhali.gov.bd)

Figure 6.2.18 Organization of the DC Office (Patuakhali District)



Source: DDM

Figure 6.2.19 DRRO Section



Source: DDM

Figure 6.2.20 PIO Section

a) Boats

The following table shows the number of boats that are currently owned and operated by DDM (stored by DRRO).

Table 6.2.10 Boats owned by DDM (Stored by DRRO)

Equipment	Number in Operation	Remarks
Rescue boat	23 (nationwide)	Only 23 out of 80 owned boats are operational; the other 57 have been broken down or too deteriorated to operate.
Ambulance boat	6	ECCRP procurement (2015/02/10, small marine rescue boats (12) are being procured)

Source: DDM

b) Other Equipment

Upon conducting telephone surveys with DRRO offices in 12 districts, six offices gave responses. The following table shows the inventory of equipment held by these offices.

Table 6.2.11 Equipment held by DRRO Offices

DRRO Office	HF base set	VHF base set	Portable generator	Megaphone	Siren	First aid kit	Life jacket
Barguna	0	1 (Broken down)	0	2	1 (Broken down)	2	12
Patuakhali	1	1	1	Numerous	Numerous	Numerous	Numerous
Bhola	0	0	0	1 (Broken down)	0	0	0
Barisal	0	1	1 (Broken down)	2	1	1	2
Noakhali	0	0	0	1 (Broken down)	0	0	1
Chittagong	0	0	0	1	1 (Broken down)	Numerous	12

Source: Telephone survey by the Study Team

(b) Maintenance System

a) Boats

Concerning boat maintenance, boat engines are operated and checked each morning. Moreover, because DDM has no directly managed repair workshops, repairs are entrusted to private workshops whenever breakdown occur. The DRROs (DCs) invoice DDM for the repair costs.

b) Other Equipment

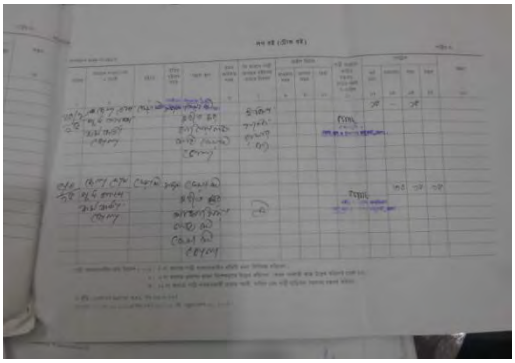
When parts wear out and need to be replaced and so on, the manufacturers are requested to conduct repairs. DDM does not keep any stock of replacement parts, etc.

Figure 6.2.21 DDM Boats (Chandpur District) (Left) Rescue Boat, (Right) Ambulance Boat, (Behind) FSCD Fire Float

(c) Management Structure

a) Boats

Rescue boats are stored and managed at pontoons via the DC offices under the responsibility of DRRO officers. The DRRO offices do not employ personnel (drivers, crew) who can operate the rescue boats, etc.; however, the DC offices provide such personnel, while the DDM bears the personnel expenses, fuel costs and maintenance costs.



Boat operating Logbook (DRRO Bhola)

Logbook such as that shown on the right are used to manage boats, and these contain records concerning date, operating time, purpose of use, fuel consumption and operating distance.

Upon conducting telephone surveys with DRRO offices in 12 districts, two offices gave responses. The following table shows the annual number dispatch days of rescue boats according to the information obtained from the DRRO offices.

Table 6.2.12 Annual Dispatch Days of Rescue Boats at Each DRRO Office (2010~2014)

District	2010	2011	2012	2013	2014
Barguna	23 days	20 days	21 days	19 days	20 days
Barisal	Unknown	10 days	10 days	10 days	5 days

Source: Telephone survey by the Study Team

b) Other Equipment

Equipment is supplied to the DRROs and PIOs via the DC offices, after which it is managed under the responsibility of the DRRO and PIO officers. Equipment is stored in the DRRO and PIO offices, where records are kept of items, quantities, etc. A wireless operator is assigned to each DRRO office, and he/she manages the telecommunications equipment including PIO wireless set that

belongs to each Upazila; however, due to breakdowns or lack of budget, wireless equipment is not assigned to the DRRO offices in many cases and the wireless operators are often engaged in work that is not related to their intended duties.

Table 6.2.13 Wireless Operators and Condition of Wireless Equipment in District DRRO

DRRO	Number of Wireless Operators	Wireless Equipment
1. Barisal	1	1
2. Patuakhali	1	2
3. Bhola	1	None
4. Bagerthat	1	Broken down
5. Barguna	1	Broken down
6. Jhalokathi	1	None
7. Pirojpur	1	Broken down
8. Khulna	1	Broken down
9. Satkhira	1	Broken down
10. Chittagong	1	None
11. Cox'x Bazar	1	None
12. Noakhali	1	None

Source: Telephone survey by the Study Team

(d) Method of Budget Allocation to Each Office

The budget that covers operation and maintenance costs is allocated to each DRRO via the following route: MoF→MoDMR→DDM→each DC. Budget requests are made in the previous year via the route of each DRRO→DC→DDM. After approval is given by the DG of the DDM, the budget request is finally sent to the MoDMR. The DDM operating budget (fuel costs) for the 23 DDM boats currently in operation in 2015/16 is BDT 2,500,000, and the maintenance budget, not including personnel costs, is BDT 6,000,000.

The following table shows the budget requests from each DRRO office to the DRRO HQ, as well as the amounts that are actually distributed to the DRRO offices. Disparities can be seen regarding the percentages of actual budget allocations. In particular, concerning maintenance cost items, the three DRROs of Bagerhat, Barguna and Patuakhali make larger budget requests than the other DRROs; however, only around half of the requested amount is actually allocated.

Table 6.2.14 Budget Requests and Allocated Amounts (Khulna Division 2015-2016)

BDT

Sl. No.	Name of the DRRO	2014-15 Actual request budget		2014-15 distribute budget by DDM		percentage	
		Petrol & Lubricant	Operation& Maintenance	Petrol & Lubricant	Operation& Maintenance	Petrol & Lubricant	Operation& Maintenance
1	Khulna	50,000.00	100,000.00	50,000.00	100,000.00	100%	100%
2	Satkhihra	50,000.00	75,000.00	50,000.00	50,000.00	100%	67%
3	Bagerhat	100,000.00	100,000.00	75,000.00	50,000.00	75%	50%
4	Barguna	100,000.00	305,000.00	75,000.00	150,000.00	75%	49%
5	Patuakhali	70,000.00	400,000.00	50,000.00	200,000.00	71%	50%
6	Pirojpur	80,000.00	70,000.00	50,000.00	50,000.00	63%	71%
7	Jhalokhathi	70,000.00	–	50,000.00	–	71%	—
8	Bhola	100,000.00	80,000.00	60,000.00	80,000.00	60%	100%
9	Barisal	50,000.00	–	50,000.00	–	100%	—
10	Noakhali	100,000.00	300,000.00	100,000.00	200,000.00	100%	67%
11	Chittagong	100,000.00	250,000.00	100,000.00	200,000.00	100%	80%
12	Cox's Bazar	50,000.00	80,000.00	50,000.00	80,000.00	100%	100%

(e) Management Condition of Wireless and Rescue Boats

Results of survey at Bagerhat DC Office, DRRO (implemented in June 2015)

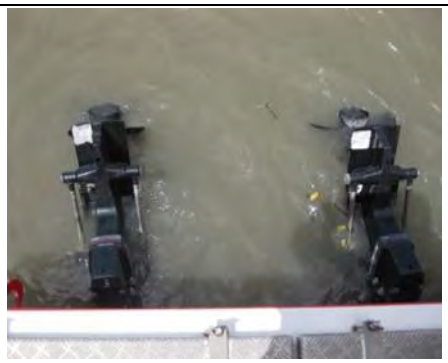
The office owns one speedboat that was provided under assistance from the Netherlands in 2014 and it keeps this moored at Vayrab River. One of the boat's two engines have broken down. The boat has not yet been dispatched for emergency. The DM office also has one speedboat. The boat appears to be in relatively good condition; however, the engine cannot receive repairs due to shortage of budget.

Bagerhat DC Office
(DRRO Office on the 3rd floor)

Disaster response poster 2015

Bagerhat DRRO and Upazila Bagerhat PIO officer

Bagerhat DRRO

	
The left screw engine is broken down	Broken down engine
	
Interview with the Upazila Bagerhat PIO officer with handy microphone speakers (2)	Speed boat managed by Bagerhat DC Office
	
Speed boat managed by Bagerhat	Speed boat cabin (for 6 people)
	
Patuakhali DC Office	Interviews at Patuakhali DC Office

(2) FSCD Operation and Maintenance System and Capacity

(a) Budget

FSCD has 8,254 employees, and its overall budget in recent years is as shown below.

Table 6.2.15 Overall Budget of FSCD in Recent Years

Fiscal Year	2010	2011	2012	2013	2014
Total Budget (Million BDT)	1,222.741	1,345.994	1,472.997	2,028.618	2,572.973

Source: FSCD

The FSCD equipment planned for procurement mainly consists of rescue boats and emergency telecommunications equipment (VHF wireless equipment). The FSCD divisions concerned with the target area (12 districts) are Khulna, Barisal and Chittagong. The following table shows the existing equipment of FSCD that is related to rescue boats and emergency telecommunications equipment.

Table 6.2.16 FSCD Equipment related to Water Disasters

Division	Fire Station	River Fire Station	Rescue Fire Float	Speed Boat	Life Jacket	No. of VHF Base Stations	No. of VHF Repeaters	No. of Walkie Talkies
Dhaka	80	5	2	1	110	35	4	120
Chittagong	66 (30 targeted)	2 (1 targeted)	1	0	40	22	2	20
Khulna	38 (14 target)	1 (1 target)	0	1	40	14	1	15
Rajshahi	43	0	0	0	0	11	1	10
Sylhet	19	0	0	0	0	17	1	20
Barisal	27 (27 target)	2 (2 target)	1	2	60	5	1	7
Rangpur	32	0	0	0	0	4	1	3
Total	305 (71 target)	10 (4 target)	4	4	250	108	11	195

Source: FSCD

Source: FSCD

Figure 6.2.22 Existing FSCD Boats (Dhaka District): Left: Fire Float, Right: Rescue Boat

(b) Maintenance system

a) Boats

Concerning boat maintenance, the River Fire Stations conduct trial operation four times a day and report the results to each FSCD Division control room by wireless. (The trial operation, which is conducted at 09:00, 12:00, 16:00 and 21:00, trials running the engine for two minutes and checking its condition).

The FSCD maintenance workshop is in charge of boat maintenance (engine repairs, procurement of spare parts, etc.). However, major repairs of boat hulls, etc. are conducted at the private sector Khulna Shipyard Company or the government-owned Narayanjonj Dockyard Company, both of which possess dock facilities.

The structure of the FSCD maintenance workshops is as follows:

Dhaka (central maintenance workshop): 67 employees; Chittagong: 26 employees, Rajshahi: 26 employees, Khulna: 26 employees, Rangpur: 12 employees. The workshops at Barisal and Sylhet are currently planned and under construction, and Dhaka Workshop is acting for them.

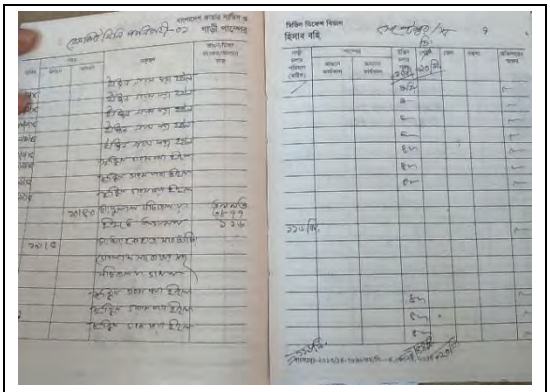
b) Other equipment

Parts for wireless equipment, etc. (not including field communication vehicles) can be ordered and obtained through the agents and suppliers of Japanese equipment manufacturers based in Dhaka. Parts arrive in 1~2 months when delivered by boat and around 2 weeks when delivered by air (according to interviews with makers/suppliers based in Dhaka (two companies that started business in 1972 and 2000)). Moreover, each FSCD can perform minor equipment repairs and battery charging and so on.

(c) Management System:

a) Boats

Rescue boats are stored and managed at pontoons under the responsibility of the River Fire Station Senior Station Officer and Station Officer. Logbooks are used to manage boats, and these contain records concerning date, operating time, purpose of use, fuel consumption and operating distance. These results are submitted to the FSCD Division to which each River Fire Station is affiliated once per month.



Boat Operating Ledger (FSCD Dhaka)

The following tables show the recent rescue dispatch record of FSCD Barisal Division (rescue fire float and rescue speed boat).

Table 6.2.17 Yearly Operational Record of Rescue Fire Float and Rescue Speed Boat (Barisal River Station)

SL. No.	Year	Date of Operation	Type of Incident	Place of Incident	Victim Rescued		Remarks
					Alive	Dead	
Rescue Fire Float							
1)	2015	11/06/15	Launch Capsize	Monpura, Bhola	-	-	
Rescue Speed Boat							
1)	2014	09/03/14	River Accident	Beltola Kheyaghat, Bharishal	-	-	
2)	2014	03/05/14	Launch Capsize	Kalagachhi, Patuakhali	08	08	
3)	2014	06/09/14	River Break	Taltali Bridge, Barishal	01	-	
4)	2014	12/09/14	Launch Capsize	Charbaria, Barishal	02	-	
5)	2015	29/07/15	Launch Capsize	Charbaria, Barishal	-	-	

Source: FSCD

The following table shows the employer number of four river fire stations in the target area. Each fire station has enough personnel assigned to operate one rescue fire float and one rescue speed boat.

FSCD fire stations are categorized into three types according to size: Class A, which has 35 employees, Class B, which has 27, and Class C, which has 16. There are also plans to create a Class S that has 52 employees.

Moreover, FSCD is currently implementing a plan to establish an additional 156 fire stations by 2016 and it is currently recruiting new personnel. There is concern, however, over issues of land acquisition for construction of the fire stations, and whether or not the construction work can be finished by 2016.

Table 6.2.18 Personnel and Equipment of FSCD Fire Stations in the Target Area

Equipment	Chittagong (sea going)	Barisal (Barisal)	Barisal (Patuakhali)	Khulna
Existing Employees				
Total	16	16	17	18
Existing Equipment				
Rescue fire float	0	1	0	0
Rescue speed boat	0	1	1	1

Source: FSCD

b) Other equipment

FSCD equipment apart from boats is initially held in the Central Store at FSCD Headquarters, where the types and quantities of equipment are controlled in a logbook. The logbook is used to

keep a record of the types and quantities of equipment that are brought into the Central Store, the dates they are brought in, and the names, quantities and dates of equipment deliveries to local FSCD Stations (there are 298 stations in Bangladesh).

The equipment including parts that are allocated to FSCD fire stations are stored in each fire station's warehouse and recorded according to each item. The frequency of use is managed in control logbook, which indicate whether equipment is in use, broken down or undergoing maintenance. The FSCDS station officers manage the logbook. Moreover, as with boats, the main equipment including wireless equipment undergoes operation checks four times a day, and the results are reported to the control room of each FSCD Division.

Incidentally, the effective operating rate of vehicles, etc. (approximately 500 fire engines, etc.) at Dhaka Workshop is 92% (according to the results of hearings with maintenance officers).

Equipment Ledger at FSCD Central Store

Equipment Storage Conditions at Central Store

Source: FSCD

Figure 6.2.23 Equipment Storage Condition at Central Store

(d) Method of Budget Allocation to Each Office

The operation and maintenance budget is allocated to each FSCD Station via the following route: MoF→MoHA→FSCD HQ→each FSCD Division. Budget requests are made in the previous year via the route of each FSCD Station→ Each FSCD Division→FSCD HQ. After approval is given by the DG of the FSCD HQ, the budget request is finally sent to the MoHA.

The current boat operating budget (fuel costs) is 55,000 BDT/month/boat for rescue fire floats and 30,000 BDT/month/boat for rescue speed boats. The following table shows the budget requests from Khulna Division and Barisal Division to FSCD HQ, as well as the amounts that are actually distributed. The allocated budgets represent 72% of the amount requested by Khulna and 76% of the amount requested by Barisal.

Table 6.2.19 Budget Requests and Allocated Amounts (Khulna Division 2015-2016)

BDT

Sl. No.	Financial code no. & Head	2015-16 Actual request budget from Khulna	2015-16 distribute budget by HQ	percentage
1	4501-Salary for officers	3,300,000.00	2,400,000.00	73%
2	4601-salary for r staff (without going)	88,000,000.00	70,000,000.00	80%
3	4701- Dearness Allowance	26,300,000.00	11,000,000.00	42%
4	4705-House rent	45,000,000.00	32,000,000.00	71%
5	4709- Recreation Allowance	2,440,000.00	3,000,000.00	123%
6	4713- Festival Bonus	15,300,000.00	13,000,000.00	85%
7	4717-Medical Allowance	8,100,000.00	7,200,000.00	89%
8	4755-Tifin Allowance	1,975,000.00	1,500,000.00	76%
9	4765- Transport Allowance	495,000.00	500,000.00	101%
10	4773-Edcation Allowance	1,480,000.00	1,300,000.00	88%
11	4781-Risk Allowance	26,000,000.00	21,500,000.00	83%
12	4795-Others Allowance (Award Allowance)	1,200,000.00	1,000,000.00	83%
13	4801-Travel Expenses	4,200,000.00	2,200,000.00	52%
14	4802-Transfar Expenses	720,000.00	500,000.00	69%
15	4810-Tax City corporation	1,110,000.00	800,000.00	72%
16	4811-Tax Land	35,000.00	20,000.00	57%
17	4815-Telegram	55,000.00	75,000.00	136%
18	4816-Telephone	630,000.00	400,000.00	63%
19	4818-Registration fee	1,000,000.00	600,000.00	60%
20	4819-Water	175,000.00	110,000.00	63%
21	4821-Electricity	3,800,000.00	3,200,000.00	84%
22	4823-Petrol and Lubricant	10,000,000.00	8,000,000.00	80%
23	4831-Books publication	40,000.00	5,000.00	13%
24	4840-Training	500,000.00	100,000.00	20%
25	4840- Bed	360,000.00	5,000.00	1%
26	4883-Honorarium Allowance	100,000.00	15,000.00	15%
27	4899-Others expenses (a)	2,100,000.00	466,300.00	22%
	(b)	1,233,706.00	1,233,700.00	100%
28	4901-Motor vehicle	490,000.00	100,000.00	20%
29	4911-Computer, office equipment	400,000.00	200,000.00	50%
30	4916-Equipment and machinery	6,200,000.00	-	0%
31	4955-Signal and wireless	100,000.00	30,000.00	30%
32	6815-Computer and equipment	890,000.00	250,000.00	28%
33	6821-Furniture	1,200,000.00	500,000.00	42%
34	Total	**254,928,706.00**	**183,210,000.00**	**72%**

Source: FSCD

Table 6.2.20 Budget Requests and Allocated Amounts (Barisal Division 2015-2016)

BDT

Sl. No.	Financial code no. & Head	2015-16 Actual request budget from Barisal	2015-16 distribute budget by HQ	percentage
1	4501-Salary for officers	1,600,000.00	1,200,000.00	75%
2	4601-salary for r staff	50,000,000.00	40,000,000.00	80%
3	4701- Dearness Allowance	15,000,000.00	5,000,000.00	33%
4	4705-House rent	20,000,000.00	18,500,000.00	93%
5	4709- Recreation Allowance	1,500,000.00	1,500,000.00	100%
6	4713- Festival Bonus	8,000,000.00	8,000,000.00	100%
7	4717-Medical Allowance	5,000,000.00	4,200,000.00	84%
8	4755-Tifin Allowance	950,000.00	900,000.00	95%
9	4765- Transport Allowance	950,000.00	150,000.00	16%
10	4773-Edcation Allowance	680,000.00	700,000.00	103%
11	4781-Risk Allowance	14,000,000.00	12,500,000.00	89%
12	4795-Others Allowance (Award Allowance)	550,000.00	600,000.00	109%
13	4801-Travel Expenses	2,300,000.00	1,300,000.00	57%
14	4802-Transfar Expenses	550,000.00	300,000.00	55%
15	4806-House Rent	350,000.00	350,000.00	100%
16	4810-Tax City corporation	2,030,000.00	1,150,000.00	57%
17	4811-Tax Land	4,000.00	5,000.00	125%
18	4815-Telegram	30,000.00	55,000.00	183%
19	4816-Telephone	450,000.00	350,000.00	78%
20	4818-Registration fee	1,330,000.00	400,000.00	30%
21	4819-Water	210,000.00	200,000.00	95%
22	4821-Electricity	2,100,000.00	2,000,000.00	95%
23	4823-Petrol and Lubricant	7,000,000.00	6,000,000.00	86%
24	4831-Books publication	10,000.00	4,000.00	40%
25	4840-Training	200,000.00	100,000.00	50%
26	4871- Bed	50,000.00	40,000.00	80%
27	4883-Honorarium Allowance	90,000.00	15,000.00	17%
28	4899-Others expenses (a)	1,000,000.00	297,600.00	30%
	(b)	1,202,600.00	1,202,400.00	100%
29	4901-Motor vehicle	400,000.00	80,000.00	20%
30	4911-Computer, office equipment	100,000.00	80,000.00	80%
31	4916-Equipment and machinery	2,500,000.00	-	0%
32	4955-Signal and wireless	-	-	0%
33	6815-Computer and equipment	1,000,000.00	180,000.00	18%
34	6821-Furniture	500,000.00	300,000.00	60%
35	Total	**141,636,600.00**	**107,659,000.00**	**76%**

Source: FSCD

(e) Management Condition of Wireless and Rescue Boats

Results of survey at FSCD Barisal River Fire Station, Patuakhali River Fire Station (implemented in June 2015)

FSCD Barisal currently has only one rescue fire float (one boat, 16m long x 5m wide, with no wireless equipment (station officers' mobile phones are the only available means of communication), manufactured in 1993), and one speed boat (one boat, 5m long x 1.5m wide, manufactured in 2009). This boat can only travel at speeds of 15 knots (normal time) and 25 knots (fastest), even though it was designed at 30~45 knots. According to the hearing at Barisal river fire station, the scope of service is limited and there is a need to improve the boat capability especialy for a speed and number of the boat. In addition, implement capacity building for the station officers is required, because they work on land normally. Maintenance conditions are deemed to be relatively good.

	
Barisal River Fire Station Office-FSCD	Rescue fire float and rescue speed boat (left)
	
Rescue speed boat	Rescue speed boat
	
Rescue fire float and FSCD manager	Rescue fire float

	
Rescue fire float siren and water canon	Rescue fire float-Barisal and steerage There is no wireless equipment

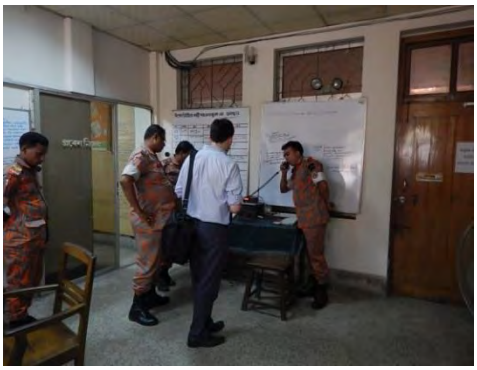
FSCD Patuakhali River Fire Station has one rescue speed boat. It has owned this since 2013 and also uses it to conduct emergency medical care services and so on for residents living on the opposite shore. In the hearing with Patuakhali River Fire Station, it was said that the boat's engine is in poor shape and the boat cannot be used during cyclones and other disasters. The staff members mentioned the need for training geared to the capacity building of rescue team members, because they work on land normally.

Maintenance conditions are deemed to be relatively good; however, the fire station cannot implement engine repairs due to the shortage of budget.

	
Patuakhali River Fire Station- FSCD	Rescue speed boat and jetty
	
Rescue speed boat	Rescue speed boat

FSCD Dakha Headquarters (implemented August 2015)

The following table shows the situation regarding use of VHF in FSCD Dakha Headquarters. The Dakha HQ telecommunications department conducts settings and adjustment of the VHF wireless equipment. FSCD has enough personnel to operate the VHF wireless equipment (not including field communication vehicles). Maintenance of the VHF wireless equipment (not including field communication vehicles) is implemented by the manufacturers as the need dictates. The FSCD telecommunications department can perform minor repairs and battery charging and so on for walkie-talkies. Maintenance conditions are deemed to be good.



From top left to bottom right: General view, control room with VHF, VHF (Vertex Standard), vehicle on-board VHF, electronics maintenance room, central workshop main room.

(3) Assessment of Operation and Maintenance System

(a) DDM

In light of the fact that wireless operators have been assigned to the DRROs, they are deemed to be capable of implementing operation and maintenance for HF wireless equipment.

The following tables show the costs, personnel and equipment that are deemed to be required in order to conduct operation and maintenance of the equipment planned for procurement in the Project.

Table 6.2.21 Necessary Costs of Operation and Maintenance in DDM

Item	Operation Unit Cost (year)	Maintenance Unit Cost (year)	Procured Quantity (Plan)	Annual Total (Operation)	Annual Total (Maintenance)	Unit Cost Reference
Rescue speed boat	2,500,000/23 boats = 108,696	6,000,000/23 boats = 260,870	12	1,304,352	3,130,440	DDM data

Table 6.2.22 Necessary Personnel for Operation and Maintenance in DDM

Item	Current Equipment Quantity	Procured Quantity (Plan)	Total Equipment Quantity	Required Operating Personnel	Current Personnel/ Equipment	Personnel/ Equipment Needs	Reference for Personnel/ Equipment Needs
Rescue speed boat	0	12	12	12	0	12	1 person/ boat 1driver by DC Office
Increase of operating budget (assuming average salary of 16,000BDT/month)						2,304,000	BDT/year

Based on the above calculations, the annual operation and maintenance cost of the boats planned for supply to DDM will be: BDT 3,130,440 + 1,304,352＝4,434,792. Since the cost in 2014/15 was BDT 6,000,000＋2,500,000 = 8,500,000, this represents an increase of approximately +52% (4,434,792/ 8,500,000). Also, the DC offices in the target districts will need to assign 12 boat operators (1 person per district).

Since the DDM revenue budget in 2014/15 was BDT 127,659,000, this represents an increase of approximately +3.5% (4,434,792/ 127,659,000).

Considering the growth rate (5% or more) of Bangladesh in recent years, an increase of 3.5 % is deemed to be affordable. Moreover, since it will be necessary to newly assign personnel (12 personnel to DC offices in the target districts) to operate the equipment, it will also be necessary to give these personnel training (HF wireless and boat operation). The following table shows the recommended training program.

Table 6.2.23 DDM Training Program for Component 2 (Plan)

Item	Scheduled Time and Duration	Training Contents	Officers on the Bangladesh Side
▪ HF wireless ▪ Related equipment	▪ When installing equipment at DRRO and PIO offices, 2 weeks ▪ 1 year following start of use, 1 week	▪ Handling of HF equipment ▪ Mechanism of telecommunications equipment ▪ Communications procedure at normal times and in emergencies	▪ Wireless operators at PIO, DRRO, DRRO offices (12x2+35 = 59 personnel) ▪ Staff (4 members) and executives (2) at Dhaka DDM ▪ Staff (4 members) and executives (2) at Dhaka MoDMR HQ ▪ Total approximately 71 members
▪ Rescue speed boat ▪ Related equipment	▪ When conducting trial operation at DC offices, 2 weeks	▪ Handling of equipment ▪ Boat operation at normal times (patrols) and in emergencies ▪ Boat maintenance (engines)	▪ DRRO and assistants at DC offices (2 x 12 members) ▪ Additional staff (drivers, 12 members) for operating boats ▪ Executives (4) at Dhaka HQ ▪ Total approximately 40 members

(b) FSCD

In light of the experience and capacity of the telecommunications department with the use of VHF wireless, the FSCD is deemed to be capable of conducting the operation and maintenance of the VHF wireless equipment.

The following table shows the costs and personnel required for the additional operation and maintenance of the following items to be procured in the Project.

- Boats: Rescue fire float, Rescue speed boat, Jiminy boat
- Field communication vehicles

Table 6.2.24 Necessary Costs for Operation and Maintenance of FSCD Equipment

Item	Operation Cost (monthly)	Mainten-ance Costs (monthly)	Number of Equip-ments	Total Operation Cost	Total Mainten-ance Cost	Reference for Costs
Rescue fire float	95,000	55,000	6	570,000	330,000	Data from FSCD
Rescue speed boat	65,000	30,000	12	780,000	360,000	Data from FSCD
Jiminy boat	65,000	30,000	12	780,000	360,000	Estimated to be the same as the rescue speed boat
Field communication vehicle	65,000	30,000	12	780,000	360,000	
			Total per month	2,910,000	1,410,000	BDT/month
			Total per year	**34,920,000**	**16,920,000**	BDT/year

Table 6.2.25 Additional Cost for O&M of FSCD Equipment

Item	Existing Equpt.	Proposed Equpt.	Total Equpt.	Staff Demand	Existing Staff	Staff Needed	Remarks
Rescue fire float	1	6	7	7×7= 49	Total for 4 river fire stations 67	(49+60+36) – 67 = 78	7 staff /1 float FSCD hearing
Rescue speed boat	3	12	15	15×4= 60			4 staff /1 float FSCD hearing
Jiminy boat	0	12	12	12×3= 36			3 staff / 1 boat driver 1, diver 2
Field communication vehicle	0	12	12	12×3= 36	0	36	3 staff / 1 boat driver 1, operator 2
					Total	**114**	staff
					Based on average staff salary of 16,000 BDT/month	**21,888,000**	BDT/year

Based on the above calculations, the increase in the annual operation and maintenance cost will be BDT16,920,000, and the increase in the overall budget (including operation and maintenance) will be 34,920,000+16,920,000+21,888,000 = BDT 73,728,000. Since the maintenance budget in 2014/15 was BDT 50,000,000, this represents an increase of approximately +34% (i.e.,16,920,000/50,000,000). For comparison, since the overall budget for 2014/15 was BDT 2,572,973,000, the increase is approximately +2.9% (i.e., 73,728,000 / 2,572,973,000).

Considering the growth rate of Bangladesh in recent years (5% or more), an increase of 2.9% is deemed to be affordable. In line with this, it will be necessary to assign new personnel (approximately 114 personnel) to operate the equipment.

The following table shows the recommended training program including the handling, operation and management of equipment.

Table 6.2.26 FSCD's Training Program for Component 2 (Plan)

Item	Scheduled Time and Duration	Training Contents	Officers on the Bangladesh Side
▪ VHF wireless ▪ Field communication vehicle ▪ Related equipment	▪ When installing equipment at river fire stations, 2 weeks	▪ Handling of VHF equipment ▪ Mechanism of telecommunication equipment ▪ Communications procedure at normal time and in emergency	▪ Fire station and division employees in the target area (112+3 persons) ▪ Additional staff for field communication vehicles (36 persons) ▪ Wireless unit (5 persons) and executives (4 persons) at Dhaka HQ ▪ Total: approx. 160 personnel
▪ Rescue fire float and sea going boat ▪ Rescue speed boat ▪ Jiminy boat ▪ Related equipment	▪ When installing equipment at river fire stations, 2 weeks	▪ Handling of equipment ▪ Boat operation at normal time (patrols) and in emergency ▪ Boat maintenance (engines, pumps)	▪ River station, division and workshop employees in the target area (67+3+3 persons) ▪ Additional staff for operating boats (Crew: 78 persons) ▪ Executive and workshop employees at Dhaka HQ (4+2 persons) ▪ Total: approx. 157 personnel

6.2.3 Organization of O&M for Component 3

The Project Implementation Unit (PIU), which will manage the "Disaster Recovery Fund for Quick and Effective Recovery and Reconstruction" in Component 3, will be three (3); namely, DDM PIU, LGED PIUand BWDB PIU.

DDM PIU will be headed by a Director of DDM as Project Director (PD). The day-to-day fund activities will be managed by the personnel of DDM under supervision of the PD. The O&M of the Fund itself (i.e., implementation of project, research of new funds, etc) is the responsibility of the three (3) PIUs. The O&M of the infrastructure implemented under the Fund will be the responsibility of the relevant authority (DDM, LGED, BWDB).

The Disaster Management Act of 2012 established the current organizations of the MoDMR and DDM. It defines the missions of MoDMR and DDM to organize the relief operations and distribution, the rehabilitation activities and support to vulnerable groups, etc. In addition to these activities, the DDM has the experience of implementation of infrastructure (e.g., unpaved roads, bridge and culverts of less than 15 meters long) in rural areas. The organization structure of the DDM PIU for Component 3 (Disaster Recovery Fund) is shown as follows:

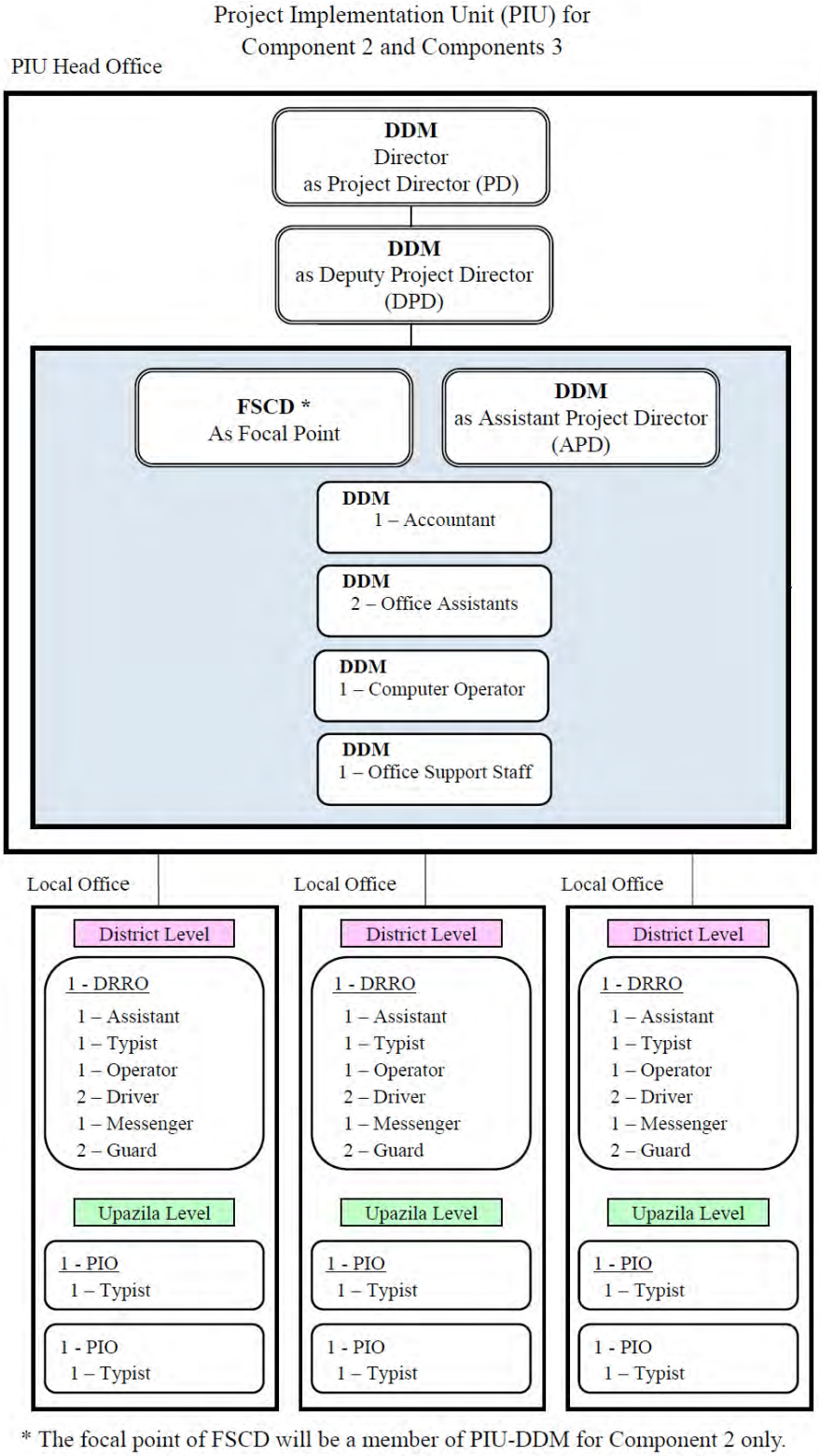


Figure 6.2.24 Organization Structure for Component 3

At present, the MoDMR has no specific O&M budget. The O&M costs of the infrastructures implemented under the Fund will be borne by the relevant authority: BWDB, LGED, etc. The Fund shall be allocated from time to time to sustain activities in the future. The amount of allocated fund for recovery and rehabilitation

will depend on the rate of disbursement of the Fund and it shall be evaluated after 1 year of the Fund operation. The MoDMR will be responsible for finding the sources to the allocated Fund from the GOB budget and from contributions of international donors.

Much interactive communication will be needed among MoDMR staff of the PCMU, and staff of DDM, LGED and BWDB. The roles of the PCMU are to ensure that the Fund is correctly used, the cost of the project is properly estimated and the project is effectively implemented. Through these activities, the PCMU will take overall management of the Fund.

It is necessary for MoDMR staff of the PCMU to obtain basic knowledge of infrastructure (e.g., embankment, road, bridges, etc) which are operated and managed by DDM, BWDB and LGED. For this purpose, a training program will be essential for the staff of the PCMU. The proposed training program is shown as follow:

Table 6.2.27 Proposed Training Program for Staff of PCMU

Item	Expected time and Duration of Training	Training Contents	Trainee
▪ Knowledge of infrastructure managed by BWDB	▪ 2 weeks in the period of establishment of the PIU ▪ 1 week after 1 year of operation of the PIU	▪ Maintenance procedure of embankment managed by BWDB ▪ Cost estimation and projects implemented by BWDB ▪ Site visit	▪ Members of the PIU (DDM&MoDMR staff) ▪ Total: 10 people
▪ Knowledge of infrastructure managed by LGED	▪ 2 weeks in the period of establishment of the PIU ▪ 1 week after 1 year of operation of the PIU	▪ Maintenance procedure of road and bridges managed by LGED ▪ Cost estimation and projects implemented by LGED ▪ Site visit	▪ Members of the PIU (DDM&MoDMR staff) ▪ Total: 10 people

Source: Prepared by JICA Survey Team

The trainings will mostly take place in Bangladesh, but some courses might take place overseas. The costs pertaining to the training program are estimated by using the costs of the similar training program conducted in the Emergency Cyclone Recovery and Restoration (ECRRP) project. The costs of the training program of the ECCRP project are summarised in the following table.

Table 6.2.28 Costs of Training program of ECCRP Project

Budget of the Training/Workshop:

Name of the Courses	No.	Unit Cost	Total Cost
International Training			
Int'l. Course - Research Based field study : Hurricane and Typhoon affected countries (Including registration, tuition fee DSA and travel abroad - *6 persons*)	01	20.00	20.00
Int'l. Course - Advance DM Course for Master trainers: International (Including registration, tuition fee DSA and International travel - *10 persons*)	01	60.00	60.00
Int'l. Course: MVA modeling and Information Management International course (Including registration, tuition fee, DSA and international travel – aprx. *5 persons*)	01	28.00	28.00
National Training program			
DNA training for DDM, and other department (2days)	04	1.50	6.00
DNA training for the field officials	35	0.48	16.80
Capacity Building program			
Training of DMCs / CPP members and comm. people in SIDR affected District 0.68 x 13 0.62 x 35 0.56 x 24	72	L.S.	43.98
Training of the CPP volunteers force in SIDR affected District	144	0.56	80.64
Simulation Exercises within DMCs in SIDR affected District	72	1.00	72.00
National and field level workshop			
National level and field level policy workshops on MRVA and DNA issues	08	2.00	16.00
Stakeholder Planning workshop of the Sub-components	03	2.00	6.00
Organize validation workshop on D-Form	35	0.48	16.80
Total			**366.22**

(lack taka)

Source: DPP of the ECCRP project (DDM part)

According to the table above, the unit cost of the training program for 2 days was BDT 1.5 lack or BDT 150 thousand. The cost for 1 week training is estimated to be BDT 4.5 lack (BDT 450 thousand). Considering the necessary trainings to aquire basic knowledge of infrastructure under operation and management of BWDB and LGED, the overall training period will be 6 weeks. Thus, the total cost of the training for PIU staff is estimated to be BDT 27 lack (BDT 2.7 million).

CHAPTER 7. LIVELIHOOD SUPPORT

7.1 Activities of Livelihood Restoration and Evaluation

7.1.1 Activities of Livelihood Restoration by the Bangladesh Government

There are more than 60 livelihood restoration programs in Bangladesh. Regarding the recovery from disasters, there are two types of programs; namely, the relief programs implemented as the response to disasters and the support programs for vulnerable persons even in normal times.

The relief programs are conducted through the provision of food, clothes, materials or cash for housing repairs in terms of humanitarian support. On the other hand, the support program for vulnerable people is conducted as monetary reward as the labour payment of local infrastructure building or maintenance.

(1) Humanitarian Support

a) VGF (Vulnerable Grain Facility)

The DDM provides between 10 to 30 kg of food grains to each disaster affected poor households, while it covers food provision for poor people as a disaster prevention aspect. BDT 13,269 million was appropriated in the fiscal year 2014-2015.

b) Cash Grant

The DDM distributes an amount ranging from BDT 10,000 to BDT 30,000 for a family that has lost members due to the disaster, and between BDT 5,000 to BDT 15,000 for an injured person to ensure treatment. Also, poor families whose houses have been damaged by the disaster and need repairing receive BDT 3,000 along with a corrugated iron sheet as a gratuitous relief. Damaged local institutions receive BDT 20,000 cash grant each.

In 2013, the grant amounted to BDT 164.2 million.

c) GR Food

The DDM provides 10 to 30 kg of food grains to helpless persons/families and orphanage・ homes for children due to various natural disasters as emergency food support.

BDT 2,654 million was appropriated in fiscal year 2014-2015.

d) GR Cloths

The DDM provides sweaters or other warm clothes to the people/families in cold zones that, in principle, do have not sufficiently warm clothes once in a five year period. 20,000 blankets were prepared in fiscal year 2014-2015.

e) CI Sheets

The DDM provides a corrugated iron sheet to poor families whose houses or self-built shops are damaged or destroyed by natural disasters or fire. For partial damage, each family receives two

bundles of sheet and those with fully damaged houses receive three bundles once in a ten year period, in principle. 350,000 bundles of CI sheets were prepared in fiscal year 2014-2015.

f) Housing Grants

The DDM provides housing grants of BDT 10,000 to each poor family whose house is partly damaged and BDT 20,000 to those whose houses are completely destroyed. Damaged local institutions that require reconstruction can receive BDT 50,000 each.

The total amount of housing grants distributed in 2013 amounted to BDT 72 million.

(2) Livelihood Support Programs

a) DDM Programme

Food for Work (FFW)

This program is for construction, maintenance, reconstruction and development of rural infrastructure, and livelihood support for people affected by erosion and natural disasters. Under this program both food grains and cash money are allocated to the upazilas on the basis of population. The schemes are executed by the Upazila Parishad under the supervision of the D.C. through the District Steering Committee. Upazila allocates the rice/wheat/cash money for FFW schemes to the Unions. The Upazila Parishad selects and prepares the FFW schemes through the U.P. Chairman and the Upazila FFW committee scrutinizes the schemes and recommends the schemes to the District Co-ordination Committee who approves the schemes. After approval of the schemes the Upazila Parishad executes the schemes as per circular. Sometimes both food grains and money allocated by the Ministry according to electoral constitution are distributed.

Employment Generation Program for Poorest (EGPP)

The EGPP targets the most vulnerable people/families in society. First, a greater proportion of funds are channelled to the poorest upazilas (sub-districts). Second, only households with less than half an acre of land and where the household head is a manual labourer are eligible. Third, wages are set at below BDT 3,000/month to attract only those who need the money at the most.

Male and female beneficiaries receive BDT 200/day as a reward for the project which is set at 40 days labour in one phase. The projects that were proposed by the Union Parishad, are to be approved by the Project Implementation Committee (PIC) in the Upazila.

b) Other Agencies' Programme

LGED: Rural Employment and Road Maintenance Program. (RERMP)

The program views the graduation of vulnerable women headed households from ultra-poverty to a decent life by improving their financial and social status through road maintenance labour.

The program will engage ten destitute women in each of the Unions to maintain 20km of selected rural roads of the shoulders of the Upazila and Union roads. Selected women who are i) head of

household with children, ii) separated, iii) age between 18-35 years will receive a daily wage of BDT 150 during the project period of two years.

c) Summary of livelihood support program

The livelihood support programs of Bangladesh can be summarized as the following table.

Table 7.1.1 Institutions of Livelihood Restoration Support

Agency	Program	Eligible person	Type of facility	Quantity	Duration	Budget	Benefi -ciary	Donor
Humanitarian Assistances								
DDM	VGF	People/families massively damaged natural disaster who are extremely suffering for food &money.	Food grains (Rice/Wheat)	・10-30 kg/month per family.	For a period fixed by the government	BDT13,269million ('14)		
	GR Cash	・The insolvent families of wounded/dead persons damaged in any disaster or accident. ・Repair/reform aid to school/college/ madrasah/orphanage/mosque/temple/pagoda/ Kiang/library & other registered social organization damaged by natural disaster.	Cash money	Death:BDT 10,000～25,000 Wounded:BDT 5,000～15,000	For a period fixed by the government			
	GR Food	・Aggrieved & helpless person/families due to various natural disasters as emergency food facilities ・Insolvent families of person expired/wounded for any natural/man created disaster as food facility under special consideration. ・Government/non-government orphanage/free boarding/child home/orphanage/helpless shelter	Food grains (Rice/Wheat)	・Maximum 10-30 kg per aggrieved family. ・Maximum 200 kg per family in special consideration ・Maximum 5 m. ton/year Once or according to dividing by the government.		BDT2,654 million ('14)		
	GR Cloths	Usually poor & very poor people/family who cannot purchase required warm clothes & peoples/families of cold zones who do not have sufficient warm clothes	Blanket/wrap per sweater & other warm clothes.	In case of blanket wrapper 1 for an individual & maximum 2 for each family, other warm clothes 1 for individual & 3 for a family.		Blanket 20,000 ('14)		
	CI Sheet	People/families whose houses were damaged by natural disaster	CI sheet	2～3bundles (12sheet/bundle) ／year		350,000 bundle (6sheet/b)		
	Housing Grant	Damaged house	Cash	Partly damaged: BDT10,000 Completely destroyed：BDT20,000 Local institutions: BDT50,000		BDT140 million ('14)		
Safety Net Programs								
DDM	FFW Drainage canals, roads etc	Peoples who lost land by natural disasters or river erosion or vulnerable people. Land owned less than 0.5acre	Food grains (Rice/Wheat)	Rice: 6kg/day or Wheat : 8kg/day		BDT2.9 million/year (example of Sirajgan District)		

Agency	Program	Eligible person	Type of facility	Quantity	Duration	Budget	Benefi -ciary	Donor
	EGPP Drainage canals, dykes etc	People/families massively damaged by natural disaster	Cash	BDT200/day×40day×2Phase／year	2 phases in a year		1,640beneficiary/1phase (example of Sirajgan District)	WB USD500 million ('13-16)
LGED	RERMP Rural Roads maintenance labor of 20km /Union	Woman head of household with children Aged 18-35	Cash	BDT150/day	2years (can be extended in one year)	BDT11,020 million ('13-'16)	10people× 4,548 Union	Supported by EU BDT2,887 million ('13-'16)

Table 7.1.2 Existing Livelihood Restoration Support System

Agency	Program	Eligible person	Type of facility	Quantity	Disaster Management Stage			Donor
					Prevention	Response	Restoration	
Humanitarian Assistances								
DDM	VGF	Poor victims	Rice/Wheat	10～30kg/M･HH		■		
		Vulnerable	Rice/Wheat	10～30kg/ M･HH	■			
	GR Cash	Insolvent families of wounded/dead persons damaged in any disaster or accident.	Cash	Dead:BDT10,000～25,000 Wounded:BDT5,000～15,000		■		
		Insolvent families by natural disasters	Cash	BDT7,500		■		
		Public institutions damaged by natural disaster.	Cash	BDT20,000~50,000		■		
	GR Food	Aggrieved & helpless person/families due to various natural disasters	Rice/Wheat	<200kg／HH		■		
		Insolvent families of person expired/wounded for any natural/man created disaster	Rice/Wheat	10～30kg/M･HH		■		
		Orphanage, etc	Rice/Wheat	5Mt／year in the country		■		
	GR Cloths	People of cold zones who have not sufficient warm clothes	Blanket Worm clothes	Two blankets, one clothes/person		■		
	CI Sheet	House was damaged by natural disaster	CI sheet	2～3bundles／year		■		
	Housing Grant	Damaged house	Cash	Partly damaged: BDT10,000 Completely damaged: BDT20,000		■		
		Local institutions	Cash	BDT50,000		■		
Safety Net Programs								
DDM	FFW Drainage canals, roads etc	People who lost land or vulnerable people who own less than 0.5 acre of land	Rice/Wheat	Rice: 6kg/day or Wheat: 8kg/day	■			
	EGPP Drainage, canals,	People/families damaged massively by natural disaster	Cash	BDT200/day×40day×2Phase/year	■			WB USD500 million ('13-16)

Agency	Program	Eligible person	Type of facility	Quantity	Disaster Management Stage			Donor
					Prevention	Response	Restoration	
LGED	RERMP Rural Roads maintenance labour of 20km /Union	Woman head of household with children Age 18-35	Cash	BDT150/day	■			EU BDT2,887 million ('13-'16)

7.1.2 Self-help by using Microfinance

(1) Actual Situation of Microfinace System in Bangladesh

(a) Microfinance Institutions

The number of licensed Microfinance Institutions (MFI) in Bangladesh has increased to 649 with 14,674 branches and 19 million borrowers in June 2013. The total cumulative loan disbursement of top 20 MFIs was BDT 1953.03 Billion (MRA report 2013). The share of large MFIs such as BRAC and ASA has exceeded more than seventy percent.

