

Government of the People's Republic of Bangladesh

Ministry of Water Resources



Bangladesh Water Development Board

PROJECT COMPLETION REPORT: IMED 04/2003
For

**Feasibility Study for Mathematical Model Study for Integrated
Development and Sustainable Management Plan of Shabazpur
Channel of Lower Meghna River.**

October, 2023

Government of the People's Republic of Bangladesh
Ministry of Planning
Implementation Monitoring and Evaluation Division

PROJECT COMPLETION REPORT : IMED 04/2003 (Revised)

A. PROJECT DESCRIPTION :

01. **Name of the Project** : Feasibility Study for Mathematical Model Study for Integrated Development and Sustainable Management Plan of Shahbazpur Channel of Lower Meghna River.
(Project code- 224344900)
02. **Administrative Ministry** : Ministry of Water Resources (MoWR)
03. **Executing Agency** : Bangladesh Water Development Board (BWDB)
04. **Location of the Project** : Barishal, Bhola, Lakhmipur & Noakhali.

05. Objective of the Project:

The main objective of the study is the sustainable management of the lower Meghna River by investigating its bank erosion processes and planform changes of Shahbazpur channel of lower Meghna River for sustainable river management, land reclamation, afforestation, sanctuary etc. considering the climate change impact. The study also aims to devising immediate and long-term solutions measures of Shahbazpur channel and its surroundings considering technical, environmental and social aspects.

Mathematical Modelling Study (Component-1)

- To enhance the understanding of the dynamic erosion phenomena in details;
- To predict morphological changes both in long and short term;
- To assess the drainage conetion and need of dredging, dredging alignment & dredging volume with design
- To prepare dredged material management plan.
- To analyze the extreme coastal event and provide sustainable solutions.
- To establish 2-D hydrodynamic model for morphological and sediment balance and find out potential sites for land reclamation
- To analyzes of the changes of salinity of water.
- To develop different potential options for protection measures considering hydrodynamic and morphological condition;
- To prepare afforestation plan considering classification of trees.
- To develop integrated and sustainable river management plan for Shahbazpur channel and its surroundings of lower Meghna river considering climate change impact.

Environmental and Social Impact Study (Component-2)

- Preparation of environmental enhancement and conservation plan.
- Preparation of biodiversity conservation plan.
- To conduct an Environment and Social Impact Assessment (ESIA) studies.
- To develop Environmental Management and Monitoring Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.

06. Estimated Cost

:

(In lakh Taka)

	Original	Latest Revised
(a) Total	496.06	-
(b) Taka	496.06	-
(c) Foreign Currency	-	-
(d) Project Aid	-	-
(e) RPA	-	-

07. Date of Approval	:	PCP/PFS	PP
(a) Original	:	04/11/2021	-
(b) 1 st No Cost Time Extension	:	07/03/2022	-
(c) Latest No Cost Time Extension	:	28/03/2023	-

08. Implementation Period

:

	Date of Commencement	Date of Completion
(a) Original	September, 2021	June, 2022
(b) 1 st No Cost Time Extension	September, 2021	December, 2022
(c) 2 nd No Cost Time Extension	September, 2021	June, 2023
(d) Actual	September, 2021	June, 2023

09. Financing Arrangement (Source-wise):

9.1 Status of Loan/Grant

a) Foreign Financing : *Not Applicable*

Source (s)	Currency as per Agreement	Amount in US \$ (Million)	Nature (Loan/Grant/supplier's/credit)	Date of Agreement	Date of Effectiveness	Date of Closing	
						Original	Revised
1	2	3	4	5	6	7	8

b) GOB:

(In lakh Taka)

Total amount	Loan	Grant	Cash Foreign Exchange
1	2	3	4
496.06	-	496.06	-

9.2 Utilization of Project Aid: Not Applicable

(In million)

Source (s)	Total Amount		Actual Expenditure		Unutilized Amount	
	In US \$	In Local Currency	In US \$	In Local Currency	In US \$	In Local Currency
1	2	3	4	5	6	7

9.3 Re-imbursible Project Aid (RPA) : Not Applicable

(In lakh Taka)

R P A Amount		Amount Spent	Amount Claimed	Amount Re-imbursed	Remarks
As per PP	As per Agreement				
1	2	3	4	5	6

B. IMPLEMENTATION POSITION

01. Implementation Period :

Implementation Period as per PFS		Actual Implementation Period	Time Over-run (% of original implementation period)	Remarks
Original	1 st No Cost Revised			
1	2	3	4	5
September 2021 to June 2022 (10 months)	September 2021- Dec/ 2022 (16 months)	September 2021- June 2023 (22 months)	120%	Due to the adverse weather conditions and delays in fund release, hydrological data collection both by M.V. Anwasha and the South Western Meseasurement division was delayed in the financial year 2021-2022. The Hydrological data collection and associated hydrological modeling by IWM and ESIA study by CEGIS was delayed and later accomplished during the financial year 2022-2023. Due to these unavoidable circumstances, the feasibility study project has been extended up to June 2023.

