Chapter 3

Implementation

Chapter 3: Implementation

3.1 Formulation of Project Proposals/Detailed Estimates

Rule 164 of West Bengal Financial Rules (Volume-I & II) stipulates that before execution of any work, a Detailed Estimate is prepared and approved by the competent authority. Technical viability as well as cost of the work is assessed through the Estimates. Test check of 105 estimates of works (comprising of 145 selected tenders) other than FMP works relating to eight divisions revealed the following deficiencies:

3.1.1 Source of data not mentioned in the estimates

As per Indian Standard No. 14262:1995 of Planning and Design of Revetment, silt factor and river velocity data were required to be considered for designing the embankment protection and anti-bank erosion works. This also required to assess the weight and size of stone boulders to be used in the work as well as to calculate the required thickness of the protection work.

It was observed that source and age of data on silt factor and river velocity were not mentioned in 52 estimates prepared by seven test checked Divisions[18]. Further, in 39 estimates of five test-checked Divisions[19] prepared during the years 2013-18 where the source of the silt factor data was mentioned as River Research Institute under I&WD, the data taken into consideration was even upto 30 years old.

Strength and design of protection work is to be based on the silt factor and river velocity data, which vary from time to time. Therefore, updated data should have been considered instead of historical data. Thus, consideration of old data may undermine design of the embankment.

3.1.2 Inconsistency in approval process of Estimates

I&WD did not prescribe any criteria regarding timelines for approval of estimates. Audit observed that time taken for completion of the approval process of estimates from Sub-division level to Chief Engineer level ranged from 103 to 863 days in case of 21 estimates prepared in five test checked Divisions[20]. On the other hand, however, in case of 26 estimates prepared by five Divisions[21], the entire approval process was completed within one month and, in case of three estimates prepared by two Divisions[22], approvals from three different levels (from Division to CE office) were obtained in a single day. The exemplary promptness shown in these three estimates did not, however,

---

[18] *Malda Irrigation Division, Mahananda Embankment Division, Coochbehar Irrigation Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[19] *Coochbehar Irrigation Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[20] *Howrah Irrigation Division, Malda Irrigation Division, Mahananda Embankment Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[21] *Mahananda Embankment Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[22] *Howrah Irrigation Division and Jalpaiguri Irrigation Division.*

help in quick execution. Only one work was completed within the scheduled date of completion, another work was completed with a delay of 54 days and the remaining work was on-going as of May 2018 even after the scheduled date of completion in April 2018.

Thus, irrespective of the time taken in approval process, there were delays in execution of works under Flood Control Programme.

3.2 Execution of Projects

I&WD executed (1) embankment protection, (2) anti-river erosion, (3) drainage improvement works for flood control during the years 2013-18. It also included two major projects namely Kandi Master Plan (KMP) and Kaliaghai-Kapaleswari-Baghai (KKB) under Flood Management Programme (FMP) with shared funding by the Centre and the State. As per Para 4.2 of the "Revised guidelines for providing Central Assistance to State Governments for the Schemes/Proposals of Flood Control and River Management Works under FMP (2007-12)", Central and State share was to be in the ratio of 75:25. The DPRs of both KMP[23] and KKB[24] were stated to have been prepared as per the guidelines of GFCC/CWC and relevant IS codes.

3.2.1 Kandi Master Plan

An area of about 510 sq. km.[25] in Murshidabad district is critically prone to perpetual flooding and drainage congestion and remains totally cut-off for several days at a time during floods. Most of the embankments, constructed decades ago, are in dilapidated condition. I&WD prepared (June 2012) the Detailed Project Report (DPR) for the Kandi Master Plan to ameliorate the flood situation. The project primarily comprised of structural measures like :

(i) raising/strengthening of a total of 223 km embankments of five different rivers[26],

(ii) protection work of different river embankments of a total length of 38.72 km,

(iii) resuscitation of four khals[27],

(iv) renovation of 57 existing sluices,

(v) creation of additional capacity of waterways by renovating 12 existing rail/road bridges and culverts and

(vi) construction of three double lane River Bridges.

Investment clearance of ₹ 438.94 crore was accorded by the erstwhile Planning Commission, GoI in June 2012 under Flood Management Programme (FMP) with target date of completion by March 2017.

---

[23] *Page 7 of Chapter 7 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[24] *Page IV-16, X-2, X-10, XI-8 and XIII-1 of Final Report Volume-I and Page 2 of Supplementary Volume-II (Revised) of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin.*

[25] *Consisting of entire Bharatpur-I, parts of Khargram, Burwan and Kandi blocks.*

[26] *Mayurakshi, Bele, Dwarka, Kuye-Babla and Kana Mayurakshi.*

[27] *Small drainage channels namely Jibanti Khal, Jhumjhum Khali Khal, Banki Khal and Swarup Khali Khal.*

First instalment of the Central Fund was released in March 2014. Approval of State Planning Board was accorded in May 2014. Administrative Approval was given by I&WD to Chief Engineer (North) in December 2014 and the project work commenced in January 2015. As per the approved DPR, the project was to be completed by March 2017, but it was executed in different phases and only six out of 12 phases were completed as on March 2018. I&WD proposed (October 2017) to complete the project by March 2019, which was yet to be approved by GoI (December 2018).

