

Figure - 5 Seasonal Operations by Boat Type

Name of boat	Operational Period												Position of River	
	J	F	M	A	M	J	J	A	S	O	N	D		
Cosha	■	■	■	■	■	■	■	■	■	■	■	■	■	Outer river
														Inner river
Shoronga	■	■	■	■	■	■	■	■	■	■	■	■	■	Outer river
														Inner river
Fishing (big)	■	■	■	■	■	■	■	■	■	■	■	■	■	Outer river
														Inner river
Fishing (small)	■	■	■	■	■	■	■	■	■	■	■	■	■	Outer river
														Inner river

* A few fishing boat from the outer river enter into the inner river overtopping the embankment during the monsoon and go back to the outer river after monsoon. There are a few boat in the inner river. In the draught season those are kept under water at the deepest part of the river. In the peak monsoon those boats start operation in the inner river.

3.3 Changes in the Country Boat Sector

3.3.1 Technical Change

Country boats were traditionally operated manually by polling, rowing, sailing and drifting. Road development and competition have led boat owners and operators with a financing capacity to mechanize. Owners who failed to mechanize have lost out. In the mid-1980s mechanization started on the Jamuna on Kosha type boats with engines usually used for irrigation pumps. Multi-purpose use for irrigation and boats power has become common with the transfer from pump to boat made after the irrigation season has finished. Following the success of mechanising Kosha boats, other type have also been similarly mechanised. Surveys in Singra, showed Kosha (Finish boat) owners mechanizing first in 1987 when a decade ago the Kosha boat were not seen in this route but are now prominent. People not only introduced mechanization but also brought in new types of boats. Except for dingi and donga, more than 90% boats are now mechanized and competing successfully with road transport.

3.3.2 Change in Speed

The traditional boat operation was hard work and only allowed speeds of 2 miles per hour. From Baghabari to Mohadevpur is 210 km; a distance that would take six days and nights to cover. A mechanized boat covers this in one day and night. Mechanized boats are six times as fast than non-mechanized boats.

3.3.3 Change in Construction Material

Before mechanization all the traditional vessels were wooden. Wooden boats proved unsuitable for mechanization as heavy engine vibration loosened the joints of the planks which led to water leakage and decay. Alternative construction materials like G.I sheet and plain iron sheet are now being successfully used. These boats are lighter and have a longer life span. Only the fishermen and fishtraders have not converted for the god reason that they use their boats as a fish well for transport of live catches. The tin boats overheat the water and fish die before reaching their destination.

3.3.4 Change in Size, Type, Name and Number of Boats

At the end of the 1970s commercial boats faced draft problems and the big boat numbers declined. Soon after people introduced the shallow drafted cosha boat. Now the commercial boats have regained their previous numbers. Due to operational problems domestic boats are being replaced by commercial boats. To compete with road transport and modern water vessels country boat owners changed their type and size of boats. Soon after mechanization shallow draughted boats, like Kosha, were found more suitable for mechanisation. Navigational problems meant that big boats were sold or became damaged. New construction has focused on smaller boats with shallower draughts. Change in name seen include the old Ubori being replaced by Kosha and Kosha was replaced by finish boat.

3.3.5 Change in Ownership Pattern

Traditionally the middle class, lower-middle class and landless-poor own boats. In the NWR, boats are mostly owned by the individual or extended family. In Sirajgonj district weaving on handlooms has flourished. Here donga and dingi are often constructed or purchased under joint ownership with weavers going to their workplace by boat during the monsoon. With the advent of mechanization, rich boat owners installed engines on boats. To survive, poor boat owners joined with farmers with irrigation pumps but who could not afford to own a boat. Unwritten contract form the basis of the joint ownership systems which have since developed. On the Atrai, both ownership patterns were found. Single owners nevertheless enjoy higher profits.

3.3.6 Share System, Recruiting Procedure and Distribution of Income

From studies in different locations in Bangladesh income of boatmen have been found to range from 750-900 taka per month as indicated in Table 3.6.

Table - 3.6 Income and Employment Generated by Country Boat

Boat Category	Total Number	Rate of Employment per Boat	Total Number Employed	Per Capita Monthly Income	Total Income (Tk)
Commercial Boat	16,000	3	48,000	Tk. 900/=	43,200,000
Fishing Boat	5,221	3	15,663	Tk.1,000/=	15,663,000

The share system has been established based on the capacity of boat, not the volume of income or number of crew as shown in Table 3.7.

Table - 3.7 Cost and Income Sharing Systems

Capacity of Boat	Share of Boat	Share of the Crew
50 - 200 mds	Equal to a Crew	Rest of the income
200 - 275 mds	33% of income	67%
300 - 500 mds	42% of income	58%
500 - 1000 mds	50% of income	50%
1000 - more	60% of income	40%

The equal distribution of income amongst the boat and crew excludes all operational and maintenance costs but not major repairs, feeding and fuel. The crew shares are equally distributed among them. Recruiting was always share based but elsewhere in the region the traditional system is mostly practised. On the Atrai, the recruiting procedure has changed significantly. Most boats are not owner operated and crews were recruited on daily or monthly salary basis. Dry season salaries range from 350 taka to 600 taka per month. In the monsoon when labour options are very limited they get a lower salary from the boat owners.

The following are typical sharing arrangements where for the Ghashi there are 3 persons as crew and for the Manjhee and Kosha there are two persons.

Malar: The boat and engine will receive 70% of the net income, of which 60% will be shared equally between boat and engine (if two different owners own engine and boat) and 10% will be kept reserve for repairing boat. 6.25% of the rest will be received by the head of the crew (manjhee) for his leadership. the rest will be shared among the manjhee and the crew equally.

