

**A REPORT ON THE IMPACT OF FARAKKA BARRAGE
ON THE HUMAN FABRIC**

(A study of the upstream and downstream areas of Farakka Barrage)

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One crore = Ten Million

One cusec = 0.02831 cubic metres per second.

One lakh = 100,000

Block : Administrative unit of a district

Mouza : Smallest administrative unit for collection of Revenue, a village can be comprised of several mouzas.

Char: Chars are the riverine mud banks or sandbanks, as they are locally called

Thana : Police Station

Abash: Residence

Yojana: Planning

Acronyms

I & W : Irrigation & Waterways

FBP : Farakka Barrage Project

CURRENCY

1 US \$ = approximately Rs. 43.40 as per exchange rates prevailing on 9 November 1999.



WHAT IS FARAKKA BARRAGE PROJECT

The Farakka Barrage Project is designed to serve the need of preservation and maintenance of the Calcutta Port by improving the regime and navigability of the Bhagirathi-Hoogly River system. The Farakka Barrage Project Organisation has been assigned the work of execution of the following principal components of the Project:-

- ⇒ A 2245 metre long barrage across the river Ganga with rail-cum-road bridge, necessary river training works and a head regulator on the right side.
- ⇒ A 213 metre long barrage across the river Bhagirathi at Jangipur.
- ⇒ Feeder Canal of 1133 cumec (40,000 cusec) carrying capacity and 38.38 km long, taken off the Head Regulator on the right of the Farakka Barrage.
- ⇒ Navigation works such as locks, lock channels, shelter basins, navigation lights and other infrastructure.

Source: Union Ministry of Water Resources web site, downloaded in Sept. 1999

A REPORT ON THE IMPACT OF FARAKKA BARRAGE ON THE HUMAN FABRIC

(A study of the upstream and downstream areas of Farakka Barrage)

Abstract:

The Farakka Barrage Project taken up for the resuscitation of the navigational status of the Port of Calcutta have resulted in massive devastation in Malda on its upstream and Murshidabad on its downstream in West Bengal. Huge sedimentation, increasing flood intensity and increasing tendency of bank failure are some of its impacts. Erosion has swept away large areas of these two districts causing large-scale population displacement, border disputes with Bihar and Bangladesh, pauperization and marginalisation of the rural communities living by the river and creation of neo-refugees on the chars. Moreover the government strategies to combat this problem is not proactive but reactive, localised and temporary resulting in few spurs and embankments to be washed out each year. This has led to corruption and other malpractices. The solution lies in taking up the problem as a whole instead of piece-meal remedies; to go for a thorough study of the whole Ganga Basin and provide effective Basin-management plan by regulating the flow of the river.

“My object was to make Man triumphant over the sands and water and stones, which conspired against him. I had not the time to trouble my mind about what would happen to some wretched maize fields of some wretched cultivator in some place or other.”

Bibhuti, the technocrat who bounded the waterfall of Muktheadhara in Tagore’s play *The Waterfall* 1922

“Purely from economic and financial considerations the cost for protecting agricultural areas from erosion are too heavy to be justified.”

Report of the Ganga River Erosion Committee.
Govt. of West Bengal 1980

Introduction: It has now come in the discourse that a particular technology by itself does not translate into development. With the ‘mining’ attitude over resources more often technological feats achieved in ‘harnessing’ nature ultimately results in enormous plight of the people in the receiving end, the common people.

In dealing with the current study of the impact of Farakka Barrage upon the human fabric, the basic argument is that Farakka Barrage is not only a technical issue, it cannot be judged merely in the frame of technical achievements and failures belonging to a specialised structural category since its impact apart from creating mounting controversy with a neighboring nation (which is out of the scope of this study) has created enormous damage, displacing lakhs of people of that very land which was supposed to be proud of this. At the same time this issue is also a question of realpolitik.

So far the dominant trend has been to analyse Farakka Barrage within its structural frame and suggesting structural remedies for the problems generated. But it is overlooked that this technological interception has affected a whole system, the ecological processes of nature which renews life support systems, a river like Ganga with a rich socio-cultural history, the human population living on its banks, their lives and livelihood, their culture. A river is not an inanimate object to be studied with the computers in the laboratories, the humans living with it are not merely mute witnesses. The technocrats and politicians are not the absolute legislators of knowledge.

The knowledge owned by the people living for ages with the river, the oft-quoted traditional wisdom, is not primitive being non-technical, but futuristic, which has to be acknowledged. In its limited scope this study is unable to elaborate on the different components of this issue, but wishes to focus on a life-centered approach instead of a techno-central approach.

Objectives of the study: The broad objective of the study is to see the impact of the Farakka Barrage resulting into aggravation of flood and riverbank erosion upon the people living in the immediate upstream and downstream area. The problem of rural impoverisation and marginalisation and response to the situation is observed

along with the background history of the barrage, expert's assessment of the situation and possible solutions.

Methodology of the study: The study areas identified are the two districts of West Bengal, Malda in the upstream where the river is eroding the left bank and Murshidabad in the downstream where the river is affecting the right bank. The study included:

⇒ Data collection from available documents from both Government and Non-governmental sources.

⇒ Field investigation in the worst affected areas of Malda and Murshidabad districts. This was carried extensively in Panchanandapur in Malda, and in a more selected way in Jalangi, Akheriganj, Dhulian of Murshidabad. Participatory observation, dialogue and survey methods were used to gather relevant data.

Constraints of the study: Due to the limited period of the study extensive survey could not be done in the affected areas. The area is huge and proper documentation of the extent of the problem is not available with the authorities.

Background: To understand the problem in depth, one has to trace the path of the river Ganga. It emerges from a glacier at Gangotri, about 7010 mts. above mean sea level in the Himalayas and flows down to the Bay of Bengal covering a distance of 2525 km. In this length, Ganga passes along 29 class-I cities (population over 1,00,000), 23 class-II cities (population between 50,000-1,00,000) and 48 towns having less than 50,000 population. About 50% of Indian population live in the Ganga basin, 43% of total irrigated area in the country is also in the Ganga basin and there are about 100 urban settlements with a total population of about 120 million on its banks. [1]

The Ganga-Brahmaputra basin comprises an area of about 10.98 lakh sq. km and the delta area is about 1,50,000 sq.km. Each year Ganga and Brahmaputra bring around 166.70 crore tonnes of silt and it is this silt which has created the world's largest delta and the delta-building process is still ongoing. As the Ganga enters West Bengal, it swings the Rajmahal hill range opposite Maniharighat and starts flowing almost south. After Rajmahal upto Maharajpur in Bihar the deep channel of the river flows by the right bank and has been existing for over a century without any change. This has been possible as the right bank is hilly area and the material is composed of hard rock. Below Rajmahal the river is divided in two with Bhutni Diara in between. Now the river is flowing through the western channel as the eastern channel has dried up due to siltation. On the eastern side of Bhutni, a branch of Koshi river (Mara Koshi) and Fulhar (a tributary of Mahananda) has joined Ganga. From the meeting point of Fulhar and Ganga, Kalindri has emerged which flowing has later merged with Mahananda at Nimasarai Ghat of Malda city. Bhagirathi (not to be confused with the main Bhagirathi) and Pagla after emerging from Mathurapur and Khasmahal has flown in the east later merging with each other near Malda-Bangladesh border and then merged with Mahananda. The length from Bhutni to Jalangi is 137 km.