The loan to victims damaged by natural disasters has a certain result with one to five year moratoriums. According to JICA reports, the borrower of microfinance after the occasion of Cyclone Sidr accounted for 50 to 60 percent in the total number of victims.

The real situation of users will be examined in the study of the Livelihood Restoration Activities for Disaster Victims.

Table 7.1.3 Cumulative Loan Distribution of Top 20 MFIs (Billion BDT)

Name of MFIs	2009	2010	2011	2012	2013
BRAC	394.35	469.46	544.39	642.12	754.77
ASA	305.08	377.49	454.96	549.58	645.76
Buro Bangladesh	23.6	33.38	44.87	58.14	80.25
TMSS	31.11	38.71	48.45	60.3	74.94
Jagorani Chakra Foundation	12.77	17.29	25.29	34.65	45.73
SSS	19.23	24.78	32.01	41.48	53.88
Shakti Foundation	13.2	18.33	26.93	29.24	34.27
Proshika	41.04	43.07	45.04	47.34	49.64
Uddipan	9.27	13.15	17.76	23.5	30.36
Padakhep	8.34	11.1	14.62	20.04	24.71
RDRS	8.82	10.79	13.48	16.65	20.06
Palli Mangal Karmashuchi	7.67	9.77	12.31	15.27	18.83
Caritas	10.38	11.72	13.91	16.42	19.16
CDIP	3.72	5.44	7.97	11.22	15.11
Sajida Foundation	4.9	6.85	9.11	12.34	16.10
CSS	2.92	4.18	6.99	8.58	11.40
RRF	7.05	8.59	10.82	13.17	15.76
RIC	4.25	5.66	8.26	11.01	14.10
POPI	5.89	8.28	9.21	11.32	13.76
DSK	5.26	6.31	8.24	10.56	14.46
Total	**918.86**	**1124.35**	**1354.64**	**1632.93**	**1953.03**

Source : MRA - MIS Database-2013

Table 7.1.4 Source of Fund for Microfinance

Source of Fund	Jun/08		Jun/10		Jun/11		Jun/12		Jun/13	
	(Million Tk.)	(%)	(Million Tk.)	(%)	(Million Tk.)	(%)	(Million Tk.)	(%)	(Million Tk.)	(%)
Clients' Savings	40,526.91	29.73	47,436.35	31.15	63295.9	34.46	74989.36	32.62	93998.01	33.62
Loan from PKSF	22,666.20	16.63	24,484.12	16.08	31767.8	17.3	33576.45	14.61	34072.27	12.16
Loan from Commercial Banks	23,896.37	17.53	23,006.41	15.11	23577.9	12.84	32652.41	14.20	42699.37	15.26
Donors' Fund	22,666.20	3.02	4,109.29	2.7	7008.37	3.82	7061.28	3.07	7104.57	2.64
Cumulative Surplus	36,261.74	26.6	42,339.27	27.8	50298.7	27.38	65437.78	28.47	83262.38	29.77
Other Funds	8,847.97	6.49	10,907.40	7.16	7727.32	4.21	16167.91	7.03	18390.89	6.55
Total	**136,309.48**	**100**	**152,282.84**	**100**	**183676**	**100**	**229885.2**	**100**	**279527.48**	**100**

Source : MRA - MIS Database-2013

(b) Regulatory Framework of Microfinance

The Microfinance system of Bangladesh has been institutionalized by the assumption that the poor can free themselves from poverty through their own efforts - what they need is drive on their part and small amounts of credit.

To bring microfinance sector under regulatory framework, and ensuring transparency and accountability in the activities of microcredit organisations the Government of Bangladesh enacted "Microfinance Regulatory Authority Act, 2006", and under the Act, established Microfinance Regulatory Authority (MRA) to monitor and supervise the microfinance activities of the MFIs.

According to Microfinance Regulatory Authority Act, 2006, MFI are required license from MRA to operate microfinance program. Within the stipulated period, MRA received applications from 4,241 MFIs. Till June, 2014 MRA had approved licenses in favor of 742 NGOs and rejected 3,454 applications, and kept the remaining 45 application under process for final decision.

Not only need small scale credit but also can use it efficiently.

(2) The function and existing situation of PKSF

(a) The function of PKSF

Palli Karma Sahayak Foundation (PKSF) was set up by the Government of Bangladesh (GOB) in 1990 and is registered under the Companies Act of 1913/1994 with the registrar of Joint Stock Companies. The principal objective of PKSF is to initiate and promote activities that help reduce poverty, with emphasis on employment generation. PKSF leads the wholesale funding segment of the market of poor reduction and it operates through partner organizations (PO) that perfoms as MFI.

Initially, in pursuance of conventional practices in the country, it took off with microcredit lender with two main objectives - i) expand outreach to reach the poor with financial services, and ii) assist MFIs

to achieve institutional and financial viability for sustainable service provision to both rural and urban poor.

(b) Existing Situation of PKSF

Presently, PKSF has 273 POs. put together, these POs serve some 10.64 million people that include 8.13 million borrowers (of the total borrowers, 91.22 percent is women). As on June 30, 2014, savings of members stood at BDT 40.69 billion; amount of loan outstanding of PKSF with POs stood at BDT 37.03 billion and amount of loan outstanding of POs with borrowers stood at BDT 104.95 billion.

As itsmandate was wider than microfinance, over the years, PKSF diversified its operations to contribute more meaningfully to poverty alleviation program. Accordingly, it became involved in development processes and interventions relating to education, training, healthcare and access to resources as well as disaster risk reduction and climate change adaptation.

(c) PKSF,s Program Interventions

Jagoron : for Rural Areas

It targets poor household who own an arable land of less than 50 decimals or a total asset that is materially worth less than the value of one acre of land. In urban areas, target members of Jagoron are people living in a particular locality for at least three and have very little asset and a monthly income of less than BDT 4000-5000. Individuals having business of a temporary nature and good record in handling the previous loans receive this support with 12 % of interest rate.

Buniad : Ultra Poor Loan

It targets the extreme poor (below poverty line) and offer loan with flexibility in terms of loan repayment, attendance in group meeting etc. with 10% of interest rate. In addition to the financial support, this program includes different non-financial assistance like primary healthcare services, technical services to implement various Income Generating Activities (IGAs), capacity building support to the disaster-stricken people, training, awareness building on nutrition and social issue.

Agrosor : Micro Enterprise Loan

It targets progressive borrowers of microcredit programs and potential individual entrepreneurs offer them, individually, any amount of investment within BDT 40,000 to BDT 150,000 to run and expand their small businesses with 12.5% of interest rate.

Sufolon : Agriculture and Seasonal Loan

It offers loans to poor farmers, individually, for investing in different IGAs such as crop cultivation and processing, livestock, fisheries, agro-forestry and agro-processing. Along with the credit facility, it includes agriculture extension service and all-inclusive training support to help farmers enhance their skills and productivity through technology transfer into the traditional farming communities. The loan is 12 % of interest rate.

Agriculture Extension Service

It provides assistance to the farmers to access microfinance services based on the seasonality of agricultural activities, useful, modern and environment-friendly agricultural technologies, market linkages of agricultural commodities and skilled human resources with 13% of interest rate..

Livestock rearing Support Service

It is a support to poor and extreme poor households for sustainable livestock production through accessing financial services, technology, information, skill development , quality improvement and marketing.

Promoting Agricultural Commercialization and Enterprises

It is loan program that targets microentrepreneurs who are moderate and extreme poor farmers involved in field crops, horticulture, fisheries, livestock production etc. with the three components such as a) financial services for microentrepreneurs, b) value chain development and c) technologies and product adaptations to increase sales and incomes from existing and new microenterprises and create new wage employment opportunities.

Scholarship to Students

It provides financial assistance to poor and extreme poor families and encourages them to send their children to the schools.

Ultra Poor Program -Ujjibito

It targets the extreme poor households and aims to sustainably reduce extreme poverty and hunger. The program combines non-financial services along with financial assistance. Financial assistance includes cash grant and the non-financial elements include a) awareness on nutrition, reproductive health and maternal and child care and b) trained on agricultural (such as homestead gardening, nursery, vermi-compost production, mixed fish culture, crab fattening, goat rearing, beef fattening and poultry rearing) and non-farm skill development (such as tailoring, stitching, handicrafts and mat-making).

Shahos : Emergency Loan

This fund mainly seeks to address the needs of the vulnerable people in coping and recovery mechanisms, livelihood restoration (including repairing of houses, tube-wells and latrines); restoring the existing IGAs and ensuring consumption capabilities during the post-disaster period. It also guarantees the provision of emergency medical services, water and sanitation. It provides loans not exceeding BDT 10,000 per programme participant at a time to be repaid with 4.0%. After Sidr and Aila, PKSF provided this loan without interest.

Table 7.1.5 Information of PKSF Loan

Name of Program	Nature of Installment	Interest Rate (Flat)
Jagoron (Rural and Urban Microcredit) Especially farmers	Weekly (46)	13%
Buniad means Ultra Poor Loan (UP) Family below poverty line	Weekly (46)	10%
Ogrosor (Micro enterprise loan) Especially small business	Monthly (12) or weekly (46)	13%
Sufolon (Agriculture and Seasonal loan) Especially Seasonal Basis	One installment (after 3 or 6 month considering harvesting time of crops)	13%
Agriculture extension service Agricultural Crops and Seasonal loan	One (1) installment; Installment depends on use of fund as per beneficiaries' requirement. After use, beneficiary repays the amount. Most loans are provided for six months.	13%
Livestock rearing support service (Technical Support- mostly training)	N/A	N/A
Promoting Agricultural Commercialization and Enterprises (loans are provided to entrepreneurs)	Monthly (12)	13%
Scholarship to students (grants are provided to poor students based on their results)	N/A	N/A
Ultra poor program –Ujjibito (Grants are provided)	N/A	N/A
Sahos (Emergency loan) Especially for livelihood restoration after Disaster	Two (2)	4% *(After Sidr and Aila, PKSF provided this loan without interest)*

7.1.3 Donors and NGO Assistance in Past Disasters

With regard to Donors' assistance during the past disasters, in the case of Cyclone Sidr, it was found that donors responded quickly to the crisis.

World Vision and IFRC, for instance, launched relief operations in the most affected districts on the 16th and 18th of November, respectively. They distributed plastic sheets, blankets, and cash, as well as family packages that included rice, lentils, and oil. The World Food Programme (WFP) had distributed High Energy Biscuits and rice through NGO partners to 249,187 families in the affected districts as of 03 December 2007. UNDP, UNICEF, OXFAM, SCF Alliance, World Vision, Care Bangladesh, Islamic Relief, Caritas, Christian Aid, Concern Worldwide, and Action Aid Bangladesh also distributed relief packages.

Several national organizations also launched relief operations. Building Resources Across Communities (BRAC), for instance, distributed more than 80,000 food packets to families in eleven districts. Their medical teams also treated more than 7,800 patients. Adventist Development and Relief Agency International (ADRA) and other national NGOs delivered food and non-food relief items to the affected families. Grameen Bank, BRAC, and ASA extendedloan payments for members who were affected by the cyclone.

Table 7.1.6 Distribution of Food by Different Agencies

Responding GoB/A	No of Families	No of Beneficiaries	Food (MT)	Food Commodities
GoB	1,126,000	5,630,000	16,890	Rice
UNICEF	46,272	231,360	93	BP5 biscuits
UNDP	70,000	350,000	420	Flattened rice, molasses
WFP	249,187	1,250,000	1,088	Biscuits, rice
Action Aid	17,000	85,000	426	Rice, pulse, oil, salt, sugar, suji
ADRA	3,927	19,635	100	Rice, lentils, flattened rice, sugar, salt
BRAC	148,825	744,125	2,130	Rice, lentils, flattened rice, sugar, salt
CARE	24,000	120,000	600	Flattened rice, molasses, rice, salt, pulse, oil, potato, onion
CARITAS	51,000	255,000	1,051	Rice, pulse, oil, salt
Christian Aid	19,086	95,430	284	Rice, lentils, oil
Concern	26,000	130,000	810	Rice, pulse, oil, salt, sugar, suji
Islamic Relief	80,000	400,000	360	Flattened rice, molasses, salt
IFRC	64,800	324,000	560	Rice, pulse, oil, salt
Netz Partnership	20,050	100,250	352	Rice, pulse, oil, salt, sugar, suji, molasses, potatoes, flattened rice
OXFAM	30,000	150,000		Rice, pulse, oil
Salvation Army	3,000	15,000	75	Rice, lentils, oil, salt, potatoes
SCF Alliance	186,470	932,350	130	Biscuits
World Vision	24,400	122,000	456	Flattened rice, molasses
Total	**2,190,017**	**10,954,150**	**25,825**	

Source: DMB, Emergency Response and Action Plans Interim Report, 27 December 2007.

Although no formal international appeal for foreign assistance was made by the Government of Bangladesh, the international community was quick to respond and pledged approximately US$ 241.7 million in aid as of 17 December 2007 (see Table 7.1.7).

Table 7.1.7 Donor Commitment (over US$ 1million)

Donor	Commitment	Donor	Commitment
Saudi Individual	$130 m	Italy	$4.47 m
Saudi Arabia	$102.88 m	Norway	$4.37 m
Japan	$90 m[9]	Swtizerland	$3.36 m
United Nations	$28.4 m	Denmark	$2.96 m
USA	$20.2 m	Germany	$2.64 m
United Kingdom	$19.8 m	Belgium	$2.18 m
European Commission	$12.3 m	China	$2.05 m
Kuwait	$10.02 m	Iran	$1.38 m
Australia	$9.84 m	Spain	$1.25 m
Netherlands	$8.16 m	India	$1 m
Sweden	$7.54 m	Libya	$1 m
Islamic Relief	$5.64 m	Turkey	$1 m
Canada	$4.9 m		

Source: DMB, February 2008

Other than the above, the World Bank contributed quickly, disbursing US$ 100 million budget for support to reduce the fiscal pressure on the Government of Bangladesh. In addition, US$ 100 million was allocated for

the restoration of livelihoods to support post-cyclone recovery and a further US$ 125 million was allocated for the medium- and long-term restoration and rehabilitation of critical infrastructure assets. The Asian Development Bank has also approved a project for US$ 150 million in order to finance reconstruction of damage caused by the floods and cyclones.

7.1.4 Needs Assessment of Affected People on Livelihood Restoration

(1) Questionnaire Survey on Affected people

The questionnaire survey was conducted by research associates in four unions from four targeted upazilas (Assasuni under Satkhira, Morrelganj under Bagerhat, Kalapara under Patuakhali and Babuganj under Barisal district) which were selected in consultation with the JICA Study Team to collect information on the needs for livelihood restoration program. A total of 120 household surveys were conducted (30 in each targeted union). In each union, 30 sample households were selected from disaster affected households that received support after disaster (20 households that received safety net support after disaster and 10 households that received micro-credit support for livelihood restoration from PKSF partners). The research made use of probability sampling in order to select the respondents for investigation.

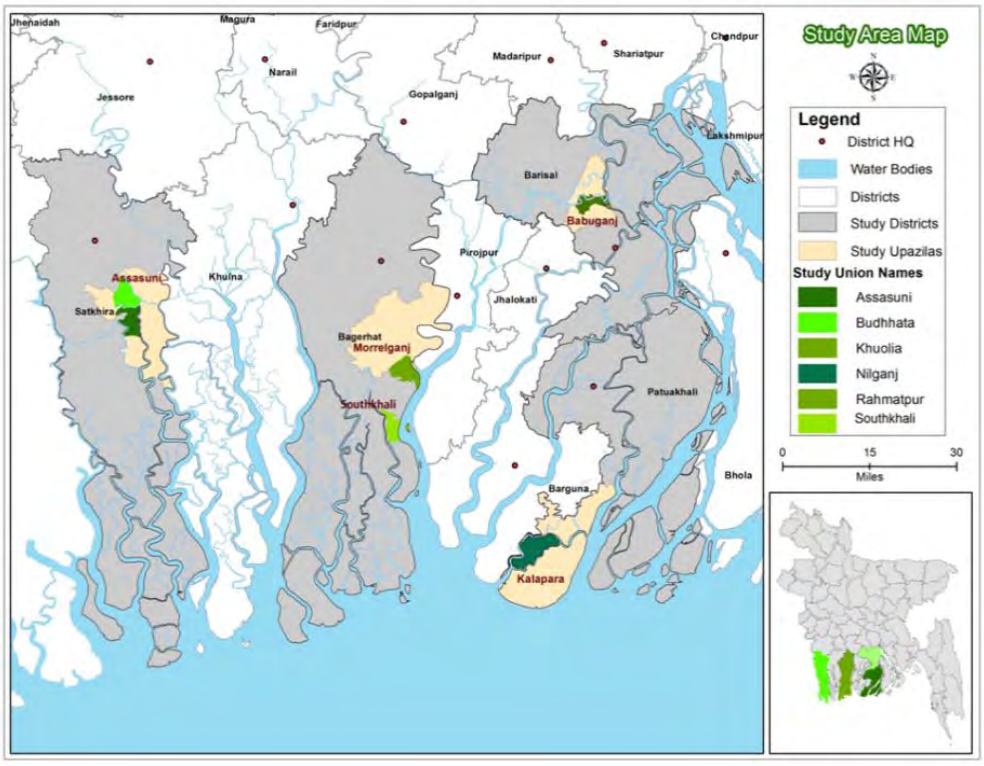


Figure 7.1.1 Location Map of the Research of Livelihood Support

The questionnaire was developed into the following questions:

- Situation of disaster (type of disaster, casualty, damage of house, inundation level and period, livestock)

- Received goods and food
- Household income (before and after the disaster)
- Received support for restoration of livelihood (cash grants, housing grants, cash for work, received assistance of microcredit and debt moratorium (before and after the disaster)
- Request for the build back-better.

(2) Results of Questionnaire Survey

(a) Damage

Nearly all of the surveyed households experienced inundation during the disasters. About 31.7 percent of houses went under 6 feet deep of water; it was more pronounced in Morrelganj (70 percent).

Table 7.1.8 Inundation Level

Upazilas	Up to Knee	Up to Waist	Up to Head	Total
Assasuni	13.3%	30.0%	56.7%	100.0%
Babuganj	100.0%	0.0%	0.0%	100.0%
Kalapara	93.3%	3.3%	0.0%	100.0%
Morrelganj	0.0%	30.0%	70.0%	96.6%
Overall	51.7%	15.8%	31.7%	99.2%

(b) Impact on Land and House

In Assasuni and Babuganj, many of the affected households have lost their homestead; and presently they are living in land not owned by them. Also, the average sizes of the homestead of the affected HHs have decreased. However, it should be noted that some of the affected families were able to increase the size of their homesteads . It suggest that disasters affect households irrespective of their socioeconomic status and create opportunities for well-off people to increase their assets.

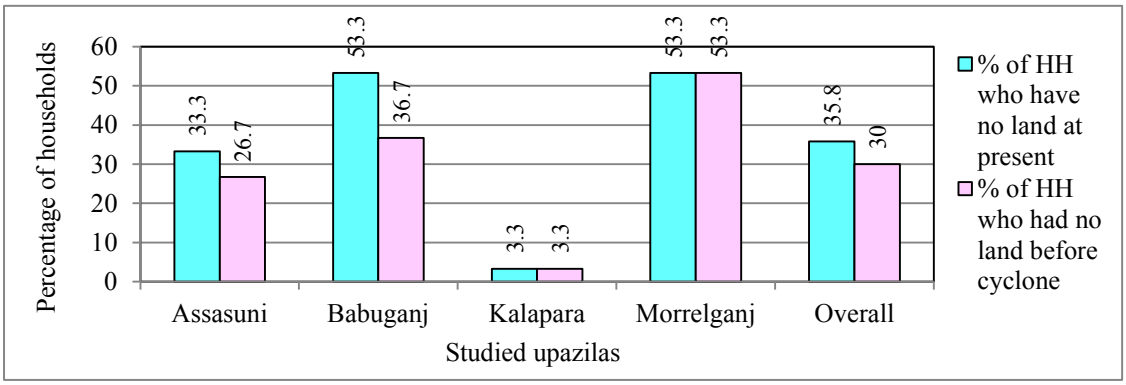


Figure 7.1.2 Distribution of Households with No Homestead

Among them, overall, 42.5 percent had their houses completely damaged. 97.5 percent of the studied households suffered house damage.

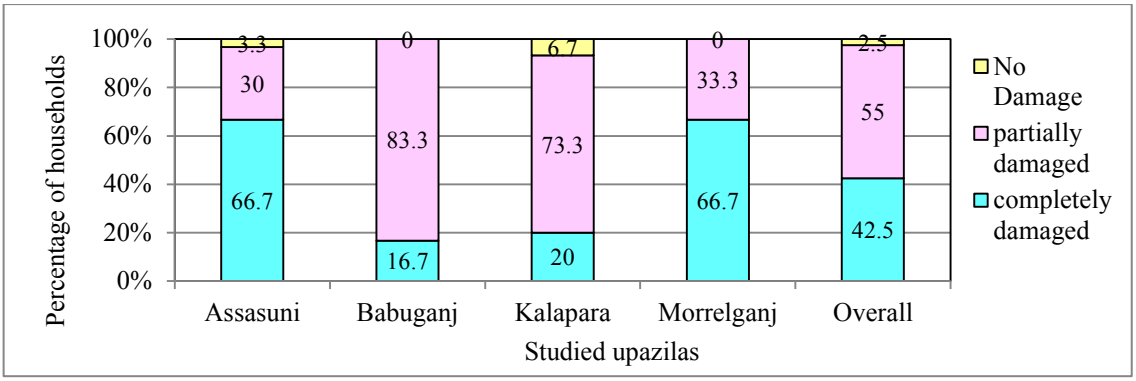


Figure 7.1.3 Distribution of Households by Extent of Damage to House

(c) Impact on Life and Livelihood

Overall, 38.3 percent has to change their main occupation.

Table 7.1.9 Occupation Change of Affected Households

Upazila	Occupation change of affected households
Assasuni	16.7 %
Babuganj	56.7 %
Kalapara	36.7 %
Morrelganj	43.3 %
Overall	38.3 %

Significant proportion of households in the area (excluding Kalapara) who relied on farming (crop, fish and shrimp) declined. In Assasuni, those who could not continue farming became daily waged laborers. In contrast, in Babuganj and Morrelganj, they participated in petty businesses (e.g., tea stalls, grocery shops or vending).

Table 7.1.10 Changes in Main Occupation of Affected Households by Upazila

Upazila	Agricultural labor	Non-agricultural labor	Agricultural farming	Petty business
Assasuni	10.0 %	3.3 %	-13.3 %	0.0 %
Babuganj	-13.3%	33.3 %	-30.0 %	10.0 %
Kalapara	10.0 %	-23.3 %	3.3 %	13.3 %
Morrelganj	-10.0 %	-3.3 %	-13.3 %	20.0 %
Overall	-0.8 %	2.5 %	-13.3 %	10.8 %

Among the surveyed households, incomes adjusted by GDP deflator shows that average for real incomes for Assasuni and Morrelganj has decreased; in contrast, average real income has increased in Babuganj and Kalapara. Communities in Assasuni being affected by Cyclone Aila have lost their livelihood and their income remained less compared to what they have had before the cyclone. People in Babuganj had lost their lands and houses due to riverbank erosion. They were forced to migrate to other places. Many of them could find better options for livelihood in their new locations. Thereby they could raise their incomes (by interview).

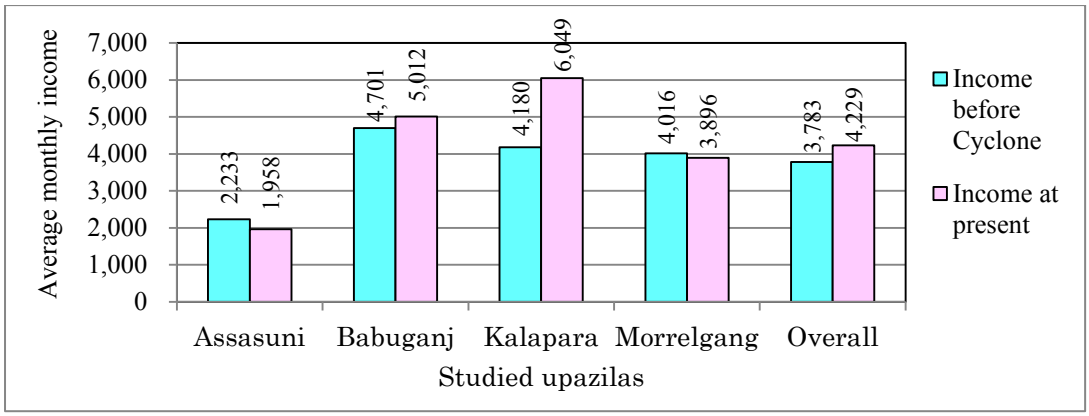


Figure 7.1.4 Distribution of Households by Average Monthly Income adjusted by GDP Deflator

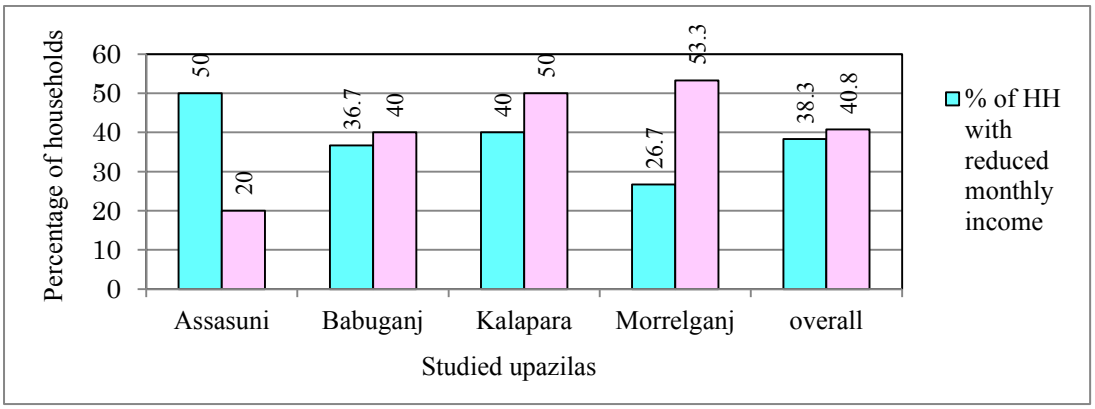


Figure 7.1.5 Distribution of Households by Change in Monthly Income

(d) Support Provisions for Disaster Affected People

Emergency Relief

Nearly all surveyed households received relief support either from the Government or from the NGOs. Both GOB and NGOs' coverage were extensive in Morrelganj - this upazila was devastated by cyclone Sidr and the impacts of the disaster were highly visible. Although, NGOs presence was very low, all of the surveyed households in Assasuni received potable water and about one-third of them received ready to eat food. It should be noted that, the surveyed households did not receive construction materials but they continue to receive food aid until now.

Table 7.1.11 Percentage of Households that received Relief Items from GOB or NGOs immediately after Disaster

Upazila	Only Government	Only NGO	Both Organizations	No Organization
Assasuni	96.7 %	3.3 %	0.0 %	0.0 %
Babuganj	60.0 %	33.3 %	6.7 %	0.0 %
Kalapara	13.3 %	43.3 %	10.0 %	33.3 %
Morrelganj	0.0 %	6.7 %	93.3 %	0.0 %
Overall	42.5 %	21.6 %	27.5 %	8.3 %

Table 7.1.12 Relief Items received by Households immediately after Disaster

Upazila	Ready to eat food	Potable water	Food items	Household goods	Construction materials	Cash taka
Assasuni	33.3 %	100.0 %	93.3 %	6.7 %	0.0 %	13.3 %
Babuganj	30.0 %	0.0 %	30.0 %	0.0 %	36.7 %	10.0 %
Kalapara	4.5 %	18.2 %	81.8 %	9.1 %	0.0 %	0.0 %
Morrelganj	100.0 %	100.0 %	73.3 %	60.0 %	43.3 %	26.7 %
Overall	42.0 %	54.6 %	69.6 %	19.0 %	20.0 %	12.5 %

Safety Net Support

In response to disaster, Cash for Work (CFW) was launched in the communities aimed to help disaster households restore or maintain their income. Only about one-third of the surveyed households were able to participate in the Cash for Work program. Then, half of the participants worked for only 30 days or less, although the program provided work for 80 days. In addition, overall, 14.3 percent of respondent's households received Food for Work support.

More recently, both Cash for Work and Food for Work programs started again in Assasuni and only the Cash for Work program started in Kalapara upazila.

About 55.8 percent received Vulnerable Grain Facility (VGF) support provided from the Government. Almost 50 percent of the households who received VGF support got 10 kg of rice per month.

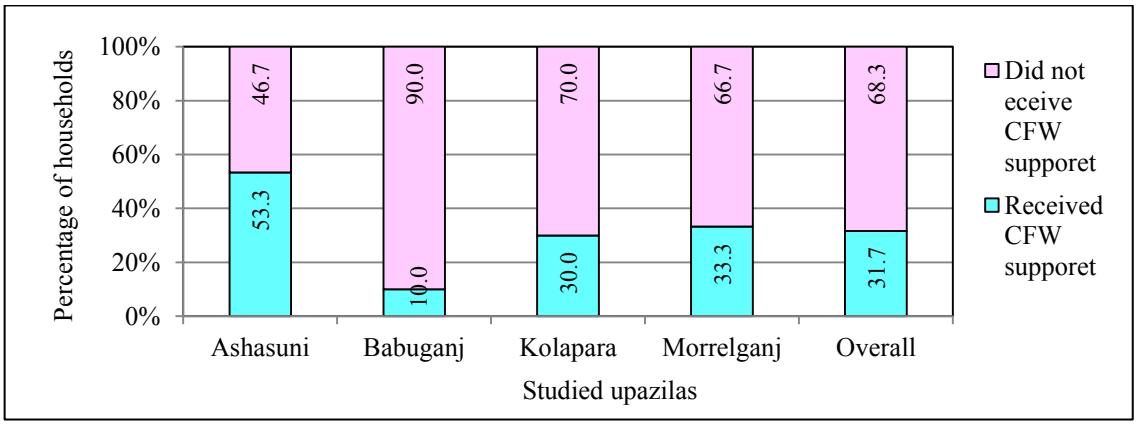


Figure 7.1.6 Distribution of Households that received CFW

Table 7.1.13 Percentage of Households by Quantity of VGF Support

Upazila	6 kg/month	10 kg/month	15 kg/month	20 kg/month	30 kg/month
Assasuni	0.0 %	0.0 %	0.0 %	100.0 %	0.0 %
Babuganj	0.0 %	72.7 %	0.0 %	27.3 %	0.0 %
Kalapara	3.8 %	92.3 %	0.0 %	0.0 %	3.8 %
Morrelganj	0.0 %	5.3 %	47.4 %	0.0 %	47.4 %
Overall	1.5 %	49.3 %	13.4 %	20.9 %	14.9 %

Microfinance Support

Among the studied area of this survey, all of the surveyed households in Assasuni (affected by cyclone Aila) and more than three-fourths in Kalapara (affected by cyclone Mahasen) received microfinance support after the disaster. Along with PNGOs of PKSF, Grameen Bank, BRAC and Asha play the lead role in this sector in the studied area. Around 90 percent households were able to repay the loan in time . However, about one-fifth of the borrowers had to borrow again to repay their loans.

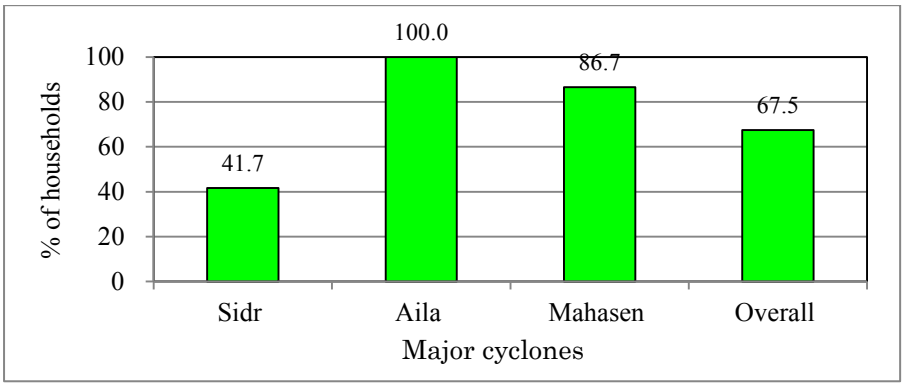


Figure 7.1.7 Proportion of Households that received Microfinance Support for Disaster

Table 7.1.14 Microfinance Support received from Different Organizations

Upazila	Grameen Bank	BRAC	ASHA	Krishi Bank	PKSF PNGOs
Assasuni	51.7 %	17.2 %	0.0 %	0.0 %	41.3 %
Babuganj	15.4 %	30.8 %	30.8 %	7.7 %	61.5 %
Kalapara	3.8 %	19.2 %	19.2 %	7.7 %	73.1 %
Morrelganj	0.0 %	9.1 %	18.2 %	0.0 %	90.9 %

Table 7.1.15 Repayment of Loans by Household

Upazila	Timely repayment of loans	Used new loan for payment of their previous loan
Assasuni	82.8 %	14.3 %
Babuganj	85.7 %	28.6 %
Kalapara	80.8 %	0.0 %
Morrelganj	90.9 %	36.4 %
Overall	85.1 %	19.8 %

(e) Comment for Support Needs

Aged 65 (Male)

- One of his family members died and his previous house and battery shop were fully damaged during Sidr.
- Elderly person should be considered for "Cash for Work" or, "Food for Work" support for a long time, but insisted to be positively included as an elderly person.

- Flexible cash loan support to run business, make a strong house or purchase land may be included in the rehabilitation program (since he did not get any support for recovery of his business). Also, according to his opinion, corruption by local leaders and officials should be stopped during the emergency program. Presence of fair political government is very important to the victims during disaster situation.

Aged 32 (Male)

- Previous house was fully damaged during Sidr.
- He received emergency relief only from NGOs and got BDT 6,500 for house construction from the government through union parishad. Except one month Cash-for-Work of BDT 9,000 he did not get any kind of loan and livelihood or safety net support.
- Cash support to run own business should be included in the rehabilitation program of the GO-NGOs. Also, according to his opinion, corruption by local leaders should be stopped and relief should be distributed directly to the victims after any disaster.

Aged 23 (Male)

- Previous house was fully damaged during Sidr. He got emergency relief only from NGOs and got support of BDT ,000 for house construction from the government through union parishad.
- He did not get any kind of loan and livelihood or safety net support from an NGO, except special support on orphanage category.
- Cash support for poor fishermen (labor) should be included in the rehabilitation program. During beneficiary selection, corruption should be stopped and relief should be distributed directly to the victims. Honest leadership should also be an important part of proper relief distribution.

(3) Issues and Needs from Questionnaire Survey and Interview

(a) Livelihood support system

Inadequate Support for Income Recovery

Humanitarian response therefore is able to meet only some needs of some affected people because available resources are meager and needs are huge. To overcome this challenge, humanitarian system endeavor to apply minimum standards for humanitarian assistance. The study noted that about half of the studied households in Assasuni, despite receiving livelihood support, continued to suffer from reduction in their incomes. Sometimes livelihood supports package for disaster affected people are inadequate, and it does not enable households prevents slide into chronic poverty.

Inadequate Support for Recovery of Agriculture

The livelihood recovery program in Bangladesh acknowledges that a large portion of the rural population relies on farming for their livelihood. It is a common practice in post disaster interventions to provide local farmers with agricultural inputs such as seeds, fertilizers, tools and equipment. However, sometimes, such support is inadequate or less effective, and they could not restart agricultural activities.

In Assasuni, about 13 percent of the surveyed households failed to continue farming as their main occupation. It was partly because the type and quantity of support they received was not enough to meet their basic needs and restart farming.

More importantly, Cyclone Aila caused inundation with sea water, and contaminated soil and water sources. To restart agricultural activities the local farmers needed crop varieties, cropping system and technologies that could sustain agriculture in high saline zones.

(b) Microfinance Support System

Provision for House Building Loan Missing

Rebuilding shelter is a critical need for the disaster affected households. To rebuild their shelters, disaster affected households need substantial volume of material and financial resources. They may partially get it for temporary housing through grant, but the reconstruction of low income households has not progressed because the current structure or portfolio of the microfinance system in Bangladesh do not cover such a provisions of housing reconstruction to affected households.

A support program of business recovery could be required in terms of better livelihood while there is a considerable number of farmers or fishermen who do small business on the side.

7.2 Assuming Methodology of Livelihood Support

7.2.1 Consultation for Livelihood Restoration Support System

The grant support programs for emergency response have been implemented by DDM in terms of livelihood support as safety net for disaster affected people. Additionally, DDM and other agencies have implemented actively livelihood restoration programs such as Cash for Work and Food for Work for poor households. On the other hand, according to the result of "Survey of Livelihood Restoration Support Activities", there is a finding of needs to the occupational support of agriculture. Additionally, it is required to secure the reconstruction of damaged houses with user-friendly financial support system, because of the lack of sufficient allowance in-kind and grant. It can be said that ivelihood restoration must be a good opportunity to realize better quality of life in terms of BBB, if the new financing is introduced with low interest.

There is a program regarding low-interest loan in PKSF, but, its cap is very low so that it is not apparently enough. Therefore, in this project, the following is to be recommended:

- "Provision of Low-interest Loan"

Targeting

- Occupational support to agriculture or other enterprises
- Reconstruction of housing.

7.2.2 Consultation for Implementation of Livelihood Restoration Support

(1) Implementation Body

(a) Case of DDM Initiative

DDM has a mandate to pursue the objectives of the Disaster Management Act of 2012, and its responsibilities include directing emergency humanitarian assistance. To discharge its duties, DDM commits resources for emergency response. However, the nature of the support that DDM plans and provides to disaster affected and distressed people are always conditional or unconditional grants. Therefore, every time a disaster strikes, DDM has to freshly mobilize resources. There are at least four reasons that prevent DDM to use methodologies for resource recycling such as micro-credit.

- Firstly, policy imperative - there is a range of policy instruments that guide DDM to plan and implement its emergency response activities. The Humanitarian Assistance Programme Implementation Guidelines for 2012-13 explicitly describes the nature, quantity and quality of the humanitarian support packages as well as their delivery procedure. It does not allow DDM to recover the costs or recycle the goods delivered.
- Secondly, conditionality for resource availability – DDM get resources from the safety net provisions and the Prime Minister's Relief Fund. By definition, goods and services supplied through these sources must be delivered free of cost.
- Thirdly, targeting criteria – according to the guidelines DDM is expected to select recipients of humanitarian assistance from among the destitute people applying the safety-net program beneficiary selection criteria. People under this category are rarely able to repay the costs of the humanitarian support package.
- Fourthly, operational constraints – DDM does not have enough human resources at the local level to deliver goods and services directly to the disaster affected people. It renders its services through the local Administration and the Local Government bodies. Therefore, it is most unlikely for DDM to be able deliver micro-credit support which requires elaborated and time consuming processes for service delivery and loan recovery.

(b) Case of PKSF Assistance

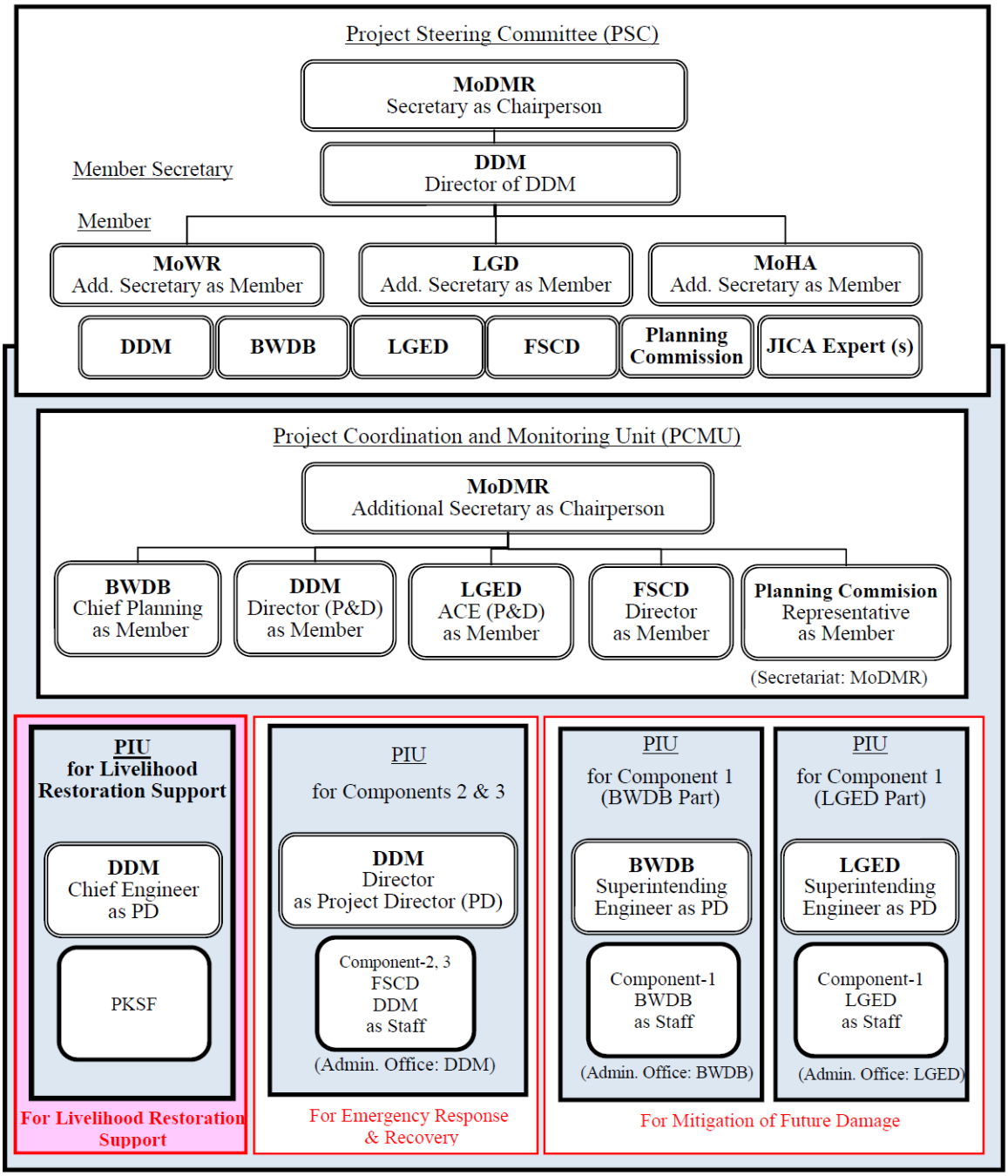
PKSF has already institutionalized to disburse a financing and to collect credit with long term experience of microfinance operation in cooperation with PO. At the time of disaster, PKSF is to collect local information from PO immediately, and should be capable to implement financing based

on the needs of affected people. Moreover, PKSF has programs of advisory and training regarding livelihood promotion.

Therefore, it is appropriate that implementation of the livelihood restoration loan will be operated through PKSF.

(2) Institutionalization of Financing

This Project shall be implemented and managed by the Government of Bangladesh (GOB) through the project implementation organization shown in Figure 7.2.1, in order to ensure and achieve the objectives and outputs of the Project. The implementation of livelihood restoration support also should be coordinated, overseen and implemented by the Project Steering Committee (PSC) as the final decision-making body and Secretariat chaired by the Secretary or Representative of MoDMR and with representatives from MoWR and MoLGRDC as members. As the Secretariat, the PSC is to operate with support from the Project Coordination and Monitoring Unit (PCMU) which shall be headed by a representative of MoDMR with assistance from the representatives of three (3) project implementation units (PIUs) which will be the actual implementing units for project activities. As shown in the same figure, the implementation of livelihood restoration support will be the responsibility of the concerned PIU; namely, DDM and PKSF.



Note: ▭ : DPP prepared by MoDMR for Components 2, 3 and Livelihood Restoration Support, and LGED and BWDB for Component 1.

Source: MoDMR, DDM, JICA office and JICA Survey Team

Figure 7.2.1 Draft of Livelihood Restoration Support Service under the Project Management Structure

(3) Procedure of Implementation

Declaration for heavy disaster is legally processed by the Secretary of the MoDMR, but materially it is initiated by the Deputy Commissioner (DC) based on the report from Union and Upazila level, before the Secretary of MoDMR recognizes the disaster. Therefore, PKSF should start to collect information on the disaster immediately after getting disaster recognition from MoDMR while selecting the target area and the amount of financing, before referral of the matter to PSC through PCMU.

