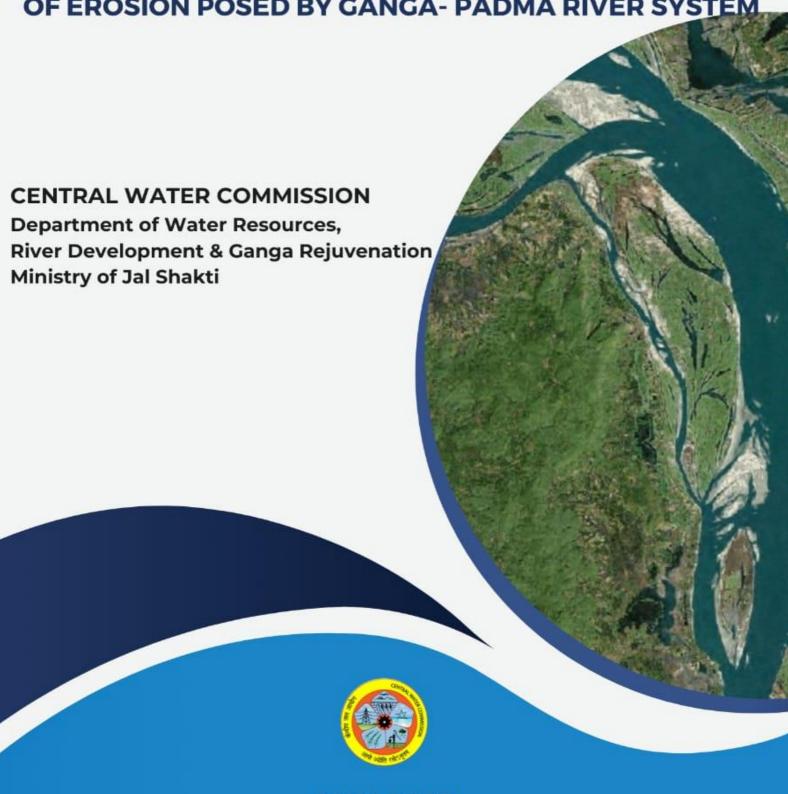


ADDENDUM TO REPORT OF THE COMMITTEE FOR CONDUCTING JOINT DETAILED TECHNICAL STUDY TO FORMULATE AN INTEGRATED PLAN TO COMBAT THREAT OF EROSION POSED BY GANGA- PADMA RIVER SYSTEM.



MAY, 2025

# Acknowledgement Executive Summary

#### **Contents**

1.0	Introduction	11
1.	1 Problem of Erosion in Ganga-Padma River System	11
1.	.2 Historical River Changes (As reported by the Government of West Bengal)	14
2.0	Background of the Committee	15
2.1 (	Composition of the Committee	16
2.2	Terms of Reference of the Committee	16
•	Para 3.0 of the DoWR, RD & GR, Ministry of Jalshakti, GoI vide OM No Z-16011/3/ M Section-MOWR dated 09.02.2023 order):	
3.0	Meetings of the Committee	17
3.	1 1st Meeting held on 06.04.2023	17
3.	.2 2nd Meeting held on 21.06 .2023	21
3.	.3 3rd Meeting held on 24.11.2023	21
3.	.4 4th Meeting held on 22.03.2024	22
3.	.5 5th Meeting held on 16.05.2024	23
3.	.6 6th Meeting held on 03.09.2024	24
4.0 9	Study Reach	25
5.0 (	Mathematical Modelling	26
5.	1 General Methodology	28
5.	2 Data Collection and Preparation	29
5.	.3 Model Configuration, Calibration & Validation	32
	5.3.1 1D HD Model (Sahibganj to Hardinge Bridge)-M1	32
	5.3.2 2D HD Model (Sahibganj to Farakka) & (Farakka to Hardinge Bridge)- M2	& M334
	5.3.3 2D HD Scenario Simulation with Spurs and Sakrigali Paleo Channel- M4 &	M534
5.	.4 Results	34
5.	.5 Assumption and Limitations	40
6.0 I	Remote Sensing Image Analysis to assess the present condition of reach	42

7.0 Identification of Critical Reaches for Planning and Design of Riverbank A Measures and Training Works	
Weasures and Training Works	40
8.0 Gate Operation Schedule	56
9.0 Mitigation Measures	59
9.1 Existing River Bank Protection Measures	59
9.2 Proposed Mitigation Measures	65
10.0 Jurisdiction of Farakka Barrage Project	70
11.0 Conclusions & Recommendations	71
References	76

# Appendix:

Appendix I: Report by Tractebel Engineering Pvt Ltd

Appendix II: Hydraulic Model Studies for Revision of Gate Operation Schedule of Farakka

Barrage, West Bengal by CWPRS, June'2022.