02. Cost of the Project :

(In lakh Taka)

Description	Estimated Cost		Actual Expenditure	Cost over-run (% of original cost)	Remarks
	Original	Latest revised			
1	2	3	4	5	6
TOTAL	496.06	-	414.43	-	Unspent Tk.= 81.63 (lakh) The actual expenditure was less than the Original PFS cost.
TAKA	496.06	-	414.43	-	
PA	-	-	-	-	-

03. Project Personnel:

Sanctioned strength as per PPF	Manpower employed during execution	Status of the existing manpower			Manpower Employed	
		Manpower requirement for O&M as per pp	Existing manpower for O & M	Others	Male	Female
1	2	3	4	5	Male	Female
Officer (s)	17	-	-	-	14	1
Staff(s)	21	-	-	-	19	2
Total :	38	Existing Manpower of ICZCCM, Survey & Study Division, BWDB, Dhaka, and South Western Meseasurement division, BWDB, Faridpur.			35	3

04. Training of Project Personnel (Foreign/Local): No provision of training in this project.

Field of Training /Study tour/workshop/Seminer etc.	Provision as per PP		Actual		Remarks
	Number of person	Man - months	Number of person	Man - months	
1	2	3	4	5	6
a. Foreign	-	-	-	-	-
b. Local	-	-	-	-	-

05. Component-wise Progress (As per latest Expenditure of PFS) :

(In lakh Taka)

Items of work (as per PFS)	Unit	Target (as per PFS)		Actual Progress		Reasons for deviation (±)
		Financial	Physical (Quantity)	Financial	Physical (Quantity)	
1	2	3	4	5	6	7
Revenue						
Other Expenses (Honorarium)	LS	3.00	100.00%	1.94	64.67%	
Advertising & Publication	LS	1.00	100.00%	0.00	0.00%	
Travelling Allowances	LS	8.00	100.00%	4.94	62.13%	
Petrol, Oil and Lubricants	LS	2.00	100.00%	1.55	77.50%	
Fuel and Gas	LS	5.00	100.00%	0.73	14.60%	
Computar parts	LS	1.78	100.00%	1.78	100.00%	
Stationery,Seals&Stamp	LS	1.50	100.00%	0.00	0.00%	
Mathematical ModelStudy (IWM, 46 MM)	1	207.62	100.00%	203.27	97.91%	
Environmental and Social Impact Study (CEGIS, 8 MM)	1	47.57	100.00%	45.87	96.43%	
Data collection .	2	19.99	100.00%	19.98	99.95%	
Survey & Investigation by M.V. Anwasha under SSD, BWDB, Dhaka.	9	130.40	100.00%	129.37	99.21%	
Sub-total (Revenue):		427.86	100.00%	409.43	95.69%	
Capital						
Computer supply (3Nos.with printer, Laptop- 2Nos.)	1	5.00	100.00%	5.00	100.00%	
Supply of ADCP,Salino meter,Submersible Pump, Pressure Sensor,Echo- sounder etc.	1	63.20	100.00%	0.00	0.00%	63.20 (Cancelled as per the Decision of the Steering Committee)
Sub-total (Capital):		68.20	100.00%	5.00	7.33%	
Grand-Total		496.06	100.00%	414.43	83.54%	

06. Information regarding Project Director (s):

Name & Designation with pay Scale.	Full time	Part time	Responsible for more than one project	Date of		Remarks
				Joining	Transfer	
1	2	3	4	5	6	7
Mr. Mohammad Mizanur Rahman, (Civil) CE, ICZCCM, BWDB, Dhaka. Grade-3 (56,500 to 74,400)	Full time		No	09-12-2021	31-10-2022	
Mr. Md. Helal Ur Rashid SE, ICZCCM, BWDB, Dhaka. Grade-4 (50,000 to 71,200)	Full time		No	01-11-2022	Till date	

07. Procurement of Transport (in Nos.): Not Applicable

Type of transport	Number as per P.P.	Procured with date	Transferred to Transport Pool with date	Transferred to O & M with date	Condemned/damaged with date	Remarks
1	2	3	4	5	6	7