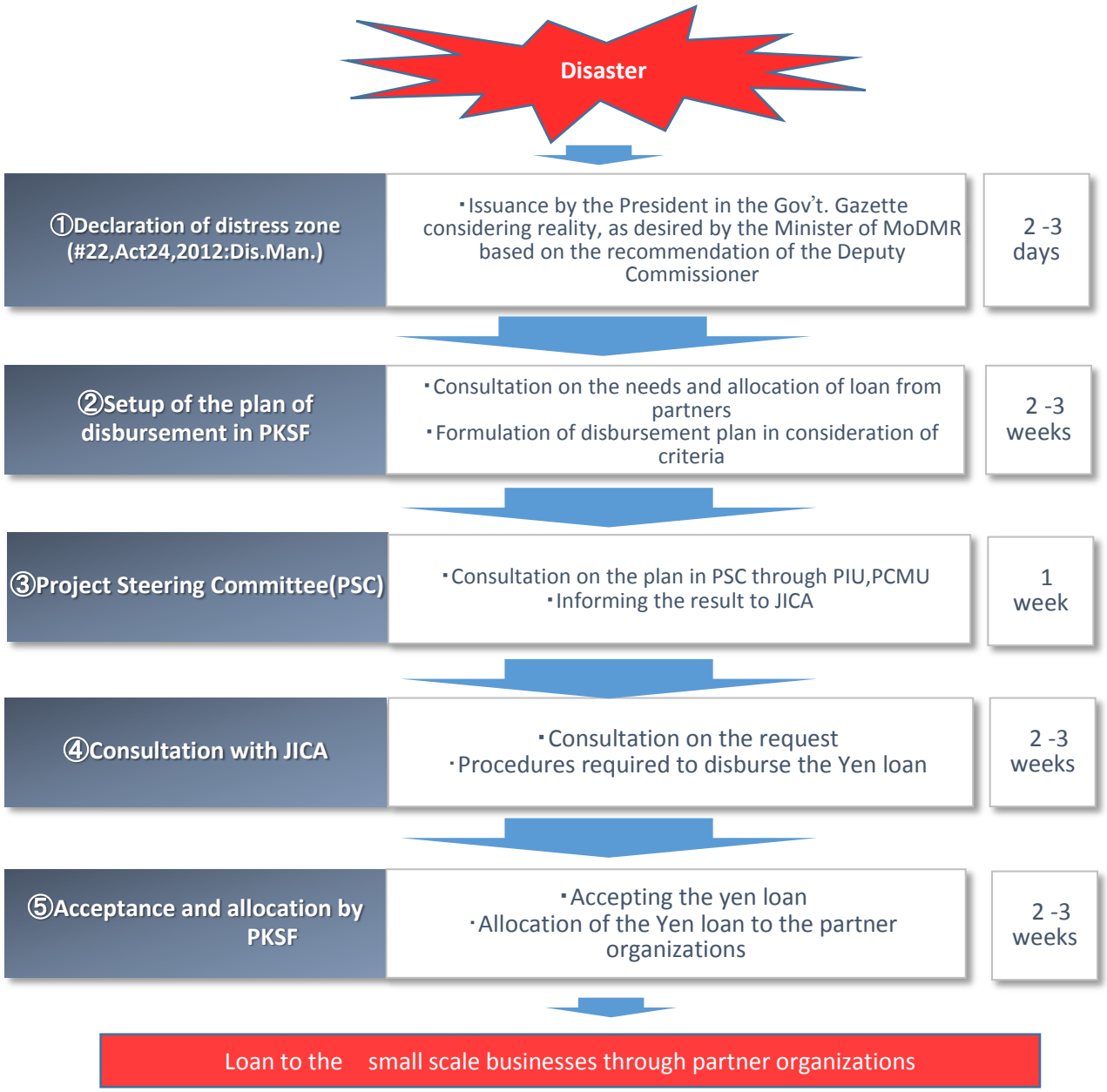


Figure 7.2.2 Draft of Procedure of Livelihood Restoration Support Service

(4) Challenges in Implementation

(a) Further Investigation of Loan Sale

There are various loan scales while needs of the loan program is considered to be high in terms of better livelihood, occupation, agriculture, and business in a target. Thereby, further investigation of loan scale must be required along with the conditions and interest of loan considering flexibility.

(b) Detail Investigation of Implementation System

PKSF, the assumed loan partner, has experience in disaster emergency loan programs independently by using financial support from WB and other donors even though it was established by an initiative of GOB. Hence, immediate disaster response as well as fairness is to be required. Thereby, detail investigations need to be conducted in consultation with institutions so as to correspond to the fast-acting even though this system is under the PSC.

CHAPTER 8. CONSTRUCTION AND PROCUREMENT PLAN

8.1 Construction Plan (Component 1)

8.1.1 Basic Conditions

(1) Working Rate

Working rate is calculated based on rainfall data obtained from the Bangladesh Meteorological Department, in accordance with JICA Design and Cost Estimate Manual (Civil Works, 2009) as follows:

- Daily rainfall data from April 2010 through March 2015;
- Summary of available data of the eight (8) BMD Rainfall Stations located at south coastal regions (Khulna, Mongla, Satkhira, Barisal, Bhola, Patuakhali, Chittagong, Cox's Baza);
- Public holidays, Friday;
- Holiday and national holiday except the day that overlaps with a public holiday;
- Non-workable day due to rain exceeding 10 millimetres per day;
- No double counting between holiday and non-workable day.

The calculated rates are shown in the table below.

Table 8.1.1 Working Rate based on Rainfall Data

年	2010/4～2015/3												
月 / 場所	4	5	6	7	8	9	10	11	12	1	2	3	計
Khulna	0.773	0.619	0.593	0.555	0.471	0.580	0.684	0.782	0.771	0.813	0.794	0.774	**0.684**
Mongla	0.793	0.619	0.533	0.503	0.523	0.573	0.651	0.782	0.771	0.813	0.801	0.787	**0.679**
Satkhira	0.773	0.600	0.633	0.574	0.542	0.613	0.684	0.782	0.771	0.819	0.801	0.748	**0.695**
Barisal	0.767	0.620	0.567	0.555	0.529	0.546	0.710	0.776	0.771	0.813	0.801	0.780	**0.686**
Bhola	0.753	0.600	0.560	0.497	0.484	0.574	0.677	0.769	0.771	0.826	0.808	0.768	**0.674**
Patuakhali	0.780	0.607	0.527	0.439	0.420	0.540	0.665	0.776	0.771	0.826	0.816	0.768	**0.661**
Chittagong	0.753	0.581	0.413	0.542	0.400	0.607	0.632	0.789	0.771	0.826	0.801	0.768	**0.657**
Cox's Bazar	0.773	0.535	0.400	0.361	0.374	0.620	0.632	0.789	0.765	0.826	0.808	0.780	**0.639**
平均	0.771	0.598	0.528	0.503	0.468	0.582	0.667	0.781	0.770	0.820	0.804	0.772	**0.672**

As shown above, the average workday rate is 0.672 in the eight costal regions during the past 10 yeas, equivalent to 245 workdays per year. In this case, work pause coefficient is 1.49 (=1/0.672)

Also, rainy season is from May to October; whereas, dry season is from November to April. Average workday rates calculated for rainy and dry seasons, respectively, are 0.558 and 0.786, between which great difference exists.

Workable coefficient for general works affected due to rain in the JICA Design and Cost estimate Manual is defined as 1.35, the workday rate is 0.741 which is equivalent to 270 workdays per year.

Therefore, the number of workdays in the eight coastal regions is 25 days less than the said general works in the JICA manual. This resulted from both falling number of workable days in rainy season and total of about 20 holidays per year, which is relatively large.

In the above calculation, non-workable days are simply counted for rainfall of over 10 mm per day. However, for foundation works of a bridge and river revetment works, for example, the construction is difficult when river water level is high. Also, for embankment works, it will take more time for resuming work due to high water content of material even after rain has ceased. From the above, the actual occupancy rate is expected to decrease further, which requires a sufficient margin when the project implementation process schedule is prepared.

(2) Procurement Condition of Materials, Labour, and Machines

Procurement situation of material, labour, and machine are as discussed below.

(a) Procurement Condition of Materials

a) Concrete

- According to Japanese construction companies and local leading companies, quality of ready-mixed concrete of commercial batching plants is very poor. There is lack of consciousness of quality management, for example, adding water immediately when slump decreases in transportation. Thus Japanese and local construction companies usually produce concrete and manage by themselves installing batching plant or simple mixer on a project to project basis, instead of using a commercial batching plant. Small-medium companies without production facilities may rent machinery from leading firms. However, in reality, many small-medium contractors mix raw materials manually without any mix specification.
- Regarding cement, there are many foreign suppliers and their quality is good. However, quality of cement produced by a local supplier is generally not so good.
- Coarse aggregate and fine aggregate (sand) are usually mined from Sylhet District in at the north-east part of the country. River-sand from dredging is not appropriate because of too small particle size. These materials are sometimes imported from India.

b) Steel Materials

- There are no problems in the quality of reinforcement because reliable suppliers exist like KSRM, BSRM, and RSRM.
- Steel materials excluding reinforcement are limited in small sizes such as I-shaped steel up to 150 millimetre and angle steel up to 75 millimetres. It is necessary to procure large-sized steel from overseas.

- It is necessary to procure steel sheet piles from overseas because there is no local supplier. It is common to use cast-in-situ piles for the wall cofferdam instead of the steel sheet piles in Bangladesh.
- It is necessary to import PC steel wire for PC Bridge, PC pile, PHC pile, etc.

d) Embankment Material

- It is common to use river sand from dredge for road embankment because there is little quantity of sandy soils suitable for embankment construction in Bangladesh. Clayey soils excavated from farmland in vicinity are used for covering the slope of embankment.
- It is common to obtain soils for polder dike from farmland in vicinity almost without specifying a borrow pit.
- Since good quality soils for embankment are scarce in the country, even excavated surplus soils are precious construction materials. Therefore, it is not necessary, basically, to a specify site and then surplus soils are utilized in surrounding landfill and raising of ground.

e) Subbase Course Materials

- Similar to concrete, aggregate materials are obtained from Sylhet District in the northeast of Bangladesh.
- Bricks are often used as subbase course materials. The materials are abundantly produced all over the country and can be procured anywhere.

f) Pile

- Cast in-situ piles and RC piles are commonly used as pipe types in Bangladesh
- There are cast in-situ pile construction companies.
- It is common to manufacture RC piles at the site of each project. However, PC piles, PHC piles and steel pipe piles have to be imported.

g) Wood

- It is difficult to obtain wood from the little forest source in the country.
- Local contractors normally use steel formwork rather than imported plywood formworks.

(b) Labour

- To ensure labour supply, it is a common practice for major local contractors to execute a contract with a labour supplier on the project to project basis. Bangladesh conventionally exports its labour to overseas countries such as Southeast Asia and Middle East at low price, which proves that there are abundant workers;

- According to the report from Japanese general contractors in Bangladesh, although the number of workers is abundant, the quality and productivity of skilled labour like carpenters and bar-benders are much less compared to Japanese workers.

(c) Machines

- Leading contractors possess various construction machines, for example, dump trunk, backhoe, vibratory roller, tire roller, concrete mixer vehicle, rough terrain crane, etc.; which makes them have capacities to handle various works like earthworks, road, concrete, and building construction.
- It appears that many of the above machines have been imported from Thailand and Singapore as second hand goods.
- As to leading construction contractors, they possess batching plants and mobile simple mixers for producing ready-mixed concrete and asphalt.
- Small and medium-sized construction firms in Dhaka and regional level areas only possess general purpose machines such as dump truck and backhoe. Hence, there is a great difference between the major local contractors and the small to medium-sized local contractors - the latter have a tendency of relying on manpower for construction.

8.1.2 Features of Local Construction Methods

As mentioned above, there is a great difference between major contractors and small-medium size contractors on equipment type and number. Hence, in reality, construction method varies by size of the awarded company. Regional contractors, without adequate machines, are likely to rely on manual construction. Even for leading companies, in case of a small size project, human construction also tends to be selected for reasons of difficulty of access by machine. The reason is significantly cheaper labor in Bangladesh, unlike Japan where manual construction is selected only for some limited cases.

Features of local construction method on related works are described below.

(a) Foundation Works

- Percussion method is commonly used for cast in-situ pile with diameter of 400 millimetres to 600 millimetres. Hanging the hit by using winch wire from the top of tripod and dropping it to the ground to crush strata to dig, which is different from the generally used method of digging into the ground using a large machine.
- Diesel pile hammer is also used to strike RC pile made in place.

(b) Earth Works, Earth Restraint Works and Road Works

- Material for embankment is commonly purchased from a supplier having a dredging permit from the Ministry of Natural Resources and shipped to site.

- Cohesive soils are generally obtained by excavation in nearby farmlands. However, it may affect slope stability of embankment. As stated later, civil works specifications developed by BWDB stipulates the minimum distance from the end of slope to the borrow pit.
- Steel and wood materials are difficult to procure in the country as stated above. Therefore, open-cut excavation is applied as much as possible even in bad geotechnical conditions. When slope stability can not be obtained with only excavation, it is considered to utilize wood piles. The use of water pump is only available method for dewatering in Bangladesh.
- Continuous underground wall is generally used to retain soils when excavating near an existing building in urban area. It is rare to build earth retaining wall using steel sheet pile and H-shape pile and horizontal wood panel in Bangladesh, where there are little steel and wood to procure.

(c) Concrete

- Concrete is generally produced by mobile concrete mixer except in a large scale project;
- Regardless of amount of pouring of concrete, mobile concrete pump has not been used. Ready-mixed concrete is transported to the location and be poured in small portions by manual labour. In case of tall building, pouring concrete is conducted by lift or tower crane.
- Height of one-time pouring is generally less than 2 meters, which is time consuming due to human pouring.

(d) Bridge Works

- Concrete for upper part is generally poured in place with support from the ground. Cast-on-site method is applied in many cases in RC bridge as well as PC bridge construction. It is performed by a few contractors who are capable of girder erection with crawler crane. The support from the ground is normally considered because of low labour cost.
- Supporting works is generally assembled using small diameter steel pipe as pillar combined with angles or channels.
- Foundation works is generally conducted during dry season when river table is low. In pier construction, excavation is conducted while scaffolding of heavy equipment is made by filling the river partially using soil.
- In the case of high water level resulting in difficulty for construction of foundation, cofferdam is often built around the foundation. Steel pipes of about 100mm diameter are set at two rows with a pith of 1~2m, inside which bamboo mats are laid without gap. Then dredged river sand is filled within the bamboo mats to form a cofferdam wall. Local contractors often build this type of cofferdam since materials can be procured are limited.

8.1.3 Construction Procedure

(1) Work Type

Work types relating to the repair and improvement project are envisioned as below.

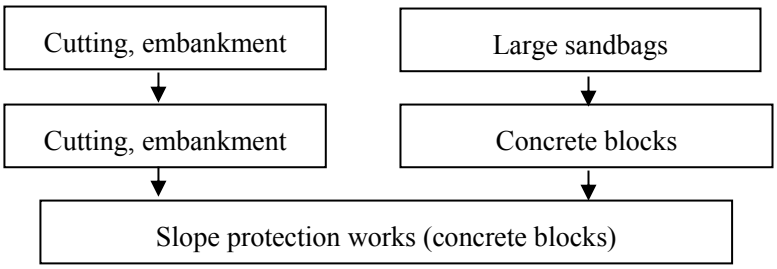
- Embankment, revetment, Sluiceway（BWDB）
- Road, Bridge（LGED）

(2) Construction Procedure

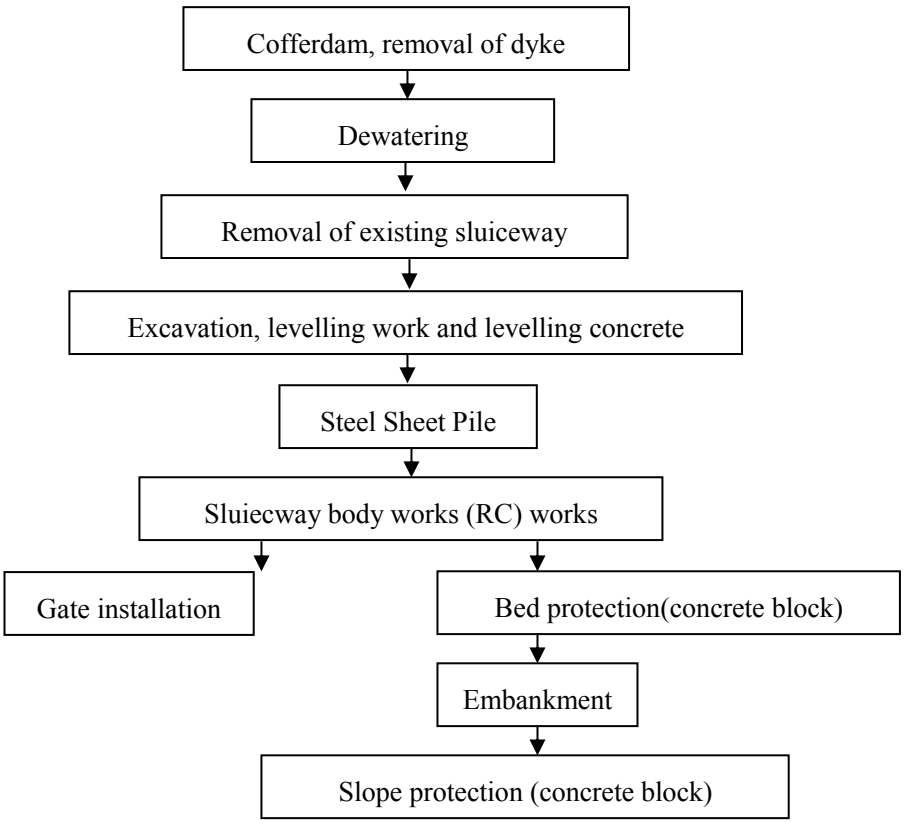
(a) General Construction Procedure

General construction procedures on the above works are as shown below.

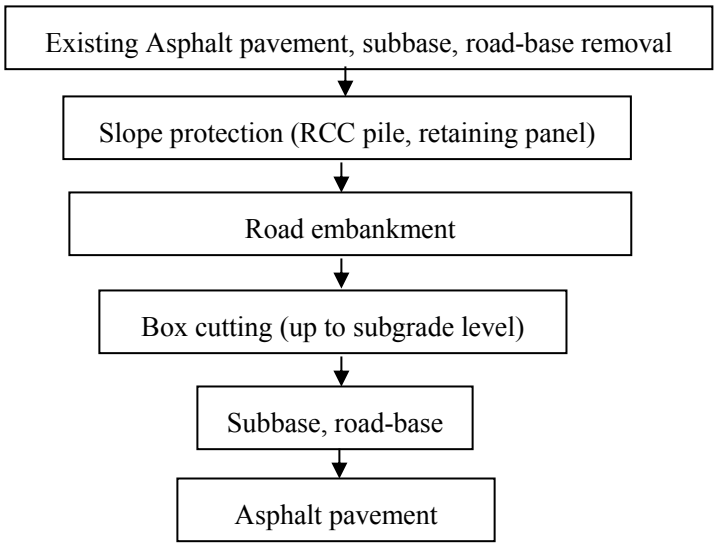
a) Embankment, Revetment



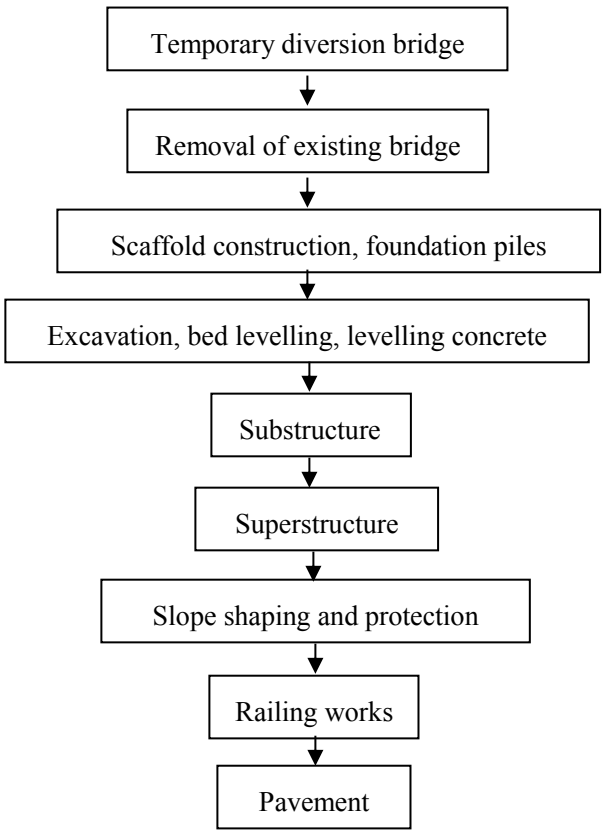
b) Sluiceway



c) Road



d) Bridge

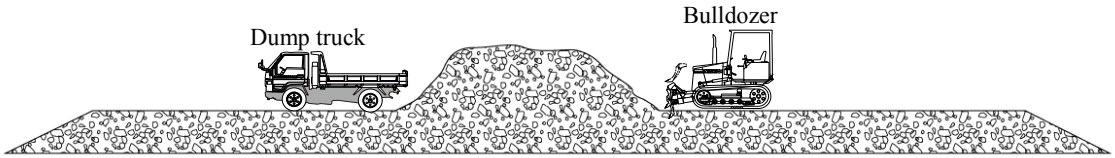


(b) Detailed Construction Procedure

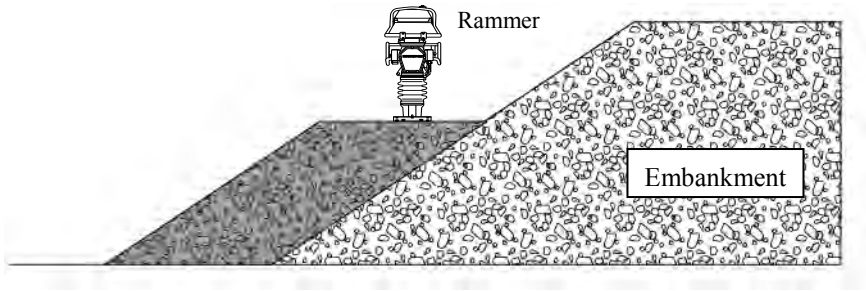
Further detailed construction procedures on road and bridge works are illustrated below. The method and machine below are commonly used and removal of existing structure is omitted.

a) Detailed Construction Procedure on Road Works

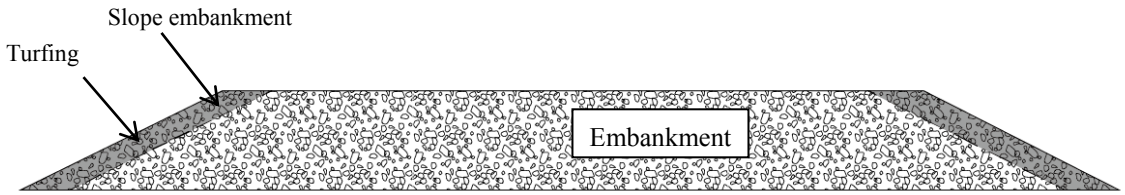
① Embankment



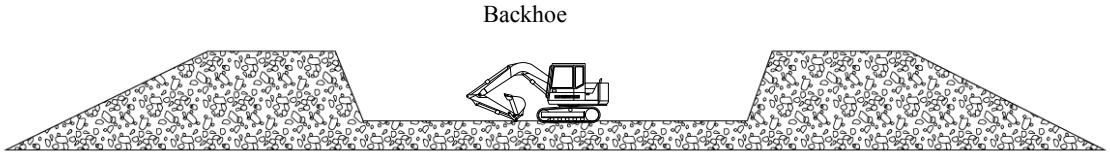
② Slope surface works



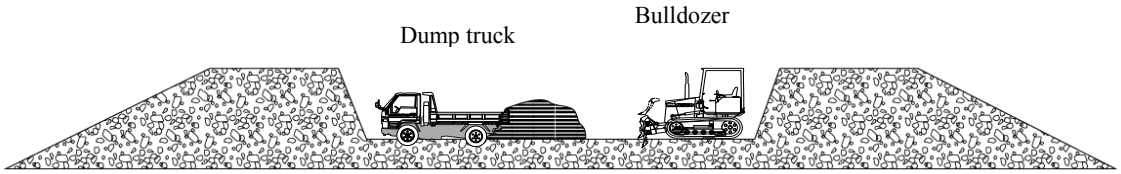
③ Embankment completion



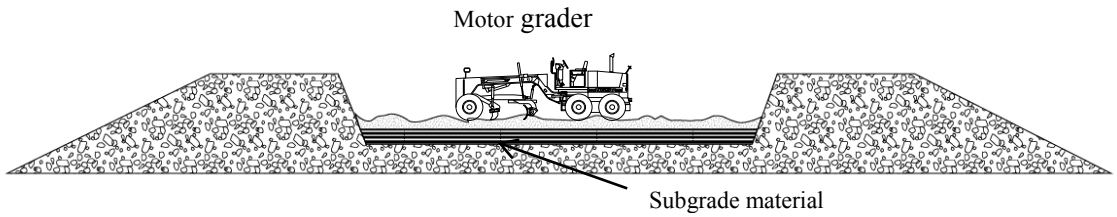
④ Excavation to subgrade



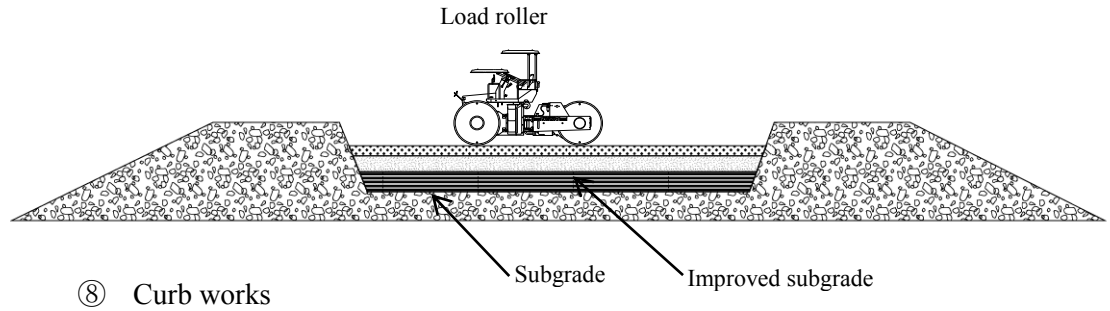
⑤ Subgrade works



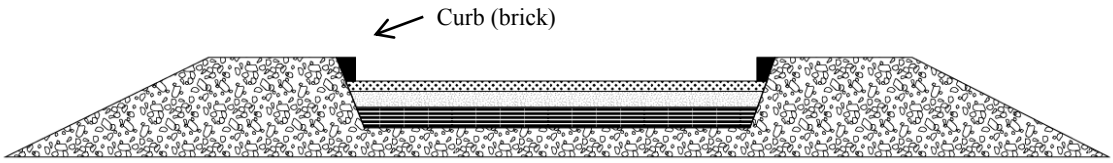
⑥ Subgrade improved works（t=250mm）



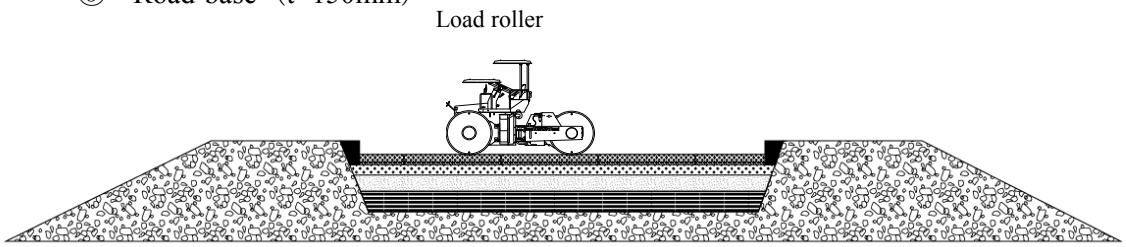
⑦ Subbase （t=150mm）



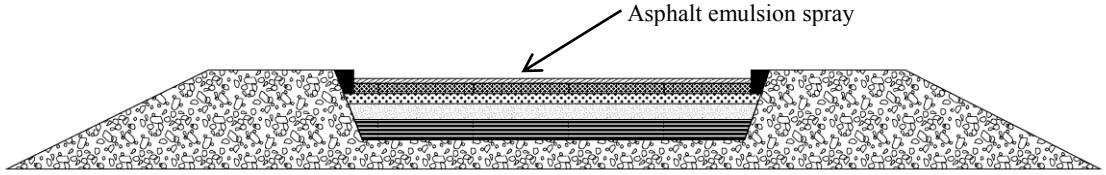
⑧ Curb works



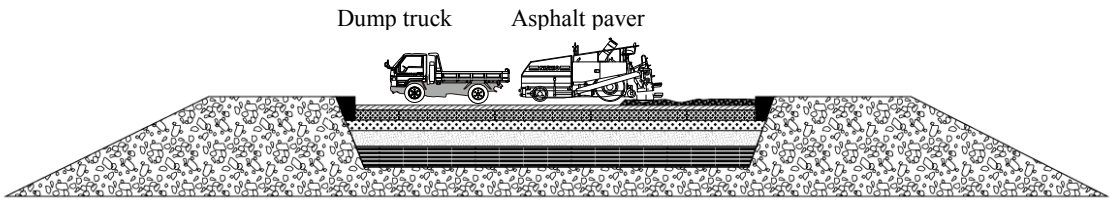
⑨ Road-base（t=150mm）



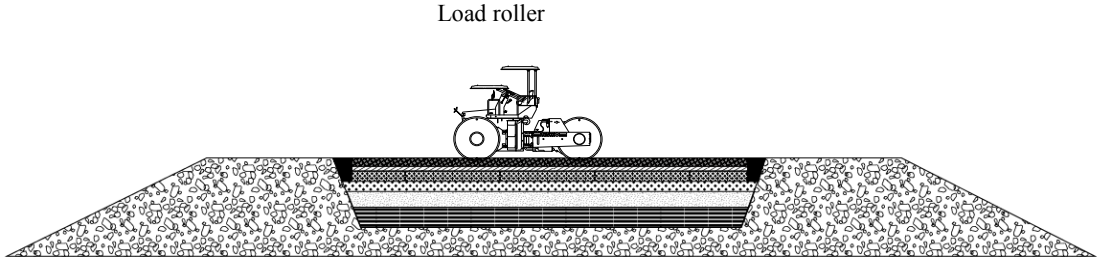
⑩ Prime coat



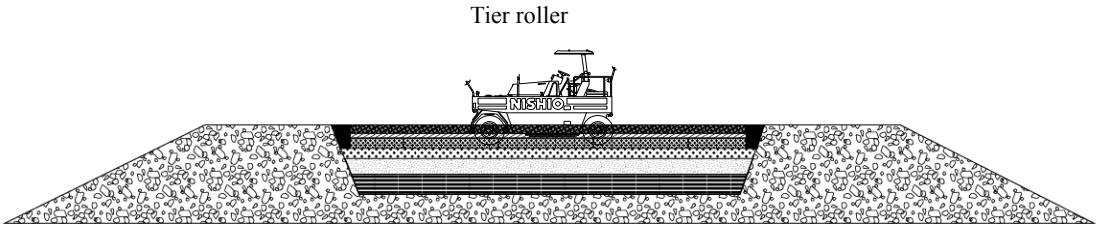
⑪ Asphalt laying and levelling



⑫ Asphalt compaction (primary compaction)

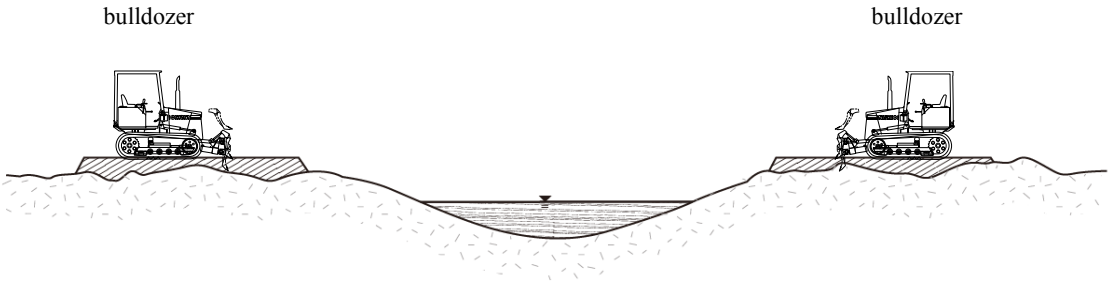


⑬ Asphalt compaction（second compaction）

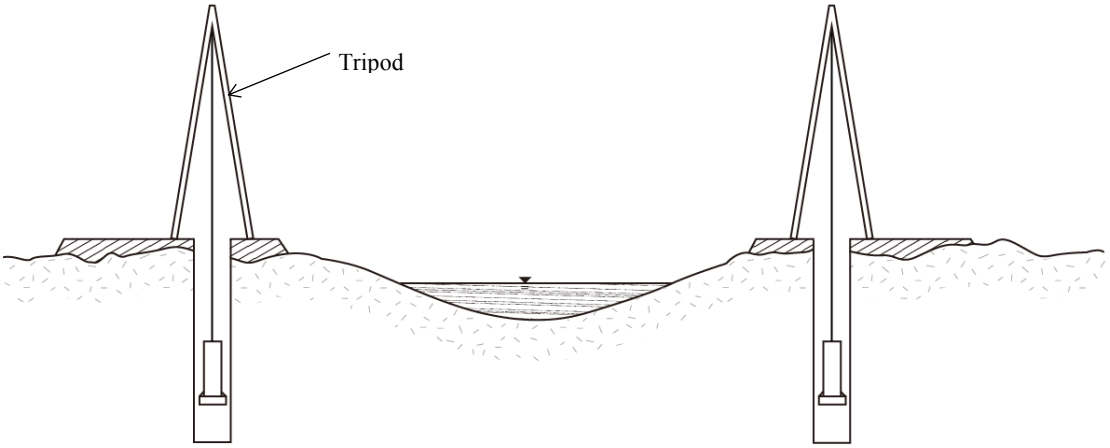


b) Detailed Procedures of Bridge Construction

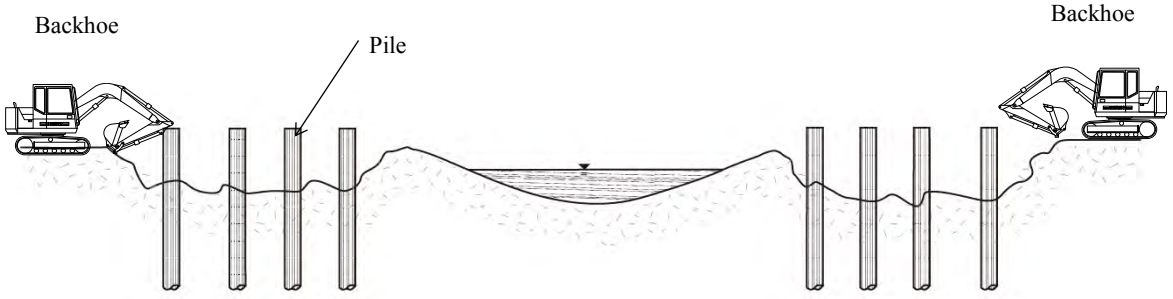
① Ground levelling, scaffold construction



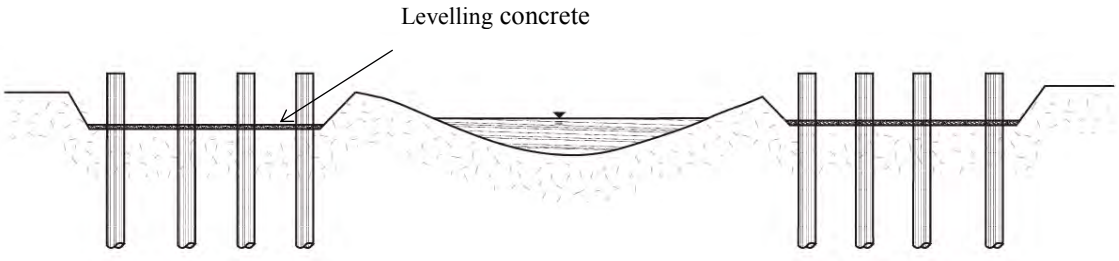
② Cast-in-situ pile (percussion method)



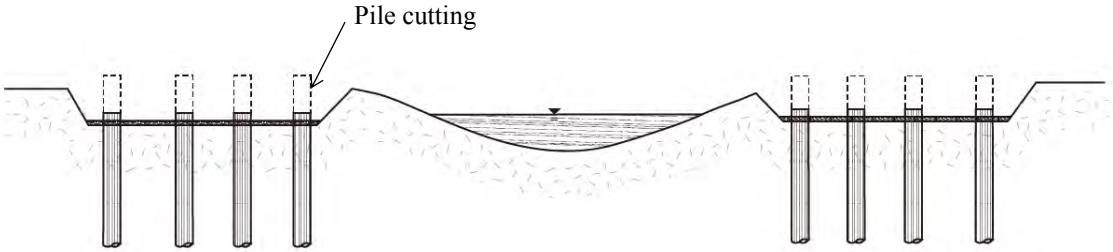
③ excavation



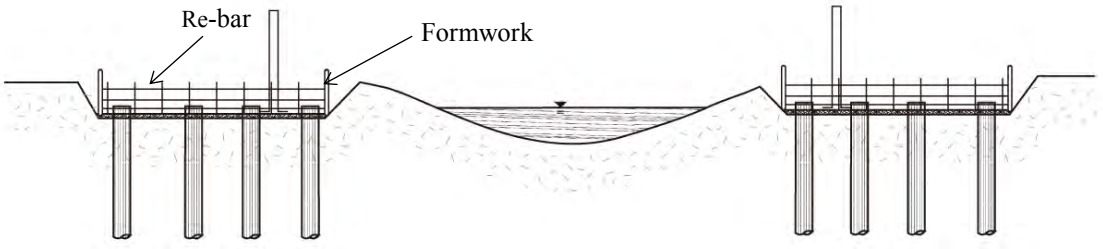
④ Ground levelling, levelling concrete



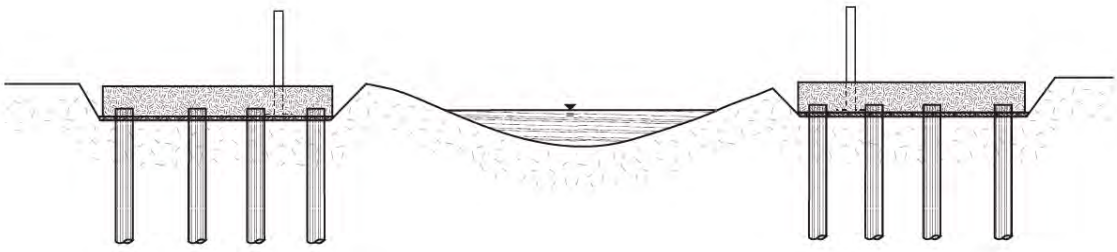
⑤ Pile head cutting



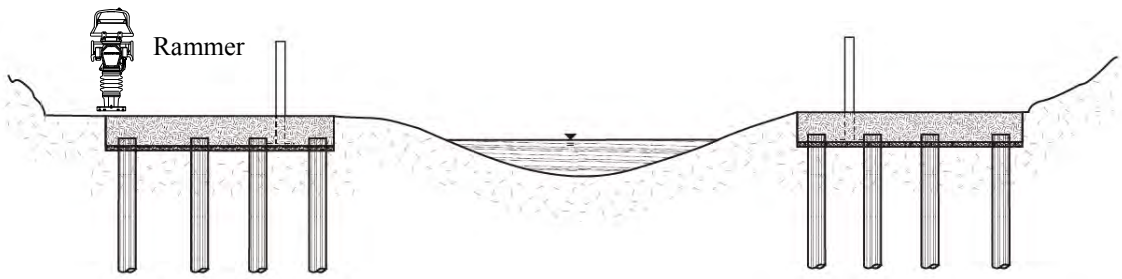
⑥ Rebar, formwork for base slab



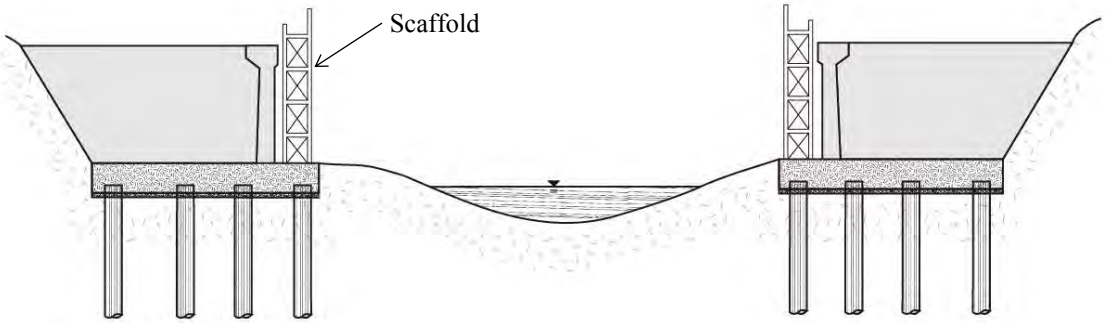
⑦ Pouring of base slab concrete



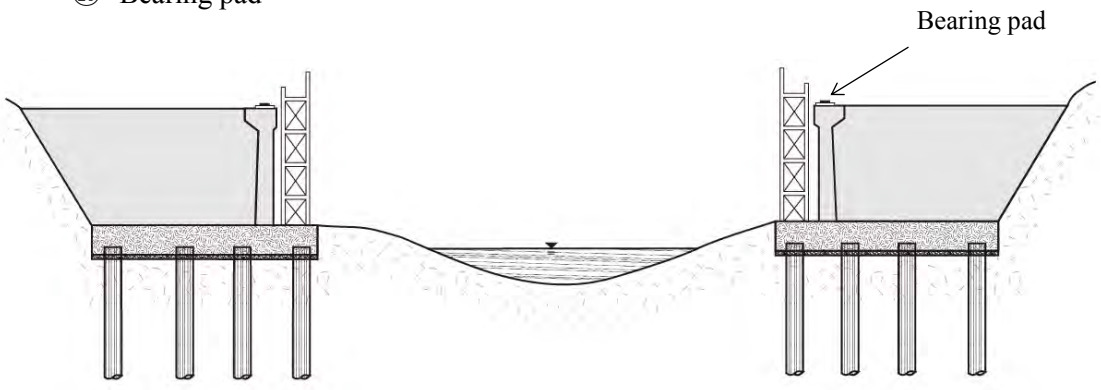
⑧ Backfill



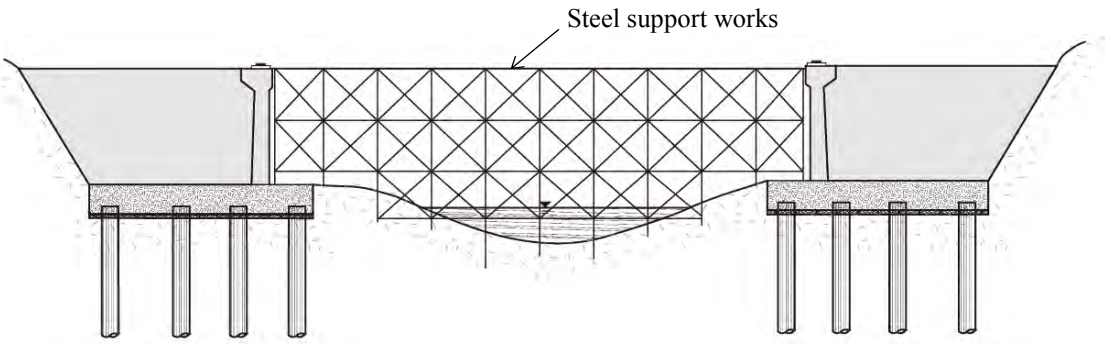
⑨ Abutment （1st lift） and backfill



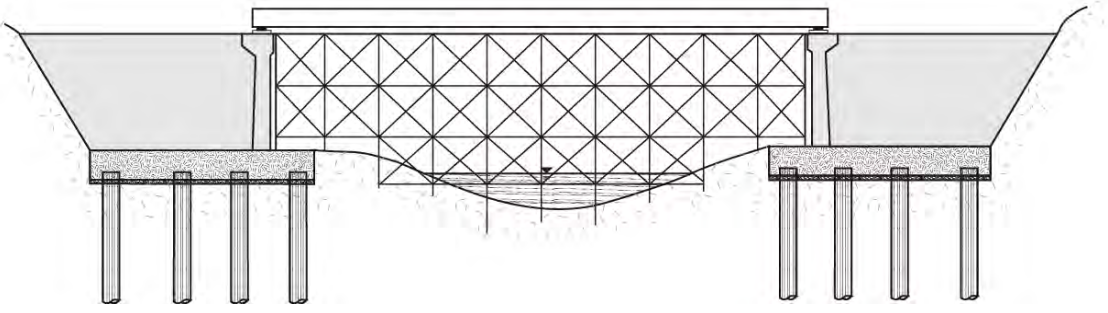
⑩ Bearing pad



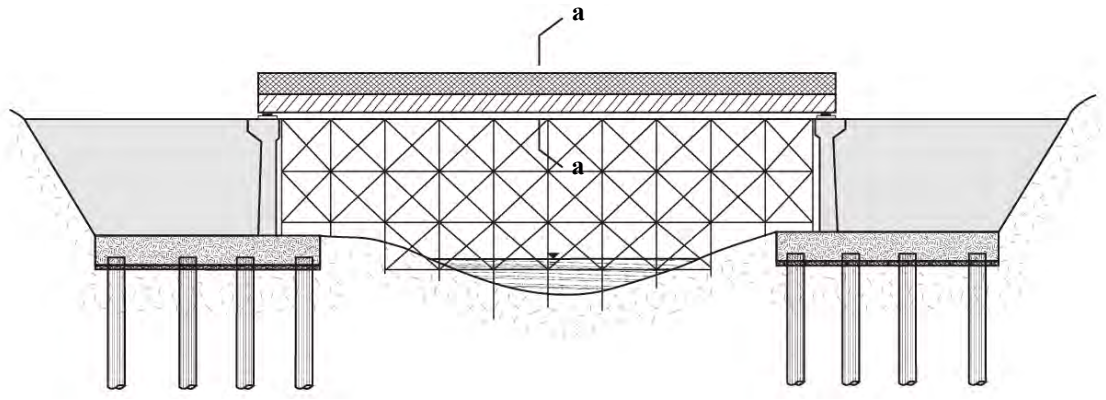
⑪ Support works

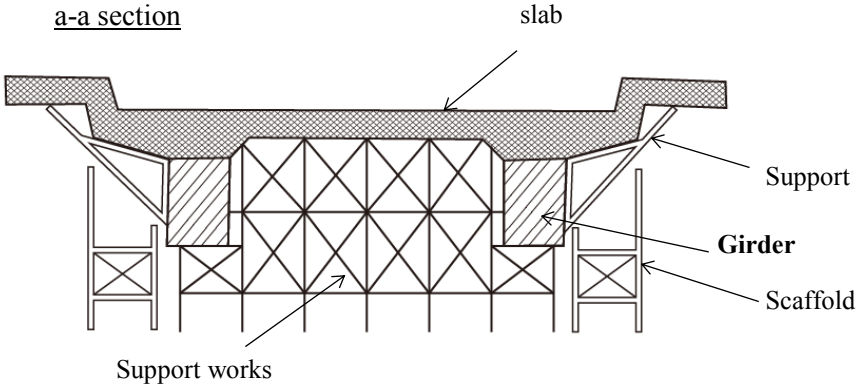


⑫ Girder (rebar, formwork, concrete)

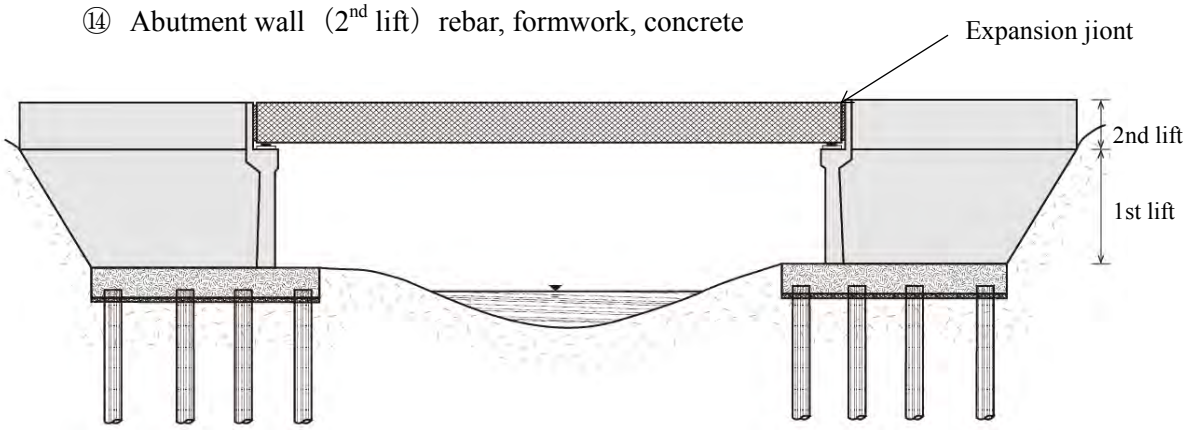


⑬ Floor slab (rebar, formwork, concrete)

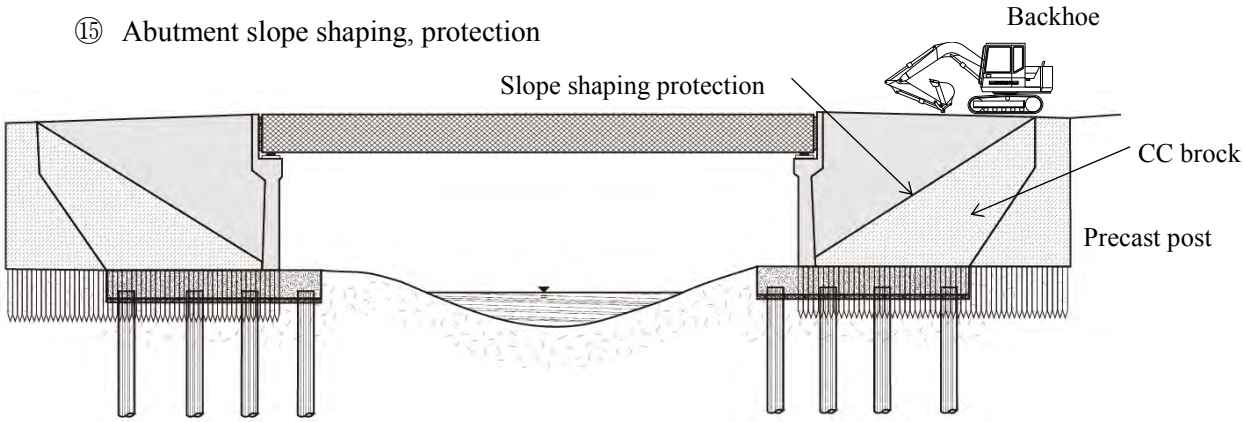




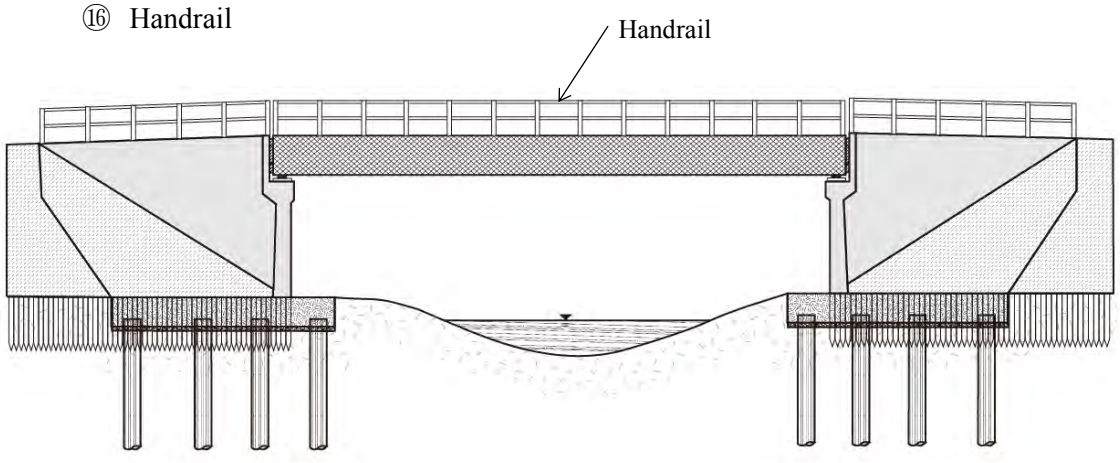
⑭ Abutment wall（2nd lift）rebar, formwork, concrete



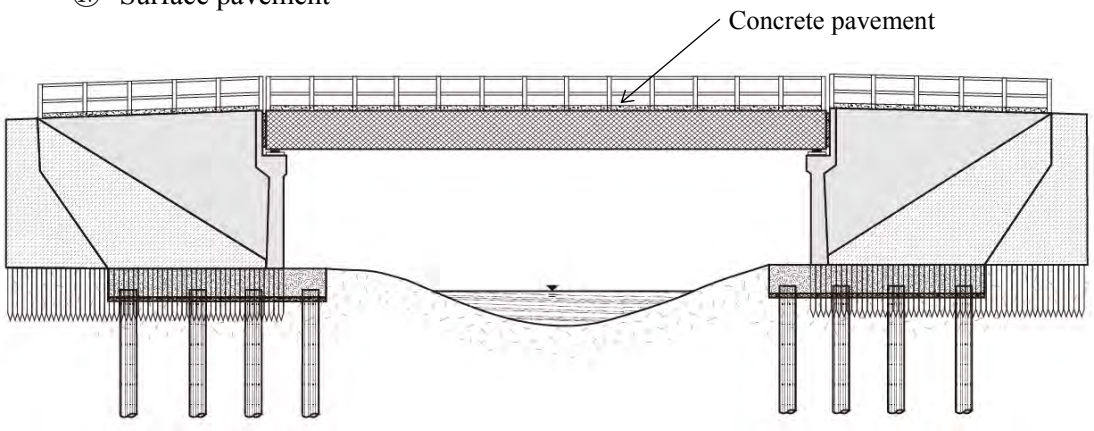
⑮ Abutment slope shaping, protection



⑯ Handrail



⑰ Surface pavement



8.1.4 Machines

Primary machines used in the project are listed in the table below. However, machines will vary according to possession conditions of contractor, project size, and condition of site. Accordingly, the following table shows commonly used machines by a major contractor.

