

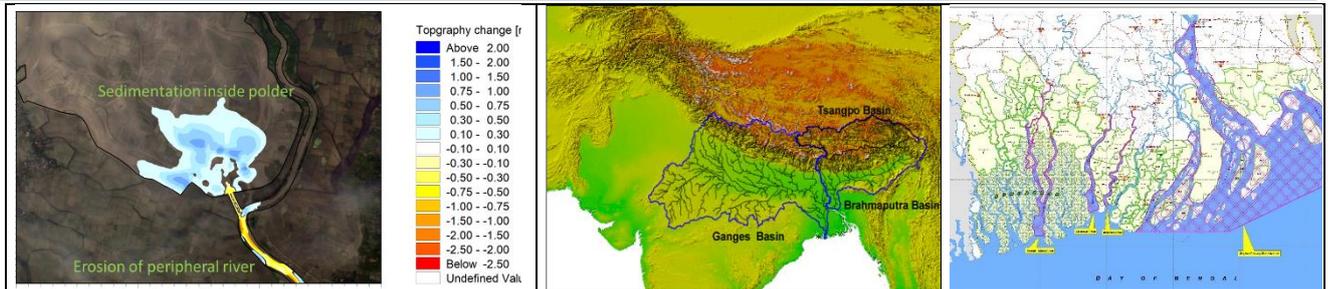
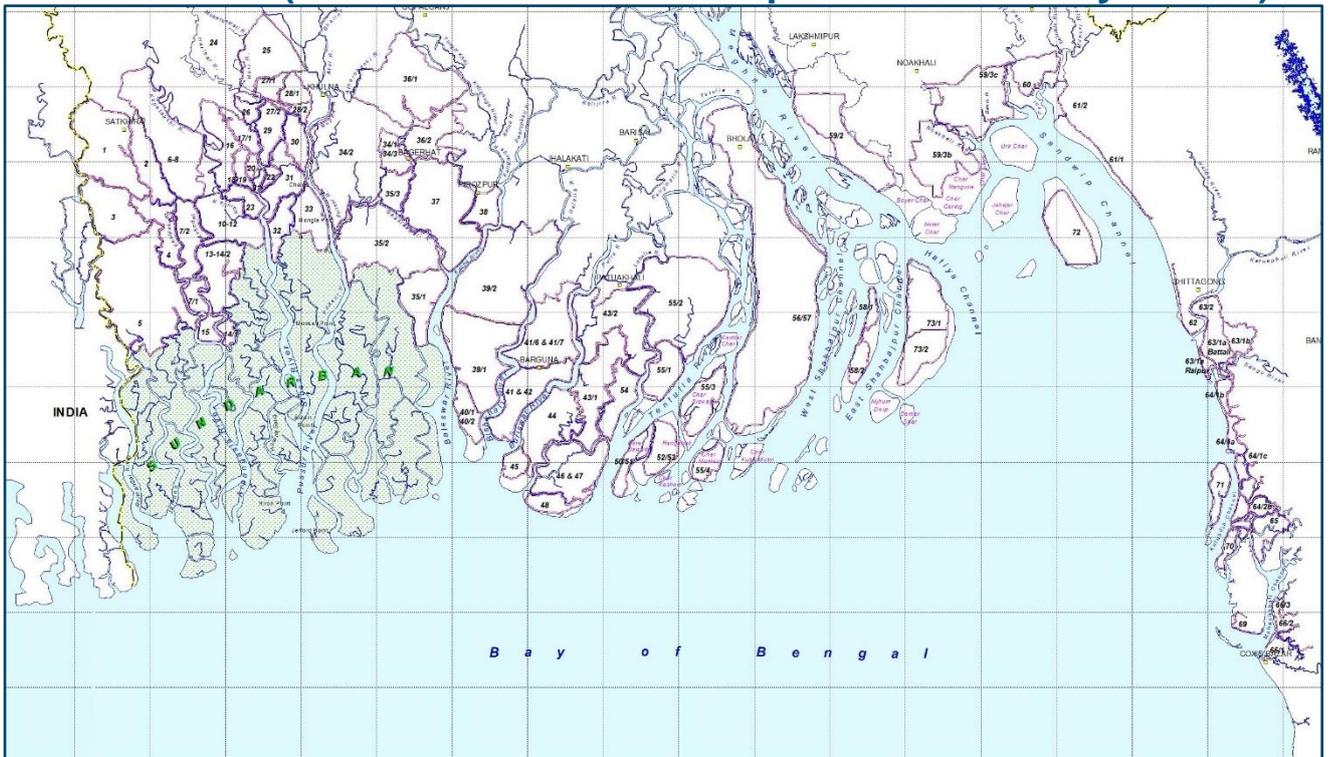
Ministry of Water Resources



Bangladesh Water Development Board

Coastal Embankment Improvement Project, Phase-I (CEIP-I)

Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone (Sustainable Polders Adapted to Coastal Dynamics)



QUARTERLY PROGRESS REPORT-8

January 2021





**Ministry of Water Resources**



**Bangladesh Water Development Board**

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Bangladesh Water Development Board  
Coastal Embankment Improvement Project, Phase-I (CEIP-I)

## Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone

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Memo No: CEIP/LTMRA/0121/96

19 January 2021

Project Management Unit  
Coastal Embankment Improvement Project, Phase-I (CEIP-I)  
House No.15, 4th Floor, Road  
No.24(CNW) Gulshan, Dhaka-1212

**Attn: Mr. Syed Hasan Imam, Project Director**

Dear Mr Imam,

**Subject: Submission of Quarterly Progress Report-8**

May I at the outset welcome you to your new position as our Project Director our best wishes for a successful tenure.

It is our pleasure to submit herewith three copies of the Quarterly Progress Report-8. This is the 8<sup>th</sup> Quarterly Progress Report describing the progress made between 1<sup>st</sup> July 2020 and 30<sup>th</sup> September 2020. We regret that the submission of the report has been severely delayed due to interruption of travel and our intra-project communications by the COVID-19 crisis.

The report comprises 5 chapters describing progress in development of input datasets for modelling including coastal database, modelling long term processes, subsidence and climate change studies. We have listed the number of reports delivered to you during the project and the other related documents that can be found in the Project Sharepoint Folder.

We are unfortunately unable to report progress in the Polder Development Plan, and the Investment Plan because the travel restrictions arising from the COVID-19 crisis made it impossible to deploy the international staff for this purpose and design parameters.

Thanking you,

Yours sincerely,



Dr Ranjit Galappatti  
Team Leader

Copies: Engineer Mohammad Ali, Director General, BWDB  
Engr. A K M Waheduddin Chowdhury, ADG (Planning), BWDB  
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## ACRONYMS AND ABBREVIATIONS

- ADCP- Acoustic Doppler Current Profiler
- BDP2100- Bangladesh Delta Plan 2100
- BIWTA- Bangladesh Inland Water Transport Authority
- BMD- Bangladesh Meteorological Department
- BoB- Bay of Bengal
- BWDB- Bangladesh Water Development Board
- CBA- Coast Benefit Analysis

CCP- Chittagong Coastal Plain  
CDMP-Comprehensive Disaster Management Program  
CDSP- Char Development Settlement Project  
CEA- Cost Effectiveness Analysis  
CEGIS- Centre for Environmental and Geographic Information Services  
CEIP- Coastal Embankment Improvement Project  
CEP- Coastal Embankment Project  
CERP-Coastal Embankment Rehabilitation Project  
CPA- Chittagong Port Authority  
CPP-Cyclone Protection Project  
CSPS-Cyclone Shelter Preparatory Study  
DDM- Department of Disaster Management  
DEM- Digital Elevation Model  
DOE- Department of Environment  
EDP- Estuary Development Program  
FAP- Flood Action Plan  
FM- Flexible Mesh  
GBM- Ganges Brahmaputra Meghna  
GCM- General Circulation Model  
GIS- Geographical Information System  
GTPE- Ganges Tidal Plain East  
GTPW- Ganges Tidal Plain West  
HD- Hydrodynamic  
InSAR- Interferometric Synthetic Aperture Radar  
IPCC- Intergovernmental Panel for Climate Change  
IPSWAM- Integrated Planning for Sustainable Water Management  
IWM- Institute of Water Modelling  
LCC- Life Cycle Costs  
LGED- Local Government Engineering Department  
LGI- local Government Institute  
LRP- Land Reclamation Project



MCA- Multi Criteria Analysis  
MES- Meghna Estuary Study  
MoWR- Ministry of Water Resources  
MPA- Mongla Port Authority  
NAM - Nedbor Afstromnings Model  
PPMM- Participatory Polder Management Model  
RCP- Representative Concentration Pathways  
RTK- Real-Time Kinematic  
SET-MH- Surface Elevation Tables – Marker Horizons  
SLR- Sea Level Rise  
SOB- Survey of Bangladesh  
SSC- Suspended Sediment Concentration  
SWRM- South West Region Model  
TBM- Temporary Bench Mark  
ToR- Terms of Reference  
WARPO- Water Resources Planning Organization  
WL - Water Level

# 1 INTRODUCTION

The coastal zone of Bangladesh spans over 710 km of coastline and is subject to multiple threats. Sixty-two percent of the coastal land has an elevation less than 3 meters above mean sea level. The coastal lands, being subject to regular flooding by saline water during high tides, could not be used for normal agricultural production in a country with a very high demand for land.

The Coastal Embankment Project made possible the reclamation of large tracts of land for agriculture from 1960 onwards. Polder building proceeded continuously until today. We now have 1.2 million hectares reclaimed in 139 active polders in the coastal zone of Bangladesh.

In over half century of its existence, a number of challenges have surfaced, threatening the long-term safety and even the very existence of the polder system as a viable and sustainable resource. These are:

- The interference with natural tidal regime created severe siltation problems in some rivers resulting in severe drainage congestion in some polders.
- Sea level rise and changes in precipitation and water discharge due to climate change
- Threats of damming and diversion to the delivery of river sediments from upstream
- Subsidence of lands (except where it has been allowed to be rebuilt by tidal flooding) and structures founded on existing land
- Increasing vulnerability to cyclones and storm surges

The damage caused by Cyclones Sidr and Aila in 2007 and 2009 led to a major new investment of World Bank funds called the Coastal Embankment Improvement Project through which the coastal embankment system was to be improved and made much more climate resilient, over several phases of construction. After the feasibility study of the first phase CEIP-1, it was recommended that certain gaps in our knowledge of the delta should be addressed by the research study which was to be known as the **Long-Term Monitoring, Research and Analysis of Bangladesh Coastal Zone**.

After a very long gestation period, the study was initiated on 15 October 2018 and the Inception Phase was completed in January 2019. The Inception Report was treated as the first Quarterly Progress Report (QPR-1). The Second Quarterly Progress Report which was submitted in April 2019 covered the period 1 January 2019 to 31 March 2019. The Third Quarterly Progress Report (QPR-3) covers the period 1 April 2019 to 30 June 2019. QPR-4 covered the period from 1 July 2019 to 30 September 2019. QPR-5 covering the period 1 October 2019 to 31 December 2019 was submitted in February 2020.

The advent of the COVID-19 crisis in early 2020 signalled the beginnings of a global pandemic that would affect the progress of this project which is carried out by a large international team of experts, expected to travel frequently between Bangladesh and their countries of origin. QPR-6 covered period 1 January to 31 March 2020. The work of the project during the 6<sup>th</sup> Quarter was not seriously affected because the international experts working in Dhaka were not recalled by their home offices until the 15<sup>th</sup> of March 2020. The Seventh Quarterly Progress Report (QPR-7) describing the progress made between 1st April to 30th June 2020 covered the first period where the original work schedule was badly affected by the travel bans imposed by Denmark, The Netherlands and the United States.

This report (QPR-8) covers the progress of work in the period 1<sup>st</sup> July to 30<sup>th</sup> September 2020 also under the serious constraints imposed by the COVID-19 crisis. The constraints imposed by the travel bans which prevented the field inputs (in Bangladesh) by International Staff was the subject of several rounds of protracted negotiations between the Consultant and the Client – has made some progress in the face of growing global uncertainty. The preparation of this report has been delayed due to by these difficulties.