Ghashi and Kosha: In the case of the Ghashi and Kosha 50% of the net income will be shared among the boat and the engine. The rest will be shared among the crews equally. g Change in Profitability

Traditionally boats were more profitable than other modes of transport. Study at Nakalia found that boat men could recover capital costs of boats within six to eighteen months time. With development of road transport this time has extended to four to six years and the resulting downward trend of profitability.

In the early eighties the country boats failed to earn profit and began to decline rapidly until mechanization took place. The country boat sub-sector received a new lease of life, but remained unprofitable, because the engine were costlier. By the end of the last decade when Bangladesh started to import cheaper engines from China and South Korea the situation improved and the country boats began to predominate in passenger carrying and cargo carrying. Today these mechanised country boats are 2.5 times more profitable than the traditional non-mechanized boats.

However, along the Atrai, while river passenger boats ply round the year and can maintain profitability, cargo carrying boats can ply only in the monsoon and their profitability is more difficult. Since these boats have become popular with the businessmen, profitability depends on whether the route regains all year round navigation access.

3.3.7 Changes in the Volume of Trade

Recent changes in the production system have affected trade volumes. Farmers, particularly along the river Atrai, were mostly dependent on B. Aman and Boro before the advent of modern irrigation. Aus paddy was not very popular. For paddy cultivation, the farmers were solely dependent on the main river Atrai. Now production of HYV IRRI varieties has boosted the volume of paddy produced exploiting both groundwater and surface water. Rice processing industries became established by the side of Bogra-Mohadevpur, Pabna-Iswardi, Iswardi-Pakshi, Pabna-Natore and Natore-Bogra roads.

Arottders confirmed that prior to rice processing mills rice sellers accumulated their rice in the hats and it was not possible to buy rice without hatday. Now one can buy rice on the non-hatdays from the mills making it difficult to estimate real trade volume from the hat stock. They confirmed also that the direction of trade has changed. Prior to contemporary road transport developments most traders would come with their own boats and a small section would hire boats from their own area. Most traders were rural based selling their goods at centres (kol or gala) established by the river.

With road transport development most of these rural centres were abolished and were relocated to the town. The relations established through the decades between the boatmen and trader was broken down. Since mechanization a revival has been occurring. The Arottders reported that many local traders now deal in paddy to the boiler mills and the outgoing traders no long deal in paddy but concentrate on rice trade. So, the switching over from paddy to rice and the competition and services of road transport have impacted the role of the country boats sector.

The statistical yearbook suggests that around 1977, the boats of Chalan Beel were carrying cargo of about 1,628,100 maunds. Since then, production and the potential cargo has increased 4-5 times in the area. The current field surveys collected information about the transported cargo through five important centre and estimates the cargo carried here at about 2,500,000 mds. The amount of potential cargo throughout this area may well be more than ten million mounds yearly.

The trend of trade volumes is expanding as indicated in Table 3.8 which shows estimates provided by traders and commission agents from their experience. The calculations are based on the number of market day in a year and average commodity available in a market day.

3.3.8 Competition Between Trucks and Boats

Before mechanization of country boats, trucks competed out boats. After mechanization boats regained their position. During the dry season when the river Atrai dries up people erect cross-dams across the river bed for irrigation purposes. This stops the movement of country boats and road transport is the only viable option. In the monsoon the river regains navigability and the movement of country boat becomes easy and freight rate becomes cheaper. People again turn to country boats. If Atrai river were dredged boats could ply round the year and complete. This would however have conflicting objectives with the needs of local people to conserve water in the river system through the use of cross dams.

The advantages and disadvantages of boat and truck can be summarised as follows :

Table - 3.8 Some Trader Estimate of Total Road and Boat Trade Volumes in Selected Centres

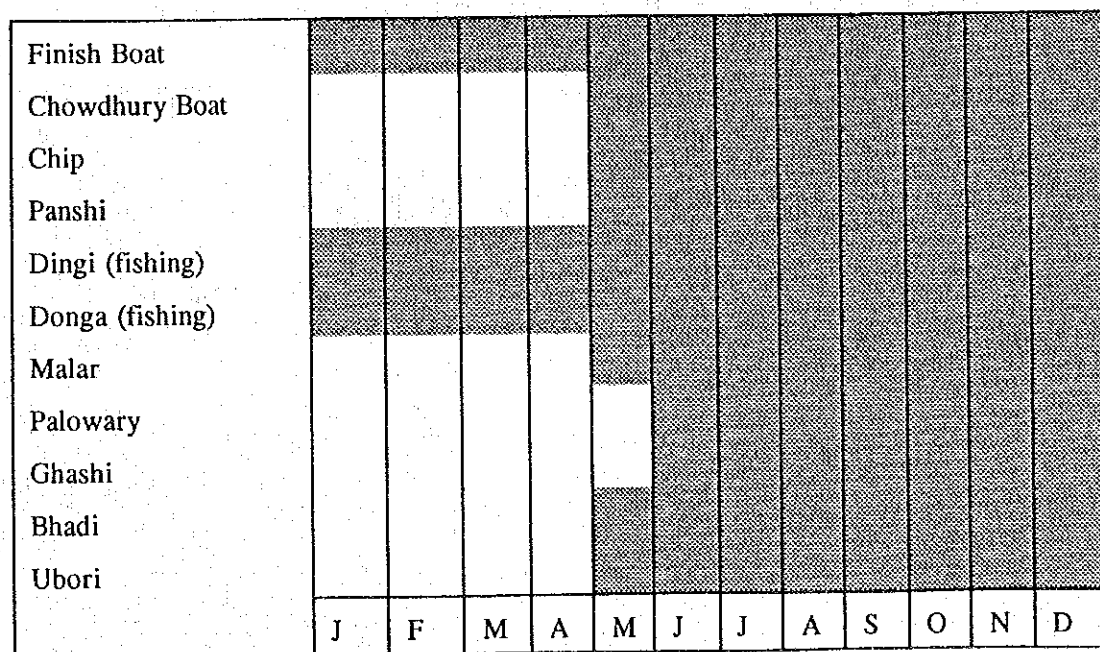
Centre	1992				1985				1980			
	Cargo/commodity				Cargo/commodity				Cargo/commodity			
	Paddy	Rice	Jute	Onion	Paddy	Rice	Jute	Onion	Paddy	Rice	Jute	Onion
Mohadevpur	198,000	286,000	2,600	x	62,400	83,200	5,200	x	31,200	41,600	78,000	x
Atraï	300,000	150,000	10,400	30,000	175,000	100,000	125,000	20,000	31,000	48,000	130,000	16,000
Singra	104,000	306,000	100,000	x	72,800	153,000	13,000	x	125,000	52,000	13,000	x
Chanchkoir	120,000	520,000	416,000	x	104,000	312,000	62,400	x	26,000	208,000	78,000	x
Taherpur	62,000	x	125,000	228,800	41,600	x	150,000	124,800	31,200	x	160,000	115,000
Total	784,000	1252000	193,000	278,800	455,800	386,200	442,600	144,800	234,400	349,600	359,000	141,000