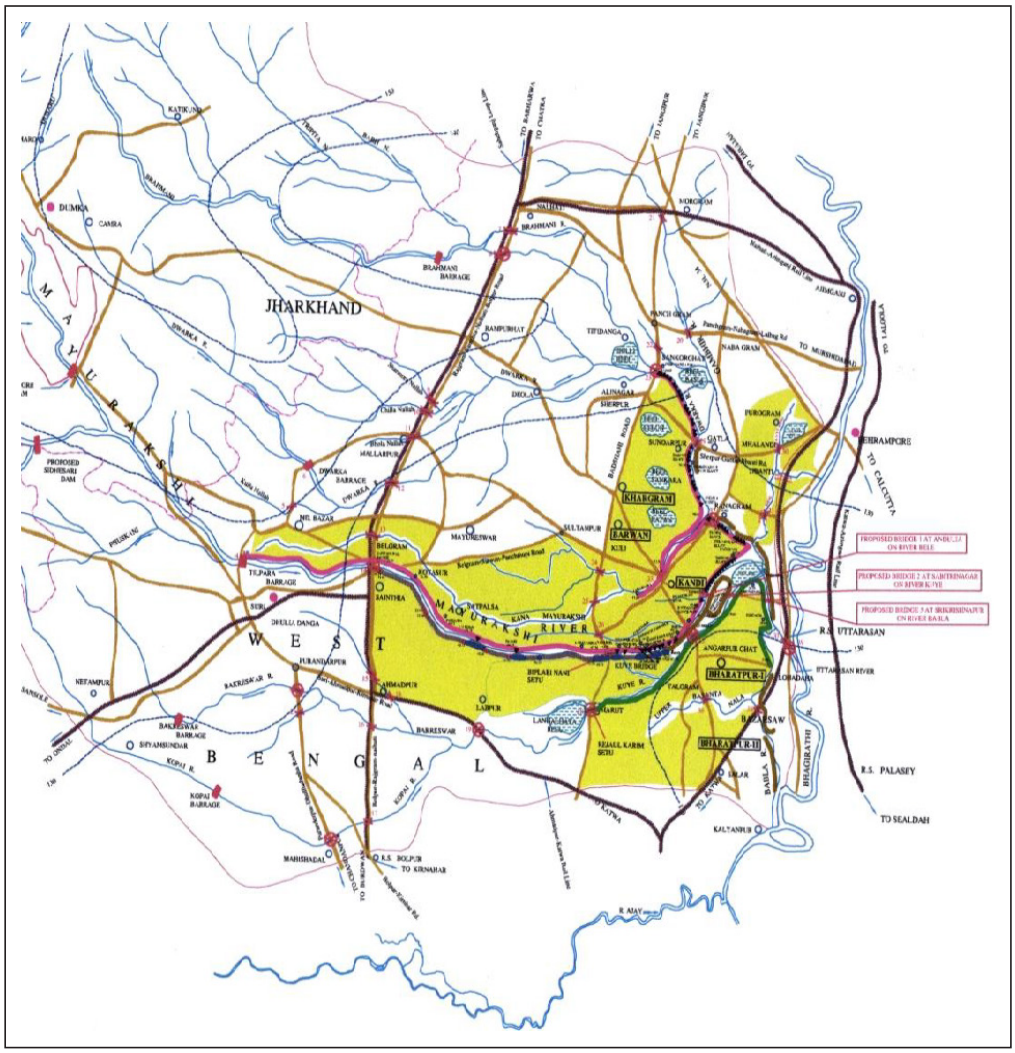

Figure 3.1 : Index Map of Kandi Basin Project

3.2.1.1 Financial arrangements

Against the approved project cost of ₹ 438.94 crore, an amount of ₹ 209.32 crore (Central Share ₹ 24.98 crore and State Share ₹ 184.34 crore) was released and spent during the years 2013-18.

Out of the total amount spent on this project so far, GoI has contributed only ₹ 24.98 crore (12 *per cent*) instead of ₹ 157 crore (75 *per cent*), mainly due to delay in submission of UCs by the State Government.

3.2.1.2 Physical progress

As on 31 March 2018, physical progress of the project was as depicted in the **Table 3.1**.

Table 3.1: Physical progress of the Kandi Master Plan (KMP)

Sl. No.	Components	Provision as per DPR	Executed as on March 2018	Progress in percentage
1	**Raising and Strengthening of embankment**	223 km	Completed: 130 km Ongoing: 64 km	58
2	**Embankment protection work**	38.72 km	32.71 km completed	84
3	**Resuscitation of drainage channels (four khals)**	40.50 km	Completed: 24.90 km Ongoing: 6 km	61
4	**Renovation of existing sluices**	57 nos.	47 nos.	82
5	**Creation of additional waterway by renovating 12 existing rail/road bridges and culverts**	635 m	Nil	Nil
6	**Construction of double lane river bridge**	3 nos.	Ongoing: 3 nos	80

(Source: Divisional records)

3.2.1.3 Defective Detailed Project Report

Scrutiny of execution of the project works under 12 different phases revealed following defects in the approved Detailed Project Report (DPR), as discussed below:

Schematic diagram of embankment protection work is shown in figure below:

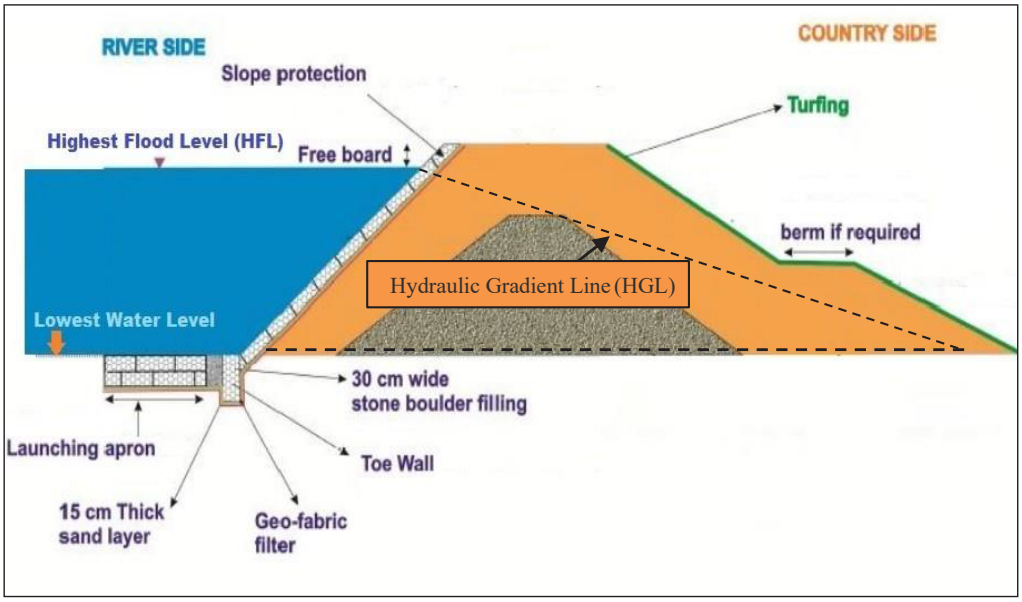

Figure 3.2: Cross section of river embankment

Non-execution of embankment protection work[28] in vulnerable stretches

DPR[29] of the KMP stipulated that protection work should be provided only in those reaches where the embankment is within 50 m of the existing bank line. Accordingly, provision for embankment protection work for a length of 38.72 km. was provided in the DPR for the entire KMP. During preparation of

[28] *Boulder pitching with launching apron (Figure-3.2).*

[29] *Page 3 and 4, Chapter 8 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

estimates in 2015-16, I&WD noticed that rivers Mayurakshi and Kuye-Babla under KMP came very close (within 50 m) of their embankments in several reaches where protection work was urgently required. Protection work was, however, not undertaken for those reaches as the same was not included in the DPR though actually required. Thus, the embankment protection work was not executed as per the present condition of the rivers, leaving those portions vulnerable to erosion.

In reply, I&WD stated (October 2018) that all the vulnerable reaches under KMP had been covered/protected as on date.

It was, however, noted in the estimates of Left Bank of river Mayurakshi (23.59 km to 39.30 km) and Right Bank of river Kuye-Babla (14.00 km to 29.00 km) under KMP that provision of protection for such vulnerable reaches was not incorporated though required as the same was not included in the original DPR of KMP. Thus, estimates were incomplete and did not account for the dynamic ground realities.

3.2.1.4 Deviations from approved DPR

Scrutiny of execution of the project works under 12 different phases revealed following deviations from the approved Detailed Project Report (DPR), as detailed below:

(a) Required Country Side Slope as per DPR not provided

In the DPR[30] of KMP, the country side slope was considered 3H:1V or as required to cover the Hydraulic Gradient Line (HGL)[31] for which 277.38 ha land was to be acquired at a cost of ₹ 96.47 crore. The Embankment Manual, CW&PC, 1960 also stipulates that the slope of the embankment should not be steeper than 3H:1V, for embankment higher than 4.5 m.