## 1.1 Work Plan

The Inception Report (DHI, 2019) gave a detailed description of the work to be carried out by this project. Table 1.1 shows the full schedule of activities originally scheduled to be carried out during the 30 months of the project. This work plan is based on the plan shown in the Inception Report published in December 2018. This work plan is a more detailed version with some adjustments that have had to be made due to contingencies and developments in the field.

The advent of the COVID pandemic early in the year has disrupted the work especially because of the travel restrictions placed on international staff by their respective governments from March 2020 onwards. The work plan and the staff deployment plan has been under continuous negotiation since March 2020.

The project duration has now been extended till the end of year 2021. The work programme has been modified and will accommodate the travel restrictions imposed by the COVID-19 crisis if the international experts are granted permission to work from home office as long as travel restrictions persist. This programme involves some staffing and budget changes currently under discussion. Section 1.2 describes the current adjusted work schedules and the corresponding lists of deliverables.

**Table 1. 1: Original Activity Schedule Page 1**

Overview of Deliverables ( Effective Date of commencement is 15 October 2018)			15-Oct-18	15-Nov-18	15-Dec-18	15-Jan-19	15-Feb-19	15-Mar-19	15-Apr-19	15-May-19	15-Jun-19	15-Jul-19	15-Aug-19	15-Sep-19	15-Oct-19	15-Nov-19	15-Dec-19	15-Jan-20	15-Feb-20	15-Mar-20	15-Apr-20	15-May-20	15-Jun-20	15-Jul-20	15-Aug-20	15-Sep-20	15-Oct-20	15-Nov-20	15-Dec-20	15-Jan-21	15-Feb-21	15-Mar-21	15-Apr-21			
No	TOR Reference/ Deliverables Code	TOR Deliverables	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
D-1	D-1	Inception Workshop Inception Report (Workplan etc)																																		
D-2	D-2	<b>Literature Review &amp; Lessons Learnt</b> Literature Inventory & Interim Review 1 Literature Inventory & Interim Review 2 Literature Review & Lessons Learnt																																		
D-3		<b>Development of Input datasets for modelling the physical processes</b> 1) Soft and hard copies of map of the location of all the current field measurement stations, by tape, stored in Database of BWDB, Map showing the location of primary BM with values 2) Raw datasets of all type of data. Including meta-data. Stored in Database of BWDB																																		
	D-3:1,2	Completed and validated dataset including meta-data, stored in Database of BWDB (Database design																																		
	D-3:3	GIS based National Coastal Polder Database/ Management Information System/ Database (GIS based																																		
	D-3:4	Boundary conditions and data for calibration and validation of models																																		
	D-3:5	Monitoring results on sedimentation rate in rivers and floodplain																																		
	D-3:6	Annual and seasonal sediment load of major rivers and to Bay of Bengal																																		
	D-3:7	Technical memorandum describing the validation and completion procedures that have been used by the consultant for all type of data; for reproducibility purposes and to be stored in Database of BWDB																																		
	D-3:8	Memorandum with recommendations to improve the data collection, processing, validation and dissemination within the GoB																																		
D-4		<b>Modelling of the long-term physical processes</b>																																		
D-4A-1		<b>Morphology on a macro scale</b>																																		
	D-4A-1:1	The software newly developed under this project with all source code and accompanying technical document with detailed explanation of the methodology and assumptions																																		
	D-4A-1:2	Geospatial datasets of main sources and deposits of sediment at present, including full meta-data a restored and archived in Database of BWDB;																																		
	D-4A-1:2,3	Geospatial datasets of main sources and deposits of sediment for 100 years from present, including full meta-data are published and archived in Database of BWDB.																																		
	D-4A-1:4	Technical reports (one report for 4A-1 Final Report on Morphological Trend)																																		

Table 1.1 (contd) Original Activity Schedule Page 2

No	TOR Reference/ Deliverables Code	TOR Deliverables	15-Oct-18	15-Nov-18	15-Dec-18	15-Jan-19	15-Feb-19	15-Mar-19	15-Apr-19	15-May-19	15-Jun-19	15-Jul-19	15-Aug-19	15-Sep-19	15-Oct-19	15-Nov-19	15-Dec-19	15-Jan-20	15-Feb-20	15-Mar-20	15-Apr-20	15-May-20	15-Jun-20	15-Jul-20	15-Aug-20	15-Sep-20	15-Oct-20	15-Nov-20	15-Dec-20	15-Jan-21	15-Feb-21	15-Mar-21	15-Apr-21				
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
D-4A-2	D-4A-2:1	<b>Morphology on a meso scale</b>																																			
		Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions.																																			
		Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
		Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB;																																			
D-4A-2	D-4A-2:2,3	Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
		Technical report (one report for 4A-2 - FINAL REPORT ON ESTUARINE MORPHOLOGY )																																			
		<b>Bank Erosion on Meso scale</b>																																			
		Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions.																																			
D-4A-2	D-4A-2:1,2	Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
		Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
		Technical report (one report for 4A-1 and 4A-2 )																																			
		<b>Other special purpose models</b>																																			
D-4D-3	D-4D-3:1,2,3,4,5	Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB.																																			
		Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB.																																			
		Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now.																																			
		Exceedance frequency curves for water levels in the same 20 stations at present, and at 25, 50 and 100 years from now.																																			
D-4D-3	D-4D-3:1,2,3,4,5	Define extreme water levels in the polder of coastal zone at 25, 50 and 100 years from now, due to cyclonic storm surges																																			

Table 1.1 (contd) Original Activity Schedule Page 3

No	TOR Reference/ Deliverables Code	TOR Deliverables	15-Oct-18	15-Nov-18	15-Dec-18	15-Jan-19	15-Feb-19	15-Mar-19	15-Apr-19	15-May-19	15-Jun-19	15-Jul-19	15-Aug-19	15-Sep-19	15-Oct-19	15-Nov-19	15-Dec-19	15-Jan-20	15-Feb-20	15-Mar-20	15-Apr-20	15-May-20	15-Jun-20	15-Jul-20	15-Aug-20	15-Sep-20	15-Oct-20	15-Nov-20	15-Dec-20	15-Jan-21	15-Feb-21	15-Mar-21	15-Apr-21			
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
D-4A-3	D-4A-3:1,2,3	The model setup developed will be updated under this project with all accompanying technical document with detailed explanation of the methodology and assumptions.																																		
		A report that describes the pros and cons of the different methodologies to prevent water-logging within the polder and sedimentation of tidal river system including polder-subsidence. The report will include meta-data on the models used and measurements, recommendations for polder design including drainage and long term management plan, and recommendations for pilot area/ polder to implement the ideas, such as but not limited to location, methods and measurements. Recommended plan to manage sediment at the downstream stretch of the tidal river and in the polder.																																		
D-4B	D-4B:1,2,3	<b>Subsidence</b>																																		
		Geospatial datasets of total subsidence at present and for 25, 50 and 100 years from now, including full metadata and stored in Database of BWDB and Estimate the annual rate of subsidence. Detailed Technical Report with description and explanation of geospatial analysis of the total subsidence in the four regions of the polder area of the coastal zone at present and for 25, 50 and 100 years from present, including description of the causes of subsidence, full metadata and stored in Database of BWDB. Report on the total subsidence in specific polders (designated by BWDB) in 25, 50 and 100 years from now when no sediment is supplied to the polder, including the amount of sediment needed to counteract this subsidence.																																		
D-4C	D-4C:1,2	<b>Meteorology</b>																																		
		Technical Report describing current trends and future scenarios in rainfall in the polder area of coastal zone for four coastal regions (including estimation of rainfall distribution over the year) and cyclone frequency and intensity for the next 25, 50 and 100 years from now, including meta-data of the datasets used for the trend analyses and store and archived in Database of BWDB. The Research Team shall include a description of the statistical and downscaling methods used for reproducibility reasons. Geospatial Dataset and archived in Database of BWDB.																																		
D-4D	D-4D:1,2,3	<b>Climate Change Effects</b>																																		
		Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB.																																		
		Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB.																																		
D-4D:4,5	D-4D:4,5	Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now.																																		
		Exceedance frequency curves for water levels in the same 20 stations at present, and at 25, 50 and 100 years from now.																																		
D-4D:6	D-4D:6	Define extreme water levels in the polder of coastal zone at 25, 50 and 100 years from now, due to cycnic storm surges.																																		
		Technical Report with description and explanation of the geospatial datasets of surface and ground water salinity, and the tidal salinity and water level curves, including description of relevant seasonal variations, used models, indication of more and less likely scenarios and full metadata. The Research Team shall also discuss the effect of at least two relevant options of redistribution of river water in the South West delta on salt intrusion.																																		

Table 1.1 (contd) Original Activity Schedule Page 4

No	TOR Reference/ Deliverables Code	TOR Deliverables	15-Oct-18	15-Nov-18	15-Dec-18	15-Jan-19	15-Feb-19	15-Mar-19	15-Apr-19	15-May-19	15-Jun-19	15-Jul-19	15-Aug-19	15-Sep-19	15-Oct-19	15-Nov-19	15-Dec-19	15-Jan-20	15-Feb-20	15-Mar-20	15-Apr-20	15-May-20	15-Jun-20	15-Jul-20	15-Aug-20	15-Sep-20	15-Oct-20	15-Nov-20	15-Dec-20	15-Jan-21	15-Feb-21	15-Mar-21	15-Apr-21		
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
D-5 D-5A	D-5A:1 D-5A:1 D-5A:1 D-5A:2  D-5A:3	Technical Report on Long Term Polder Improvement measures and Polder Development Plan																																	
		Design of polder improvement measures of 17 polders under CEIP-I with consideration of existing improvements. Draft report focusing on initial 4 Polders to be optimised. Final report, 17 polders																																	
D-5B		Report describing the Interdependencies and relations between the processes and parameters, consequences for the boundary conditions and recommendations for future action plan/ research																																	
D-6	D-6.1	<b>Updating of design paramerters and specifaitions for construction works and management practices</b> Report with updated set of design parameters and specifications for construction/ reconstruction of the polders as well as associated appurtenant structures. Detailed delivery plan to be developed during the inception phase.																																	
D-6.2 & D-6.3	D-6.2 & D-6.3	Report on Management plans for the polders including review approaches of polder management and performance monitoring mechanism Detailed delivery plan to be developed during the inception phase																																	
D-6.3	D-6.3	Report on participatory monitoring mechanism with goals and targets Detailed delivery plan to be developed during the inception phase																																	
D-7	D-7:1 D-7:2 D-7:3	<b>Investment Plan for Entire CEIP</b> An investment plan describing a phaased polder improvement roadmap and required budget An investment plan for long term management of the polders, including the expansion of monitoring An execution plan including financing and fundraising strategies and plan and technical collaboration plan																																	
D-8		<b>Action Plan for Capacity Building</b> On the job technical training in country Report on: results of the on the job training, list of participants International Workshop Teach the teacher, Teaching at the universities																																	
D-9.1	D-9.1:1	<b>Outreach Program</b> Workshops																																	
D-9.2	D-9.1:2	Workshop Report (Stakeholder's workshop at Barisal and Khuina & Mid-term workshop at Dhaka)																																	
		<b>Communication Strategy</b> Storage of all datasets of BWDB and Communication materials																																	

 Draft submission of report     Revised submission of report

## 1.2 Revised List of Non-Modelling Milestones and Deliverables)

Table 1.2 a: List of non-modelling milestones and deliverables (Part 1)

