



BANGLADESH WATER DEVELOPMENT BOARD

New Member of Sentinel Asia

Presented by

A M Mustofa Sorwar
Superintending Engineer

Central GIS Directorate
Bangladesh Water Development Board (BWDB)

Sentinel Asia Membership



Sentinel Asia

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News

2023-05-12

Bangladesh Water Development Board (BWDB) became a member of Sentinel Asia (May 2023)



Brief History of BWDB

After two consecutive catastrophic floods in 1954 & 1955, **Krug Mission** was appointed in 1957 with UNDP support

As per Krug Mission recommendations **EPWAPDA (East Pakistan Water & Power Development Authority)** was established in 1959

After the independence of Bangladesh (1971), Water Wing was separated from Power Wing and BWDB was born under Presidential Order in 1972.

Reformed under BWDB Act 2000, since then BWDB managed by Governing Council (GC) with thirteen Members headed by the Minister, Ministry of water Resources



New Building
(Pani Bhaban)



Vision of BWDB

Vision

- Sustainable development of water resources in Bangladesh through participatory water management,
- Protection of people's lives and property through **water related disaster management**
- Improvement of socio-economic condition of the people by ensuring food security through development of irrigation system.



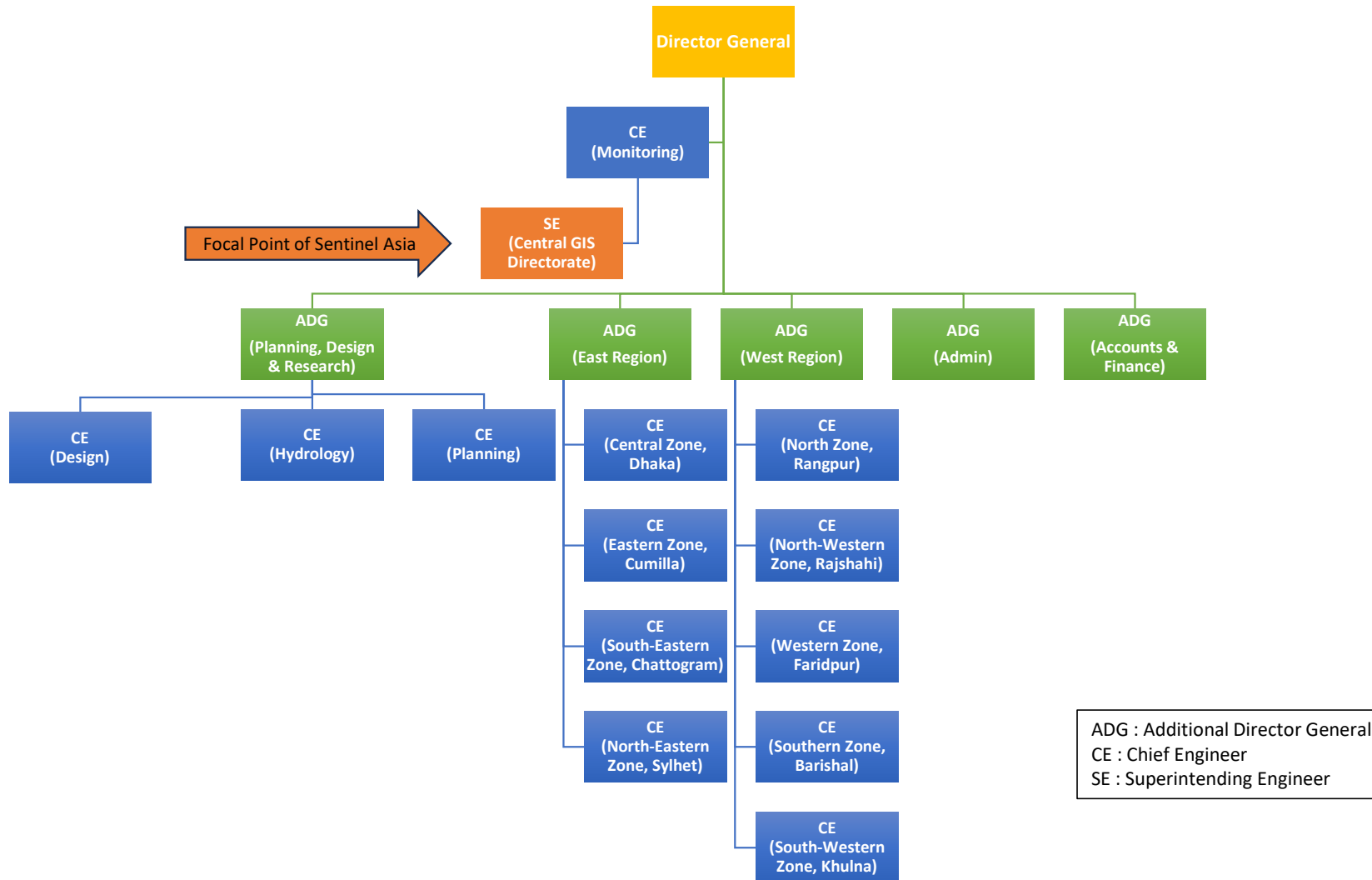
Mission of BWDB

Mission

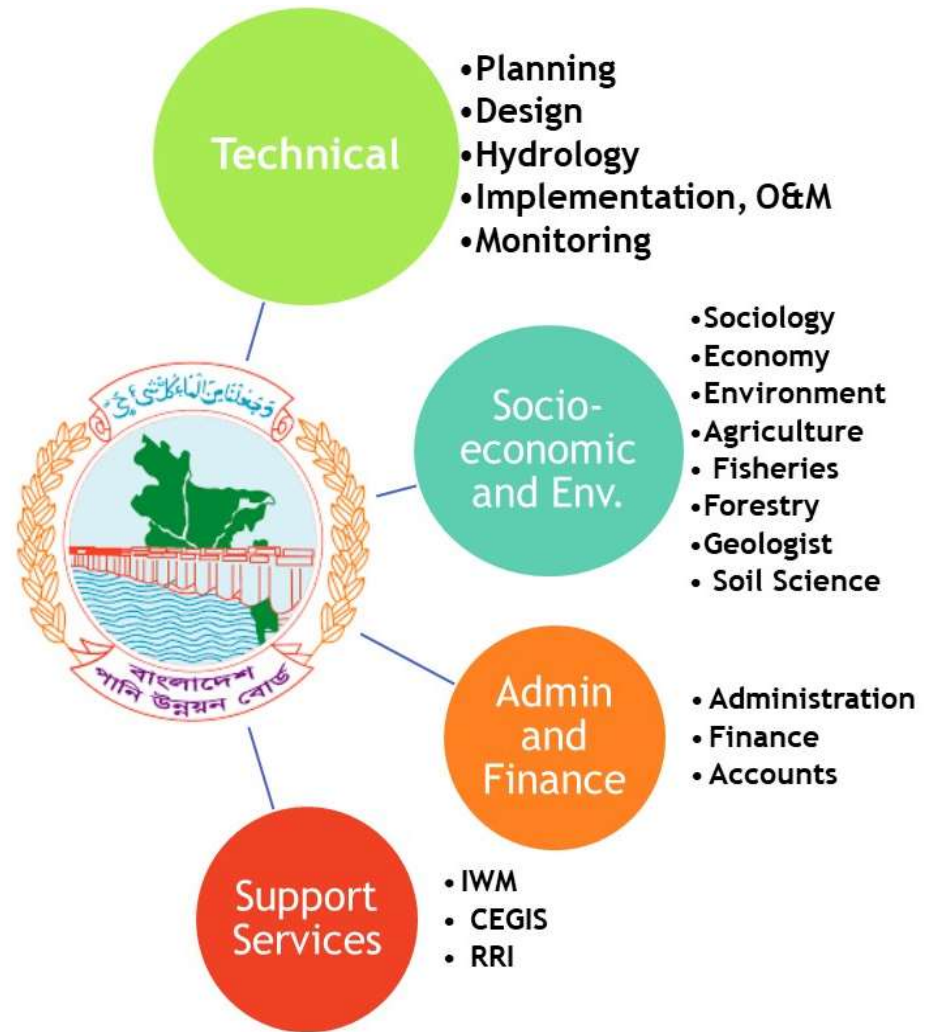
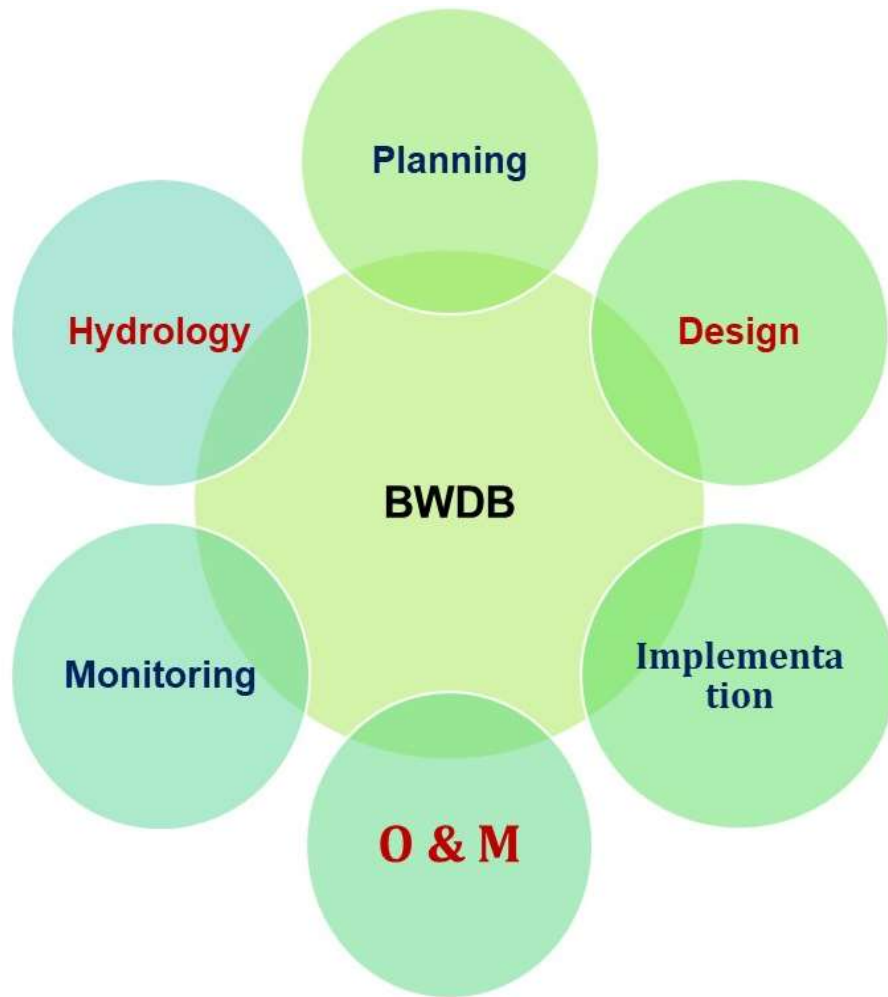
- Flood control under strategic planning,
- Development of drainage and irrigation systems
- Food security & alleviation of poverty
- Prevention of river erosion,
- Addressing salinity intrusion problem
- Land reclamation
- Management of water related disasters
- Addressing the adverse effects of climate change in line with integrated coastal management;
- Increasing public engagement through people's participation in integrated water resource management.



Organogram of BWDB



BWDB : A unique multidisciplinary organization



Overview of water related disasters in Bangladesh

- Most of the disasters are water related such as **Floods**, Tropical **Cyclones**, Storm Surge, **River Bank Erosion**, Drought, **Salinity Intrusion** etc.
- The floods have caused devastation in Bangladesh in 1987, 1988, 1998, 2007 etc. and Cyclones occurred in 1970, 1991, 2007, 2009 etc.
- River bank erosion is an endemic and recurrent natural hazard in Bangladesh.

Floods: four types :

- i. Flash Flood ii. Rain-fed Flood iii. River Flood iv. Flood due to Cyclonic Storm Surges

Cyclones: Hit the coastal regions of Bangladesh almost every year, in early summer (April-May) or late rainy season (October-November).

River Bank Erosion: Ganges, Brahmaputra and Meghna are sluggish and meander or braid. These rivers undergo massive riverbank erosion.



Social condition of Bangladesh

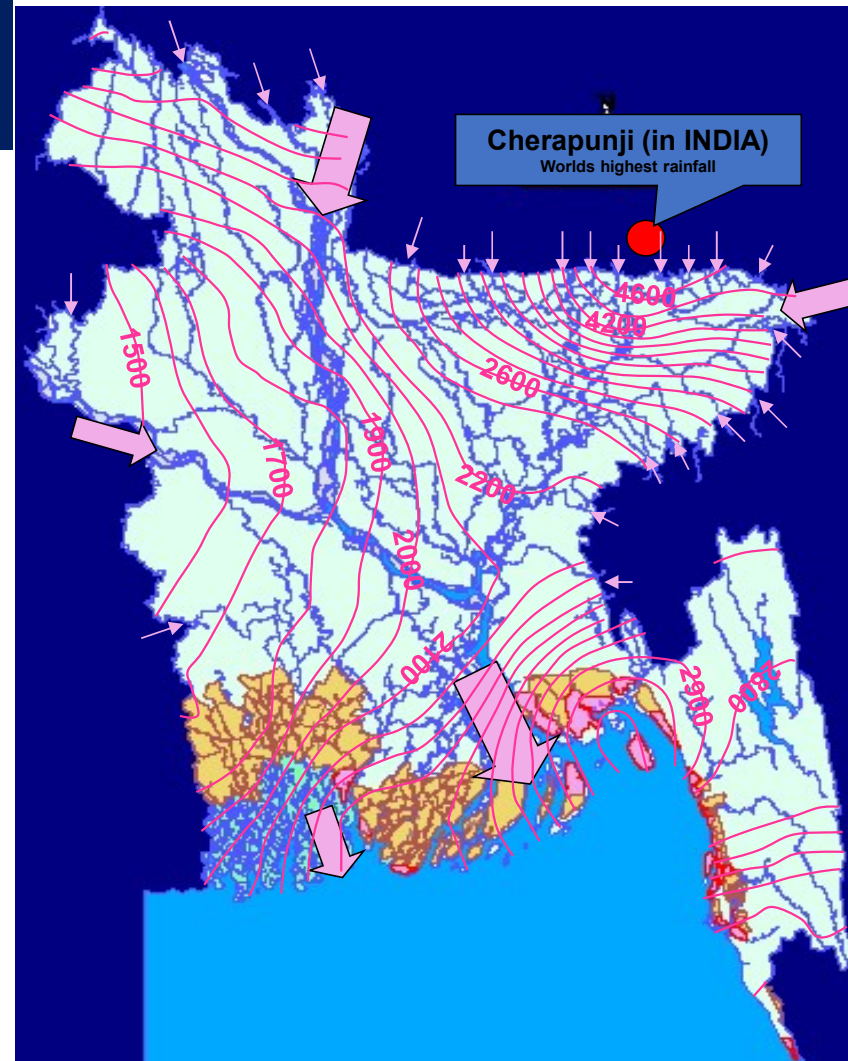
Population

- One of the most densely populated countries in the world with 1305 living per square Kilometre.
- Bangladesh population has reached 169.8 million in 2022.