08. Procurement of Goods, Works and Consultancy Services:

08.1 Goods & Works of the Project costing above Tk. 200.00 lakh. and Consultancy above Tk. 100.00 lakh :

Description of procurement (goods/works/consultancy) as per bid document	Tender/Bid/Proposal Cost (in lakh Taka)		Tender/Bid/Proposal		Date of completion of works/services and supply of goods	
	As per PFS	Contracted value	Invitation date	Contract signing/ L.C opening date	As per contract	Actual
1	2	3	4	5	6	7
Consultancy Service for "Mathematical Model Study for Integrated Development and Sustainable Management Plan of Shabazpur Channel of Lower Meghna River"	207.62	206.97	29/12/2021	16/03/2022	23/11/2022	30/06/2023

8.2 Use of Project Consultant (s) (Foreign/Local):

Name of the Field	Approved man month		Actual man month utilised	Remarks
	As per PFS	As per contract		
1	2	3	4	5
a) Foreign :	-	-	-	-
b) Local:				
Mathematical Modelling Study	46.00	46.00	46.00	Conducted by the Institute of Water Modelling
ESIA Study	8.00	8.00	8.00	Conducted by the Center for Environmental and Geographic Information Services

09. Construction/Erection/Installation Tools & Equipment: Not Applicable

Description of items	Quantity (as per PP)	Quantity procured with date	Transferred to O & M with date	Disposed off as per rule with date	Balance	Remarks
1	2	3	4	5	6	7
Computer supply (3Nos.with printer, Laptop-2Nos)	1 lot	Computer 3Nos.with printer, Laptop-2Nos Date: 02/06/2022	-	-	Computer 3Nos.with printer, Laptop-2Nos	Being used by a)Computer: SE/ICZCCM, EE/SSD & AE/SSD b)Laptop:EE/SSD & SAE/SSD BWDB, Dhaka.
Computer equipment etc.	1 lot	Table-02 No.& Revol.chair-02No.			Table-02 No.& Revol.chair-02 Nos.	AE/SSD and AE/ICZCCM
		Scnar-01No.			Scnar-01No.	CE/ICZCCM

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C. FINANCIAL AND PHYSICAL PROGRAMME :

01. (a) **Original and revised schedule as per PFS :**

(In lakh Taka)

Financial Year	Financial provision & physical target as per original PFS				Financial provision & physical target as per latest revised PFS			
	Total	Taka	P. A.	Physical %	Total	Taka	P.A.	Physical %
1	2	3	4	5	6	7	8	9
2021-22	496.06	496.06	-	100	150.00	150.00	-	30 %
2022-23	-	-	-	100	316.00	316.00	-	70 %
Total	496.06	496.06	-	100	466.00	466.00	-	100 %

01. (b) **Revised ADP allocation and progress :**

(In lakh Taka)

Financial Year	Revised Allocation & target				Taka release	Expenditure & physical progress			
	Total	Taka	P.A	Physical %		Total	Taka	P.A	Physical %
1	2	3	4	5	6	7	8	9	10
2021-22	150.00	150.00	-	100.00	150.00	103.41	103.41	-	68.94%
2022-23	316.00	316.00	-	100.00	316.00	311.02	311.02	-	98.42%
Total	466.00	466.00	-		466.00	414.43	414.43	-	83.54 %



D. ACHIEVEMENT OF OBJECTIVES OF THE PROJECT:

Objectives as per PFS	Actual achievement	Reasons for shortfall, if any
Objectives of Mathematical Modeling Study:		
To enhance the understanding of the dynamic erosion phenomena in details;	Dynamic erosion phenomena in details Shown in Final Reports Section- 3.5 and 3.6 and Page: 37-48	-
To predict morphological changes both in long and short term;	Morphological changes Shown in Final Reports Section -5.2 Page: 75-76	
To assess the drainage congetion and need of dredging, dredging alignment & dredging volume with design	Drainage congetion Shown in Final Reports Section 6.1.5 and 6.1.6, Page-105-123	
To prepare dredged material management plan.	Dredged material management plan. Shown in Final Reports Section- 6.1.7, Page: 124-130	
To analyze the extreme coastal event and provide sustainable solutions.	Analyze the extreme coastal event and provide sustainable solutions. Shown in Final Reports, Section 5.6.1 and 5.6.2 page: 86-92	
To analyzes of the changes of salinity of water.	The changes of salinity of water. Shown in Final Reports, Section 6.10, Page: 153-154	
To develop different potential options for protection measures considering hydrodynamic and morphological condition;	Protection measures considering hydrodynamic and morphological condition; Shown in Final Reports Section- 6.1.1 and 6.1.2 Page: 93	
To prepare afforestation plan considering classification of trees.	Shown in Final Reports Section- 6.9 Page: 148-151	
To develop integrated and sustainable river management plan for Shahbazpur channel and its surroundings of lower Meghna river	Shown in Final Reports Section -7.1 Page: 157-158	
Objectives of ESIA Study:		
To prepare environmental enhancement and conservation plan	Environmental enhancement and conservation plans have been prepared considering the important environmental and social components (IESC) which are incorporated in the main report (Volume-	-