Overview of Deliverables		As per Consultant				
No	ToR Deliverables	Program Item	Status	Deadline as per Signed Contract	Date of Submission to PIU	Proposed Revised Deadline
<b>D-1</b>	<b>Inception</b>					
	Inception Workshop	Inception Workshop	Accepted	4-Jan-19	9-Jan-19	
	Inception Report (Workplan etc)	Inception Report (Workplan etc)	Accepted	4-Jan-19	30-Jan-19	
<b>D-2</b>	<b>Detailed Literature Review and its Summary and Lessons Learnt</b>					
	Literature Inventory & Interim Review 1	Literature Inventory & Interim Review 1	Submitted	4-Feb-19	24-Jun-19	January 2021
	Literature Inventory & Interim Review 2	Literature Inventory & Interim Review 2	Pending	4-Oct-20		March 2021
	Literature Review & Lessons Learnt	Literature Review & Lessons Learnt	Pending	4-Oct-20		March 2021
<b>D-3</b>	<b>Development of Input Datasets for Modelling the physical processes</b>					
	Soft and hard copies of map of the location of all the current field measurement stations, by tape, stored in Database of BWDB, Map showing the location of primary BM with values	Data Report, Inventory & Quality Checks (Includes field Data collection and monitoring programmes)	Submitted	4-Jul-19	29-Sep-19	
	Raw datasets of all type of data. Including meta-data. Stored in Database of BWDB					
	Completed and validated dataset including meta-data, stored in Database of BWDB	Database Design Report	Submitted	4-Jul-19	11-Sep-19	
	GIS based National Coastal Polder Database/ Management Information System/ Database	GIS Based Maps	Submitted	4-Jul-19	25-Sep-19	
		GIS Based Database/ MIS system/ Sharepoint	Pending	4-Jul-19		Sep/21
	Boundary conditions and data for calibration and validation of models	Supply of Model Boundary Data	Submitted	4-Jul-19	25-Sep-19	
	Monitoring results on sedimentation rate in rivers and floodplain	Monitoring Results on Sedimentation rate in rivers	Pending	4-Jul-19		Nov/20
	Annual and seasonal sediment load of major rivers and to Bay of Bengal	Annual & Seasonal Sediment load of Major rivers & to Bay of Bengal	Pending	4-Aug-19		March 2021
	Technical memorandum describing the validation and completion procedures that have been used by the consultant for all type of data; for reproducibility purposes and to be stored in Database of BWDB	Technical Report of Data analysis & Validation	Pending	4-Aug-19		Dec-20
	Memorandum with recommendations to improve the data collection, processing, validation and dissemination within the GoB	Technical Report on improving Data collection	Pending	4-Aug-19		Dec-20
<b>D-5A</b>	<b>Finalization of approach for reconstruction of the Polder at different coastal zones including their phasing and construction program</b>					
	Technical Report on Long Term Polder Improvement measures and Polder Development Plan	Draft		4-Apr-21		Sep-21
		Final				Oct-2021
	Design of polder improvement measures of 17 polders under CEIP-1 with consideration of existing improvements with a description of ; opportunities for livelihood, spatial planning, water management and operation, subsidence, raising of low lying area and future climate change scenarios.	Draft	Pending	4-Apr-21		February 2021
		Final	Pending			Apr-21
	Report for each of the 3-5 polders with a description of; • Present situation • Boundary conditions (scenarios) • Establish design, including management plan • Costs and benefits • Matching with polder options	Draft	Pending	4-Jul-20		Jul-21
		Final	Pending			Aug-21
<b>D-5B</b>	<b>Coherence and Overall picture of Delta</b>					
	Report describing the Interdependencies and relations between the processes and parameters, consequences for the boundary conditions and recommendations for future action plan/ research	Coherence with respect to Overall Delta		4-Apr-21		Jul-21
		Environmental Assessment of Proposed Interventions	Pending			
<b>D-6.1</b>	<b>Updating of design parameters and specifications for construction works</b>					
	Report with updated set of design parameters and specifications for construction/ reconstruction of the polders as well as associated appurtenant structures	Updated Design Parameters & Specifications		4-Apr-21		July 2021
	Detailed delivery plan to be developed during the inception phase for D-6.1	Detailed Delivery Plan	Submitted	4-Feb-19	11-Apr-20	
<b>D-6.2</b>	<b>Review of approaches for management of polders with emphasis on active participation of beneficiaries and local stakeholders</b>					
	Report on Management plans for the polders	Polder Management Plan	Pending	4-Apr-21		Nov-21
	Detailed delivery plan to be developed during the inception phase for D-6.2	Detailed Delivery Plan	Submitted	4-Feb-19	11-Apr-20	
<b>D-6.3</b>	<b>Setting up a performance monitoring Mechanism</b>					
	Report on participatory monitoring mechanism with goals and targets	Performance Monitoring Mechanisms		4-Apr-21		Nov-21
	Detailed delivery plan to be developed during the inception phase for D-6.3	Detailed Delivery Plan	Submitted	4-Feb-19	11-Apr-20	

Table 1.2 b: List of non-modelling milestones and deliverables (Part 2)

<b>D-7</b>	<b>Investment plan for the Entire CEIP</b>					
	An investment plan describing a phaased polder improvement roadmap and required budget	An investment plan describing a phaased polder improvement roadmap and required budget		4-Apr-21		Nov-21
	An investment plan for long term management of the polders, including the expansion of monitoring	An investment plan for long term management of the polders, including the expansion of monitoring		4-Apr-21		Nov-21
	An execution plan including financing and fundraising strategies and plan and technical collaboration plan	An execution plan including financing and fundraising strategies and plan and technical collaboration plan		4-Apr-21		Nov-21
<b>D-8</b>	<b>Action Plan for Capacity Building</b>					
	On the job technical training in country	In-country on-the- job Training	Pending	Continuous		december 2021
	Report on: results of the on the job training, list of participants	Training Report with list of trainees	Pending	Bi Annually		december 2021
	International Workshop	International Workshop	Pending	4-Jul-20		december 2021
	Teach the teacher, Teaching at the universities	Curriculum Development	Pending	4-Apr-21		december 2021
<b>D-9.1</b>	<b>Outreach Program</b>					
	Workshops	Workshop 1 - Barishal	Accepted		30-Mar-19	
	Workshops	Workshop 2 - Khulna	Accepted		27-Apr-19	
	Workshops	Workshop 3 - Mid Term Progress Workshop	Accepted		6-Feb-20	
	Workshops	Workshop 4	Pending			
	Workshops	Workshop 5	Pending			
	Workshops	Workshop 6	Pending			
	Workshops	Workshop 7	Pending			
	Workshop Report	Workshop 1 Report - Barishal	Submitted		20-Feb-20	
	Workshop Report	Workshop 2 Report - Khulna	Submitted		20-Feb-20	
	Workshop Report	Workshop 3 Report - Mid Term Progress Workshop	Pending			
	Workshop Report	Workshop 4 Report	Pending			
	Workshop Report	Workshop 5 Report	Pending			
	Workshop Report	Workshop 6 Report	Pending			
	Workshop Report	Workshop 7 Report	Pending			
<b>D-9.2</b>	<b>Communication Strategy</b>					
	Storage of all datasets BWDB	Storage of all datasets BWDB		4-Apr-21		December 2021
	Communication materials such as brochures, animations etc.	Communication materials such as brochures, animations etc.		4-Oct-20		December 2021

## 1.3 Revised List of Modelling Milestones and Deliverables

**Table 1.3 a: List of Modelling Deliverables & Milestones (Part 1)**

DELIVERABLES RELATED TO MODELLING ACTIVITIES							
TOR Reference	TOR Deliverables	Scale	Model	Status	Delivery Dates as per signed Contract	Delivery Dates (by Consultant)	Proposed Revised Deadline
D-4A-1: 1	The software newly developed under this project with all source code and accompanying technical document with detailed explanation of the methodology and assumptions			Pending	4-Apr-21	At the end of each model	
D-4A-1: 2, 3	Geospatial datasets of main sources and deposits of sediment at present, including full meta-data a restored and archived in Database of BWDB Geospatial datasets of main sources and deposits of sediment for 100 years from present, including full meta-data are published and archived in Database of BWDB.	Macro	GBM Basin Model	Pending	D-4A-1: 2 (Jan 20) D-4A-1: 3 (Oct 20)	Mar-20	Feb-21
		Macro	Macro scale River Model	Pending		Mar-20	
		Macro	Macro scale River Model	Pending		Mar-20	
		Macro	GBM Basin Model Applications	Pending		7th Quarter	
		Macro	Macro scale River Model Applications	Pending		7th Quarter	
		Macro	Macro scale River Model Applications	Pending		7th Quarter	
		Macro	Sediment Budget Analyses	Pending		Apr-20	
D-4A-1:4	Technical report (one report for 4A-1 & 4A-2)			Pending	Draft (Jul 20) Final (Jan 21)	Oct-20	Feb-21
<b>Long Term Morphology Modelling</b>							
D-4A-2: 1	Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions.	Meso	Pussur Sbsa	Pending	4-Oct-19	Mar-20	oct-20
		Meso	Baleswar-Bshkhal Model	Pending		Mar-20	
		Meso	Lower Meghna	Pending		Mar-20	
		Meso	Sangu	Pending		Mar-20	
D-4A-2: 2, 3	Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB. Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB	Meso	Pussur Sbsa	Pending	D-4A-2: 2 (Apr 20) D-4A-2: 3 (Jul 20)	7th Quarter	Apr-21
		Meso	Baleswar-Bshkhal Model	Pending		7th Quarter	Apr-21
		Meso	Lower Meghna	Pending		7th Quarter	Apr-21
		Meso	Sangu	Pending		7th Quarter	Apr-21
D-4A-2: 4	Technical report (one report for 4A-1 & 4A-2)			Pending	Draft (Jul 20) Final (Oct 20)	Nov-20	Apr-21
<b>Bank Erosion on Meso Scale</b>							
D-4A-2: 1, 2	Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions. Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB	Meso	Pussur	Pending	4-Oct-19	Apr-20	Interim Reports: October 2020 Final Report May 2021
		Meso	Sbsa	Pending		Apr-20	
		Meso	Baleswar	Pending		Apr-20	
		Meso	Bshkhal	Pending		Apr-20	
		Meso	Lower Meghna	Pending		Apr-20	
		Meso	Sangu	Pending		Apr-20	
D-4A-2: 3	Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB	Meso	Pussur	Pending	D-4A-2: 2 (Apr 20) D-4A-2: 3 (Jul 20)	Dec-20	April 2021
		Meso	Sbsa	Pending		Dec-20	
		Meso	Baleswar	Pending		Dec-20	
		Meso	Bshkhal	Pending		Dec-20	
		Meso	Lower Meghna	Pending		Dec-20	
		Meso	Sangu	Pending		Dec-20	
		Meso	Pussur-Sbsa fine sediment model- ext	Pending		Jan-20	
D-4A-2: 4	Technical report (one report for 4A-1 and 4A-2)	Meso	<b>FINAL REPORT ON BANK EROSION</b>		Draft (Jul 20) Final (Oct 20)	Jan-21	April 2021
D-4A-3: 1, 2, 3	The model setup developed will be updated under this project with all accompanying technical document with detailed explanation of the methodology and assumptions. A report that describes the pros and cons of the different methodologies to prevent water-logging within the polder and sedimentation of tidal river system including polder-subsidence. The report will include meta-data on the models used and measurements, recommendations for polder design including drainage and long term management plan, and recommendations for pilot area/ polder to implement the ideas, such as but not limited to location, methods and measurements. Recommended plan to manage sediment at the downstream stretch of the tidal river and in the polder.	Micro	Pilot TRM Model for Polders 24 etc	Pending	4-Oct-20	Mar-20	Interim Report: November 2020 Final Report: May 2021
		Micro	5 or more polder models	Pending		20-Sep	Mar/21