The delta of Ganga can be said to start from Farakka in West Bengal. The river divides into two arms about 40 km south-east below Farakka at Khejurtala village in Murshidabad district. The right arm of the river (which was the original course of Ganga) continues to flow south in West Bengal in the name of the Bhagirathi (called Hooghly in its downstream stretch) which crosses 500 km. to the sea. The left arm of the main Ganga flows into Bangladesh after flowing by the border of Murshidabad for 60 kms in the name of Padma and joined by the Brahmaputra and the Meghna and all these rivers form this huge delta before ultimately falling into the Bay of Bengal.

In this basin annual average rainfall is 1030mm. Through the path of 200 kms plain land between Rajmahal hill in the east and the Meghalay plateau in the west, all the water of North India, Nepal and Tibet come down. And this water flows down through the border of Malda and Murshidabad districts of West Bengal. In the lean seasons (March-April) the flow of water in Farakka is 55000 cusecs and during monsoon (August-September) it varies between 18-27 lakh cusecs [2].

Justification for Farakka Barrage: There is considerable evidence that originally Bhagirathi formed the main course of the Ganga. Gradually the shifting of the Ganges near Gaur according to Major F.C. Hirst, by bringing the Padma more in a direct line of flow, placed her in a more favourable position for drawing the Ganges flood [3]. Within historical times, the Bhagirathi has experienced number of changes of its off-take positions in relation to the present river. For example in Rennell's "Memoirs of a map of Hindoostan," (1788) it is stated that the entrance of the Bhagirathi was near the village Suti of Murshidabad and found the river almost dry from October to May. The mud and sand that enter the Bhagirathi with the Ganga water during the monsoons cannot all be flushed out to sea owing to choking of the mouth and stopping of the currents as soon as the rains are over. And so Bhagirathi remained separated from Ganga in the nine lean months of the year as the water in Ganges flow nearly one meter lower than the bed of Bhagirathi [4].

Calcutta Port was established in 1890 without consideration of "proper technical and hydraulic factors" [5] but even prior to that the Bhagirathi-Hooghly being cut-off from the Ganga for 9 months, was gradually drying up and each year 9 crore cubic feet silt accumulated in the Hooghly river. The permissible drafts for ships entering or leaving the port have been seriously declining from 1938 to 1959. Till 1948 ships with drafts of about 8 m (26 ft.) could come for a number of days throughout the year but then the mean drafts permissible were from 21 to 23 ft. (Loss of each foot of draft means a loss of 600 ton of cargo-carrying capacity.) The gradual choking of the channel has also led to steady rise in the salinity or brackishness of its waters affecting drinking water in Calcutta.

Proposals for improving navigable approach to Calcutta have been coming up for a long time since the late years of the East India Company rule. The first was to avoid the Hooghly altogether and in 1831, Government ordered a survey with a view to the proposed excavation of a ship canal to the head of the Matla river, 25 kms. south of Calcutta. This scheme had been presented from time to time, attention was drawn to

it by the committee of 1853. In 1863 a new port Canning was established on the Matla in conjunction with the Calcutta and South-Eastern Railway, but this was abandoned around 1866.

Sir Arthur Cotton, an eminent engineer (1853), the committee on the state of the river Hooghly (1854), Mr. L.F.Vernon Harcourt (1896), the Stevenson-More Committee (1916-19), Sir William Willcocks, an eminent engineer from Egypt (1928-30), Mr. T.M. Oag (1939), Mr. W.A.Webster, Chief engineer of the Calcutta port (1946), Sir Claude Inglis (1946), the expert committee on the river Hooghly (1952), Sir S.C. Majumdar (1953) among others have examined the problems facing the Port of Calcutta as a result of the deterioration in the regime of the river Bhagirathi-Hooghly. Each one has, in its own time, come to the conclusion that it was necessary to take positive steps to improve the head water supply of the Hooghly on which depended the very existence of Calcutta [6]. Most were of this opinion that this could be done by building a permanent barrage across the Ganga and diverting some of the Ganga waters to resuscitate the Bhagirathi.

The last expert, Dr. Ing. Walter Hensen (1957) of West Germany, an expert on river hydraulics, who carried out the most comprehensive examination of this problem, recommended that a minimum upland discharge of 40,000 cusecs must be assured to have the desired effect on the moribund navigable channel arresting the upland sand movement. This was endorsed by Dr. J.J.Dronkers, expert from Netherlands, Dr. D.V.Joglekar, who was associated with the Central Water and Power Research station at Pune. The electrical analogue model used by the Calcutta Port Commissioners in the research for the study of the behaviour of the Bhagirathi-Hooghly, primarily indicated that 40,000 cusecs of water can bring about a balance between the flood and ebb tide velocities during the dry season, flush the already deposited sediments on the Bhagirathi-Hooghly bed and also flush a trench in the Hooghly river bed deep and wide enough for larger ships to ply all the year around.

It must be noted here that no Environmental Impact Assessment was done in this stage regarding the Project. Geological Survey of India did a geo-technical assessment of the project mainly to ascertain the best site for the barrage.

Thus a decision to construct a barrage across Ganga was taken by the Government of India to divert 40,000 cusecs of water from its prevailing main flow in the Padma to its moribund branch Bhagirathi. The objective was to improve navigation of Calcutta Port, improve potable water supply to the city and establish inland water transport etc. The site chosen was Farakka, 160 miles almost due north of Calcutta, situated on the Bengal-Bihar border near Rajmahal. The principal components of the project were:

- ⇒ 2.62 km. long barrage across the Ganga, which also carries a railway-cum-road bridge, very important link between northern and southern part of West Bengal.
- ⇒ 213 metre long barrage across the river Bhagirathi at Jangipur.
- ⇒ Feeder canal of 40,000 cusec carrying capacity.