It was noticed that the country side slope of embankment of entire KMP was restricted to 2H:1V without any berm[32], though height of embankment was more than 4.5 m. Additional land acquisition was required in country side to make the slope 3H: 1V with execution of required berm. The slope was restricted due to non-acquisition of land.

Thus, by constructing embankments with countryside slope of 2H:1V, it was not possible to cover the HGL for the entire reach, making embankments vulnerable to seepage in those reaches.

In reply I&WD stated that by constructing the embankment slope 2H:1V sufficient cover of HGL was provided.

[30] *Page 48, Chapter 5 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[31] *A line of 4H:1V (for clayey soil) from High Flood Level (HFL) to the country side indicates the line of seepage through the embankments.*

[32] *A horizontal shelf built into the embankment to strengthen its stability or to catch and arrest slide material.*

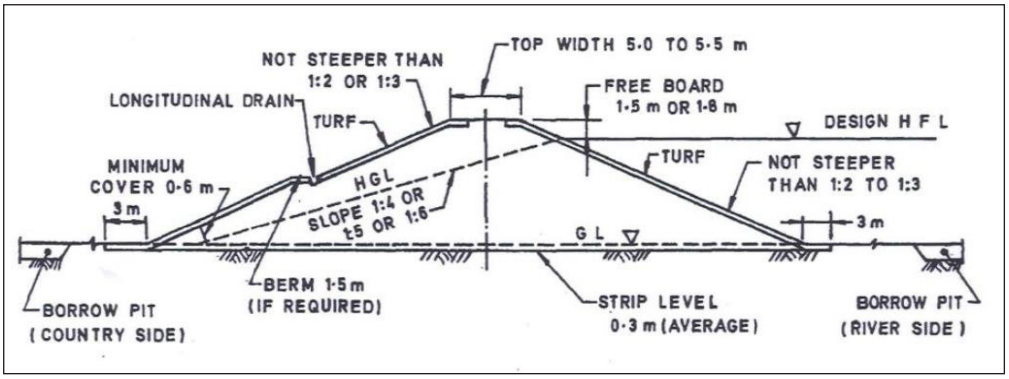

Figure 3.3: Schematic design of a river embankment

The cross sectional drawing of the embankment attached with the DPR of Phase II of KMP, however, reflected that it was not possible to cover the HGL for the entire length of the embankment with the actually executed slope of 2H:1V. Also, the reply was in contradiction to the guidelines for preparation of DPR for flood management projects, 2018.

(b) Height of embankment constructed less than the actual requirement

In the DPR[33] of KMP, minimum free board[34] of 1.80 m on river Mayurakshi having design discharge more than 3000 cumecs and 1.50 m on rivers Dwarka, Kuye and Babla having design discharge less than 3000 cumecs was provided. Accordingly, height of embankments proposed to be constructed was to cover the free boards.

It was observed that as against the free board of 1.50 m on the Kuye and Babla rivers, the height of embankment was short by 0.91m to 1.41 m in the stretches between 3.60 kmp and 6.00 kmp under Phase-IV and 20.30 kmp and 20.60 kmp under Phase-IX.

Thus, construction of embankments under Phase-IV and IX at a cost of ₹ 21.76 crore (upto March 2018) was still vulnerable to overflow during floods as the embankments constructed were below the height of the proposed free boards at different locations.

In reply, I&WD stated that during test check of audit the work was in progress and as on date the construction of embankment has been completed with the required free board.

The reply is not based on facts as the audit observation was made as per the level books[35] submitted with the final bills of the works. Thus, constructed embankment was neither as per approved DPR nor according to the GFCC guidelines relating to Design of Embankments.

(c) Non-creation of additional waterway

The existing bridges and culverts over the canals were hindering the smooth flow of canal water and creating upstream impounding of water specially during rainy season. As such, the work was taken up for reconstruction/renovation of bridges to clear the hindrances to the flow of water. Hence, a provision for

[33] *Page 48, Chapter 5 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[34] *Additional height of embankment provided over HFL to protect overtopping even with the intense wave wash or any other unexpected rise in water level (Figure-3.3).*

[35] *Book containing cross section-wise graphical representation of pre and post level of earth work.*

creation of additional waterway width of 635.58 m by renovating 12 existing bridges and culverts at a cost of ₹ 25.42 crore was made in the DPR for proper drainage of the basin water. National Commission on Floods had recommended (1976) that closer coordination amongst concerned agencies like the Railways, National Highways *etc*., was needed to ensure that structures like bridges, roads and railways do not cause flood problems.

Although the work of KMP commenced in January 2015, such linear waterways could not be provided by re-construction/renovation of the existing bridges as I&WD failed to co-ordinate with the concerned Departments (Railway and PWD) for necessary approvals to commence such works. Without providing the linear waterway, the draining of the entire basin water would not be possible. This would lead to water logging and stagnation of flood water. In reply, I&WD stated that it had already persuaded concerned Railway and PWD authorities several times. The fact, however, remains that the matter is yet to be resolved even after a lapse of more than three years.

(d) Non-execution of embankment

Provision was made in the DPR[36] of KMP for raising and strengthening of embankments from 0.00 km to 14.00 km of right bank of river Kuye. The raising and strengthening of embankment from 3.00 km to 14.00 km was, however, only considered. There was no existing right bank embankment from 0.00 km to 3.00 km and construction of embankment was not taken up due to non-acquisition of required land. Owing to non-construction of embankment from 0.00 to 3.00 km, safety of the three km stretch was compromised and protection of agricultural land of that area could not be ensured.

In reply, I&WD stated that raising and strengthening work for the initial reach of 0.00 km to 3.00 km was not considered as it flows through high land. It was noted, however, that the DPR of KMP had made the provision considering the actual site condition.

(e) Execution of less thickness of boulder pitching work

As per DPR[37], Dwarka right embankment from Indradangapara to Barpari sluice for a length of about 17 km was to be protected with 60 cm thick boulder pitching over Geo-synthetic filter. As against the planned length of 17 km and thickness of 60 cm, provision for 45 cm thick boulder pitching over Geo-synthetic filter for a length of only 13.27 km between Indradangapara and Barpari sluice was made at a total estimated cost of ₹ 28.89 crore under Phase-II and III.

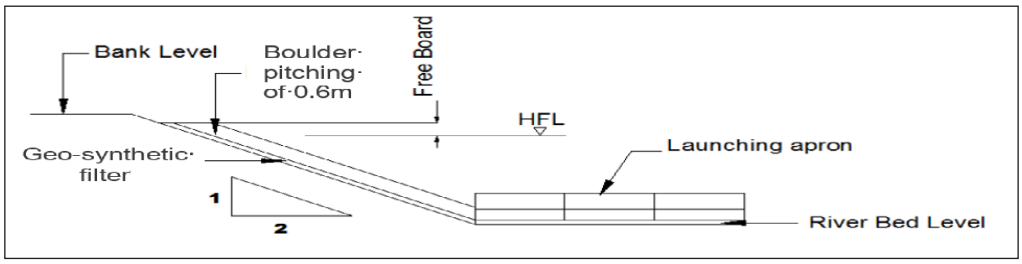

Figure 3.4: Diagram of location of Boulder pitching and Geo-synthetic filter

[36] *Page 21, Chapter 9 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[37] *Page 26, Chapter 7 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

Thus, due to execution of inadequate thickness of the boulder pitching, the length of 13.27 km of embankment remained vulnerable to erosion even after incurring expenditure of ₹20.84 crore (upto March 2018). Further, boulder pitching for the remaining length of 3.73 km was yet to be initiated for execution.