**Table 1.3 b: List of Modelling Milestones and Deliverables (Part 2)**

SUBSIDENCE							
D-4B: 1, 2,3	Geospatial datasets of total subsidence at present and for 25, 50 and 100 years from now, including full metadata and stored in Database of BWDB and Estimate the annual rate of subsidence.		Field Campaigns (several)	Pending		Dec-20	July 2021
	Detailed Technical Report with description and explanation of geospatial analysis of the total subsidence in the four regions of the polder area of the coastal zone at present and for 25, 50 and 100 years from present, including description of the causes of subsidence, full metadata and stored in Database of BWDB.		Subsidence Geospatial Datasets	Pending	D-4B: 1, 2 (Oct 20) D-4B: 3 (Report: Draft - July 20, Final - Oct 20)	Oct-20	
	Report on the total subsidence in specific polders (designated by BWDB) in 25, 50 and 100 years from now when no sediment is supplied to the			Pending		Oct-20	
METEOROLOGY (these are covered under other modelling and data topics)							
D-4C: 1, 2	Technical Report describing current trends and future scenarios in rainfall in the polder area of coastal zone for four coastal regions (including estimation of rainfall distribution over the year) and cyclone frequency and intensity for the next 25, 50 and 100 years from now, including meta-data of the datasets used for the trend analyses and store and archived in Database of BWDB. The Research Team shall include a description of the statistical and downscaling methods used for reproducibility reasons.  Geospatial Dataset and archived in Database of BWDB.		Technical reports & Database	Pending	D-4C: 1 (Apr 20) D-4C: 2 (Jul 20)		Jan 2021
CLIMATE CHANGE EFFECTS							
D-4D: 1, 2, 3	Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB.  Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB.  Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now.		Salinity intrusion & Groundwater Salinity	Pending		Oct-20	February 2021
D-4D: 4, 5	Exceedance frequency curves for water levels in the same 20 stations at present, and at 25, 50 and 100 years from now.  Define extreme water levels in the polder of coastal zone at 25, 50 and 100 years from now, due to cyclonic storm surges.		Extreme Storm Surges	Pending		Oct-20	February 2021
D-4D: 6	Technical Report with description and explanation of the geospatial datasets of surface and ground water salinity, and the tidal salinity and water level curves, including description of relevant seasonal variations, used models, indication of more and less likely scenarios and full metadata. The Research Team shall also discuss the effect of at least two relevant options of redistribution of river water in the South West delta on salt intrusion.			Pending		Nov-20	February 2021
Other special purpose models							
D-4D: 1, 2, 3, 4, 5	Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB.	Bay of Bengal	Storm Surge Model	Pending		Dec-19	February 2021
	Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB.	Bay of Bengal	Storm Surge Model	Pending		Dec-20	Interim Report: February 2021 Final Report June 2021
	Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now.	Bay of Bengal	Wave Propagation Model	Pending		Dec-20	
	Exceedance frequency curves for water levels in the same 20 stations at present, and at 25, 50 and 100 years from now.  Define extreme water levels in the polder of coastal zone at 25, 50 and 100 years from now, due to cyclonic storm surges	Bay of Bengal	Salinity Model	Pending		2020 end	

## 1.4 List of Deliverables Submitted

**Table 1.4 a: List of Deliverables Submitted**

SL No.	Name of the Report	Date of Submission (m/d/y)	Reference as per Tracker	Program Item/Description as per Tracker
1	Final Inception Report	1/30/2019	D-1: 2	Inception Report (Workplan etc)
2	QPR-2	04/07/2019	Q 2	QPR-2
3	1st interim Literature Review Report	6/24/2019	D-2: 1	Literature Inventory & Interim Review 1
4	Report on Selection of Polders for Conceptual Design as Pilot Program	8/6/2019	D-5A:1	Polder Development Plan
5	QPR-3	08/06/2019	Q 3	QPR-3
6	Database Design Report (1 <sup>st</sup> submission)	9/11/2019	D-3: 3	Database Design Report
7	Report on Regional Stakeholder's Consultation Workshop, Barisal (Both English and Bengali versions),	9/24/2019	D-9.1: 2	Workshop 1 Report - Barishal
8	Report on Regional Stakeholder's Consultation Workshop, Khulna (Both English and Bengali versions),	9/24/2019	D-9.1: 2	Workshop 2 Report - Khulna
9	Supply of GIS Based Maps	9/25/2019	D-3: 4	GIS Based Maps
10	Supply of Boundary Data for Models at Various Scales	9/25/2019	D-3: 5	Supply of Model Boundary Data
11	Data Reports, Inventory, Quality Checks	9/29/2019	D-3: 1, 2	Data Report, Inventory & Quality Checks (Includes field Data collection and monitoring programmes)
12	QPR-4	11/7/2019	Q 4	QPR-4
13	Interim Literature Review Report 2	1/15/2020	D-2: 2	Literature Inventory & Interim Review 2
14	QPR-5	3/2/2020	Q 5	QPR-5
15	Database Design Report (Revised)	5/21/2020	D-3: 3	Database Design Report
16	Revised Interim Literature Review Report 1	5/31/2020	D-2: 1	Literature Inventory & Interim Review 1
17	Mid-term Progress Workshop Report	6/8/2020	D-9.1: 2	Workshop 3 Report - Mid Term Progress Workshop
18	QPR-6	6/10/2020	Q 6	QPR-6
19	Boundary conditions and data for calibration and validation of models (Revised Submission)	6/11/2020	D-3: 5	Supply of Model Boundary Data
20	GBM Basin Model and Macro Scale river and coastal model - current scenario (1 <sup>st</sup> submission)	8/12/2020; 8/16/2020;	D-4A-1: 2, 3	Model Set up Calibration & Validation
21	Meso-scale Interim Report: Effect of human interventions on tidal and sediment dynamics in	Sep 2020	D-4A-2: 3	Pussur Sibsa Fine Sediment Model

SL No.	Name of the Report	Date of Submission (m/d/y)	Reference as per Tracker	Program Item/Description as per Tracker
	the Pussur-Sibsa basin (1 <sup>st</sup> submission)			
22	QPR-7	9/6/2020	Q 7	QPR-7
23	MIKE 21C Bishkhali Meso-scale Bank Erosion Morphological Modelling Study: Model Development Report	10/08/2020	D-4A-2: 1, 2	Bishkhali: Model Set up Calibration & Validation
24	Interim Subsidence Report	10/30/2020	D-4B: 1, 2,3	Report
25	MIKE 21C Pussur meso-scale bank erosion morphological modelling study: Model development report	10/30/2020	D-4A-2: 1, 2	Pussur: Model Set up Calibration & Validation
26	MIKE 21C Sibsa meso-scale bank erosion morphological modelling study: Model development report	10/30/2020	D-4A-2: 1, 2	Sibsa: Model Set up Calibration & Validation
27	GBM Basin Model and Macro Scale river and coastal model - current scenario (Revised)	11/19/2020	D-4A-1: 2, 3	Model Set up Calibration & Validation
28	Lower Meghna-Tetulia river system morphological modelling study-Current situation	12/02/2020	D-4A-2: 1	Lower Meghna: Model Set up Calibration & Validation
29	Meso-scale Interim Report: Effect of human interventions on tidal and sediment dynamics in the Pussur-Sibsa basin (revised)	12/04/2020	D-4A-2: 3	Pussur Sibsa Fine Sediment Model
30	Monitoring Results on Sedimentation rate in Rivers and Floodplain	12/12/2020	D-3:6	Monitoring Results on Sedimentation rate in rivers
31	Baleswar-Bishkhali morphological modelling study- Current situation- Interim Report	01/06/2021	D-4A-2: 1	Baleswar-Bishkhali: Model Set up Calibration & Validation
32	Pussur-Sibsa morphological modelling study-Current situation - Interim Report	01/06/2021	D-4A-2: 1	Pussur Sibsa: Model Set up Calibration & Validation
33	Sangu River morphological modelling study- Interim Report	01/06/2021	D-4A-2: 1	Sangu: Model Set up Calibration & Validation
34	Review/Improvements on-going work (CEIP-I)	01/17/2021	D-5A:2	Improvement to 17 Polders

## 2 DEVELOPMENT OF INPUT DATASETS FOR MODELLING PHYSICAL PROCESSES (DATA ACQUISITION)

### 2.1 Collecting Existing Data

IWM already has a very comprehensive database comprising hydrometric, meteorological and morphological and environmental data collected over many decades all over the territory of Bangladesh and the adjacent ocean. These data have the advantage of having been used many times over in a large model studies which have also established the quality of the data through repeated verification.

The present study requires the addition of socio-economic data and its subdivision in to a polder-wise demarcated body of data. The availability of data is described in the Inception Report and is too large to be included in this progress report. The reader is directed to the Inception report for an outline of availability. Appendix A of the Second Quarter Progress Review Report gives a list of available data.

### 2.2 Field Surveys carried out by IWM

#### 2.2.1 Mobilization

The survey team was mobilized on 05 February 2019. A team of 12 personnel comprising the IWM survey Expert, experienced hydrographic surveyor and land surveyors has been deployed for conducting the planned data collection campaign as per specification.

#### 2.2.2 Summary of Field Survey Activities in the 8th Quarter (ending 30 September 2020)

In this quarter from July 2020 to September 2020, field survey for the 5 selected polders is being carried out for modelling TRM, cyclone storm surge/ flood hazard and finally conceptual polder design.

In addition, routine discharge and sediment measurements at Bahadurabad of Brahmaputra river and at Hardinge Bridge of Ganges river are also being continued for the better understanding of the sediment rating curve. As the discharge observations at Bahadurabad and Harding Bridge could not be achieved according to the planned schedule during March 2020 to September 2020 due to the lockdown of COVID-19 and also due to breakdown of two number ADCP, it is planned to continue the measurements over those two locations up to July 2021 during the extended period of the project. In this period, measurements will be done with a more frequency to achieve the target number of measurements which would also helpful for more understanding in the sediment rating curve analysis.

The survey methodology for the 5 polders survey employed by IWM survey teams is described in the Seventh Quarterly Report and the methodology for the others survey is described in details in the Second Quarterly Progress Report.

In this quarter from July 2020 to September 2020, the progress of discharge and sediment monitoring has been shown in Table 2-2 to Table 2-4.

### Survey methodology/progress for the 5 polders:

The survey was started in Feb-2020. However, due to the lockdown under COVID-19, the field work was suspended in 20/03/2020 which has been restarted again in June-2020.

The main feature of the 5 polders survey included cross-section of surrounding embankment and internal drainage canals, detail structure inventory, cross-section of the surrounding rivers/canals, and land level survey. Out of these, the cross sections survey of the surrounding embankment and internal drainage canal and structure inventory have been already completed. Now, the cross sections survey of the surrounding river is underway which would be completed by November 10, 2020. The land level survey will be started from first week of November 2020. The progress of the survey for 5 polders has been shown in Table 2.1.

### Establishment of Benchmarks:

#### 1. Benchmark Fly:

The survey work for the all polders has been conducted with reference to available existing Survey of Bangladesh (SOB) benchmark (BM) situated around the polders area. TBMs have been kept by engraving on the permanent structures like regulator and sluices during the survey. Closing error will be checked to maintain the survey accuracy.

**Table 2. 1: List of reference Benchmark**

1	BM-1039	The pillar is situated on the Upazilla Research center compound, PS: Dumuria, Dist: Khulna.	2.135	748347	2524502	Polder 29
2	BM-148	The pillar situated on the N/E corner of pond behind the house of Mr. Rumi commissioner east side of Patharghata Hospital road, Vill: Patharghata Hospital road, UP: Patharghata, Dist: Barguna.	2.137	806423	2439568	In Polder 40/1
3	BM-4103	Situated in the Turabgonj High School Compound, PS: Kamalnagar, Dist: Laxmipur	4.314	280961	2524625	In Polder 59/2
4	GPS-214	Situated in the Motirhat High School compound, PS: Komolnagar, Dist: Laxmipur	3.624	272674	2524873	
5	GPS-274	The pillar is situated at west side of Sandwip Para cyclone shelter and east bank of pond, Vill: Sandwip Para, UP: Bashkhali	3.599	383788	2446678	In Polder 64/1A and Polder 64/1B
6	BM-5117	SOB BM pillar no-5117 situated in SE corner of 73no Sora Primary School. Vill: Sora, Up: Gabura, PS: Shyamnagar, Dist: Satkhira	2.044	732187	2459629	In Polder 15

## 2. Embankment cross section:

Cross sections of the existing embankment are taken at 500 meter intervals. Apart from the Polder 15, a total of 296Km embankment cross section survey has been carried out for the other 5 polders. The embankment cross sections of Polder 15 were conducted during 2016 under CEIP-I. However, some part of the embankment in Polder 15 has been damaged significantly due to the recent cyclone Amphan during May 20, 2020. This changed part of the embankment will be revisited through conducting long profile together with some representative cross sections to cover the damaged part of the embankment. All cross sections are taken with perpendicular to the alignment of the embankment and has been extended at least 15 m beyond the toe in the country side (C/S) and 50 meter in the river side (R/S). At locations of breaches, damages, cross-sections have been taken at the closer intervals to represent the correct configuration of the cross-section. Cross section has been carried out by using optical level and handheld GPS.