One of the major critics of this proposal was Kapil Bhattacharya, an eminent

engineer (a former engineer in chief of West Bengal). He categorically affirmed that it would be impossible to get 40,000 cusecs water during lean season. Thus the barrage will definitely fail in its promise of navigability. Moreover Barrage sill is not built below the lean season bed of the river. Previously during flood the flow of the water used to cut through the riverbed increasing its depth from as much as 50 to 150 ft. This process is obstructed now and maximum discharge capacity will be severely affected. Now as a result of the obstruction in the natural process of desiltation the bed of the river in West Bengal, Bihar and U.P. has gone up. Also he predicted huge floods in Malda, Murshidabad districts of West Bengal and in Patna, Barauni, North Munger, Bhagalpur and Purnia districts of Bihar. Immediately after the construction of the barrage, in 1971 and 1972 there were huge floods. He pointed out that the design discharge of the Barrage which is 27 lakh cusecs is much less than what is required and it should be 40 lakh cusecs. In the flood of 1971 it was observed that the Barrage can discharge only 23 lakh cusecs and the excess water has drowned Malda [8].

The then Pakistan endorsed Kapil Bhattacharya's view and appealed to international bodies against this scheme as a result of which Sri Bhattacharya was branded as a traitor, an agent of Pakistan and had to subsequently resign from his job.

The work started in 1962 and ended in 1971. Four more years were needed to build up the feeder canal and the project was dedicated to the nation on the 21st May 1975.

International disputes: This barrage and its water flow management has been a long-lingering source of dispute with the then Pakistan and now Bangladesh. Bangladesh has objected to the construction and operation of this project on the grounds that:

- ⇒ The average lean period flow of the Ganga at Farakka, estimated at 55,000 cusecs, is her normal requirement for Ganga waters.
- ⇒ River navigation, the heart of Bangladesh's transport network will be seriously affected.
- ⇒ Estuarine saline intrusion inland will adversely affect agricultural production, will affect crop by lowering the ground water level in the basin area and will have adverse effects on riverine and estuarine fisheries.

Pakistan invited two eminent experts, Dr.A.T.Ippen and Clarence F. Wicker, to review the problem. They were not given all the data available to Indian engineers but they were given the reports which India had supplied to the Pakistan Government. These experts concluded that the diversion of fresh water into the Hooghly River through the construction of the Farakka Barrage will not contribute to the solution of but is likely to accentuate the serious shoaling problems in the river and to the preservation of the Port of Calcutta. Indian engineers argued that Ippen and Wicker did not have all the information. But why these were not made available to them is still a debated issue. Control of information since the inception of the barrage has further intensified the issue as India Government has refused to release the measurements, which would show whether or not Farakka diversions are

effective [7].

The international dimensions of the issue are beyond the scope of the paper and what is mentioned here is only by way of giving fuller picture of the issues.

Basic components of the Farakka project:**A. Farakka Barrage**

Length: 2.62 kms

No. of Bays: 109

Lowest Bed Level: 10.30 m. above m.s.l.

Pond Level: 21.9 m. above m.s.l.

B. Feeder Canal:

Length: 38.3 kms

Design discharge: 1133 cumecs (40,000 cusecs)

Bed Width: 150.8 m.

Full Supply Depth: 6.10m

C. Jangipur Barrage:

Length: 212.70m

No. of Bays: 15

Crest Level: 12.8 m above m.s.l

Post-Farakka situation: Effects at a glance:

(Source: Prof. Kalyan Rudra, Lecture delivered at Bose Institute-Calcutta, 4.9.99)

Upstream

- Interception of the flow channel/ changed from straight to oblique
- Sedimentation (640×10^6 metric tonnes/ year)
- Reduction of the cross-sectional area
- Declining slope of the long profile
- Widening of the river and increasing length
- Increase in flood frequency and magnitude
- Severe bank erosion and displacement
- Rising ground water table
- Tendency to bypass the Farakka barrage along Kalindri -Mahananda

Downstream:

- land reallocation from right to left
- Population displacement
- Indo-Bangladesh border dispute
- Falling ground water table
- Communication delinkage
- Threat to Farakka barrage at Fazilpur point

The Barrage has caused serious interception in the dynamic equilibrium of the river hindering the natural oscillation of the river within its meandering belt. The meandering belt of Ganga in Malda and Murshidabad is 10 km wide. The water level

of the Ganga rose about 8 mtr. upstream of the Farakka barrage and the ground water level experienced corresponding upheaval in the district of Malda. The river which flowed in a South Easterly course between Rajmahal and Farakka during early decades of this century has now formed a mighty meander loop concentration to accommodate the additional discharge accumulated due to the barrage leading to massive erosion of the left bank [9]. Due to the obstruction caused by the Barrage each year nearly 64 crore tonnes of silt is accumulated in the riverbed. In the last three decades this has resulted in the accumulation of nearly 1856 crore tonnes of silt. In Malda the river looks like a closed marshland with aquatic plants flowing in it. Each year in Malda the riverbed is rising at the rate of 50 cm resulting in declining slope in the opposite direction between Farakka and Rajmahal. In the lean seasons the depth of Ganga near Manikchak ghat is barely 10 metres. Ganga is trying to bypass this obstruction and may be in one devastating flood it will merge with Kalindri in the eastern side and the combined flow will merge with Mahananda at Nimasarai Ghat of Malda and afterwards the collective flow will merge with Ganga/ Padma in Godagari Ghat of Bangladesh. In the expert committee report set up by the Planning Commission in 1996 it is stated that once the Ganga is allowed to avulse into one of its abandoned channels on the left bank, Farakka Barrage will be outflanked.

According to the design of Farakka Barrage, in the 109 bays of the barrage the highest capacity of water flow is 500 cusecs per ft. But now the flow is passing through the right 54 gates only and so during monsoon the water accumulated here is 700-cusecs/ft. Feeder canal can bear only 40,000 cusecs. And the rest looks for a way out and flows through Kalindri, Pagla and others. In 1998 the flow was 26.80 lakh cusecs which couldn't go through the barrage. The flow got obstructed between Rajmahal hills whose stony rocks it couldn't cut through and made its way through these rivers causing the century's biggest flood in Malda. The sedimentation in this stretch poses further problem, which has taken an alarming magnitude leading to closure of 56 sluice gates.

The Ganga being a meandering channel, erosion of the bank is a common feature. But it has been observed that since the beginning of the Barrage construction, the severity of erosion has increased as admitted by the authorities. "The severity of erosion has increased after the construction of Farakka Barrage" vide Memorandum for Expenditure Finance Committee, Proposal for Central Grant for prevention of erosion of the Ganga/ Padma in the districts of Malda and Murshidabad in the State of West Bengal to be executed during 9th five year plan. (Irrigation & Waterways Department, pg. 1 para 1.2)

The social impact of the erosion

Malda: In Malda, the upstream area of Farakka, on the left bank of Ganga for a long time five community development blocks are being more or less affected by erosion. They are Manikchak, Kaliachak 1, Kaliachak 2, Kaliachak 3 and Ratua since last three decades. According to the report of the Committee set up by Planning Commission mentioned earlier nearly 4.5 lakhs of people have lost their homes due

to left bank erosion and 22 mouzas have gone in the river of Manickchak, Kaliachak 1 and Kaliachak 2.