Issues	Country Boats	Trucks
1. Seasonal Mobility	Dry season movement restricted by FCDI	Restricted to roads available
	Monsoon movement routes restricted by FCD.	Limited access in monsoon.
2. Cargo Volume	Large volume carried	Limited capacity.
3. Speed	Slower than truck	Faster than boat
4. Traffic Congestion	None	Urban congestion and wet season congestion at river crossings common
5. Costs	Low cost medium	Medium to high cost.

3.3.9 Seasonal Variation in Movement

Since the mid-1960s and the growth in pumped irrigation most channels have dried up in the period February through May, but sometimes to mid-June. This feature and cross dams make navigation difficult. Behind the dams, shallow drafted passenger and cargo boats, small Dongas and Dingis can ply with difficulty but local and inter-regional navigation is restricted to between June to October, and still has to contend with the obstruction of FCD projects. Figure 6 shows the seasonal operations.

Figure - 6 Seasonal Country Boat Operations



The Finish boats, now prominent in the route, ply almost round the year. Donga and Dingi (Fishing) withdrew from the river to paddy fields.

CHAPTER 4

WATER TRANSPORT PLANNING ISSUES

4.1 The Range of Issues

No single factor is responsible for problems affecting the sector and navigation. Several factors combine to hamper navigation opportunities. They are:

1. Development of surface and groundwater irrigation.
2. Siltation and river morphology.
3. Cross border issues.
4. Flood control embankments, polders and unplanned roads.
5. The movements of engine boats.
6. Access to construction materials.
7. Competition with road transport.
8. Harassment of boat people.
9. Projects planned in other sectors and IWTA plans

4.2 Irrigation Impacts

Irrigation by both surface and underground water has negative effects on navigation. First, traditionally the people, particularly those on both sides of the Atrai river, erect cross-dams in the river to make water level high enough for allowing canals to connect to IRRI and boro lands to withdraw water from river. Second, modern irrigation system use LLP pumps of different size and capacity directly withdrawing water from the river. Third, shallow and deep tube wells are being used on a large scale in irrigation exploiting underground water seasonally lowering the water table. Each of these affects navigation.

4.3 Siltation

Bangladesh's three principal rivers are estimated to carry about 2.4 billion tons of sediment each year. These sediment are being distributed to the distributaries, tributaries and the connectors of the three principal rivers and sand bank are being made in the river bed, thereby hampering the navigability of the river. Figures for the internal catchment situation for the main rivers are not available.

All the river routes in the NWR are seasonal and unrecognized. Big Inland Water Transport boats (IWT) seldom move in these routes unlike the SWR and NER. Country boats face similar problems everywhere in Bangladesh. However, the NWR faces draught problems which boats in other parts of the country do not face where major cargo boats of the Government's IWT ply and where, if a navigation problem arises, Government dredging operations are mobilised. As a result the regionally important routes along the Atrai, Boral, Korotoya and Barnai, have been silting up, making navigation more seasonal.

4.4 Cross Border and International Issues

Indian barrages on the Padma at Farrakka and on the Teesta divert flow for other uses in India. Seasonal discharges have thus been reduced entering Bangladesh. The main dry season flows have been particularly affected which limits navigation on the Padma and Teesta. Embanking on the Indian side of the border on the Atrai and Purnarbhaba may also have longer term downstream impacts on hydrology and morphology that could affect navigation. Proposals for establishing a major international navigation link canal between Bangladesh, Indian and Nepal have been raised using the route from the Jamuna along the Karatoya. There have been no studies to establish the physical or economic feasibility or likely time frame of this proposal. There can thus be no benefit for considering this under regional planning at this stage. All these issues can only be effectively dealt with through bilateral cooperation through the Bangladesh - India Joint River Commission (JRC).