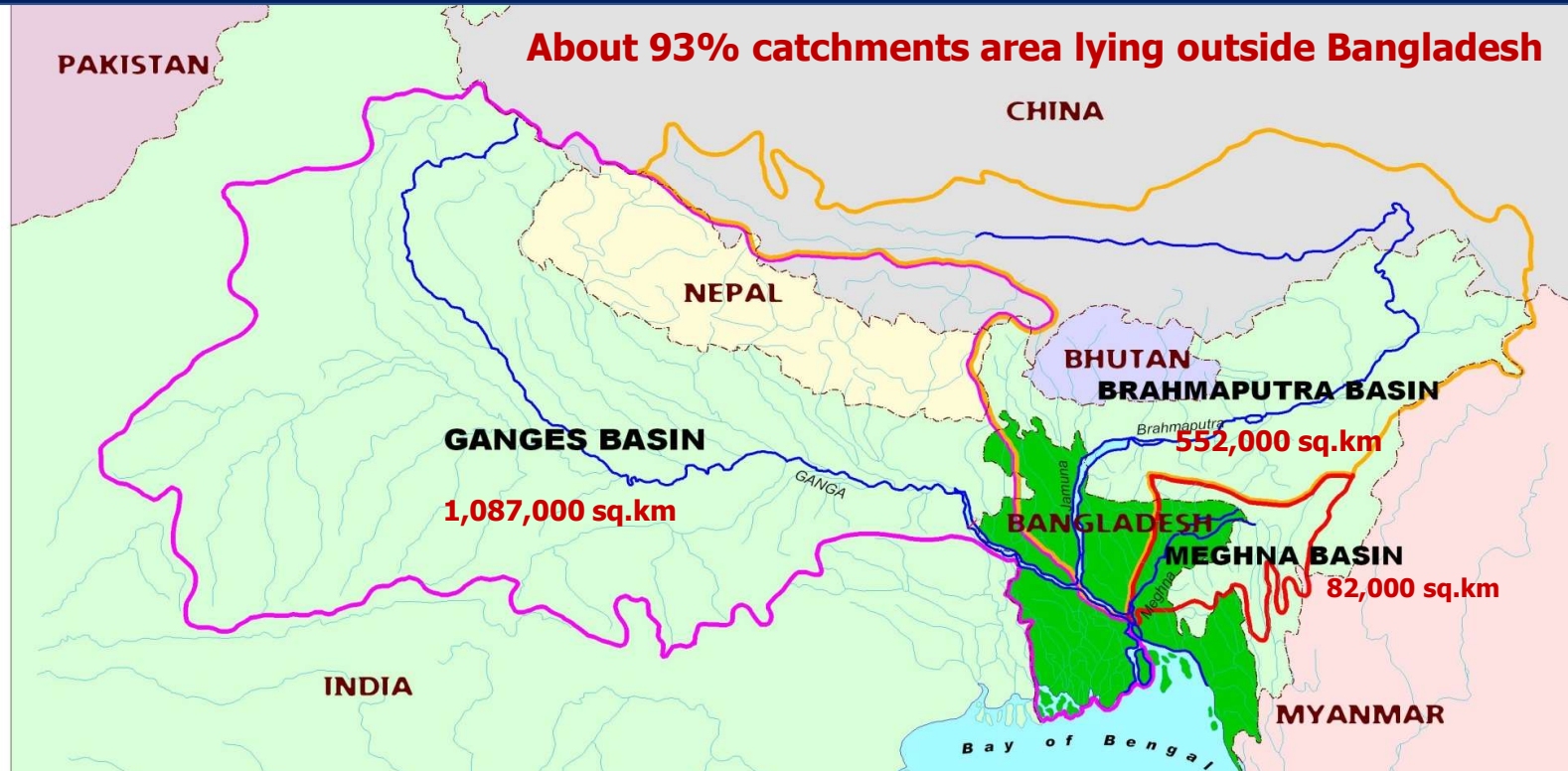


A riverine country with about 405 rivers

- Total river length : 24,000 km
- Annual Ave. Rainfall: 1200mm in NW to 5500mm in NE
- Trans-boundary rivers : 57 nos. (54 from India and 3 from Myanmar)
- Lower riparian to all trans-boundary Rivers



Catchment Area of Major Rivers



Flow

The Ganges:	1,000 ~ 80,000 cumec
The Brahmaputra:	2,400 ~ 102,000 cumec
The Meghna:	500 ~ 30,000 cumec

➤ Annual Sediment Transport

❑ The Ganges:	286 Mtons
❑ The Brahmaputra:	600 Mtons
❑ The Meghna:	1 Mtons

Total estimated sediment load 1.00 ~ 1.10 BMT

Catchment of main three rivers only 7% lies within Bangladesh

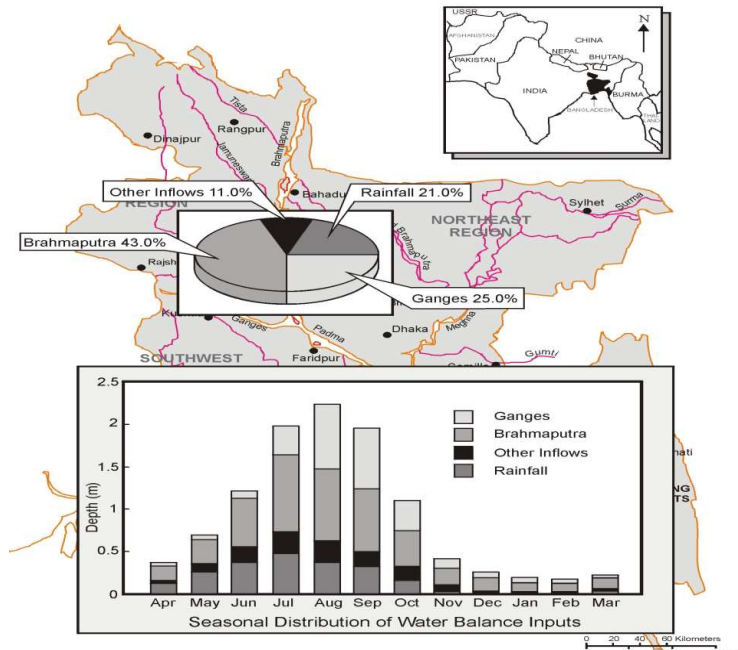
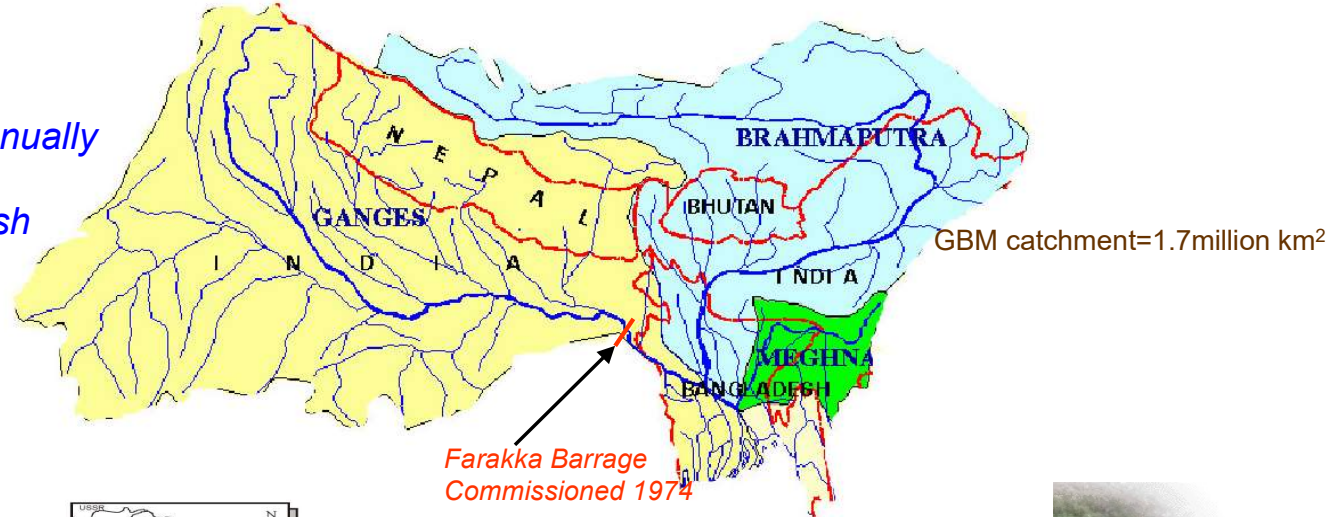