In all these cases, deviations from the approved DPRs were noticed because of which risk of the infirmities adversely impacting the arrangements of flood management cannot be ruled out.

3.2.1.5 Non-compliance to Indian Standards Code and GFCC/ Technical Expert Committee recommendations

(a) Non-execution of sand cushion layer[38]

Para 3.7 of the IS Code 14262:1995 provided 150 mm thick sand layer over the filter fabric to prevent mechanical rupture of the fabric by revetment stones. Therefore, a cushion of 100-150 mm of locally available river bed materials/ sand was to be provided over Geo-textile filter.[39]

Boulder revetment work with Geo-textile filter for 25.11 km embankments of rivers Mayurakshi, Bele and Dwarka were taken up under Phase-II and III of KMP after May 2016. Sand layer over Geo-textile filter as recommended in IS code was, however, not included in the DPR and hence not executed. While conducting monitoring visit in May 2016, GFCC also observed that during boulder revetment works[40] on slope of embankment non-laying of sand cushion layer, may lead to puncture of the filter.

Therefore, non-execution of sand cushion layer compromised the quality of works executed at a cost of ₹ 21.81 crore upto March 2018 and may also lead to failure of the protection work on the embankments.

Accepting the audit observation, I&WD stated that there were some difficulties in bearing the extra expenditure within the tender provision. Extra care had, however, been taken during execution of works to minimise the possibility of puncture of Geo-textile filter.

(b) Non-execution of sausage crate[41] **in step**

As per 5th Technical Expert Committee meeting of I&WD, GoWB on implementation of river bank erosion in February 2015, in the reaches where there is no scope to set back the bank line, the required slope is to be generated by dumping boulder in crates over sand filled bags. GFCC also recommended (May 2016) that in case of steeper slope towards river side, where there was land constraint, sausage crate had to be provided *i.e.* at Sundarpur, Bhatkhanda or places where necessary over the right bank of Dwarka and left bank of river Bele.

---

38 *A sand layer over Geo-textile filter.*

39 *A filter layer made with Geo-jute laid over the earthen embankment in protection work with boulder pitching to protect the erosion of earthen embankment by river water.*

40 *Sloping structures with boulders placed on embankment.*

41 *Wire net filled with boulders, used for embankment protection.*

Figure 3.5 : Image of Boulder Pitching in sausage crate

Figure 3.6 : Image of Loose Boulder Pitching

It was observed from the estimates and contractor's bills that the protection work of right bank of river Dwarka and left bank of river Bele were taken up under Phase-II and III of KMP respectively with the provision of loose boulder pitching in the estimates. Provision for boulder pitching in sausage crate was not made in DPR and the work was being executed with loose boulder pitching as on March 2018. As a result, stability of the steeper river side slopes over the right bank of Dwarka and left bank of river Bele was not ensured, endangering the stability of the embankments.

In reply, I&WD stated that boulder pitching in sausage crate was provided in those locations after approving the excess-savings statements. No such document in support of execution of such item was, however, produced to Audit.

(c) Avoidable extra expenditure in embankment protection work

IS code 14262:1995 on Planning and Design of Revetment and Handbook of Central Water Commission (CWC), GoI, on Flood Protection, Anti-Erosion and River Training Works-2012 stipulates that the width of the launching apron[42]

[42] *A launching apron is a flexible stone cover placed on the bed of the river which settles into the scouring area as scouring takes place and covers the base and side of the scour hole, preventing it from developing further scouring.*

depends upon the scour[43] depth below High Flood Level (HFL). Average thickness of launching apron should be 1.5 times of the thickness of boulder pitching.

It was observed that the average thickness of launching apron was provided 1.88 times of the thickness of boulder pitching (0.45 m) in the estimates instead of 1.5 times and executed subsequently for 18.14 km embankment protection works on the rivers of Dwarka and Bele under Phase-II and Phase-III of KMP. Thus, due to execution of excess thickness of launching apron, extra expenditure of ₹ 3.53 crore was incurred by I&WD which could have been avoided.

In reply, I&WD stated that considering the criteria laid down in clause 5.6.2 of Indian Standard 10751:1994 (design of Guide banks), such thickness was provided for launching apron. The fact, however, is that this code is applicable for designing Guide banks[44] and not for embankment protection.

Thus, the intended benefits of the KMP project could not be assured only by the raising and strengthening of embankments of different rivers, without creating additional waterways by renovating the existing bridges and culverts. The already executed improvement works of different embankments were also not in conformity with the approved DPR or guidelines of GFCC.

The inundation maps below show the comparison between the water available in the catchment area of KMP and the floods that had taken place in the catchment area in the years 2011 (before the commencement of the project), 2015 and 2017.

Flood Report of 2017 reflects that all the four blocks (Bharatpur-I, Khargram, Burwan and Kandi) included under KMP were inundated by flood water in July 2017. The flood protection measures taken by I&WD may, therefore, not have been adequate.

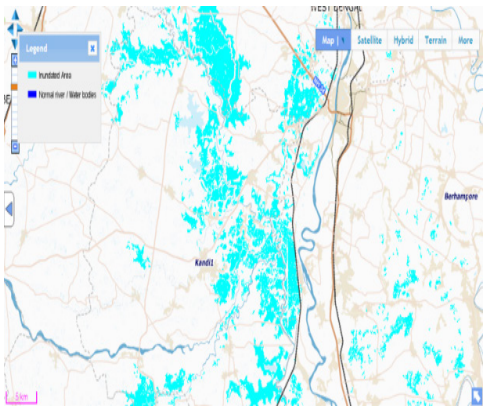

Figure 3.7: Inundation map of Kandi Basin on 16.08.2011

Figure 3.8: Inundation map of Kandi Basin in dry season

[43] *'Scouring' is the name given to the removal of the bed or bank of a water course by the action of flowing.*

[44] *Guide Bank is defined as the site of a barrage to guide the river flow through the confined waterway without causing damage to the structure and its approaches.*

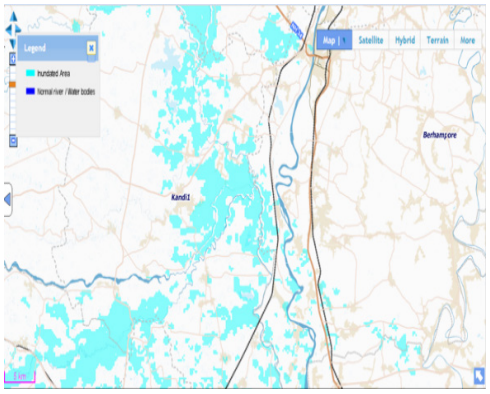

Figure 3.9: Inundation map of Kandi Basin on 07.08.2015

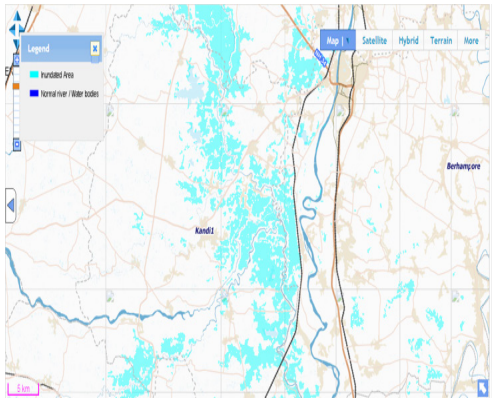

Figure 3.10: Inundation map of Kandi Basin during 23-25.08.2016

I&WD stated that though the blocks were inundated, the extent of inundation was less compared to previous years.