The following information is derived from the 1991 Census Handbook of Malda taken. In this book certain villages are indicated as uninhabited. Field queries have revealed that such villages have been washed away by erosion.

⇒ According to the census taken on 1991, the total population of Manickchak is 177,572. Total number of household is 31,357. Till 1990, Ganga has eroded 47 villages.

⇒ In Kaliachak block 2, total population is 163,871. Total number of household is 28,820 including the homeless. Till 1990, 17 villages are lost in erosion.

⇒ In Kaliachak block 3, total population is 143,531 including the homeless. Number of villages- 75.

⇒ Kaliachak block 1 has a population of 243,787. Total number of villages 66. Total household 41,432 including the homeless. There is no record of uninhabited villages in these two blocks as erosion started here after 1990 when this Census was taken.

⇒ Not much data is available of Ratua, part of which is included in Bhutnidiara. The major part of Bhutni is included in Manickchak block.

The worst-hit areas lie in the unprotected zone on the left bank of the river stretch between Bhutnidiara to Panchanandapore in the Kaliachak II block. It is this Panchanandapore where the people's movement for their life and livelihood is gaining momentum led by Ganga Bhangon Pratirodh Action Nagarik Committee.

Even 40 years back, Panchanandapur was a flourishing river-port and trading centre. Apart from block headquarter, high school, sugar mill it had a regular weekly market where traders used to come by large boats from Rajmahal, Sahebganj, Dhulian. Today's Panchanandapur has shifted to Chethrumahajantola after going through the eroding process of 5/6 years. As no official data was available, the Nagarik Committee's survey revealed loss of 750 square kilometre area in the last 30 years in Kaliachak and Manickchak area. 60 primary schools, 14 high schools, coveted mango orchards have gone leaving 40,000 affected families. Also here due to erosion the distance between Ganga and Pagla is rapidly diminishing. In 1923 it was 8.53 km, in 1966, it was 2.04 km, in 1975, it came to be 0.95 km and in 1999 it is 300 mtrs only.

At midnight on 21st July 1998, water entered Malda breaking the fifth retired embankment. The district was inundated till 13 Sept. As the water receded massive erosion started. Affected include all the 15 blocks, 2 municipal areas. According to official estimate, the damage is about Rs. 878.58 crores.

This year the much coveted spur no. 24 under reconstruction (proposed budget about 18 crores) with latest innovative technology (Geomatics, Geojute and Polypolyne fibre, a technology from Netherlands) has already been washed away as predicted by independent experts and the Nagarik Committee. In a statement the Additional District Magistrate has stated (19.08.99) that on an average a stretch of

20 metres is being eroded by the Ganga each day. So far about 800 metres of the river's bank have already been eroded in the Manikchak and Kaliachak areas. [The Statesman, 20 August, 1999]

The strange fate of spur no. 24: The riparians of the Malda district have been mute witness of the annual rituals of boulder pitching and construction of embankment during last three decades. But these futile preventive measures benefited none other than the contractors, politicians and unfair bureaucrats. Some twenty spurs have so far been swept away and five embankments have been breached. To the utter surprise of the people, the reconstruction of spur no. 24 (proposed 900 metres with cost around 18 crores at Goloktola in the Kaliachak II block area.) started in late May and it was anticipated that this too will be washed away before completion. The Irrigation Department turned a deaf ear to the repeated demands of the Ganga Bhangon Pratirodh Action Nagarik Committee to complete the preventive measures before the rainy season. On 5th January, 5000 strong cyclists took out a rally to the District Magistrate, Malda. On 8th April, same demand was raised to the General Manager, Farakka Project. Again from 3rd to 7th May a *dharna* took place before District Magistrate's office with the same demand. Apart from these large-scale demonstrations memorandums were given to various authorities, even to the State Governor regarding this issue. It was obvious then that the cost involved in this work amounting to Rs. 18 crores will go astray.

More importantly, since the construction work started, the Ganga has been gnawing its bank upstream of the work site and the village Panchkaritola is in peril. The Finance Minister promised on 1st July that the work will be completed within 15 days, yet till the end of this fateful spur only 30 % work was complete. And so the spur was completely washed away by the end of August and five thousand people of Panchkoritala, Khaskol, Golaktola and Janutola villages have taken refuge on the sixth retired embankment. The school building of 1928 has been washed away. Sixth retired embankment too is under constant threat and once broken will completely inundate Englishbazar, Manikchak and Kaliachak blocks. On August 21, a surprised District Magistrate learnt that the irrigation department had no maps showing the extent of the damage. Over the past ten years the Ganga has eroded almost eight kms along its banks, and the District Magistrate admitted that the local irrigation department was not equipped to check the menace. Short-time measures like dumping boulders along affected spurs could not provide a lasting solution and a detailed planning for a permanent solution was required.

The people believe that construction of two long spurs near Manikchakghat as was proposed in the Report of the Planning Commission (1996) might have produced better result. The District Magistrate also admitted on August 18, that the demand of additional spurs by the local anti-erosion Nagarik committee was justified. If put up, those spurs might have saved spur no. 24 from being washed away. So much for the famous debate of technical and non-technical expertise. All that is left for the engineers is to continue to fight over the method to be adopted to buttress and repair damaged spurs. The construction of embankments does not offer any guarantee against flood yet the engineer- contractor-politician nexus operates in the same

fashion every year.

And then comes the announcement of State Irrigation Minister Debabrata Bandopadhyay on August 19, that the state government has launched a Rs. 1200 crores project to combat floods and repair embankments in the state.

Murshidabad: The river Ganga/Padma before Nimitita i.e., about 20 km. downstream of Farakka Barrage flows along the international boundary with Bangladesh in the left bank. Any loss of land in the Right Bank due to erosion is therefore a permanent loss to Indian Territory. The river has bankline of 94 km along its Right Bank from downstream of Farakka Barrage to Jalangi in the district of Murshidabad.

The limited functioning of the barrage gates and concentration of flow along the right bank have led water striking and causing severe erosion all along the right bank, downstream of the barrage. Any diversion of water from the main channel would obviously cause reduction of water level in the downstream section. This phenomenon becomes acute during lean months (pre-monsoon). Deltaic rivers receive substantial supply of water from the ground water table when the river level goes down a critical limit. This situation results in more and more seepage of ground water towards the river. In the case of Ganga/ Padma this flow of ground water towards the river removes the underlying unconsolidated sands composing the lower strata of the bank and thereby the overlying strata finds no support to stand in its original position. The ultimate result is vertical collapse of the bank threatening the human habitation thereon.