Physical Setting of Bangladesh

About 1350 BCM flow generated Annually

93% flow passes through Bangladesh

80% in five months of monsoon

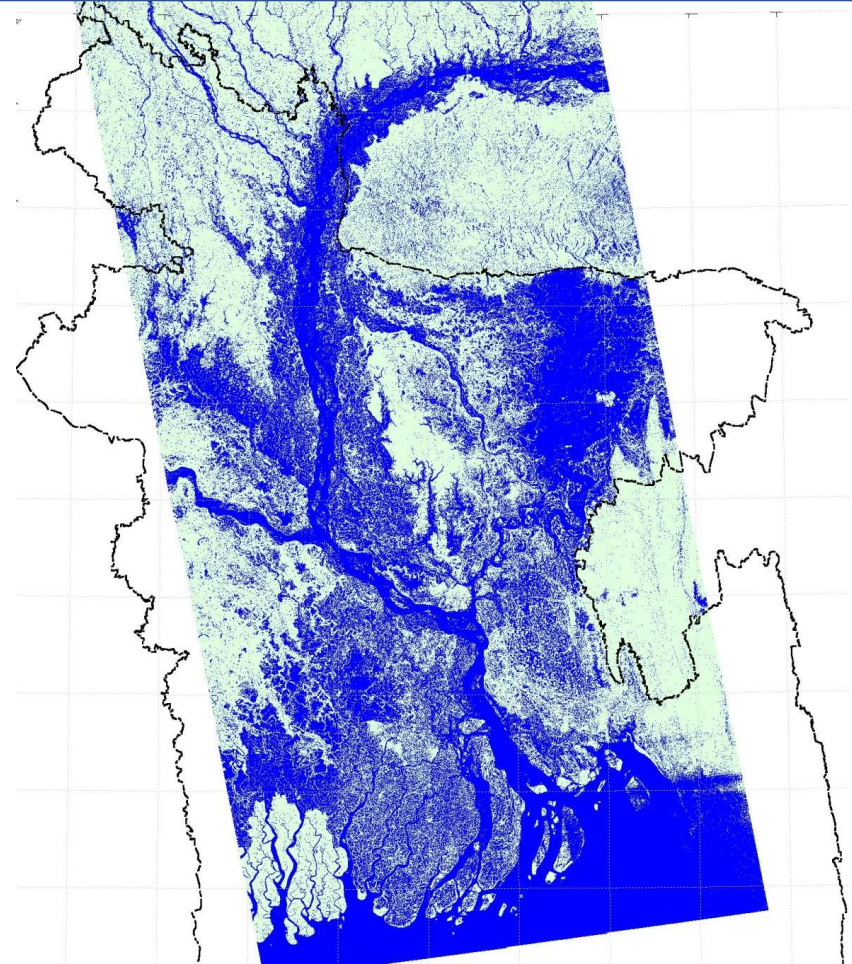


Too much water



Floods in Bangladesh

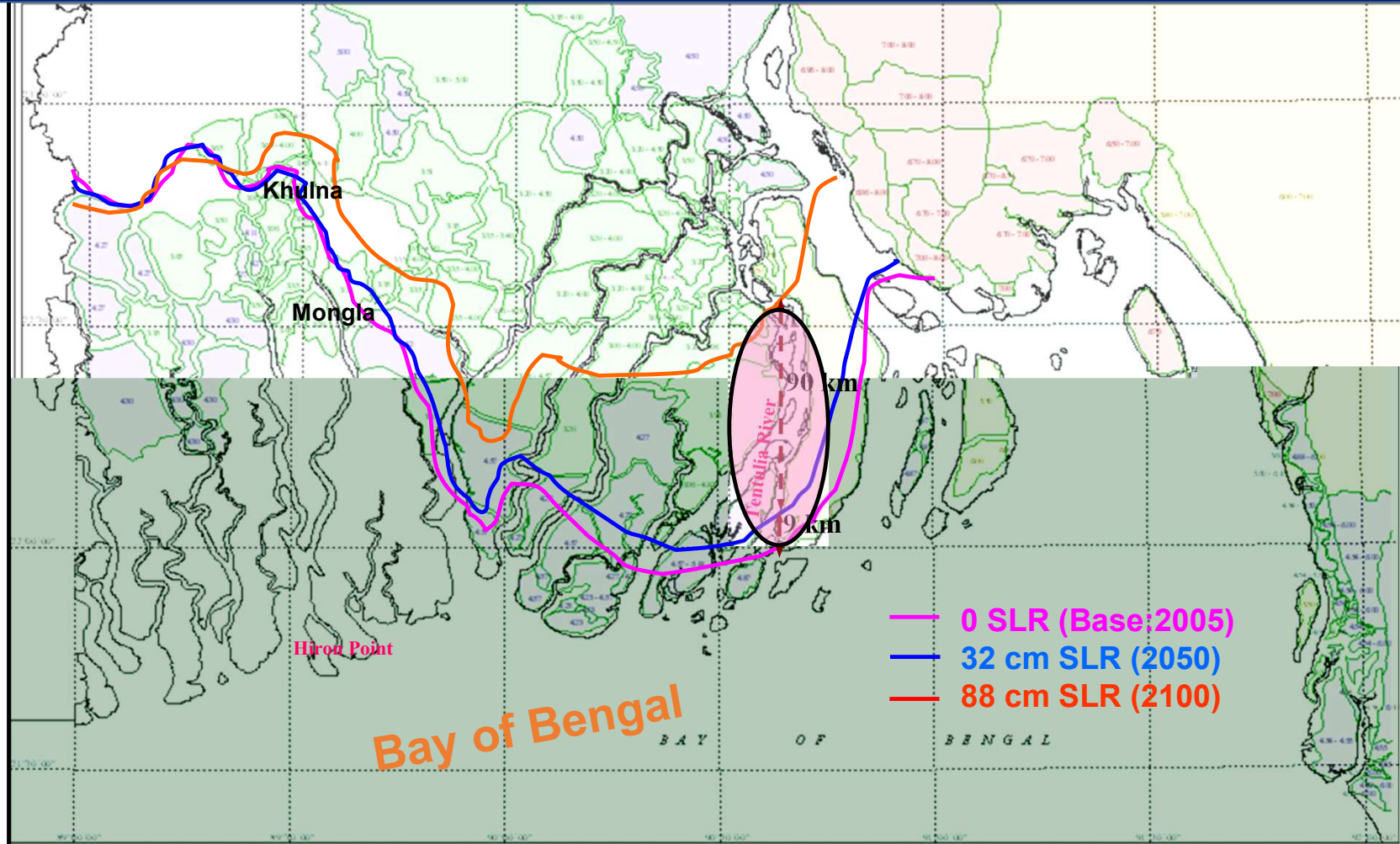
- Large area on the floodplains in the major rivers of Bangladesh is flooded during the wet season.
- Every year about 20 % of the cultivable area is inundated more than one meter about 4 to 6 months period
- Situation deteriorates during floods of higher magnitude
 - Catastrophic floods: 1987,1988, 1998, 2004
 - Casualties in 1998 floods
 - *Over 60% area inundated*
 - *Over 30 million people affected*
 - *Over 4300 km of roads damaged*
 - *Food grain loss 2.2 million tons*
 - *270 thousands fish farms washed away*
 - *More than 3000 industries were affected*
- Flooding reduces economical activities and enhances poverty



1998 Flood (Source: SWMC)



Salinity Problem: Climate Change Scenario



Source: IWM



Addressing All These Problems: Two types of interventions Taken by BWDB

- *Structural Measures*
- *Non-Structural Measures*



Structural Interventions

Flood Control, Drainage and Irrigation projects

Coastal embankment, submergible embankment in Haor area

Dredging/re-excavation to increase conveyance

Riverbank Protection

Accelerated Land Reclamation

Prevention from Salinity Intrusion

Surface water retention



Non-structural Interventions

Disaster Management: Flood forecasting and warning

Disaster Management: Flood Extent mapping using RS

Hydrological data collection and survey

Erosion Prediction (planned)

Capacity Development

Mathematical Modelling

Participatory water management



Interventions of BWDB

Flood Control, Drainage and Irrigation

Riverbank Protection

River Dredging

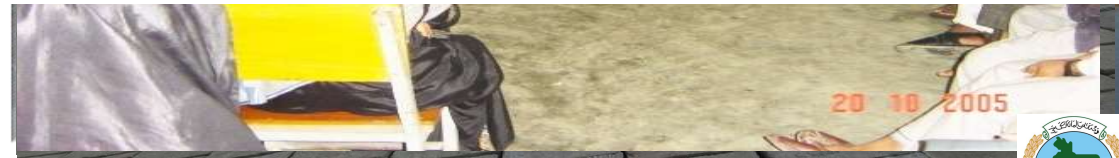
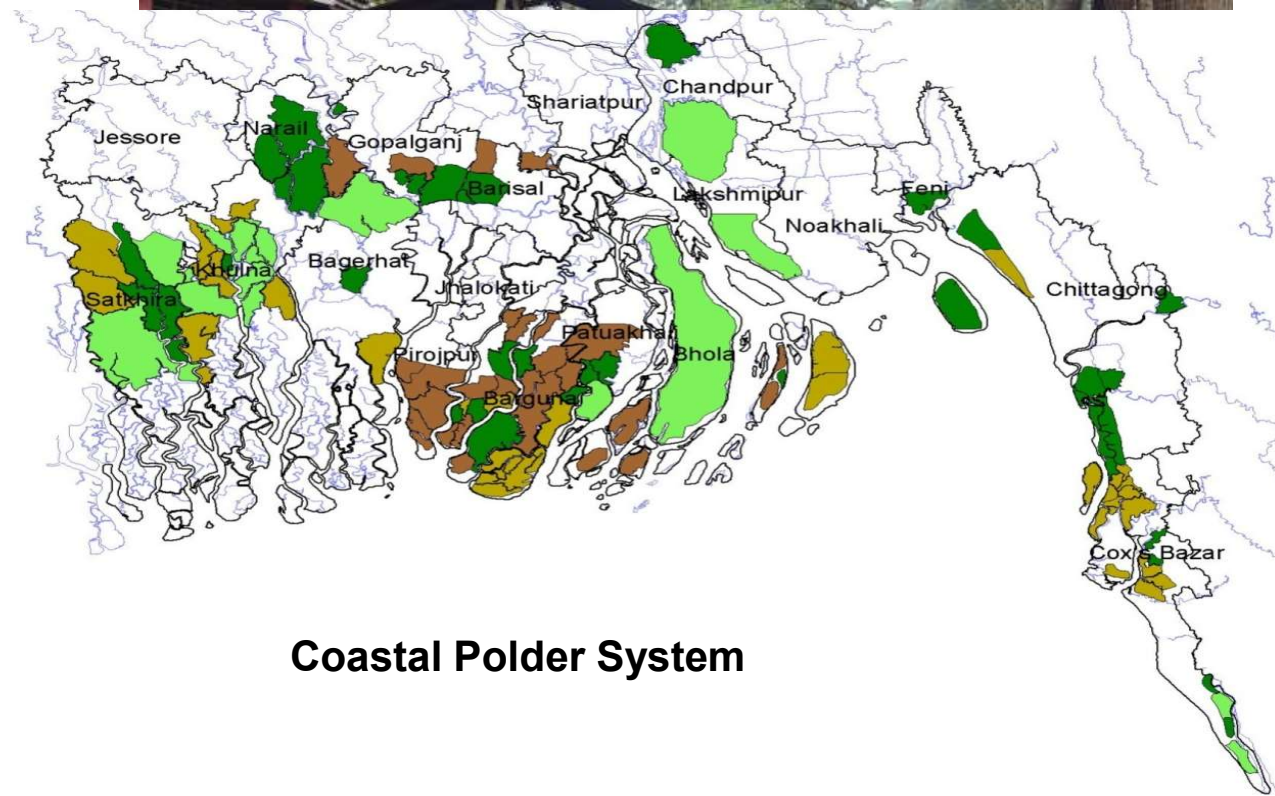
Land Reclamation

Salinity Management

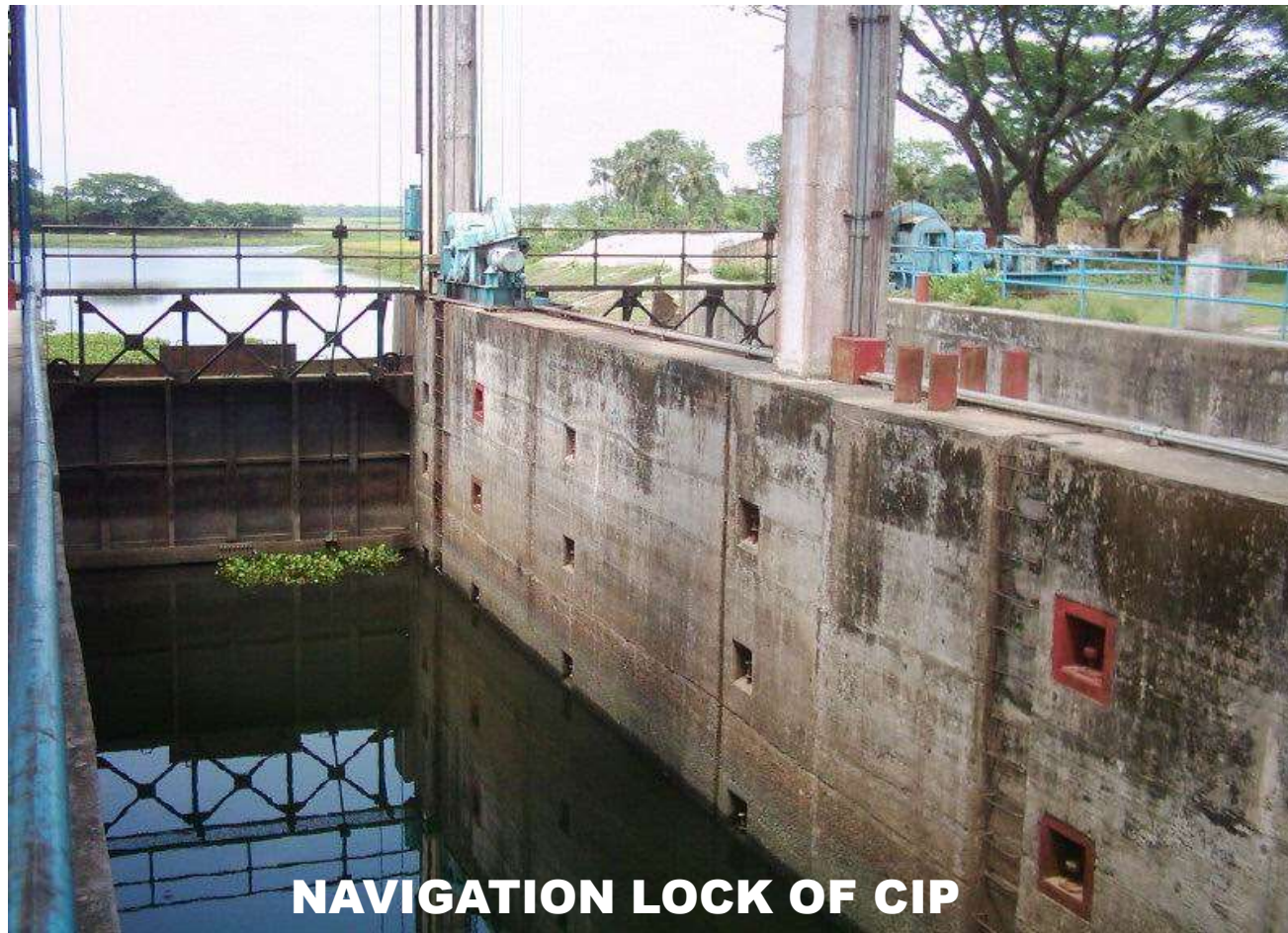
Flood forecasting

Hydrological data collection and study

Integrated Water Resources Management



Structural Measure: Chandpur Irrigation Project (CIP)



NAVIGATION LOCK OF CIP



Structural Measure: Rubber Dam



Major Structural Interventions: till date

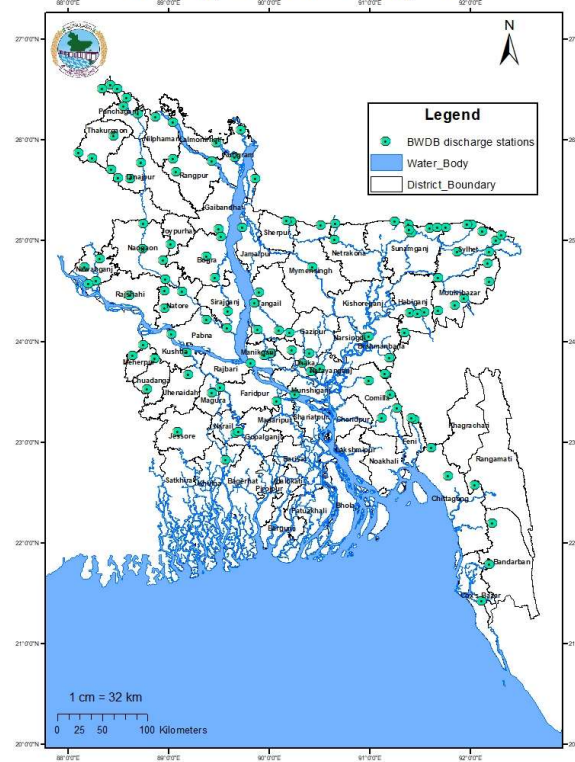
Number of projects implemented	938 Nos.
Area covered by irrigation, flood control and drainage facilities	65.16 lakh hectares
Area covered by irrigation facilities (139 irrigation projects implemented)	16.49 lakh hectares
Barrages (Tista, Manu, Buri Teesta and Tangon)	4 nos.
Land creation/reclamation	1086.62 square km.
District town protected from river erosion	31 nos.
Bank protection works to prevent river bank erosion	1457.24 km.
Spur construction	251
Construction of flood wall	19.224 km.
Length of completed embankment	16528 km.
a) Coastal embankment (139 polders)	5816 km.
b) Submersible embankment (through 99 haor/haor sub-projects)	2728 km.
c) Other flood control embankments	7984 km.
Irrigation canal dikes	3613 km.
Length of irrigation canal	5355 km.
Length of drainage canal	4502 km.
Hydraulic structure	15769 nos.
Number of Pump Houses	23 nos.
Closure	1428 nos.
Bridge/Culvert	5776 nos.
Rubber Dam (Pekua, Mahamaya, Palakata, Kahua, Baggujara)	5 nos.
River reclamation	3081 km.
River dredging	1294 km.