Table 8.1.2 Work Type and Primary Machine

Work Type	Primary Machine	Application
Foundation works	Pile driver (cast in place pile, percussion method)	Abutment foundation
Embankment	Dump truck 4t～10t	Fill material loading
	bulldozer 8t～10t	Laying levelling, compaction
	Vibration roller 8t～10t	Surface compaction
	Rammer	Slope surface compaction
Road works	Backhoe 0.4m3～0.8m3	Subgrade section excavation
	Dump truck 4t～10t	Subgrade soil, base material and asphalt material loading
	bulldozer 8t～10t	Subgrade soil base course material laid levelling (rough finish)
	Motor graders 8t～14t	Subgrade soil, base course material laid levelling (finish)
	Vibration roller 8t～10t	Subgrade compaction
	Water tank truck	Subgrade tightening (water tightening)
	Load roller 8t～10t	Base course compaction, asphalt primary compaction
	Tire roller 8t～15t	Base course compaction, asphalt secondary compaction
	Asphalt distributor	Asphalt emulsion spray
	Asphalt pavers 6t～14t	Asphalt laying levelling
	Wheel loaders 1.0m3～3.0m3	Asphalt mixture transportation loading
Concrete works	Simple mobile mixer	Ready mixed concrete manufacturing
	Concrete vibrators	Concrete compaction
	Concrete mixer vehicle	Concrete transportation (for long transportation distance)
	Rough terrain 20t～25t	Hanging into rebar, formwork (if manual transportation is difficult)

8.1.5 Items of Quality Management

Items of quality management determined by BWDB and LGED related to earth works, concrete works, and civil works are shown below.

(1) BWDB

BWDB's technical specifications (1995) civil engineering works indicates items of quality management and standard values, as shown below.

Table 8.1.3 Items of Quality Management and Standard Values (BWDB)

Item	Standard Value
1. Civil works	
Embankment	Construction water content being within optimum water content ratio ±2%
	Min. standard compaction 90% (over 90% of maximum dry density using sand replacement method)
Backfilling	Layer thickness: 150mm(human power) or 230mm (machine)
Borrow pit position	Minimum distance from slope end: whichever is greater for 1.5 x depth of the pit and 3 meters.
2. Concrete works	
First mix	12 specimens (six for 7 day strength, six for 28day strength)
Slump test	Within 10% of the test slump
Pouring thickness	Below 450mm
Pouring fall height	Below 1200mm
Curing period	Over 10days or over 3/4 of 28 day strength
Demoulding period	Girder, wall, pillars (no applied load) 3days Slab lower end (with supporting) 14 days Removal period for floor slab support: 21 days Lower end of girder (with supporting): 21 days Removal period for girder support: 28days
Rebar lap joints	30 times diameter of rebar (with fork) 45 times diameter of rebar (without fork)
Rebar cover	Wall, slab (underground): 60 mm (normal), 75mm (salt water) Wall, slab(air, underwater): 50mm (normal), 60mm (salt water)

(2) LGED

Road Design Standards (2005) dedicates items of quality management and standard values related to earthworks, road works, which are shown below.

Table 8.1.4 Items of Quality Management and Standard Values (LGED)

Item	Standard Value
Embankment materials	Liquid limit of fraction passing: > 50%, Plasticity index of fraction passing>20% Soaked CBR greater than 3% at 95 MDD
Embankment fill	Min.95% Standard compaction Maximum dynamic cone penetrometer tests:45mm/blow Moisture content at compaction: optimum water content±5%
Side slope	Cohesive soil with PI of 8～20%
Subgrade (min. 300mm thickness)	98% standard compaction
Improved subgrade	Clay FM of sand 0.80 min , PI value<6 Soaked CBR >8%
Improved subgrade fill	Layer of maximum 150mm (compacted) thickness

construction method	Dry density not be less than 98% of MDD Moisture content at compaction: OMC±3% Finished surface: within a tolerance of ±20mm of planned grade
Brick on end edging	Brick (consist of First Class or Picked Jhama bricks) First Class: 240mm×115mm×70mm, unit weight>1,100kg/m3 Picked Jhama: 235mm×110mm×65mm, unit weight>1,200kg/m3 Crushing strength: First Class >17N/mm2, Picked Jhama >14N/mm2
Subbase materials	Fineness modulus of sand not less than 0.8 Liquid limit not greater than 25 Plasticity index not greater than 6 Soaked CBR value not less than 30% Sieve size distribution meeting grading envelop as shown in the design standard
Subbase construction method	Using power roller weighing 8 to 10 tons or equivalent vibratory roller Dry density compaction not being less than 98% Moisture content being optimum moisture content ±3% Finished surface being within a tolerance of ±10mm of elevation Average depth being as per drawing Minimum depth not being less than 95% of specified depth
Water bound macadam base course	Crushed Bricks (First Class or Picked Jhama) Los Angeles abrasion test with less than 40% at 500 revolutions of not more than 30% Aggregate impact value of not more than 30% Conforms to the grading envelope shown in design standard
Water bound macadam base course construction methods	Using power roller weighing 8 to 10 tons or equivalent vibratory roller Compacted thickness of each layer not exceeding 100 mm Finished surface being within a tolerance of ±10mm of elevation depth being equal or more than required base course thickness
Bituminous material	Aggregate crushing value not greater than 30% Bulk specific gravity not less than 2.5 Flakiness index not greater than 35% Aggregates shall comply with grading given in design standard
Bituminous material construction methods	Compacted using an approved roller (preferably a pneumatic tyre roller of 8-10 Ton) Finished surface being within a tolerance of ±5mm of elevation specified Not varying at any place more than 5mm from the straight edge 3m long applied to the surface both longitudinally and transverse. Laying temperature of the mixture not being less than 130℃

Following table shows the items of quality of management and standard values given in the Road Structures Manual for Single Lane Bridges.

Table 8.1.5 Items of Quality Management and Standard Values for Road Structures (BWDB)

Item	Standard value
Concrete strength	>25Mpa (28 day strength)
Slump	Cast in place pile 100mm~150mm Others 50mm~75mm
Cement	Initial setting time more than 50min. Soundness: ≤10 Loss on ignition: ≤4% Strength: ≥8Mpa (2 days) and ≥ 40Mpa (28days)
Reinforcing steel	Yield strength≥ 413N/mm2
Rebar lap joints	Tensile rebar 40 times rebar diameter (Zigzag joint) 56 times rebar diameter (Potato joint) 78 times rebar diameter (Potato joint, support required) Compressive rebar 30 times rebar diameter
Concrete Cover	Handrail strut: 20mm Handrail :20mm Sidewalk: 25mm Slab: 50mm on top, 40mm on bottom, 50mm on sides Main girder and cross girder: 50mm on top, 40 on bottom, 50mm on sides Abutment and wing wall: 75mm at ground side, 50mm at water side Pile cap (bottom slab): 75mm

8.2 Procurement Plan

8.2.1 Procurement Circumstances of Similar Projects in Banguradesh

(1) General Situation of Bidding and Contract for General Civil Engineering Works

The central Procurement Technical Unit under the Ministry of Planning is responsible for formulation and publication, on the website, of the Public Procurement Rules (PPR) and Standard Tender Documents for Procurement of Goods under Limited Tendering Method (STD), which state principles, methods and process, etc., regarding the public procurement including contractor selection, consultant selection, equipment procurement, etc. Furthermore, standard documents for procurement of general civil engineering works are categorized into the following six groups according to the differences between Local Competitive Bidding (LCB) and International Competitive Bidding (ICB), open competitive bidding and limited competitive bidding with prequalification documents (PQ) or without PQ, and difference in estimated price (upper limit, lower limit).

1. PW1 (LCB or ICB, for values up to Tk. 0.5 million)
2. PW2 (LCB, limited competitive bid, for values up to Tk. 10 million)
3. PW3 (LCB, open competitive bid, not need PQ, for values up to Tk. 350 million)

4. PW4 (LCB, open competitive bid, need PQ, for values above Tk. 350 million)
5. PW5 (ICB, with PQ, for values above Tk. 350 million)

According to the interviews with related organizations such as BWDB, LGED, in case of bid for civil works which are performed by self-fund, the compliance with PPR and STD developed by CPTU is mandatory. However, procurement policies of donor should prevail in case of loan projects; hence the guidelines for JICA procurement will be the basis under Japanese ODA loans.

In order to ensure transparency and impartiality of bidding activity, the Government of Bangladesh introduced e-Government Procurement in 2014, which is applied to procurement for values of up to Tk. 500 million. Government procurement, including tender notice, bid opening and successful bidder notification, may be undertaken using the electronic processing systems following the principles governing e-GP. Currently, although there are differences in current situations on the use of e-GP among related organizations, it is expected to become mandatory to use the system in the future.

(2) General Situation Regarding Local Consultants

There are 35 consultants belonging to the Bangladesh Association of Consulting Engineers and they are relatively large companies in the nation. The major consultants shown below have capability for design, bidding assistance and construction supervision for projects funded by the government or by loan.

- BETS Consulting Services Ltd
- Development Design Consultants Ltd
- BCL Associates Limited
- Aqua Consultant and Associates Ltd
- Design Planning and Management Consultants Ltd
- Engineering & Planning Consultants Ltd
- Desh-Upodesh Ltd
- HB Consultants Ltd
- Dev Consultants Ltd
- Dexterous Consultants Ltd

Among the above, BETS Consulting Services Ltd. and Development Design Consultants Ltd are leading consulting firms and have provided consulting services in broad sectors such as civil works and building works. BCL Associates Limited excels in airport and road projects, and Dexterous Consultants Ltd excels in tall buildings.

Leading consultants such as BETS Consulting Services Ltd and Development Design Consultants Ltd. were founded in the 1970s and have provided services for various loan projects funded by the World Bank, Asia Development Bank, and JICA.

However, other consultants not included in the above list are lacking in experience in independent design, bidding assistance, project implementation and supervision, and it is difficult for them to acquire tenders independently. It appears, generally, that they should form a joint venture with reputed leading consultants to win tenders and make track records.

In case of loan projects undertaken by ICB, it is difficult to win tender independently for leading consultants even like BETS Consulting Services Ltd and they usually have to win tenders by forming a joint venture with reputed international consultants. The reasons are as presented below.

- Insufficient experience overseas.
- Scarce design software held compared to the internationally experienced consultants.
- Enough trust has not been obtained from donors for the reasons above.

(3) General Situation Regarding Local Construction Industry

There are about 70 companies as members of the Bangladesh Association of Construction Industry, and the major contractors shown below have executed various projects funded by the Bangladesh government, loan (LCB and ICB), and private projects.

- Abdul Monem Ltd.
- Mir Akhter Hossan Ltd.
- Spectra Engineers Ltd.
- Toma Construction & Co., Ltd.
- Monico Ltd.
- Navana Construction Ltd.
- Associated Builders Corporation Ltd.
- Natinal Dev.Engineers Ltd.
- The Civil Engineers Ltd.
- Max Automobile Products Ltd.
- Concord Engineers & Construction Ltd.
- Project Builders Ltd.
- Pubali Engineering & Construction Co., Ltd.

The companies above have been awarded as contractors and executed diverse projects in various sectors such as dikes, road, bridge, sewer, and building structures, which ranged in costs from several hundred million to several billion.

However, it is general to form a joint venture with internationally reputed construction companies because of difficulty to satisfy PQ requirements independently. It is also general for them to participate as subcontractors of foreign companies in case of large size and complex projects like large-scale bridge, power plant, airport, etc.

These leading construction companies possess various construction machinery and equipment. According to interview with one leading firms, the following machinery are possessed.

- Dump truck : 56
- Concrete mixer : 2
- Backhoe : 15
- Wheel Loader : 12
- Bulldozer : 5
- Vibrating Roller : 13
- Motor Graders : 7
- Tire Roller : 6
- Tandem Roller : 7
- Asphalt Pavers : 3
- Asphalt Distributor : 4
- Rough Terrain Crane : 3
- Tower Cranes : 2

It is said that approximately 70% of the above machinery is second hand purchased from Japanese construction firms when their projects were accomplished and the remaining one was newly purchased.

In addition to the above list, these leading construction companies also possess batching plants and mobile concrete mixer for producing ready mixed concrete and asphalt.

On the other hand, small and medium sized construction firms, in Dhaka and regional area, only possess general machinery such as dump truck and backhoe. Hence, there is great difference between leading companies and small to medium ones; the latter have a tendency of relying on manpower construction.

In addition, it is general to ensure the labour through labour contract with labour supplier on a project basis for leading companies.

(4) General Situation Regarding Procurement of Necessary Materials and Equipment

The procurement situation regarding materials and equipment necessary for this project are as described below.

(a) Construction Machinery

Small and medium construction companies have few equipment. Therefore, it is usual to rent equipment from leading construction firms, machinery rental companies and government agencies. Construction firms based in Dhaka commonly rent machinery from leading companies and machinery rental companies. On the other hand, construction companies based in regional area, where there are no leading construction companies and machinery rental companies, rely on rental from local

government. However, in this case, in addition to high rental cost, maintenance status of machinery is not good, which often results in breakdown after the rental.

(5) Construction Materials

(a) Concrete

- According to Japanese construction companies and local leading companies, quality of ready-mixed concrete of commercial batching plants is very poor. They lack consciousness of quality management, for example, adding water immediately when slump decreased in transportation. Thus Japanese and local construction companies usually produce concrete and manage themselves installing batching plant or simple mixer by project base, instead of using commercial batching plant. Small-medium companies without production facilities may rent machinery from leading firms. However, in reality, many small-medium contractors by mixing raw material by labour only without mix design.
- Regarding cement, there are many foreign suppliers and their quality are good. However quality of cement produced by local supplier is generally not so good.
- Coarse aggregate and fine aggregate (sand) are usually collected from Sylhet District in the north-east of the country. River-sand from dredging is not appropriate because of utilizing for too small particle size. Also, these materials maybe imported from India, sometimes.

(b) Steel Materials

- There are no problems in quality of reinforcement because reliable suppliers exist.
- Steel materials excluding reinforcement are limited in small sizes such as I-shaped steel up to 150 millimetres and angle steel up to 75 millimetres. It is necessary to procure large-sized shaped steel from overseas.
- It is necessary to procure steel sheet piles from overseas because there is no local supplier. It is common to use cast-in-site piles for the wall cofferdam instead of steel sheet piles in Bangladesh.
- It is necessary to import PC steel wire used for PC Bridge, PC pile, PHC pile, etc.

(c) Embankment Materials

- It is common to use river sand dredged for road embankment because there is little quantity of sandy soils suitable for embankment construction in Bangladesh. Clayey soils are used for covering the embankment at the slope, which are excavated from farmland in vicinity.
- It is common to obtain soils for polder dike from farmland in vicinity almost without specifying a borrow pit.

- Since good quality soils for embankment are scarce in the country, even excavated surplus soils are precious construction materials. Therefore, it is not basically necessary to specify disposal site and then surplus soils are utilized in surrounding landfill and rising of ground.

(d) Subbase Course Materials

- Similarly like concrete, aggregate materials are obtained from Sylhet District in the northeast of Bangladesh.
- Bricks are often used as subbase course materials. The materials are abundantly produced all over the country and can be procured anywhere.

(e) Pipe

- Cast in site pipes and RC pipes are commonly used pipe types in Bangladesh
- There are cast in site pipe construction companies.
- It is common to manufacture RC piles in the site of each project. However, PC piles, PHC piles and steel pipe piles have to be imported.

8.2.2 Setup of Bidding Method and Contract Conditions

Upon setting the bidding method and contract conditions, it is necessary to firstly determine procurement category which fall under the local competitive (LCB) group or international competitive (ICB) group. As stated in Section 1.02 of the Guidelines for Procurement under Japanese ODA Loans, "ICB is the best method for satisfying the requirements regarding procurement of goods and services for projects". On the other hand, in Section 1.03 of the same reference, "These Guidelines will not apply in the case of procurement of goods and services which are, by nature or scope, unlikely to attract foreign firms and ,thus, to be domestically procured. Procurement of such goods and services shall, however, be effected with due attention to the considerations stated in Section 1.01(3), JICA deems it appropriate that such procurement be effected through Local Competitive Bidding (LCB) in accordance with the procurement procedures generally used in the Borrower's country" is clearly specified. In brief, in case of LCB, the Public Procurement Rules (PPR) and Standard Tender Documents (STD), as domestic procurement rules in Bangladesh, are applied; in case of ICB, Guidelines for Procurement under Japanese ODA Loans and Standard Bidding Documents are basically applicable. It is obliged in Section 1.01 "Guidelines for Procurement under Japanese ODA Loans are applicable to the ODA Loans provided by JAPAN INTERNATIONAL COOPERATION AGENCY (hereinafter referred to as "JICA", under Clause (a), Item (ii),Paragraph 1, Article 13 of the Act of THE INCORPORATED ADMINISTRATIVE AGENCY-JAPAN INTERNATIONAL COOPERATION AGENCY". It is also obliged in Section 4.01 that "Borrowers shall use the appropriate Standard Bidding Documents (SBDs) of the latest version issued by JICA with minimum changes acceptable to JICA, as necessary to address project specific conditions".

Standard Bidding Documents of JICA has been issued, which was developed referring to FIDIC (PINK BOOK, October 2012). Also Standard Tender Document on Bangladesh is formulated from contract form and standard

tender documents of FIDIC. Therefore, it is considered that there are no great differences between the two documents.

However, the following points are different between the procurement policy under the JICA guidelines and the PPR of Bangladesh.

1. As stated in Section 8.2 of the standard bidding documents of the Bangladesh PPR, the upper and lower limits of bid estimated price is to be disclosed. This policy is different from the Notes on Section 1.01 of the JICA Guidelines which states: "To emphasize free competition among bidders, JICA, in principle, does not accept the idea to disclose the estimated price for the contract before the bidding although some Borrowers and International Financial Institutions accept such disclosure in view of transparency in the process".
2. In case of performing ICB in a general competitive method, item (1) (e) of PPR83 suggests preferential margins or domestic preferences. Item (21) (e) of PPR98 states that upon comparison of evaluated tender prices, that of foreign companies may be increased by a percentage up to 7.5% for 'domestic preference'. This also conflicts with the Notes on Section 1.01 in the Guidelines of JICA, which states: "With due consideration to non-discrimination among eligible bidders, neither preferential margins nor domestic preferences are permitted when prequalifying applicants or evaluating bids under Japanese ODA Loans".

8.2.3 Selection and Employment of Consultant

Confidential

Confidential

Confidential

Confidential

8.2.4 Selection of Contractor

Confidential

Confidential

Confidential

Confidential

Table 8.2.1 Package and Bidding Method of Component 1

Confidential

Confidential

Table 8.2.2 Package and Bidding Method of Component 2

Confidential

Confidential

Table 8.2.3 Package and Bidding Method of Component 3

Confidential

8.2.5 Consideration for Management of Contract

Confidential

Confidential

CHAPTER 9. CONSULTING SERVICE

9.1 Objective of Consulting Service

The objective of the .consulting services is to achieve the efficient and proper preparation and implementation of the Project through the following works:

Confidential

9.2 Expected Time Schedule

Confidential

Table 9.2.1 Expected Time Schedule

Confidential

Confidential

9.3 Manning Schedule

Confidential

Table 9.3.1 Estimated Man-Months for Component 1: BWDB Portion

Confidential

Table 9.3.2 Estimated Man-Months for Component 1: BWDB Portion

Confidential

Table 9.3.3 Estimated Man-Months for Component 1: LGED Portion

Confidential

Table 9.3.4 Estimated Man-Months for Component 1: Intersectional Portion

Confidential

Table 9.3.5 Estimated Man-Months for Component 1: Total

Confidential

Table 9.3.6 Estimated Man-Months for Component 2

Confidential

Confidential

Table 9.3.7 Estimated Man-Months for Component 3

Confidential

Table 9.3.8 Estimated Man-Months for Overall, Component 1, 2 and 3

Confidential

Table 9.3.9 Manning Schedule for the Consulting Services

Confidential

CHAPTER 10. IMPLEMENTATION SCHEDULE AND PRELIMINARY COST ESTIMATE

10.1 Implementation Schedule

10.1.1 General Conditions

Confidential

10.1.2 Implementation Schedule

Based on the above conditions, the implementation schedule is prepared as follows:

Table 10.1.1 Implementation Schedule

Confidential

10.2 Project Cost Estimate

10.2.1 General Conditions of Cost Estimate

(1) Items of Project Cost

The breakdown of project cost for equipment and infrastructure project is shown below.

- Equipment cost and construction cost
- Price escalation for equipment and construction cost
- Physical contingency on the main project cost
- Interest during construction
- Consultant service cost (including physical contingency)

The following items are non-eligible for financing.

- Land acquisition cost, etc. (not included in equipment project)
- VAT and import taxes
- Project administrative cost of the employer (project implementing body)

(2) Conditions for the Calculation of Project Cost

Confidential

Table 10.2.1 Conditions applied to the Cost Estimate for Infrastructure (Component 1)

Confidential

Confidential

Table 10.2.2 Conditions applied for the Cost Estimate of Equipment (Component 2)

Confidential

Table 10.2.3 Calculation Method of Each Component

Confidential

10.2.2 Construction Cost for Component 1

(1) Basic Unit Price and Construction Unit Price

(a) Basic Unit Price

Confidential

Table 10.2.4 Basic Unit Price of Materials

Confidential

Table 10.2.5 Basic Unit Price of Equipment

Confidential

Confidential

Table 10.2.6 Basic Unit Price of Labor

Confidential

(b) Construction Unit Price

The construction unit prices of major items used in the cost estimate are shown in the following table.

Table 10.2.7 Construction Unit Prices of Major Work Items

Confidential

(2) Construction Cost

The estimated construction cost of each sub-project is shown below.

Table 10.2.8 Estimated Construction Cost of Sub-project under BWDB

Confidential

Table 10.2.9 Estimated Construction Cost of Sub-project under LGED

Confidential

10.2.3 Equipment Procurement Cost for Component 2

(1) Quoted Unit Price

Confidential

Table 10.2.10 Quoted Unit Price of Equipment for DDM

Confidential

Confidential

Table 10.2.11 Quoted Unit Price of Equipment for FSCD

Confidential

(2) Equipment Procurement Cost

The estimated equipment procurement cost for each item is shown below.

Table 10.2.12 Estimated Equipment Cost under DDM

Confidential

Confidential

Table 10.2.13 Estimated Equipment Cost under FSCD

Confidential

Table 10.2.14 Estimated Equipment Procurement Cost under DDM

Confidential

Table 10.2.15 Estimated Equipment Procurement Cost under FSCD

Confidential

10.2.4 Project Cost

Confidential

Table 10.2.16 Estimated Project Cost

Confidential

Table 10.2.17 Annual Fund Requirement

Confidential

CHAPTER 11. PROJECT EVALUATION

11.1 General

In this chapter, the quantitative and qualitative effects of the projects are evaluated. The Economic Internal Rate of Return (EIRR) and the Number of Beneficiaries are used as the indicators of the quantitative effects. The indicators such as Benefit-Cost Ratio (BCR) and Net Present Value (NPV) are calculated as well. The qualitative effect evaluation is conducted as to the effectiveness of projects which could not be evaluated quantitatively. The operation and effect indicators for the projects are then proposed.

11.2 Quantitative Effect

11.2.1 Economic Internal Rate of Return (EIRR)

(1) General

The main purpose of economic analysis is to show the effects of project implementation. Although there are many projects proposed in the public sector for the improvement of life of people in the state, the budget is often limited. The economic analysis estimates whether the project is beneficial to the national economy by analysing the expense consumption of national resources.

While financial analysis appraises the project viability from the viewpoint of private entity, benefit of firms and private are calculated and the actual figure spent are calculated as cost, economic analysis uses discounted cash flow analysis for cost-benefit analysis. Cost-Benefit analysis is the method that compares economic benefits and economic costs. EIRR is the indicator which shows the efficiency of a project.

The economic analysis for this study is undertaken using the methods which are often used to evaluate a disaster-prevention project, although the evaluated projects in this study were in fact repair and rehabilitation of the infrastructures damaged severely by past disasters such as Cyclone Sidr[15]. There are few cases of rehabilitation and/or reconstruction from disatster project found in which EIRR is calculated to show the efficiency of the projects. Not only that, in Japan, the Ministry of Land, Infrastructure, Transport and Tourism of Japan (MLIT) has clearly articulated that Cost-Benefit Analysis should not be conducted in the recovery projects from the Great East Japan Earthquake. Another case is that there is no evaluation principle; no method and/or criteria has been set for recovery from disaster and rehabilitation projects of existing infrastructure in the evaluation guideline of MILT. Based on the situation mentioned above, evaluation methods for disaster-prevention projects are used. It means that the project is analysed based on the benefits of the expected avoidable damage

[15] Projects of Component 1 execute the repair and rehabilitation of flood countermeasure facilities, rural roads and bridges, which could be damaged by water induced disasters in near future.

(or the expected avoidable additional cost) on the assumption that implementation of the project reduces the damage to assets and/or the additional costs arising from a disaster.

It should be mentioned that less information and data on damages of past disasters in regional areas of Bangladesh have been recorded and/or assembled, and there was time constraint to collect the information and data needed in conducting the analysis, resulting in using a number of secondhand data. Thus, the economic analysis results in this study such as EIRR, BCR and NPV shall be considered as reference information.

(2) Projects Subject to Analysis

The subjects of analysis are the subprojects in Component 1 (CP1), repair and rehabilitation of infrastructure. As for Competent 2 (CP2), economic analysis is not undertaken due to difficulty in the measurement of economic benefits. Besides, CP2 consists of the procurement of communication and warning system and rescue tools. Instead, other quantitative effects and qualitative effects that come from the implementation of subprojects are evaluated. Disaster Recovery Fund was designed in Component 3 (CP3). As for the subprojects in Component 3, they will be selected at the time of disaster in future. Therefore, economic analysis for CP3 is not performed in this study.

It is reasonable to think that the EIRRs of the subprojects in CP3 would be higher than that of the projects funded by Japanese Yen Loan with normal procedures, because preparedness of Disaster Recovery Fund will make recovery from disasters earlier, reducing the expected damages which would be burdened if no the fund exists. EIRRs of the whole project were not calculated.

CP1 consists of 18 subprojects as shown in the table below. The EIRR of the 18 sub-projects in CP1 is calculated as one package. On the other hand, the EIRRs by implementation agency, BWDB with 8 subprojects and LGED with 10 subprojects, are calculated as one package, respectively. The 18 subprojects are categorized into 4 different types of infrastructure. The appropriate evaluation approach and method are employed for each different type of infrastructure. The outline of benefits supposed to be estimated in each infrastructure type are shown in the table below.

Table 11.2.1 CP1 Sub-projects subjected to Economic Analysis

	Implementation Agency	Project No.	Infrastructure Type	Outline of Estimated Benefits
CP1	BWDB	5	Embankment	Avoidable damages from flooding on assets inside polders - Damage to houses and household assets - Damage to agricultural production and fisheries
		6		
		7		
		10		
		21		
		33		
		19	Revetment	Avoidable damages on critical infrastructure - Barisal Airport - Bir Shrestha Captain Mohiuddin
		20		

				Jahangir Bridge (National Road No.8)
	LGED	BR1	Bridge	Avoidable costs on usage of detour routes - Vehicle opration cost (VOC) - Travel time cost (TTC)
		BR2		
		BR3		
		BR4		
		BR6		
		BR11		
		BR12		
		HW1	Road	
		HW13		
		HW16		

Source: JICA Survey Team

(3) Basic Assumption

(a) Benefit Calculation Method (Embankment, BWDB)

The selected embankment where the subproject is subject to be implemented is a part of the embankment that surrounds a polder, which is exposed to high risk of embankment collapse due to vulnerability caused by wave action and/or riverbed scouring. Once the embankment has collapsed, a lot of land in the polder would be inundated and various assets inside the polder will be severely damaged (Without Project Case). On the other hand, it can be expected that asset damage caused by inundation will be avoidable by the project implementation (With Project Case). In this study, the economic analysis is done based on the assumption that this avoidable damage to assets in the polder is considered as a benefit.

Besides that, the appraisal report on the "Coastal Embankment Improvement Project Phase I (CEIP-I), World Bank, 2013" and the assessment report on "Cyclone Sidr in Bangladesh Damage, Loss and Needs Assessment for Disaster Recovery and Reconstruction (Sidr Report), GOB assisted by the International Development Community, 2008" was consulted in this economic analysis.

Expected avoidable damage is calculated by the following formulae:

Expected avoidable damage

= a) Asset value exposed x b) Expected damage rate x c) Reduced probability of inundation

a) Asset Value Exposed

In the absence of the project, storm surges/river floods would inundate the polders affecting various types of assets, such as crops, livestock, roads, schools, properties and human lives. Those assets are exposed to the risk. In this study, an asset type of "Properties", which consists of housings and household contents, is to be measured as the Asset value exposed, because the amount of damage

in this housing sector is highest in total damages and losses caused by Cyclone Sidr[16]. Asset types of "Agriculture" and "Fisheries" are measured, because the losses of which took up respectively a larger share in Sidr case and are usually measured in the economic analysis conducted by BWDB for the embankment development projects in the coastal area. Asset value exposed is calculated by the following formulae:

- Housing value = Appraisal value (BDT/household) x Number of households[17]
- Household contents value = Appraisal value (BDT/household) x Number of households
- Agriculture and Fisheries asset value

  = Area of production (ha) x Average yields (Mt/ha) x Price of product (BDT/Mt)[18]

The affected area where the asset exposed would be damaged was determined based on the assumption that all the area in the polder where it is not protected by at least an upazila level embankment road will be inundated due to flooding which would occur if the embankment is breached.

b) Expected Rate of Damage

Expected rate of damage, which shows the extent of assets damaged by disasters, is usually used in the economic analysis of a flood control project. It can be perceivable that the scale of assets damaged varies with the extent of disaster. However, few information and data on damage by disasters could be found at the regional level. Thus, in this study, the damage rates of Cyclone Sidr, Aila and Mohasen[19], which were respectively easier to obtain among the projects sites, are used as the expected rates of damage in this economic analysis.

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[16] Sidr Report shows that the damage amount of House Asset made up about 50% and that of Agriculture was 30% of the total damages and losses of BDT 115,569 million.

[17] There are three types of housing which have different types of structure in the project area; *Pucca*, *Semi-Pucca*, *Kutcha* . The appraisal values of each type of housing and household contents were surveyed briefly by the JICA Survey Team. Number of households was collected from the Population Census of 2011 using the number of total population of a target Upazila divided by the average number of family members of the Upazila.

[18] The area and yield data for the latest three years of Agiculture and Fisheries were collected by JICA Survey Team from the upazila office at the project area. The price data, which is the average wholesale price of each product for the latest three years assembled by the Department Agriculture Marketing of Bangladesh were used. As for the formulae, the most of the production loss by storm surge or river flooding in the fisheries sector in the south coastal area is aqua-friming of fish and shrimp. They are cultivated in fish and shrimp ponds. Thus the formulae can be applied to estimate the asset value of fisheries.

[19] The damage rates were respectively determined based on the damage information reported in Form D and the information from interviews collected from the PIO of the project area.

Another thing is that, in this analysis, the evaluation approach used in the appraisal report of the former CEIP-I project is employed. In the report it was assumed that the damages to assets caused by any flooding would be similar to those caused by Sidr, because if there were an embankment getting overtopped or breached, the damages to agriculture and fisheries would be similar to those in the Sidr case. On the other hand, damage to properties are assumed to be 50 percent of those caused by Sidr, because damage to properties might vary depending on different flooding intensity.

c) Reduced probability of inundation

Implementation of the sub-projects, which are repair and rehabilitation of embankments, will reduce the risk of getting inundated of the assets inside the polder. Reduced probability of inundation means the difference between with-project case and without-project case in terms of probability of inundation. In this study, the probability of inundation in without-project case assumed to be 1 in 2 years due to their weakness, and that of the with-project case is assumed to be 1 in 6 years[20].

(b) Benefit Calculation Method (Revetment, BWDB)

The revetments selected are located along the river where intensive water impingements are occurring due to the meandering streams. These circumstances make the progressive river erosions over both revetments and their inlands quite rapid. The critical infrastructures lying inland of the embankment will be impacted losing their functions, and then additional costs will be required to recover them, if the river erosions will progress at the same pace as they are now (Without-Project Case). On the other hand, it can be expected that the critical infrastructures will avoid the impacts, reducing the additional costs, if the projects are implemented (With-Project Case). In this study, the economic analysis is performed based on the assumption that those avoidable additional costs are the benefits.

The avoidable additional costs are varied depending on the type of critical infrastucture, which are shown in the table below.

Table 11.2.2 Critical Infrastructure subject to Analysis

Project No.	Name of Essential Facility
19	Barisal Airport
20	Bir Shrestha Captain Mohiuddin Jahangir Bridge (National Route 8)

Source: JICA Survey Team

The scenarios where bank erosions will generate the additional costs are as follows.

[20] The propabiltiy of inundation before project implimentation is determined as one in two years except for the sluice gate project which is one in four years, as evaluated by the JICA Survey Team. As for the probability of inundation after project implemention, it is decided from the design return period of embankments, which is one in six years.

a) Barisal Airport (Subproject No.19)

The river which runs in the northern side of Barisal Airport is widely meandering. According to the presumption using satellite images (from year of 2006 to 2015) by JICA Survey Team, the river erosion toward Barisal Airport has proceeded at a pace from 150m to 200m in eight years (20-25m per year). The river erosion will reach Barisal Airport within 20 years, if it proceeds at the same pace as the present. Therefore, the additional cost from developing a similar size of airport as a backup will be required. On the other hand, if the project is implemented, it will be possible to avoid additional cost. In this study, this avoidable cost is taken as benefit of the project, the amount of which was considered as the replacement cost of the airport. Meanwhile, there is a future extention plan[21] of the airport, in which the runway of the airport is supposed to be extended by 900 meters toward the river. An immediate countermeasure is being required..

b) Bir Shrestha Captain Mohiuddin Jahangir Bridge (No.20)

The bridge, well known at its former name as Doaraika Bridge, is an essential route for connecting capital city of Dhaka to Barisal Division and Khulna Division. Erosion of the revetment and embankment established to protect the abutment and approach road at the Barisal side of the bridge from river bank erosion is proceeding rapidly. According to extrapolation from satellite images, if the situation continues, the approach road will collapse due to further bank erosion over the existing revetment and embankment. It is assumed that the collapse will make the bridge impassable to vehicles, forcing the vehicles crossing the bridge to take alternative routes. The detours would normally require a longer travel distance with worse surface conditions. Due to these detours, Vehicle Operation Cost (VOC) and Travel Time Cost (TTC) of crossing vehicles are higher than those of crossing on the regular route (Without-Project Case). The JICA Survey Team assumes that VOCs and TTCs are the additional costs. The method to estimate additional cost is the same as the method stated in item "(c), Benefit Calculation Method (Bridge and Road, LGED)". The Exceptions were that the acutual AADT provided by RHD was used and the VOC and TTC were calculated based on "RHD Road User Cost Annual Report for 2014"[22], because the bridge is under the jurisdiction of RHD.

(c) Benefit Calculation Method (Bridge and Road, LGED)

The selected bridges and roads have been damaged severely by past disasters, resulting in hazards to traffic. The vehicles that normally pass through these roads and bridges are forced to take alternative routes that require a longer travel distance with worse surface conditions. Due to these detours, Vehicle Operation Cost (VOC) and Travel Time Cost (TTC) are higher than those of passing through

[21] The DPP was submitted from the Civil Aviation Agency (CAA) to the Planning Commission and is under reviewing. CAA has started discussions about the issue of the river bank erosion with BWDB since 2010.

[22] The data of unit VOC and TTC are shown in Appendix

the regular routes (Without-Project Case). On the other hand, the implementation of projects for the repair of bridges and roads make it possible for the vehicles to return to the regular routes, reducing VOC and TTC in comparison to the detouring ones (With-Project Case). The difference of VOC/TCC between the regular routes and the detour routes can be considered as the benefit of the project. This is based on the assumption that the vehicles continue to travel on the detour routes until completion of project implementation. Additionally, "Incremental VOC and TTC arise from Traffic Disruption (Traffic Diversion)" described in the guideline of "A Draft of Guideline of Flood Damage Analysis, July 2013, MILT" and other evaluation cases for similar projects in Bangladesh and Japan consulted in order to determine this benefit calculation method.

Reduction of VOC is calculated with the following formula:

$$B_{xc} = \sum_i AADT_{xi} \times (DL_0 \times VOC_{0i} - DL_w \times VOC_{wi}) \times d$$

Where:

Bxc : VOC savings at year X

AADTxi : Average Annual Daily Traffic of vehicle type i in year X

DL0 : Length of detour route (km)

DLw : Length of regular route (km)

VOC0i :VOC of vehicle type i along detour route (BDT/km)

VOCwi : VOC of vehicle type i along regular route (BDT/km)

d : Number of impassable days with regular route

Reduction of TTC is calculated with the following formula:

$$B_{xt} = \sum_i AADT_{xi} \times \left(\frac{DL_0}{V_{0i}} - DL_w - \frac{DL_w}{V_{wi}}\right) \times TTC_i \times d$$

Where:

Bxt : TTC savings at year X

AADTxi : Average Annual Daily Traffic of vehicle type i in year X

DL0 : Length of detour route (km)

DLw : Length of regular route (km)

TTCi : VOC of vehicle type i along detour route (BDT/km)

Voi : Vehicle operating speed of vehicle type i along detour route (km/h)

Vwi : Vehicle operating speed of vehicle type i along regular route (km/h)

d : Number of impassable days with regular route

a) Assumption of Detour Route

The detour route assumed is determined as the alternative to the regular route on which there have been hazards to traffic. It is selected from several major options by using the Digital Road Map[23] that LGED provides and is the shortest and similar or higher class to the regular route to ensure a practical route.

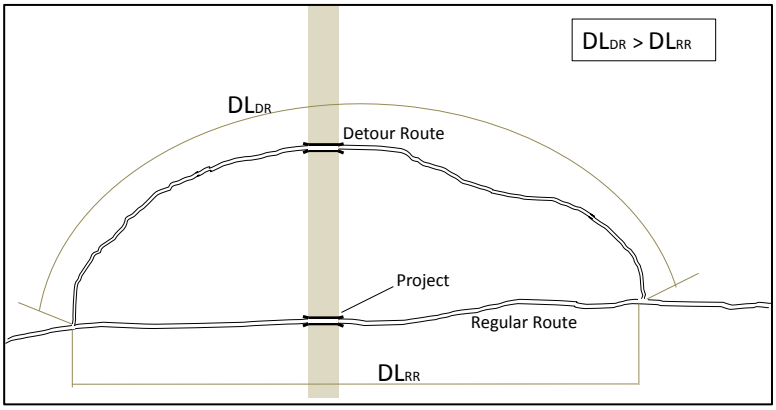

Figure 11.2.1 Concept of Detour Route

b) Annual Average Daily Traffic (AADT)

The hazards to traffic have substantially and continuously occurred on the selected roads and bridges. Thus the AADTs of the roads and bridges in normal condition are determined on the assumption that there is less impact to traffic caused by the hazards and based on the information from the Upazila offices of LGED. Traffic is estimated in accordance with the following types of vehicle[24]: Car, Utility, Microbus, Minibus, Large Bus, Small Track, Medium Truck, Auto Rickshaw, and Motor Cycle.

c) Vehicle Operating Cost (VOC)

The data set on unit VOCs for various vehicle types and surface roughness surveyed by the "Rural Infrastructure Improvement Project (RIIP) RDP-25 (2009, LGED, GTZ)" are employed in order to calculate the VOCs in both "With-Project Case" and "Without-Project Case", with some

[23] http://www.lged.gov.bd/ViewMap.aspx

[24] There may be a possibility that non-motorized vehicles such as rickshaw-van and bicycle, e.g., keep on using the regular route in some cases. The extent of this usage is different from the cases which have different extents of damage to infrastructures and hence take long time to determine the actual usage of each road and bridge sup-project. Due to the time constraints, in this study, non –mortorized vehicles are not taken into account to estimate the benefits.

modifications considering the consumer price index (CPI). The unit VOCs by road surface roughness (IRI) is as presented in the following table[25].

Table 11.2.3 VOC by Road Roughness (2015 Economic Price)

Road Surface Condition	IRI	Truck	Large Bus	Mini Bus/Micro Bus	Utility	Car	Auto Rickshaw	Motor Cycle
Good	6	28.42	116.48	37.38	27.57	27.81	8.07	5.20
Fair	9	32.44	122.41	40.51	32.61	30.16	9.29	5.30
Bad	12	38.51	131.51	50.29	41.89	37.04	9.70	5.61
V. Bad	15	40.18	134.19	53.61	44.27	39.00	10.00	6.09

Source: Estimated based on "Rural Infrastructure Improvement Project (RIIP) RDP-25 (2009, LGED, GTZ)" and CPI

Table 11.2.4 CPI Index and Growth Index

	2009	2015	Growth Index 2015/2009
CPI	133.097	211.033	1.59

Source：IMF, World Economic Outlook, 2015

d) Travel Time Cost (TTC)

The concept of travel time cost is based on the premise that the time spent for travelling could be used for an alternate activity which also produces or might produce some significant cost benefit. If the alternative activity can have a monetary value assigned to it, this can be used as part of road user cost in economic analysis of projects[26]. Table 11.2.5 shows TTC by vehicle type.