4.5 Flood Control Embankments, Polders and Unplanned Roads

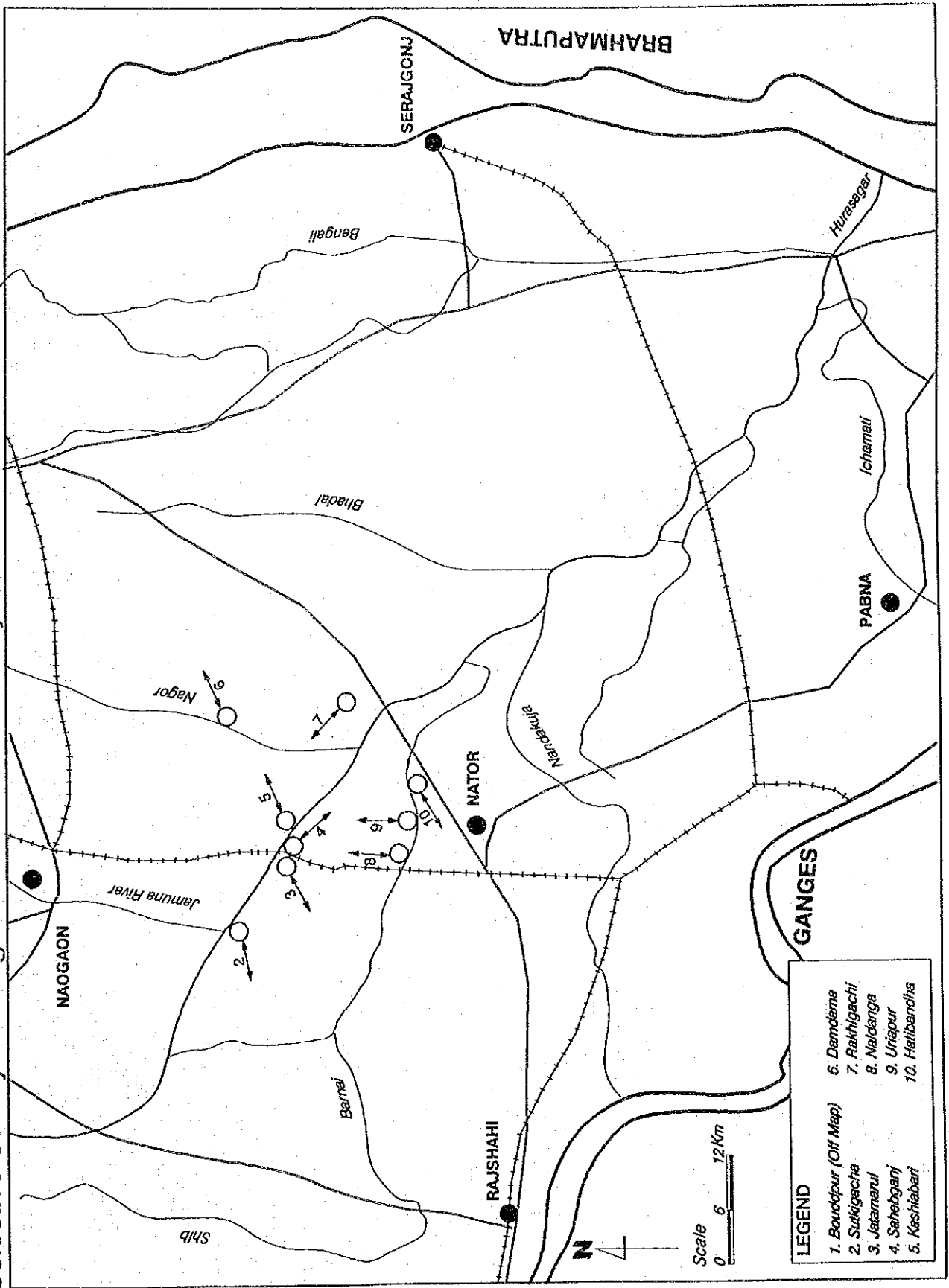
The modern context of infrastructure development and flood control by embankments developed in the early sixties. Planning and implementation then only thought of the positive and not the negative impacts. All side effects and external impacts were bypassed or not considered.

Increasing road construction and flood control infrastructure often cut across waterways stopping traffic and also seriously affected internal navigation within the embankment areas on the Class III and IV routes. Bridges are often inadequately sized or located and canals along the river Atrai have been blocked by embankments and sluice gates denying boats access to the interior during the monsoon. This has affected cargo carrying traffic, small traders and village commerce, as well as social visits in the unrecognized routes. Also some embankments were built on the river bank and every year are eroded by strong currents causing heavy siltation. The poor and uncertain navigability of rivers, canals and khals are very commonly associated with blockages caused by embankments, earth roads and bridges which often have cumulative effects through the chain of navigation linkages and thus affect the total system. A very limited survey of a selected part of the Lower Atrai/Chalan Beel system where blockages occurs is indicated in Figure 7.

Apart from the riverside business centres there are many hats, bazaars and growth centres in the interior area in the NWR. To connect these centres a good number of irrigation canals become navigable in the monsoon. The boat men accompanying the traders would purchase paddy and rice directly from the farmers from July to October every year. Farmers would also carry their commodities from the fields to their homesteads, big hats or business centres through these canals. Examples of concern raised in the survey included the construction of FCD -III, Polder No. 1 from Naogaon to Mohadevpur and Naogaon to Loulamara; the embankments on both the sides of the Atrai; the embankment, from Tarash to Mirjapur; the Sarekol-Kolom-Singra embankments; the Singra-Natore road; and the Brammaputra Right Embankment. The following are some of the impacts of flood control embankments affecting navigation.

Figure 7

Selective Survey of Navigation Routes Blocked by Sluice or Embankments in Chalan Beel Area



a. Transport Demand

Unplanned roads and embankments have created artificial flood and poor drainage patterns in low-lying land. The affected land cannot be cultivated early in the cropping season. This delay affects the next cropping season, thereby limiting the cropping intensity and gross production and overall demand for transport. In contrast places inside the Boral embankment now do not have floods as before and changes in soil composition and fertility from clay to sand were reported. Therefore, impacts from both the over-flooding and no-flooding are apparent.