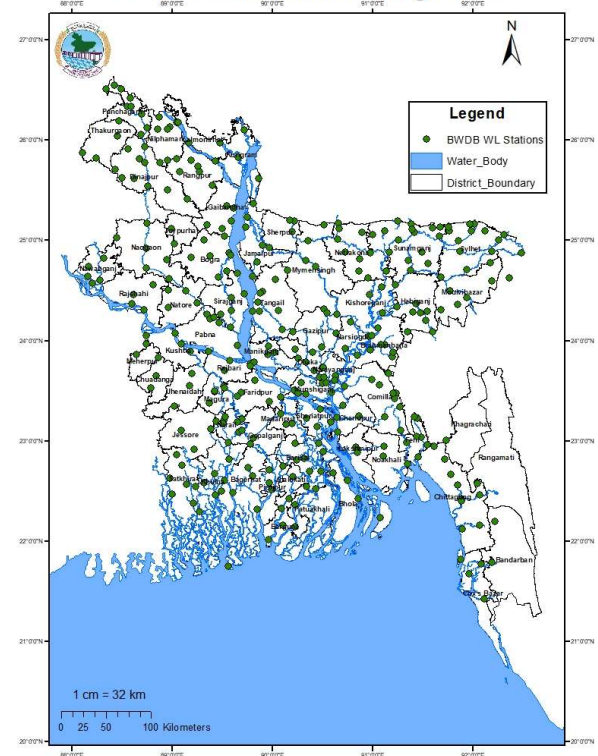
Data Collection: BWDB Measurement Stations

Hydrological stations				
Serial No.	Type of Data	No. of Stations	Frequency of Observations	
1	Water Level	357	Daily 7 times (tidal) Daily 5 times (non-tidal)	
2	Discharge	Non tidal	123	Daily/Weekly/Fortnightly
		tidal	06	Fortnightly
		Semi tidal	07	Dry season
3	Surface Water Quality	83	Monthly	
4	Salinity	Static	100	Daily/Weekly/Fortnightly
		Dynamic	66	Once in a year
5	Sediment	20	Weekly/Fortnightly	
6	Rainfall	274	Daily	
7	Metrological	2	Daily	
8	Evaporation	39	Daily	

Discharge Stations of Bangladesh



Water Level Stations of Bangladesh

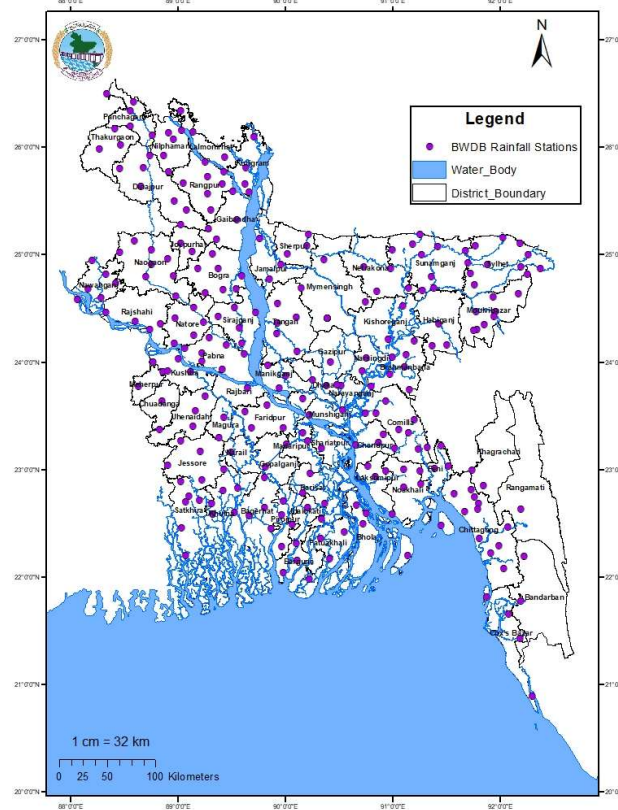


Data Collection: BWDB Measurement Stations

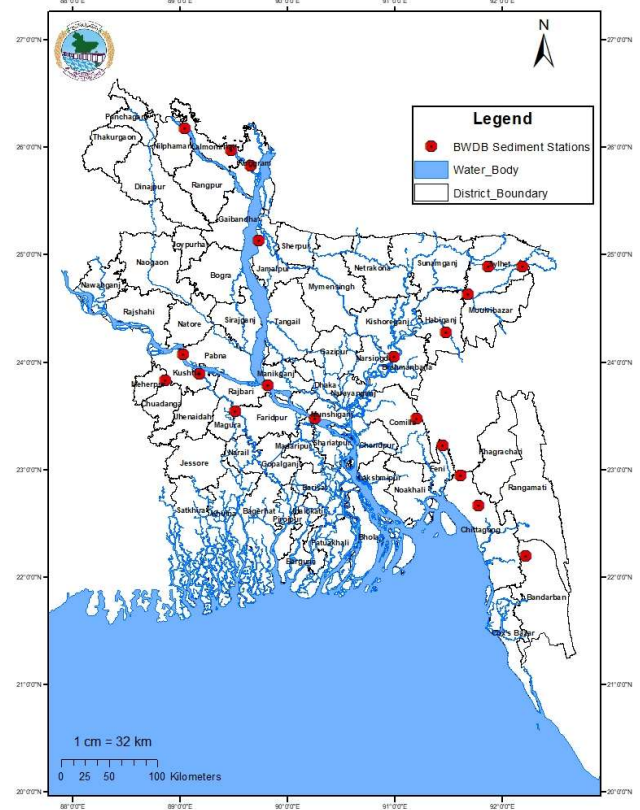
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Rainfall Stations of Bangladesh



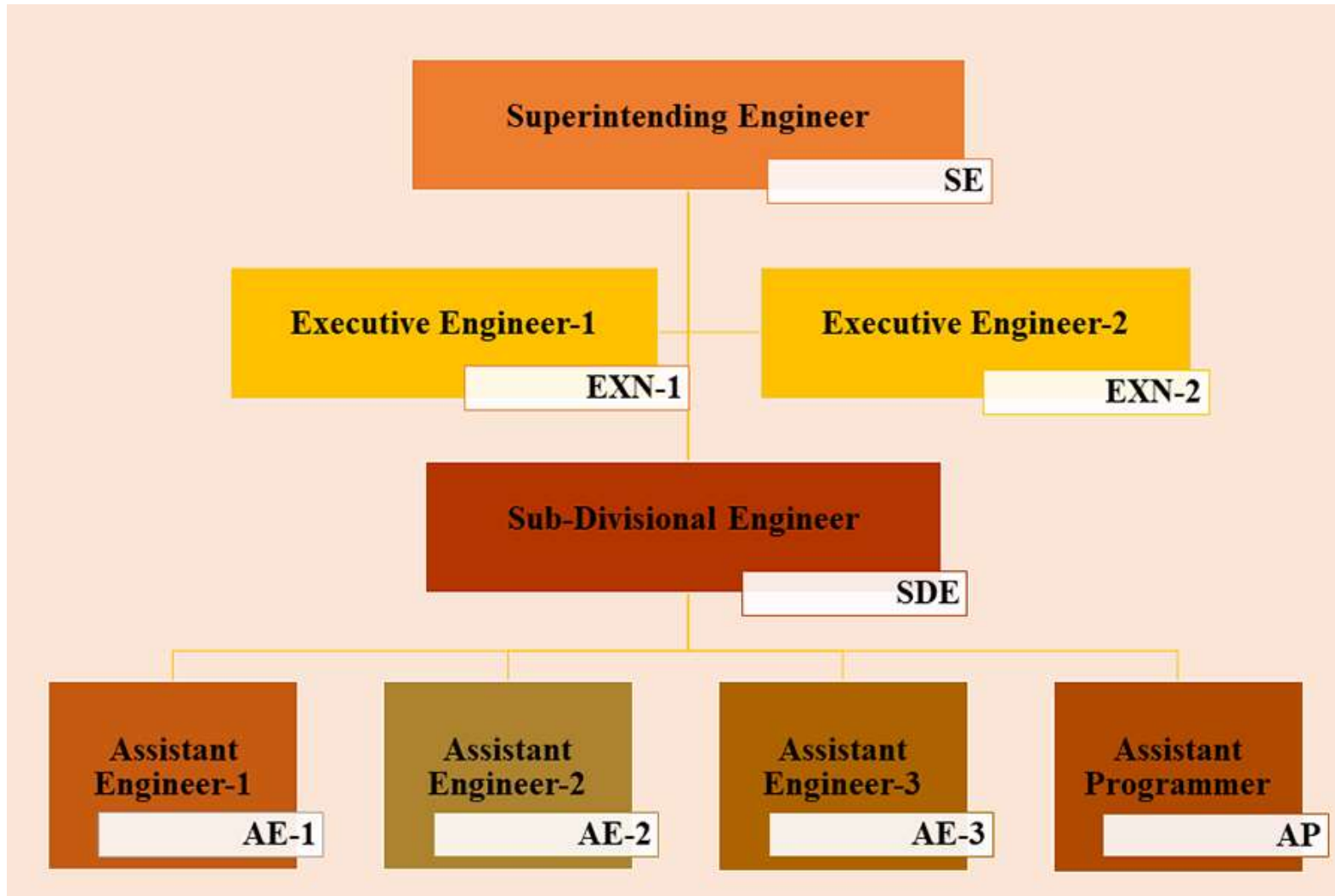
Sediment Stations of Bangladesh



CENTRAL GIS DIRECTORATE
BWDB Focal Point for Sentinel Asia



Organogram of Central GIS Directorate



Hardware and Software

GIS Software

ArcGIS Desktop (Advanced) 10.6.1 (Perpetual License)

ArcGIS Pro (Standard) 2.6 (Perpetual License)

ArcGIS Desktop (Standard) 10.6.1 (Perpetual License)

ArcGIS Enterprise Server 10.6.1 (Perpetual License)

QGIS 3.28 (Free and Open Source Software)

Geoserver 2.18.5 (Free and Open Source Software)



Geospatial Imagery Analysis Software

ENVI 5.5.2 (Perpetual License)



Hydraulic and/or Hydrological Modelling Software

HEC-RAS 6.0 (Free but closed source)

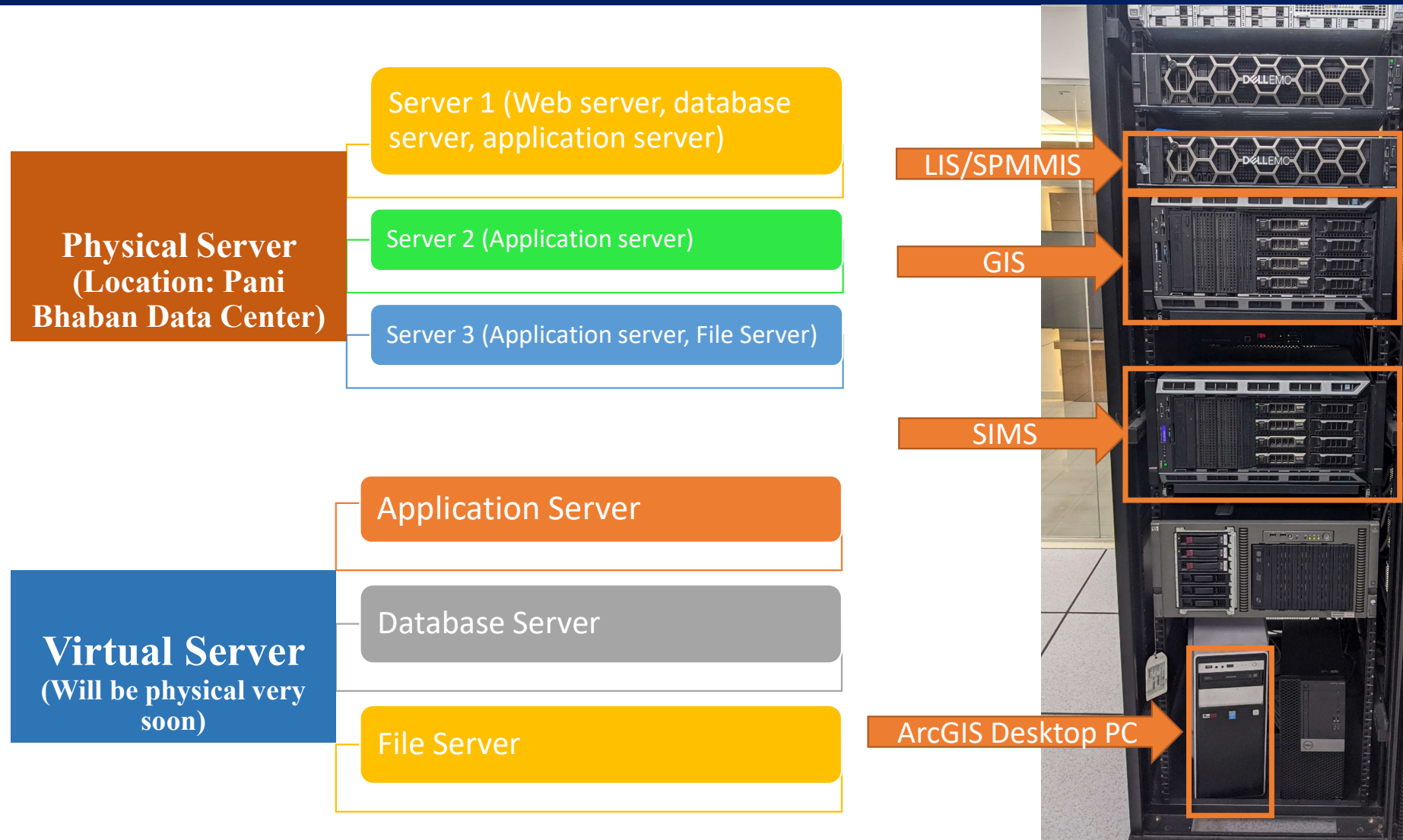
HEC-HMS 4.8 (Free but closed source)

MIKE 11 or MIKE Hydro River (Perpetual License)

MIKE 21c (Perpetual License)



Hardware and Software



Hardware and Software



Field Survey Equipment

RTK Base Setup



Phantom 4 RTK with DRTK-2



Drone Survey



Drone survey of Polder 18-19 in Paikgacha, Khulna, Bangladesh

Functions of Central GIS Directorate



Database &
Inventory

- Project Data (Completed, Current, Up-coming)
- Haor and Wetlands
- Coastal Embankments and Polders



Disaster Impact
Assessment

- Damage assessment due to flood and natural disaster



Morphological
Study from
Remotely
Sensed (RS)
imagery

- Identify the erosion prone areas and vulnerability mapping
- Advise BWDB to undertake dredging and re-excavation activities



GIS Apps and
Mathematical
Models

- Provide advice on preparation of Term of Reference (ToR) for Consultancy Services
- Receive and store GIS applications and Mathematical Models and update according to BWDB needs
- Disseminate through Web-GIS





Database & Inventory

- Project Data (Completed, Current, Up-coming)
- Haor and Wetlands
- Coastal Embankments and Polders

- **GIS Database:** PostgreSQL 13 with PostGIS Extension Enterprise Database
- **Data Center Database:** Oracle 19c with Oracle Spatial
- **Data Specification:** ISO/TC 211 (Technical Committee of Geographic Information/ Geomatics) has standardized the rules of Data Product Specifications (DPS) as **ISO 19131**, (finalized in 2007). National Spatial Data Infrastructure (NSDI) – SOB prepared standards and guidelines.