3.2.2 Kaliaghai-Kapaleswari-Baghai Project

The entire KKB (Kaliaghai-Kapaleswari-Baghai) basin covers an area of 2145 sq. km. spread over the districts of Paschim and Purba Midnapore. The southern portion of the basin, having low lying terrain, historically suffers from flood and tidal inundation.

The project primarily comprised of structural measures like:

(i) Excavation/re-sectioning of a total of 186 km embankments of five rivers/ tributaries[45],

(ii) Realignment of the flood protective embankments of Kaliaghai, Kapaleswari and Baghai and construction of embankments as per standard specification,

(iii) Construction of Rubber dam type regulator on river Kaliaghai at Chabukia downstream of outfall of Kapaleswari,

(iv) Construction of three bridges across river Chandia at Sridharpur, Ejmali Chak and Chandipur *etc*.

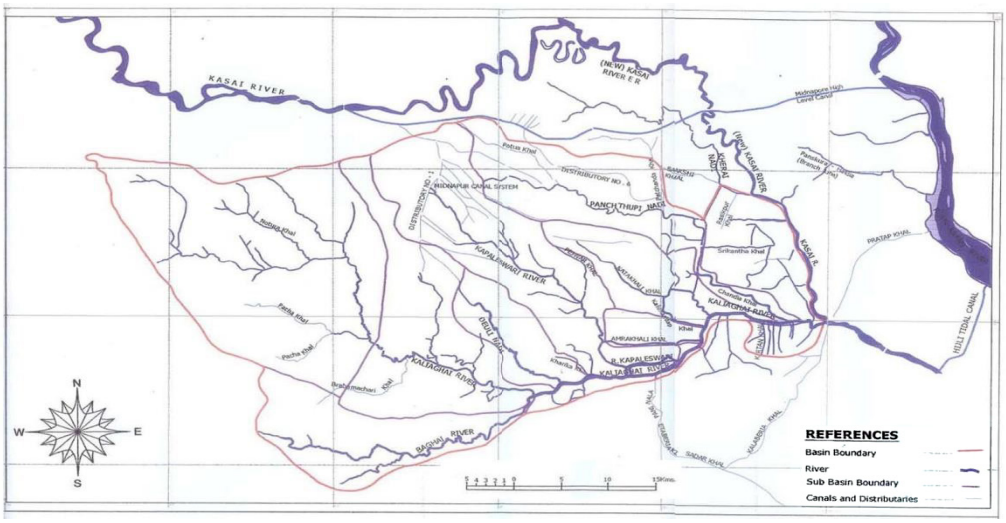

Figure 3.11 : Index Map of KKB Drainage Basin Project

[45] *Kaliaghai, Kapaleswari, Baghai, Deuli, Chandia and Kalimandap, Amrakhali.*

The KKB Drainage Scheme was initiated to provide relief to seven flood prone blocks in Paschim and Purba Medinipur districts. The scheme was envisaged to benefit a total area of 621 sq. km. with population of four lakh.

Investment clearance of ₹ 650.38 crore for KKB project was accorded by the Planning Commission, GoI in March 2010 with target date of completion by March 2015. The project was included under FMP with a funding ratio of 75:25 (Central:State) in July 2010. The project was commenced in March 2011 and ₹ 347.78 crore (Central Share ₹165.73 crore and State Share ₹182.05 crore) was released against which expenditure of ₹340.24 crore was incurred up to March 2018. Release of Central Share was 36.46 *per cent*[46] less as the project could not be completed within the stipulated time. Meanwhile, the State Government released funds in anticipation of receipt of Central fund. I&WD proposed (August 2017) to complete the project by March 2019 which was yet to be approved by GoI. The project was still (December 2018) ongoing.

The project could not be completed within stipulated period mainly due to delay in land acquisition. Only 35 *per cent* of the estimated land was acquired up to March 2018. The main rivers were excavated with reduced design bed width due to non-availability of required land. The length of the rivers/channels were resuscitated only on the available Government land (*i.e.* river course) and to the extent of land acquired for the purpose. Besides, resuscitation works were executed in khals not in the original scope of the DPR.

Physical progress under different components of KKB is shown in **Table 3.2**.

Table 3.2: Physical progress of different components of the KKB project

Sl. No.	Name of the Component	Unit	Estimated quantity	Completed upto March 2018	Progress in Percentage
1.	**Land Acquisition**	Ha	500.00	173	35
2.	**Resuscitation of main rivers**	Km	141.00	128.85	91
3.	**Resuscitation of small drainage channels**	Km	170.00	170.46	100
4.	**Earth work**	Lakh Cum	484.47	414.12	85
5.	**Concrete work**	Cum	6000.37	5490.00	91

(Source: Divisional records)

3.2.2.1 Land acquisition

Clause-4.6 of the FMP Guidelines (2009) stipulates that while submitting a new proposal, the State Government should ensure acquisition of land required under the scheme and submit a certificate to this effect. Failing this, no fund would be released to the State Government.

Approximately 500 ha of land was targeted for acquisition by I&WD involving 223 mouzas in seven blocks for the project. While obtaining techno-economical clearance, I&WD replied to MoWR (GoI) that only small stretch of land would need to be acquired for this project which would not be a problem as the local affected people were urging for the project.

[46] *₹165.73 crore against ₹260.84 crore (75 percent of ₹347.78 crore).*

I&WD published (December 2010) a notification for acquisition of land on emergency basis so that the land acquisition could be made before the monsoon period of 2011 for timely completion of the project. It was, however, observed that I&WD did not initiate any land acquisition proposal prior to May 2011. Against the target of 500 ha, only 173 ha of land (35 *per cent*) was acquired till March 2018. It was observed that the resuscitation of rivers through excavation and/or widening of bed width were made only within available land. As a result, design bed width[47] as per DPR had to be compromised.

As I&WD failed to acquire requisite land the bed width of rivers stipulated in the DPRs for smooth drainage of flood waters could not be achieved.