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Objectives as per PFS	Actual achievement	Reasons for shortfall, if any
	I) in the chapter eight (page no. 337 to 357). Besides these, the Agriculture Development plan (Annex-I), Fisheries Development and Conservation Plan (Annex-II), Biodiversity Conservation Plan (Annex-III), Urbanization and Navigation Development Plan (Annex-IV); and Habitat Suitability Assessment for Major Fish Species (Annex-V) have been prepared and Annexed as Volume-II.	
To prepare biodiversity conservation plan	Biodiversity conservation plan has been prepared considering the major habitats identified from the field visit information and secondary literature review. The biodiversity conservation plan has been incorporated in Volume-II (Annexes) as Annex-III.	-
To conduct Environmental and Social Impact Assessment (ESIA) study	The ESIA study report has been prepared as per approved ToR of BWDB and Department of Environment (DoE). The main report has twelve (12) chapters and designated as Volume-I. There are five annexes of this report which are annexed as Volume-II.	-
To develop Environmental Management and Monitoring Plan (EMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries, etc.	Environmental Management and Monitoring Plan (EMP) including mitigation measures, enhancement measures for different resources based on positive or negative impacts have been prepared considering the proposed interventions provided by Technical Study Team (IWM). These have been incorporated in the chapter eight of the main report (Volume-I) from page 337 to 357.	-

E. BENEFIT ANALYSIS

01. Annual Out-put: Not Applicable for the Study Project.

Items of out-put	Unit	Estimated quantity expected at full capacity	Actual quantity of out-put during the 1st year of operation at full capacity (or during, real production for newly completed project).
-	-	-	-

02. Cost / Benefit: Not Applicable for the Study Project

Item	Estimated	Actual
(1) Benefit cost ratio of the project		
(i) Financial		
(ii) Economic		
(2) Internal Rate of Return		
(i) Financial		
(ii) Economic		

03. Please give reasons for shortfall, if any, between the estimated and actual benefit:
Not Applicable

F. MONITORING AND AUDITING

01. Monitoring:

Name & designation of the inspecting official	Date of Inspection	Identified Problems	Recommendations
1	2	3	4
a) Ministry / Agency:	Planning Division		
b) IMED :	19/01/2023		
c) Others:			

02. Auditing during and after Implementation:

2.1. Internal Audit: No audit conducted.

Period of Audit	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4
-	-	-	-

2.2. External Audit: No audit conducted.

Audit period	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4
-	-	-	-

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G. DESCRIPTIVE REPORT

1. General Observations/Remarks of the Project on:

1.1 Background

The Meghna Estuary is a very dynamic estuarine and coastal system. Here, one of the world's greatest rivers, the Lower Meghna River finds its way to the Bay of Bengal (Figure 1). The Lower Meghna conveys the combined flows of the Brahmaputra (called in Bangladesh Jamuna), the Ganges, and the Upper Meghna. Shahbazpur is the widest channel of the aforside river system to discharge in the Bay of Bengal (Fig-1). The sediment discharge from the Lower Meghna River is the highest (Coleman, 1969) and the water discharge the third highest, of all river systems in the world (Milliman, 1991). Due to shallow depth of Shahbazpur channel for deposition of sediment peak flood prolongs in Bangladesh. Consequence of prolong floods are huge damages/loss of property, suffering of people and severe negative impact on economic of the country. This channel is also very important shipping route of Bangladesh. Erosion and accretion rates are high and the area is periodically subject to severe storms and cyclones, these latter accompanied by tidal bores and storm surges. Implementation of any development plan thus necessitates close monitoring and continuous surveying.

The knowledge about the physical processes and morpho-dynamic behaviour of the Lower Meghna Estuary system is still fairly limited. A complicated interplay between the forces of the river, tide and the waves creates a complex pattern of sediment displacement in the estuary. Large quantities of sediment are transferred continuously towards the shallow coastal region of Bangladesh. Since almost no sediment is exchanged with the deeper parts of the Bay of Bengal, the overall sediment budget is determined by the process of continuous redistribution of sediment in the river system upstream. The displacement of sediment is a part of a continuous process of the estuarine-landscape striving to achieve dynamic equilibrium between the physical shape (morphology), and the continuously changing river discharge conditions and tidal flows.