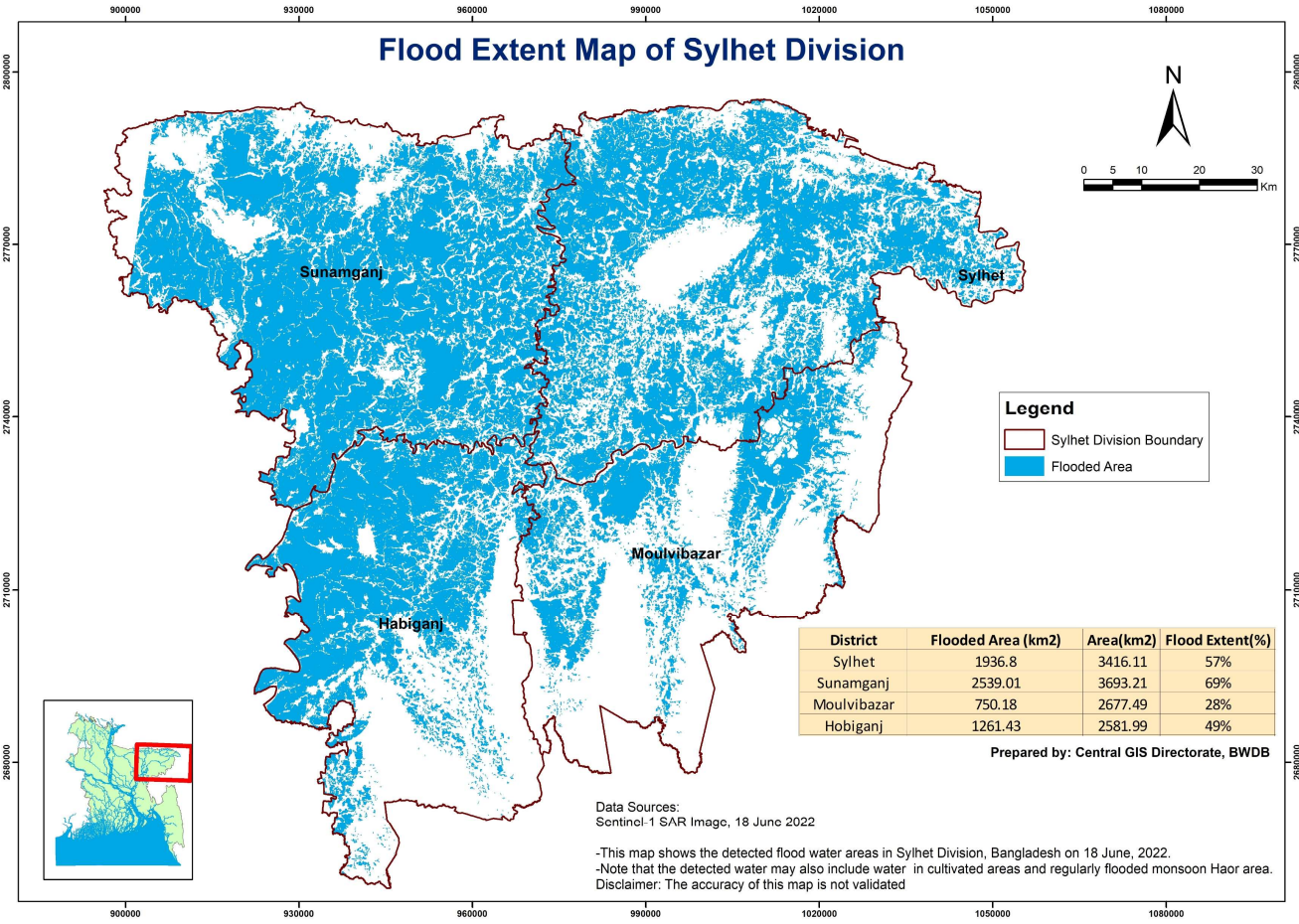
The screenshot displays the pgAdmin 4 web interface. The left sidebar shows the 'Browser' tree with 'Servers (1)' expanded to 'PostgreSQL 13', which contains 'Databases (3)' (postgres, rmmc_sdb, sdb) and 'Login/Group Roles (10)'. The 'Query Editor' is active, showing a query: `SELECT * FROM public.river ORDER BY id ASC`. Below the query editor, the 'Geometry Viewer' shows a map of a region with a blue river and several blue polygons. The map includes labels for 'চনপাড়া' and 'নারায়ণগঞ্জ'.





Disaster Impact Assessment

- Damage assessment due to flood and natural disaster
- Flood event, June 2022: Sylhet Division





Disaster Impact Assessment

- Flood event, June 2022: Sylhet Division



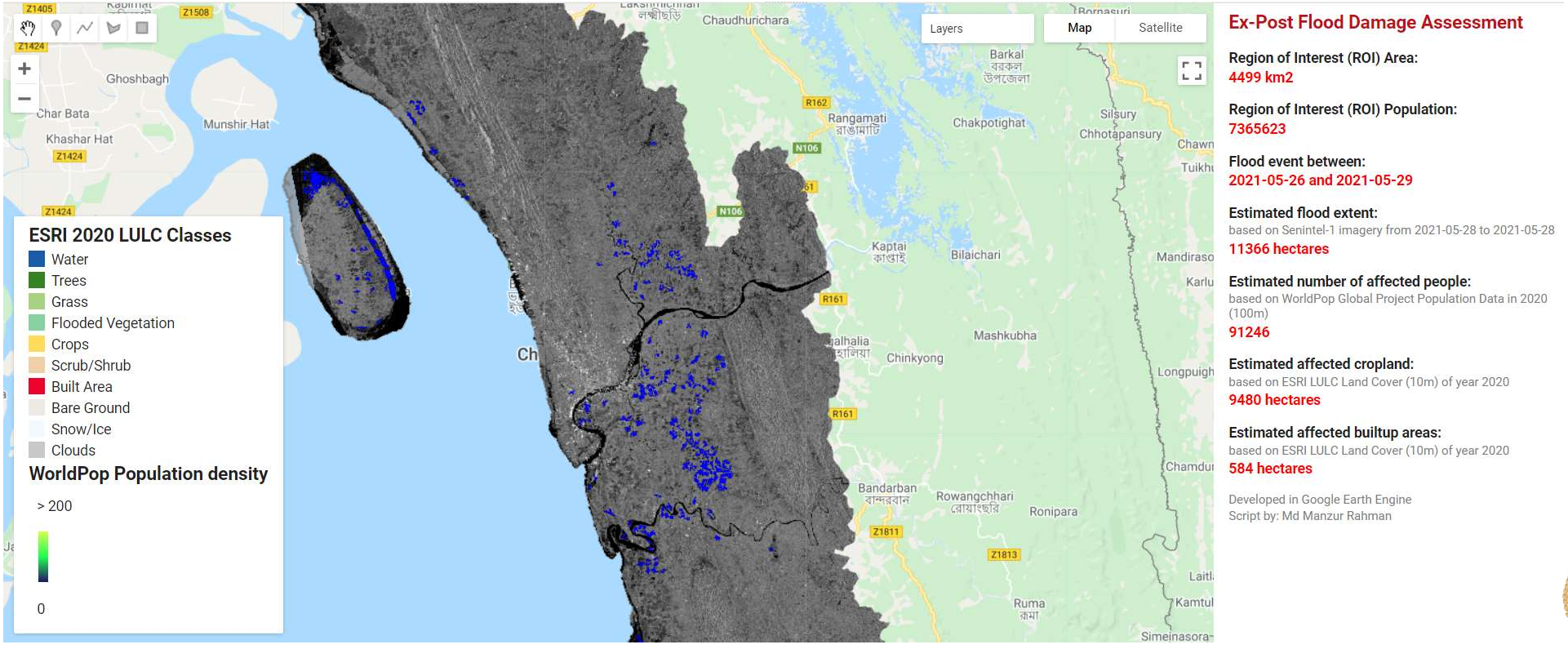


Disaster Impact Assessment

- Damage assessment due to flood and natural disaster

❑ Damage assessment due to flood and natural disaster

- Case study for post-flood damage of Cyclone Yaas on 26th May 2021

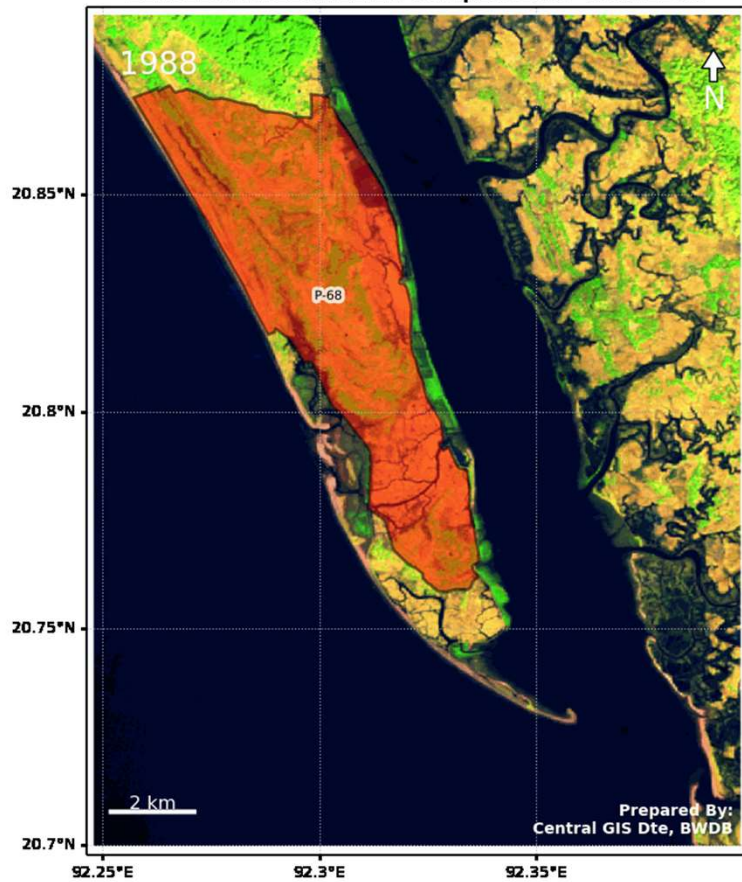




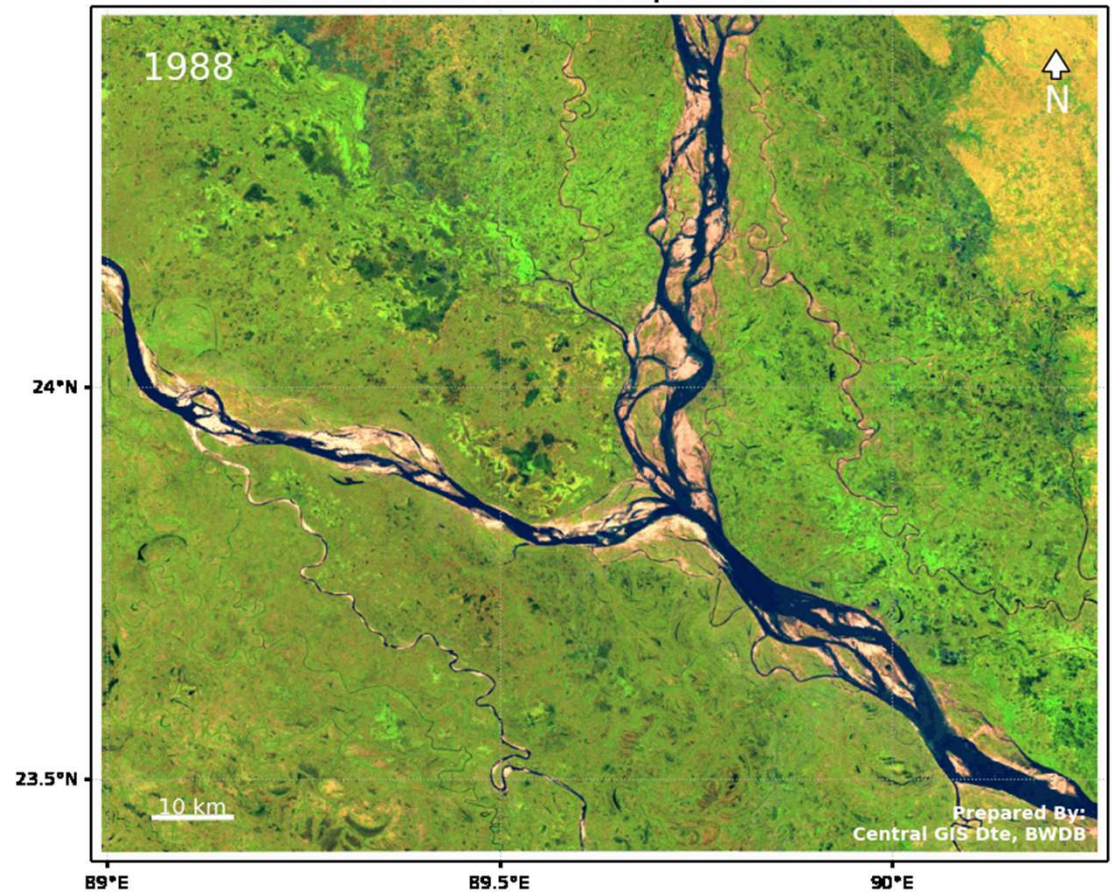
Morphological Study from Remotely Sensed (RS) imagery