## **List of Figures**

Figure 1 :Reach of river Ganga passing through West Bengal 13
Figure 2: Plot of Area under Erosion since 1979 U/S of Farakka in Dist Malda 14
Figure 3: Plot of Approx area of Erosion D/S of Farakka on the Right Bank (1931-77) 15
Figure 4: Line Diagram for the Study Reach
Figure 5 :Location of Gauge/Discharge Sites
Figure 6: Study Reach
Figure 7 : Simulated water level at Rajmahal for different Manning's value
Figure 8 : Simulated water level at Nimtita for different Manning's value
Figure 9 :Comparison of observed water level (seasonal) and simulated water level for the simulation period, 2018-2023, at Ramayanpur
Figure 10:Comparison of observed water level (seasonal) and simulated water level for the simulation period, 2018-2023, at Rajmahal
Figure 11:Comparison of observed water level (seasonal) and simulated water level for the simulation period, 2018-2023, at Manikchak
Figure 12:Comparison of observed water level and simulated water level for the simulation period, 2018-2023, at the upstream of Farakka Barrage, i.e., pond level 36
Figure 13:Comparison of observed water level and simulated water level for the simulation period, 2018-2023, at Farakka Barrage Downstream
Figure 14:Comparison of observed discharge and simulated discharge for the simulation period, 2018-2023, at Farakka Barrage Downstream
Figure 15:Comparison of observed water level (seasonal) and simulated water level for the simulation period, 2018-2023, at Nimtita
Figure 16:Comparison of observed water level and simulated water level for the simulation period, 2018-2023, at Nurpur(G)
Figure 17:Comparison of observed water level (seasonal) and simulated water level for the simulation period, 2018-2020, at Geria
Figure 18:Comparison of observed water level (seasonal) and simulated water level for the monsoon period of 2019 at Rajshahi
Figure 19: Comparison of 1D & 2D simulated water level at Sahibganj
Figure 20: Comparison of 1D & 2D simulated water level at Rajmahal
Figure 21 :Comparison of 1D & 2D simulated water level at Nimtita
Figure 22: Reference Level at which gates of Farakka Barrage start to open and close 58

## **List of Tables**

Table 1: Composition of the Committee	. 16
Table 2: Summary of the models run in different identified reaches	. 27
Table 3: Input Data for Mathematical Modelling	. 29
Table 4: Flood Frequency Analysis	. 32
Table 5: Simulated vs Observed Water Level for 1D Model	. 35
Table 6: Simulated vs Observed Discharge for 1D Model	. 35
Table 7 : Simulated vs Observed Water Level at Rajmahal	. 39
Table 8: Simulated vs Observed Water Level at Nimtita	. 39
Table 9: Erosion Area (1988-2023)	. 43
Table 10 : Deposition Area (1988-2023)	. 43
Table 11: Site characteristics U/S & D/S of Farakka	. 47
Table 12: Status of existing protection works	. 59
Table 13: Summary of Proposed Mitigation Measures	. 72

### **List of Plates**

Plate 1:Existing Works at Meghu Tola, Jhabu Tola, Subedhar Tola to cut end of TCP Embankment along the Left Edge of River Ganga (Pardiyara)
Plate 2:Existing Works at Meghu Tola, Jhabu Tola, Subedhar Tola to cut end of TCP Embankment along the Left Edge of River Ganga (Jhabu Tola School)
Plate 3: Bank Erosion at Bhutni Manikchak
Plate 4: Bank Erosion at Narayanpur, Manikchak
Plate 5: Bank Erosion at Purba Debidaspur, under Block & P.S. Samserganj
Plate 6: Bank Erosion at Maheshtola ,Block & P.SSamserganj
Plate 7: Satellite Image showing year wise shifting of bankline of River Ganga towards River Fulhar (Mahananda) (2016-22)
Plate 8: Satellite Image showing year wise shifting of bankline of River Ganga from Meghu Tola to Cut End of T.C.P Embankment
Plate 9: Satellite Image showing year wise shifting of bankline of River Ganga (2016-2022) 19
Plate10:Erosion and Deposition observed in Ratua-I and Manikchak Kaliachak Reach (U/S of Farakka)
Plate11:Erosion and Deposition observed in Dhulian, Lalgola and Bhagwangola Reach (D/S of Farakka)
Plate 12: Status of Existing Anti-Erosion Works U/S & D/S of Farakka in the Ganga-Padma River System
Plate13:Layout of Proposed River Bank Protection Works in Ratua-I reach of Ganga-Padma River  System
Plate14:Layout of Proposed River Bank Protection Works in Kaliachak reach of Ganga-Padma River  System
Plate15:Layout of Proposed River Bank Protection Works in Dhulian reach of Ganga-Padma River  System
Plate16:Layout of Proposed River Bank Protection Works in Lalgola-Bhagwangola reach of Ganga-Padma River System