Table 11.2.5 TTC by Vehicle Type (2015, Economic Price)

Vehicle Category		Truck	Large Bus	Mini Bus/Micro Bus	Utility	Car	Auto Rickshaw	Motor Cycle
TTC per passenger	(BDT/hr)	-	26.3	35.9	50.7	80.1	37.0	66.0
TTC per Vehicle	(BDT/hr)	-	1342.7	1045.4	151.2	247.6	112.0	66.0

Note: Estimated based on "Rural Infrastructure Improvement Project (RIIP) RDP-25 (2009, LGED, GTZ)" and CPI.

(d) Implementation Schedule

The Implementation schedule of the subprojects are set as provided in Chapter 10.

(e) Evaluation Period

Evaluation period of an infrastructure project in economic analysis is often determined on the basis of useful time of the infrastructure. The evaluation period of embankments and revetments of the

[25] Based on the past study results of LGED, four types of road surface condition are selected: "Good", "Fair", "Bad" and "Very Bad".

[26] It is assumed in this analysis that the percentage of alternative activity that can have a monetary value is 75% based on the study result in the "RIIP RDP-25" report.

subprojects, which are taken as relatively smaller scale projects, is usually considered as 20 years in BWDB[27]. The evaluation period of the roads are also assumed to be 20 years. This assumption has been used in a number of LGED road rehabilitation projects[28]. As for the evaluation period of bridges, though their useful time is usually considered as a long life of more than 50 years, it is assumed to be the same period of 20 years with the residual value for the remaining period left out of consideration so that it can keep consistency as a whole project component. Thus the evaluation period of this analysis is determined as 20 years starting from 2017 to 2036.

(f) Discount Rate

BWDB is usually using the discount rate of 12 percent in their project evaluations. LGED also used 12 percent in their feasibility study which is similar to the sub-projects in CP2 as the standard discount rate[29]. Thereforet, the analysis used a discount rate of 12 percent.

(g) Exchange Rate

The following exchange rate is applied in the analysis: 1.0 BDT = 1.6 JPY[30]

(h) Economic Costs

a) Project Cost

The project costs stated in Chapter 10 are used in the analysis. For economic analysis, financial costs are converted to economic costs by deducting the tax and subsidy portions, and applying a standard conversion factor (SCF) to the portion of non-trade goods. For this analysis, a value of 0.9 is applied[31] to the local portion of costs in order to adjust the price.

The table below shows the economic cost of each subproject.

[27] Based on the discussion with an economic specialist in BWDB

[28] Feasibiltiy study report on CNRIDP, Draft Final Report, LGED, June 2004

[29] Based of the interview with BWDB and "Feasiblity study report on CNRIDP Draft Final Report LGED, June 2004"

[30] As of September 2015

[31] SCF 0.902 was employed in the economic analysis of CEIP-I, and SCF 0.9 is currently employed in the analysis of all the development project under BWDB.

Table 11.2.6 Project Cost (Economic Cost)

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b) Operation and Maintenance Cost

The operation and maintenance costs stated in Chapter 6 are used in the analysis.

(4) Economic Benefits

(a) Embankment (BWDB)

The economic benefit, in other words the Expected avoidable damage, of each subproject is shown in Table 11.2.7 and the procedure of estimating the benefit is shown below. The reference data is provided in Appendix 11.

- The total asset value in each asset type of agriculture, fisheries and properties in the upazila where a subproject will be implemented is estimated[32]

[32] The commodity prices of agriculture and fisheries and appraisal values of properties, which are used to estimate the monetary values of the asset value exposed, are converted to 2015 economic price from the monetary values in their surveyed year by using two factors: CPI and Standard Conversion Factor (SCF)

- The total damage value of each asset type in the upazila is calculated[33] using the total asset value estimated above and the corresponding expected damage rate from Form D. Damage rates of cyclone Aila are employed for the subprojects located in Satkhira and Khulna District, and those of cyclone Sidr are employed for Barguna and Patuakhali District[34], depending on of the path of the cyclones.
- The anticipated inundated area is measured[35].
- The total damage value for the subproject was calculated from upazila basis total damage value multiplied by the ratio of the anticipated inundated area measured above to the affected area from the corresponding Form D.
- The expected avoidable damage for the subproject is calculated from the total damage value of the subproject multiplied by the reduced probability of inundation obtained from the difference in probabilities of with and without project case.
- Additionally, the annual growth rates of each asset type during the evaluation period of 2017 to 2036 are assumed as follows
  - As for the assets of Agriculture and Fisheries, sector wise annual growth rates of GDP in constant price are used, which are 1.77% and 6.38% respectively[36].

[33] In the calculation, the correlation between the occurencies of damage on assets and the seasonalities in agriculture and fishery production are taken into account in the following ways. As for agriculture production, the seasonal probability to be hit by a tropical storm surge during Rabi compared to Kharif is set as 33 percent vs. 66 percent, reffering to the evaluation approach of CEIP-I. For fishery production, it is assumed that it requires 8 months in a year for the production cycle from fish juvenile to matured fish enough to have a market value (Only in the Bagda case, it is assumed to have two times of production cycle of 4 months in a year). Meanwhile, with regard to the damage of properties, it is assumed in CEIP-I that it fully damaged kutcha houses and caused partial damage to the remaining kutcha, pacca and semi-pucca houses, because the same proportion was found in Sidr case and it was considered to be the same in Sidr-like storm. In addition, the costs which would be needed to recover the damsges on housing and household assets are assumed to be 50% of household contents for Pucca and Semi-pucca, and 100% of housing and household content for Kutcha. The same assumption is employed in the analysis as well. Additonally, the cost for partial damage of Kutcha is assumed to be 50% of household contents.

[34] Form D of the other cyclone is reffered in order to substitute for the lack of data in some cases. The damage rate of properties for Koira upazila is substituted for the damage rate of properties for Shamnagor since the upazilas have similarity in geographical features.

[35] They are measured by using the Digital Map which LGED provided and GIS data, finding out the shape of the embankment polders and the roads which would protect the assets from flooding. It is assumed that all the area inside a polder would be inundated, if there were not more than upazila roads found.

[36] National Food Policy Plan of Action and County Investment Plan Monitoring Report, 2015

- As for the assets of Properties, annual growth rate of the national population is used as the growth rate of number of households[37]. Besides, for the purpose of predicting the number of housings by structure type in future, it is assumed in CEIP-I that 1,000 pucca houses and 1,800 semi-pucca houses in the first year of the project period would be 20,000 pucca houses and 4,500 semi-pucca houses in the 30th year, because it is considered that people are likely to live in more expensive houses as their incomes increase. In this analysis the same idea and growth ratios are employed, which are 10.16% for Pucca houses and 1.78% for Semi-pucca houses. As for Kutcha houses it uses the remaining number.

Table 11.2.7 Economic Benefit of Embankment Project (Economic Cost)

Project No.	Polder No.	District	Upazila	Affected area (km2)	Anticipated Inundated area (km2)	Asset Exposed	Damage rate	Annual Benefit of Expected Avoidable Damage Value (000BDT)
5	5	Satkhira	Shymanagar	360	23.42	Agriculture	27%*1	6,135
						Fisheries	White Fish: 27.3% Golda: 32.4% Bagda: 15.6%	16,468
						Properties	Fully: 51.7%*2 Partially: 40.4%	15,740
6,7	4	Satkhira	Assasuni	205	48.59	Agriculture	19%*1	10,246
						Fisheries	White Fish: 14.9% Golda: 15.3% Bagda: 7.8%	34,658
						Properties	Fully: 19% Partially: 41.7%	30,235
10	13-14/2	Khulna	Koyra	220*3	37.92	Agriculture	15%*1	11,980
						Fisheries	White Fish: 33.2% Golda: 34.3% Bagda: 14.4%	10,621
						Properties	Fully: 51.7% Partially: 40.4%	25,472
21	40/1	Barguna	Patharghata*4	136	20.2	Agriculture	67%	28,168
						Fisheries	White Fish: 23.6% Golda: 21.7% Bagda: 9.9%	2,960
						Properties	Fully: 2.5% Partially: 34.7%	6,728
33	46	Patuakhali	Kalapala	336*5	31.15	Agriculture	63%	10,612
						Fisheries	White Fish: 20.6% Golda: 17.7% Bagda: 9.6%	2,791
						Properties	Fully: 34.1% Partially: 41.7%	3,559

*1: Damage rate of Agriculture in cyclone Aila case were outliers. Damage rates in Sidr were used instead.
*2: Damage rate of Properties was not available. Damage rate for Koyra was used instead.
*3: Affected area in Aila case was not available. Affected area in Sidr case was used instead.
*4: D-form in Sidr for Patharghata was not avilable. D-form in Mohasen was used instead.
*5: Affected area in Sidr case were not available. Affected area in Mohasen case were used instead.

Source: JICA Survey Team

[37] Population Household Census, 2011

(b) Revetment (BWDB)

a) Barisal Airport (No.19)

The economic benefit, in other words the Expected avoidable damage of Subproject No.19 is shown in Table 11.2.8. The replacement cost of the airport can be considered as the damage value in this case. There is a development plan for the extension of Barisal Airport. In the plan, it is reported that the approximate project cost is estimated to be BDT 6.5 billion and its construction period is 3 years. In the analysis it is assumed that this project cost for the extention is the replacement cost of the airport[38] and the commencement of replacement would be in 2030 which is 5 years before the airport is affected by river bank erosion.

Table 11.2.8 Economic Benefit of Subproject No.19 (BWDB)

(000BDT)

Year	1st	2nd	3rd	Total
Amount	975,000	3,900,000	1,625,000	6,500,000

Source: JICA Survey Team

b) Bir Shrestha Captain Mohiuddin Jahangir Bridge (No.20)

The economic benefit, in other words the annual expected avoidable damage of Subproject No.20 is shown in Table 11.2.9. The method to estimate the benefit is the same as in the following item "(c) Bridges and Roads (LGED)". The access road of the bridge is assumed to collapse by 2020 in the without-project case. The AADT for the route on which the bridge locates is used in the analysis[39].

Table 11.2.9 Economic Benefit of Subproject No.20 (BWDB)

Project No.	District/Upazila	Road Class	AADT							Annual Saved VOCs (000BDT)	Annual Saved TTCs (000BDT)	Annual Benefit of Expected Avoidable Cost (000BDT)
			Truck	Large Bus	Mini/ Micro Bus	Utility	Car	Auto Rickshaw	Motor Cycle			
20	Barisal/Babuganj	National	1527	769	631	118	173	1496	1460	87,492	22,845	110,337

Source: JICA Survey Team

[38] Since the development cost of the extension project does not include the cost for some parts of the existing facilities, it can be perceived to be smaller and, therefore, more conservative than the actual replacement cost. The cost is converted to economic price by deducting the transfer price.

[39] The AADT is counted by the RHD Barisal office in 2015. The old national road No.8 was selected as the detour route based on the discussion with RHD. Although there is a river on the detour route requiring taking a ferry to go across, the cost incured from usage of the ferry was not added as the benefit of the project.

(c) Bridges and Roads (LGED)

The economic benefit, in other words the expected avoidable damage of each subproject is shown in Table 11.2.10, and the procedure of estimating the benefit is shown below. The reference data is provided in Appendix 11.

- The AADT in the regular route where few hazards to traffic for each subproject is estimated.
- The detour route which is assumed as the most used in case a traffic hazard occurs on the regular route is selected using LGED's Digital Map. The route distance is measured and the road roughness is evaluated for both regular route and detour route of each subproject.
- The sum of VOC and TTC for both the regular route and the detour route are calculated respectively. The difference in the sum of VOC and TTC between the regular route and the detour route expressed the expected avoidable damage.
- In addition, the traffic volume is assumed to naturally increase by 6.0% each year throughout the evaluation period[40].

Table 11.2.10 Economic Benefit of Bridge and Road Project (LGED)

Type	Project No.	District/Upazila	Road Class	AADT							Annual Saved VOCs (000BDT)	Annual Saved TTCs (000BDT)	Annual Benefit of Expected Avoidable Cost (000BDT)
				Truck	Large Bus	Mini/ Micro Bus	Utility	Car	Auto Rickshaw	Motor Cycle			
Road	HW1	Satkhira/Kaliganj	Upazila	121	21	59	66	24	246	504	42,061	5,682	47,743
	HW13	Jhalokati/Sadar	Upazila	0	0	0	16	6	900	770	8,231	1,500	9,731
	HW16	Patuakhali/Sadar	Upazila	13	7	18	3	1	139	632	13,627	2,358	15,985
Bridge	BR1	Bagerhat/Sadar	Village	1	0	0	5	2	31	681	4,694	802	5,497
	BR2	Bagerhat/Mongla	Union	0	0	0	1	1	27	405	5,025	775	5,800
	BR3	Bagerhat/Mongla	Union	1	0	0	2	1	54	227	4,260	790	5,050
	BR4	Bagerhat/Mongla	Village	3	0	0	5	2	132	227	5,873	960	6,833
	BR6	Jhalokati/Nalcity	Upazila	131	39	108	79	29	268	593	7,381	1,062	8,443
	BR11	Barguna/Sadar	Upazila	11	7	20	60	21	105	405	7,775	1,074	8,850
	BR12	Bhola/Sadar	Village	6	0	0	11	4	264	395	10,613	1,954	12,567

Source: JICA Surey Team

(5) Economic Evaluation

Based on the economic costs and benefits mentioned above, the economic analysis has been conducted, and the results are shown in the table below. As such the EIRRs are higher than the discount rate of 12%, i.e., all the three indicators of the economic analysis ensure economic feasibility of the proposed project.

[40] Though there was a discussion with LGED that the annual growth rate could be 9% since the current growth rates in some rural areas have reached up to 12-15%, it was determined to have assumption of 6% conservatively reffering to other reports of LGED's similar projects such as RIIP-I (7.5%) and TRIDP (6%).

Table 11.2.11 Economic Analysis Result of the Project

Case	EIRR	B/C	NPV (Million BDT)
Component 1 Total	18.2%	1.5	1,689
BWDB Part	17.0%	1.4	1,054
LGED Part	22.3%	1.8	635

Source: JICA Survey Team

(6) Sensitivity Analysis

Project sensitivity with respect to the changes in benefit and cost is evaluated to analyse the sustainability of the project. Two alternative options are given for benefit and cost respectively, which are -10% and -20% for benefit and +10% and +20% for cost. Even under the worst case that the benefit is -20% and the cost is +20%, the EIRR is higher than or similar to the criteria (EIRR=12%). Therefore, the project is justified to be economically feasible.

Table 11.2.12 Result of Sensitive Analysist

[Component1 Total]

		Benefit		
		±0%	-10%	-20%
Cost	±0%	18.2%	16.5%	14.8%
	+10%	16.7%	15.1%	13.4%
	+20%	15.4%	13.8%	12.2%

[BWDB Part]

		Benefit		
		±0%	-10%	-20%
Cost	±0%	17.0%	15.5%	13.8%
	+10%	15.6%	14.1%	12.6%
	+20%	14.4%	13.0%	11.4%

[LGED Part]

		Benefit		
		±0%	-10%	-20%
Cost	±0%	22.3%	20.1%	17.9%
	+10%	20.3%	18.3%	16.2%
	+20%	18.6%	16.7%	14.7%

Source: JICA Survey Team

11.2.2 Number of Beneficiaries

In this Subsection, the number of beneficiaries of each project component is evaluated. The number of beneficiaries in the year 2021, when construction of the projects are completed, are estimated based on the population growth rate of the project area[41].

[41]The population growth rates are caluculated from the population census data (2001 & 2011) of the project areas.

(1) Repair and Improvement of Infrastructure (Component 1)

(a) Embankments

It is expected that people living in the polders where the project will be implemented will escape or reduce the damage caused by storm surges and/or river flooding on their assets and themselves. Therefore, the total population in the polders[42] is assumed to be the number of beneficiaries from the projects. The number of beneficiaries for each subproject is as shown in the following table.

Table 11.2.13 Number of Beneficiaries (Embankment)

Proj.No.	District	Upazilla	Expected Outcome	Expected Contribution to Community	No. of Beneficiaries
5	Satkihira	Shyamnagar	Prevention of Flood into Polder	Protection of residents, agricultural land, land for aquaculture, infrastructure, etc., from disaster damages	466,668
6,7	Satkihira	Assasuni	Prevention of Flood into Polder	Protection of residents, agricultural land, land for aquaculture, infrastructure, etc., from disaster damages	75,679
10	Khulna	Koira	Prevention of Flood into Polder	Protection of residents, agricultural land, land for aquaculture, infrastructure, etc., from disaster damages	132,047
21	Barguna	Patharghata	Prevention of Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damages	12,687
33	Patuakhali	Kalapara	Prevention of Flood into Polder	Protection of residents, agricultural land, infrastructure, etc., from disaster damages	34,157

Note: Subproject No.6 and 7 are located on the same polder embankment.

Source: JICA Survey Team based on population census data of 2011

(b) Revetment

The repair and rehabilitation of revetment will protect the critical infrastructures located inland from river bank erosion. The direct and/or indirect beneficiaries of the infrastructures which will be protected are considered as the beneficiaries of the project.

Barisal Airport is one of the local airports in Bangladesh, which are essential for not only the regional economy but also relief operations during and after disaster.

Airport is being utilized by local passengers who live or visit Barisal region and also utilized for freight transportation shuttling regularly between Barisal and Dhaka. In the time of emergency such as disaster, the airport is utilized as a critical disaster-prevention facility. At the time of cyclone Sidr,

[42] The total population of the polders are estimated based on the union-wise population densities from census data (2011) multiplied by the areas of the polders.

since river and road transportation networks were heavily damaged, relief materials including safe water, milk, rice and blankets were sent to the disaster affected people living in whole Barisal Division from the airport. Various international and domestic aid groups such as United Nations, Christian Aid and Oxfam used the airport, and CAA, which is the operator of the airport, played important roles in the delivery of relief materials such as air traffic control of cargo planes and unloading and storing of materials at the airport, for about fourteen days from the occurrence of Cyclone Sidr. As seen above, disaster affected people in Barisal region are considered to be the beneficiaries, the number of which is assumed to be half of the total population of the region estimated to be about 4,130,000, because the number of affected people was approximately 4.2 million[43] which was half of the total population at the time.

Bir Shrestha Captain Mohiuddin Jahangir Bridge, located on National Route 8 which connects Dhaka Cap to Patuakhali, the capital of the southern part of Barisal Division, is spreading the benefits onto the whole Barisal Division. The number of user of the bridge was estimated at 25,236,000 per anuum from the traffic data[44].

Table 11.2.14 Number of Beneficiaries (Revetment)

No.	District	Upazilla	Expected Outcome	Expected Contribution to Community	No. of Beneficiaries
19	Barisal	Babuganj	Protection against Bank Erosion and prevention of Flood into Polder	Protection of airport, the most important base for relief operation in the region	4,130,000
20	Barisal	Babuganj	Protection against Bank Erosion and prevention of Flood into Polder	Protection of bridge abutment and approach road on the most important regional transportation network	25,236,000 p.a.

Source: JICA Survey Team

(c) Road and Bridge

Repair and rehabilitation of the bridges and roads will improve the access to markets, schools, hospitals and cyclone shelters for people living around the infrastructures. The people living along the routes where the project will be implemented are considered to be the beneficiaries. The number of beneficiaries[45]for each subproject are shown below.

[43] From Sidr Report

[44] Based on the AADT on the bridge provided by RHD and the numbers of average occupancy by vechle type from " RHD Road User Cost Annual Report for FY2004/05"

[45] The numbers of beneficiaries for each subproject were calculated from the population per kilometer multiplying the length of route on which the subproject will be implemented. Such population per kiloeter can be obtained from the total population of the

Table 11.2.15 Number of Beneficiaries (Bridges and Roads)

Code	District/ Upazila	Expected Outcome	Expected Contribution to Community	Population of Upazila
HW1	Satkhira/ Kaliganj	Enhancement of livelihood; Travel time reduction; Enhancement of safe and smooth traffic flow	Contribute to transportation of products from prawn farms, Community vitalization by improvement of access to market or public facilities	73,159
HW13	Jhalokati/ Jhalokati Sadar	Enhancement of safe and smooth traffic flow	Safe and smooth mobility; Protection of houses and schools from inundation	72,883
HW16	Patuakhali / Patuakhali Sadar	Enhancement of livelihood, travel time reduction, enhancement of safe and smooth flow	Protection of houses from inundation; expansion of fresh food supply due to improved access to markets	70,195
BR1	Bagerhat/ Bagerhat Sadar	Enhancement of traffic safety, improvement of evacuation access	Safe and smooth evacuation during disaster, vitalization of community due to enhanced connectivity	5,375
BR2	Bagerhat/Mongla	Enhancement of traffic safety, improvement of evacuation access	Contribute to transportation of products from prawn farms, vitalization of community due to enhanced connectivity	11,722
BR3	Bagerhat/Mongla	Enhancement of traffic safety, improvement of evacuation access	Safe and smooth evacuation during disaster, vitalization of community due to enhanced connectivity	11,064
BR4	Bagerhat/Mongla	Enhancement of traffic safety, improvement of evacuation access, vitalization of community	Expansion of fresh food supply due to improved access to markets, safe and smooth evacuation during disaster	1,252
BR6	Jhalokati/Nalcity	Enhancement of traffic safety, improvement of evacuation access	Safe and smooth evacuation during disaster, vitalization of community due to enhanced connectivity	33,793
BR11	Barguna/ Barguna Sadar	Recovery from isolation, enhancement of traffic safety, improvement of evacuation access	Expansion of fresh food supply due to improved access to markets, safe and smooth evacuation during disaster	37,809
BR12	Bhola/Bhola Sadar	Recovery from isolation, enhancement of traffic safety, improvement of evacuation access	Expansion of fresh food supply due to improved access to markets, safe and smooth evacuation during disaster	4,365

Source: JICA Survery Team

corresponding district dividing by the total aggregated length (km) of the same type roads in the district. (Road type: Upazila road, Union road and Village road)

(2) Equipment (Component 2)

(a) Communication Network System

The communication network system for each of the 12 districts will enable people living in the target areas avoid damage or secure their assets and lives from disaster, because emergency response will become more effective, i.e., people can receive information or help more quickly at the time of disaster. The number of beneficiaries is considered to be the total population of the 12 districts, which is approximately 29,991,000.

(b) Equipment for Emergency Rescue

With the utilization of equipment for emergency rescue, it will become quicker to communicate evacuation instructions and to conduct rescue activities at the time of disaster. DDM has established its local offices in 35 upazilas which are considered as the vulnerable areas to flooding, and allocated PIO for each office. The population of approximately 10,315,000 of the 35 upazilas are considered to be the beneficiaries of the emergency rescue equipment to be povided.

11.3 Qualitative Effect

The qualitative effect of Component 1 and Component2 is described below. Component 3 shall be evaluated after selection of the subproject for the component.

(1) Repair and Improvement of Infrastructure (Component 1)

(a) Embankment and Revetment

The repair and rehabilitation embankment and revetment vulnerable to disasters can be expected to generate the qualitative effects described as follows:

- Reduction of flood damage on crops, cultured fishes, houses and livelihood.
- Mitigation of salt damage to idle farmlands due to waterlogging.
- Reduction of losses such as loss to human life, loss of time and money required for people and livestock to evacuate temporarily, and decrease of income.
- Improvement of routes in terms of convenience and safety for people living around the infrastructures to transport goods or take emergency evacuation, if the embankments have a road on it.
- Deterrent effect on decresing land price.
- Reduction of population migration to urban areas.
- Mitigation of the Risk of flood damages on inhabitants because embankment roads would protect them from flood
- Reduction of poverty by providing low-income and affected families or people with job opportunities during project implementation.

(b) Bridge and Road

The repair or rehabilitation of damaged bridges and roads, or have a possibility to be damaged by coming disasters, can be expected to generate the qualitative effects described as follows.

a) Road

- Resolution of the isolation of the villages due to roads severed by disaster.
- Improvement of bumpy roads and travel performance of users. Such improved roads can be used as safe transportation routes for urgent relief materials.
- Improvement of access to markets, hospitals and growth centers.
- The roads will be less likely to be submerged, making it possible to:
  - Ensure safety and reliablility of routes for access and evacuation.
  - Avoid detouring of road users at the time of evacuation.
  - Utilize the roads as temporary evacuation areas for people and livestock affected.
- Reduction of poverty by providing low-income affected families or people with job opportunities during project implementations.

e) Bridge

- The roads will be resilient to disasters, maiking it possible to:
  - Ensure safe and smooth evacuation routes.
  - Avoid detouring of users due to collapse of bridges at the time of evacuation (Time saving for evacuation).
  - Resolve community severance caused by bridge collapses at the time of disasters.
  - Utilize the bridges as temporary evacuation areas.
- The bridges will be improved in terms of operation and maintenance as "maintenance-free" which results in a long-life bridge.
- The bridges can be utilized as reliable water gauging stations.
- Reduction of poverty by providing lower- income and affected families or people with job opportunities during project implementation.

(2) Equipment (Component 2)

Procurement and installation of the equipment needed for responding to disasters can be expected to generate the qualitative effects as follows:

(a) Communication Network System

- Improvement of the communication network system from the current system which depends on mobile phones to the system with advanced equipment such as VHF/HF and ICT cars.
- Improvement of the communication network system by applying Japanese technologies which have higher advantages.
- Improvement of the ability of DDM/FSCD. Communication in emergency disaster operations such as giving instructions or orders become more secure and quicker, and sharing of

information among operation teams also become quicker because the system allows simultaneous communication.

(b) Equipment for Emergency Rescue

- There were a number of casualties in the past disasters. The possibility of saving rescuer's lives will increase significantly by delivering the means to transport or move like rescue boats, other types of boat and their accompanying equipment because the equipment contribute to carrying out the purpose quickly. They can be used for transmitting warnings as well.
- The ability of DDM/FSCD will be improved by installing Japanese technologies which have higher advantages. Additionally, with the awareness that Japanese equipment are trouble-free for a long period and thus fostered by the users, they can have complete reliance on these equipment, focusing more on their duties.
- The chance of educational activities on disaster prevention will be provided to people especially children like the demonstration of fire-fighting operation at school. The learners can acquire accurate knowledge of disaster prevention and knowledge about how to protect their lives.
- The installation of equipment will heighten the motivation of staff members engaged in emergency rescue operations.

11.4 Operation and Effect Indicator

(1) Outline

JICA introduced operation and effect indicators in 2000 as performance indicators to enable project monitoring and evaluation on the basis of consistent indicators used from the ex-ante to ex-post stages.

In ODA loan projects, two levels of matters are often written in the "project purpose" as a result of the facilities and equipment (outputs) built or procured by a project: (i) The outputs are operated and used appropriately and (ii) they have effects on the beneficiaries or target region. Operation indicators apply to (i) and effect indicators to (ii).

Definition of operation and effect indicators:

1) **Operation Indicator**: An indicator to measure, quantitatively, the operational status of a project.

2) **Effect Indicator**: An indicator to measure, quantitatively, the effects generated by a project.

(2) Operation and Effect Indicator (Proposal)

To evaluate the impacts from the subprojects in Component 1 and 2 in a quantitative way, the JICA Survey Team and local counterparts, BWDB, LGED, DDM and FSCD have agreed to utilize the evaluation indicators below. The summary of discussions among the above is presented in Appendix 11. The methodology, baseline and target figure will be determined after the selection of subprojects, discussion among the stakeholders and baseline surveys.

Table 11.4.1 Operation and Effect Indicators

Component	Type of Project (Implementation Agency)	Indicator (unit)
1. Repair and Improvement of Infrastructure	Embankment (BWDB)	Operation Indicator: 1. Maximum water level of observation point (m) Effect Indicator: 1. Decreasing frequency of inundation inside the subproject area caused by embankment breach (times/year)
	Revetment (BWDB)	Operation Indicator: Monitor eroded points of the revetments (Number) Effect Indicator: Decreasing distance in riverbank line shifting (m)
	Bridge and Road (LGED)	Operation Indicator: Annual average daily traffic (vehicle/day) Effect Indicator: 1. Decreasing impassable day caused by disasters (day/year) 2. Shortening of travel time (minutes) 3. Increasing annual average daily traffic (vehicle/day)
2. Procurement of Equipment for Emergency Rescue and Relief	Communication Network System (DDM)	Operation Indicator: 1. Maintenance report (times/year) 2. Training report (times/year) Effect Indicator: 1. Increasing number of equipped office (number) 2. Reduction of response time for emergency (hour)
	Equipment for Emergency Rescue (DDM)	Operation Indicator: 1. Maintenance report (times/year) 2. Operation report (times) 3. Training report (times/year) Effect Indicator: 1. Increasing number of equipped office (number) 2. Increasing number of people rescued by the equipment (number) 3. Reduction of response time for emergency (hour)
	Communication Network System (FSCD)	Operation Indicator: 1. Maintenance report (times/year) 2. Operation report (only for movable system) (times) 3. Training report (only for movable system) (times/year) Effect Indicator: 1. Increasing number of equipped Fire Station (own area basis number) 2. Reduction of response time for emergency (hour)
	Equipment for Emergency Rescue (FSCD)	Operation Indicator: 1. Maintenance report (times/year) 2. Operation report (times) 3. Training report (times/year) Effect Indicator: 1. Increasing of number of equipped Fire Station (own area basis number) 2. Reduction of response time for emergency response (hour) 3. Increasing of number of people rescued by the equipment (number)

3. Disaster Recovery Fund	Stengthen Bangladesh government's capacity on comprehensive disaster risk reduction (DDM)	Operation Indicator: 2. Number of disaster recovery and reconstruction projects implemented through coordination between ministries under the scheme of DRF (Number)
	Early response and recovery (DDM)	Operation Indicator: 1. The number of disaster recovery and reconstruction projects that are completed within a year of disaster stricken under the scheme of DRF (number) 2. The number of days which are required a recovery and reconstruction project to be approved under the scheme of DRF (day)

※The baseline, methodology and target figure will be determined after the discussion among the stakeholders.

Source: JICA Survey Team

CHAPTER 12. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

12.1 Basic Information about Environmental and Social Considerations

The project is tentatively classified as "Category B" since it is not considered to be a large-scale project in river/erosion control, road and bridge sectors under the JICA Guidelines for Environmental and Social Considerations (April, 2010) (hereinafter referred to as the "JICA Guidelines"), and it is not likely to bring about a significant adverse impact on the environment. Another reason for Category B includes: that the project will not have negative impact source/factor, or it is not located in an environmentally critical area.

The Survey firstly confirmed the environmental licensing procedures for development projects in Bangladesh during the first field survey. Then, during the second field survey, surveys for the sub-projects will be conducted; namely, prediction and evaluation of environmental and social impacts; analysis of alternative plans; examination of mitigation measures including those by means of avoidance, minimization, and compensation for the negative impacts; formulation of environmental management and monitoring plans; and support for holding stakeholder meetings, etc.

Specifically, in the first field survey (May to July 2015), the following surveys were implemented:

(1) Data collection on current environmental and social situations (land use, natural environment, inhabited area of indigenous people, socio-economic situation, etc.) in the target area of the proposed sub-projects, confirmation of a sensitive area under the JICA Guidelines; and

(2) Confirmation of the institutional system and organizations regarding environmental and social considerations in Bangladesh

- Laws, standards, etc. regarding environmental and social considerations (EIA, information disclosure, etc.);
- Gap between the JICA and Bangladeshi Guidelines; and
- Roles of the related agencies.

Furthermore, in the second field survey (scheduled in August to October 2015), necessary surveys for "Impact Prediction and Evaluation, Formulation of Mitigation Measures and Monitoring Plan for Proposed Sub-projects" will be implemented following the results of the first field survey and "Scoping and Selection of the Project" (Refer to "Impact Prediction and Evaluation, Formulation of Mitigation Measures and Monitoring Plan for Proposed Sub-projects that are likely to have Significant Potential Adverse Impacts on Environment and Social Components".

The results of the first field survey (May to July 2015) are described in detail below.

12.1.1 Environmental and Social Situations in the Study Area

(1) Sensitive Area

In order to ensure in situ conservation of biodiversity, the Government of Bangladesh has designated 34 Protected Areas (PAs) and 12 Ecologically Critical Areas (ECAs) until 2012. Among the PAs, 17 are national parks while the remaining 17 are wildlife sanctuaries. The designated PAs, managed under the Wildlife Preservation (Amendment) Act, cover approximately 2,700 sq. km. which is about 11 percent of the total forest area of the country.

The Ecological Critical Areas (ECAs) declared under the Environment Conservation Act of 1995 are mostly located inland and in the coastal wetlands area. The ECAs are managed by the Department of Environment.

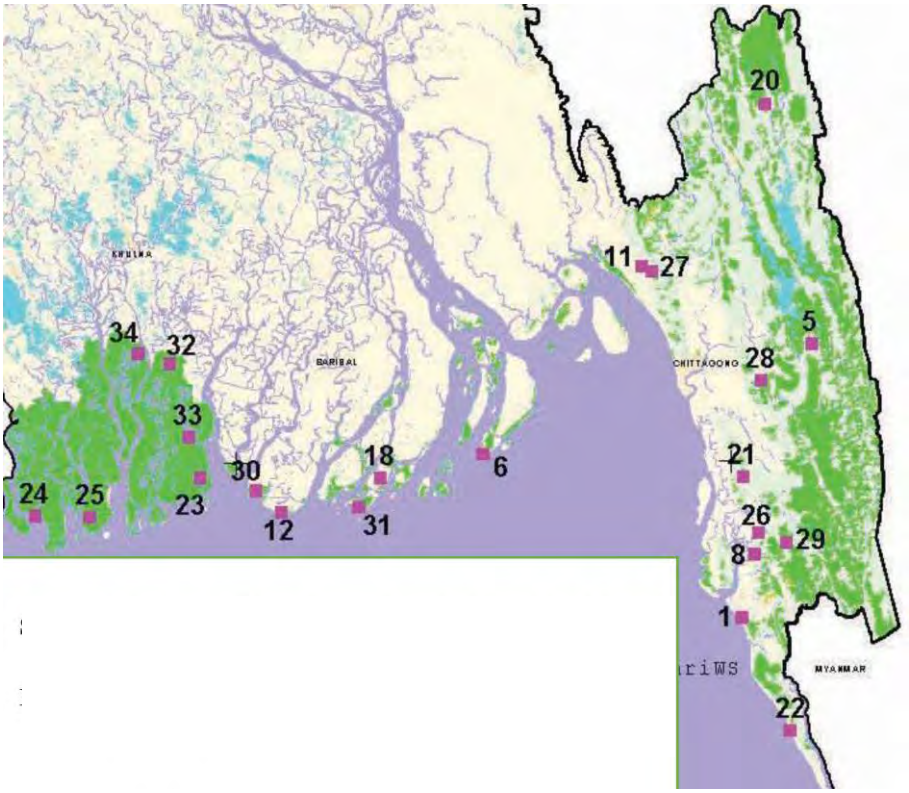
The protected areas of the study area is shown in Table 12.1.1, and their locations are as indicated in Figure 12.1.1. Sundarbans (south, east, and west) is covered with mangrove forests, and it is the largest protected area of Bengal Tigers (Registered wetland under the Ramsar Convention: May 21, 1992, and Designated as a UNESCO World Heritage Site: year 1997). Moreover, 292,926 ha of Sundarbans was designated as ecologically critical area (ECAs) by DoE (Figure 12.1.2).

Table 12.1.1 Protected Areas of the Study Area

SL.	Name	Location	Area (ha)	Established	Location No.
National Parks					
4	Himchari	Cox's Bazar	1729.00	1980	1
6	Kaptai	Ctg. Hill Tracts	5464.00	1999	5
7	Nijhum Dweep	Noakhali	16352.23	2001	6
8	Medha Kachhapia	Cox's Bazar	395.92	2008	8
10	Khadim Nagar	Sylhet	678.80	2006	11
12	Kuakata	Patuakhali	1613	2010	12
Wildlife sanctuaries					
2	Char Kukri Mukri	Bhola	40	1981	18
3	Sundarbans (East)	Bagerhat	31226.94	1996	23
4	Sundarbans(West)	Satkhira	71502.1	1996	24
5	Sundarbans (South)	Khulna	36970.45	1996	25
6	Pablakhali	Ctg. Hill Tracts	42087.00	1983	20
7	Chunati	Chittagong	7763.97	1986	21
8	Fashiakhali	Cox's Bazar	1302.43	2007	26
9	DudhPukuria-Dhopachari	Chittagong	4716.57	2010	28
10	Hazarikhil	Chittagong	1177.53	2010	27
11	Sangu	Bandarban	2331.98	2010	29
12	Teknaf	Cox's Bazar	11615.00	2010	22
13	Tengragiri	Barguna	4048.58	2010	30
14	Dudhmukhi	Bagerhat	170	2012	33
15	Chadpai	Bagerhat	560	2012	32
16	Dhangmari	Bagerhat	340	2012	34
17	Sonarchar	Patuakhali	2026.48	2011	31
Conservation sites which are not designated as PAs					
4	Sitakunda Botanical Garden and Eco-park	Chittagong	808	1998	-
5	Dulahazara Safari Parks	Cox's Bazar	600	1999	-

Ecologically Critical Areas Declared by the Department of Environment				
SL.	Name of ECA	Ecosystem type	Area (ha)	
1	Sundarbans (10 km landward periphery)	Coastal-Marine	292,926	
2	Cox's Bazar-Teknaf Peninsula	Coastal-Marine	20,373	
3	St. Martin's Island under Teknaf Upazila	Marine Island with Coral Reefs	1,214	
4	Sonadia Island under Moheshkhali Upazila	Marine Island	10,298	

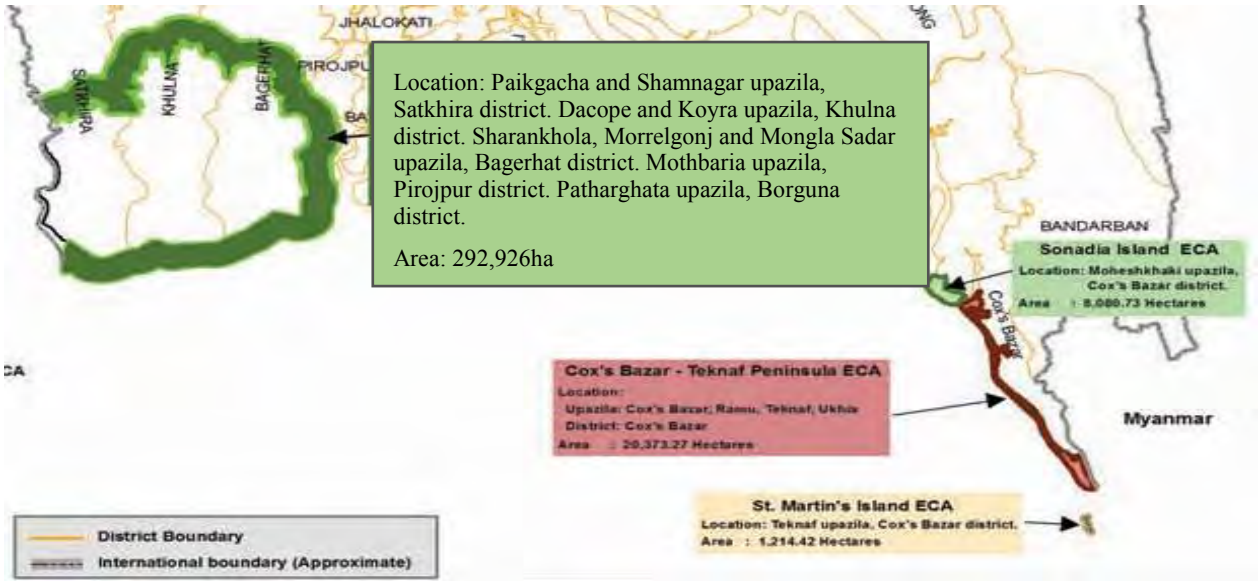
Source: Bangladesh Environment and Climate Change Outlook 2012, DoE



Source: Bangladesh Environment and Climate Change Outlook 2012, DoE

Remarks: Location number corresponds to the one at the right column of Table 12.1.1

Figure 12.1.1 Location Map of Protected Areas (Extraction)



Source: Bangladesh Environment and Climate Change Outlook 2012, DoE

Figure 12.1.2 Ecologically Critical Areas (ECAs) (Extraction)

(2) Land Use

(a) Whole Country

Sixty-two percent (62%) of the population in Bangladesh engage in agriculture. More than 70% of the population live in rural areas. Major agricultural products are rice and jute. Bangladesh is the fourth largest producer of rice in the world and the production of rice is slightly increasing. According to the survey by the Food and Agriculture Organization (FAO), self-sufficiency of grains of Bangladesh is over 90%, especially, almost 100% of rice self-sufficiency. Table 12.1.2 shows the land use of Bangladesh in 2006/07.

Table 12.1.2 Land Use of Bangladesh (2006/07)

Land Use	%
Total Land Area	100%
Forest Area	18%
Area not available for Cultivation	24%
Abandoned Agricultural Land	2%
Fallow Area	4%
Cropped Area	53%
Single Cropped Area	19%
Double Cropped Area	27%
Triple Cropped Area	7%

Source: Agricultural Statistics 2009, BBS

(b) Barisal Division

Barisal Division is located in a humid region, lying in the river-mouth delta of the Ganges River (Padma River). The administrative capital, Barisal City, is a rice trading centre in the region, being located along the riverbank of the Arial Khan River (Kirtonkhola River).

Barisal Division is one of the highest-level local administrative divisions of Bangladesh. It borders with the Khulna Division, the Dhaka Division, and the Chittagong Division, facing the Indian Ocean along the coastline. The administrative districts are Barisal District, Barguna District, Bhola District, Jhalokati District, Patuakhali District, and Pirojpur District.

Table 12.1.3 shows the agricultural area of the Barisal, Patuakhali, Bargna and Bhola Districts. According to this table, the percentage of the agricultural area of the Barisal District is 88%, higher than 58% of the total area of Bangladesh. On the hand, the percentages of the Patuakhali, Bargna and Bhola Districts are 49% and 39% respectively, lower than the 58%.

Table 12.1.3 Agricultural Area of Barisal, Patuakhali and Bhola Districts

Area of District	Total Area	Permanent Cropped Area	Temporary Cropped Area	Permanent Fallow Area	Others
Barisal District 2,784.52 km^2 (688,045 acres)	603,422	50,190	349,275	34,855	153,955
100%	88%	7%	51%	5%	22%
Patuakhali District 3,221.31 km^2 (795,974 acres)	388,411	22,790	305,077	983	60,541
100 %	49 %	3 %	38 %	0.1 %	8 %
Bargna District 1,831.31 km^2 (452,510acres)	242,530	22,429	183,023	1,314	37,078
100 %	54 %	5 %	40 %	0.3 %	8 %
Bohla District 3,403.45km^2 (840,980acres)	327,946	41,847	228,163	-	53,451
100 %	39 %	5 %	27 %	-	6 %

Source: Compilation of District Statistics 2011, BBS

(c) Khulna Division

The Ganges River flows through the north of the Khulna Division. Other rivers such as the Madhumati River, the Bhairob River, and the Kopotokkho River also flow through the Khulna Division.

Khulna Division is one of the administrative divisions of Bangladesh. It borders with the Rajshahi Division, the Dhaka Division, and the Barisal Division. It also borders with India to the West. The administrative districts are Bagerhat District, Chuadanga District, Jessore District, Jhenaidah District, Khulna District, Kushtia District, Magura District, Meherpur District, Narail District, and Satkhira District.

Table 12.1.4 shows the agricultural area of the Khulna, Satkhira and Bagerhat Districts. According to this table, the percentages of the Khulna, Satkhira and Bagerhat Districts are 33%, 45% and 39% respectively, lower than 58% of the total area of Bangladesh.

Table 12.1.4 Agricultural Area of Khulna, Satkhira and Bagerhat Districts

Unit: acre

Area of District	Total Area	Permanent Cropped Area	Temporary Cropped Area	Permanent Fallow Area	Others
Khulna District 4,389.10 km^2 (1,084,530 acres)	361,761	17,323	253,964	-	90,474
100%	33%	2%	23%	-	8%
Satkhira District 3,817.29 km^2 (943,238acres)	424,525	21,585	257,347	2,351	145,593
100 %	45 %	2 %	27 %	0.2 %	15 %
Bagerhat District 3,959.06 km^2 (978,269acres)	381,671	53,193	249,898	4,294	78,583
100 %	39 %	5 %	26 %	0.4 %	8 %

Source: Compilation of District Statistics 2011, BBS

(d) Chittagong Division

Chittagong Division faces the Bay of Bengal on the west, being home to Cox's Bazaar, one of the world's longest natural beaches; as well as St. Martin's Island, Bangladesh's sole coral reef. The Chittagong Hill Tracts (CHT), the only extensive hilly area in Bangladesh lies in eastern part of the division, the area of which is approximately one-tenth of the total area of Bangladesh.

Chittagong Division borders with the Barisal Division, the Dhaka Division, and the Sylhet Division on the north. It also borders with India and Myanmar on the east.

The administrative districts are Brahmanbaria District, Comilla District, Chandpur District, Lakshmipur District, Noakhali District, Feni District, Chittagong District, Khagrachhari District, Rangamati District, Bandarban District, and Cox's Bazar District.

Table 12.1.5 shows the agricultural area of the Chittagong and Cox's Bazar Districts. According to this table, the percentage of the agricultural area of Chittagong and Cox's Bazar Districts is 38% and 33% respectively, lower than 58% of the total area of Bangladesh.

Table 12.1.5 Agricultural Area of Chittagong and Cox's Bazar Districts

Unit: acre

Area of District	Total Area	Permanent Cropped Area	Temporary Cropped Area	Permanent Fallow Area	Others
Chittagong District 5282.92 km^2 (1,305,410 acres)	499,656	30,633	304,051	3,892	43,640
100%	38%	2.3%	23%	0.3%	3.3%
Cox's Bazar District 2,491.85 km^2 (615,727acres)	200,468	12,140	131,159	1,377	55,792
100 %	33 %	2 %	21 %	0.2 %	9 %

Source: Compilation of District Statistics 2011, BBS

(3) Natural Environment

The climate of Bangladesh is tropical monsoon with the features of high temperature and humidity and a great change of precipitation seasonally. In Bangladesh with large plains facing the Bay of Bengal, there is not much difference in climate by region. Seasons are generally divided into three, hot season from March to June, rainy, hot, and humid monsoon from June to November (sultry summer), and cool and dry winter from December to February. In most parts of Bangladesh the most humid season is in April when maximum temperature rises from 38°C to about 41°C. It becomes the coldest in January, when it is from 16°C to 20°C during the day and occasionally below 10°C at night.

Winter wind is characterized by mostly weak wind blowing from the north or northwest. Breeze blows 1 to 3km/h in northern Bangladesh and the central region, and 3 to 6 km/h in the coastal areas. From March through May, there is a violent thunderstorm called "Northwesters" with a strong wind blowing at 60km/h. In early summer with violent storms and in the monsoon season, a very strong southerly wind blows at speeds of more than 160 km/h.

Table 12.1.6 shows the Meteorology in Barisal. According to this table, the average maximum temperature of Barisal has the highest of 33.3°C in April, the average minimum temperature is the lowest of 11.9°C in January, and precipitation is the most at 409mm in June.