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Landsat Annual Median Composite for Year: 1988



Landsat Annual Median Composite for Year: 1988

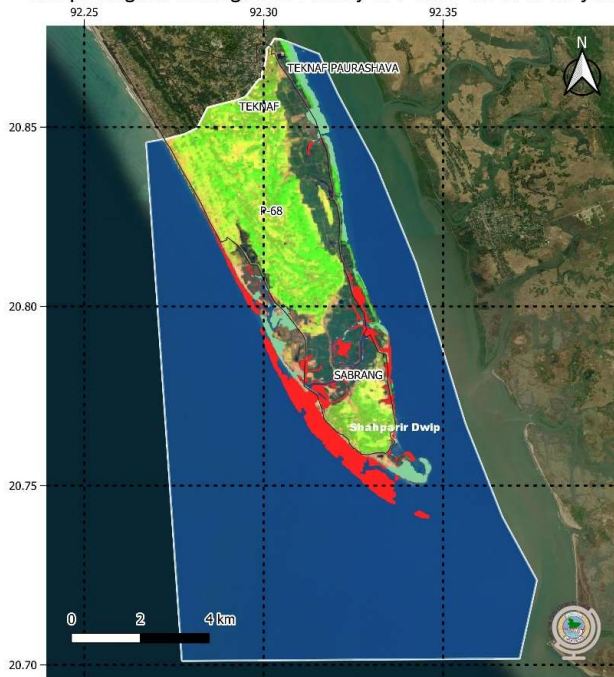




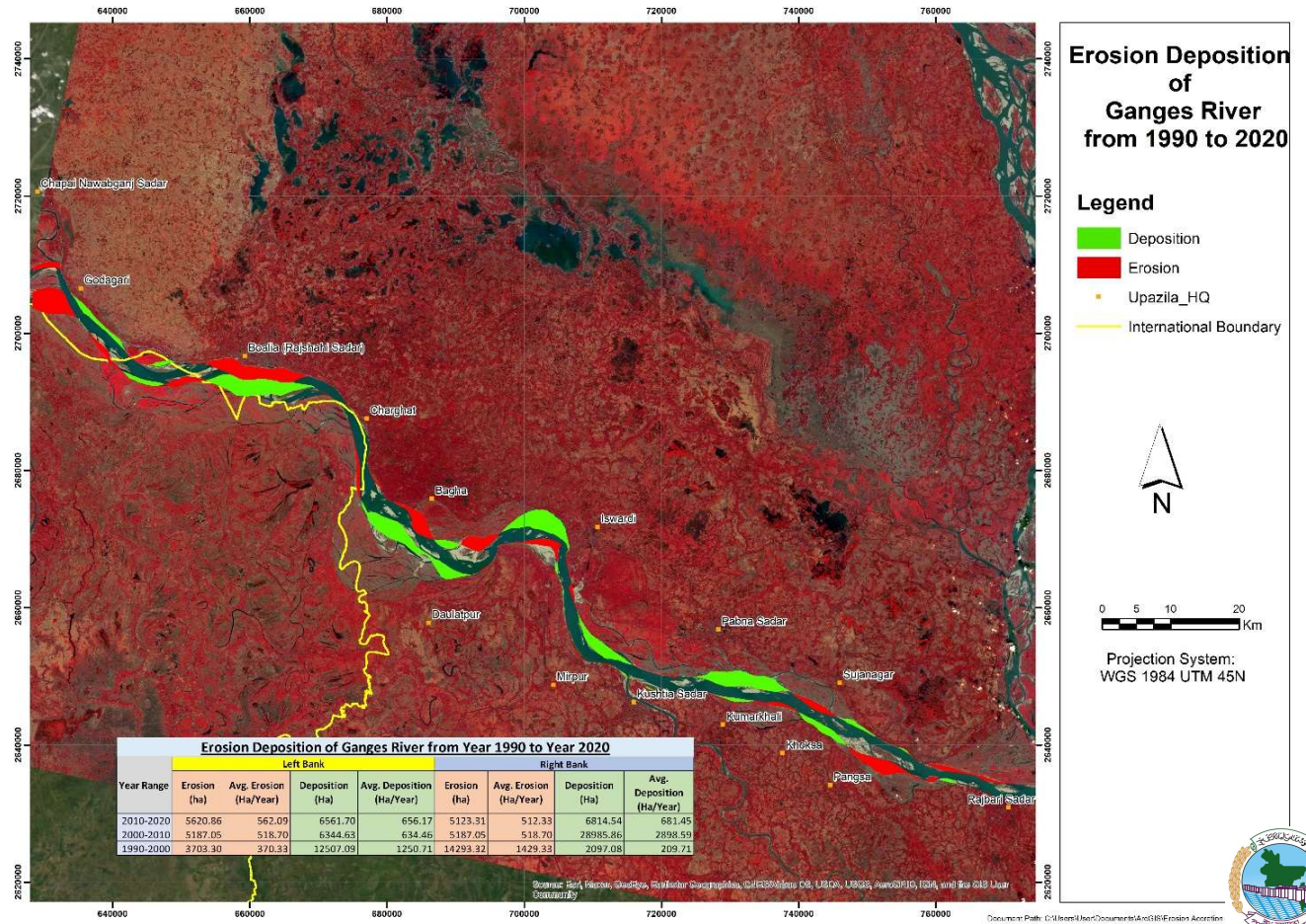
Morphological Study from Remotely Sensed (RS) imagery

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Morphological Changes in Vicinity of Polder 68 over 15 years



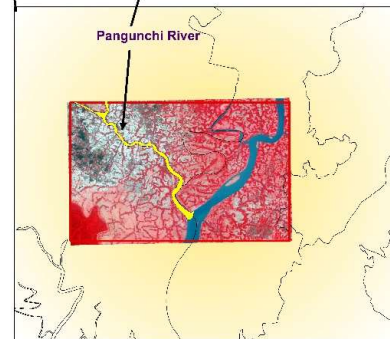
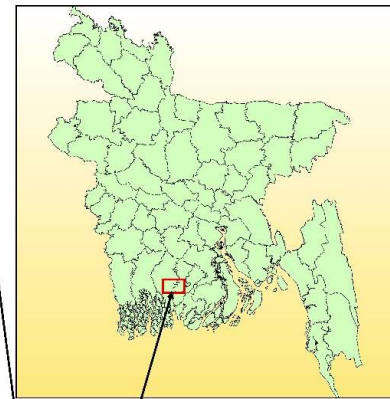
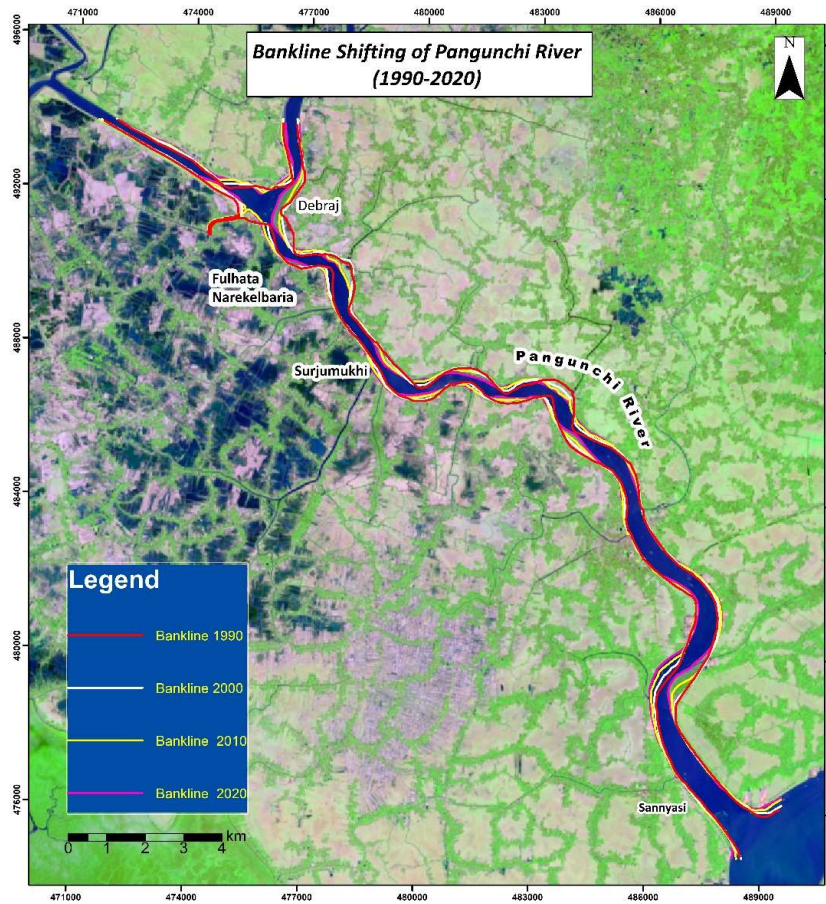
Map Information	Change Detection Study from 2005 to 2020
ROI: Sabrang union, Teknaf Upazilla	Methodology
Basemap: ESRI Satellite	Normalized Difference Water Index with manual threshold value of 0 was used to extract water body around the area from multispectral images. Accretion, Erosion and Unchanged water area were calculated using vector operations.
Geographic Coordinate System: WGS84	Results
Scale: 1:75000	Area of Interest=14637 ha (Enclosed by white boundary; Teknaf Road on north)
Images: Landsat Yearly Median composite 2005 and 2020 cloud masked, surface reflectance value.	Water Area in 2005 = 10573 ha; Land Area in 2005 = 4064 ha
Prepared by: Md Mazzur Rahman, SDE	Water Area in 2020 = 10827 ha; Land Area in 2020 = 3810 ha
Legends	Area of Accretion = 231 ha; Accretion rate = 15.40 ha/yr
<ul style="list-style-type: none"> Eroded Area (485 ha) Accretion (231 ha) Water Body 	Area of Erosion = 485 ha; Erosion rate = 32.33 ha/yr
	Important observations
	Based on the change detection study, seaside of Shahparir Dwip is highly susceptible to erosion. Highly vulnerable condition (Erosion rate is twice as high as deposition)



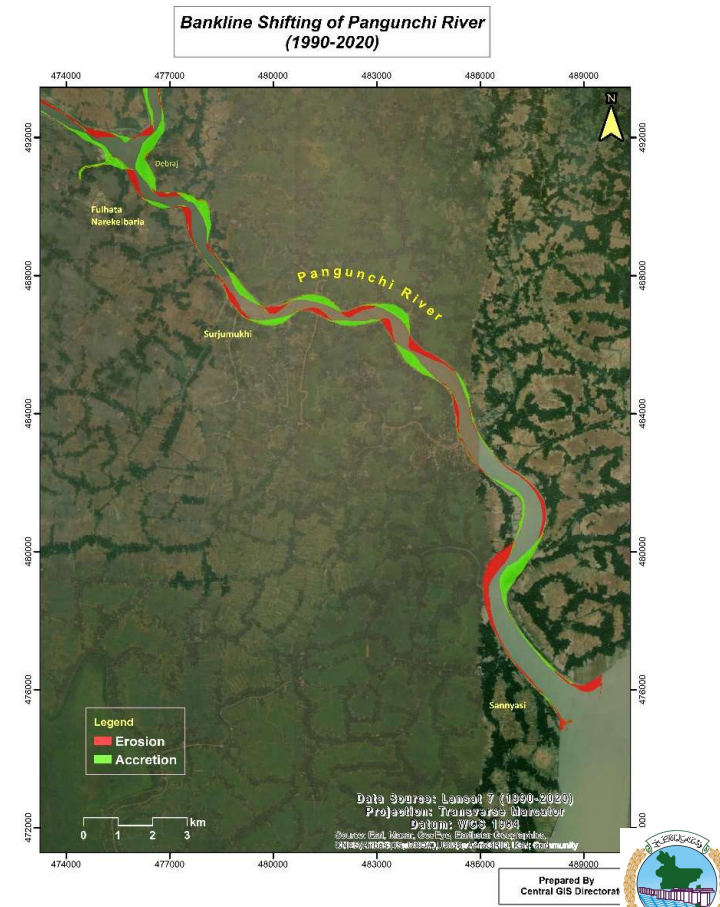


Morphological Study from Remotely Sensed (RS) imagery

- Identify the erosion prone areas and vulnerability mapping
- Advise BWDB to undertake dredging and re-excavation activities