#### **List of Annexures**

- I Index map of the river system in the segment
- II Constitution of the Committee under Chairmanship of Chairman Central Water Commission vide DoWR, RD & GR, Ministry of Jalshakti, Gol OM No Z-16011/3/2023-FM Section-MOWR dated 09.02.2023
- Additional Terms of Reference for the Committee vide DoWR, RD & GR, Ministry of Jalshakti, Gol OM No Z-16011/3/2023-FM Section-MOWR Dated 27.12.2023
- IV Minutes of Meeting
  - Minutes of 1<sup>st</sup> Meeting (Annexure IV A)
  - Minutes of 2<sup>nd</sup> Meeting (Annexure IV B)
  - Minutes of 3<sup>rd</sup> Meeting (Annexure IV C)
  - Minutes of 4<sup>th</sup> Meeting (Annexure IV D)
  - Minutes of 5<sup>th</sup> Meeting (Annexure IV E)
  - Minutes of 6<sup>th</sup> Meeting (Annexure IV F)
- V Analysis of Manning's coefficient 'n' as observed in River Ganga at Azmabad
- VI Key Hydraulic Parameters obtained through Mathematical Modelling
- VII Indicative Drawings of Proposed Mitigation Measures
- VIII Line Diagram of Proposed and Existing Anti Erosion Works

#### **Contents**

#### **List of Annexures**

IX Minutes of Seventh (7<sup>th</sup>) Meeting of the Committee for conducting joint detailed technical study to formulate an integrated plan to combat threat of erosion posed by Ganga Padma River System in West Bengal held on 06.12.2024

#### 1.0 PRIORITIZATION OF WORKS RECOMMENDED BY THE COMMITTEE

The comprehensive report on "Joint Detailed Technical Study to formulate an integrated plan for mitigating erosion threats posed by the Ganga-Padma River System in West Bengal" was prepared and finalized in the sixth meeting held on September 3, 2024, under the Chairmanship of the Chairman, Central Water Commission.

The report was presented before the Hon'ble Minister of Jal Shakti on October 15, 2024. During this presentation, the Hon'ble Minister desired prioritizing the mitigation measures outlined in the study report, in consultations with the State governments of West Bengal, Bihar, and Jharkhand.

Thereafter, the seventh meeting of the Committee was convened on December 6, 2024, at CWC(HQ), New Delhi, wherein, State governments were formally requested to submit brief notes on the prioritization of the proposed mitigation measures. Minutes of the Meeting are enclosed in the **Annexure-IX**.

Meanwhile, a prioritization note prepared by the Consultant appointed by the West Bengal State government was circulated among the participating States for their comments and suggestions. Since no formal responses were received from the States, the note was reviewed and revised. The prioritization of works is proposed as under:

# 1<sup>st</sup> Priority: - Ratua-I reach (from Bengal- Bihar border to the confluence of River Fulhar with Ganga)

In this reach of river Ganga, continuous shifting of the river towards left bank has been observed. The thalweg is also observed to be near to the left bank hence, this is identified as the most vulnerable reach to be taken up immediately. The phasing of work and implementation plan in Ratua-I reach is as follows: -

SI no	Description of activity	Implementation plan		
		2025	2026	2027
1	Bank Revetment	70%	30%	
2	Spur construction	50%	50%	
3	RCC porcupine screen	100%		
4	Paleo Channel activation		70%	30%