Thirty years ago the country's river, canals, pools and ditches were full of fishes and their attendant fishing vessels and fishing employment. The Jamuna flood plain and the vast Chalan Beel wetlands were the main fishing grounds and where deep water Aman was cultivated providing a paddy-fish culture system. Due to the embankment on the major rivers the fish fry cannot enter into the paddy field or the interior khals, beels and pools. So the production of fish has dramatically decreased. As a result people are losing the main source of protein and traditional demands for fishing boats.

b. The Movement of Engine Boats

The continual movement of mechanised boats is one major reason creating siltation that affects navigation. The faster moving mechanised boats create waves that hit the banks and wash out soil that is deposited in the main channel. Since the monsoon movement of engine boats has increased with mechanisation this problem has been escalated.

c. Construction Material

Timber is the principal construction material for the country boats. There is no state forest in the NWR like the Sundarbans, Modhupur and Vawal and the forests of Chittagong and Hilltracts. Boat owners depend on social forestry. Depleted forest reserves and increased scarcity of timber has increased prices and forced owners to use immature and different tree species of wood which reduces the life span of the boats.

d. Competition with Road Transport

This informal sector has to compete with highly subsidized road transport. Boats sometimes fail to attract cargo and have to work at a cheaper freight rate which has reduced the income of the boatmen.

e. Harassment of Boat People

Traditional and mechanised country boats are still not recognized by the police who often stop them during operation and collect money forcefully from the boatmen.

f. Project Development in Other Sectors and IWTA Planning

Certain project development in other sector could have a direct impact on the nature of navigation in the region. There are no firm projects known which are being implemented now or in the immediate future that would affect planning. In the mining sector and IWTA plans there are proposals to supply limestone from Joypurhat and hard rock from Modhapukur (Mithapukur) along the Atrai-Little Jamuna and Karatoya river systems. This long term proposal was planned under the National Water Plan (MPO) to take place in the period 1990-2005. Any improvement of facilities and capacity along these routes would have direct implications for navigation benefits in the country boats and smaller boat sector and on employment. Under the present terms of reference integrated planning to achieve a full compatibility of objectives and designs for FCD and IWTA long term plans has not been possible. It is recommended that before a future strategy for flood alleviation in the NWR is agreed within the FAP there should be full discussions with to fully integrate long term planning for the two sectors. This may lead to modifications to the basic strategy for flood alleviation taken on its own.

4.6 Impact Review

The overall situation in the sector would highlight the following issues:

Bio-Physical Effects

- Changes to natural channel formation and habitats. When rivers flow naturally navigable channels tend to be maintained and encouraged by the regular passage and wake of boats. Artificial impediments on river or canal from embankments and structures exacerbates the problems of sedimentation and navigability.

Economic Effects

- Declining numbers of country boats and employment.
- Disparity of incomes between water and road sectors as rich truck-owners become richer and poor boat owners poorer. Country boats are traditionally rural based while road transport is urban based. Income disparity is enhanced between rural and urban areas.
- Agricultural price effects. In Chalan beel road transport is yet to be fully developed. Ox-carts during the dry season and boats during the monsoon still remain the main means of transport. Due to the embankment farmers are unable to carry their summer crops to the big hats and receive competitive prices and thus loose their incentive of growing more crops.

Social and Cultural Effects

- Country boat occupy a prominent place in Bengali culture. In the monsoon, farmers are under-employed and usually visit their relatives together with all the family. Rural women generally feel comfort in country boat. As boats no longer have easy access visiting relatives by boats has become infrequent. Embankments have impeded movement between villages and undermined an important element of rural culture, social visits and domestic activities.
- Boat races are one of the common medium of amusement, symbolic conflict resolution and social cohesion for rural people. In the monsoon, rich farmer traditionally arranged boat race in the beels or currentless river. Race boat (Panshi Nouka) from the surrounding areas participated. Now it is almost impossible to arrange boat race because of embankments.
- Mechanisation of country boats has made a considerable difference to the situation of access and communications of people on the Jamuna and Teesta charlands particularly at those times of the year when river flows are high.

The time appears overdue for proper consideration to be given to the country boat sector to improve its operational routes. Mechanization has substantially improved the speed efficiency and its potential to expand its operational area, while also offering seasonally low-cost transport services by comparison to road transport. To achieve this rivers, canals and pools must be maintained to keep them navigable. This will require dredging, either by technical or by manual means. The cost analyses is very difficult to estimate without a proper in depth survey since the areas and problems cover a vast area. Working out and rationalising routes and inter-connection from field to small navigable channels and principle routes require a considerable level of study beyond the scope of this survey. The information which follows is thus indicative only.

4.7 Solution Suggested From Public Consultations

Two public sentiments were noted in the surveys. One is completely against the embankments which reflected opinions from the traders, Arotiders, country boat owners and operators. Farmers were in favour of embankments wanting strong, high and planned embankments with sufficient sluice gates and gate men. From this debate it was clear that the region is gaining something at the expense of loosing something. The approach to the solutions needs to consider both viewpoints. The following solutions were identified:

1. River Dredging

With constant siltation in the river bed and no care being taken either by the Government or by local people channel capacity and draught have been substantially decreased. Low-cost manual dredging was suggested which would also create jobs for poor people.

2. Embankments Strengthening and Retirement

In parts existing embankments are not strong enough or high enough where they close on the river. In peak floods breaches, erosion and overtopping occur. The road/embankment on the left bank of Puran Jamuna from Raninagar to Atrai falls in this category. At Roshulpur and its neighbouring areas two breaches and overtopping took place during the last flood. At Nagar Kashempur, it touches the river and at any time a big part will be eroded.

3. Bridges and Gates Should be Made Wider

Bridges and gates on the roads and embankments are poorly researched and designed. Generally there are not wide enough to pass boats. The inability to pass water flows smoothly results in water logging and artificial flooding. When the current becomes severe erosion causes damages to crops, human shelter and can affect the ecology.

4. Establish Small Transit Port on Confluences

Navigation options should be made available for the country boat especially for the rainy season. To control flood and to ensure the movements of boat, hats or business centres located at the confluence of the important canals or river connections should can be established. Thereafter boats from remote areas with outgoing cargo and passenger would be able to come to the sluice gates and return with incoming cargo and passengers brought in by outside movements of big boats. Traders would transfer cargo at some additional cost, but at levels that would still be cheaper than truck.