Figure: Embankment Cross section Survey

## 3. Drainage Channel Survey:

The cross section of the Khal has been carried out at an interval of 500 meter or closer where ever necessary, to represent the correct configuration of the khal. A total of 326 Km drainage channel cross section survey will be carried out in the five polders excluding Polder 15. The cross section survey has been conducted during March 2016 in Polder 15 can be utilized here in this study. Cross section has been extended at 15 m beyond the bankline and spot level to be taken maximum 5 m apart or less as necessary to represent the correct configuration of the cross section. Cross sections of the drainage channel have been conducted by using optical level and hand GPS. The tentative locations of the cross section are made by delineating the alignment of the existing drainage channel.

## 4. Structure Inventory:

The structural dimensions/level, information like operational practice, physical condition of structure, launching apron and drainage channels condition has been recorded during the survey A log-sheet was prepared and followed in the field for recording the necessary information regarding the structure.



Figure. Sluice-10 of P-64/1A



Figure: Asanghar Sluice of P-29

### 5. Cross section of the surrounding river:

A total of 340 cross-sections of the peripheral river of all 6 polders is being conducted. River section survey is being carried out at 500m-1000m interval considering the existence of the drainage regulator and also along the river bend. The cross sections extended up to high bank or up to embankment. The survey has been done by using DGPS & Echo sounder for the channel part while the shallower part and the dry land have been surveyed by using Optical Level.



Figure: Bathymetry Survey at the surrounding river of Polder 29.

### 6. Topographic Survey:

Spot levels together x, y co-ordinate will be carried out around 50mx50m interval by using optical level and GPS or total station for the drainage model. Spot level will be undertaken in the open area mainly and some representative spot level will be also recorded inside the homestead. Assuming the 70% area of polder is open area, it is planned 50% of the open area will be surveyed, as the secondary spot level data (in the lower resolution) are available by Survey of Bangladesh (SOB). In polder 40/1, spot level will be taken in the whole area. Accordingly, a total of 175 Km<sup>2</sup> area will be carried out by December 2020. Level data has been processed in Arc View GIS software to produce spot level with reference to MSL vertical datum. The spot levels have been taken along with physical features ID like khals, road, embankment, paddy land etc.

**Table 2. 2: Progress/future plan of survey for 5 polders**

SI No	Polder	Item of work	Actual Quantity	Target Quantity	Progress	Remarks
1	(P-40/1) Patharghata, Barguna	Embankment (Km)	22	22	Complete	Land Level survey will be carried out over the whole area
		structure (Nos.)	27	27	Complete	
		Drainage Canal (Km)	27	27	Complete	
		Perepheral River Section (nos.)	43	43	Complete	
		Land Level (Km <sup>2</sup> )	20	14	Will be done in Nov-2020	
2	(P-29) Dumuria/Batiaghata, Khulina	Embankment (Km)	49	49	Complete	Land level survey will be carried out over 30% of the total area as the secondary topo data (From SOB) is also available in this area
		structure (Nos.)	41	41	Complete	
		Drainage Canal (Km)	121	121	Complete	
		Perepheral River Section (nos.)	120	120	Ongoing	
		Land Level (Km <sup>2</sup> )	79	28	Will be done in Nov-2020	
3	(P-59/2) Char Alexander/Kamalnagar, Noakhali	Embankment (Km)	88	88	Complete	Land level survey will be carried out over 30% of the total area as the secondary topo data (From SOB) is also available in this area
		structure (Nos.)	8	8	Complete	
		Drainage Canal (Km)	73	73	Complete	
		Perepheral River Section (nos.)	61	61	Will be done in Nov-2020	
		Land Level (Km <sup>2</sup> )	209	73	Will be done in Dec-2020	
4	(P-64/1A) Bashkhali, Chittagong	Embankment (Km)	54	54	Complete	Land level survey will be carried out over 30% of the total area as the secondary topo data (From SOB) is also available in this area
		structure (Nos.)	5	5	Complete	
		Drainage Canal (Km)	42	42	Complete	
		Perepheral River Section (nos.)	56	56	Will be done in Nov-2020	
		Land Level (Km <sup>2</sup> )	52	18	Will be done in Dec-2020	
5	(P-64/1B) Bashkhali, Chittagong	Embankment (Km)	83	83	Complete	Land level survey will be carried out over 30% of the total area as the secondary topo data (From SOB) is also available in this area
		structure (Nos.)	50	50	Complete	
		Drainage Canal (Km)	63	63	Complete	
		Perepheral River Section (nos.)	24	24	Will be done in Nov-2020	
		Land Level (Km <sup>2</sup> )	90	32	Will be done in Dec-2020	
6	(P-15) Syamnagar, Satkhira	Embankment (Km)	27	27	Complete	The data collected during Mar-2016 under CEIP-1 will be utilized here. Revisit of the structure inventory and the perepheral river survey are being carried out.
		structure (Nos.)	7	7	Complete	
		Drainage Canal (Km)	20	20	Complete	
		Perepheral River Section (nos.)	36	36	Complete	
		Land Level (Km <sup>2</sup> )	31	11	Complete	
Total	Total	Embankment (Km)	323	323		
		structure (Nos.)	138	138		
		Drainage Canal (Km)	346	346		
		Perepheral River Section (nos.)	340	340		
		Land Level (Km <sup>2</sup> )	481	175		

**Table 2. 3: Progress of the discharge observation**

SL no.	Location/ River Name	Target (Number)		Progress upto June-2020	Progress in between Jul - Sep 2020	Cumulative progress upto Sep-2020	Remarks
		TOR	Modified				
A	3 main rivers						
1	Bahadurabad, Brahmaputra	18	48	20	2	22	Due to lockdown under COVID-19, data collection could not be done in April and May-2020
2	Hardinge Bridge, Ganges	18	48	21	0	21	
3	Bhairab Bazar, Upper Meghna	18	48	24	2	26	
Total of A		54	144	65	4	69	
B	Lower Meghna						
4	Chandpur, Lower Meghna	3	5	5	0	5	2 spring+ 1 neap during monsoon and 2 nos. 1 Spring +1 Neap for dry season
C	5 nos. Tidal rivers surrounding the Polders.						
5	U/S of Mongla port, Pusur	44	8	8	0	8	For each location 8 measurement: 1 spring in every two months and -1 neap in every six months for the periods of one year.
6	Nalian, Shibsha		8	8	0	8	
7	Charduani, Baleswar		8	8	0	8	
8	Bhandaria, Baleswar		8	8	0	8	
9	Polder-17/2, Gangril		8	8	0	8	
Total of C		44	40	40	0	40	
D	Additional 3 tidal River						
10	Dasmina, Tetulia	0	2	4	0	4	2 nos. measurement during June-Oct-19, 1 Spring+ 1 Neap
11	Kakchira, Bishkhali	0	3	3	0	3	Total 3 nos. -1 spring in dry season and 1-Neap+1-Spring for monsoon
12	Taliar dwip, Shangu	0	2	2	0	2	2 nos. measurement during June-Oct-19, 1 Spring+ 1 Neap
Total of D		0	7	9	0	9	

**Table 2. 4: Progress of suspended sediment sampling for total concentration**

SL no.	Location/ River Name	Discharge observation		Suspended Sediment Sampling for Total concentration			
		As per TOR	Modified	As per TOR	Progress upto Jun-2020	Progress from Jun-Sep 2020	Cumulative Progress upto Sep 2019
A	3 main rivers						
1	Bahadurabad, Brahmaputra	18	48	1056	1729	62	1791
2	Hardinge Bridge, Ganges	18	48				
3	Bhairab Bazar, Upper Meghna	18	48				
B	Lower Meghna						
4	Chandpur, Lower Meghna	3	5	234	149	0	149
C	5 nos. Tidal rivers surrounding the Polders.						
5	U/S of Mongla port, Pusur	44	40	3432	2736	0	2736
6	Nalian, Shibsha						
7	Charduani, Baleswar						
8	Bhandaria, Baleswar						
9	Polder-17/2, Gangril						
D	Additional 3 tidal River (as per modified plan)						
10	Dasmina, Tetulia	0	2	0	633	0	633
11	Kakchira, Bishkhali	0	3				
12	Taliar dwip, Shangu	0	2				

**Table 2. 5: Progress of suspended sediment and bed sampling for grain size distribution**

SL no.	Item	Sediment Sampling				Remarks
		As per TOR	Progress upto Mar-2020	Progress in between Apr to Jun-2020	Achieved upto Jun-2020	
1	Suspended Sediment sampling	33	23	0	23	More sample will be collected during discharge observation upto Jul-2021.
2	Collection of Bed Sample	55	63	0	63	Collection of five bed samples from each river discharge observation



## 3 DEVELOPMENT OF INTERACTIVE GEODATABASE OF COASTAL ZONE

### 3.1 Introduction

This report presents the progress of tasks and activities for developing an Interactive Geodatabase for Coastal Zone (IGDCZ) during the 8<sup>th</sup> quarter (Jul-Sep 2020) of the project.

According to the Terms and Reference (ToR) of the project in Component-3 the objectives are:

- To collect all input datasets, undertake Quality Assurance/Quality Checking (QA/QC) and update/modify datasets as necessary for use in the modelling of the physical processes in the coast zone of Bangladesh
- To improve the process of data collection, QA/QC and data dissemination and sharing among the government agencies

In order to achieve the above objectives, a web GIS based Interactive Geodatabase for Coastal Zone (IGDCZ) has been developing under this project. In doing this database application several tasks and activities are being carried out. This report presents the progress of these tasks which have been performed during the 8<sup>th</sup> quarter of the project tenure.

### 3.2 Data Collection and Data Processing

#### **Hydro-meteorological data**

Data collection and data processing both are ongoing tasks in which IWM has collected meteorological data for the period from 2013 to 2019 from BMD. The database team has performed data processing (transformation of BMD data formats into IGDCZ data formats) and subsequently followed the required data verification, validation and compilation processes for IGDCZ database.

#### **Compilation of Field Information**

IWM team of LTP project conducted several BWDB field office visits for collecting data information relating to the latest situation of polders through reviewing documents, drawings and maps and interviewing with BWDB engineer. The related data and maps (highlighted maps from field) have been collected to improve the stored database. Subsequently, the IGDCZ database is being updated and amended based on the findings of the field visits.

### 3.3 Satellite Image Processing

#### **River/Sea Bank Erosion**

Successfully completed the tasks of temporal changes in river erosions have been generated from satellite images for the years 1989, 1995, 2000, 2005, 2010, 2015 and 2020 and subsequently the spatial data layers have been prepared IGDCZ database.

#### **Land Use change in the coastal area**

Land used maps are being generated for the years 1990, 2000 and 2020 using available satellite images. The task is ongoing and about 75% of this work is completed.

### 3.4 Web GIS Application Development

The Web GIS based database application entitled “Interactive Geodatabase for Coastal Zone (IGDCZ)” is still under development. The application is already hosted in development server located in IWM. A significant progress has been made by the development team, concurrently, there were several numbers of user feedback, suggestions which have been provided by the users in the user feedback section in the application. Accordingly, the received feedback and suggestions are being addressed. In this manner user acceptance tests are being performed.

A new look of Dashboard is under development stage in the application. The old one was built with access point for accessing different modules. The new dashboard will consist of some interfaces of summary information of polder database and the links to access different modules of the application.

A standard metadata template has been developed according to the Dublin Core (<https://dublincore.org/>) and Geospatial Data Standard (<https://www.fgdc.gov/standards>), both standards followed the ISO specifications. The template consists of sixteen elements of the meta information of the data, these include are *Name or title, Data type, Subject, Description (Abstract, history, process description, purpose), coverage (spatial, temporal), date of published, creator, contributor, publisher, source, relation, language, rights, identifier, and format*. The metadata are being prepared database feature/record basis.