# 2<sup>nd</sup> Priority: - Dhulian Reach (D/S of Farakka barrage)

In the area near the Dhulian town along both the left and right banks, erosion is observed. Most of the river reach from Dhulian town to Nimtita, had undergone erosion during the last two flood season. Higher velocity and variation in discharge of river resulted in toe erosion and consequent sloughing and sliding of the bank. This zone is identified as  $2^{nd}$  priority. The phasing of work and implementation plan in Dhulian reach is as follows:-

SI no	Description of activity	Implementation plan		
		2025	2026	2027
1	Bank Revetment	40%	60%	
2	Concrete ghat development		100%	
3	RCC porcupine screen		100%	
4	Char Dredging		70%	30%

# 3<sup>rd</sup>Priority: -Manikchalk- Kaliachalk Reach (from confluence of river Fulhar with river Ganga to Farakka Barrage)

Bank erosion is the major issue on the left bank. The top level of existing embankment along the left bank in Manikchalk block is below the HFL at some distinct locations. This zone is identified as 3<sup>rd</sup> priority. The phasing of work and implementation plan in Manikchalk-Kaliachalk reach is as follows: -

SI	Description of activity	Implementation plan		
no				
		2025	2026	2027
1	Embankment Raising		60%	40%
2	Bank Revetment		50%	50%

# 4<sup>th</sup> Priority: -Lalgola- Bhagwangola Reach

Bank erosion is the major issue in this zone. Most of the bankline is unprotected making it highly vulnerable to erosion during flood. The right bank of the river is protected by revetment and six spurs are laid up to the border area. This zone is identified as 4<sup>th</sup> priority. The phasing of work and implementation plan in Lalgola- Bhagwangola Reach is as follows: -

SI	Description of activity	Implementation plan		
no				
		2025	2026	2027
1	Bank Revetment		20%	80%
2	RCC porcupine screen		50%	50%

#### **Annexure-IX**



विंग-1, प्रथम तल, पश्चिम खंड -2, आर. के. पुरम, नई दिल्ली -110606

Date: 17-Dec-24

Subject: Minutes of Seventh (7th) Meeting of the Committee for conducting joint detailed technical study to formulate an integrated plan to combat threat of erosion posed by Ganga Padma River System in West Bengal-reg

Seventh (7<sup>th</sup>) Meeting of the Committee for conducting joint technical study to formulate an integrated plan to combat erosion posed by Ganga Padma River System, was held under the Chairmanship of Member, D&R, CWC on December 06, 2024 at Sewa Bhawan, New Delhi. The minutes of the meeting are enclosed for information and necessary action.

This issue with the approval of competent authority.

Encl: As Above

To (Members of the Committee)

- 1. Member (D&R), CWC, New Delhi
- 2. Member (RM), CWC, New Delhi
- 3. Chairman, GFCC, Patna
- 4. Commissioner (FM), DoWR RD & GR, New Delhi
- 5. General Manager, Farakka Barrage Project
- 6. Director, CWPRS, Pune
- 7. Chief Engineer and Project Manager (JMVP), IWAI, MoPSW
- 8. Chief Engineer (North), I&W Directorate, Govt of West Bengal
- 9. Joint Secretary (Works), I&W Directorate, Govt of West Bengal
- 10. Chief Engineer, Flood Control and Drainage, Katihar, WRD, Govt of Bihar
- 11. Chief Engineer, Water Resources Department, Deoghar, Govt of Jharkhand
- 12. Group Director, Water Resources Remote Sensing Applications Area, NRSC, Hyderabad

7.19.9.14 (D P Mathuria)

Chief Engineer (P&DO), CWC Email: cepd-cwc@nic.in

> Tel: 011-29583836 श्री.पी. गणुरिया/D.P. MATHURIA युष्य क्रीणिता/Chief Engineer (P&D) क्रीकीय जल आजेग/C.W.C.

शारत सरकार ∕ Govt. of India वर्ष दिल्लो ∕ Now Delhi

# File No.T-38075/1/2023-MORPH-CC

# Copy for kind information

- 1. PPS to Chairman, CWC, New Delhi
- 2. PPS to Member(RM), CWC, New Delhi
- 3. Director (TC), CWC, New Delhi
- 4. Director, Hydrology (S), CWC, New Delhi
- Director, FMP, CWC, New Delhi
   Director, FCA, CWC, New Delhi

Minutes of Seventh (7<sup>th</sup>) Meeting of the Committee for conducting joint detailed technical study to formulate an integrated plan to combat threat of erosion posed by Ganga Padma River System in West Bengal

The Seventh (7<sup>th</sup>) Meeting of the Committee for conducting joint detailed technical study to formulate an integrated plan to combat threat of erosion posed by Ganga Padma River System in West Bengal was held under the chairmanship of West Bengal Shri Bhopal Singh, Member, D&R, CWC on December 06, 2024 at Sewa Bhawan, R, CWC on I New Delhi. The list of participants is attached at **Annexure-I**.