Table 12.1.6 Meteorology in Barisal

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average Maximum Temperature (°C)	25.6	28.2	32.2	33.3	33.0	31.7	30.9	30.9	31.5	31.5	29.6	26.5
Average Minimum Temperature (°C)	11.9	14.9	20.2	23.6	24.7	25.6	25.5	25.5	25.3	23.6	18.8	13.3
Precipitation (mm)	8	27	56	128	230	409	408	370	258	162	53	15
Number of rainy days	1	3	3	7	11	18	23	22	16	8	2	0

Source: http://www2m.biglobe.ne.jp/ZenTech/world/kion/Bangladesh/index.htm

Khulna Division lies in the south-western part of the country and falls under the Gangetic Plain with fertile land, and is very rich with respect toflora and fauna. More than one-third of the southern part of the division is covered by thick forest of mangroves, canes creepers and other trees thriving on muddy saline trees which are the most valuable and beautiful of all the trees in the forest. The district faces flood during the monsoon almost regularly. The impact is, however, very much felt in the flora and fauna of the division.

Table 2.6.7 shows the Meteorology in Chittagong. According to this table, the average maximum temperature of Chittagong has the highest of 32.3°C in May, the average minimum temperature is the lowest of 13.9°C in January, and precipitation is the most at 733mm in July.

Table 12.1.7 Meteorology in Chittagong

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average Maximum Temperature (°C)	26	28	30.6	31.8	32.3	31.5	30.9	31.2	31.7	31.5	29.8	26.9

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average Minimum Temperature (°C)	13.9	16.2	20.3	23.3	24.7	25.2	25.1	25.1	25	24	20.3	15.5
Precipitation (mm)	5	23	55	141	307	600	733	538	263	190	71	13
Number of rainy days	0	2	3	7	12	18	22	20	16	9	3	0

Source: http://www2m.biglobe.ne.jp/ZenTech/world/kion/Bangladesh/index.htm

(4) Living Area of the Indigenous People

According to "The Ethnic and Religious Minority and Disaster in Bangladesh - A Case Study of Disaster Assistance of a Christian Organization-" (by Nobuko Uesawa, 2012), basic information about the indigenous people and their living area are described as follows:

"The relationship between "the majority" and "the minority" is complicated in Bangladesh. The ethnic distribution of Bangladesh is that Bengalis account for 98% of the overall population of 14.04 million and non-Bengalis account for 2%, i.e., 1.78 million. The religious distribution is that Muslims constitute 89.7% and non-Muslims 10.3%. Non-Muslim groups comprise Hindus 9.2%, Buddhists 0.7%, and Christians 0.3% according to the census in 2001. For example, the Bengali Muslims are always the ethnic and religious majority while Bengali Hindus are the ethnic majority but religious minority. The non-Bengali non-Muslims including the Garos are the ethnic and religious minority.

The ethnic minorities of Bangladesh, 29 tribes of 1,205,978 people, are considered living in mainly the north flat and southeast Chittagong Hill Tract according to the census in 1991. The Dravidian tribal groups such as the Santhal tribe and the Oraon tribe, and the Mongoloid tribal groups such as the Garo tribe, the Manipuri tribe, and the Khasi tribe live on the flat. 13 Mongoloid ethnic tribes such as the Chakma tribe, the Marma tribe, the Mro tribe, and the Tripuri tribe live on the Chittagong Hill Tract. They have a variety of cultural, religious, linguistics characteristics and distinguished ethnically from the Bengalis who make up 98% of the entire population."

"A part of the ethnic minority tribal groups have chosen to collaborate with the international community since the 1980's. They are divided mainly into two ethnic minority groups. The first is a group which adopts the words "human right" and campaigns for empowerment of human rights in collaboration with the international human-rights group. The typical group is an autonomous group called the "Jumma," a collective group for the indigenous peoples of the Chittagong Hill Tracts where there has been a dispute for over 20 years. The second group adopts the words "poverty alleviation" and "development terms" and develops villages and empowers the residents in cooperation with the international NGOs."

(5) Economic and Social Situations

(a) Whole Country

Bangladesh economy, being influenced by the economic crisis in Europe, achieved growth of 6.3% in the Fiscal Year 2011-2012 (from July 2011 to June 2012). The contributing factors were the exports of needlework, the stable increase in cash transfer from overseas workers, the relatively balanced

industrial structure, and the stable growth of the agricultural sector. However, the Bangladesh economy has structural vulnerability since it depends largely on the exports of needlework and cash transfer from overseas workers. The problems are industry diversification and basic infrastructure improvement such as electricity and road. Table 12.1.8 shows data on the economy in Bangladesh.

Table 12.1.8 Economy in Bangladesh

1. Main Industry	Clothing and Needlework Industry, Agriculture
2. Real GDP	115.6 billion US dollars (2013, Bangladesh Bank)
3. GDP per capita	960 US dollars (2013, Bangladesh Bureau of Statistics)
4. Economic Growth Rate (GDP)	6.18% (2013, Bangladesh Bureau of Statistics)
5. Appreciation Rate of Consumer Price Index	7.97% (2012, Bangladesh Bank)
6. Workforce Market	53.7 million people: Agriculture (48.1%), Service Business (37.4%), Mining and Manufacturing (14.6%), (2010, Ministry of Finance)
7. GDP Breakdown	Service Business (49.5%), Industry and Construction (31.3%), Agriculture, Forestry and Fisheries (19.3%) (Provisional Value of 2012, Bangladesh Bank)

Source: Extract of Basic Data on People's Republic of Bangladesh, May 12, 2014, Ministry of Foreign Affairs of Japan

Bangladesh has maintained an increase in population. It was estimated at106.3 million people in 1991, 124.5 million in 2001, and 152.51 million in 2011. The population of Bangladesh increased dramatically in the preceding century, while the growth rate of population in the current century is stable due to demographic transition and decline in rate of natural birth. The average rate of increase from 1991 to 2001 was 1.58% while it is 1.34% from 2001 to 2011. The population and its growth rate per division after 2001 are indicated in Table 12.1.9.

Table 12.1.9 Population and Growth Rate per Division

Division	Population (1,000 people)		Average Annual Rate of Increase (%)
	2001	2011	2001-2011
Bangladesh	124,355	142,319	1.34
Dhaka	39,045	46,729	1.8
Barisal	8,174	8,147	0
Khulna	14,705	15,563	0.6

Source: Population Census 2011, BBS

Bangladesh has one of the highest population densities in the world (except small nations, the highest in the world). According to the preliminary results of the population census 2011, the population density per square kilometer increased from 834 people in 2001 to 1,015 people. There are disparities in the distribution of population between divisions. At the division level, the highest population density is observed in Dhaka, 1,502 inhabitants per square kilometer, while the lowest is in Barisal division, 613 inhabitants per square kilometer.

The education system in Bangladesh is 5-5-2 year courses, i.e., 5-year cycle of primary education, 5 years of junior secondary education, and 2 years of higher secondary education. The literacy rate was 53.5% in 2009. Only primary education is compulsory. With the achievement of school attendance rate of 95% in 2000, the literacy rate is gradually increasing. However, there are problems that 30% of school children drop out of school and school children do not make academic progress due to poor quality of educational circumstances including classes.

(b) Barisal Division

Barisal was once known as "the granary of Bengal" and rice still remains as the major crop. There are a bread factory, textile facility, and pharmaceutical plant in Barisal. Fisheries and agriculture are promoted in Patuakhali. The major crops are rice, jute products (fiber products made from burlap), and various vegetables.

(c) Khulna Division

Khulna Division is otherwise known as "Shilpa Nagola" meaning an industrial city, since Khulna Division was the only foreign currency earner as a centre of jute industry during the era when Bangladesh was called East Pakistan. In Khalispur, located in a suburb of Khluna, there are many jute mills and heavy industries have developed. Khluna Dvision also has the Bangladesh's only shipbuilding yard. In Bagerhat, there is the Mongla Port, the second largest seaport in Bangladesh. In two upazilas of Bagerhat, shrimp culture is promoted and shrimp products are major trade goods. Table 12.1.10 shows the number of establishments by activity in Khulna Division. According to this table, wholesale and retail trade is the largest number making up about 60% of the total and manufacturing is the second accounting for about 10%.

In Khluna Division, the education rate per capita is the highest in Bangladesh. There are many institutions of higher education including Khluna University. Students are allowed to engage freely in political activities. There are also libraries opening to the public and hospitals adopting the latest technology. These facilities are managed by a public institution or a private investor.

Table 12.1.10 Number of Establishments by Activity in Khulna Division

Activity	Establishments		
	Total	Urban	Rural
Mining and quarrying	27	8	19
Manufacturing	9085	2925	6160
Electricity, gas and water supply	37	33	4
Construction	54	53	1
Wholesale and retail trade	51883	36858	15025
Hotels and restaurants	4232	3083	1149
Transport, storage and communication	2119	1930	189
Bank, insurance and financial institution	489	335	154
Real estate and renting	698	562	136
Public administration and defence	572	465	107
Education	2344	915	1429
Heath and social work	1653	839	814
Community, social and personal services	7164	3410	3754
Khulna District	80357	51416	2894

Source: District Statistics 2011, BBS

(d) Chittagong Division

Chittagong is the port-city of Bangladesh and the busiest port in South Asia.

Chittagong leads the Bangladesh Economic boom with $500 million coming from Shipbuilding, $5.5 Billion coming from Apparel export and another $4-5 Billion coming from other sectors. Big conglomerates are located in the bank of Karnaphuli River; the industrial hub of Chittagong. Chittagong Export Processing Zone is ranked the 3rd most competitive industrial zone in the world.

Chittagong's per capita income is $5,719; highest in the country and poverty rate and unemployment rate is lowest; reported 4% and 4.70% in 2014. Chittagong has the best standard of living among all Bangladeshi Divisions.

Income from agricultural products of rice, potatoes, cotton, tea, fruits, etc. accounts for 57% of total income in the Division.

(6) Nation's Health and Sanitation

A majority of the citizens do not possess their own land or they live in a flood-prone low marshy place with poor sanitation where cholera or dysentery epidemics frequently occur via water. The international organizations have carried out activities for improvement of this situation. Especially, they have promoted installation of wells for improvement of drinking water after independence. However, a new problem is emerging that many wells are contaminated with high concentration of arsenic included originally in the ground. Consequently, many people become victims of arsenic poisoning. It is considered that more than a quarter of the population is likely to suffer from arsenic poisoning or face cancer caused by arsenic.

Bangladesh is the sixth country among 22 Tuberculosis High-Burden Countries (HBC). Tuberculosis is one of the leading causes of death among adults. Separated by the administrative division, in 2006, there were 46,000 patients in Dhaka which was the largest number, 9,100 in Barisal Division, and 16,000 in Khulna Division. Table 12.1.11 indicates the number of registered private health facilities.

Table 12.1.11 Number of Registered Private Health Facilities

Division	Dhaka	Barisal	Khulna
Hospitals & Clinics	1,089	64	502
Diagnostic Centres	2,057	147	378

Source: Hospital Service Management, DGHS.

The epidemic area of malaria is the hill districts bordering India and Myanmar. Ninety-five percent (95%) of malaria patients in Bangladesh are reportedly from 13 of the hill districts. As a major problem in public health, about 50.6 million people, making up approximately 34% of the population, live in the malaria epidemic area, and, especially, 7% of the population live in the hyper-epidemic area.

Since the first HIV patient was reported in 1989, the HIV prevalence rate among the general population has been less than 1% in Bangladesh. However, the rate among the male injecting drug users (IDU) has increased to 7% in 2006. Consequently, Bangladesh turned from a low prevalence country to a country with a concentrated epidemic. As of 2009, it was assumed there were around 6,300 (5,200-8,300) HIV patients. 63% of newly infected people in 2009 were males. Separated by age, 32% of newly infected people belonged to the age group 26-35 years, 30% to 36-45 years, and 20% to 16-25 years.

12.1.2 Institutional System regarding Environmental and Social Considerations

(1) Laws, Regulations, etc.

(a) Overview of Legal Framework on Environmental and Social Considerations

The Government of Bangladesh formulated the National Conservation Strategy (NCS) in 1992 as a basic policy for environmental and social considerations of the country. The NCS was formulated by the Ministry of Environment and Forest (MoEF) to address the country's increasing environmental pollution and devastation of the natural environment at that time. Following the formulation of the NCS, the government adopted the National Environmental Policy (NEP) in the same year, and then the Bangladesh Environmental Conservation Act (BECA) was established in 1995 as the country's basic law for environmental conservation. The National Environment Management Action Plan (NEMAP) was enacted in the same year aiming at the comprehensive management of wetlands which are the main issue of environmental conservation in the country.

Following the establishment of the Environmental Conservation Act (1995), the Government enacted the Environmental Conservation Rules (ECR) in 1997. The ECR states the rules of declaring ecologically critical areas and those of requiring environmental clearance for development projects. It stipulates that all industrial units and development projects are required to obtain the Environmental

Clearance Certificate (ECC) from the Department of Environment (DoE). Necessary documents and procedures for the ECC application are prescribed by the NCR as well.

The DoE issued the Environmental Guidelines for Industries in the same year (1997) when the Environmental Conservation Rules (ECR) was enacted. The ECR is a generic guidelines stating the details of specific environmental issues depending on the types of industry, the process of environmental impact assessment, format of EIA report, etc. Sectoral EIA Guidelines were issued afterwards related to cement, natural gas, coal, pharmacy, textile industries, etc. The Guideline for Environmental Assessment of Water Management (Flood Control, Drainage and Irrigation) Project was issued by the Ministry of Water Resources (MoWR) in 2006.

Afterwards, the Environmental Court Act was enacted in 2000, aiming at the establishment of environmental courts and resolving the disputes on environmental issues, penalty for violating court orders, etc.

The outline of the laws and regulations pertaining to the environmental and social considerations in Bangladesh are described as follows:

a) National Environmental Strategy (NES), 1992

The NES was formulated in 1992 under a project of the Government of Bangladesh in the Ministry of Environment and Forest (MoEF) and coordinated by the Bangladesh Agricultural Research Council with financial assistance f International Union for Conservation of Nature and Natural Resources (IUCN) in order to address the country's increasing environmental pollution and devastation of the natural environment.

b) National Environmental Policy (NEP), 1992

The NEP was adopted and enacted by the Government of Bangladesh to comprehensively address the increasing environmental issues, with the following objectives: 1) to maintain the balance between environmental conservation and sustainable development; 2) to protect the nation from all kinds of natural hazards and to identify and control all kinds of pollution; 3) to ensure environmentally sustainable development in all sectors; 4) to ensure effective, long term and sustainable usage of natural resources, and 5) to engage in all types of international initiatives related to environment.

c) Bangladesh Environmental Conservation Act (BECA), 1995

The BECA was established in February 1995, stipulating conservation, improvement of quality standards, and control and mitigation of environmental pollution. This act has driven power to the Department of Environment (DoE) to enforce the environmental laws and regulations. It also states the penalty, appeal procedures and obligation of the respective authorities who caused environmental degradation. This act is supported by the Environmental Conservation Rules (1997).

d) National Environment Management Action Plan (NEMAP), 1995

NEMAP aims to tackle a wide range of environmental issues, which builds on and extends the statements set out in the National Environmental Policy (NEP). NEMAP was developed to address the environmental issues for the period of 1995 to 2005, and set out the framework within the recommendations of the National Conservation Strategy (NCS).

e) Environmental Conservation Rules (ECR), 1997

The ECR was empowered by Section 20 of the National Environment Management Action Plan (NEMAP), 1995, providing the following four aspects: 1) Declaration of ecologically critical areas; 2) Classification of industrial units and development projects into four categories; 3) Procedures for issuing the Environmental Clearance Certificate (ECC); and 4) Determination of environmental quality standards. The ECR was amended in February and August, 2002 and April, 2003.

f) Environmental Court Act, 2000

The Environmental Court Act was promulgated for the establishment of environmental courts and providing stipulations to resolve the disputes and the penalties. This act stipulates the jurisdictions of environmental court, penalties for violating court's order, trial procedures in special magistrate's court, power for entry and search, procedure for investigation, procedure and power of environmental court, appeal procedure and formation of environmental appeal court.

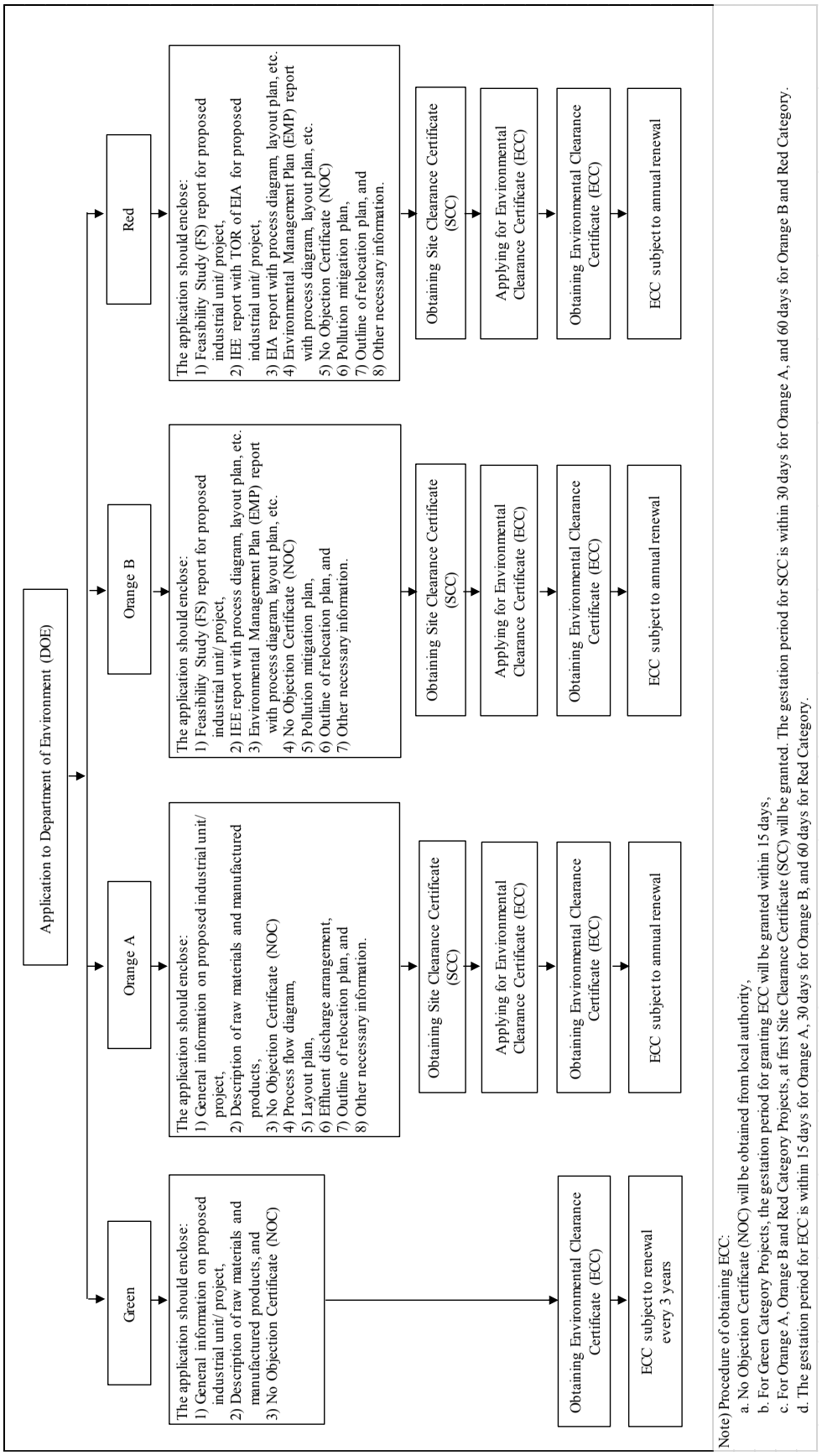
(b) Environmental Impact Assessment System in Bangladesh

The Environmental Impact Assessment System in Bangladesh was provided by the establishment of the Environmental Conservation Rules (ECR) in 1997. Rule No. 7 of the ECR classifies all industrial units and development projects into four categories; Green, Orange A, Orange B, and Red, for granting the Environmental Clearance Certificate (ECC) depending on the anticipated environmental impact and location.

Industrial units and development projects of which environmental pollution are anticipated to be negligible are classified into Green. These will be granted with ECC by submission of general information of proposed industrial units and projects to the competent authority. On the other hand, the industrial units and projects of which environmental impacts are anticipated to be moderate to significant are classified into Orange A, Orange B or Red, and then are requested to submit various kinds of documents to the authority in addition to general information on the industrial units and projects. The procedures of ECC acquisition include the issuance of Site Clearance Certificate at first and then proceed to the application of ECC and its issuance. With regard to the industrial units and projects categorized as Orange B and Red, a Feasibility Study (F/S) Report and an Initial Environmental Examination (IEE) Report are required to be submitted. Further, with regard to those categorized as Red, the proponent is required to submit a Terms of Reference (TOR) for EIA for approval by DoE, to conduct an EIA Study and prepare the EIA Report, and, finally, obtain approval of the report for the ECC acquisition. In the case of Red category, types of documents for submission

and the period for ECC acquisition will be more compared with the other categories. In this connection, land acquisition for the Project site is not included in the jurisdiction of DoE. It is, however, a part of ECC acquisition and the proponent is required to report the result of land acquisition to DoE.

The proponent of development projects cannot proceed to the construction of development projects unless the EIA Report is approved and the ECC is issued by the DoE. Figure 12.1.3 presents the procedural flow of ECC application.



Source : JICA Survey Team, arranged based on Environmental Conservation Rules (1997)

Figure 12.1.3 Procedural Flow of ECC Acquisition

(c) Environmental Quality Standards (EQS)

The Environmental Quality Standards in Bangladesh are stipulated in the Environmental Conservation Rules (1997), aiming to prescribe the concentration and/or discharge volume of wastewater, solid waste, emission gas, etc. The EQS in Bangladesh are less strict compared with those in developed countries, to encourage industrialization in the country.

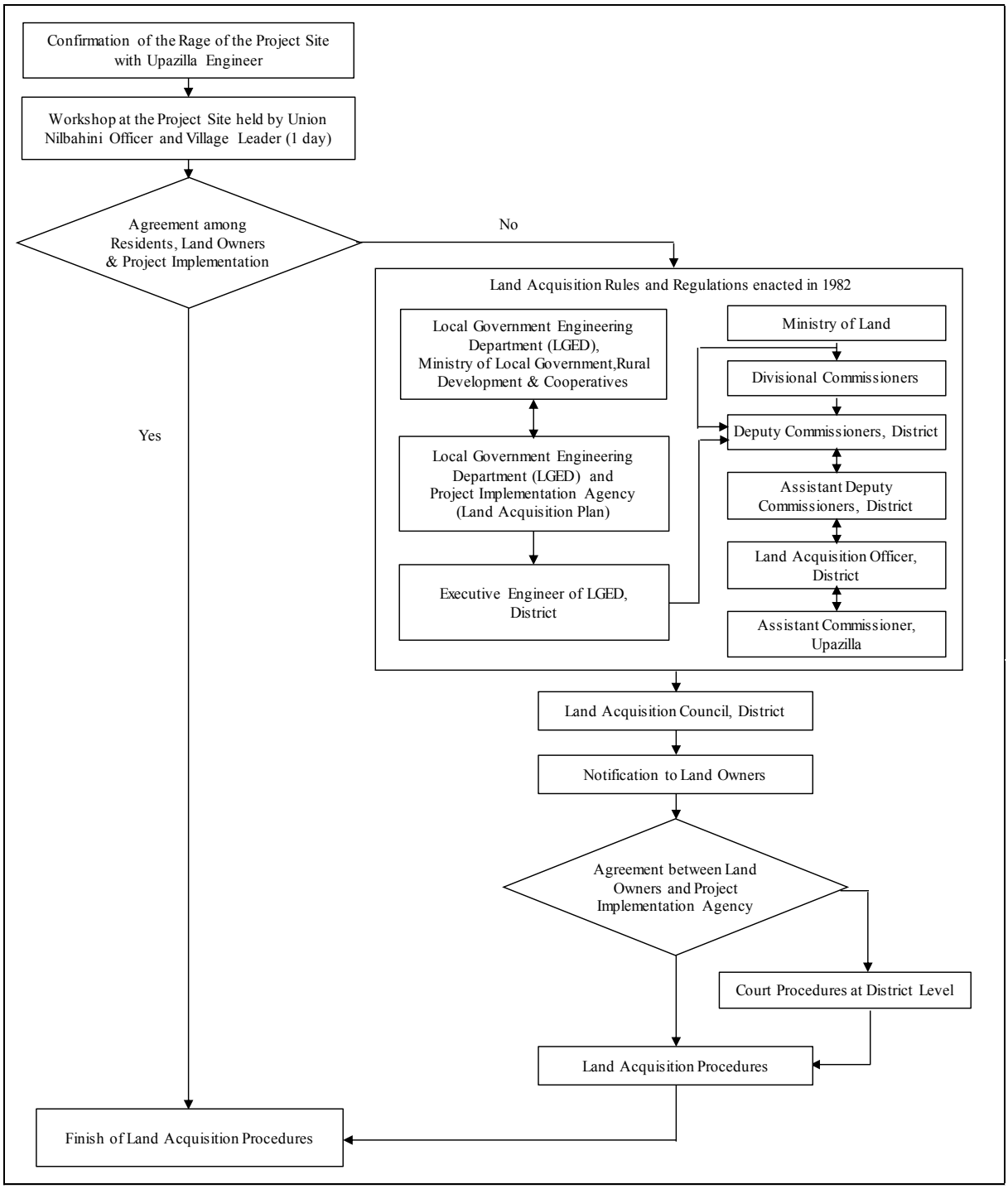
The Environmental Conservation Rules stipulate the following quality standards: Standards for Air, Standards for Water (inland surface water and drinking water), Standards for Sound, Standards for Sound originating from Motor Vehicles or Mechanized Vessels, Standards for Emission (Motor Vehicles and Motorized Vessels), Standards for Odour, Standards for Sewage Discharge, Standards for Waste from Industrial Units or Projects Waste, Standards for Gaseous Emission from Industries or Projects, and Standards for Sector-wise Industrial Effluent or Emission.

(d) Legal Basis for Land Acquisition

As for the legal basis of land acquisition for development projects in Bangladesh, there is the Acquisition and Requisition of Immovable Property Ordinance in 1982. This ordinance is restricted to "legal" owners of properties as supported by records of ownership such as deeds, titles or agreements to compensate for land, etc. It specifies the methods for calculation of market value of property based on recorded prices obtained from relevant government departments, which include the Registrar (land), the Public Works Department (structures), the Department of Forest (trees), the Department of Agriculture (crops) and the Department of Fisheries (fish stock).

Compensation for property and land acquisition is divided into two cases in general: one is for land and the other is for those adjuncts to the land. The former is compensation for lands for housing lot, agricultural land, fishpond, and so on, and the monetary compensation equivalent to the market value of the land is to be done. The latter is monetary compensation too for the adjuncts to the land such as buildings, structures, trees and crops, depending also on the market value at present.

The Ministry of Land (MOL) is authorized to deal with land acquisition. The MOL delegates some of this authority to the Commissioner at the Division level and to the Deputy Commissioner at the District level. The Deputy Commissioners (DCs) are empowered by the MOL to process land acquisition under this ordinance and provide compensation to the legal owners of the acquired property. Figure 12.1.4 shows the procedural flow of land acquisition. Actual land acquisition for development projects in Bangladesh, however, is often concluded based on mutual agreement between the landowner and the project proponent.



Source: Prepared by the JICA Survey Team based on "the People's Republic of Bangladesh, the Preparatory Survey Report for the Formulation of Meghna River Watershed Management Plan (2010)".

Figure 12.1.4 Procedural Flow of Land Acquisition

(2) Gap between the JICA and Bangladeshi Guidelines

Consistency between the JICA Guidelines and the EIA System in Bangladesh is as summarized in Table 12.1.12 Gap and measures to be taken in implementation of sub-projects are described in the following table.

Table 12.1.12 Consistency between JICA Guidelines and EIA System in Bangladesh

Main Considerations	JICA Guidelines	EIA System of Bangladesh	Gap	Measures
Impacts to be Assessed	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.	There is no distinct stipulation about scope of environmental and social components to be considered in Environmental Conservation Rules (1997) which is the legal basis of the EIA system in Bangladesh. However, the sectoral Environmental Guidelines formulated by relevant ministry, department of central government and/or local government clearly provide the components to be considered in EIA study. The Guidelines for Environmental Assessment of Water Management (Flood control, Drainage and Irrigation) Projects, 2006 formulated by the Ministry of Water Resources stipulate the following components: climate, water resources (surface water flow and volumes, surface water quantity, salinity, groundwater), land resources (topography, land use, soils, agriculture and livestock, renewable energy resources, water transportation), biological resources (open water capture fisheries, closed water culture fisheries, wildlife), human resources (socio-demographic conditions, socio-economic conditions, public health, hazards, cumulative impacts and constraints).	No	For IEE study items, the study was conducted by a local consultant in accordance with the TOR including a wide range of environmental items defined by JICA and the Bangladesh guidelines.
Alternatives	Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	There is no distinct stipulation regarding the necessity of alternative study in the Environmental Conservation Rules (1997). However, the sectoral Environmental Guidelines formulated by relevant ministry, department of central government and/or local government clearly describe the necessity of alternative study. The Guidelines for Environmental Assessment of Water Management (the same) Projects, 2006 stipulate the necessity of alternative study (including without project) during planning stage. Further, the Guidelines require that the purpose, rationality, environmental impacts and cost of the alternatives be described in the EIA Report.	No	Alternatives will be examined in the basic design stage.

Main Considerations	JICA Guidelines	EIA System of Bangladesh	Gap	Measures
Information Disclosure and Consultations with Stakeholders	JICA itself discloses information on environmental and social considerations in collaboration with project proponents, etc., in order to ensure accountability and to promote the participation of various stakeholders. JICA incorporates stakeholder opinions into decision-making processes regarding environmental and social considerations by ensuring the meaningful participation of stakeholders in order to have consideration for environmental and social factors and to reach a consensus accordingly. For Category A studies, after the disclosure of the scoping drafts, project proponents, etc., conduct consultations with local stakeholders based on stakeholder analyses. For Category B studies, project proponents, etc., consult with local stakeholders after the disclosure of scoping drafts when necessary.	There is no distinct stipulation regarding the information disclosure and public participation in the Environmental Conservation Rules (1997). These procedures are not the requirements of legal framework in Bangladesh. However, the Guidelines for Environmental Assessment of Water Management (the same) Projects, 2006 describe the purpose of public participation, scope of stakeholders, and procedural flow of public participation in IEE and EIA to encourage active public participation.	No	Stakeholder consultations were carried out.
Categorization	Category A: Proposed projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. Category B: Proposed projects are classified as Category B if their potential adverse impacts on the environment and society are less adverse than those of Category A projects. Category C: Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society.	All industrial units and development projects are classified into four categories (Green, Orange A, Orange B, and Red) based on the anticipated environmental impacts and location. Green: the magnitude of environmental impact is anticipated to be negligible, and EIA study is not required accordingly. **Orange A:** environmental impact of the unit/project is anticipated to some extent, and general information on the proposed unit/ project is required to be submitted to DoE (but EIA study is not required). **Orange B:** environmental impact of the unit/project is anticipated to be larger than Orange A, and IEE Report for new project, as well as Environmental Management Plan (EMP) for existing project are required to be submitted to DoE. **Red:** environmental impact of the unit/project is anticipated to be significant, and based on the IEE Report, TOR of EIA Study has to be submitted for approval by DoE, and implementation of EIA Study and submission of EIA Report are required for new project. EMP, etc. are required for existing project.	Yes	IEE study on five sub-projects was carried out since those projects were classified as category "B" defined by JICA guidelines. On the other hand, it does not always clearly specify the dimension or volume of the project in the categorization by EIA System of Bangladesh. The proponent is required to consult with DOE on necessity of the submission of the EIA study, since construction/ reconstruction/expansion of flood control embankment are classified as "RED" category in Bangladesh.

Source: JICA Survey Team

In the series of assistance itemized above, it is necessary to meet not only the requirements including the surveys, documents and procedures stipulated in the EIA system in Bangladesh but also those described in the JICA Guidelines in case there is a gap between the two.

For example, a wide range of environmental components described in the JICA Guidelines shall be covered in the implementation of an IEE/EIA Study by itemizing them in the TOR of the study. An

alternative study including the case of zero option, namely, without project case, is required to be done as a part of impact assessment. Necessity of the alternative study is stipulated in the relevant Guidelines of Environmental Assessment (ref. Table 2.6.10), and the results of the study shall be described in the EIA Report. Consequently, the contents of the EIA Report shall meet both the requirements of the EIA system in Bangladesh and the JICA Guidelines. The JICA Survey Team shall prepare the report for approval of the JICA Environmental and social Considerations Review Division.

Requirements on information disclosure, stakeholder meeting and procedures on public participation (referred to as "Information Disclosure") are not stipulated in the EIA system in Bangladesh, but described in the JICA Guidelines. (There is a description of Information Disclosure in the relevant EIA Guidelines.) It is, therefore, necessary for the JICA Survey Team to assist the proponent of the sub-projects in implementing the Information Disclosure in a timely manner. In fact, it is observed especially in the case of donor-funded projects in Bangladesh that public participation is practiced in the EIA process. The JICA Survey Team, therefore, needs to assist the proponent in ensuring Information Disclosure in an appropriate manner for the sub-projects to be adopted.

On the other hand, consistency between JICA Guidelines and the legal framework of land acquisition in Bangladesh are as listed in Table 12.1.13.

Table 12.1.13 Consistency between JICA Guidelines and Legal Framework of Land Acquisition in Bangladesh

No.	Considerations	JICA Guidelines	Bangladesh "Acquisition and Requisition of Immovable Property Ordinance (1982)," and Acquisition of Immovable Property Rules (1982)	Mitigation Measures for gaps (proposal)
1	Avoidance of unnecessary land acquisition	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	No clause or stipulation on necessity of avoidance of involuntary resettlement and/or land acquisition is provided.	Avoidance of involuntary resettlement and land acquisition shall be considered during design stages of project facilities as much as possible.
2	Minimization of social impacts and compensation	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken.	There are only the following stipulations that other usage of acquired land than original purpose is prohibited, and that lands which remain unused be returned to the original owners. Yet, compensation for property loss is restricted to "legal" owners of acquired lands.	Minimization of impacts due to land acquisition shall be considered during detail design stage.
3	Target of compensation and its level	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production to pre-project levels.	There is no provision to assess the impacts on peoples' income, livelihood, loss of employment and business to restore loss of income and livelihood.	Abbreviated RAP (ARAP) shall be prepared including the conduct of necessary surveys during detail design stage, and mitigation measures for the social impacts shall be discussed.

No.	Considerations	JICA Guidelines	Bangladesh "Acquisition and Requisition of Immovable Property Ordinance (1982)," and Acquisition of Immovable Property Rules (1982)	Mitigation Measures for gaps (proposal)
4	Compensation cost	Compensation must be based on the full replacement cost.	Although the law stipulates payment of compensation at market prices for acquired lands as the just compensation. However, the legal assessment procedures always results in prices that are far below the actual market prices.	During ARAP preparation (above), compensation at market prices is to be secured through negotiation with relevant government officials.
5	Timing of compensation	Compensation and other kinds of assistance must be provided prior to displacement.	The law stipulates that compensation is to be completed prior to the processes of land acquisition. However, the process to determine entitlements takes too much time to ensure payment compensation prior to the displacement.	During ARAP preparation (above), compensation payment prior to the displacement is to be secured through negotiation with relevant government officials.
6	Preparation of RAP and its publication	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public.	There is no clause on preparation of RAP or its disclosure in the law.	Disclosure of ARAP prepared, except for confidential contents, at relevant organizations and on web site is to be recommended to the project proponent.
7	Implementation of public consultation on RAP	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	There is no clause on preparation of RAP or public consultation regarding RAP in the law.	Preparation of ARAP and public consultation on ARAP shall be done during detail design stage.
8	Method of consultation	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.	Ditto	Public consultation regarding ARAP shall be presented in the language (Bengali) understood by local community.
9	Public involvement to the Project	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.	The existing legal framework does not have any provisions to mitigate long-term impacts on peoples' income loss and livelihoods caused by their displacement.	An expert in charge of social consideration is to be mobilized during implementation stage for monitoring of PAPs and mitigation measures for the social impacts.
10	Mechanism of grievance redress	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	There is no clause on grievance mechanisms in the law.	Abbreviated RAP (ARAP) shall be prepared including the conduct of necessary surveys during detail design stage, and grievance mechanisms shall be clearly formulated.

Source: JICA Survey Team

As for the legal basis of land acquisition in Bangladesh, there is the Acquisition and Requisition of Immovable Property Ordinance in 1982. This ordinance limits the eligibility for compensation to "legal" owners of properties as supported by records of ownership such as deeds, titles or agreements, etc.

Although it stipulates payment of compensation at "market price" for acquired land as the just compensation, the legal assessment procedures result in prices far below the actual market prices. Furthermore, there is no provision to assess the impacts on peoples' income and livelihood and to restore loss of them. Thus, there are big gaps between JICA guidelines and Bangladesh legal framework regarding land acquisition. Mitigation measures to resolve the gaps are described as proposal in the above table.

(3) Role of Government Agencies related to Environmental and Social Considerations

The Ministry of Environment and Forest (MoEF), among others, is the hub institution of the government for the environmental administration governing all matters of conservation activities. In the MoEF, there are two key institutions in terms of environmental conservation: the Department of Environment (DoE), which administers the formulation of strategy to address environmental pollution, stipulation and enforcement of environmental quality standards and ECC issuance for development projects, and the Department of Forest (DoF), which administers the conservation of all Reserve Forests in the country. The Ministry of Land is another key government institution which administers the matters of land acquisition and requisition for public interests. The following describes the role and responsibility of these institutions.

(a) Ministry of Environment and Forest (MoEF)

The Ministry of Environment and Forest (MoEF) is the centre of government institutions which govern all the environmental issues including stipulation of environmental policy and quality standards in the country. The MoEF was established in 1989 to address the increasing importance of environmental issues in the 1980's by replacing the Ministry of Forest. The MoEF is a permanent member of the Executive Committee of the National Economic Council at present. The council is the major decision-making body for economic policy issues and is also responsible for approving all public investment projects. The MoEF governs the activities of the following three agencies:

- Department of Environment (DoE)
- Department of Forest (DoF)
- Forest Industries Development Corporation (FIDC)

The MoEF administers the planning, coordination, facilitation of implementation and management of environmental and forestry programs in the central government institutions. Its activities centre on the investigation and protection of flora and fauna and wildlife, measures for environmental pollution, forestation and rehabilitation of devastated land for managing all the environmental conservation activities being implemented in the whole nation. Especially, the MoEF is a leading agency of forestation (Mangrove forestation, in particular) in the aspect of disaster management. It is involved in the management and monitoring of Tsunami for disaster mitigation along the seashore area, which is led by WARPO (Water Resources Planning Organization), an institution under the Ministry of Water Resources (MoWR). It is also participating in the projects addressing climate change, being involved

in various activities on improvement of storm surge levee, assistance in agricultural development, environmental education, etc.

(b) Department of Environment (DoE)

The Government of Bangladesh established the Environmental Pollution Control Ordinance in 1977, for addressing the necessity to enforce environmental management covering a wide range of environment in the 1970's. Following the establishment, the Government founded the Environmental Pollution Control Board, which should be responsible for the formulation of the environmental policy for pollution control. Afterwards in 1982, the Board was renamed as the Department of Environmental Pollution Control (DEPC), and six divisions were organized in the country; namely, Dhaka、Chittagong、Khulna、Barisal、Sylhet、and Rajshahi. The DEPC was again renamed as the Department of Environment (DoE) by the presidential order in 1989 and placed under the Ministry of Environment and Forest.

The DoE is empowered to approve the EIA Report for industrial units and development projects to issue ECC as aforementioned, as well as to enforce environmental quality standards in all sectors in the country.

(c) Department of Forest (DoF)

The Department of Forest (DoF), which is placed under the MoEF, is responsible for the protection and management of all reserve forests in the country. The personnel of the department extend down to the Union level in areas where there are reserve forests, and are involved in the agroforestry programs. The officials of the DoF are also responsible for the protection of wildlife in the forests.

(d) Ministry of Land (MoL)

The Ministry of Land (MoL) administers the matters of land management and transfer in the country, covering the government lands (khas lands), sairat mahals (jalmahal, shirmp mahal, etc.) and invested/utilized and abandoned properties. The MoL is also in charge of collection of land development tax, including land survey and recording and updating the survey results. It is, as aforementioned, also responsible for land acquisition and requisition for development projects.

12.2 Environmental and Social Screening on Sub-projects (Component 1)

12.2.1 Description of Sub-projects

In this Project, 18 sub-projects were proposed as target projects at present under Component 1. However, these sub-projects could not be decided until the implementation agencies will review them based on selection criteria and budget before the implementation stage. For description of the 18 sub-projects, refer to Section 3.2 Screening of Sub-project.

12.2.2 Environmental Screening by JICA Guidelines

(1) Category FI

As shown in Subsection 12.2.1, since the sub-projects cannot be specified prior to JICA's appraisal of the yen loan project, they are classified into Category FI. However, since those sub-projects are expected to have potential negative impact on the environment, checklists for ESMS were examined and offered for confirmation of capacity of the implementing agency (LGED and BWDB) regarding the sub-projects'environmental and social considerations with reference to "Category FI" defined by the JICA Guidelines. Regarding the DDM, which is another implementing agency of Component 3, the recovery projects implemented by DDM include a small-scale infrastructure only, and undesirable effects on the environment and society has been confirmed to be a minimum. Therefore, the ESMS checklist of the DDM is not provided. The results is shown in Table 12.2.1.

Table 12.2.1 Checklist for ESMS of Financial Intermediary/Implementing Agency

No.	Questions	BWDB	LGED
1. Policy			
(1)	Does the financial intermediary/executing (implementing) agency have any formal environmental policy or procedures? If yes, please describe them and provide appropriate documentation. If no, does the financial intermediary/executing agency have any plan to set such policy or procedures?	No. Though, BWDB follows Environmental Conservation Rules 1997 and Water Resources Planning Organization (WARPO) Guidelines for Environmental Assessment of Water Management Projects, 2003 for environmental procedures under the JICA funded projects.	Yes. LGED have formal environmental policy or procedures followed in development projects. LGED had produced a document titled as "Environment Assessment Guidelines for LGED Projects" which published in2008. This guidelines have been prepared in line with the Environmental Conservation Rules, 1997 and "EIA Guidelines for Industries", published by the Department of Environment in June, 1997.
(2)	Are there any types of projects in which the financial intermediary/executing agency will not take part due to the environmental risks? (e.g., projects involving handling of hazardous wastes or endangered plants or animals)	No. The JICA funded projects do not include "Category A" sub-projects under the JICA Guidelines.	No. The JICA funded projects do not include "Category A" sub-projects under the JICA Guidelines.
2. Procedures			
(3)	Does the financial intermediary/executing agency have any environmental procedures such as screening, categorization and environmental review? If yes, please describe.	Yes The WARPO Guidelines cover screening, categorization, scoping, environmental audit, etc.	Yes. LGED's operational manual on "Environment Assessment Guidelines for LGED Projects stipulates environmental assessment procedures such as screening, categorization and environmental review.
(4)	Please describe how you ensure that your sub-project companies and their sub-projects are operated in compliance with the national laws and regulations and applicable JICA's requirements.	BWDB assigns Independent Consulting Firms to carry out Environmental and Social Studies. Those Firms follow DoE and WARPO Guidelines.	An Environmental Management Plan (EMP) is made part and parcel of the contract document so that the contractors (sub-project companies) are obliged to implement the EMP. A strong monitoring is done by the EA and consultants to ensure the implementation of EMP.

No.	Questions	BWDB	LGED
(5)	How are environmental considerations taken into account in the credit review and approval process for project loans or equity investments? (For financial intermediary only)	Not Applicable.	This is not applicable because LGED does not function as financial intermediary.
(6)	How are environmental issues taken into account in deciding whether to offer or extend commercial credit, working capital finance, trade finance, payment services and other financial services to a company? (For financial intermediary only)	Not Applicable.	This is not applicable for LGED.
3. Organization and Staff			
(7)	Please provide us with the organization chart of the financial intermediary/executing agency's environmental and Socia1Management System (ESMS).	Environmental and Social Management Wing directly works under the Chief Planning and Director, Planning-l, BWDB, Dhaka. Chart attached. Refer to the organogram of BWDB attached.	Organogram of LGED is attached.
(8)	Who is responsible for environmental and social management within the financial intermediary/executing agency? (name/role and title)	Interim Project Director (Director planning-2) is responsible during project formulation stage and Project Director (PD) of PIU is responsible during project detail design and implementation stages for environmental and social management aspects.	LGED has a cell (committee) dealing with environment and climate change related issues. The cell is headed by Additional Chief Engineer (Integrated Water Resources Management).
(9)	Are there any staff with training for environmental and social considerations in the financial intermediary/executing agency? If so, describe.	Yes Existing limited number of staffs of Environmental and Social wing have adequate training on environmental and social considerations.	Yes, LGED does have a training unit. All trainings are conducted by the training unit of LGED.
(10)	Are there any technical staff with an engineering/industry background responsible for technical analysis of credit proposals?	Yes Senventy percent (70%) of staffs of BWDB having engineering background. Present staffs in positions of Deputy Chief- Soil, Assistant Chief- Economics and Research Officer- Sociology of Environmental and Social wing are capable in analyzing credit proposal.	Not applicable for LGED.
(11)	What experience, if any, does the financial intermediary/executing agency have of hiring or dealing with environmental consultants?	BWDB used to employ environmental consultants to conduct environmental and social studies for GOB funded projects to comply with the ECR'97 to obtain ECC from DOE.	LGED is well experienced in hiring or dealing with environmental consultants for project implementation.

No.	Questions	BWDB	LGED
(12)	What was the budget allocated to the ESMS and its implementation during a year? Please provide budget details including staff costs and training as well as any actual costs.	Available staffs related to the environmental and social management aspects are holding permanent position and their salaries are included within the Government Revenue Budget. Therefore BWDB does not require allocating separate budget during without-project period. In case of any new project under grant/credit fund, BWDB allocates necessary budget for environmental and social considerations according to the loan agreement.	LGED does not prepare any separate budget for Environment and Safeguard Section. Environmental and social training usually initiates by different financiers to enhance organizational capacity under various development projects. Financier develops the estimated budget regarding implementation of environmental and social considerations during feasibility / preparatory survey stage and this budget includes in the credit proposal.
4. Monitoring and Reporting			
(13)	Do you receive environmental and social monitoring reports from sub-project companies that you finance?	Yes. Subproject companies carry out environmental and social monitoring studies as prescribed in EMP of respective project and submit report to Project Director, Head of PMU.	Yes as per requirement LGED receives environmental and social monitoring reports from subproject companies.
(14)	Please describe how you monitor the sub-project company and their sub-projects' social and environmental performance.	During project implementation stage, BWDB creates necessary contractual obligation (in contract document) to ensure social and environmental performance of environmental consultant of subproject in compliance with national regulation and safeguard policy of respective financier. In case of loan project, BWDB includes the environmental and social studies under scope of detail design. Therefore detail design consultant, the prime contractor remains responsible for monitoring of subproject environmental consultant activities along with reporting to BWDB.	The performance of the sub-project companies are monitored by the EA (Executing Agency) as well as by the consultants on regular basis through standard formats developed with respect to EMP.
(15)	Is there an internal process to report on social and environmental issues to senior management?	Yes. Environmental and Social wing inform Director Planning-2 in case of such identified social and environmental issues that require immediate action.	Yes. Environment and Climate Change Committee is entrusted with these responsibilities.
(16)	Do you prepare any social and environmental reports: -For other multilateral agencies or other stakeholders - E&S reporting in the Annua1 Report	- Yes. - Yes.	- Yes. - Yes. "LGED's Annual Report 2012-13"describes environmental and social considerations.
5. Experience			
(17)	Has the financial intermediary/executing agency signed any national or international agreements or declarations concerning environmental issues?	Yes. Refer to Annex No.17 Bangladesh International Agreements.	Yes. Refer to Annex No.17 Bangladesh International Agreements.