Study Area:

Shahabazpur Channel is the lower part of the Meghna River which starts from Mehendiganj, Barishal district & it falls in the Bay of Bengal. This coastal area is located at the southern part of Bangladesh which includes the following Administrative Area (Divisions/ districts /upazillas) of Bangladesh are as follows :

	Divisions	Districts	Upazillas
Shahabazpur Channel	Barishal	Barishal	Mehindiganj
	Barishal	Bhola	Bhola Sadar, Daulatkhan, Lalmohan, Tazumaddin, Charfason, Monpura
	Chattogram	Lakhmipur	Ramgati
		Noakali	Hatia

Bhola and Hatia are surrounded by major branches of the Lower Meghna, which carries the combined flow of the Ganges, Brahmaputra and Meghna Rivers. Average length of the shahbazpur channel is about 125km & average width is about 15km (125km*15km=1875sq.km). The combination of these three rivers flows passes through Bhola & Hatia and fall into Bay of Bengal. Bhola and Hatia island are located on the west and east side of shahbazpur channel respectively.

1.2 Justification/Adequacy:

Water bodies mainly rivers with its tributaries and khals are the lifeblood of economy and social life of Bangladesh. In the dynamic morphological environment of Bangladesh, riverbank and coastal erosion will remain as a significant issue. Large scale sediment transport in rivers is mainly activated due to higher discharges, which leads to huge sediment load into the Meghna Estuary through Lower Meghna river. It is however not known authentically that how much sediment transport through shahbazpur channel and impact of upstream developments. It is also not clear that how sediment transport is influenced by sea level rise and its consequence on erosion, sedimentation and formation of bars/chars near shahbazpur channel.

Freshwater availability is scarce in the Monpura & Hatia area due to salt water intrusion as a consequence of tidal action. Large part of the coastal area suffers from a shortfall of freshwater availability during dry season. Drinking water supply is also a severe problem for project area. At this situation a comprehensive study is required in channel to management erosion, accretion, dredging & eco-system.

To meet Sustainable Development Goals, it is essential to protect and restore water related ecosystems such as wetlands and rivers. Urgent action must be taken to reduce the loss of natural habitats and biodiversity which are part of our common heritage. Besides, National Water Policy (NWPO-1999) indicates priorities for different multi-sectoral needs to be ensured in planning & development of water management projects.

1.3 Objectives

The main objective of the study is the sustainable management of the lower Meghna River by investigating its bank erosion processes and planform changes of Shahbazpur channel of lower Meghna river for sustainable river management, land reclamation, afforestation, sanctuary etc. considering the climate change impact. The study also aims to devising immediate and long-term solutions measures of Shahbazpur channel and its surroundings considering technical, environmental and social aspects.

Mathematical Modeling Study (Component-1):

- To enhance the understanding of the dynamic erosion phenomena in details;
- To predict morphological changes both in long and short term;
- To assess the drainage congetion and need of dredging, dredging alignment & dredging volume with design
- To prepare dredged material management plan.
- To analyze the extreme coastal event and provide sustainable solutions.
- To establish 2-D hydrodynamic model for morphological and sediment balance and find out potential sites for land reclamation
- To analyzes of the changes of salinity of water.
- To develop different potential options for protection measures considering hydrodynamic and morphological condition;
- To prepare afforestation plan considering classification of trees.
- To develop integrated and sustainable river management plan for Shahbazpur channel and its surroundings of lower Meghna river considering climate change impact.

Environmental and Social Impact Assessment study (Component-2):

- Environmental Management Plan (EMP), which should include:
 - ❖ Mitigation Plan;
 - ❖ Enhancement Plan;
 - ❖ Compensation Plan;
 - ❖ Environmental Monitoring Plan.
- Environmental and Social Impact Assessment study report;
- Reports of the study.

1.4 Project revision with reasons: Not Applicable

2. Rationale of the project in respect of Concept, Design, Location and Timing:

The lower Meghna River is the third largest river of in the world and the largest river of Bangladesh in terms of flow volume. The river carries the combined flow and sediment of the Ganges, Brahmaputra, and Upper Meghna River. The project area mostly covers the territory of the Meghna estuary. The project area starts from Mehendiganj, Barishal in the north and ends at the southern portion of Char Nizam, Dhal Char and Char Sakuchi. In the west it is bounded by Bhola Island and in the east by Lakshmipur and Noakhali zilla. Riverbank erosion, navigation problems, salinity intrusion, cyclone storm surge induced inundation etc. are the major problems in this location. From the field observation it is perceived that char formation within the channel and thalweg shifting to near bank are the main reason reasons of bank erosion in most of the cases. Long term morphological model was carried out to understand the char movement and bank line shifting. Moreover, there are small islands within Meghna estuary where human settlement is observed. There is potential for land development in these areas. Carefully observing the bathymetric condition, dredging alignment are designed and dredging depths are calculated. Dredging alignments (alignment no 1, 2 and 3) are mainly proposed in Mehendiganj upazilla of Barisal district. There is a Launch terminal at this location. Position of submerged chars are detected approximately 800 meter from the river bank. Dredging at this location (alignment 15, 16, 17 and 18) not only improves the navigation but also decrease the erosion vulnerability of that area.