The overall progress of this application development work is about 80% where 10% progress has been made during this 8<sup>th</sup> quarter of the project. Item-wise overall progress and plan progress for next quarter is resented in the following **Table 3. 1**:

**Table 3. 1: Item-wise Overall Progress and Plan for next quarter**

SI No	Task & Activities	Progress (%) Upto 7 <sup>th</sup> Quarter	Progress (%) during this (8 <sup>th</sup> ) Quarter	Total Progress (%) Upto 8 <sup>th</sup> Quarter	Plan of Next Quarter	Remarks
<b>1</b>	<b>Inception Phase</b>					
1.1	Review Existing Systems	100	-	100	-	
1.2	Consultation with Project Team	continue		continue	continue	
1.3	Consultation with Project Client	continue		continue	continue	
1.4	Requirement Analysis	100	-	100	-	
1.5	Data Requirements and Data sources	100	-	100	-	
1.6	Conceptual System Architecture	100	-	100	-	
1.7	Inception Report	100	-	100	-	
<b>2</b>	<b>Data Collection and Processing</b>					
2.1	Coastal Bank Erosion (Satellite Image)	95	5	100	-	
2.2	Land use Classification (Satellite Image)	35	45	75	25	
2.3	Other Data Collection (shapefile & tabular)	80	10	90	10	
2.4	Other Data Processing (spatial & non-spatial)	75	5	80	10	

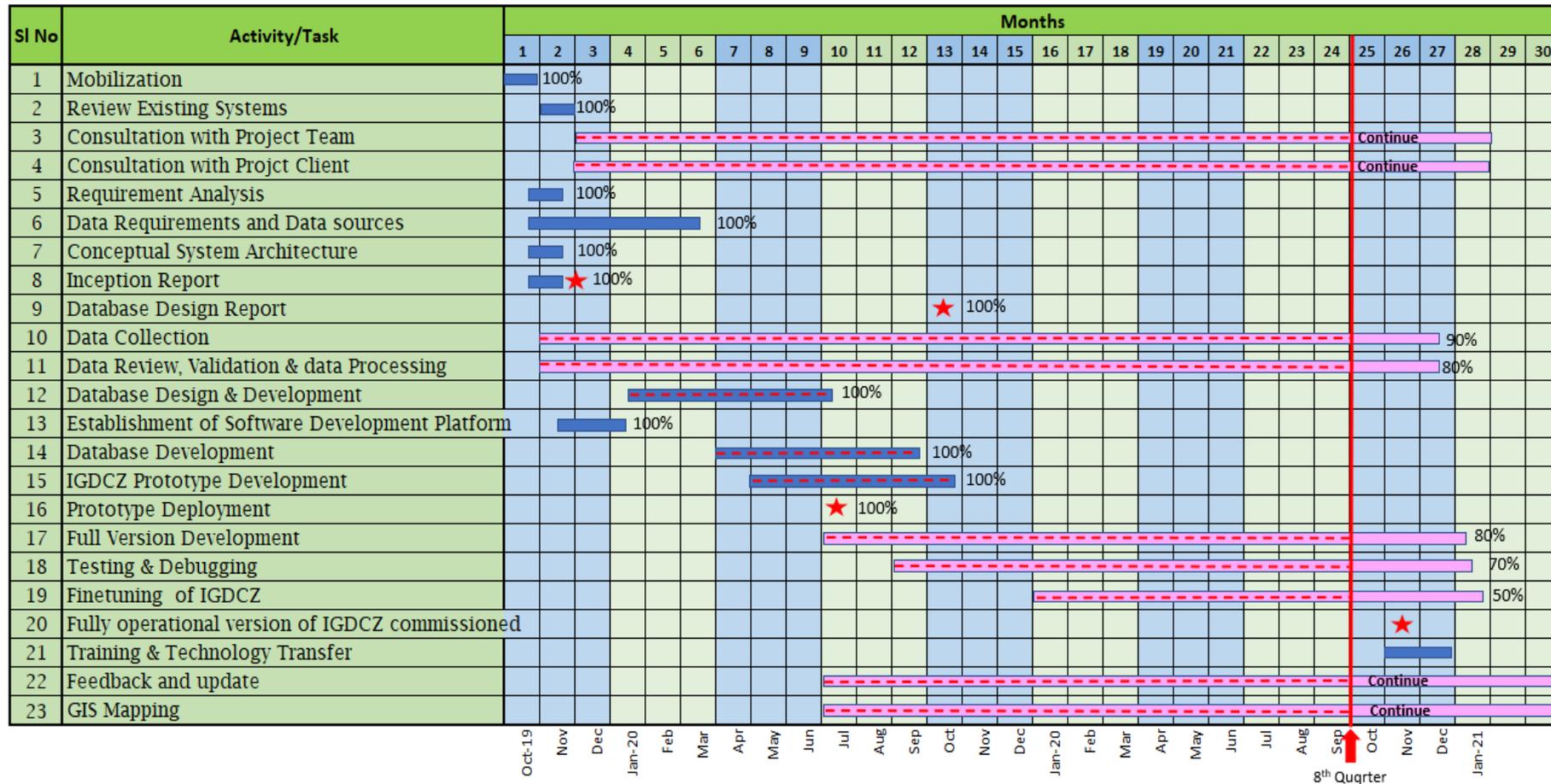
SI No	Task & Activities	Progress (%) Upto 7 <sup>th</sup> Quarter	Progress (%) during this (8 <sup>th</sup> ) Quarter	Total Progress (%) Upto 8 <sup>th</sup> Quarter	Plan of Next Quarter	Remarks
<b>3</b>	<b>GIS Mapping</b>					
3.1	Polder Maps for Data Collection	50	25	75	10	
<b>4</b>	<b>Database Design &amp; Development</b>					
4.1	Database Design Development	100	-	100	-	
4.2	Database Design Report	100	-	100	-	
4.3	Database Implement	80	5	85	10	
<b>5</b>	<b>Web GIS Application Development</b>					
5.1	IGDCZ Prototype Development	100	-	100	-	
5.2	Full Version Development	70	10	80	10	
5.2.1	Dashboard	-	50	50	25	A new dashboard interface is under development for accessing different modules and interfaces of summary information of database items.
5.2.2	GIS Core Module	70	10	80	5	
5.2.3	Metadata Module	0	10	10	20	

SI No	Task & Activities	Progress (%) Upto 7 <sup>th</sup> Quarter	Progress (%) during this (8 <sup>th</sup> ) Quarter	Total Progress (%) Upto 8 <sup>th</sup> Quarter	Plan of Next Quarter	Remarks
	Metadata of Spatial and non-Spatial database of Application					
5.2.4	Documents Archiving: Document Archive Library	100	-	-	-	
5.2.5	Project Management	100	-	-	-	
5.2.6	User Administration	70	-	70	10	
5.2.7	Testing & Debugging	60	10	70	10	
5.3	Fully operational commissioning	0	50	50	10	
<b>6</b>	<b>Training &amp; Technology Transfer</b>	-	-	-	-	
<b>7</b>	<b>Feedback and update</b>	continued	continued	continued	Demonstration and meeting with BWDB ICT team	



### 3.5 Work Plan

The development work has been conducted according a prepared workplan. Following Figure 3-1 shows the work plan with current status of different tasks and activities.