Downstream of Jangipur Barrage the river Ganga/Padma is swinging away close to river Bhagirathi at Fazilpur leaving only 1.34 km. in width. In 1996, this distance was 2.86 km. If Ganga/Padma actually merges with Bhagirathi due to the natural tendency, it will lead to flood and catastrophe in the entire Bhagirathi basin. Bhagirathi water remains at a higher elevation than the river Ganga/Padma during lean season and if they merge the water of the feeder canal will flow through Padma to Bangladesh defeating the very purpose of the Farakka Project. This is stated in the report of the expert committee, set up by the Planning Commission of the Central government in September, 1996 and this report was produced before the Division Bench of Calcutta High Court on 30th June, 1999 [The Statesman, 2 July, 1999]. The Minutes of the Eleventh sitting of the Standing Committee on Agriculture comprising members from Lok Sabha, Rajya Sabha and Secretariat held on 2nd July, 1998 at Parliament House, New Delhi has stated in its Recommendation No. 23 that due to progressive erosion in the downstream of Farakka, the National Highway No. 34, the railway lines and the feeder canal are under threat of being washed away. If this erosion goes unchecked in this sensitive international border area, the very objective of the Farakka Project would be completely defeated.

The following blocks have to face the burnt of erosion year after year: Farakka, Samsanganj, Suti I, Suti II, Raghunathganj II, Lalgola, Bhagwangola I, Bhagwangola II, Raninagar I, Raninagar II and Jalangi.

According to govt. reports (Status Report on erosion in Murshidabad) between 1988 and 1994, 206.60 square km. land was eroded displacing 14,236 families. In *A case study on char lands*, Shri M.L.Meena, District Magistrate, Murshidabad (92-94) states that the change of the river has been passing through a transition period particularly after the commissioning of Farakka Barrage in 1975. Dhulian and its adjoining areas were greatly affected in mid 1970s when about 50,000 people became homeless. The encroaching river wiped out 50 mouzas and engulfed about 10,000 hectares of fertile land. This year till now nearly 50 families have been rendered homeless. At Sankopara between the new railway line and Ganga the distance was 518 mtrs in 1980 which is now 165 mtrs. People in Murshidabad had been experiencing erosion for the last two centuries but the ravages caused by the mighty Padma at Akheriganj in 1989 and 1990 surpassed all previous records. Akheriganj disappeared from the map destroying 2766 houses, leaving 23,394 persons homeless many of whom migrated to the newly emerged Nirmal char along the opposite bank. Akheriganj of Bhagawangola II is still the most vulnerable point in Murshidabad. This area has lost its school, college, places of worship, panchayat office to the raging Padma. This year protection work along the river bank was done of 960 meters but 230 metes of protective work has already washed away. The budget for this work was Rs. 9.06 crore.

Prime agricultural land, inhabited villages, trade centers and townships like Dhulian, Nimtita, Aurangabad, Lalgola, Akheriganj and Jalangi have been subjected to erosion. Original Akheriganj of nearly 20,000 inhabitants have gone into the river around 1994.

Jalangi situated 50 km east of Beharampur district headquarter has suffered tremendously in 1994-95. At Jalangi Bazaar severe erosion started in September 1995 engulfing nearly 400 metre width of land within a week and then high built up homestead land thereby destroying Jalangi High School, Gram Panchayat Office, Thana and innumerable buildings rendering nearly 12000 people homeless. This erosion has also engulfed Beharampur-Karimpore road at Jalangi point. This year also severe erosion has affected Sarkarpara, Jayakrishnapur and Muradpur.

In all these affected areas the major complain of the people is that the protection work have started quite late, not in the lean seasons but at the advent of monsoon leading to total failure and waste of huge amount of money. In most cases people suspect foul play by the contractor-bureaucrat-politician nexus causing this delay to usurp allotted money. This is a major dilemma and one cannot find any satisfactory explanation from the authorities regarding such callousness.

Human Impact: The main theme of this study is to find the extent of the impact of the technical feat of building of the Farakka barrage on people living both in the upstream and downstream of the Barrage.

Floods usually gets more highlighted in the national and international arena but one has to remember that its consequences are of short range as economic recovery is

possible within a predictable time. In this connection the opinion of the riparians is that flood brings fertile soil helping in ripe harvesting. But the slow and steady disaster of riverbank erosion has a permanent effect upon the socio-economic conditions and demographic dislocation.

In a rural economy based primarily on land, landlessness poses to be a major threat leading to further marginalisation and pauperisation of the people. The major impact found here in terms of occupation has been a shift from agriculture in own land to primarily day labourers and petty service activities. In the border areas of Murshidabad one of the major shift is from the life of a peasant to that of a petty courier involved in smuggling. Such demoralising effect is rampant in all along the bankline of Padma with Bangladesh on the other side. As many people have pointed out, this is the only means of livelihood which have saved them from starvation.

In Malda, people have migrated in search of work to as far as Gujarat and Maharashtra where they are working as labourers in any kind of work. As locals of Panchanandapur point out, at Byculla, Mumbai one can find a whole colony of erosion-affected people of this area. And to add to their misery, they are often branded as Bangladeshi infiltrators as all their valuable documents have been lost in erosion. The fate of these neo-refugees within their own land has never been properly studied or addressed in any plans.

And for the rest in both the districts the annual fete of the irrigation department in protecting their riverbank provides the job of labourers for carrying boulders to the very river, which has ruined them. The women have started working in the *bidi*-making industry.

Before erosion majority of the households used to till their own land to earn their daily bread and were not dependent on the market, afterwards they are forced to the market to sell their labour resulting in their susceptibility to the market forces causing severe hardship. As for the educated rich, few in number, they have shifted to settle in nearby towns.

One has to understand that vitually all of a displacee's normal network is lost with displacement. Their options are limited to 1) purchasing new lands if they have the necessary financial resources, 2) becoming landless rural day-labourers, 3) migrating out of the area 4) settle on government land.

Yet they prefer to stay close to their community. Perhaps to avoid the social and cultural stress in a relocated environment. Also the hope of getting back their lands in the form of chars makes them stay closer to their original homestead.

According to the district administration, erosion has increased in Murshidabad particularly after the commissioning of the Farakka Barrage in 1975. Every year thousand of families are being affected directly and shifting of these families to safer place is a regular problem to the district administration. And they have felt the need for a detailed study of the history of erosion and bank failure from consideration of

the Geo-morphology of the rivers to arrive at a method to protect the extent of erosion. The problem is not confined to that of erosion and displacement, this is creating border problem as the char areas are being developed towards Bangladesh. As per official estimate, till 1992-94 more than 10,000 hectares of chars have developed in main places, which have become inaccessible from the Indian side but can be reached easily from Bangladesh. The erosion wiped away boundary posts at many places creating border dispute. In Parliament when this issue was raised the House was assured that the boundary was fixed on the map even though the river has shifted [10].