Dredging at Lakshmipur zilla are proposed. Dredging at this location will decrease the near bank velocity but also char munshi can be developed with dredged earth material of these dredging alignment. Dredging alignment 23 and 24 are designed near char Mozammel. Char Mozammel will be developed with the dredged material. Bhola Sadar, Tajumuddin, Burharuddin and Char Fasson are the erosion vulnerable locations. Lakshmipur and Noakhali are the most erosion prone locations among the erosion protection work is proposed. From the storm surge model and wave model simulation crest level of the embankment for polder 56/57, polder 58 and polder 73 are computed for 25-year, 50-year and 100-year return period. Dhal char, Char Mozammel, Char Kolatoli and Char Jahiruddin are productive lands. These lands are proposed to be empoldered in the project.

3. Brief description on planning and financing of the project and its applicability.

◆ Project Identification:

Shahabazpur Channel is the lower part of the Meghna River which starts from Mehendiganj, Barishal district & it falls in the Bay of Bengal. This coastal area is located at the southern part of Bangladesh which includes the following Administrative Area (Divisions/ districts /upazillas) of Bangladesh are as follows :

Shahabazpur Channel	Divisions	Districts	Upazillas
	Barishal	Barishal	Mehindiganj
	Barishal	Bhola	Bhola Sadar, Daulatkhan, Lalmohan, Tazumaddin, Charfason, Monpura
	Chattogram	Lakhmipur Noakali	Ramgati Hatia

◆ Project Preparation:

To meet Sustainable Development Goals, it is essential to protect and restore water related ecosystems such as : wetlands and rivers. Urgent action must be taken to reduce the loss of natural habitats and biodiversity which are part of our common heritage. For sustainable management of the lower Meghna River by investigating its bank erosion processes and planform changes of Shahbazpur channel of lower Meghna river the study project was prepared.

◆ **Appraisal:** Apprised on Departmental Project Evaluation (DPEC) meeting held on 05/09/2021.

◆ **Credit Negotiation:** N/A

◆ **Credit Agreement:** N/A

◆ **Credit Effectiveness:** N/A

◆ **Loan Disbursement:** N/A

◆ **Loan Conditionalities:** N/A

◆ **Project Approval:** The project was approved by Honorable State Minister, MoWR on 04/11/2021

◆ **Others (if any).**

4. Analysis of the Post-Implementation situation and result of the project: *Not Applicable for this study project.*

4.1 **Whether the beneficiaries of the project have clear knowledge about the Target/ Objectives of the project.**

4.2 **Programme for use of created-facilities of the project**

- 4.3 O & M programme of the project.
- 4.4 Impact of the project -
 - 4.4.1 Direct
 - 4.4.2 Indirect
- 4.5 Transfer of Technology and Institutional Building through the project
- 4.6 Employment generation through the project.
- 4.7 Possibility of Self employment
- 4.8 Possibility of women-employment opportunity
- 4.9 Women's participation in development
- 4.10 Probable Impact on Socio-Economic activity.
- 4.11 Impact on environment
- 4.12 Sustainability of the project
- 4.13 Contribution to poverty alleviation/reduction
- 4.14 Opinion of the public representatives, local elite, local administration, teachers, religious leaders, women's representatives etc.
- 4.15 Contribution of Micro-credit programmes and Comments on overlapping with any NGO activities.

5. **Problems encountered during Implementation (with duration & steps taken to remove those):** It is a consultancy service procurement project. The below mentioned problems do not occur.

- | | |
|---|---|
| 5.1 Project Management | 5.12 Project aid disbursement and reimbursement |
| 5.2 Project Director | |
| 5.3 Land Acquisition | 5.13 Mission of the development partners. |
| 5.4 Procurement | 5.14 Time & Cost Over-run |
| 5.5 Consultancy | 5.15 Project Supervision/Inspection |
| 5.6 Contractor | 5.16 Delay in Decision |
| 5.7 Manpower | 5.17 Transport |
| 5.8 law & Order | 5.18 Training |
| 5.9 Natural calamity | 5.19 Approval |
| 5.10 Project financing, allocation and release. | 5.20 Others. |
| 5.11 Design formulation/approval | |

6. Remarks & Recommendations of the Project Director:

Feasibility Study for “Mathematical Model Study for Integrated Development and Sustainable Management Plan of Shabazpur Channel of Lower Meghna River.” Project code- 224344900 was sanctioned administrative approval by Ministry of Water Resources vide Memo no: 42.00.0000.040.014.001.2021-402, Dated: 04-11-2021. The Project has been completed on 30/06/2023 successfully.