4.8 Conclusion

Flood control and creation of navigability are often seen to be in opposition and sometimes inter-related. Navigation can be enhanced by either omitting or re-designing sluice gates, embankments and bridges and by making the navigation channels deeper through dredging. The omission of structure and embankments can encourage flooding and oppose flood control while dredging will increase the channel capacity thereby helping to control flood. Simple re-design or re-sizing of structures is often all that is required but is not within the normal criteria of the engineers involved in construction of infrastructure whether in the realms of FCD planning or that of local roads and bridges.

The analysis of past projects in the GIP area (as at the regional level) confirm the any selection of design criteria for FCD water control structures that ignores the requirements of navigation will impose economic, social, and transport disbenefits and hamper development overall. Wherever, the project seek to make improvements taking account of the requirement for local and regional navigational routes and trade boatmen and fishermen alike will be included as beneficiaries. These deficiencies can only be fully resolved if the issues are also taken up outside of the confines of FCD planning since considerable problems are also caused through unplanned roads and other local infrastructural programmes. Such developments need to be better coordinated, designed and constructed and approved for this set of problems to be resolved. The full involvement of representatives from the boating and fishing sectors would ensure a more rational future approach.

4.8.1 Dredging and Re-excavation Programmes

The river Atrai has silted up in many areas along its lower reaches creating a draft problem. No remedial works of any kind have been taken yet to deal with these problems. Many distributaries and canals are also being silted up. The shallow drafted rivers have been losing their channel capacities and causing flooding through bank over-spilling and hampering water transport. It would not be impossible to dredge the full length of the river, at least at the main trouble points affecting navigation. Some places where dredging is most needed are listed below and indicate in Figure 8.

1. A little down from Mohadevpur.
2. Near Chuarman and Bandhykhara.
3. At Shutkigacha.
4. From Ahshangonj to Kashiabari and near Somashpara.
5. At the Chanchkoir ghat where cross damn is made.
6. Near Jothbazer.

The result of dredging would be:

(a) Expanded Navigability:

The additional depth and durability of navigation will increase the season by at least three months. It is estimated that around 16,000 commercial and 5,221 fishing boats could benefit. In addition many domestic boats can render local services throughout the whole year. Further if suggestions made in the Health study for government and NGOs to make use of boats for river ambulances and servicing local rural areas by boat were to be considered there would be further benefits accruing to other sector.

The following financial benefit will be gained:

Type Boat	No. of Boats	Monthly Income Tk	Additional Income
Commercial	16,000	43,200,000	$43,200,000 \times 3 = 129,600,000$
Fishing	5,221	15,663,000	$15,663,000 \times 3 = 4,68,84,000$

63,663 people will get jobs for three extra months and 150,000 families will benefit directly.

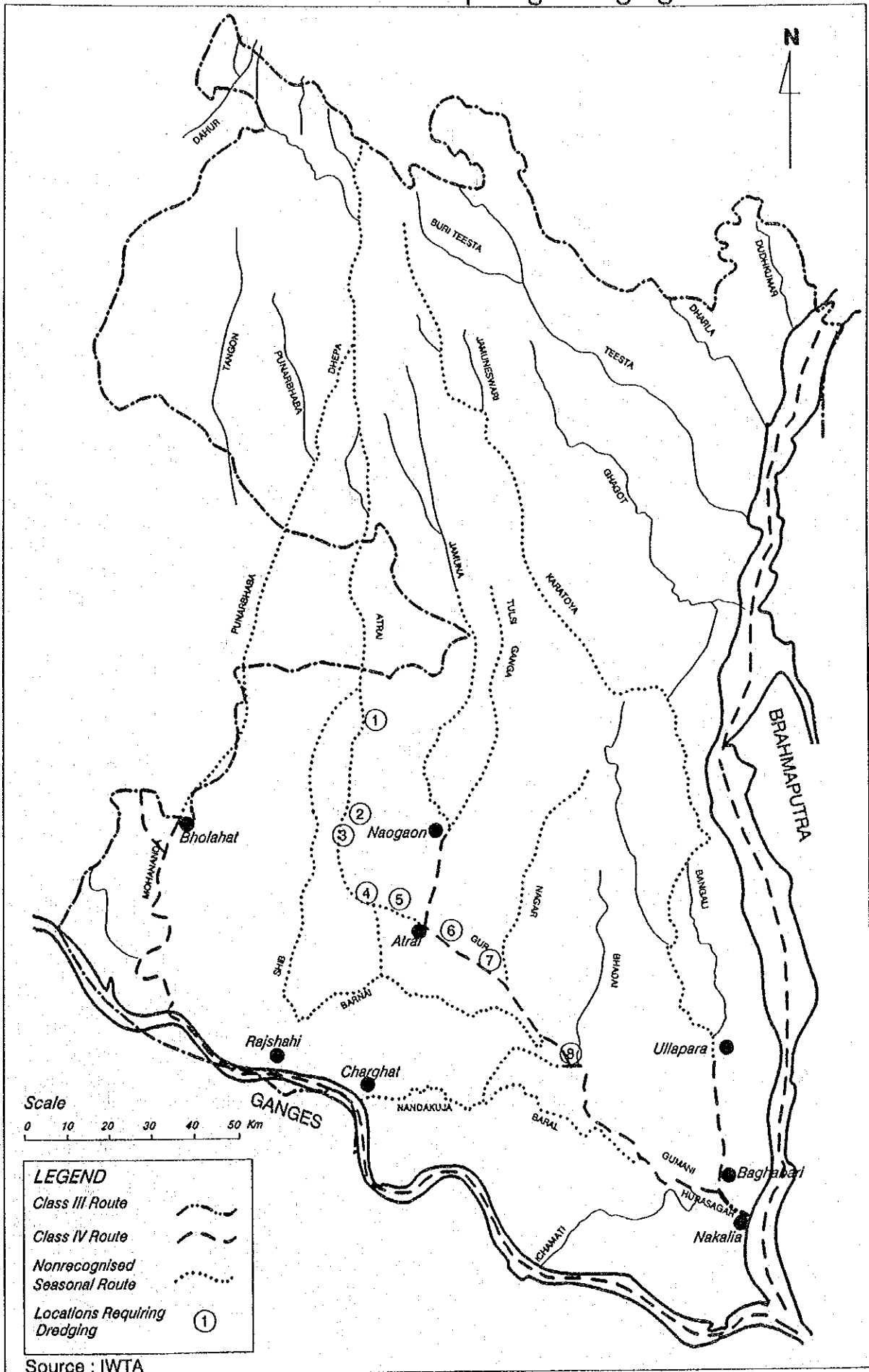
(b) Enhanced Flood Control:

Due to additional depth the waters catchment of river will increase and it will stop the over spilling of bank. By this way flood will be kept under control.

(c) Increased Production of Fish:

The rivers of the North-West region are wither dry or shallow drafted. And it is a threatening for the fish. So at the end of Autumn when flood water starts to recede, the fish follows the water. If the river get sufficient depth the fish can stay here this way production of wild fish can be increased substantially and the fishermen and fish dealing community can have additional job.

Figure 8
Locations Requiring Dredging in Lower Atrai



Source : IWTA

(d) Assistance to Irrigation :

The production of crops along the river Atrai mostly depend on it. Recently the peasants are suffering from irrigation water due to the low flow in the river. In the peak draught the shallow tubewells fail to discharge underground water. As a result the peasants keep the river block in the whole season. But they did it only 7 to 12 days in previous time. After dredging the river will be able to supply more water for irrigation and the production of irri paddy and boro will increase substantially.

(e) Employment Generation:

If the rivers are manually dredge a considerable number of employments can be generated. An amount of 1000 cu ft earth work within 200 ft distance involves six mandays. If the river Atrai is dredged it alone can generate hundreds of millions of mandays through earth work. And each manday will coast 30 to 40 taka.

4.8.2 Removing or Replacing Sluice Gates by Lockgates

Along the river Atrai there are dozens of irrigation canals on both sides which are the potential arteries of the rural transport system supplying the business centers established on the riverbanks. After embankments had been constructed these canals have been blocked either by embankments or by sluice gate. As a result both exit and entrance of boats through the canals have stopped. The replacement of sluice gate by lockgates would allow these boats to properly ply again.

The survey could not cover all the multitude of small inter-connections. The following are some of the more important canals where navigation has been impeded according to the local people interviewed.

- | | | |
|------------------------|-----|--------------------|
| Connecting Mohadevpur: | (a) | Bouddapur canal. |
| Connecting Atrai : | (a) | Jatramul Canal. |
| | (b) | Shutkigacha canal. |
| | (c) | Shahebgonj canal. |
| | (d) | Kashiabari canal. |
| Connecting Singra : | (a) | Rakhalgachi canal. |
| | (b) | Dimdoma canal. |
| Connecting Taherpur: | (a) | Uriapirer canal. |
| | (b) | Hatibandha canal. |
| | (c) | Noldanga canal. |

The result of replacement would be that rural transportation will be easier, farmers will get the real price of their products, and easier seasonal communication through rural water transport network could be ensured.

CHAPTER 5

NAVIGATION IN THE GAIBANDHA IMPROVEMENT PROJECT AREA

5.1 Transport Systems and Their Development

The GIP area is bounded on the east by the Brahmaputra and on the north by the Teesta. The Teesta originates from India flows south-east to its confluence with the Brahmaputra near Sundarganj. The Brahmaputra crossing from the Indian border flows South. The Ghagot is a distributary from the Teesta branching off near Ghagot. One branch meets the Manos and the other meets the Katakali and is called the Alai. The Manosh originates from a low lying beel of Bamandanga and flows towards eastern direction and meets with Ghagot at Ghagot and finally falls into the Brahmaputra. Some narrow canals flows through the project area like Matherhat and Burail canals.

The GIP has a railway running parallel to the river ways with a connection to Fulsory. Road transport is recent and not yet highly developed. Gobindagonj and Polashbari are situated on the Asian Highway. Sadullapur has recently received road communication. The two upazilas of Sundarganj and Fulsary are badly connected by road. Even though four upazilas are on the river (excluding Gobindaganj and Polashbari) river routes are not currently considered an important means of transportation and communication. Nevertheless this does not reflect the potential possibilities for a low cost seasonal water transport system.

A list of the markets and ports on each river follows and are located in Figure 9.

River Ghagot	-	Gaibandha, Sadullahpur, Baandanga, Boriati, Chowdhuarni
River Manos	-	Daraipur, Dhopadanga
River Matherhat	-	Matherhat, Talmodhupur
River Barail	-	Bholanathhat
River Brahmaputra	-	Kamarjani, Rasulpurghat
River Teesta	-	Sundarganj

5.2 The Importance of Country Boats

Gaibandha has no tradition as being historically important for country boats. The river routes along its boundaries on the Brahmaputra and Teesta were far more important. A few centres along the Brahmaputra and Teesta provided services to the interior and to the people of charlands. The survey interviews found the respondents describing not the boats of their own area but the glories of boats from other districts. A good number of boats regularly used to visit the area through the Ghagot and Manos rivers. Traders and boatmen of Rasulpur, Kamarjani, Sadullapur, Bamondanga and Sundarganj reported that boats would come from Jessore and Khulna with coconut. The boats came in during August and returned in autumn, after the durgapuja. Boats from Pabna and Sirajganj would come with clay pots and return after a month. Both anchored from ghat to ghat and used to sell their goods. The local Chowdhury and Garaboa and the shoronga made frequent trip to Dhaka and Narayanganj loaded with paddy and jute and returned with salt, kerosine, oil and stationery. Traders and consumers depended on country boats for internal distribution. This system stopped after the embankments and the sluice gate were constructed. Now in the monsoon very few country boats are seen plying in the river. They are either mechanized or traditional country boats.