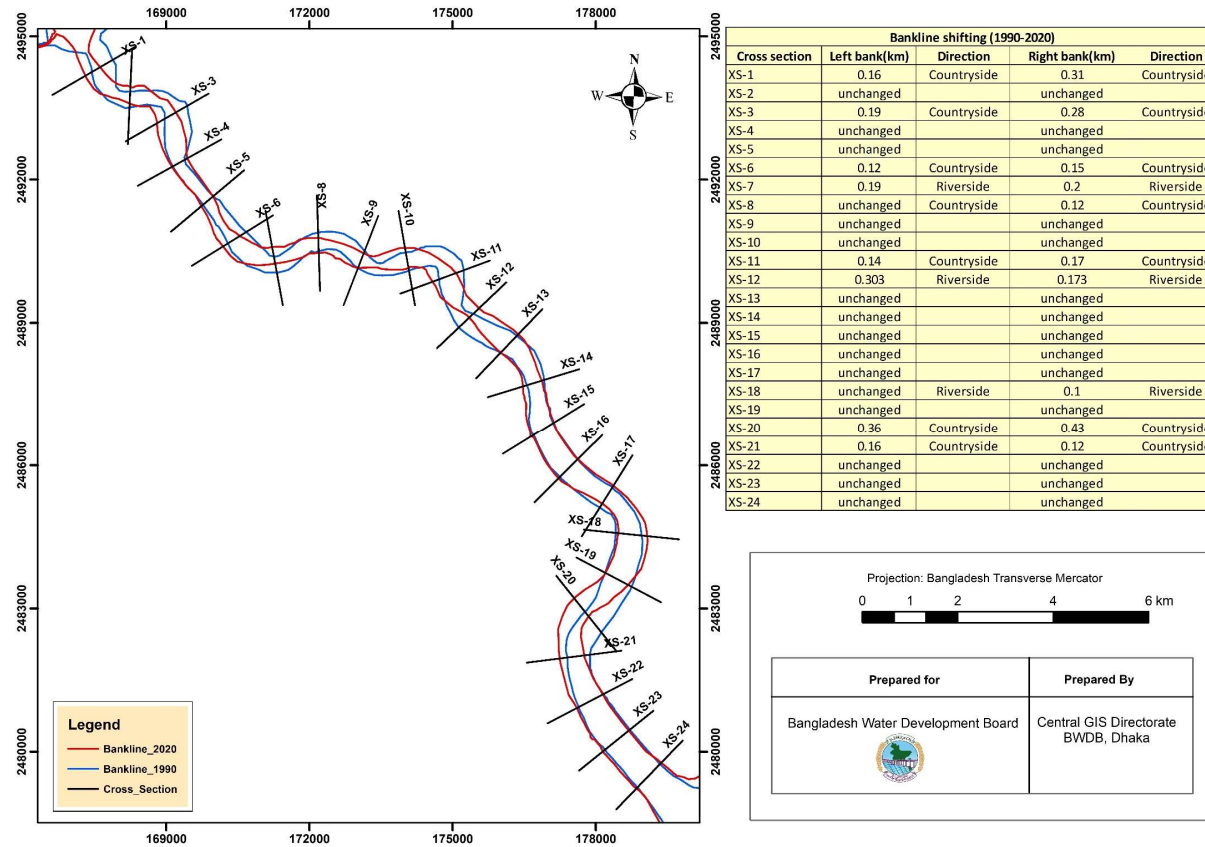
Prepared By
Central GIS Directorate





Morphological Study from Remotely Sensed (RS) imagery

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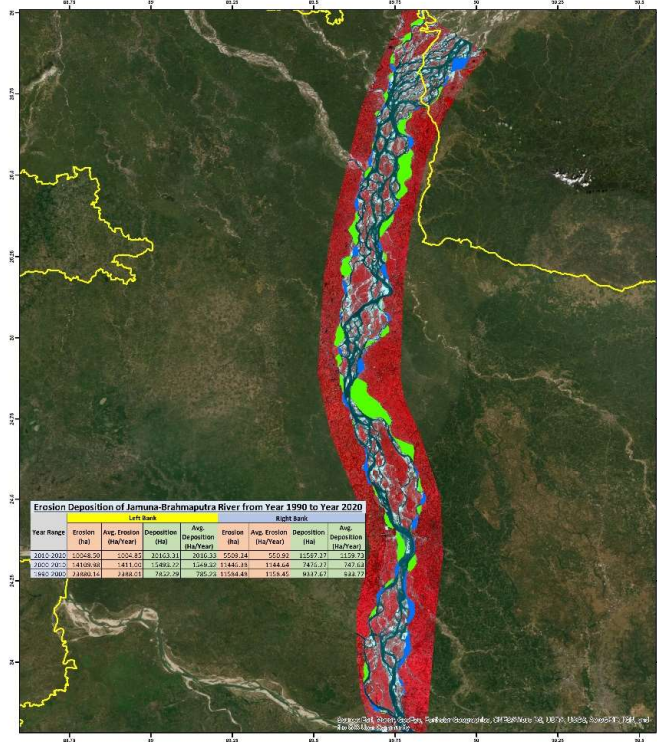
Quantification of Bank Line Shifting at Panguchi River





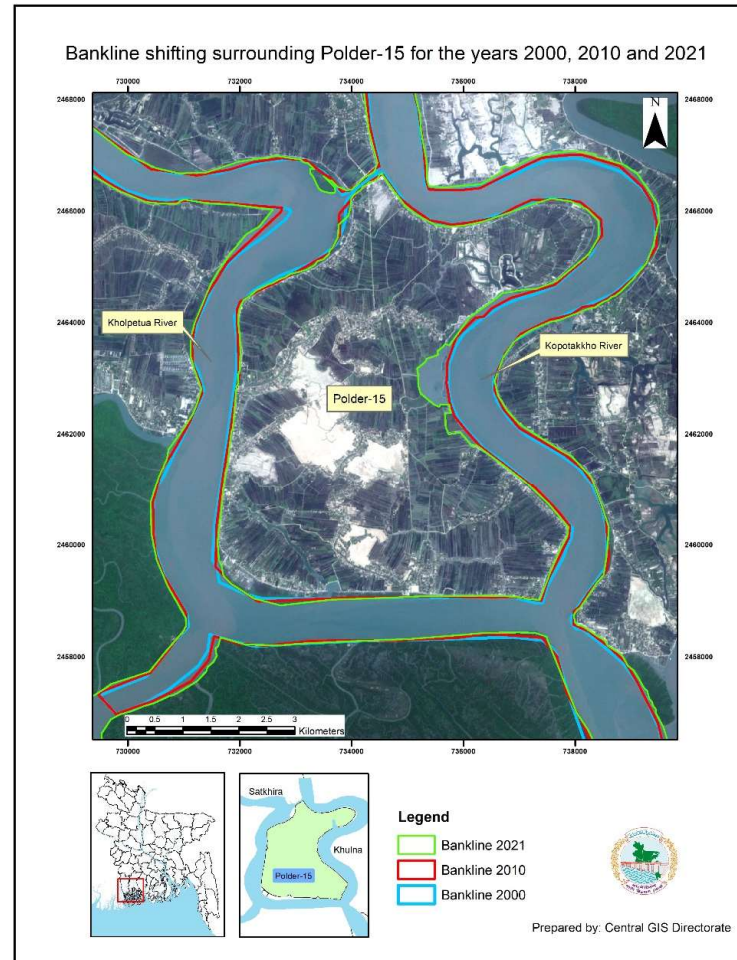
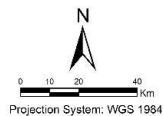
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Erosion Deposition of Jamuna-Brahmaputra River from 2010 to 2020

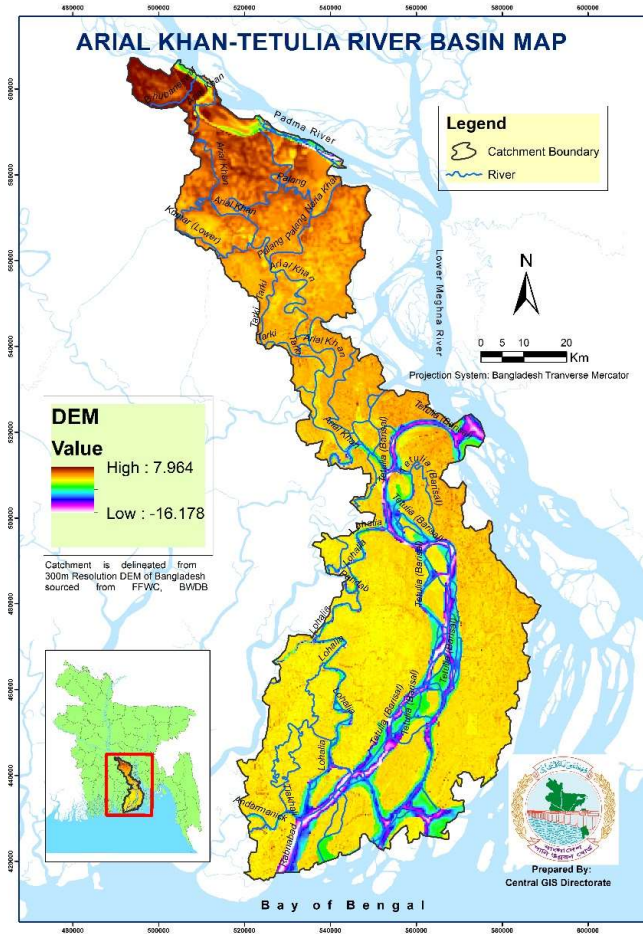
Legend
■ Erosion
■ Deposition
— International Boundary





Catchment Delineation

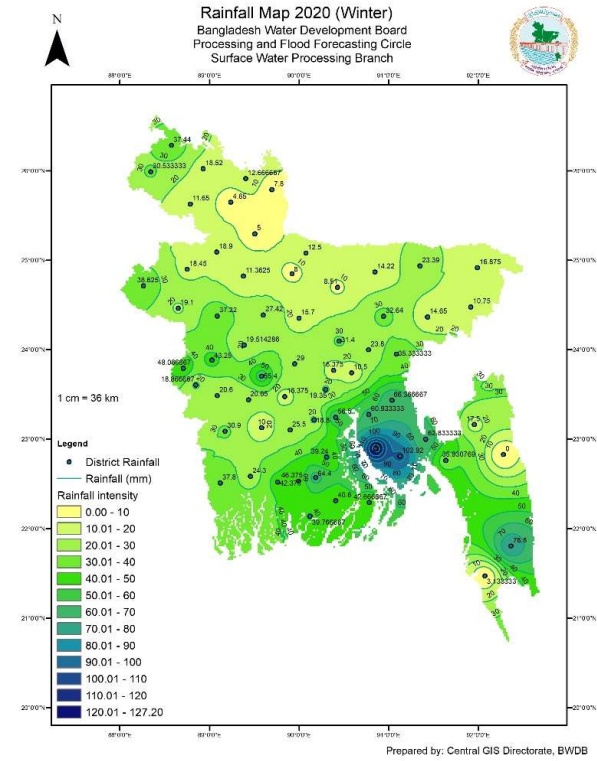
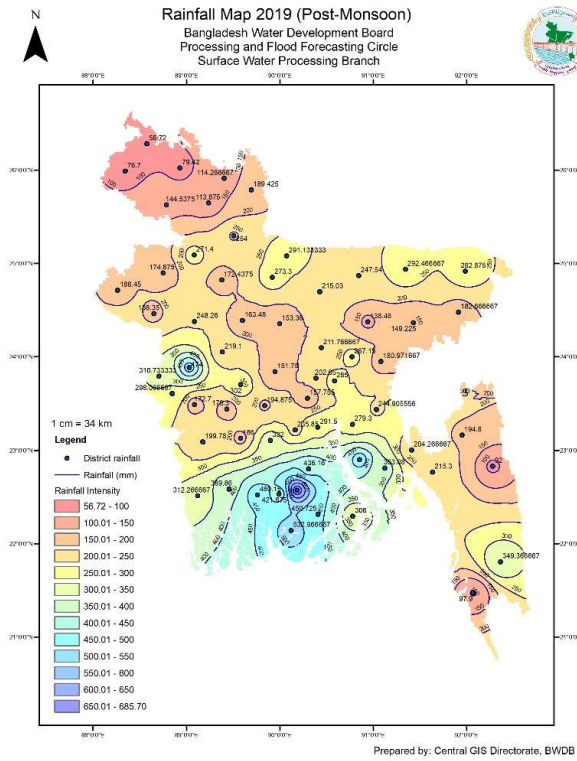
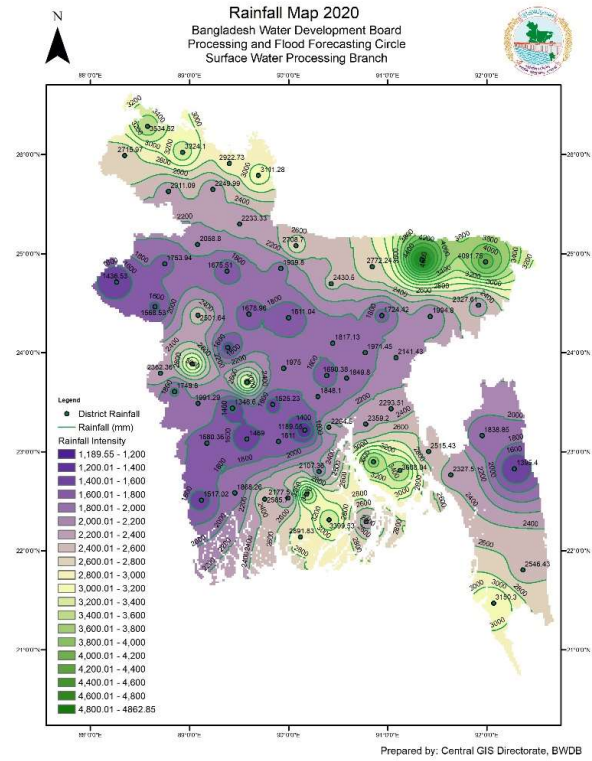
- Catchment Delineation from Digital Elevation Model (DEM)





Hydrological Study

• Rainfall Map





GIS Apps and Mathematical Models

- Receive and store GIS applications and Mathematical Models

SiMS Smart - Scheme Information Management System of BWDB

Home

Legend Basemap Clear Selection

BWDB Boundary

- Zone Boundary
- Circle Boundary
- Division Boundary

Admin Boundary

- BD Division
- District
- Upazila

Zoom To

Select Zone

Select Circle

Select Division

Select Scheme

Map Style Selector:

- Newspaper Map
- Human Geography Map
- Human Geography Dark Map
- Modern Antique Map
- Mid-Century Map
- Nova Map