The lower Meghna River is the third largest river of in the world and the largest river of Bangladesh in terms of flow volume. The river carries the combined flow and sediment of the Ganges, Brahmaputra, and Upper Meghna River. The project area mostly covers the territory of the Meghna estuary. The project area starts from Mehendiganj, Barishal in the north and ends at the southern portion of Char Nizam, Dhal Char and Char Sakuchi. In the west it is bounded by Bhola Island and in the east by Lakshmipur and Noakhali zilla.

Riverbank erosion, navigation problems, salinity intrusion, cyclone storm surge induced inundation etc. are the major problems in this location. From the field observation it is perceived that char formation within the channel and thalweg shifting to near bank are the main reason reasons of bank erosion in most of the cases. Long term morphological model was carried out to understand the char movement and bank line shifting. Moreover, there are small islands within Meghna estuary where human settlement is observed. There is potential for land development in these areas.

Carefully observing the bathymetric condition, dredging alignment are designed and dredging depths are calculated. Dredging alignments (alignment no 1, 2 and 3) are mainly proposed in Mehendiganj upazilla of Barisal district. There is a Launch terminal at this location. Position of submerged chars are detected approximately 800 meter from the river bank. Dredging at this location (alignment 15, 16, 17 and 18) not only improves the navigation but also decrease the erosion vulnerability of that area. Dredging at Lakshmipur zilla are proposed. Dredging at this location will decrease the near bank velocity but also char munshi can be developed with dredged earth material of these dredging alignment. Dredging alignment 23 and 24 are designed near char Mozammel. Char Mozammel will be developed with the dredged material.

Bhola Sadar, Tajumuddin, Burharuddin and Char Fasson are the erosion vulnerable locations. Lakshmipur and Noakhali are the most erosion prone locations among the erosion protection work is proposed. From the storm surge model and wave model simulation crest level of the embankment for polder 56/57, polder 58 and polder 73 are computed for 25-year, 50-year and 100-year return period. Dhal char, Char Mozammel, Char Kolatoli and Char Jahiruddin are productive lands. These lands are proposed to be empoldered in the project.

Salinity intrusion modelling are performed for base condition 20 cm & 92cm sea level rise condition. Salinity intrusion map can be used as a reference for the mangrove afforestation planning and planning for suitable water intake facility.

From the satellite image analysis and velocity vector two suitable locations for cross dam are proposed (at Banan char and Domer char). Furthermore, tourism facility is proposed at Nijhum dwip, char Kukri Mukri, Monpura island, and in Char Fasson (Betua Launch Ghat Park).

The technical study has several limitations, thereby mentioned following:

1. The hindcast of the morphological model shows acceptable performance. The prediction of the estuarine dynamics may not provide actual scenario.
2. The morphological model prediction is qualitative not quantitative.
3. Future interventions in the project area (that are planned after the study) can produce different scenarios rather than the projected river bed change;
4. Extreme weather event (which is not considered within the boundary condition) may affect the morphological situation in the Meghna estuary.
5. Dredging are proposed in the study area beside Lakshmipur zilla to reduce the risk of erosion is significant. To achieve that amount dredging is significant. This dredging must be done at a time to achieve the benefit of near bank velocity reduction. Achieving this target is challenging because of higher re-siltation rate of dredged channel in the shallow zone.

Recommendations of the study is divided into two parts. First part, demonstrates the intervention plan of the study and second part specifies the phasing of the intervention work.

The recommendation of the study is mentioned following:

Proposed Interventions: -

1. Dredging alignment is proposed near Mehendiganj upazilla, Lakshmipur zilla (near Char Falcon, Char Lawrance) and near char Mozammel. Dredging at alignment 15, 16, 17 and 18 will reduce the near bank velocity at Lakshmipur upazilla and the dredged material can be used to develop the low-lying land/reclaim the land beside the char.
2. Two cross dams are proposed. One between Banar char and Hatyia island and one between Domer char and Hatyia Island. Again, from dredged earth disposal uncultivated and under developed portion of char mozammel will be prepared for improved settlement.
3. New Feasibility study should be formulated for construction of new polder-system "char Jahiruddin-char Mozammel", "char Kolatoli" and "Dhal char".

4. Tourist friendly facilities are proposed to develop at Char Kukri Mukri Monpura Island and Nijhum Dwip. And environment friend friendly sub-sea tidal turbine is proposed to construct at Mukhtaria channel.
5. 19 km Betua canal are proposed to dredge for facilitating navigation facility inside Bhola Island, dredging of the canal will enhance the internal drainage of Bhola island.
6. Polder crest level is proposed for Polder 56/57, Polder 58, Polder 73 at 25-year return period storm surge condition.
7. Fresh water intake points are proposed one near Ilisha Ghat and other at Moju choudhurir hat.