No.	Questions	BWDB	LGED
(18)	Has the financial intermediary/executing agency ever received any criticism of its environmental record? If so, what was the criticism?	No.	No.
(19)	Does the financial intermediary/executing agency carry out environmental audits of its properties to analyse health and safety issues, waste disposal, etc. ?	Yes Day to day monitoring of construction activities, environmental performance of construction contractors and periodic evaluation of monitoring findings should be enough considering project size, interventions and duration.	Yes. Though, audit program of LGED is limited to monitoring of EMP implementation and evaluation of findings of monitoring program.
(20)	Please state any difficulties and/or constrains related to the implementation of the ESMS.	The number of staffs in Environmental and Social Wing under planning-2 is adequate but question rise on their personal ability to handle environmental and social aspects. All the staffs of this wing are junior level.	Lack of awareness on ESMS is a major problem in implementation and monitoring. LGED does not have any exclusive environmental and social division. Even the Environment and Safeguard Section has only three staffs of different positions and those are often replaced by new personnel without having experience in relevant fields.

No.	Questions	BWDB	LGED
6. Need of Capacity Development and Improvement Plan			
		Issues BWDB recognized the following issues to establish the ESMS. - Positions in Environmental and Social Wing are vacant. - There are remarkable numbers of staffs. But their roles and responsibilities are far from environmental and social management aspects. - Strengthening staff's own ability through both OJT and Off-JT is necessary. **"Need of Capacity Development and ESMS Improvement Plan"** The followings are required to solve the ESMS issues before Loan Agreement. 1) BWDB shall deploy two staffs with environmental and social background. 2) Strengthening staff's own ability through both OJT and Off-JT is necessary. 3) Staffs in BWDB PIU and Local Office will receive necessary training in assistance with JICA's policy on environmental and social considerations. 4) Capacity development/ enhancement plan will be developed by including training program. 5) An educational program of occupational health and safety for local workers shall be arranged in assistance with JICA. 6) Training Program shall include methodologies of IEE, EIA and RAP studies on reconstruction of embankment and sluice gate based on JICA Guidelines.	**Issues** LGED recognized the following issues to establish the ESMS. 1) Lack of awareness on ESMS. 2) Lack of experienced staffs in the Environment and Safeguard Section. 3) Project Implementation Unit finds difficulty to comply with the financier's safe guard policy. **"Need of Capacity Development and Improvement Plan" for Implementation of ESMS** The following will be implemented to solve the ESMS issues before Loan Agreement. 1) Capacity development and improvement plan will be included in training program. 2) Two more staff with training for environmental and social consideration will be allocated to 'Project Implementation Unit.' 3) Staff in LGED Local Office will receive training for environmental and social consideration. 4) An educational program of occupational health and safety for local workers will be created. 5) LGED will incorporate methodology of IEE studies on reconstruction of road and bridge based on JICA Guidelines.

Source: JICA Survey Team

Next, in addition to the check list of ESMS, describe the implementation system of environmental and social considerations and their procedures in the implementation agency.

The organization chart of BWDB is shown in Figure 12.2.1. Environment and Social Management System of BWDB includes two different line managements considering different stages of project. During Project Formulation Stage, Environmental and Social Wing is responsible for the followings.

① To coordinate, cooperate and assist with the Feasibility Study Consultant / Preparatory Survey Team and relevant stakeholders.

② To provide necessary support in assistance with environmental and social wing to incorporate environmental and social issues in feasibility report and in DPP.

③ To employ environmental consultant to undertake environmental and social studies during feasibility study for GOB funding project and to obtain ECC from DOE.

④ To review the environmental and social concerns of credit proposal with assistance of environmental and social wing.

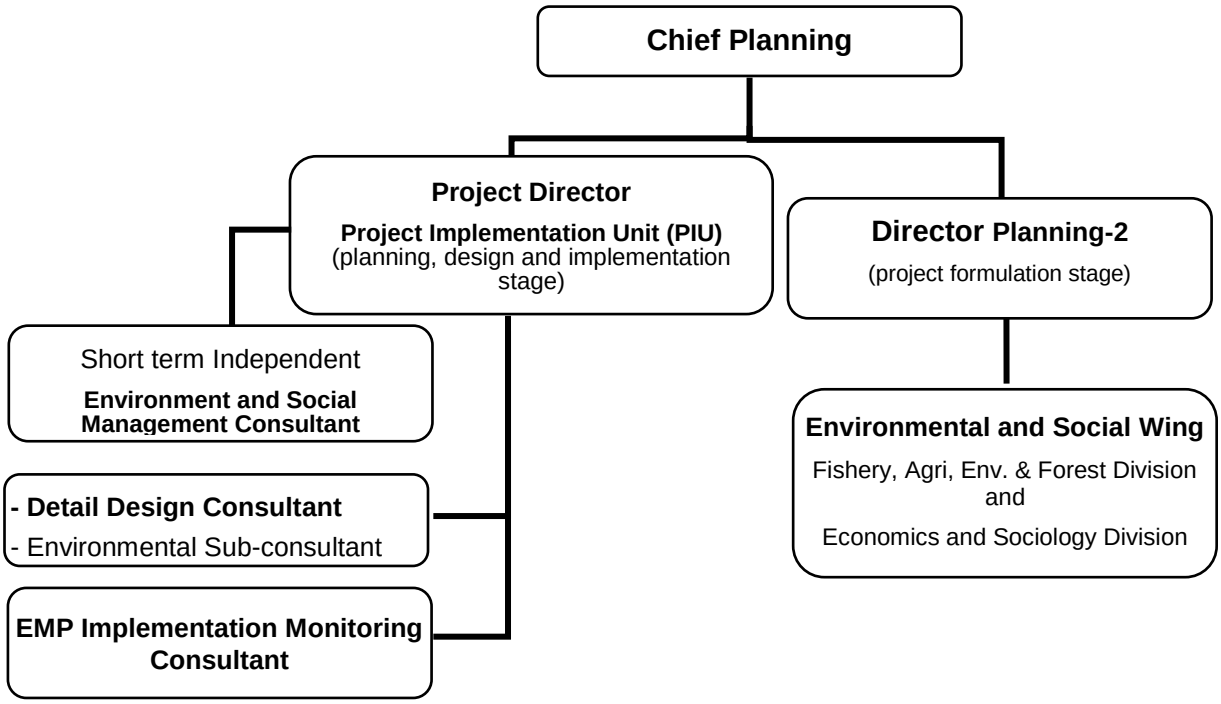
During Planning, Detail Design and Implementation Stage, Project Implementation Unit is responsibilities for the following.

① To coordinate and cooperate with Project financier and relevant stakeholders.

② Recruitment of Detail design/Environmental consultant/EMP Implementation Monitoring consultant.

③ Finalization of Study reports and submission to various stakeholders for approval according to reporting schedule.

④ Disclosure, etc.

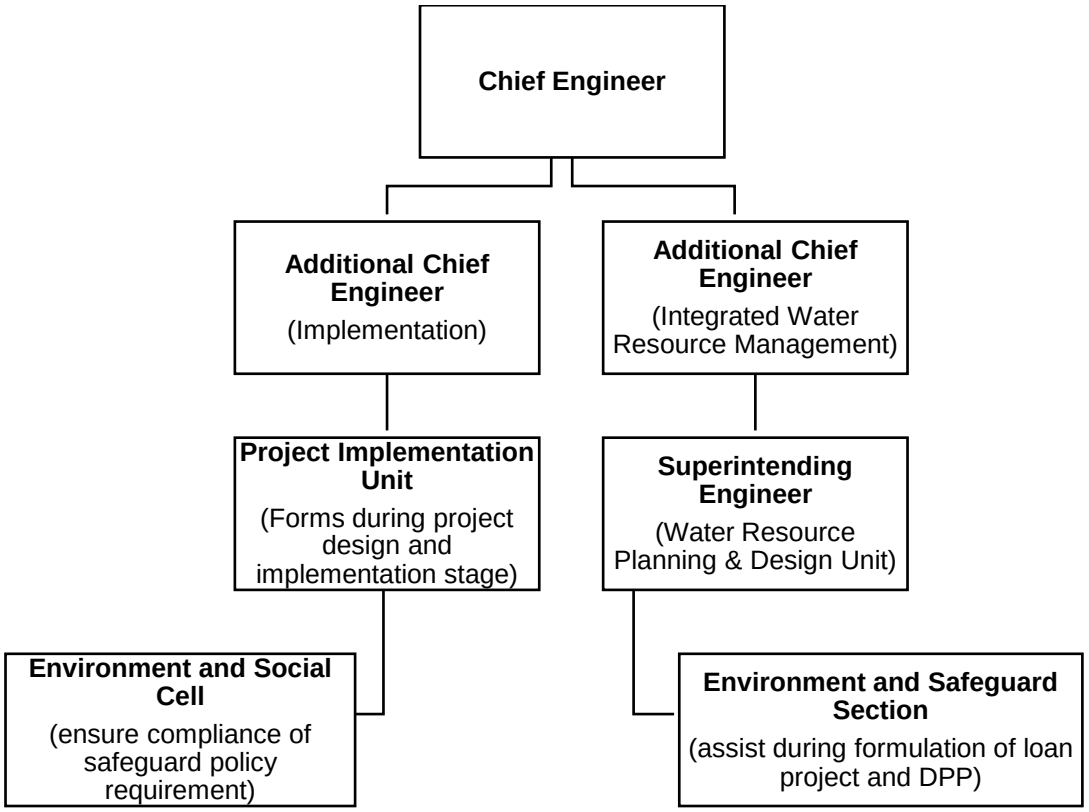


Source: BWDB

Figure 12.2.1 Organization Chart of BWDB for Environmental and Social Management

The organization chart of LGED is shown in Figure 12.2.2. Environment and Social Management System of LGED includes two different line managements considering different stages of project. Environment and Safeguard Section is the permanent Environment and Social Management section that provides necessary support to Planning and Design division during feasibility/preparatory survey that initiates by different financiers (i.e. WB/ADB/JICA, etc.) to formulate grant/loan project and to finalize credit proposal. As well as the unit also assists Planning and Design division to develop and finalize

Development Project Proposal (DPP) for the GOB finance project. On the other hand, Implementation Division establishes the Project Implementation Unit during project detail design stage. Project Implementation Unit creates Environment and Social Cell (ES Cell) that ensure compliance of safeguard policy requirements prescribed in the Environmental Management Plan (EMP) that usually prepares by the feasibility/preparatory survey consultant. During detail design and planning stage, the ES Cell is assisted by the Environmental sub-consultant to prepare the environmental and social reports and to obtain necessary environmental clearances upon approval of reports. The monitoring consultant assists the ES Cell through monitoring of EMP implementation activities and preparation of Monitoring Reports during project implementation stage.



Source: LGED

Figure 12.2.2 Organization Chart of LGED for Environmental and Social Management

Procedures for environmental and social considerations in the implementation agency (BWDB and LGED) are shown in Figure 12.3.1 Sub-project Organization Chart.

(2) Environmental Checklist

An environmental checklist was prepared for the proposed 18 sub-projects based on the discussion with official/s (counterpart/s) from LGED and BWDB under the JICA Guidelines. The checklist includes

the following contents itemized in Table 12.2.2. The drafts of environmental checklist filled out for "River and flood control", "Road" and "Bridge" are shown in Appendix 12.1.

Table 12.2.2 Basic Items of Checklists based on the JICA Guidelines

Category	Environmental Item
1. Permits and Dissemination	(1) EIA and Environmental Permits; (2) Socialization of the project to the Local Stakeholders; (3) Examination of Alternatives
2. Pollution Control	(1) Water Quality; (2) Wastes; (3) Subsidence, etc.
3. Natural Environment	(1) Protected Areas; (2) Ecosystem; (3) Hydrology; (4) Topography and Geology
4. Social Environment	(1) Resettlement; (2) Living and Livelihood; (3) Cultural Heritage; (4) Landscape; (5) Ethnic Minorities and Indigenous Peoples; (6) Work Safety
5. Others	(1) Impact during Construction; (2) Environmental Monitoring
6. Notes	Reference to Checklist of Other Sectors, Note on Using Environmental Checklist

Source: JICA Guidelines

In 1999, the Government of Bangladesh declared Sundarban (along with 10km radius area around the Sundarban Reserve Forest) as "Ecologically Critical Area (ECA)" authorized under Sub-clause (1) of Clause-5 of the "Environment Conservation Act'95". Five of the selected 18 subproject sites are located in Sundarban ECA (Table 12.2.3).

Table 12.2.3 List of Subprojects located in the Sundarban ECA

Sub-project			Distance from the Sundarban Reserve Forest
Point	District	Upazilla	
No.5	Satkhira	Shyamnagar	0.15 km
No.10	Khulna	Koyra	8 km
No.21	Barguna	Patharghata	7.5 km
BR3	Bagerhat	Mongla	8 km
BR4	Bagerhat	Mongla	3 km

Source: JICA Survey Team

According to the NOTIFICATION issued on 13th January 2015, a list of mouza is declared as the ECA. The NOTIFICATION includes a set of activitivities that are prohibited in the ECA.

1. Natural forest and tree can not be cut or collected,
2. All types of hunting and wild animal killing,
3. Catch or collect all types of wild animal,
4. Destruction or creation of such activities that shall destroy natural habitat of flora and fauna,
5. All activities that may disrupt/alter the natural characteristic of land and water,
6. Establishment of soil, water, air and noise polluting industry or organization,
7. All activities that are harmful for fish and other aquatic fauna.

12.2.3 Environmental Screening in ECR'97

(1) Deliverables necessary for ECC

According to the ECR'97, Table 1.2.4 shows the deliverables that consider categorizing sub-projects:

Table 12.2.4 Deliverables that consider categorizing Sub-projects

SL NO	Types of Sub-project	Category according to Schedule-1 of ECR'97	Document required for Environmental Permit according to Clause-7.(6) (c) & (d) of ECR'97	
			New Project	Existing Project
1	Construction/reconstruction/expansion of flood control embankment, polder, dike, etc.	Falls under **Item-66 of RED category.**	-Feasibility study report -IEE report -EIA report, etc.	-EMP report -Other documents
2	Construction, re-construction and extension of road **(feeder road, local road)**	Falls under **Item-63 of Orange-B** category.	-Feasibility study report -IEE report, etc.	-EMP report -Other documents
3	Construction, re-construction and extension of road **(regional, national and international road)**	Falls under **Item-67 of Red** category.	-Feasibility study report -IEE report -EIA report, etc.	-EMP report -Other documents
4	Construction, re-construction and extension of bridge (length below 100 meters)	Falls under **Item-64 of Orange-B category.**	-Feasibility study report -IEE report, etc.	-EMP report -Other documents
5	Construction/reconstruction/expansion of bridge (length 100 meter and above)	Falls under **Item-68 of RED category.**	-Feasibility study report -IEE report -EIA report, etc.	-EMP report -Other documents

Source: JICA Survey Team

(2) Preparatory IEE Study

(a) Sub-projects Selected for IEE

Support of the JICA Survey Team to the Proponent of the sub-projects to be adopted in terms of environmental and social considerations includes the following:

1) Site reconnaissance in terms of environmental and social considerations in the surrounding areas of the sub-projects.
2) Understanding of the environmental and social settings around the sites of sub-projects (Collection of existing data).
3) Preparation of TOR of IEE and approval from JICA.
4) Selection of Subcontractor by bidding (in the presence of JICA official, if necessary).
5) Implementation of IEE Study, and preparation of IEE Report

Five (5) sub-projects for IEE on reconstruction of road, bridge, sluice gate, revetment and embankment were selected from 18 ones (Table 12.2.5). The selection conditions are that types of infrastructure differ from each other, and the project sites are geographically scattered.

Table 12.2.5 Description of Five Sub-projects for IEE selected from 18 Sub-projects

SL NO	Type of Sub-project	Category according to Schedule-1 of ECR'97	Document required for obtaining ECC	Comments
1.	'Reconstruction of LGED Road' at Kaliganj, Satkhira. If it is **feeder road, local road**	Falls under **Item-63 of Orange-B** category.	-EMP report -and other doc	*Kaliganj Upazila LGED office confirmed that the 'candidate sub-project' is a 'Feeder' road.* ***Decision:*** *The sub-project at Kaliganj, Satkhira falls under Orange-B category and requires EMP report to obtain ECC.*
	If it is **regional, national and international road**	Falls under **Item-67 of Red** category.	-EIA report -and other doc	
2	'Reconstruction of LGED Bridge' at Bhola Sadar Upazila. (length below 100 meters)	Falls under **Item-64 of Orange-B category.**	-EMP report -and other doc	-
3	'Reconstruction of BWDB Sluice Gate' at Kolapara, Patuakhali	Schedule-1 of ECR'97 did not include this type of project but DOE shall consider the sub-project under **Item-66 of RED category.**	-EIA report -and other doc	A type of these sub-projects is reconstruction of existing projects. It seems logical inconsistency that they fall under Red category and need ECC, because the ECCs have not been issued yet. Therefore, it should be mentioned that necessity of IEE implementation will be reconfirmed with DOE. This is likely to become an issue to be addressed in the future.
4	'Revetment of bank erosion' (rehabilitation of BWDB embankment) at Bauganj, Barisal	Falls under **Item-66 of RED category.**	-EIA report -and other doc	
5	'Reconstruction of BWDB Embankment' at Koira, Khulna	Falls under **Item-66 of RED category.**	-EIA report -and other doc	

Source: JICA Survey Team

(b) Preparatory Survey on Sub-projects for IEE and Future Support

JICA Survey Team conducted a preliminary survey prior to the implementation of IEE study for the five (5) sub-projects in terms of environmental and social considerations. Details and results of the survey are as follows:

(i) Site reconnaissance in terms of environmental and social considerations was carried out between 11th and 16th September, 2015 around the sites of sub-projects..

(ii) The environmental and social settings around the sites of sub-projects were understood by collection of secondary data and interview survey to the residents.

(iii) TOR for IEE study was prepared based on the site reconnaissance and approved by JICA.

(iv) Subcontractor by bidding (in the presence of JICA official) was selected.

(v) The IEE study was implemented, and the IEE report was prepared in January, 2016.

(vi) Assistance in information disclosure, stakeholder meeting and public participation were provided

Support after the IEE study are as follows:

(vii) The proponent will be assisted in ECC application for the project (if requested by LGED and BWDB).

(c) Environmental Situation and Preliminary Simplified Screening for Sub-projects Requiring IEE

Based on the results of preliminary survey, and secondary data collection and interview surveys mentioned in the previouw section, environmental settings at the sites and simplified screening results are shown in Table 12.2.6 and Table 12.2.7 respectively.

Table 12.2.6 Environmental Situation at the Sites

Sub-project	Reconstruction of Sluice Gate (No.33) by BWDB	Reconstruction of Bridge (BR12) by LGED	Revetment against Bank Erosion (No.19) by BWDB	Reconstruction of Embankment (No.10) by BWDB	Reconstruction of Road (HW-1) by LGED
Date (2015)	11th Sept. 2015	12th Sept. 2015	13th Sept. 2015	15th Sept. 2015	16th Sept. 2015
Region	Upazila- Kalapara, Dist-Patoakhali	Upazila- Bhola Sadar, Dist-Bhola	Upazila- Babuganj, Dist-Barisal	Upazila- Koira, Dist-Khulna	Upazila- Kaliganj, Dist-Satkhira
Location	Mouza- Tungi Baria, Union- Nilganj	Mouza- Char Gazi, Union- 10 No Velu Mia	Mouza- Khudra kathi,, Khanupura, Uttar rahmatpur, Doarkia, Raompolli, Manik Kathi, Union- Rahmatpur	Mouza- Dashali, Union- Maharajpur	Union- Kushulia, Daskin Sripur, Bishnupur
Village	Polder No.46 (Tungi Baria, Hosenpur, Chandpur, Nijkata, Nabipur, Ghuta, Pacha, Nawa para, Gamurtola, Pakhimara, Mokimpur)	9 ward and 11 villages Bridge User: Peoples of '10 No velu mia' and 'veduria' unions.	6 villages located along the river bank	Polder No.13-14/2 (Maharajpur, Moheshwary pur, Bagali, Koira, Uttar betkashi)	5 villages in Kushulia, 11 villages in Daskin Sripur, and 15 villages in Bishnupur.
Union Chairman	Mr. Abdul Malek Khan	Mr. Abdus Salam Mal	MD Habibur Rahman	MD Moniuojjaman	Mr. Ebadul Islam (Kushulia) Didarul Islam (Daskin Sripur) MD Rafiqul Islam – in charge (Bishnupur)
Livelihood	Primary- Agriculture and Secondary- daily wage labour and Fishery	Primary- Agriculture, Fishery, Wage labour and Secondary- Business, Livestock rasing	Primary- Daily wage labour, Agriculture and Secondary- job and Fishery	Fishery, Gher (shrimp Farm) and daily wage labour	Fishery, Agriculture and daily wage labour
Natural Habitats	Andhar Manik River (next to the site), a centaury of Hilsha Fish.	Only Fulgazi Canal	River passes along the site	Sub-project located within the "Dashali' mouza of Maharajpur union, which falls under the list of mouza that are declared as "Ecologically Critical Area (ECA)"	Jhiler Khal, Mdina Dargar Khal, Dewana Bazar and the River Gowal Ghashia are the naural habitats of Shrimp fry.

Sub-project	Reconstruction of Sluice Gate (No.33) by BWDB	Reconstruction of Bridge (BR12) by LGED	Revetment against Bank Erosion (No.19) by BWDB	Reconstruction of Embankment (No.10) by BWDB	Reconstruction of Road (HW-1) by LGED
Indigenous Peoples	None	None	None	None	None
Cultural Property	'Radha Gobinda Shebasram' located 2km south-west from the site at Chand para village.	None	None	None	None
Forestry	'Kachu Patra' reserve forest located approx 700 meter north from the site covering 21.05 km2.	None	None	None	Densely homestead forestry (firewood and timber) and commercial fruits gardens (mango, litchi, pineapple, etc) are observed.
Labour Standards	Many among the villagers have experience as construction labour. Agri and non-agri wage labour are available.	Skilled and unskilled labour are available.	Daily wage labour is the primary source of income of the villagers.	Approx. 20% of the total population of Maharajpur union are daily wage labour.	Both male and female agri- wage labour are available.
Photo	 Interview survey	 River ferry	 River erosion	 Repair of embankment	 Overturned cart

Source: JICA Survey Team

Table 12.2.7 Simplified Screening Results

Sub-project	No.33 Upazila Kalapara, Dist-Patoakhali	B12 Upazila Bhola Sadar, Dist-Bhola	No.19 Upazila Babuganj, Dist-Barisal	No.10 Upazila Koira, Dist-Khulna	HW-1 Upazila Kaliganj, Dist-Satkhira
Impairment of historical/cultural monuments and other areas, and loss/damage to these sites	No	No	No	No	No
Encroachment into precious ecosystems (e.g. sensitive habitats like protected forest areas or terrestrial wildlife habitats)	No	No	No	No	No

Sub-project	No.33 Upazila Kalapara, Dist-Patoakhali	B12 Upazila Bhola Sadar, Dist-Bhola	No.19 Upazila Babuganj, Dist-Barisal	No.10 Upazila Koira, Dist-Khulna	HW-1 Upazila Kaliganj, Dist-Satkhira
Involuntary resettlement of people	No	No	Yes A 20 feet/ 6 meter wide strip of land shall be required all along the river bank for rehabilitation of the embankment (SDE, WDB, Babuganj). Few structures might need to be removed.	No	No
Aesthetic degradation and property value loss due to implementation of the sub-projects	No	No	No	No	No
Social conflicts between construction workers from other areas and community workers	Yes Might be	No	Yes Skilled and unskilled labour are available	Yes Might be	Yes Might be
Short-term soil erosion and silt runoff due to construction	Yes	Yes Only during construction but insignificant	Yes	Yes	Yes Only during construction
Noise and dust from construction activities	Yes	Yes Only during construction	Yes	Yes	
Fugitive dust during transportation, unloading, storage, etc.	No	Yes Only during construction. During operation-insignificant	Yes	Yes	
Risk of oil spills, which could pollute surface and ground water and soil	Yes Insignificant and only during construction	Yes Insignificant and only during construction. Canal has tidal effect.	Yes Only during construction	Yes Insignificant and only during construction	Yes Insignificant and only during construction
Obstacle in natural waterbodies?	No	Yes Short term during construction	No	No	Yes There are 3 canals that criss-cross the site and surroundings.
Pollution of water bodies and aquatic ecosystem due to construction activities	Yes Insignificant and only during construction	Yes Insignificant	No	No	Yes Insignificant and only during construction

Sub-project	No.33 Upazila Kalapara, Dist-Patoakhali	B12 Upazila Bhola Sadar, Dist-Bhola	No.19 Upazila Babuganj, Dist-Barisal	No.10 Upazila Koira, Dist-Khulna	HW-1 Upazila Kaliganj, Dist-Satkhira
Air pollution	No	Yes Insignificant. There is a cement bagging plant, a rice mill and a number of brickfield located within 2 km radius of the site.	Yes Only during construction from vehicle and other equipment	No	No
Public health and safety hazards due to waste from workers, shade and equipment movement during construction	No unlikely	No unlikely	Yes If workers sources from outside.	No unlikely	No unlikely
Sub-project benefits – Positive impacts	Yes Protection of peoples' livelihood of 11 villages	Yes Student, farmers, poultry and dairy farm owners, fisheries project owners, small scale businessman, daily waged labour, etc. of two union parishods shall enjoy day to day benefits of livelihood.	Yes Protection of airport and livelihood in 6 villages	Yes Protection of livelihood of people of 25 villages and shrimp farm that cover approx 70% of total 17, 000 hectares of land.	Yes Land use of the sub-project site is diversified and rich. The area is famous for harvesting shrimp, crab, mango, litchi, pineapple and vegetables. There are 4 growth centers, 2 fish landing centers and one large whole sale market situated next to the 12km long road side.

Source: JICA Survey Team

12.3 Evaluation of Environmental and Social Impacts of Sub-projects

12.3.1 Implementation of IEE

As described earlier, out of the 18 sub-projects, 5 sub-projects have been selected for the IEE (Table 11.2.5).

Deliverables necessary for the Environmental Compliance Certificated (ECC) as shown in Table 12.2.5, were confirmed through the ECC Director of DOE and ECR'97. The Kaliganj Upazila LGED Office had confirmed that the "candidate sub-project" is a "Feeder road".

The Terms of Reference (TOR) for IEE of the 5 sub-projects is summarized in Table 12.3.1.

Table 12.3.1 TOR for the IEE of 5 Sub-projects

	Content	Remarks
Item	1) Implementation of scoping (means to clarify a range of significant and potentially significant impacts, and their evaluation methods); 2) Prediction of impacts of the proposed sub-projects; Assessment of the environmental potential impacts and analysis of alternatives, including "without project;" 3) Examination/Formulation of mitigation measures, including those by means of avoidance, minimization, and compensation; 4) Formulation of environmental monitoring plans, including institutional arrangements and methodology 5) Clarification of budgeting, funding, and implementing structures 6) Support for holding stakeholder meetings focusing on the purpose, participants to be invited, agenda, etc.	・ IEE study is carried out since the sub-projects are tentatively classified as "Category B" under the JICA Guidelines. ・ The study will be done in accordance with both JICA Guidelines (Apr. 2010) and environmental laws and regulations in Bangladesh. ・ An environmental checklist will be prepared through data consolidation based on the IEE results.  This photo shows the site of Bohla Bridge destroyed by cyclone. Students are obliged to go to school by ferry boat.

Source: JICA Survey Team

The TOR is given in Appendix 12.2.

Project description is shown below. In this section, name of sub-project is indicated as "S-1" to "S-5".

Table 12.3.2 Project Description

Acronym	Name of Sub-project	Description
S-1	Kalapara Sub-project	Reconstruction of Sluice Gate (No,33) by BWDB Upazila- Kalapara, Dist-Patuakhali
S-2	Bhola Sadar Sub-project	Reconstruction of Bridge (BR12) by LGED Upazila- Bhola Sadar, Dist-Bhola
S-3	Babuganj Sub-project	Revetment against Bank Erosion (No.19) by BWDB Upazila- Babuganj, Dist-Barisal
S-4	Koira Sub-project	Reconstruction of Embankment (No.10) by BWDB Upazila- Koira, Dist-Khulna
S-5	Kaliganj Sub-project	Reconstruction of Road (HW-1) by LGED Upazila- Kaliganj, Dist-Satkhira

The table of contents of the IEE report is shown below. Since the contents of 1. INTRODUCTION, 2. PROJECT DESCRIPTION, and 3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK have a lot in common with those of the Final Report, they are not described in this section.

Table 12.3.3 Table of Contents of IEE Report

12.3.2 Scoping Results

Environmental impacts of the project (society, nature, and pollution) were evaluated during the pre-construction, construction and operation stages and no major negative impact (A-) was found. The scoping results are shown in Table 12.3.4.

Table 12.3.4 Scoping Results

No.	Item	Project Stages	S-1	S-2	S-3	S-4	S-5
Social Environment							
1	Involuntary Resettlement	P	D	D	B-	D	D
		C, O	D	D	D	D	D
2	Local Economy such as Employment and Livelihood	P	D	D	D	D	D
		C	B+	B+	B+	B+	B+
		O	B+	B+	B+	B+	B+
3	Land Use and Utilization of Local Resources	P	D	D	D	D	D
		C	B-	B-	B-	B-	B-
		O	D	D	B+	B+	D
4	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	P	D	D	D	D	D
		C	D	D	D	D	D
		O	D	D	B+	B+	D
5	Existing Social Infrastructure and Services	P, C	D	D	D	D	D
		O	D	D	D	D	B+
6	Poor, Indigenous and Ethnic People	P, C, O	D	D	D	D	D
7	Misdistribution of Benefit and Damage	P	D	D	D	D	D
		C	B+	B+	B+	B+	B+
		O	D	B+	D	D	B+
8	Cultural Heritage	P, C, O	D	D	D	D	D
9	Local Conflicts of Interest	P, C, O	D	D	D	D	D
10	Working Conditions	P,O	D	D	D	D	D
		C	D	D	D	D	B-
11	Accident	P,O	D	D	D	D	D
		C	B-	B-	B-	B-	B-
12	Hazards (Risk), Infectious Diseases such as HIV/AIDS	P, O	D	D	D	D	D
		C	B-	B-	B-	B-	B-
13	Sanitation	P, O	D	D	D	D	D
		C	D	D	D	D	D
Natural Environment							
14	Topography and Geographical Features	P, C, O	D	D	D	D	D
15	Soil Erosion	P,O	D	D	D	D	D
		C	D	D	B-	B-	B-
16	River Transportation	P	D	D	D	D	D
		C	D	B-	B-	B-	D
		O	D	B-	D	D	D
17	Groundwater	P, C, O	D	D	D	D	D
18	Hydrological Situation	P,O	D	D	D	D	D
		C	D	D	D	D	B-
19	Flora, Fauna and Biodiversity	P, O	D	D	D	D	D
		C	B-	B-	B-	B-	B-
20	Protected Area	P, O	D	D	D	D	D
		C	D	D	D	D	D
21	Meteorology	P, C, O	D	D	D	D	D

22	Landscape	P, C, O	D	D	D	D	D
23	Global Warming	P, C, O	D	D	D	D	D
Pollution							
24	Air Pollution	P	D	D	D	D	D
		C	B-	B-	B-	B-	B-
		O	D	B-	D	D	B-
25	Water Pollution	P, O	D	D	D	D	D
		C	B-	B-	B-	B-	B-
26	Soil Pollution	P, O	D	D	D	D	D
		C	B-	B-	B-	B-	B-
27	Waste	P, O	D	D	D	D	D
		C	B-	B-	B-	B-	B-
28	Noise and Vibration	P	D	D	D	D	D
		C	B-	B-	B-	B-	B-
		O	D	B-	D	D	B-
29	Ground Subsidence	P, C, O	D	D	D	D	D
30	Offensive Odor	P, O	D	D	D	D	D
		C	B-	B-	B-	B-	B-
31	Bottom Sediment	P, O	D	D	D	D	D
		C	B-	B-	B-	B-	B-

Legend of project stage
P: Pre-construction Stage
C: Construction Stage
O: Operation Stage

Rating criteria
A-: Major negative impact
A+: Major positive impact
B-: Moderate negative impact
B+: Moderate positive impact
C-: Impact uncertain
D: No impact expected. No need for further assessment

Source: IEE result

12.3.3 Environmental and Social Conditions

Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed sub-project sites. The literature survey broadly covered the following:

i. Sub-project details, reports, maps, and other documents made available by the JICA preparatory survey team and BWDB;

ii. Relevant acts and extraordinary gazettes, as well as guidelines issued by Government of Bangladesh agencies; and

iii. Literature on land use, soil, geology, hydrology, climate and socioeconomic profiles documents collected from Government of Bangladesh agencies and websites.

Field visit to the sub-project sites were made during the IEE stage to assess the existing environment (physical, biological, and socioeconomic) and gather information with regard to the proposed site and scale of the proposed sub-project.

The data was analyzed and interpretations made to assess the physical, biological, and socioeconomic features of the project area. The relevant information is presented in Table 12.3.5 and Table 12.3.6.

Table 12.3.5 Environmental and Social Baseline (1)

Sub-project	S-1	S-2	S-3
Climatic Condition	Several climatic zones occur within Bangladesh, with the study area falling within the South- eastern region. The climate is tropical in Kalapara. Rainfall is significant in most months of the year, and the short dry season has little effect.	Several climatic zones occur within Bangladesh, with the study area falling within the South-eastern region. The climate is tropical in Bhola. In winter, there is much less rainfall in Bhola than in summer.	Several climatic zones occur within Bangladesh, with the study area falling within the South-central region. Barisal has tropical climate. In winter, there is much less rainfall in Barisal than in summer.
Topography, Physiography and Soils	The sub-project areas are located in the Ganges tidal floodplain. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the lower Meghna.	The sub-project areas are located in the Ganges tidal floodplain. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the lower Meghna.	The sub-project areas are located in the Ganges tidal floodplain. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the lower Meghna.
Land use	According to the land zoning report of Kalapara Upazila (2011), Nilganj Union is identified as agro-fishery zone (open water-rivers, canals, etc.) comprised of agriculture (60%), settlement (20%) and water body (20%). A 2 km land use map of the project study area has been prepared from LGED map and google image. This reveals that the land use/land cover consists mainly of agricultural land, settlement and water bodies.	According to the land zoning report of Bhola Sadar Upazila (2011), Bhelumia Union is identified as agro-fisheries zone (open water-river and mangrove forest) comprised of agriculture (45%), settlement (52%) and water body (3%). A 2 km land use map of the project study area has been prepared from LGED map and google image. This reveals that the land use/land cover consists mainly of agricultural land, settlement and water bodies.	According to the land zoning report of Babuganj Upazila (2011), Rahmatpur Union is identified as agro-fisheries and urban zone comprised of agriculture (46%), settlement (29%), water body (20%), urban area (4%) and fallow land (1%). A 3 km land use map of the project study area has been prepared from LGED map and google image. This reveals that the land use/land cover consists mainly of agricultural land, settlement and water bodies.
Geology	Project site is located in Barisal gravity high tectonic framework. Barisal-Chandpur High is interpreted as gravity and magnetic anomaly caused by a magmatic body at great depth. This zone is located between Faridpur trough and Hatiya trough of the Bengal Foredeep. The width of the zone is about 60 km and apparently corresponds to an uplift of the sedimentary cover.	Project site is located in Barisal gravity high tectonic framework. Barisal-Chandpur High is interpreted as gravity and magnetic anomaly caused by a magmatic body at great depth. This zone is located between Faridpur trough and Hatiya trough of the Bengal Foredeep. The width of the zone is about 60 km and apparently corresponds to an uplift of the sedimentary cover.	The Barisal area consists of late Holocene to Recent Alluvium of the Ganges deltaic plain in north and tidal plain in south. The area is composed of sand, silt and clay in various proportions with small amount of coarse sand, which is classified into seven litho-stratigraphic units from base to top. Stratigraphic cross-sections and panel diagram through this area indicate presence of seven sedimentary cycles.
Air Quality	Major air pollution source of the project area are brick kiln, domestic work and limited vehicular emissions. Currently, no air quality monitoring stations are in operation within the upazila limit.	No major air pollution source present in the project area. Currently, no air quality monitoring station is in operation within the upazila limit.	Major air pollution source of the project area are brick kiln and limited vehicular emissions. Currently, no air quality monitoring station is in operation within the upazila limit.
Acoustic Environment	Noise pollution source anticipated in the sub-project area is only river transport.	The volume of traffic passing through this section is not significant.	The volume of traffic passing through this section is not significant.

Sub-project	S-1	S-2	S-3
Hydrology	The canal is connected with the Andhar Manik River which is 29 km long and meandering in nature. Highest difference of maximum and minimum tide is 3 m. Maximum width is 1363 m while minimum is 250 m. Highest water flowing month is July to September and lowest is February to April. Groundwater is the main source of potable water in the sub-project area. Shallow tubewell depth is 90-150 ft; whereas, deep tubewell depth is 200-250 ft in Nilganj union. There is no arsenic contamination, but iron concentration is slightly higher in some areas of Nilganj Union.	The proposed bridge will be constructed across the Char Gazi Canal which originates from Tetulia River and approximately 7.7 km long. The Tetulia River flows at approximately 1.5 km on the south west side of the project site. It is a braided river with 131km in length and maximum width of 4,494m. Highest water flowing month is July to September and lowest is February to April. Groundwater is the main source of potable water in the sub-project area. Shallow tubewell depth is 80-150 ft; whereas deep tubewell depth is 200-230 ft in Bhelu Mia Union. There is no arsenic contamination, but iron concentration is slightly higher in some areas of Bhelu Mia Union.	The Sandha River which is meandering in nature flows on the northern and eastern side of the project area. Difference of the low tide and high tide is maximum 1.75 m. It is a meandering river and 61 km long. Average width is 590 m; whereas, maximum and minimum width is 950 m and 334 m, respectively. Highest water flowing month is July to September and lowest is February to April. This river is 3rd class designated route of BIWTA. Groundwater is the main source of potable water in the sub-project area. Shallow tubewell depth is 170-180 ft whereas deep tubewell depth is 780-900 ft in Babuganj upazila. There is no arsenic contamination in this Upazila, but iron concentration is slightly higher in some areas of Babuganj Upazila.
Natural Disaster	Bangladeshi coastal areas faced 52 major cyclones in the 19th century and among them 7 cyclones were in Kalapara. During the last 10 years of the present century, coastal areas have faced at least 4 devastating cyclones of which 2 hit Kalapara Upazila. The number of deaths and loss of socio-economic condition are also increasing with the increasing number of cyclones.	The coastal belt of Bhola is known to be a place severely affected by natural disaster like cyclone and tidal surge forming in the Bay of Bengal. Due to the geographical location, Sadar Upazila is more vulnerable to cyclone and tidal surge as many other upazilas along the coast of Bhola.	Many high land of Babuganj upazila were transformed into depressions due to the devastating earth quake in 1762. Many people of this upazila died as a result of cyclone in 1770, 1822, 1825, 1832 and 1855. A serious famine occurred due to flood, causing damage to crops. Besides, the cyclone and tidal bore in 1960, and in 11 - 12 November 1970 resulted in heavy loss of life and property in the upazila.
Flora	Tree species in various ecosystems and the aquatic floral species at project site are given. Settlement with homestead is being used for combined vegetable and plantation with timber, fuel wood, fruits, fodder and other cottage industry raw material yielding trees. Raintree occupies a major portion. Strip plantation of the Forest Department consists of embankment plantation of about 19 km, and link road plantation of 6 km was found in the union.	Tree species in various ecosystems and aquatic floral species at project site were given. Homestead/ community forest were found in combination with natural vegetation and planted timber, fuel wood, fruit, fodder and other trees used as raw materials in cottage industries and household articles. Strip plantation of the Forest Department consists of roads and highway plantation of about 7 km, and Bondhujon (NGO)'s plantation of about 14 km in this union is found.	Tree species in various ecosystems and the aquatic floral species at project site are given. Settlement with homestead is being used for combined vegetable and plantation with timber, fuel wood, fruits, fodder and other trees used as raw material in cottage industries. Betel nut occupies a major portion. Strip plantation of the Forest Department consists of link road plantation of 27 km roads and highway plantation of 8 km, and embankment plantation of 3 km were found in this union.

Sub-project	S-1	S-2	S-3
Fauna	The genetic dolphin (Plastanista gangetica), known locally as Sisu or Susok, occurs in all the main river systems of Bangladesh, particularly, throughout the monsoon season. The Dolphin is identified as a threatened/ vulnerable species by the IUCN Red Book. The union has a total wetland area of 1,263 hectares, 27 of which are under aquaculture.	The genetic dolphin (Plastanista gangetica), known locally as Sisu or Susok, occurs in all the main river systems of Bangladesh, particularly, throughout the monsoon season. Gengetic dolphin is found in the Tetulia River as well. The Dolphin is identified as a threatened/vulnerable species by the IUCN Red Book. The union has a total wetland area of 3,696 acres, 182 acres of which are under aquaculture.	The genetic dolphin (Plastanista gangetica), known locally as Sisu or Susok, occurs in all the main river systems of Bangladesh, particularly, throughout the monsoon season. Gengetic dolphin is found in the Sandha River as well. The Dolphin is identified as a threatened/vulnerable species by the IUCN Red Book. The project area contains a number of rivers, canals, ponds, etc. Of the total area (2,336 hectares) of Rahmatpur Union, total wetland contains 575 hectares (25%).
Protected Areas	There is a planted mangrove patch in the northern bank of the Andharmanik River which is not a government forest area. There are no forest areas or estuaries in or near the sub-project site. No natural forest exists in the sub-project sites or in the surrounding areas.	There are no protected areas in or around sub-project sites.	There are no forest areas, mangroves or estuaries in or near the sub-project site. No natural forest exists in the sub-project sites or in the surrounding areas.
Demography	In accordance with the Census of Bangladesh (2011), total population of Nilganj Union is 29,019, out of which 14,163 and 14,856 are males and females, respectively; whereas, gender ratio is 95. Total number of households in this union is 7,282. Average size of a household is 4. Concentration of literacy rate in this union is 62.6%, which is higher than the national average of 51.8.	In accordance with the Census of Bangladesh (2011), total population of Bhelu Mia Union is 30,574, out of which 15,489 and 15,085 are males and females, respectively; whereas, gender ratio is 103. Total number of households in this union is 5,991 and average size of household is 5.1. Concentration of literacy rate in this union is 36.5%, which is much lower than the national average of 51.8.	In accordance with the Census of Bangladesh (2011), total population of Rhmatpur Union is 24,359, out of which 12,171 and 12,188 are males and females, respectively; whereas, gender ratio stands at 100. Total number of households in this union is 5,495 and average household size is 4.4. Concentration of literacy rate in this union is 75.6%, which is much higher than the national average of 51.8.
Social Classification	According to the population census (2011), Nilgonj Union is composed of 90.9% Muslim, 8.7% Hindu and 0.4% Christian.	According to the population census (2011), Bhelu Mia Union is composed of 99.1% Muslim and 0.9% Hindu.	According to the population census (2011), Rahmatpur Union is composed of 93.8% Muslim, 6.2% Hindu, 0.02% Christian, and 0.02% others.
Settlement and Housing	According to the population census (2011), total number of households in Nilgonj Union is 7,282. Predominant structure of this union is Kutcha 92.4% followed by Jhupri 5.8%, Semi-Pucka 1.3% and Pucka 0.5%. Housing tenancy of the study area is 97.8%, rented (0.7%) and Rent free (1.5%).	According to the population census (2011), total number of households in Bhelu Mia Union is 5,991. Predominant structure of this union is Kutcha 91.9%, followed by Jhupri 4.6%, Semi-Pucka 2.8% and Pucka 0.7%. Housing tenancy of the study area is 96.1%, rented (0.5%) and Rent free (3.4%).	According to the population census (2011), total number of households in Suhilpur Union is 5,495. Predominant structure of this union is Kutcha (67.2%), followed by Semi-Pucca (18.1%), Pucca (13.1%) and Jhupri (1.7%). Housing tenancy of the study area is 87.2%, rented (11.3%) and Rent free (1.5%).

Sub-project	S-1	S-2	S-3
Quality of Life Indicators	In Nilganj Union, only 27.4% of households have grid electricity connection. 99.4 percent of the population depends on tube-well water for meeting their water requirements. In the Project study union, about 41% of people use sanitary (water sealed) latrines.	In Bhelu Mia Union, only 13.3% of the households have grid electricity connection. 97.2% of the population depends on tube-well water for meeting their water requirements. In the Project study union, about 3.6% of people use sanitary (water sealed) latrines	In the Rahmapur Union, 74.2% of households have grid electricity connection. 96.2 percent of the population depends on tube-well water for meeting their water requirements. In the Project study union, about 26.9% of people use sanitary (water sealed) latrines.
Socio-economic Status	Main sources of income of Nilgsnj Union are Agriculture 40%, Agriculture labourer 20%, non-agricultural labourer 2%, Fishing 25%, Business 5%, Service 5%, living abroad 2% and others 1%.	Main sources of income is Agriculture 55.72%, non-agricultural labourer 5.43%, industry 0.50%, commerce 14.76%, transport and communication 3.33%, service 7.74%, construction 2.17%, religious service 0.39%, rent and remittance 0.41% and others 9.55%.	Main sources of income of Babuganj Upazila are Agriculture 50.58%, non-agricultural labourer 3.58%, industry 1.11%, commerce 13.54%, transport and communication 2.81%, service 15.92%, construction 1.78%, religious service 0.29%, rent and remittance 4.01% and others 6.38%.
Other existing amenities for community welfare	Educational institutions in Kalapara Upazila include 6 non-government colleges, 36 non-government high schools, 86 government primary schools, etc. Health facilities include 72 upazila health complexes and health personnel, 9 union health centers, etc.	Educational institutions in Bhola Sadar Upazila include 2 government colleges, 10 non-government colleges, 2 government high schools, 62 non-government high schools, 95 government primary schools, etc. Health facilities include 8 private hospitals or clinics, 100 upazila health complexes and health personnel, 10 union health centers, etc.	Educational institutions in Babuganj Upazila include 3 non-government colleges, 35 non-government high schools, 69 government primary schools, etc. Health facilities include 2 hospitals, 1 upazila health complex, 4 union health centers, etc.
Transportation and Communication	Transportation and communication in Kalapara Upazila include 69 km of metalled road, 106 km of semi-metalled road, 78 km of unmetalled (kacha) road, 231 km of waterway in monsoon (river and canal), 222 km of waterway in round the year (river and canal), 7 km of embankment road and 420 km of canal road.	Transportation and communication in Bhola Sadar Upazila include 351 km of metalled road, 32 km of semi-metalled road, 312 km of unmetalled (kacha) road, 26 km of waterway in monsoon (river and canal), 24 km of waterway in round the year (river and canal), 10 km of embankment road and 16 km of canal road.	Transportation and communication in Babuganj Upazila include 53.3 km of metalled road, 123.7 km of semi-metalled road, 364.8 km of unmetalled (kacha) road, 269 km of waterway in monsoon (river and canal) and 172 km of waterway in round the year (river and canal). Records at the Barisal Airport show that from 1995 to February 2015, a total of 116,012 passengers were served on various domestic and rented flights.
Historical, Cultural and Archaeological Characteristics	Archaeological heritage and relics are the Statue of Gautam Buddha installed at Keranipara, Old Buddhist Bihara (believed to be the largest Buddha statue in Asia), and Kuakata Buddhist Vihara in Kalapara Upazila. The sub-project component is not located near the site; construction work will not be conducted in the vicinity of the site.	Archaeological heritage and relics are the Buri Mosque, House of Rajani Kar (presently used as student hostel of Fazilatunnesa Mahila College), and Pancharatna Math. The sub-project component is not located near the site; construction work will not be conducted in the vicinity of the site.	There are 2 historical places in Babuganj: Samadhi Mandir of Rammohan (Madhab Pasha) and Durgasagar Dighi. The sub-project component is not located near the site; construction work will not be conducted in the vicinity of the site.