One typical example is that of Nirmal char built by eroding Akhriganj. Here a population of 20,000 lives in an area of 50 sq.km. From here Rajshahi town of Bangladesh can be reached within 45 minutes on road whereas to come to the mainland of India one has to cross the mighty Padma which will take more than three hours. Moreover the basic infrastructure provided here is too poor and the people's plight is further heightened by negligence of the mainland administration. Since there is no Primary health centre, people go to Rajshahi for treatment. The concept of international border is very much flexible here due to basic problems of living. Instances of fightings for harvesting with Bangladeshi cultivators have been reported again and again apart from the usual problem of allotting created land to the rightful owners. Once again the question of Bangladeshi infiltrators, the recent fiasco over ISI agents have increased in this district due to these char areas.

In Malda, chars have created problem with the adjoining state of Bihar. Mouzas on the charlands like Piarpore, Paranjpur, Palashghacha, Kanchi Jadupur, Srighar, Begamganj, Dogachchi, Daskathia, Nityanandapur, Mangatppur, Hosenabad, Hakimabad, Jituagar inhabited by 1 and half lakhs of population is to be accessed from Paglar Ghat in two hours by boat, it does not have a single health centre or primary school and the administration there is of Bihar. Yet for registration of land one has to come to Malda since the land belongs to Malda officially. In the census handbook these places are shown to be part of Malda. A strange kind of dual stateship prevails here.

One major reason for settling in the chars even in a vulnerable situation is the rich fertile soil where crops are available with least effort and you get rich crop without pesticides.

Decrease in land has further increased the pressure on the remaining land thereby contracting the living area and forcing people to live in cloistered areas. This has severe effect on the general health due to lack of proper sanitation facilities. With the given vulnerability of bankline (people have been displaced from 2 to maximum 16 times) the inhabitants do not wish to improve the living conditions and settle in make-shift arrangements.

As in all major dislocation process, here too women are the worst sufferers. Landlessness has forced women to take up the additional burden of providing financial support to the family apart from adjusting with the extreme domestic

hardships. In entering the market, the major options before them are to be a laborer in the thriving bidi industry both in Malda and Murshidabad or to be couriers in the smuggling nexus. The first occupation has engaged girls from their pre-adolescence stage took them away from schools and forced them to unhealthy conditions. The later is even more degrading in terms of sexual harassment and lack of security.

Who are these displaced? Another interesting side of this problem with far-reaching socio-political dimension is revealed here. The displaced comprise of two social groups. The Muslims living on the bank and an ethnic community of "Chai" Mandals living in the charlands. At Akhriganj the percentage of Muslims is 70% and "Chai" around 30%. "Chai" is a marginalised ethnic group yet to be given any scheduled caste/ tribe status. From historical time are living in the chars. They are expert farmers, very much accommodative with the normal changes of the river. On the other hand the Muslim living along the bankline is also socio-economically backward.

Impact on Fisheries Farakka Barrage has also resulted in occupational displacement of the fisherpeople in both upstream and downstream. For a long time fisher people in Bihar have been protesting against the barrage as this has hindered the natural migration of valuable fishes from the sea, specially Hilsa, a delicacy. According to Manoranjan Singha, Director, Central Inland Fisheries Research Institute, statistical records show that since the inception of the barrage, hilsa has been slowly getting extinct in Ganga. [Anandabazar Patrika, 21 July, 1999] This survey also learnt from fisherfolk in Nayansukh of Farakka area that due to lack of fish in the water, they are on the verge of losing their occupations.

Response of the administration: The dominant forms of responses at the government level is limited to engineering solutions (structural experiments) like embankments and spurs and providing temporary relief facilities such as flood shelters and emergency food ration.

For suggesting remedial measures two committees have been constituted by both State and Central governments. In 1978, Government of West Bengal constituted 'Ganga River Erosion Committee' with Sri Pritam Singh, Member, Central Water Commission as its Chairman with representatives from Railways, Survey of India and Farakka Barrage Project, besides the representative from Irrigation and Waterways Directorate, Government of West Bengal. This has recommended in its Report submitted in 1980 that due to financial constraints, anti-erosion works should normally be taken up for protection of:

- 1) Towns and groups of thickly populated village abadis.
- 2) Railway lines and roads where re-location of communications are not found to be feasible on techno-economic considerations.
- 3) For protection of portions of embankments benefiting large areas where retirement of embankments is not found to be feasible, on techno-economic considerations.

The specific remedial measures suggested were broadly structural like construction

of spurs at certain specific points and revetment of bank along with studies regarding shoal formation and the estimated budget was Rs. 294 crores.

But major portions of the recommendations were never implemented.

The devastating floods of 1996 in Malda and Murshidabad made the Planning Commission constitute an Expert's Committee in 1996 to study the bank erosion problem of river Ganga/ Padma in those districts. The committee was constituted under the Chairmanship of Shri G.H. Keskar, Member, Central Water Commission with members from Ganga Flood Control Commission, Irrigation and Waterways Directorate, Government of West Bengal, Planning Commission and also some retired expert Engineers of the field. After three months of study they submitted a proposal of Rs 926 crores for 14 short term and 4 long term remedial measures once again in the form of spurs and bank revetments at certain points.

These works are yet to be taken up.

And so the piece-meal solutions are offered each year according to emergency of the situation here and there in the form of spurs and embankments which normally get washed away during that season only. A table of the present condition of protection works is given along with this report.

On an average in both Malda and Murshidabad, Rs. 2000/ per household is given to the people affected by flood. Apart from the prevalent malpractices by local leaders and panchayat officials in dispensing with this money, one has to remember that this is all that is given from which the people are expected to rehabilitate themselves which primarily means buying land. Again in Murshidabad it is found that the homeless could not avail the provisions of Indira Awas Yojana as this presupposes ownership of land. Similarly in Malda, the housing aid proposed by Lutheran World Service could not benefit the people, as they didn't have land to build the houses. There is no provision of compensating the victims of erosion for the loss of land, which has been the prominent demand of the movement in Malda.