Continuous Input   
 Intermittent Input

Figure 3. 1: Work Plan for IGDCZ Development

## Sample Screenshots from Application

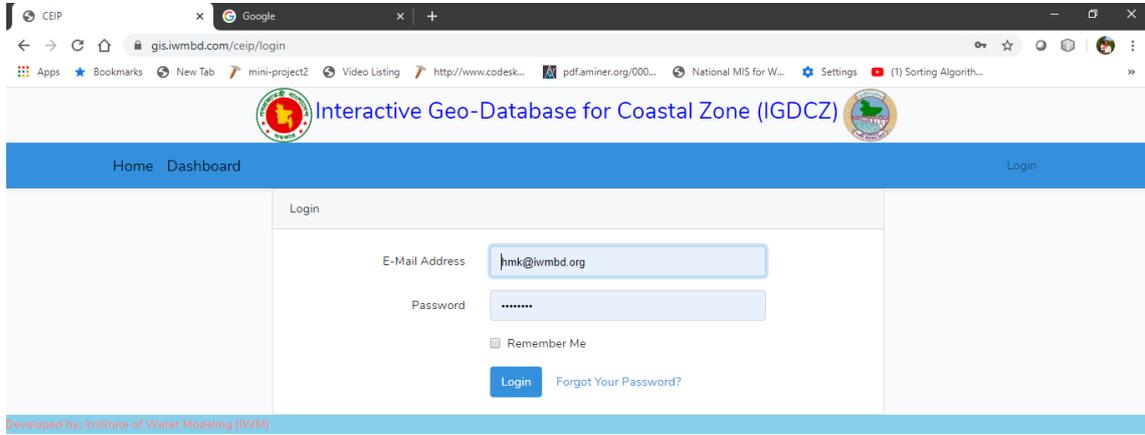


Figure 3. 2: Application Login Page

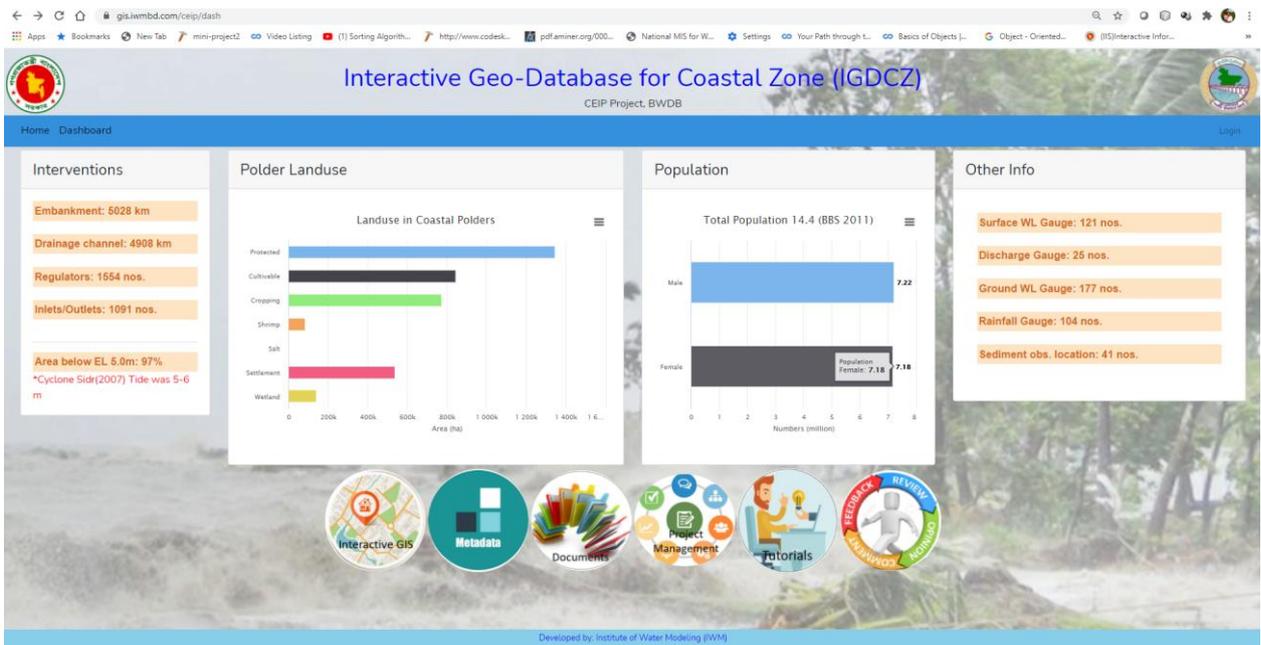


Figure 3. 3: Application Dashboard

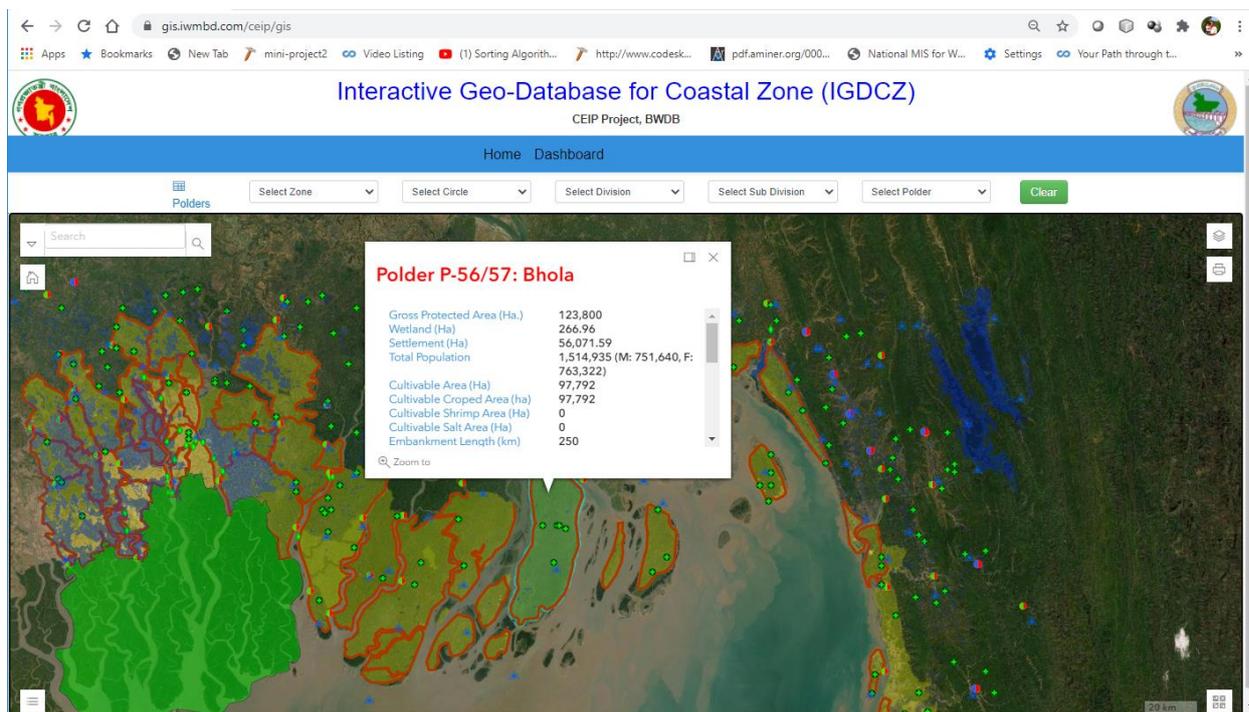


Figure 3. 4: Web GIS Core Module

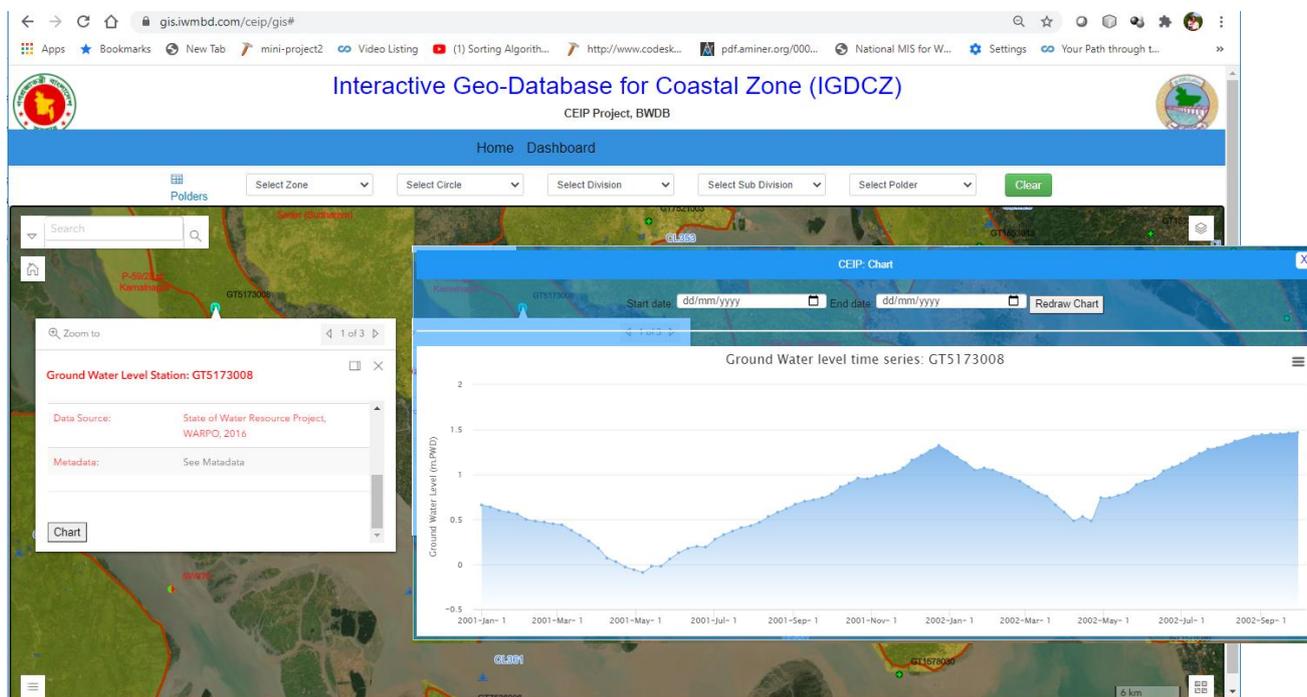


Figure 3. 5: Accessing hydrograph of Ground water monitoring well

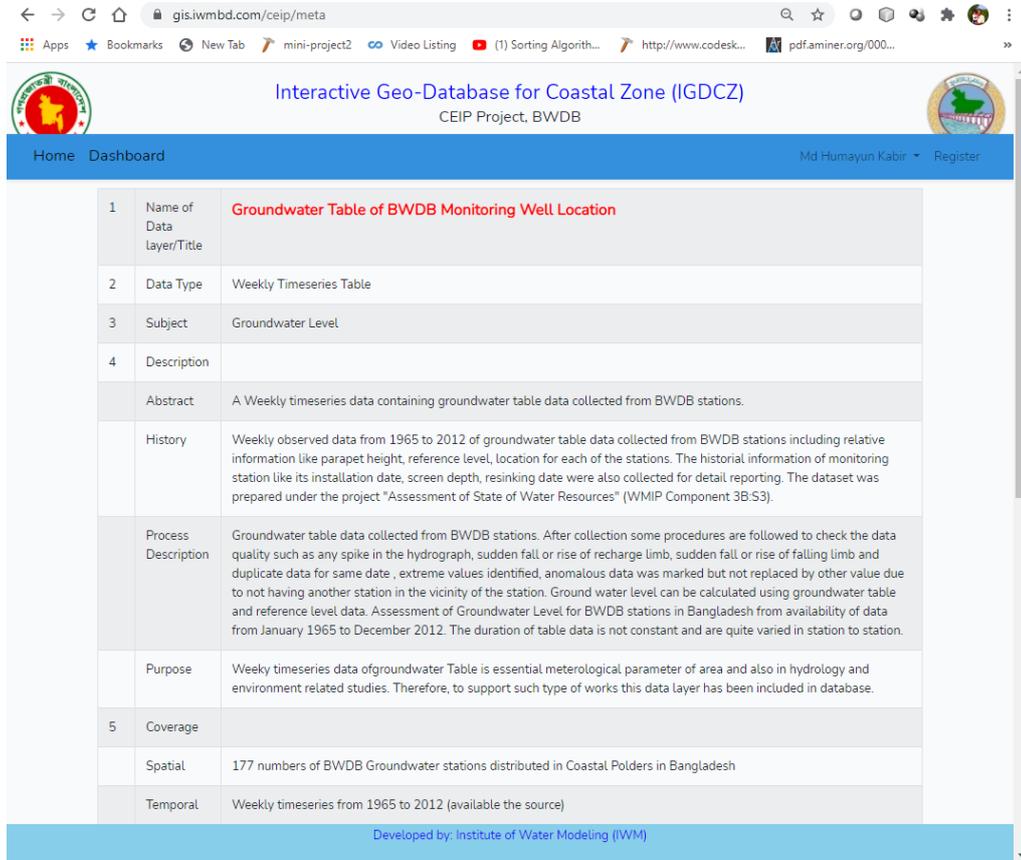


Figure 3. 6: Metadata Interface

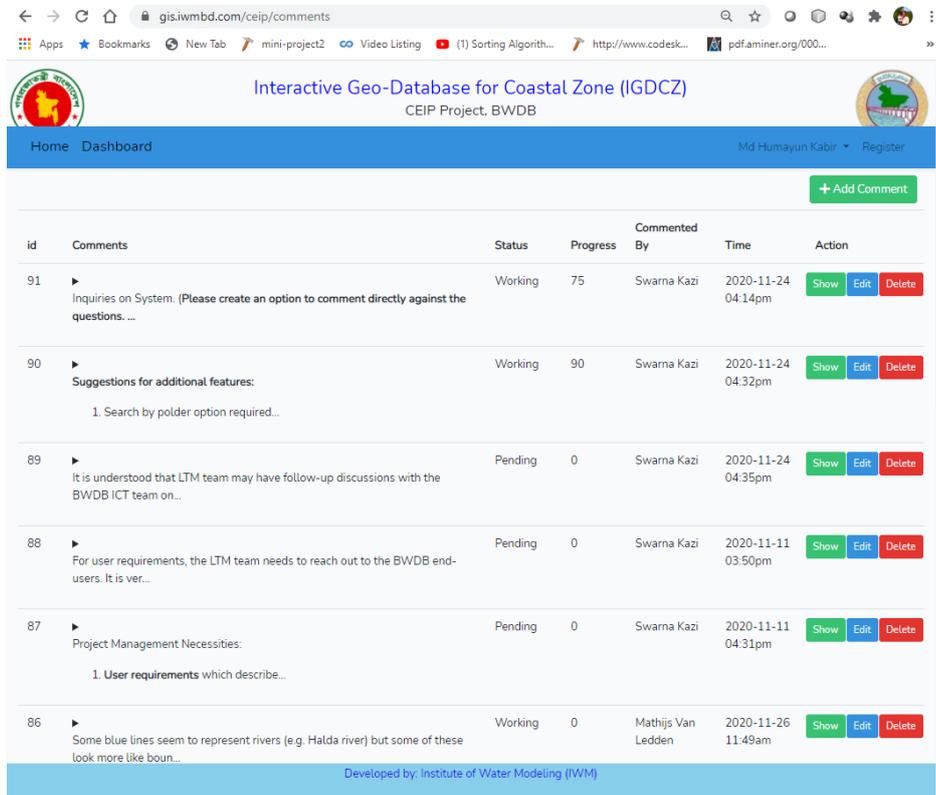


Figure 3. 7: User feedback and suggestions

## 4 MODELLING LONG TERM PROCESSES

### 4.1 Introduction

A very large proportion of the work carried out by the consultant on this project comprises the development and application of many types of mathematical models for predicting the long-term processes (evolution) of the conditions in the Bengal Delta. The evolution of the Bengal Delta under the disturbances imposed upon it by natural processes and by human interventions occur at many different length and time scales. Model development is now almost complete, and applications are underway.

There are many different types of models, using a variety of formulations and many versions of standard software being used in this study. Table 4.1 Lists the Models that are under development by the project team.

**Table 4.1: Models currently under development**

LIST OF MODELLING ACTIVITIES			
	Modelling Activity	Sub description	Scale
A	GBM Basin Model	Hydrotrend	Macro
B	Macro scale River Model	Delft3D Main River system (2D)	Macro
C	Macro scale River Model	Delft3D Main River system (1D)	Macro
D	Pussur Sibsa	Delft3D: Modelling of long term Morphology	Meso
E	Baleswar-Bishkhali Model	Delft3D: Modelling of long term Morphology	Meso
F	Lower Meghna	Delft3D: Modelling of long term Morphology	Meso
G	Sangu	Delft3D: Modelling of long term Morphology	Meso
H	Pussur Sibsa	MIKE21C: Modelling of bank erosion process	Meso
I	Baleswar-Bishkhali Model	MIKE21C: Modelling of bank erosion process	Meso
J	Lower Meghna	MIKE21C: Modelling of bank erosion process	Meso
K	Sangu	MIKE21C: Modelling of bank erosion process	Meso
M	Pussur-Sibsa fine sediment model- ext	Delft3D Fine Sediment (2D/3D)	Meso
N	Pilot TRM Model for Polder 24	MIKE11, MIKE21 AND MIKE FLOOD	Micro
O	Storm Surge Model	Generating Synthetic Storm Events	Bay of Bengal
P	Storm Surge Model	MIKE21FM & CYLONE MODEL	Bay of Bengal
Q	Salinity Model	Delft3D Salinity (2D/3D)	Total Coast

The 16 models listed in Table 4.1 have been under continuous development in the two years (8 Quarters) the project has been active. The work has been carried out by teams of modellers comprising numbers of modellers from the International Staff working in close collaboration with counterpart groups of modellers at IWM.