Map data © contributors, CC-BY-SA

Powered by Esri





GIS Apps and Mathematical Models

- Receive and store GIS applications and Mathematical Models

BWDB Land Information System

Current User **bwdb**

Khatian Information

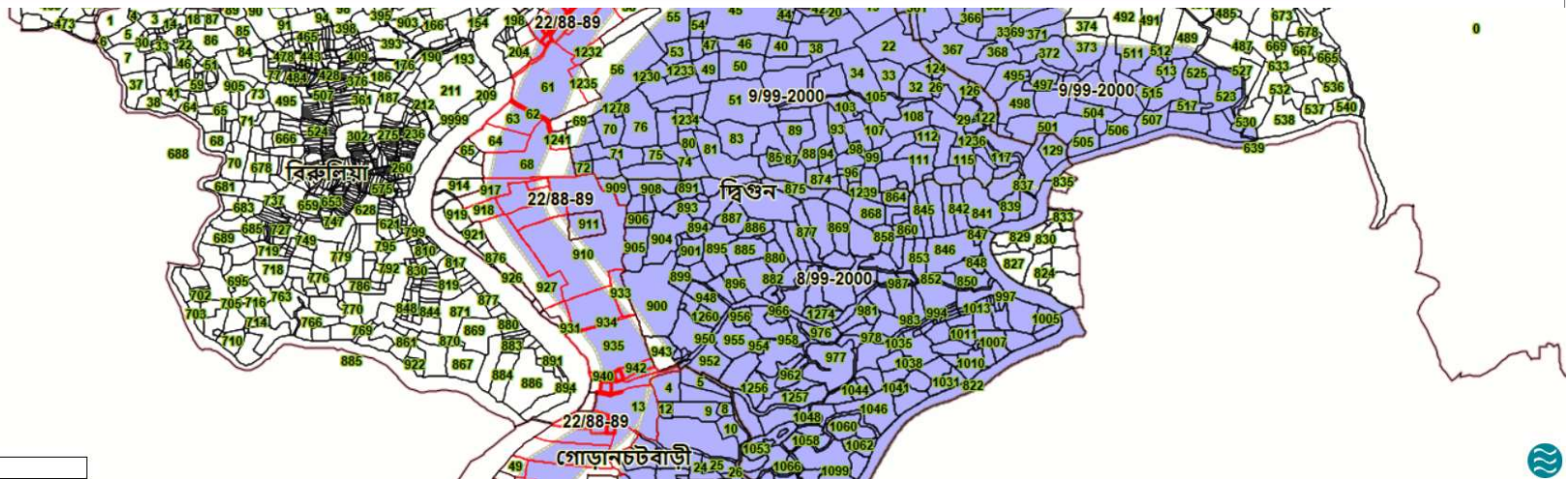
Map Viewer

LA Case Info

LA Case Owner Report

LA Case Plot Report

Printed Maps



1 km





GIS Apps and Mathematical Models

- Disseminate online based output maps of mathematical models



Interactive Geo-Database for Coastal Zone (IGDCZ)

CEIP Project, BWDB



[Home](#) [Dashboard](#)

Polders

Select Zone

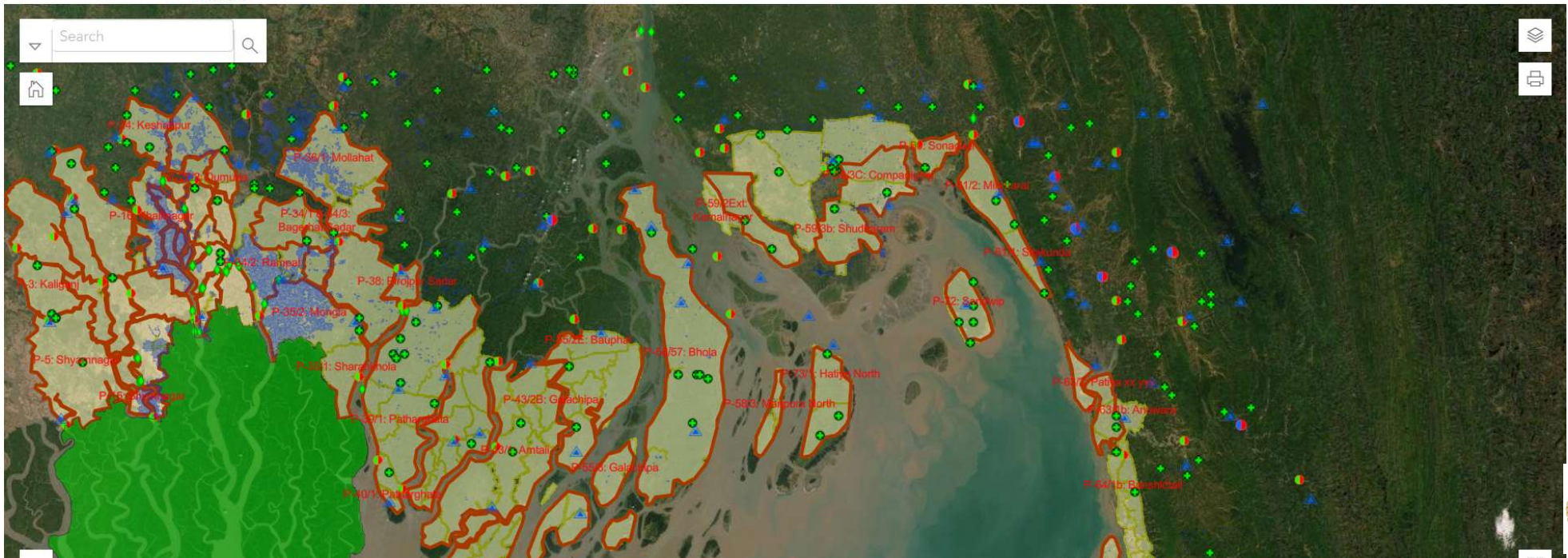
Select Circle

Select Division

Select Sub Division

Select Polder

Clear





GIS Apps and
Mathematical
Models

Disseminate through Web-GIS

Visit <https://gis.bwdb.gov.bd/arcgis/home/>
ArcGIS Enterprise Portal
of Central GIS Directorate, BWDB

Home Gallery Map Scene Groups

Sign In



GIS Applications



Interactive Map for Ongoing
Projects



CycloneCenter



Interactive Haor Map of
BWDB



Inventory of Hydraulic
Structures

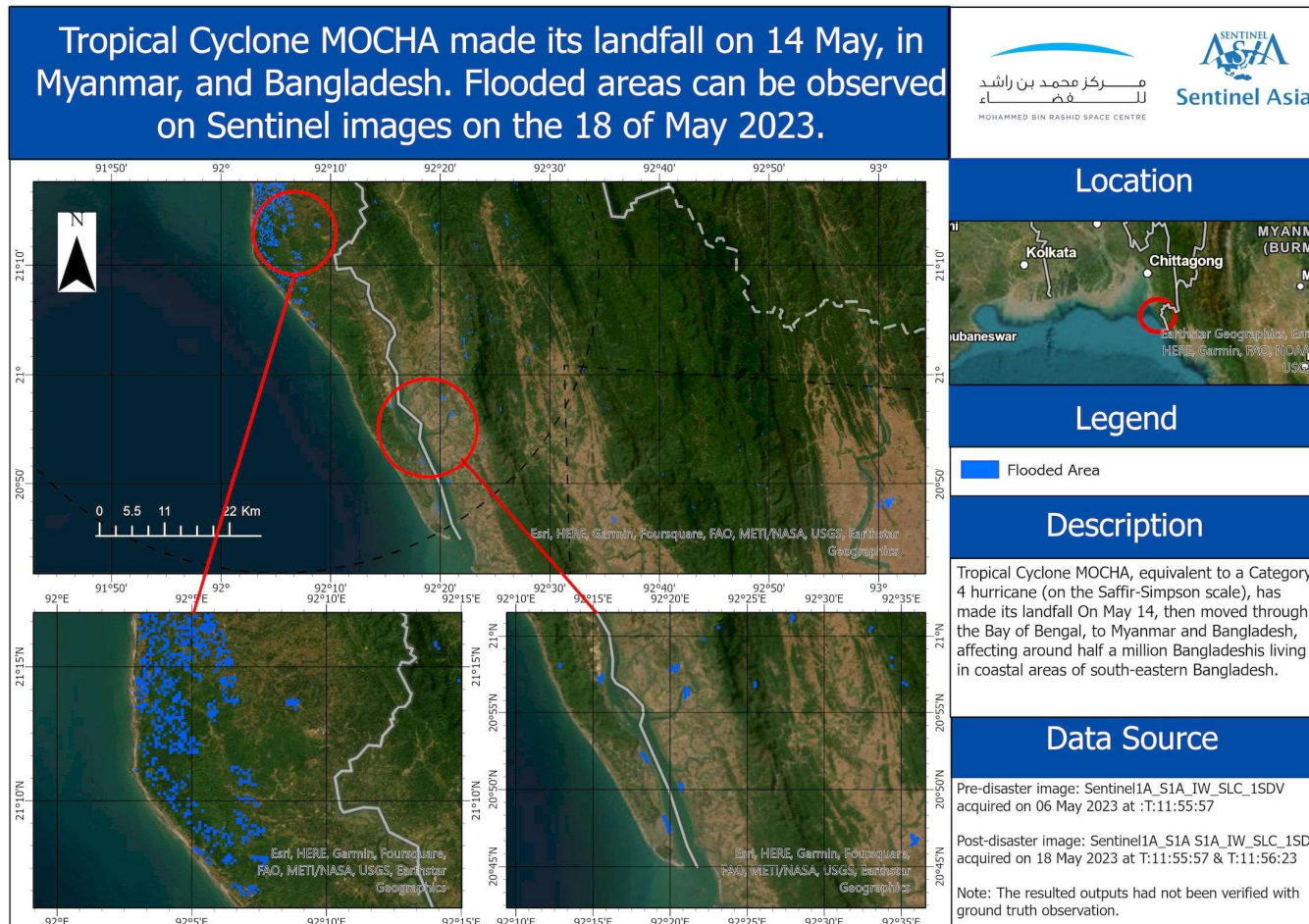
A Preliminary initiative to Host Modern GIS Applications in BWDB by
Central GIS Directorate

Bangladesh Water Development Board
Publication Year:: 2022-2023



Cyclone MOCHA in Bangladesh

Cyclone MOCHA in Bangladesh on 14 May, 2023, Processed by
MBRSC: DAN, Sentinel Asia



Cyclone MOCHA in Bangladesh

Cyclone MOCHA in Bangladesh on 14 May, 2023, Processed by
GIC. AIT. PDAN. Sentinel Asia

DETECTED WATER IN CHITTAGONG PROVINCE, BANGLADESH

As observed by ALOS-2 images on 15 May 2023



212 Km²

OBSERVED WATER

This map shows the detected water areas in Banskhali Sub-district, Chittagong District and Chakaria, Kutubdia, Maheshkhali and Cox Bazar S Sub-districts, Cox's Bazar District, Chittagong Province, Bangladesh, on May 15, 2023, due to heavy rains and strong winds from Cyclone Mocha.



0

NUMBER OF DEATHS



414,170

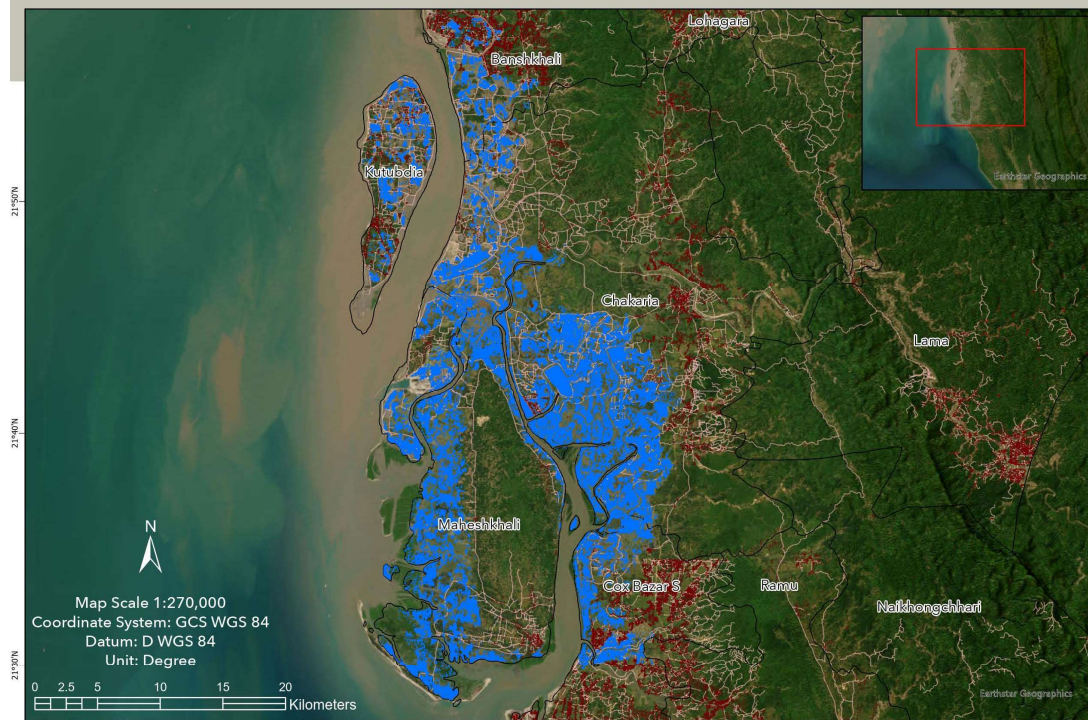
EVACUATED PEOPLE



23,027

EVACUATED LIVESTOCK

Source: ReliefWeb (MOCHA), 15/05/2023



- Detected Water
- Building
- Sub-district Boundary
- Road

Satellite Image:
Post-disaster : ALOS-2 PALSAR-2,
15 May 2023

Copyright: © JAXA (2023) -
All rights reserved.

GIS Data:
Building and Road © OSM (2023)
Administrative Boundary © GADM (2023)

Map product made by GIC-AIT (v1.0).

Disclaimer: The accuracy of this product
is not validated.



Visit <https://gis.bwdb.gov.bd> for more info



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Central GIS Directorate:: GIS | RS | Mathematical Modelling

WELCOME

Central GIS Directorate, BWDB is Dedicated office for GIS| RS| Mathematical Modelling studies under BWDB



Functionalities

GIS | RS| Mathematical Modelling

- ☑ Aims at GIS| RS| Mathematical Modelling based learning to ensure supports for sustainable planning and design of projects under BWDB
- ☑ Prepare and Maintain of Geospatial Database and data sharing among



Head of Office

A M Mustofa Sorwar

Superintending Engineer
Mr. A M Mustofa Sorwar joined Central GIS Directorate, BWDB as Superintending



Thank You