Response of the people: The response to this situation is almost opposite in the two study areas. At Panchanandapur, Malda, there is a high level of hazard awareness, perhaps due to the movement they are proactive to the situation and has tremendous awareness of both structural and non-structural dimensions of this issue. Whereas at Murshidabad, in all the places visited, Dhulian, Akheriganj and Jalangi people are more passive and have a fatalistic attitude to the whole situation. In Malda, the people can articulate their needs to governmental and non-governmental agencies, strongly critical of the existing structural remedies propounded by the authorities, whereas in Murshidabad, articulation is limited or even completely muted. Here the emphasis that the government institutions place on engineering solutions is apparently shared by most local inhabitants although they are critical about the lackadaisical nature of the work, corruption and other malpractices. When asked what they thought the government should do, the overwhelming response was to start protective work in lean seasons, strengthening

and concreting of existing embankments as well as building more embankments. But in Malda, one major opinion is that the river should be left alone after witnessing the failure of spurs and embankments and spend the money in rehabilitation instead.

The study reveals prominently that the people in Malda, living in the upstream, mostly identify Farakka Barrage as the cause of their plight. In Murshidabad, Dhulian being closer to Farakka puts the same blame but in the furthest point under this study Jalangi, the Farakka issue is not so prominent. Erosion is a historical phenomenon here, they can only point out that the rate of erosion has increased in recent years. But the educated people believe that Murshidabad has been sacrificed to save Calcutta Port, an opinion that is echoed in Malda as well.

Possible Solutions: Even though in both Pritam Singh and Keskar Committee spurs and embankments are recommended experience makes it evident that they are incapable to offer the levels of protection needed. Such steps are likely to lead to disequilibrium within the hydrodynamic situation in the region and to more problems. Therefore, any structural solution will merely be a very short-term solution. Also due to financial constrains in most cases whatever is done is piecemeal work which further intensifies the situation. Dr. P.K.Parua, Superintending Engineer, Farakka Barrage Project is of the opinion [11] that micro-analysis of the problem of a particular reach and taking protective measures for the reach will lead to similar problems in adjacent reaches and the problems will be never-ending. So a macro level analysis with micro level information is necessary to understand the problem.

Instead of isolated short bull-headed spurs and long spurs protruding inside the river, he suggests properly designed bank revetment work with adequate falling apron over properly designed bank slope with bed bars. The bank slope needs to be provided with adequate filter for proper drainage and apron to be provided with a kind of mattress or geo-synthetic layer over bed for minimum dislodgement of stone or other heavy materials. But it is seen in the case of spur no.24, geo-synthetic mats have been washed away by the tremendous flow of the river. Prof. Kalyan Rudra, Reader in the Department of Geography, Habra S.C.College, West Bengal, who has been working with this issue for a long time, in his lecture delivered at Bose Institute in Calcutta on 4th September 1999 has explained that the primary requirement is to regulate the flow of 18-27 lakh cusecs which the spurs and embankments could not stand through. According to Central Water and Power Research Station at Pune, erosion starts in Ganga when the amount of water in the river exceeds 10 lakh cusecs. Between July to September the average waterflow in the river is 15 lakh cusecs. Again during monsoons the silt that comes with the water fertilises the agricultural land. But flood-control through bank protection deposits the silt in the riverbed, which lowers the depth and water-carrying capacity of the river. And so Prof. Rudra points out that unless the monsoon flow of the water is regulated within 10 lakh cusecs, problem cannot be solved.

He asks to look at the problem in totality and suggests basin management taking Ganga basin as a whole system. Throughout the monsoon, 10886.40 crores cubic metre water has to be regulated. According to Prof. Rudra reviving traditional

methods of watershed management all over the basin to hold this water could do this. This calls for a collective approach of the five states along with West Bengal and the neighbouring country of Nepal. This would also involve a large number of village panchayats ensuring people's participation and this water could have a purposeful use instead of just flowing out. Only a collective approach of this magnitude could solve this problem.

According to his plan to regulate the monsoon flow within 10 lakh cusecs, one has to store 10886.40 crore cubic metre water all over the basin. Since we are aware of the ill-effects of big reservoirs this could be done by using traditional storing methods all over the basin involving people's participation. He has estimated that a reservoir of 100 mtr. length, 100 mtr. width and 10 mtr. depth can hold 100000 cubic metre water. Therefore 10,88,640 such reservoirs are needed all over the basin. This water can be used for useful purposes throughout the year and this will also enrich the ground water level. This will definitely need proper catchment area treatment regular dredging.

Also recommended is the change in the land-use pattern of the meander belt. Building low-cost houses with easily detachable and movable materials are necessary to avoid loss. Most important recommendation is the rehabilitation of the displaced, which never caught attention in the Committee Reports. It is felt that instead of spending millions of rupees on engineering futile experiments of spurs and embankments, this should be spent in rehabilitation of people. Over the years these preventive measures have led to build up of a corrupt nexus of contractor-Mafia-engineer-bureaucrat of which unfortunately the affected population has become a part at some places due to their fatalistic attitude.

As far as the effectiveness of the Barrage is concerned, the desired discharge was never available and this has increased siltation which has led the Port Trust Authorities to dredge 1.5 crore cubic mtr. silt per year. [Sanyal T & Chakrabarty A.K.(1995)- Farakka Barrage Project: Promises and achievement. Port of Calcutta: 125 years. Commemorative volume, Calcutta Port Trust, Calcutta} So serious doubts have been raised regarding the basic purpose of the project which is the protracted functioning of the Calcutta Port. But one can say that due to this Project, in the upper region in Murshidabad, even during lean seasons the river Bhagirathi remains full to the banks which previously was fordable.

This paper is not about assessing if the Barrage has achieved its objective but going by the experience and reports available, it has not served the purpose.

Conclusion: Late Prime Minister Jawaharlal Nehru stated in the Lok Sabha on the 16th August 1961 that the Farakka Barrage Scheme apart from other things is meant for the vital protection for the Port of Calcutta which is a matter of greatest importance. With the process of industrialisation and the Calcutta Port and numerous factories coming up along the banks of Bhagirathi one can see that even though Farakka Barrage has failed in its purpose largely, yet it is indispensable to the planners due to Calcutta Port, relationship with Bangladesh and other concerns. But the question remains, are the people living on the riverbank dispensable just

because they are socially and economically weak, and being native to remote villages has failed to organise a strong political lobby to table their problems. In this total length of 174 Km along the Ganga, nearly 26 lakhs of population live and in the last decades according to Keshkar Committee 6.20 lakh people have lost their homes. And once again when the planners go for their macro-level analysis and building up of master plan, will it be only for the safety of the barrage? Or it would include the human factor and even the 70-year-old school of Panchkaritola, which perished in this year's bank erosion?