Phasing of Intervention:

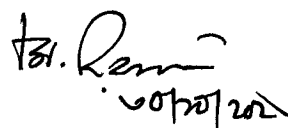
The phasing of the intervention is carried out based on the respective cost of the intervention work. The proposed interventions are categorized in such a way that, implementation of these intervention will not impact the applicability of other intervention. The phasing of intervention is mentioned in following chronological order:

Intervention	Vulnerability of the study area
<ul style="list-style-type: none"> • Erosion Protection of Monpura Island. • Northeast and North west are most vulnerable. Erosion protection work should be completed in these stretches first. 	<ul style="list-style-type: none"> • Severe erosion at north Island.
<ul style="list-style-type: none"> • Erosion Protection of Boyer char. 	<ul style="list-style-type: none"> • Severe erosion
<ul style="list-style-type: none"> • Dredging of Alignment 1,2,3. • Dredging alignment 1 and 2 will be implemented in one package. • Dredging Alignment-3 needs to be considered as another package. 	<ul style="list-style-type: none"> • Threat of erosion is mitigated by the concrete revetment.
<ul style="list-style-type: none"> • Polderization of Char Jahiruddin, Dhal char, Char Mozammel and char Kolatoli. 	<ul style="list-style-type: none"> • Vulnerability to inundation in high tide, salinity intrusion problem etc.
<ul style="list-style-type: none"> • Cross Dam between “Domer char - Hatyia Island” and “Banar char - Hatyia Island” 	<ul style="list-style-type: none"> • Severe erosion at the northeast corner of Hatyia Island
<ul style="list-style-type: none"> • Dredging of Alignment 15, 16,17 and 18 • It can be divided into three sub packages: • Package-1: Alignment 15, • Package-2: Alignment 16, 17 	<ul style="list-style-type: none"> • High erosion at the bank of Lakshmipur zilla chars are shifting towards the mainland. • Dredging work at this stretch will be very hard to maintain because of high re-siltation rate. Dredging in smaller width will not be beneficial

Intervention	Vulnerability of the study area
<ul style="list-style-type: none"> • Package-3: Alignment 18 	for near bank velocity reduction. <ul style="list-style-type: none"> • Phasing in the dredging alignment will not serve the purpose of main objective
<ul style="list-style-type: none"> • Dredging of Alignment 23 and Alignment 24 • Alignment 23 and alignment 24 should be completed in one package. 	<ul style="list-style-type: none"> • <u>No vulnerability</u>
<ul style="list-style-type: none"> • Dredging of Lalmohon- Betua Canal and Maya Canal. • “Lalmohon-Betua” and Maya canal can be considered as one p 	<ul style="list-style-type: none"> • Excavation will ensure the navigability within Bola Island. • Land acquisition is required. Before, implementation social study might be required.

The Environmental Management Plan (EMP) has been prepared with the aim of ensuring avoidance, minimization, and offsetting of adverse environmental impacts and enhancement of beneficial impacts. The EMP includes mitigation and enhancement measures to be taken during pre-implementation, implementation and post- implementation phases.

All the objectives and scopes have been accomplished under this study project. The cost estimate and ESIA have been conducted through this study. The DPP of the investment project would be finalized for implementation of the proposed physical components based on the findings of this study project.



Date :

Signature and seal of the Project Director

(Md. Helal Ur Rashid)
 Superintending Engineer (Civil)
 ICZACCM
 BWDB, Dhaka

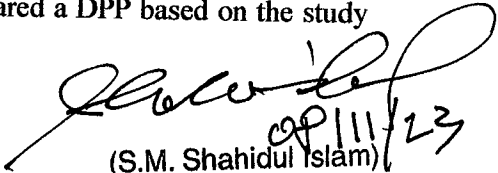
7. Remarks/Comments of Agency Head

The Lower Meghan River is the third largest river of Bangladesh in terms of flow volume. The river carries the combined flow and sediment of the Ganges, Brahmaputra, and Upper Meghna River. The project area mostly covers the territory of the Meghna estuary. The project area starts from Mehendiganj, Barishal in the north ends and at the southern portion of Char Nizam, Dhal Char and Char Sakuchi in the west and it is bounded by Bhola Island and in the eastbank at Lakshmipur and Noakhali District.

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However, to get the maximum benefit and to ensure the sustainability of the investment project, suggestions and recommendations based on the feasibility study should be followed accordingly. Bhola O&M Division-1, BWDB, Bhola has prepared a DPP based on the study report and submitted it for further processing.

Date :


(S.M. Shahidul Islam)
ID NO: 650307001
Director General
BWDB, Dhaka.
Signature and Seal

8. Remarks/Comments of the officer in- charge of the Ministry/Division

The study has been completed successfully and an investment project will be taken as per recommendation of the study.

Date :

Signature and Seal