The close collaboration which is reflected in these reports was carried out in the last two quarters under severe constraints imposed by the travel bans imposed by several governments on account of the COVID-19 crisis that prevented the International Modellers from travel to Bangladesh. This collaboration was facilitated by the relationships initiated and continuously developed during the first 6 Quarters with International staff making frequent brief visit to Bangladesh. This work continued with the International Staff contributing remotely – although constrained by contractual limits placed on the length of “home office” inputs. These limits have been under negotiation and the conditions for collaboration are being relaxed in the 8<sup>th</sup> Quarter onwards.

The 16 modelling tasks listed in Table 4.1 reports are described in sections 4.2 onwards below. They were described in greater detail the previous Quarterly Progress Reports. The actual work carried out are discussed in detail in the reports listed in Table 4.2 below.

**Table 4. 2: Modelling Reports Submitted:**

<b>Title of Report</b>	<b>Activity Code (see Table 4.1)</b>	<b>Date of Submission (m/d/y)</b>
GBM Basin Model and Macro Scale river and coastal model - current scenario	A, B, C	8/12/2020
Effect of human interventions on tidal and sediment dynamics in the Pussur-Sibsa basin	M	Sep 2020
MIKE 21C Bishkhali Meso-scale Bank Erosion Morphological Modelling Study: Model Development Report	H	10/08/2020
MIKE 21C Pussur meso-scale bank erosion morphological modelling study: Model development report	H	10/30/2020
MIKE 21C Sibsa meso-scale bank erosion morphological modelling study: Model development report	H	10/30/2020
GBM Basin Model and Macro Scale river and coastal model -current scenario (Revised)	A,B,C	11/19/2020
Lower Meghna-Tentulia river system morphological modelling study-Current situation	F	12/02/2020
Effect of human interventions on tidal and sediment dynamics in the Pussur-Sibsa basin (revised)	M	12/04/2020

## 4.2 Macro Scale Modelling (A, B & C)

Macro Scale Models are designed to investigate the processes that take place in the Bengal Delta and on larger parts of the major river system and flood plains within Bangladesh. The processes modelled are described along large space and time scales with the following objectives (see TOR):

- *Understand sediment dynamics of the GBM delta*
- *Selection and prioritization of drivers of change and development of future scenarios (example: change in transboundary flow through dams, river linking, land use change, infrastructure*

*development)*

- *Estimate future changes, using possible scenarios for future (natural and anthropogenic) developments*

These objectives required that three types of models had to be deployed to achieve them.

Hydrotrend Basin Model: The Hydrotrend model covers the flows of water and sediments within entire Ganges-Brahmaputra-Meghna (GBM) Basin over the medium and long-time scales. The overall water and sediment balances within the basin are modelled both for the current scenario and the long term taking into account climate change and upper catchment developments such as on-going dam construction.

2-D and 1-D Macro-scale models: These models based on Delft3D software studies the detailed sediment balances and morphological development in the major estuaries and the transport and redistribution of sediments along the Bay of Bengal coast line and tidal pumping of some sediments load northwards into western estuaries in the coastal zone. The first stage models (Current Scenario) present the details of these models.

### 4.3 Meso Scale Modelling of Long-Term Morphology (D, E, F & G)

The objectives of the meso scale modelling work have been described in the TOR as

- *Understanding the dynamics of the river branches and estuaries in the coastal zone of the GBM delta, channel switching and bank erosion both in the fluvial—dominated parts of the delta as well as in the tidally—influenced river delta.*
- *Estimate future changes, predicting erosion and sedimentation in the coastal area*

The long term morphological development of four estuarine rivers systems (Pussur-Sibsa, Baleshwar-Bishkhali, Lower Meghna-Tentulia and Sangu) are being modelled using Delft3D modelling software. The Current situation has been modelled and the long-term development is under development.

### 4.4 Meso Scale Modelling of Bank Erosion (H, I, J & K)

Although not specifically mentioned as an objective in the TOR, river-bank erosion has been included in the work as the experience of CEIP-1 has revealed this to be a subject crucial to the sustainability of the polder system. MIKE21C software has been used to investigate this problem on the (Pussur-Sibsa, Baleshwar- Bishkhali and Lower Meghna-Tentulia) river systems. The work on the Sangu river has not yet progressed sufficiently to justify submission.

### 4.5 Morphology on a micro scale (water-logging/polder management M & N)

A study of the impact of human intervention on the distribution of fine sediments in the Pussur Sibsa basin and the morphological impact of poldering is presented in a separate study (M). A separate study of the mechanisms of how Tidal River Management (TRM) can be used to simultaneously control sediment deposition in peripheral channels and reclaim water-logged lands in low lying beels within polders is presented in report N.

### 4.6 Storm Surge Modelling (O & P) and Saline Intrusion Modelling (Q)

The generation of a variety of cyclonic storms in the southern Bay of Bengal and their propagation along tracks approaching the GBM Delta, as well as the impacts of climate change on their intensities have been

studied (O). The propagation of storm surges into the delta and the consequent increases in estuarine water levels and the impact of wave action on the embankment have been studied in the context of designing polder drainage systems and embankment protection systems in the face of climate change and sea level rise (P). The extent of sea level rise on saline intrusion far into the Southwest and South Central Regions have also been studied (Q)

## 4.7 Conclusions

The large numbers of modelling studies described above has enables us to acquire a better, quantitative understanding of the hydraulic and morphological processes that determine the sustainability of the habitations in the coastal zone of Bangladesh, taking into account its geological under-pinning, climate change and human development activities in the entire basin. The tools developed above can be used to predict the short, medium and long-term impacts of these changes on the well-being of coastal communities. We need to keep in mind that the longer-term future depends on too many variables beyond our control. It is therefore necessary that planners keep at their disposal these modelling tools, *appropriately updated*, to be used for managing the coastal zone in the future. It is the objective of this project to ensure (through capacity building programmes) that the skills necessary for continuously updating and running these models continue to be are available for the future.

## 5 OTHER STUDIES

This Chapter covers progress of Work under Components 4B, 4C and 4D in the Terms of Reference

### 5.1 Subsidence and Delta Building

Field work on subsidence and delta building have continued during this quarter.

In order to provide planning support to the improved and sustainable embankment design instrument to capture surface erosion-sedimentation and subsidence were installed across coastal areas of Patuakhali, Bagerhat, Khulna, Satkhira and Sundarban. RSET-MH instrument were installed to measure erosion-sedimentation. GPS instrument installed to measure subsidence.

#### **Erosion-Sedimentation Measurement by RSET-MH**

A major campaign for installing RSET-MH were held in July 2019. In this initiative a number of instrument were installed in Kalapara in Patuakhali district (2 sets, one inside the embankment, another outside), Dumki in Patuakhali district (2 sets, one inside the embankment, another outside), Sharonkhola in Bagerhat district (2 sets, one inside the embankment, another outside), Assasuni in Satkhira district (2 sets, one inside the embankment, another outside), Hiron Point in Sundarban (2 sets, one near the bank, another relatively inner). For these sets of instruments a baseline measurement campaign was carried out in December 2019.

Two RSET instrument were installed in Katka Sundarban earlier than 2019. The first measurements were done for these in July 2019, then done in October 2019.

As known another sets of RSET instrument were installed in Sundarban. In this lot there were 3 locations in Sundarban (2 sets in Sarbatkhali Forest Camp, 1 set further east of Sarbatkhali, 1 set quite deep inside the Sundarban – all installed around 2014/2015). Another sets of REST was installed inside Polder 32 in Dacope upazila in Khulna district (4 locations, installed around 2017/2018). By planning for all sites two sets of measurements are to be carried out in a year – one before monsoon, and another one during a suitable time after monsoon. However, due to Covid-19 pandemic no premonsoon measurement was carried out in 2020.

#### **Subsidence Measurement by GPS**

An interim report titled Interim Subsidence Report dated October 2020 (Ref: Memo No. CEIP/LTMRA/0320/ dated 30 October 2020 received by PD office on 01 November 2020) was submitted in November 2020. This report covered all forms of subsidence measurement (GPS instrument installed for longer time, GPS campaign measurements on SOB GPS pillar etc). This report can be referred to for further details about progress on the subsidence study..

### 5.2 Climate Change Effects (analysis of historical data)

This section does not include any progress specific to this Quarter as the relevant experts have exhausted their home time allocation.

The progress made in previous quarters are described in Chapters 5.2 and 5.3 in QPR-7



## 6 APPROACH TO POLDER RECONSTRUCTION

This Chapter covers progress of Work under Components 5.A and 5.B in the Terms of Reference

Work carried out under this heading could be found in the report “Component 5A:2: Reconstruction of the Polder at different coastal zones including their phasing and construction program (December 2020)



## 7 DESIGN PARAMETERS, CONSTRUCTION MANAGEMENT & MONITORING

This Chapter covers progress of Work under Components 6.1, 6.2 and 6.3

**The work on revisiting design parameters, construction management and monitoring not progressed during this quarter.**



## 8 INVESTMENT PLAN FOR THE ENTIRE CEIP

### 8.1 Strategic Approach towards devising a Polder Reconstruction Programme

The availability of the new polder database facilitates the re-visiting of the old multicriteria analysis in with the advantage of much more data and detailed knowledge of physical processes that govern their responses of natural hazards.

Table 8.1 shows the additional data types that have to be gathered in order the facilitate the multicriteria analysis. This is Step 1 of the Road Map.

The analysis that precedes the collection of all the data and analyses for preparing the Road Map, the selection of the strategy and the detailed consultations that are required before evolving the investment plan would take a long period of time.

In the selection of possible interventions, meetings were held with the Blue Gold project and two World Bank TA projects on coastal resilience and innovative interventions, in order to use the experiences from these projects. In collaboration with the Blue Gold project the idea of “collaborative design workshops” was proposed. It is proposed to have a test, or pilot, activity with this approach for polder 29. This in order to assess the potential of this approach, especially for the measures within the polder for solutions for change in farming system, TRM and water logging. The approach would also allow for the identification of suggestions for improved polder operation and management activities in which local water management groups could take part.

The polder development plan, once developed, must be subjected to several rounds of consultation with representative groups of stakeholder and finalised thereafter, before the preparation of the Investment Plan.

Table 8. 1: Indicators for Polder Data Description

1. SI No
2. <b>Polder description</b>
3. Polder No
4. Type of Dyke
5. Location of the Polder (Upazila)
6. District (Zila)
7. Gross Area of the Polder (HA)
8. Embankment Length (Km)
9. Land use
10. Population
11. Accessebility

12. Production value
<b>13. Problem identification</b>
14. Breach of Embankment (Km)
15. Erosion (Km)
16. Requirement of BPW (Km)
17. Location in the Risk Zone
18. Drainage Congestion (Ha)
19. Salinisation
20. Subsidence
21. Sedimentation
22. Climate change
23. Flood probability
24. Flood risk
25. Cyclone probability/risk
26. Water quality
27. Security
28. Environment
29. Socio-economic situation
30. FSR/lively hoods
<b>31. Opportunities</b>
32. Innovations
33. Polder management
34. Raising of polder level
35. Land reclamation
36. Urban development potential
37. Co-financing
<b>38. Implementation</b>
39. Opinion of Stakeholder
40. Rehabilitation Cost (Core BDT)
41. Economic feasibility

42. Climate change component
43. Compliance to BDP goals
44. Compliance to SDGs
45. Resource efficiency
46. Flexible
47. Robust
48. NBS vs Grey infra
49. Transfer of problems
50. Resilience
51. O&M
52. Special Criterion
53. Remarks

## 8.2 Investment Plan for the Entire CEIP

The work on Investment Plan has not progressed during this quarter as this activity is dependent on input from the other components which were forced to stop due to insufficient home time allocation.