Lessons for the future: In the present situation the following are the main recommendations for the Government to implement and others to learn:

1. In dealing with this issue a total Ganga Basin Management Plan has to be formulated taking the basin in its totality and micro level issues being at the heart of the planning with active participation of people.
2. Consideration of full social and environmental impacts were not part of Farakka Barrage project proposal. It was weak even on hydrological issues. Had these issues been taken into account, the barrage may never have been built.
3. People were never consulted about the project and its impacts. Had they been consulted, the barrage may never have been built.
4. Even now, as the government meanders along, the impact of this meander is much worse than the meandering impact of the river.
5. Full post facto evaluation of the project is a must even at this stage to look at its comprehensive impacts and effectiveness. This may also bring out all the options for the future, including for the people in the upstream, downstream, in the port and elsewhere.
6. There are apprehensions that the floods and its severity and longevity in the much upstream areas of Bihar and Uttar Pradesh has only increased following the building of the barrage due to silt accumulation in the riverbed. This needs to be investigated.
7. Economic rehabilitation of the displaced.
8. Realignment of the roads, railways and important townships beyond the risk zone.
9. Water and silt management for the entire Ganga Basin has to be part of any future plan.
10. Scientific, equitable and planned utilisation of newly emerged char lands has to be part of future options scenario.

Table 1
Present Condition of Protection works

Upstream (Left Bank) and Downstream (Right Bank of the Barrage - After 1998 floods)

Sl. No.	Type of Protection	Present Status	Controlling Authority
UPSTREAM			
1.	Spur No. 1&2	Washed Out	FBP Authority
2.	Spur No. 3 to 7 with bank revetment	Functioning satisfactorily	-do-
3.	Marginal embankment near Biranagar	8 nos.washed away, 9th & 10th nos existing though partially damaged	8 nos I &W Directorate 9th & 10th FBP Authority
4.	Spur No. 8,10 to 15	Functioning satisfactorily	I & W Directorate
5.	Spur No. 9	Severely damaged	-do-
6.	Spur No. 17,21,22 & 23 to 26A	Washed out	-do-
7.	Spur No. 16,18 to 20	Severely damaged	-do-
8.	Marginal embankment near Aswinitola	4 Nos. washed out, 5th Nos. under construction	-do-
DOWNSTREAM			
1.	Bank Revetment with Launching apron-5.0Km below barrage	Functioning satisfactorily	FBP Authority
2.	-do- from 5.0 Km to 6.9 Km	Work planned and partially in progress	-do-
3.	Bank Revetment with launching apron between Mithipur and Moya- 16.0 Km (Below Jangipur Barrage)	About 5.0 Km complete. Work planned as per necessity	-do-
4.	-do-1.50 Km near Dhulian	Severely damaged	I & W Directorate
5.	Spurs-2 Nos. near Sekhalipur	Washed out	-do-
6.	Bank revetment with launching apron- 2.0 Km near Sekhalipur and 2.0 Km near Jalangi Bazar	Washed out	-do-
7.	Bank revetment with launching apron at Akheriganj 2.0 Km and Bamnabad 0.60 Km	Washed out	-do-
8.	Bull headed/submersible spurs 94 nos. at different reaches	43 nos washed out. 51 nos. functioning	-do-

Source : Dr.P.K.Parua, Superintending Engineer, Farakka Barrage Project

Table 2
Ganga Bank Erosion on Left Bank in Malda District
Upstream of Farakka Barrage

Year	Total length affected (Km)	Maximum width of erosion (m)	Approx. loss of land (Ha)	Approx Maximum discharge (10^3 cumecs)	Approx Maximum W.L. (m)
1931 to 1978	-	-	14,335	-	-
1979	5.0	200	60	42.80	22.90
1980	7.0	150	105	73.0	24.80
1981	11.0	400	260	57.0	23.70
1982	5.0	150	65	68.00	24.80
1983	5.0	200	90	60.5	24.90
1984	7.0	100	70	61.40	24.80
1985	6.0	150	90	57.30	24.30
1986	6.0	200	105	49.80	24.20
1987	8.0	300	240	73.90	25.40
1988	7.0	100	70	68.0	25.10
1989	10.0	150	150	36.80	22.90
1990	8.0	200	160	55.40	24.20
1991	11.0	150	170	69.70	25.30
1992	9.0	150	130	46.40	23.90
1993	7.0	200	145	54.20	-
1994	7.0	1250	160	67.90	24.90
1995	8.0	200	145	49.80	24.00
1996	15.0	250	310	71.0	25.10
1997	6.0	100	60	47.70	24.10
1998	10.0	900	330	75.90	25.40

Note: 1) Discharge above 56,600 cumecs (20.0 lakh cusecs) in 1980, 1981, 1982, 1983, 1984, 1985, 1987, 1988, 1991, 1994, 1996 and 1998.

2) Discharge above 70,800 cumecs (25.0 lakh cusecs) in 1980, 1987, 1996, and 1998 - Marginal embankment breached during these years.

3) Highest discharge so far recorded was on 7.9.98- 75,900 cumecs (26.80 lakh cusecs).

4) Maximum land erosion was on 1981, 1987, 1996 & 1998.

Source : Dr.P.K.Parua, Superintending Engineer, Farakka Barrage Project

Table 3
Ganga Bank erosion on Right Bank in Murshidabad District
Downstream of Farakka Barrage

Year	Total length affected (Km)	Maximum width of erosion (m)	Approx. area of erosion(Ha)	Approx. Maximum discharge (10 ³ cumecs)	Approx. Maximum W.L. (m)
1931-1978	-	-	28,290	-	-
1979	5.0	200	100	41.60	22.60
1980	6.0	250	100	72.20	24.60
1981	4.0	200	80	55.90	23.40
1982	5.0	200	90	66.90	24.30
1983	5.0	250	105	59.90	24.40
1984	22.0	700	635	60.50	24.20
1985	10.0	250	245	56.10	23.90
1986	10.0	200	180	48.60	23.70
1987	8.0	150	105	73.20	25.00
1988	9.0	300	255	67.40	24.90
1989	12.0	150	175	35.60	22.60
1990	10.0	150	120	54.30	23.80
1991	9.0	200	115	59.0	24.90
1992	6.0	200	115	45.30	23.60
1993	10.0	400	270	53.50	23.80
1994	33.0	1400	2585	66.90	24.60
1995	8.0	150	270	48.90	23.80
1996	10.0	1000	465	69.90	24.80
1997	4.0	100	40	46.60	23.90
1998	40.0	250	500	74.90	25.30

Note : 1) Discharge above 70,800 cumecs (25.0 lakh cusecs) in 1980,1987 and 1997.

2) Maximum discharge so far recorded was on 7.9.98 - 74,900 cumecs (26.40 lakh cusecs)

3) Maximum land erosion was in 1984,1985, 1988, 1993, 1994, 1995, 1996 and 1998.

Source: Dr.P.K.Parua, Superintending Engineer, Farakka Barrage Project

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