Member, D&R, CWC welcomed all the members of the Committee who joined physically as well as virtually and indicated that a good study has been carried out the same was discussed in the Ministry of Jal Shakti for implementation.

1. Director, Morphology & Climate Change gave a brief presentation outlining the brief background of the committee and mitigation measures proposed in the report of the Committee. In the presentation, he indicated that the report of the committee was presented before the Hon'ble Minister for Jal Shakti and it was found to be in order. However, it was decided that the mitigation measures proposed in four different zones (Ratua Reach (Zone-1), Manikchak Reach (Zone-II), Dhulian Reach (Zone-III), Lalgola Bhagwangola Reach (Zone-IV) in the report should be prioritised and accordingly implemented. Hence, priority is required from the State Governments (based on infrastructure likely to be damaged, funding available from different sources etc.) for all the four zones and to be indicated as part of the report.

# Agenda 1: Prioritization of works suggested in the Report of the Committee

2. Joint Secretary(I&WD), West Bengal indicated that Ratua-I zone includes the reach of the river, immediately after it enters West Bengal from Bihar. The river Fulhar, Koshi channel and the main river Ganga creates many small islands in this zone where population is also seen to be residing in large numbers. It is of immense importance for the State Government to protect those islands. Furthermore, the shifting of the Ganga River in this zone has brought the Ganga and Fulhar rivers dangerously close to each other, reducing the

distance from 3.6 km in 2005 to just 1.2 km today. Apart from threatening of habitat, erosion in this reach is also affecting the stability of the National Highway from Malda to Bihar. He informed the Committee that during the 2024 floods, the Ratua reach experienced massive erosion, embankment breech and was inundated for a prolonged period constantly.

In context of all the above, Ratua-I may be accorded topmost priority during implementation of works. He indicated apart from Ratua reach, Dhulian reach(Zone-3) also has many important installation and municipalities adjoining the river which need timely attention. He also suggested that for the success of the proposed mitigation measures they should be executed in coordination with the State Government of Bihar.

- 3. Chief Engineer (Katihar), Bihar suggested that heavy erosion is observed in Ratua reach and protection of the bank in this reach at topmost priority is highly recommended.
- 4. Chairman GFCC, informed that the Ratua-I reach in Bihar and West Bengal is facing similar problem of scouring and erosion, hence common specifications for proposed mitigation measures should be made to address the issue.
- 5. The Consultant gave a presentation suggesting the prioritization of works and implementation plan giving topmost priority to fixing of bank through bank revetments. Mitigation works like paleo channel activation and Ghat Development may be taken up at later stages.

The following actionable points emerged during the meeting:-

- 6. The Government of West Bengal, Bihar & Jharkhand may finalise a Detailed Project Report for the execution of the proposed mitigation measures. State Governments of West Bengal, Bihar & Jharkhand to co-ordinate with GFCC for finalization of DPR for the proposed works in a timely manner, say within two months. Suitable guidance may be provided to the State Governments during course of preparation of DPR by States to avoid delays, if any, during examination of DPR. (Action: Government of West Bengal, Bihar & Jharkhand /GFCC)
- 7. A brief note on the prioritization of works (RD/ reachwise) to be suggested by the State Governments of West Bengal, Bihar & Jharkhand to the Committee within a week following which the recommendations of the Committee may be finalized. The priority of works to be earmarked chainage wise.

(Action: Government of West Bengal, Bihar & Jharkhand/Consultant)

Due to the ongoing monsoon season and other preoccupations the field visit of the Committee could not be done which will be undertaken in due course for which Govt of West Bengal may co-ordinate with CWC.

(Action: Government of West Bengal & CWC)

Meeting ended with a vote of thanks to the chair.





X CWCOfficial\_Gol

(iii) CWCOfficial.Gol

c/CWCOfficialGol





CENTRAL WATER COMMISSION
DEPARTMENT OF WATER RESOURCES, RIVER
DEVELOPMENT & GANGA REJUVENATION
NEW DELHI