3.2.2.2 Execution of the project

(a) Non-completion of works due to defective DPR

Para-195 of Irrigation Code of I&WD stipulates that preliminary investigations should be conducted and feasibility assessed before undertaking a project. In the DPR[48] of the project, entire stretch of 63 km[49] of the Kaliaghai river was included for re-excavation work[50], *i.e.*, construction of cross bund (required for dry excavation) for de-siltation. Accordingly, NITs were invited (during March 2012 to December 2015) for the entire stretch at an estimated cost of ₹ 236.37 crore. During execution, however, it was reported by the implementing agency that dry excavation was not feasible in a 500 m stretch as it was at the confluence point of river Kaliaghai with river Haldi, which ultimately discharges water to the Bay of Bengal.

It was observed that the river was excavated for a length of 62.50 km at a cost of ₹ 206.04 crore leaving 500 m from 62.50 km to 63 km un-excavated.

Non-excavation of silt at the confluence point at downstream would hinder smooth drainage of water from the excavated upstream portion of the river and would lead to siltation at upstream again. GFCC in its monitoring visit (September 2017) also witnessed siltation at upstream reaches and confluence point. In reply, the concerned Division stated (March 2018) that the siltation was due to non-completion of the remaining 500 m.

Thus, expenditure of ₹ 206.04 crore incurred on resuscitation of the river in the upstream remained ineffective due to defective DPR as no feasibility study was conducted before taking up of the work.

(b) Selective implementation of DPR

- **Existence of Fishing Barriers in rivers**

As per DPR[51] of the project, about 150 families of the KKB basin used to catch fish using fishing barriers[52] with nylon net across the rivers. Such structures

[47] *Horizontal width of river bed.*

[48] *Page 3, Chapter VIII of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[49] *From Poktapol (46 km) to Dheubhanga (109 km) i.e. 63 km was included for re-sectioning work in the DPR.*

[50] *Excavation for de-siltation.*

[51] *Page 2, Chapter VIII of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[52] *Barriers with polythene sheets in flowing rivers for fishing.*

reduce the velocity of river flow as well as augment silt deposition. Therefore, the DPR proposed for removal of fishing barriers across main rivers.

Figure 3.12: Fishing nets across river Kaliaghai at ch 39.00 km

During joint inspection (April 2018), however, existence of numerous fishing barriers were noticed in all the major rivers, *i.e.*, Kaliaghai, Kapaleswari and Baghai.

In reply, test checked Divisions related with the project stated (April 2018) that they had no data regarding the numbers and ownership of such fishing barriers and there was also no plan for eviction of such structures. It was also observed that there was no monitoring mechanism to control placing of fishing nets across the rivers.

This indicated that the actual implementation of the project by I&WD was in variance with that of DPR. Continued existence of such structures may lead to reduced discharge of rivers and augmentation of silt deposition, thereby exacerbating floods.

- **Removal of Brick Manufacturing Units**

In the DPR[53] of KKB Project, removal of brick or tile manufacturing units from river embankments was identified as one of the absolutely unavoidable measures for meaningful flood management. Indiscriminate cutting of land and lifting of sand from the river bed leads to several hydro morphological changes in the river channel. Provision of ₹ 50 lakh was made in the DPR for rehabilitation of these units. It was observed (March to May 2018) that no rehabilitation programme was carried out by I&WD. During joint inspection (March to May 2018) of seven spots, six brick manufacturing units were noticed on the embankments[54] of Kaliaghai river.

[53] *Page 2, 3 and 6, Chapter XI of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[54] *Haorar Khea (at Ch. 55.00 km of River Kaliaghai), at Ch.42.70 km of River Kaliaghai, Chabukia (at Ch.49.20 km of River Kaliaghai).*

Figure 3.13: Brick Kilns alongside river Kaliaghai at ch. 42.70 km

Thus, I&WD failed to achieve the targets set in the DPR for removal of brick units. Existence of such manufacturing units hampered effective flood management.

(c) Non-compliance with approved DPR

- **Design Bed Width not achieved**

The resuscitation work of rivers and khals[55] under KKB was taken up to increase their carrying capacity by widening and removing silted soil up to the depth as specified in the DPR[56] to deal with the problem of frequent floods. It was observed that the design bed width as envisaged in the approved DPR could not be achieved as requisite land was not acquired. I&WD could acquire only 35 *per cent* of the estimated land up to March 2018. Design bed width was compromised in several cases due to non-availability of adequate land as shown in **Table 3.3**.

Table 3.3: River stretches where design bed width was compromised

Name of the River with chainage (km)	Effected stretch (km)	Bed width as per DPR (m)	Executed Bed width (m)
Kaliaghai (0.00 to 15.00)	15	50 to 70	35
Kaliaghai (15.00 to 34.00)	19	80 to 140	50
Kapaleswari (2.00 to 6.50)	4.50	40 to 45	30 to 44
Deuli (0.00 to 9.487)	9.487	40	15
Kaliaghai (34.00 to 49.20)	15.20	135 to 160	50 to 110
Baghai (15.60 to 7.50)	8.10	45 to 50	18 to 22

(Source: Divisional records)

[55] *Khal means a narrow water channel.*

[56] *Page 14 and 15, Table 10.4B, 10.4C, 10.4D of Kaliaghai-Kapaleswari-Baghai Drainage Basin Scheme – Gradient Statement.*

The executing Divisions replied that resuscitation of rivers was carried out only on available Government land (river course) as the required land was not acquired. Due to non-resuscitation of rivers up to the design bed width specified in the DPR, the problem of frequent flooding and drainage congestion in the basin remained unresolved.

- **Construction of Rubber Dam yet to be taken up**

In the DPR[57] of KKB Project, non-monsoon tidal ingress was identified as one of the major causes of faster siltation of the river beds. Accordingly, it was planned to construct a regulator structure[58] having one-way flow system at the confluence of river Kapaleswari with river Kaliaghai. Provision for construction of the regulating structure on river Kaliaghai was also made to store upstream water for irrigation purposes during non-monsoon period. In order to construct the regulating structure over river Kaliaghai, a cost effective **Rubber Dam** was incorporated (2010) in the DPR[59] with a stipulation to complete the work within three years of commencement, *i.e.*, by 2012-13.

I&WD, however, failed to construct the regulator at the designated site. Scrutiny of related records revealed that revised target was set by I&WD to complete the same by March 2019. I&WD was still (December 2018) in the process of preparation of modified Expression of Interest (EoI) for this work. On the issue of revised expected date of completion, the Department stated (January 2019) that due to complexity of technical know-how, no positive response was received from bidders in the past.

Figure 3.14: Image of a typical Rubber Dam

It was also observed from the report prepared by the concerned Divisional office that even after resuscitation of river Kaliaghai at a cost of ₹ 201.79 crore, huge amount of silt was carried and deposited in the upstream of the river during high-tide. The existence of heavy siltation in the portion already re-excavated in upstream of Kaliaghai river was also witnessed during the joint inspection of site (April 2018). As a result, due to non-construction of the regulator, siltation due to tidal ingress could not be prevented in the re-excavated areas and the carrying capacity of the river was reduced. The aim

[57] *Page 3, Chapter VIII of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[58] *Structure which regulates water flow.*

[59] *Page 2, Supplementary Volume II (Revised) of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin.*

of storing upstream water for irrigation purposes during non-monsoon period was also not achieved.