Source: IEE result

Table 12.3.6 Environmental and Social Baseline (2)

Sub-project	S-4	S-5
Climatic Condition	Several climatic zones occur within Bangladesh, with the study area falling within the South- central region. Khulna's climate is classified as tropical. The summers have a good deal of rainfall, while the winters have very little.	Several climatic zones occur within Bangladesh, with the study area falling within the South- western region. Satkhira has tropical climate. In winter, there is much less rainfall in Satkhira than in summer.
Topography, Physiography and Soils	The sub-project areas are located in the Ganges tidal floodplain. Local differences in elevation, generally, are less than 1 m compared with 2-3 m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the Lower Meghna.	The sub-project areas are located in the Ganges tidal floodplain. Local differences in elevation, generally, are less than 1m compared with 2-3 m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the Lower Meghna.
Land Use	According to the land zoning report of Koyra Upazila (2011), Maharajpur Union is identified as agro-aquaculture zone (Bagda with white fish), which comprises agriculture (62%), Settlement (9%), Waterbody (20%) and Bagda with white fish 36%. A 2 km land use map of the project study area has been prepared from LGED map and google image. This reveals that the land use/land cover consists mainly of fish culture followed by river, settlement with homestead vegetation, agricultural land and canal.	Land use of the sub-project site is diversified and rich. The area is famous for harvesting shrimp, crab, mango, litchi, pineapple and vegetables. Approx. 15 km^2 land area of 3 unions is occupied by shrimp and crab farming and 4.5 km^2 are agricultural land. There are 3 canals, Jhiler Khal, Madina Dargar Khal, and Dewana Bazar, which crisscross the site and surroundings. All of these canals along with Gowal Ghasia River are natural habitats of shrimp fry.
Geology	The Khulna area consists of late Holocene to Recent Alluvium of the Ganges deltaic plain in north and tidal plain in south. The area is composed of sand, silt and clay in various proportions with small amount of coarse sand, which is classified into seven litho-stratigraphic units from base to top. Stratigraphic cross-sections and panel diagram through this area indicate presence of seven sedimentary cycles.	The Khulna area consists of late Holocene to Recent Alluvium of the Ganges deltaic plain in north and tidal plain in south. The area is composed of sand, silt and clay in various proportions with small amount of coarse sand, which is classified into seven litho-stratigraphic units from base to top. Stratigraphic cross-sections and panel diagram through this area indicate presence of seven sedimentary cycles.
Air Quality	Major air pollution source of the project study area are only domestic work and limited vehicular emissions. Currently, no air quality monitoring station is in operation within the upazila limit.	Major air pollution source of the project area is vehicular emission. Currently, no air quality monitoring station is in operation within the upazila limit.
Acoustic Environment	There is no traffic movement in the project location.	The volume of traffic that passes through this section is significant. Major noise pollution source in this sub-project is traffic movement.
Hydrology	The Kapotakshi River which flows in the project area is maximum 4.25 m tide. It is a meandering river 238 km long. Average width is 244 m; whereas, maximum and minimum width is 1,105 m and 19 m, respectively. Highest water flowing month is July to September and lowest is February to April. Small and large country boats run in this river throughout the year. This river is 4th class designated route of BIWTA. Groundwater is the main source of potable water in the sub-project area. Shallow tubewell depth is 100-150 ft; whereas; deep tubewell depth is 600-700 ft in Maharajpur Union. There is no arsenic contamination, but iron concentration is slightly higher in some areas of Maharajpur Union.	Kankshiali and Galghasia rivers flow at the north and east side of the project area. Both rivers are tidal in character. The Kankshiali and Galghasia are meandering rivers 18 km and 22 km long. Average width is 80 m and 22 m; whereas; maximum width is 160 m and 137 m. Highest water flowing month is July to September and lowest is February to April. Safe drinking water is the main concern in these three unions. Salinity level in groundwater up to 350 m depth is too high for drinking. Households with financial ability buy portable water in 20 liter containers. Suppliers find difficulty in carrying these containers to the doorstep of villagers due to bad condition of the sub-project road surface. It should be noted that poor and extremely poor households are dominant among the total population, and they source their drinking water from ponds.

Sub-project	S-4	S-5
Natural Disaster	The coastal belt of Khulna is known to be a place severely affected by natural disasters like cyclones and tidal surge forming in the Bay of Bengal. Due to geographical location, Koyra Upazila is more vulnerable to cyclone and tidal surge than the other upazilas along the coast of Khulna.	The coastal belt of Satkhira is known to be a place severely affected by natural disasters like cyclones and tidal surge forming in the Bay of Bengal. Due to geographical location, Kaliganj Upazila is more vulnerable to cyclone and tidal surge than the other Upazila along the coast of Satkhira.
Flora	Tree species in various ecosystems and the aquatic floral species at project site are given. Homestead/community forest were found in combination with natural vegetation and planted timber, fuel wood, fruit, fodder and other trees used as raw material in cottage industries. Among the species used for homestead/community forest, raintree occupies a major part. Strip plantation of the Forest Department consists of embankment plantation of about 8 km found in the union.	Tree species in various ecosystems and the aquatic floral species at project site are given. Settlements with homestead forest are found in combination with natural vegetation and planted timber, fuel wood, fruit, fodder and other raw material yielding trees used in cottage industry. Raintree occupies a major portion. Strip plantation of the Forest Department consists of roads and highway plantation of about 5 km and link road plantation of about 3.50 km in Kushlia Union.
Fauna	Genetic dolphin (Plastanista gangetica), known locally as Sisu or Susok, occurs in all the main river systems of Bangladesh, particularly, throughout the monsoon season. Gengetic dolphin is found in the Kapotakshi River as well. The Dolphin is identified as a threatened/vulnerable species by the IUCN Red Book. The union has a total wetland area of 2,306 hectares, out of which 1,789 hectares are under aquaculture.	The union has a total wetland area of 2,306 hectares, out of which 1,789 hectares are under aquaculture. The genetic dolphin (Plastanista gangetica), known locally as Sisu or Susok, occur in all the main river systems of Bangladesh, particularly, throughout the monsoon season. The Dolphin is identified as a threatened/vulnerable species by the IUCN Red Book. The three unions have a total wetland area of 7,299 acres, out of which 6,832 acres are under aquaculture.
Protected Areas	The project area is located at approximately 7.70 km away from Sundarban Reserve Forest. In 1999, the Government of Bangladesh declared Sundarban (along with 10km radius area around the Sundarban Reserve Forest) as "Ecologically Critical Area (ECA)" authorized under Sub-clause (1) of Clause 5 of the Environment Conservation Act'95. Sub-project located within the "Dashali" mouza of Maharajpur Union, which falls under the list of mouza that are declared as "Ecologically Protected Area (ECA)" according to the NOTIFICATION issued on 13th January 2015, authorized under Sub-clause (1) of Clause 5 of the Environment Conservation Act'95.	There are no forest areas or estuaries in or near the sub-project site. No natural forest exists in the sub-project site or the surrounding areas.
Demography	In accordance with the Census of Bangladesh (2011), total population of Maharajpur Union is 31,068, out of which 14,994 and 16,074 are males and females; whereas, gender ratio is 93. Total households of this union is 7,156 and average size of household is 4.3. Concentration of literacy rate of this union is 41%, which is lower than the national average of 51.8.	In accordance with the Census of Bangladesh (2011), total population of Bishnupur, Dakshin Sreepur and Kushlia unions is 21,927, 17,661 and 22,955, respectively. Average sex ratio of the project area is 98.3. Total household of the project located union is 14,566. Average size of household is 4.3. Average concentration of literacy rate is 53.6%, which is higher than the national average of 51.8.
Social Classification	According to the population census (2011) Maharajpur Union is composed of 91% Muslim, 8.9% Hindu and 0.05% Christian and 0.05% others.	According to the population census (2011), Project located unions on average are composed of 79.5% Muslim, 20.2% Hindu and 0.31% Christian.
Settlement and Housing	According to the population census (2011), total household of Maharajpur Union is 7,156. Predominant structure of this union is Kutcha 89.7%, followed by Semi-Pucka 3.8%, Pucka 3.5% and Jhupri 3%. Housing tenancy of the study union is owned by 97.3%, rented (0.1%) and Rent free (2.6%).	According to population census (2011), total household of project located unions are 14,566. Predominant structure of these unions is Kutcha 56.9%, followed by Semi-Pucka 25.8%, Pucka 15.1% and Jhupri 2.2%. Housing tenancy of the study area is 97%, rented (1.5%) and Rent free (1.7%).

Sub-project	S-4	S-5
Quality of Life Indicators	In the Maharajpur Union, only 16.2% of the households have grid electricity connection. 43.3% of the population depends on tube-well water for meeting their water requirements. In the Project study union, about 23.2% of people use sanitary (water sealed) latrines.	In the project study area union, only average 31.4% of the households have grid electricity connection. 86.9% of the population depend on tube-well water for meeting their water requirements. 12.3% of people use sanitary (water sealed) latrines.
Socio-economic Status	Main sources of income in Koyra Upazila are Agriculture 66.64%, non-agricultural labourer 7.12%, industry 0.51%, commerce 12.66%, transport and communication 1.85%, service 3.54%, construction 1.31%, religious service 0.31%, rent and remittance 0.09% and others 5.97%.	Occupational pattern is dominated by closed water fish culture profession. Approx 40% are involved in shrimp firming, 25% daily labor, 15% agriculture, and the rests are transport, job, business, etc. Both male and female agricultural and construction wage laborers are available in these areas.
Other existing amenities for community welfare	Educational institutions in the Koyra Upazila include 3 non-government colleges, 37 non-government high schools, 54 government primary schools, etc. Health facilities include 4 private hospitals or clinics, 50 upazila health complexes and health personnel, 4 union health centers, etc.	Seventeen educational institutions are located in 3 unions, most of which are primary schools and Madrasa. Number of institutions for secondary, higher secondary and college level education is inadequate. Only 1 health complex, 2 community clinics, and few private practitioners are providing day to day health services.
Transportation and Communication	Transportation and communication in Koyra Upazila include 46 km metalled road, 172 km semi-metalled road, 394 km unmetalled (kacha) road, 26 km waterway in monsoon (river and canal), 24 km waterway in round the year (river and canal), 342 km embankment road and 27 km canal road.	Transportation and communication in Kaliganj Upazila include 206.5 km metalled road, 92 km semi-metalled road, 543.66 km unmetalled (kacha) road, 73 km waterway in monsoon (river and canal), 38 km waterway in round the year (river and canal), 80 km embankment road,120 km canal and 170 km other roads.
Historical, Cultural and Archaeological Characteristics	Archaeological heritage and relics in Koyra Upazila are Buro Mosque (Amadi union, 15th century), Parimala Statue (Chamunda), Mali Bari Mosque, etc.	Archaeological heritage and relics in Kaliganj Upazila are Prabajpur Jami Mosque (Dhalbaria), Dargah of Madina Pir (Kushlia), tomb of Ganjon Pir (Ratanpur), etc. The sub-project component is not located near the site; construction work will not be conducted in the vicinity of the site.

Source: IEE result

12.3.4 Anticipated Impacts and Mitigation Measures

(1) Pre-construction Stage

In the Pre-Construction Stage, S-1, S-2, S-4, and S-5 will not entail "Involuntary Resettlement" and hence no impact is expected.

As to S-3, the proposed revetment will be constructed along the river bank and a 20-foot by 6-meter wide strip of land is required along the riverbank for the rehabilitation of embankment. Since the strip of land consists of both public and private land, some structures might need to be removed. This impact can be minimized by adequate compensation to Project-Affected-Persons (PAPs). Anticipated impacts and mitigation measures are shown in Table 12.3.7.

Table 12.3.7 Anticipated Impacts and Mitigation Measures – Pre-construction Stage

No.	Item	Sub-project Site	Impact	Mitigation Measures
1	Involuntary Resettlement	S-3	A six (6) meter wide strip of land (both public and private) shall be required all along the river bank for rehabilitation of the embankment. Few structures might need to remove.	① Compensation at full replacement cost (or provision of alternative land) shall be secured in accordance with JICA Guidelines. BWDB, the proponent, is to conduct an inventory of the land and structures located in the project area, which will be supported by Deputy Commissioner (DC) of Barisal district, for clarifying all the structures and assets to be compensated, and determining the compensation price and method accordingly, and finally implement compensation.

Source: IEE result

(2) Construction Phase

In this sub-project, (a) most of the individual elements are relatively small and involve straightforward construction, so that impacts will be mainly localized and not greatly significant; (b) most of the predicted impacts are associated with the construction process, involving civil works and earth movements; and (c) being located in the rural area, impact may be caused on aquatic biodiversity values. Anticipated impacts and mitigation measures are shown in Table 12.3.8.

Table 12.3.8 Anticipated Impacts and Mitigation Measures - Construction Stage

No.	Item	Sub-project Site	Impact	Mitigation Measures
3	Land Use and Utilization of Local Resources	S-1,2,3,4,5	Significant amount of gravel, sand, and cement will be required for this sub-project. Extraction of construction materials may cause localized changes in topography and landforms. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	① Utilize readily available sources of materials. If contractor procures materials from existing borrow pits and quarries, ensure these conform to all relevant regulatory requirements. ② Borrow areas and quarries (If this is being opened up exclusively for the sub-project) must comply with environmental requirements, as applicable. No activity shall be allowed until formal agreement is signed between PIU, landowner and contractor.
10	Working Conditions	S-5	Construction work will pose little change in working conditions of the local people living along the road	① Keep adequate space for public movement. ② Limit the construction area by fence or rope.
11	Accident	S-1,2,3,4,5	Construction workers can have harmful and critical troubles	① Follow Health and Safety Management Plan (HSMP), rules and regulations designated by contractors.
12	Hazards (Risk) Infectious Diseases such as HIV/AIDS	S-1,2,3,4,5	Transmission of disease by inflow of migrant workers	① An HIV-AIDS awareness campaign via approved service provider shall be implemented.
15	Soil Erosion	S-3,4	There are earthworks required in the site and soil erosion is expected to occur	① Construction practices shall be under the measures for controlling soil erosion prior to excavation. In addition, special measures will be taken to prevent soil erosion by certain construction equipment.

		S-5	Soil erosion may occur during the earthwork for road raising	① (Same as ① of S-3,4) ② Avoid erosion and therefore, generation of sediment-laden runoff, through appropriate siting of works and minimization of exposed areas. ③ Minimize soil loss during slope creation and minimize soil loss due to erosion and slope failure in the longer-term.
16	River Transportation	S-2	Congestion of boats generates collision	① Provision of illumination at night-time around pier foundations.
		S-3,4	Congestion of boats generates collision	① Provision of illumination at night-time around heavy machinery in the river.
19	Flora, Fauna and Biodiversity	S-1	Activities being located in the rural area of Kalapara upazila. There is 'Kachu Patra' reserve forest located at approx. 700 meters north from the site covering 21.05 km^2. Aquatic biodiversity will be affected during the construction period.	① Monitor both upstream and downstream water quality of canal water. ② Any illegal discharge of waste-water, and leaked oil to the water body shall be prohibited. ③ Night lightning in construction should be restricted to the construction site.
		S-2	Activities being located in the rural area of Bhola sadar upazila. There are no protected areas in or around sub-project sites; only aquatic biodiversity will be affected during the construction period.	① Check if tree-cutting will be required during detailed design stage. No tree, shrub, or ground cover can be removed or vegetation stripped without the prior permission of the environment management specialist. ② If during detailed design cutting of trees will be required, compensatory plantation for trees lost at a rate of 10 trees for every tree cut, in addition to tree plantation as specified in the design, shall be implemented by the contractor, who shall also maintain the saplings for the duration of his contract. ③ (Same as ① of S-1) ④ (Same as ② of S-1) ⑤ (Same as ③ of S-1)
		S-3	Activities being located in the rural area of Babuganj upazila. There are no protected areas in or around sub-project sites. Some trees need to be cut down.	① (Same as ① of S-2) ② (Same as ① of S-1) ③ (Same as ② of S-1) ④ (Same as ③ of S-1)
		S-4	Activities being located in the rural area of Koyra upazila. *Sub-project located within the "Dashali' mouza of Maharajpur union, which falls under the list of mouza that are declared as "Ecologically Protected Area (ECA)" according to the NOTIFICATION issued on 13th January 2015, authorized under sub-clause (1) of clause-5 of 'Environment Conservation Act'95*.	① (Same as ① of S-1) ② (Same as ② of S-1) ③ (Same as ③ of S-1) ④ Avoid night time work. ⑤ Prevent hunting and killing of animals by workers within protected areas. ⑥ Construction contractors shall be prohibited from entering protected areas, and briefings shall be provided to all workers to this effect.

		S-5	Activities being located in the rural area of Kaliganj upazila. There are no protected areas in or around sub-project sites. Dense Homestead Forests (firewood and timber) and commercial fruit gardens (Mango, Litchi, Pineapple, etc.) exist along the road sides.	① (Same as ① of S-2) ② (Same as ② of S-2) ③ (Same as ② of S-1) ④ (Same as ③ of S-1) ⑤ (Same as ④ of S-4)
24	Air Pollution	S-1,2,3,4,5	Conducting works in dry season and moving large quantity of materials may create dusts and increase concentration of vehicle-related pollutants (such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the site. The impacts are negative and short-term, site-specific within a relatively small area and reversible by mitigation measures.	① Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather. ② Use tarpaulins to cover soils, sand and other loose materials when transported by trucks. ③ Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. ④ During construction: Dust reducing measures, such as water spraying, careful location of construction camp, slow movement of construction vehicles. ⑤ Monitor air quality.
25	Water Pollution	S-1	The construction works may cause impact of turbidity on the environment. Risk of oil leak from heavy machines increases.	① Prepare and implement a spoils management plan. ② Construction sludge generated by pile driving, concrete plant and asphalt plant shall be treated by silt basin and remaining sludge shall be disposed at designated dumping site. ③ Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Kalapara local authority on designated disposal areas. ④ Impermeable wall shall be used with cast-in-place pile ⑤ All earthworks must to be conducted during dry season to maximum extent possible to avoid difficult working conditions that prevail during monsoon season such as problems from runoff. ⑥ Location of stockyards for construction materials shall be identified at least 300m away from watercourses. Place storage areas for fuels and lubricants away from any drainage leading to water bodies. ⑦ Take all precautions to minimize the wastage of water in the construction activities. ⑧ Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies. ⑨ Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low-lying areas. ⑩ Monitor water quality according to the environmental management plan.

		S-2	Piling in water body, excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result in silt-laden runoff during rainfall which may cause siltation and reduction in the quality of water body.	(Same as ① ～⑩ of S-1)
		S-3,4	The construction works may cause impact of turbidity on the environment. Risk of oil leak from heavy machines increases.	① (Same as ① of S-1) ② Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Babuganj local authority on designated disposal areas. ③ (Same as ⑤ of S-1) ④ (Same as ⑥ of S-1) ⑤ (Same as ⑦ of S-1) ⑥ (Same as ⑧ of S-1) ⑦ (Same as ⑨ of S-1) ⑧ (Same as ⑩ of S-1)
		S-5	Earthwork, Excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result in silt-laden run-off during rainfall which may cause siltation and reduction in the quality of water body.	① (Same as ① of S-1). ② Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Kaliganj local authority on designated disposal areas. ③ (Same as ⑤ of S-1) ④ (Same as ⑥ of S-1). ⑤ (Same as ⑦ of S-1). ⑥ (Same as ⑧ of S-1) ⑦ (Same as ⑨ of S-1) ⑧ (Same as ⑩ of S-1)
26	Soil Pollution	S-1,2,3,4,5	Leakage of oil can contaminate soil	① Disposal at designated dumping site. ② Soil quality testing. ③ Disposal of waste oil without leakage. ④ Refueling place having concreted floor. ⑤ Preserved in tank surrounded with concrete fence. ⑥ Equipment and vehicles are properly maintained. ⑦ Batteries containing liquid inside shall be kept on impervious place.
27	Waste	S-1,2,3,4,5	Generation of construction sludge and domestic waste	① Minimize volume to use silt basin before disposing. ② Segregate waste to minimize waste material. ③ Disposed in designated dumping site instructed by the section handling waste. ④ Recycled as possible with consideration of soil property. ⑤ Construction wastes to be managed in accordance with national standards and best practices.
28	Noise and Vibration	S-1,2,5	Noise and vibration from construction machines and vehicles	① Periodical maintenance of construction vehicles. ② Installation of sound insulation cover on boundary near residential area.

		S-3,4	Noise and vibration from construction machines and vehicles	① (Same as ① of S-1,2,5) ② (Same as ② of S-1,2,5) ③ Strict abidance of speed limit and avoidance of unnecessary idling. ④ Avoidance of night-time construction.
30	Offensive Odor	S-1,2,3,4,5	Open burning of construction waste; improper treatment of human liquid waste; exhausted smoke from heavy equipment; etc.	① Prohibition of open burning ② Proper treatment of camp waste ③ Proper maintenance of heavy equipment
31	Bottom Sediment	S-1,2,3,4,5	Waste dumped into rivers can contaminate canal bed	① Construction contractor shall be obliged not to dump waste into canals.

Source: IEE result

(3) Operation Stage

S-1, S-3, and S-4: No impact on any environmental item is expected.

S-2 and S-5: Expected impacts are associated with "River Transportation", "Air Pollution", and "Noise and Vibration". However, the infrastructure (bridge or road) will operate with routine maintenance, which should not affect the environment. In addition, routine repair will be very small in scale can be conducted manually by small teams, and work will be very short in duration to cause significant physical impacts. Traffic may be interrupted temporarily, but the work will be very small in scale, infrequent and short in duration and hence no economic or other implications. Besides, O&M will be the responsibility of the local authority (Bhola Sadar or Kaliganj), which will be given training in this project. Mitigation measures for the expected impacts are shown in Table 12.3.9.

Table 12.3.9 Anticipated Impacts and Mitigation Measures - Operation Phase

No.	Item	Sub-project Site	Impact	Mitigation Measure
16	River Transportation	S-2	New pier foundations may obstacle passing boats	① Provision of illumination night time around the pier.
24	Air Pollution	S-2, S-5	An increase in emission of air pollutant from passing vehicles	① Compliance with traffic control rules and regulations. ② Increased road-side vegetation cover. ③ Water-spraying during heavy traffic for dust control.
28	Noise and Vibration	S-2, S-5	Noise and vibration from passing vehicles	① Compliance with traffic control rules and regulations. ② Put signage for noise regulations at sensitive locations with clear instructions of not using horns and running vehicles with limited/allowable speeds. ③ Maintain tree plantation on both sides of the roads.

Source: IEE result

12.3.5 Environmental Monitoring Plan

(1) Environmental Monitoring Plan

Table 12.3.10 shows the environmental monitoring plan during the construction stage.

Table 12.3.10 Environmental Monitoring Plan

No.	Item	Sub-project Site	Environmental Monitoring	Frequency
3	Land Use and Utilization of Local Resources	S-1,2,3,4,5	Direct survey in the occupied area to see the condition	Quarterly
10	Working Conditions	S-5	Monitor the access of public movement in the construction area	Continuous
11	Accidents	S-1,2,3,4,5	Visual monitoring of construction works by the Contractor, PIU	Continuous
12	Hazards (Risk) Infectious Diseases such as HIV/AIDS	S-1,2,3,4,5	① Monitoring workers adherence to safety procedures as stipulated in the Contractor's Health and Safety Plan. ② Monitoring regular medical check for workers and review reports by the Contractor, PIU	Continuous
15	Soil Erosion	S-3,4,5	① Visual monitoring and inspection of excavation works, construction works, and implementation of mitigation measures by the Contractor, PIU ② Inspect facilities and review procedures for compliance.	Continuous
16	River Transportation	S-2,3,4	① Giving adequate illumination	Every day
19	Flora, Fauna and Biodiversity	S-1,2,3,4,5	① Measurement of Phytoplankton, zooplankton and Benthos ② Surface water quality measurement (pH, EC, Turbidity, DO, Coliform, BOD, NH4-N, Oil and Grease)	Quarterly
24	Air Pollution	S-1,2,3,4,5	① Measurement of SPM, NOx, SO2,PM10, PM2.5, CO ② Inspection of brick and cement facilities (spot check)	① Once before construction for baseline ② Quarterly during construction or after complaint ③ Monthly
25	Water Pollution	S-1,2,3,4,5	(Surface water) Measurement of pH, EC, Turbidity, DO, Coliform, BOD, NH4-N, Oil and Grease	① Once before construction for baseline ② Quarterly during construction
26	Soil Pollution	S-1,2,3,4,5	Visual inspection, or measurement of Cd, Pb, As, oil, grease and so forth	① Once before construction for baseline ② Yearly during construction
27	Waste	S-1,2,3,4,5	Inspection of waste disposal sites and construction camps	Monthly
28	Noise and Vibration	S-1,2,3,4,5	Measurement of noise dB(A)	① Once before construction for

				baseline ② Monthly during construction
30	Offensive Odor	S-1,2,3,4,5	Odor inspection to ensure harmful odor is not released from equipment and waste	Weekly or monthly
31	Bottom Sediment	S-1,2,3,4,5	Bottom sampling of Cd, Pb, As, oil, grease and so forth	① Once before construction for baseline ② Quarterly during construction

Source: IEE result

(2) Institutional Arrangement and Monitoring Budget

Implementation of the EMP including monitoring during construction is the responsibility of the contractor, supervised by PIU. The proposed organizational set-up for sub-project implementation together with EMP implementation is shown in Figure 12.4.1.

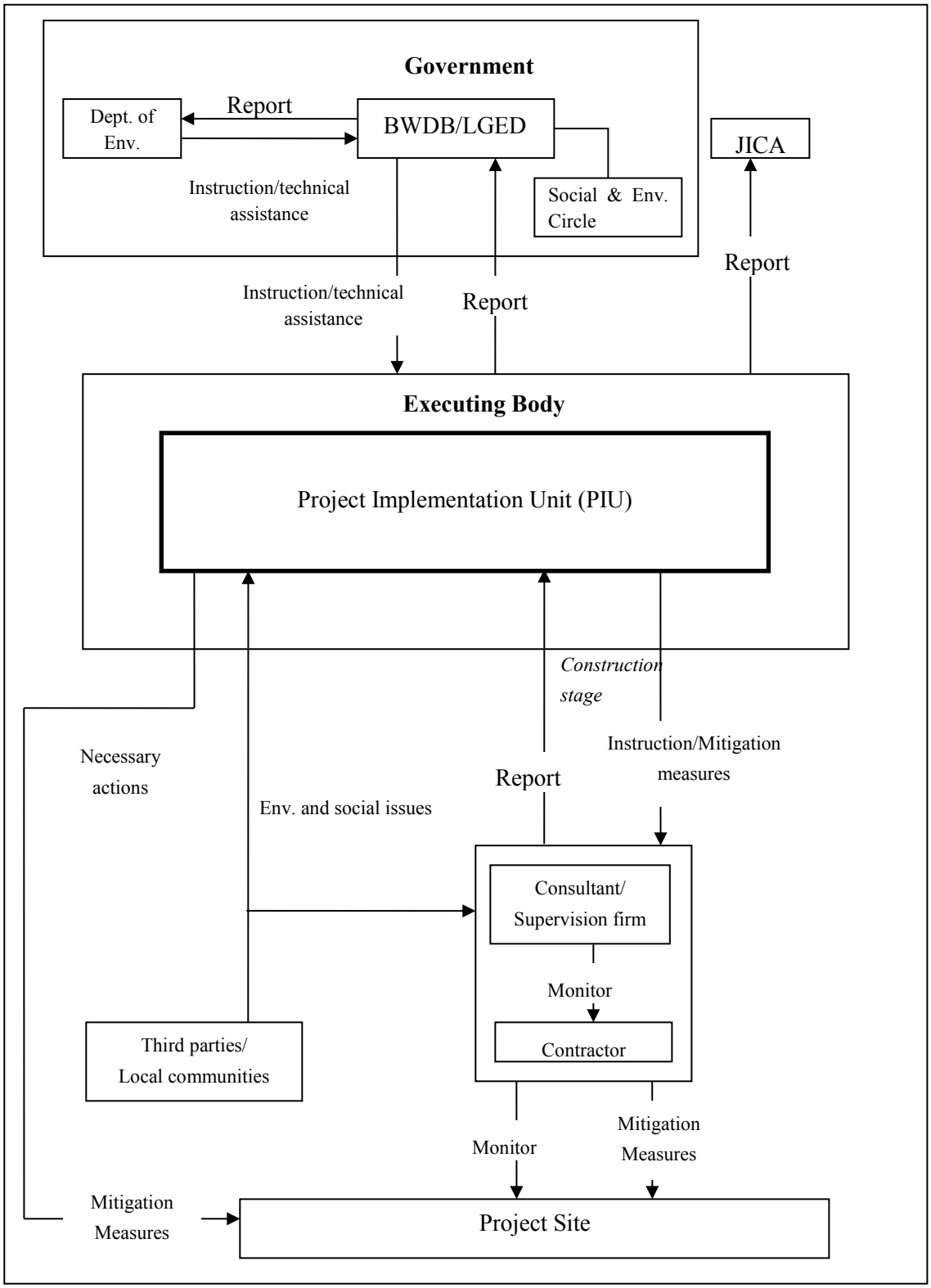
Environmental monitoring budget per year for each sub-project is given in Table 12.3.11. The budget is estimated as about 1,630-2,280 thousand BDT.

Table 12.3.11 Environmental Monitoring Budget (Per Year)

Unit: 1,000BDT

S-1	S-2	S-3	S-4	S-5
1,630	1,730	1,830	2,130	2,280

Source: IEE result



Source: IEE result

Figure 12.3.1 Sub-project Organization Chart

12.3.6 Stakeholder Consultations

(1) Identification of Stakeholder

The first step in the process of stakeholder consultation is "Identification of Stakeholder" as individual or group. Therefore, a preliminary survey was carried out at the 5 sub-project sites from 11th to 16th of September 2015 and the identification process was carried out among the government and non-government organizations, individuals and groups of people residing adjacent to or surrounding the sub-project area having 'direct stake/interest' on the sub-project. The process revealed organizations, individuals, and groups which will be benefited directly due to sub-project implementation and those which would be affected directly due to anticipated environmental and social impact from sub-project interventions. Identified stakeholders were:

Executing agencies (LGED & BWDB), Department of Environment (DOE), Chairman and commissioners of Union Parishad, Upazila agriculture, fishery, livestock, Project implementation officer (PIO), Community resource person (School teacher, Imam, Elder villagers, etc.), Villagers, Shrimp firm owners, and Female group having interest to participate in project activities

Venue, date and time of Stakeholder Consultation meetings were finalized upon discussion and preference of community resource persons. Then, the meeting schedule was announced verbally (or through mobile) three (3) days prior to the meeting among the target stakeholder through field staff of consultant, local government representatives, community resource persons, NGO personnel and imam of local mosque.

Flow of communication was:

- Field staff of Consultant Ltd. → Important villagers→ Local market, Tea-stall, Club (Social gathering places)
- Local government representatives, Community resource persons, NGOs→ Target stakeholder
- Imams of local mosques→ Worshipers

(2) Results of Stakeholder Meeting

Stakeholder consultation meetings were held at the 5 sub-project sites from 25th of October to 7th of November 2015.

Consultant Ltd. assisted BWDB/LGED in holding the stakeholder meetings. All the meetings led by BWDB/ LGED for their respective sub-projects and Consultant Ltd. played the role of facilitator. The stakeholder consultation process was assisted and supervised by the JICA Survey Team.

Minutes of stakeholder consultation meetings are shown in Table 12.3.12 to Table 12.3.19. The meetings for the Revetment against Bank Erosion (No.19) and the Reconstruction of Road (HW-1) were held separately at 2 venues (Table 12.3.14 to Table 12.3.15) and 3 venues (Table 12.3.17 to Table 12.3.19), respectively, due to separation or long distance of construction sections, leading to convenience of residents' participation.

Table 12.3.12 Minutes of Stakeholder Consultation Meeting (S-1)

Sub-project	Reconstruction of Sluice Gate (No,33) by BWDB Upazila- Kalapara, Dist-Patuakhali
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	Nichkata Gov. Primary school
Date	25th Oct. 2015
Participants (Total Number (female))	BWDB representatives (1), Upazila Chairman (1), Member Secretary (2), Women Member Secretary (1), Farmers (40), Business men (3), Fishermen (1), School Teacher (4), Student (2), EQMS Consulting Limited (4) (Total: 59 (1))
Main questions/ opinions	- Is there any possibility to change the existing site of this sluice gate (Union Chairmen) Response: No possibility. - The local people's interest in work for this project. Is it applicable for this project? (Local People) Response: Yes, it is possible as per requirement of the task. Both males and females will be given this opportunity. To be considered in detail in the IEE report. - The sluice gate should construct during the wet season to avoid impact on water body as well as fishery resources (Women Member) Response: To be considered in the detail design report. - This sluice gate covers huge area of agricultural land for cultivation. At this moment only single season cultivation is practiced here. If we are able to hold the water inside this channel for a long time, two season cultivation can be done. In this case, rubber dam can be set up near the inside of sluice gate. Such approach will remarkably increase agricultural production. (Member) Response: To be considered in the detail design report.

Table 12.3.13 Minutes of Stakeholder Consultation Meeting (S-2)

Sub-project	Reconstruction of Bridge (BR12) by LGED Upazila- Bhola Sadar, Dist-Bhola
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	Embankment of the sub-project site
Date	23rd Oct. 2015
Participants (Total Number (female))	LGED representatives (2), Upazila Chairman (1), Farmers (33), Business men (13), Fishermen (2), Senior Citizen (3), School Teacher (3), Student (5), JICA Study Team (1), EQMS Consulting Limited (4), Others(5) (Total: 72(0))
Main questions/ opinions	- Adequate initiative to create health safety awareness, especially for school children during the construction stage. (School Teacher) Response: All mitigation will be followed as per TOR (ADB's Safeguards Policy Statement (2009), World Bank Operational Guideline, IFC Health Safety Guidelines including the General EHS Guidelines and The Environment Conservation Rules, 1997) of the sub -project. Besides, during the construction phase school children need to focus on the awareness of

	necessary safety during their movement. Local government, School Headmaster and LGED need to take adequate awareness initiative to mitigate this issue. - Vehicle traffic movement needs to take in proper consideration. The project site downstream area is largely engaged in agricultural cultivation, especially, production of watermelon. A good number of large scale professional livestock firm also prevail there. Besides, common vehicle movement (rickshaw, cycle, motor cycle, battery bike, cars) and remarkable number of heavy vehicle (truck) movement are likely to be faced after this project completion. (Local Businessman) Response: Heavy vehicle traffic issues need to be considered by LGED and local government should take necessary remedial measures applicable as per project standard during the design finalization. - The bridge should construct during the wet season to avoid impact on water body as well as fishery resources.(Union Parishad Chairmen) Response: To be considered in the detail design report. - The social, economic, educational and emergency response are mostly affected by these area inhabitants due to this communication bridge. It should be given utmost priority to complete this bridge as soon as possible.(Farmer) Response: To be considered in the detail design report.

Table 12.3.14 Minutes of Stakeholder Consultation Meeting (S-3.1)

Sub-project	Revetment against Bank Erosion (No.19) by BWDB Upazila- Babuganj, Dist-Barisal
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	West Khudra Khati Jamee Mosque ground.
Date	16th Oct. 2015
Participants (Total Number (female))	BWDB representatives (4), Union Chairman (1), Member Secretary (1), Farmers (14), Business men (2), Teacher (4), Student (15), Retired Army Person (3), Imam (1), JICA Study Team (1), EQMS Consulting Limited (4), Others (7) (Total: 55 (0))
Main questions/ opinions	- Is there any requirement on land acquisition for the sub-project? (Retired Sergeant) Response: Approximately 30 feet land might be required to execute revetment task properly. Land acquisition (government) process will not be done by JICA but feasible negotiation could be applicable here if required. - Is there any possibility of engagement of local people during the construction phase of this sub-project? (Student) Response: Proponent (BWDB) will consider this issue during the construction stage of this sub-project. - It would be very convenient to construct revetment from Duarika Feri-ghat to Babuganj Steel Bridge which is approximately 4 km. (Farmer) Response: To be considered in detail design stage.

Table 12.3.15 Minutes of Stakeholder Consultation Meeting (S-3.2)

Sub-project	Revetment against Bank Erosion (No.19) by BWDB Upazila- Babuganj, Dist-Barisal
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	Middle khuddro Khati Gov. Primary school
Date	16th Oct. 2015
Participants (Total Number (female))	BWDB Babuganj Office staff (4), Rahmatpur Union Chairman (1), Member(1), Women UP Member(1), Headmaster Primary school(1), Students (6), Farmers(9), Housewife(8), JICA Study Team (1), EQMS Consulting Limited (5), Others(10) (Total: 47 (9))
Main questions/ opinions	- Quality implementation of this project should be ensured. Such revetment improvement task also happened earlier but within short time when any flood faced, it was dilapidated severely? (Rahmatpur Union Chairman) Response: Proponent (BWDB) needs to consider this issue during the design stage. - The people of this area are very poor. If they are able to get work opportunity in this project, they can earn to continue their livelihood smoothly. (Student) Response: The proponent needs to explore this expectation and incorporate it in the design stage as appropriate. - The people of the project area including common people and local elected members are very positive of this project and they have also committed to provide their best support for implementation of this project. (UP Member) Response: Considered

Table 12.3.16 Minutes of Stakeholder Consultation Meeting (S-4)

Sub-project	Reconstruction of Embankment (No.10) by BWDB Upazila- Koira, Dist-Khulna
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	Dashalia Village moral para
Date	30th Oct. 2015
Participants (Total Number (female))	BWDP representatives (1), Farmers (18), Business men (2), Journalist (1), Student (8), EQMS Consulting Limited (4) (Total: 34 (0))

Main questions/ opinions	- Is there any scope to include our areas mosque; namely, Dashalia jame mosque under this revetment project? (Teacher) Response: Based on existing scenario, the said mosque is situated outside the revetment area. Like you, other inhabitants also seek to save this mosque. To be considered in the detail IEE report. - Soil erosion is the biggest problem for people of this area in their daily life. It is very difficult to go to school, bazar during the monsoon season. For this reason, students of this area are not interested to continue their education. Due to lack of proper communication, people also suffer from natural disasters. Revetment to prevent river bank erosion is a very important project for thie union people. (Journalist) Response: To be considered in the detail IEE report. - If this revetment is constructed, then the irrigation facilities will improve. (Farmers). Response: To be considered in the detail IEE report. - This side area is largely affected by Aila. Our end situation is very hard and tough. The soil is very sandy. If the revetment crashes, the whole village will be eradicated. Then we cannot live here. We are appealing for preparation of this revetment so that we sustain here. (Headmaster of primary school) Response: To be considered in the detail IEE report..

Table 12.3.17 Minutes of Stakeholder Consultation Meeting (S-5.1)

Sub-project	Reconstruction of Road (HW-1) by LGED Upazila- Kaliganj, Dist-Satkhira
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	Fatepur high school field
Date	6th Nov. 2015
Participants (Total Number (female))	LGED Personnel's (4), Chairmen (1), Member (1), Women UP Member (1), Businessmen (22), Farmers (30), Student (2), NGO (1), EQMS Consulting Limited(4) (Total: 66 (1))
Main questions/ opinions	- Who will be locally responsible for implementation of this project? (Farmers). Response: Local proponent LGED will be responsible for overall implementation and monitoring of this project. - Is there any requirement of land acquisition from local people for the expansion of road under the project? (Farmer) Response: There is no need for land acquisition. As per confirmation from local LGED personnel, there is enough room for expansion of this feeder road over the government land. - If this feeder road is constructed in due time, our people livelihood likely to be improved. (Women member) Response : Considered.

Table 12.3.18 Minutes of Stakeholder Consultation Meeting (S-5.2)

Sub-project	Reconstruction of Road (HW-1) by LGED Upazila- Kaliganj, Dist-Satkhira
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	Daskin Sripur Union Parishad
Date	7th Nov. 2015
Participants (Total Number (female))	LGED (3), Chairmen (1), Member (1), Women Member (3), House Wife (49), Women Day Labor (30), Others (4), EQMS Consulting Limited(4), JICA Study Team (1) (Total: 96 (82))
Main questions/ opinions	- The women of this area are very poor. Are we able to take part in this project task? (Day labor) Response: Yes, JAICA also has deep concern about women empowerment. Local Contractor has to be directed accordingly for appropriate engagement. - There should be no discrimination of the wages between men and women. We are also seeking other facilities like washroom, drinking water, safety cloths along with shelter during the project implementation time. (House wife) Response: To be considered in detail in the IEE report. - Safety measures of this road (Trafic signs, road mark, bump, zebra mark, pole, curve stones) should be ensured. (UP women Member). Response: The proponent (LGED) will take necessary action and incorporate it in their design outline accordingly.

Table 12.3.19 Minutes of Stakeholder Consultation Meeting (S-5.3)

Sub-project	Reconstruction of Road (HW-1) by LGED Upazila- Kaliganj, Dist-Satkhira
Agenda	1. Introduction 2. Necessity of project 3. Requirement of Environmental and social consideration 4. Discussion 5. Concluding remarks
Venue	Bishnupir Union Parishad
Date	7th Nov. 2015
Participants (Total Number (female))	LGED representative (5), Chairmen (1), Member (2), Women Member (1), EQMS Consulting Limited (4), Housewife (33), Village Police (7), Businessmen(16), Others (5) (Total: 74(35))
Main questions/ opinions	- Under this project, is there any land acquisition required? Response: No land acquisition is required. As per local LGED confirmation. (Businessmen) - What will be the road width under the project? (Journalist) Response : The road width will be 7.3 meters - The road safety measures should be in place. We are also seeking the paved road which is currently connected to each school of this area. (House wife) Response: To be considered in detail in the IEE report.

	
Reconstruction of Sluice Gate (No.33)- Nichkata Gov. Primary school	Reconstruction of Bridge (BR12)- Embankment of the sub-project site
	
Revetment against Bank Erosion (No.19)- West Khudra Khati Jamee Mosque ground	Revetment against Bank Erosion (No.19)- Middle khuddro Khati Gov. Primary school
	
Reconstruction of Embankment (No.10)- Dashalia Village moral para	Reconstruction of Road (HW-1)- Fatepur high school field
	
Reconstruction of Road (HW-1)- Daskin Sripur Union Parishad	Reconstruction of Road (HW-1)- Bishnupir Union Parishad

12.3.7 Conclusions and Recommendations

For all Sub-projects in general:

- Most of the individual elements of the sub-projects are relatively small and involve construction and operation.
- Most of the predicted impacts are associated with the construction process which will be short term and localized.
- EMP has been developed to reduce all negative impacts to acceptable levels.
- The EMP will assist the PMU, PIU and contractor in mitigating the environmental impacts, and guide them in the environmentally sound execution of the proposed project.
- Mitigation will be assured by a program of environmental monitoring, which will include observations on-site and off-site, document checks, and interviews with workers and beneficiaries.
- The PIU will submit monitoring reports to PMU.

For individual Sub-projects:

S-1: The people of Nilganj Union will be the major beneficiaries of this sub-project. With the reconstruction of sluicegate, livelihood of 11 villagers will be protected. Therefore, the proposed sub-project is unlikely to cause significant adverse impact, and net socio economic benefits to people in 11 villages will be positive.

S-2: The people of Bhelu Mia and Veduria unions will be the major beneficiaries of this sub-project. With the reconstruction of bridge, students, farmers, poultry and dairy farm owners, fishery project owners, small scale businessmen, daily waged laborer, etc., will enjoy day to day benefits of livelihood. Therefore, the proposed sub-project is unlikely to cause significant adverse impacts, and net socioeconomic benefits to the union people will be positive.

S-3: The people of Babuganj Upazila will be the major beneficiaries of this sub-project. With the revetment of river bank, they will be protected from river bank erosion as well, and protect the Barisal airport. Therefore, the proposed sub-project is unlikely to cause significant adverse impacts, and net socioeconomic benefit to the people will be positive.

S-4: The people of Rahmatpur Union of Koyra Upazila will be the major beneficiaries of this sub-project. With the Embankment Rehabilitation and Construction of Revetment, livelihood of 25 villagers and shrimp farm that cover approx. 70% of total 17,000 hectares of land will be protected. Therefore, the proposed sub-project is unlikely to cause significant adverse impacts, and net socioeconomic benefits to the people will be positive.

S-5: The people of 5 villages in Kushulia Union, 11 villages in Daskin Sripur Union and 15 villages in Bishnupur Union will be the major beneficiaries of this sub-project. With the reconstruction of road and slope protection works, people of 31 villages and the whole Assasuni Upazila will be directly

benefited. Therefore, the proposed sub-project is unlikely to cause significant adverse impacts, and net socioeconomic benefit to the people will be positive.

12.4 Considerations

Classification of development projects into four categories based on the type of industry is prescribed in Schedule-1 of the Environmental Conservation Rules (ECR, 1997) under the EIA system in Bangladesh. However, it does not always clearly specify the dimension or volume of the project in the categorization, which hinders the clear screening process of the projects. With regard to the targeted project type of this preparatory survey, namely, flood control/revetment construction works, there is a description of "Construction/reconstruction/expansion of flood control embankment, polder, dike, etc., in No. 66 of Red Category. Thus, flood control projects can be classified as Red Category, meaning that they require implementation of EIA Study, as well as preparation and submission of various types of documents for ECC application, which also needs a longer period of processing for ECC acquisition. However, since the interpretation of ECR is different among the DOE, local environmental consultant and implementation agency such as BWDB, the environmental assessment studies conducted so far are not always consistent with the requirements under the law.

On the other hand, a local consultant who is familiar with the EIA system in Bangladesh and has the perspective that the two proposed flood control projects; namely, 1) dike construction and bank protection works around the bridge north of the airport in Barisal; and 2) dike construction and bank protection works at upstream and downstream of the ferry station in Patuakhali will be categorized as Orange B considering the magnitude of the works based on his experience and hence only the IEE is required accordingly.

Regarding the so-called "Emergency Project", the following responses of DOE are noted:

"It is obvious that reconstruction of any damaged infrastructure due to natural disaster should not be stopped for obtaining environmental clearance. In other words, environmental clearance should not be prerequisite for any such infrastructure projects (i.e., road, bridge, culvert, embankment, etc.) that facilitate livelihood of millions of people. ECR'97 is not explicit on the legislative requirement of any infrastructure project in case of emergency/post emergency restoration, when time is constrained. Respective project owners should consult with the DOE in case of emergency/ post emergency restoration of any infrastructure project to determine legislative requirement."

Thus, it is expected that flexible enforcement will be applied regarding the categorization of projects under the relevant laws and regulations on EIA in Bangladesh. With regard to coordination with the DOE, the competent authority of ECC issuance, it is required that the JICA Survey Team shall support the proponent of sub-projects in the ECC application through timely assistance in documentation and explanation to the DOE for early implementation of the sub-projects.