(d) Violation of conditions of DPRs/agreement/WBFR

The Planning Commission in the investment clearance of the scheme imposed conditions (March 2010)[60] that various components under the project shall be designed and executed as per various relevant Indian Standards and designs vetted by GFCC. Para 5.13 of the FMP guidelines also stipulates that the State Governments should ensure that the works are executed in a well-planned manner and completed within the scheduled period. The project was, however, still in progress and deviations of following conditions/guidelines was also noticed.

- **Execution beyond the scope of the DPR**

While giving Investment Clearance, Planning Commission recommended that the State Government should restrict the expenditure within approved cost and no additional expenditure would be permitted unless revised estimates were approved. Besides, designs of all works were to be vetted by the GFCC.

Audit, however, observed that total 40 works[61] were executed on public demand beyond the scope of the DPR at an expenditure of ₹ 41.94 crore. Designs of these new works were also not vetted by GFCC. Execution of works not included in the DPR without vetting by the competent authority was not permissible. Thus, execution of these works led to unauthorised expenditure from project outlay.

In reply, I&WD admitted that some works had been executed beyond the scope of the DPR due to demand of the local public. I&WD, however, remained silent about non-vetting of the design by the GFCC.

- **Extension of time on grounds other than those mentioned in the tender clause**

As per conditions of contract, time extension beyond stipulated period could be allowed only on grounds of unavoidable hindrance[62] as specified in the tender.

It was seen that in three test checked Divisions[63] under KKB, out of 87 test checked works, 79 works (90.8 *per cent*) valuing ₹ 268.67 crore got delayed for periods ranging from nine to 2113 days (nearly six years). Records relating to extension of time were not made available in 51 works. In remaining 28 works, it was observed that time-extension was allowed in eight works on the grounds[64] other than those mentioned in the tender.

Thus, granting of extension beyond stipulated time and for reasons not specified in the tender conditions resulted in delay in completion of project works.

- **Execution of work without Technical Sanction**

Rule-164 of West Bengal Financial Rules provides that technical sanction from the competent authority must be obtained before commencement of any work.

---

60 *No. 12(1)/25/2010-WR dated 9 March 2010.*

61 *Resuscitation of 31 Khals, construction of five bridges and improvement of four roads works.*

62 *Non receipt of departmental materials, land, injunction, public interference.*

63 *East Medinipur Division, Kaliaghai-Kapaleswari-Baghai Basin Project Division, Contai Irrigation Division.*

64 *Labour problem, Boro cultivation, crisis of machinery, monsoon.*

It was observed that during 2012-13 to 2016-17, four works[65] were executed at a cost of ₹ 8.68 crore without obtaining technical sanction from the competent authority and was also not vetted by the GFCC as per stipulation. Violation of provisions of WBFR not only rendered the execution of works unauthorised but also led to a risk that the works did not adhere to the prescribed technical standards.

In reply, I&WD stated that all works were duly sanctioned by the competent authority as per departmental norms. Reply of I&WD was, however, not specific to the four cases pointed out by Audit.

(e) Non-compliance of recommendation of the Independent Agency engaged by I&WD

Clause 5.8 of FMP Guidelines (2009) required performance evaluation of the project by independent professional agencies having expertise in related field. Accordingly, Indian Institute of Technology (IIT), Kharagpur was nominated by I&WD for performance evaluation of the project. IIT Kharagpur in its report recommended (April 2014) that proper maintenance of the channels be undertaken once in a year to maintain its geometry, otherwise problem may reappear due to siltation. GFCC in the Monitoring Report of January 2018 also recommended for periodical maintenance of the channels to assure the safety of the excavated channels.

Figure 3.15: Heavy siltation observed at Ch.55.00 km (approx) of River Kaliaghai

It was observed that 266.03 km of excavation works were completed in different rivers/khals during March 2011 to May 2018. The concerned Divisions, however, stated that no maintenance work was ever carried out on any of those channels. In its reply, the Department stated the project was still ongoing and for cleaning the bed siltation periodically, the Department needs to observe the situation for at least four to five years as it involves huge amount of funds. The fact remains that the excavation of canals commenced from 2011 and eight years has already elapsed without any maintenance works. Thus, non-compliance

[65] *(1) Resuscitation by excavation of Debi Khal from ch.0.00 km to ch.3.30 km, (2) Improvement of riding quality of Narghat - Gokhuri Road from 0.00 km to 11.00 km, (3) Urgent maintenance and repair of Tyaparpara More to Singlai More Sluice for a length of 6100 m, (4) Urgent maintenance and repair of Bhagabanpur More to Goalapukur for a length of 6000 m.*

of recommendations of Independent Agency/GFCC made the previous efforts in respect of excavation of rivers/ channels ineffective. During joint site visits (March to May 2018), heavy siltation in different rivers/khals[66] was also noticed.

Encroachment of embankments hampered essential maintenance and repair work. The IIT Kharagpur recommended (in its report of 2012-13 and 2015-16) that unauthorised encroachment should be strictly avoided. From the records of the Division it was noticed that there were encroachments on 955 structures[67] at different locations[68] on the embankments hampering the maintenance and repair works. The Divisional Officer requested (September 2017) the District Magistrate, Paschim Medinipur for removal of those encroachments, but without any positive result. During 31 joint site visits (March to May 2018), seven number encroachments were noticed at different locations of rivers/khals.

Figure 3.16: Encroachment over Abhoy Giri Khal

Thus, commencement of the project without ensuring land, grossly hampered execution of works leading to delay in completion of the project. Rivers/khals were not widened/excavated upto design bed width, which implied that with the limited carrying capacity, they would not be able to control frequent flooding in the areas. Inclusion of non-feasible items, non-construction of regulator at the confluence of river Kapaleswari and Kaliaghai and non-maintenance of already resuscitated rivers/khals caused heavy siltation affecting the overall drainage system of the project.

---

66 *Chabukia (at Ch.49.35 km of River Kaliaghai), Haorar Khea (at Ch.55.00 km of River Kaliaghai), Dheubhanga (at Ch.62.50 km of River Kaliaghai), Chandibenia (at Ch.22.00 km of River Chandia), Asnan Ghat (at Ch.24.00 km of River Chandia), Dheubhanga (at Ch.6.80 km of Moyna New Cut Channel), at Ch.42.70 km of River Kaliaghai and outfall of river Kapaleswari, Chabukia at Ch.49.20 km of River Kaliaghai, Birjiban (at Ch.2.00 km of Kapaleswari).*

67 *House, shops, cattle sheds, clubs, primary school, machine sheds, party offices, etc.*

68 *River Kapaleswari left embankment (2.00 kmp to 14.70 kmp), Kalimondop Khal left embankment (0.142 kmp to 0.950 kmp, 2.00 kmp to 2.50 kmp, 5.40 kmp to 6.60 kmp), Kalimondop Khal right embankment (4.60 kmp to 6.80 kmp), Kalimondop Khal both left and right at Mohanbazar, River Kaliaghai (13 kmp to 34 kmp), Ganapatkhal, Banskona khal and Amrakhali khal.*

The Annual Flood Report of 2017 of I&WD reflected that all the seven blocks[69] included under KKB were inundated in 2017. The flood protection measures taken by I&WD may, therefore, not have been adequate.

3.2.3 Implementation of other Embankment protection and anti-river erosion works

Apart from the two FMP projects as discussed above, I&WD executed embankment protection as well as anti-erosion of river bank works under State Plan, Rural Infrastructure Development Fund (RIDF), Common Border Rivers Fund, One Time Additional Central Assistance (OTACA) *etc*. In eight test checked Divisions[70] (other than project Divisions of KKB and KMP), 145 out of 357 tenders having estimated cost more than ₹ one crore each, which were executed during 2013-14 to 2017-18 under flood control measures, were selected for detailed examination.

Scrutiny of selected embankment protection and anti-erosion works revealed the following deviations which would have an adverse impact on the flood control measures:

3.2.3.1 Work done without obtaining clearance from the Forest Department

As per Forest Conservation Act, 1980, clearance from Forest Department is required for construction of embankment on forest land. Alipurduar Irrigation Division took up (December 2016) the work of 'Extension of Subhasini embankment along the left bank of river Torsa' at a cost of ₹ 5.78 crore without obtaining forest clearance. Subsequently, the work was proposed for termination by the Chief Engineer, I&WD in April 2018 due to objection raised by the Forest Department for not obtaining clearance; no reply was received from the Department in this regard.

Thus, commencement of work without obtaining forest clearance made the partially executed work worth ₹ 0.70 crore (only earth work without protection) wasteful.

3.2.3.2 Required thickness of graded filter not provided in the revetment

Para 3.7 of IS code-14262:1995 as well as Para 4.5.4 of CWC Guidelines-2012 stipulate that graded filter of size 150 mm to 300 mm thickness should be provided below the revetment[71] to prevent water from removing the underlying soil of embankments through voids in the boulder pitching.

It was noticed that in 28 estimates prepared by three test checked Divisions[72] valuing ₹ 61.83 crore, provision for only 100 mm thick filter layer of shingles under the slope pitching was made and executed in violation of the existing norms. Thus, construction of embankments with less thickness of filter layer made them vulnerable to erosion.

---

69 *Narayangar, Datan-I, Sabong, Pingla, Bhagabanpur-I, Patashpur-I and Moyna.*

70 *Howrah Irrigation Division, Malda Irrigation Division, Mahananda Embankment Division, Coochbehar Irrigation Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

71 *Embankment protection work with boulders placed along the slope of the embankments.*

72 *Coochbehar Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

In reply, I&WD stated that 100 mm thickness shingles filter is normally provided where discharge is less than 4500 cumec[73].

The reply was, however, not in consonance with the fact that neither the IS code nor the CWC guidelines recommend graded filter layer of 100 mm thickness.

3.2.3.3 Non-execution of sand cushion layer in embankment

Para 3.7 of Indian Standards code-14262:1995 stipulates that a 150 mm thick sand cushion layer should be provided over the filter fabric to prevent mechanical rupture of the fabric by revetment stones.

Mahananda Embankment Division executed nine embankment protection and anti-erosion works valuing ₹ 58.36 crore where boulder pitching on top and slope was executed over Geo-textile filter. It was, however, observed that laying of sand cushion was not envisaged in the estimates and works were executed without providing such layer.

As a result, possibility of rupture of filter layer and failure of the protection works could not be ruled out. In reply, the concerned Division stated (June 2018) that in future sand cushion layer will be included in this type of work.

3.2.3.4 Delay in execution of works

Clause-2 of standard tender agreement stipulates that time is the essence of the contract. NIT clause further stipulates that time extension may be granted only on the ground of non-receipt of departmental materials, land injunction or public interference, *etc*.

It was observed that completion of 42 works taken up by the six test checked Divisions[74] were delayed by nearly four months to four years. Further, scrutiny revealed that time extension was granted by the competent authority on grounds other than those specified in the contract agreements in all cases. This resulted in delay in achievement of the intended benefits from the projects. Moreover, delay in execution of works kept the river embankments in vulnerable condition.

3.2.3.5 Use of lower specification Galvanised Iron wires in boulder crates for construction of embankment

Para 3.6 of Indian Standard 14262:1995 on Planning and Design of Revetment stipulates that Galvanised Iron (GI) wire of minimum four mm diameter should be used for crates in revetment in the area where velocity of river is high. It was observed that in five test checked Divisions[75] crated boulder with GI wire of less than four mm diameter (ø) was used in all 48 test checked embankment protection/anti-erosion works valuing ₹ 219.79 crore during 2013-18 in violation of the norms. The works remained vulnerable due to use of below specification GI wire for boulder crates in embankment and anti-erosion works. During joint site visit (April 2018) of left bank of river Mahananda in Adampur Block of Malda District it was also noticed that the crates used in protection works were in broken condition.

[73] *Cubic metre per second.*

[74] *Howrah Irrigation Division, Malda Irrigation Division, Mahananda Embankment Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[75] *Malda Irrigation Division, Mahananda Embankment Division, Coochbehar Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

Figure 3.17: Damaged revetment constructed with below specification GI wire

3.2.3.6 Avoidable extra expenditure

(a) Para 5.6 of IS Code 14262:1995 on Planning and Design of Revetment and Para- 4.9.4 of Guidelines of Central Water Commission (CWC), GoI, on Flood Protection, Anti Erosion and River Training Works-2012 stipulate that the thickness of launching apron be 1.5 times the thickness of pitching. Test checked Malda Irrigation Division, however, executed 10 embankment protection/anti-river erosion works where the thickness of stone boulder in launching apron was provided 33 to 56 *per cent* more than the actual requirement. Thus, execution of excess thickness of apron resulted in extra expenditure of ₹ 10.44 crore which could have been avoided.

In reply, I&WD stated that as the works were executed in restricted zone of border area having rare scope of maintenance, such excess thickness was provided.

No such justification was, however, provided in the DPR. Besides, the reply appears to be an afterthought.

(b) IRC-SP-72-2007, the guidelines for the design of Flexible Pavements for low volume rural roads do not recommend laying of any bituminous base course for rural road/village road of low traffic intensity. It was observed that 50 to 75 mm Bituminous Macadam (BM) was provided on three roads[76] over earthen embankment by three test checked Divisions[77] where the roads were either of village road category or the traffic intensity was very low. Execution of unnecessary BM layer resulted in extra expenditure of ₹ 2.10 crore, which could have been avoided.

Flood protection measures taken up by the Divisions were not as per prescribed standards. It was also observed from the Annual Flood Reports of I&WD that, in 2017, the area under flood inundation of the State was more than that in the last four years, despite the flood control measures.

[76] *Malior embankment 0.00 to 10.00 kmp, Improvement of inspection road of distributary 5 of DBMC, bituminous inspection path at Bibigunj and Jhar Singhersar embankment.*

[77] *Mahananda Embankment Division, Mayurakshi North Canal Division and Jalpaiguri Irrigation Division.*