CHAPTER 6

NAVIGATION SYSTEMS

6.1 General

Most rivers relevant to navigation planning in the GIP area meander in beds of fine, sandy material as elsewhere in the region. They are again natural rivers and drainage lines the navigability of which is affected by the river morphology and hydraulics requiring detailed knowledge of channel behaviour and a long term perspective for navigation planning purposes. The important internal routes are only seasonally navigable during the monsoon season. Only the external rivers of the Jamuna and Teesta have limited navigation possibilities during the dry season. The national IWT navigational standards specify that both routes should have minimum LAD of 1.5 meters. In practice the routes do not have the necessary minimum flow.

6.2 Route Classification

The GIP area has only non-recognised seasonal routes. Only Rasulpurghat, Kamarjani and Sundarganj are connected with class III route called perennial hinterlands route that stretches from Aricha to Chilmaly via Nakalia, Sirajganj, Fulsory through Jamuna and Brahmaputra. The non-recognised seasonal routes remain navigable for only five months in a year. In the monsoon, there would have been village connecting routes. But intensive earth road network has destroyed this possibility. Figure 10 shows the route classification.

6.3 Transport Cost Comparisons

Surveys in the GIP found that road transport costs to be two times more than the country boat when calculated only including fuel consumption. Over a particular distance the difference found are shown in Table 6.1 Table 6.2 provides cost comparisons with other forms of local rural transport.

Figure 9
Location of Hats - GIP

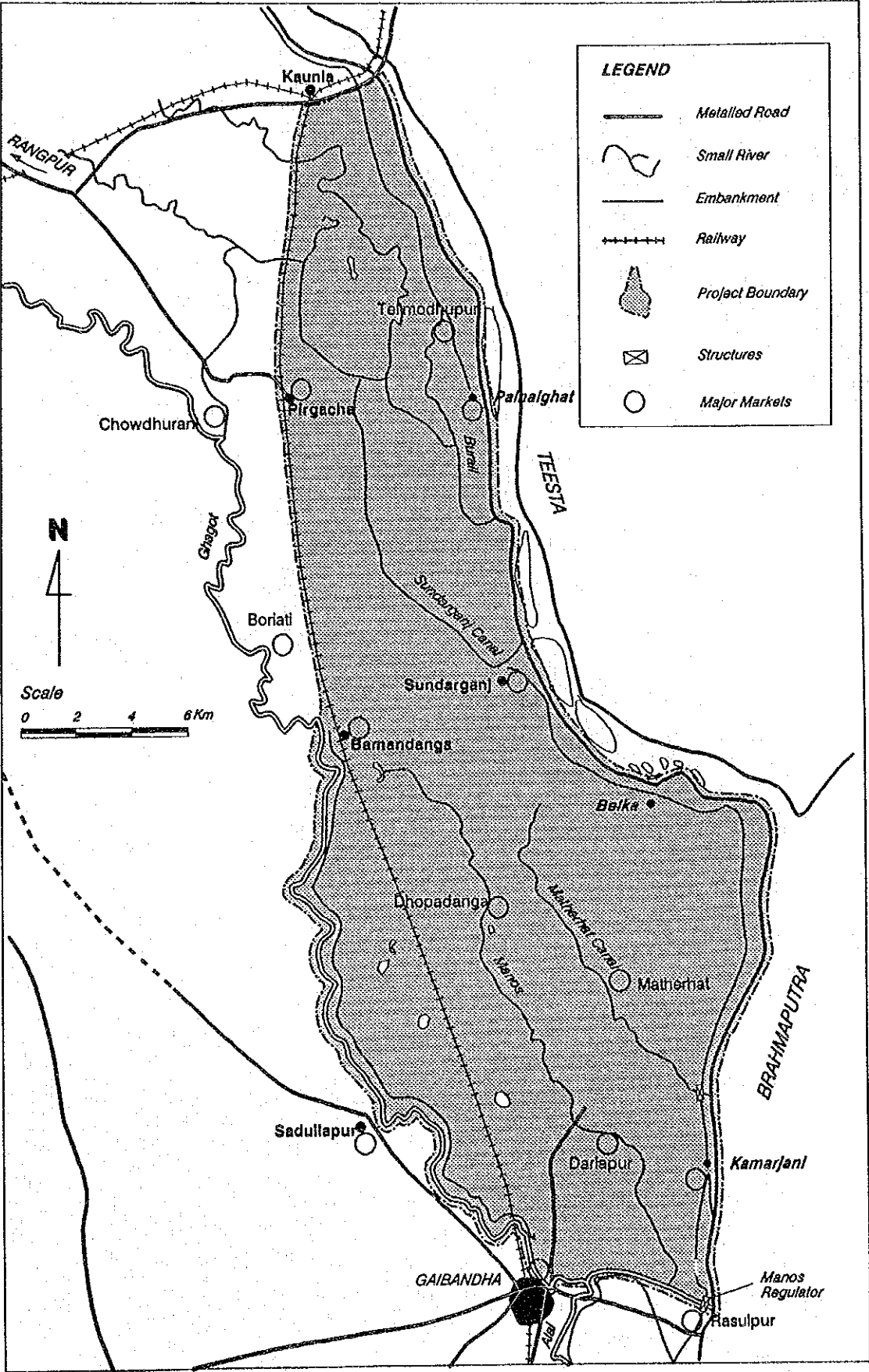


Figure 10
Route Classification - GIP

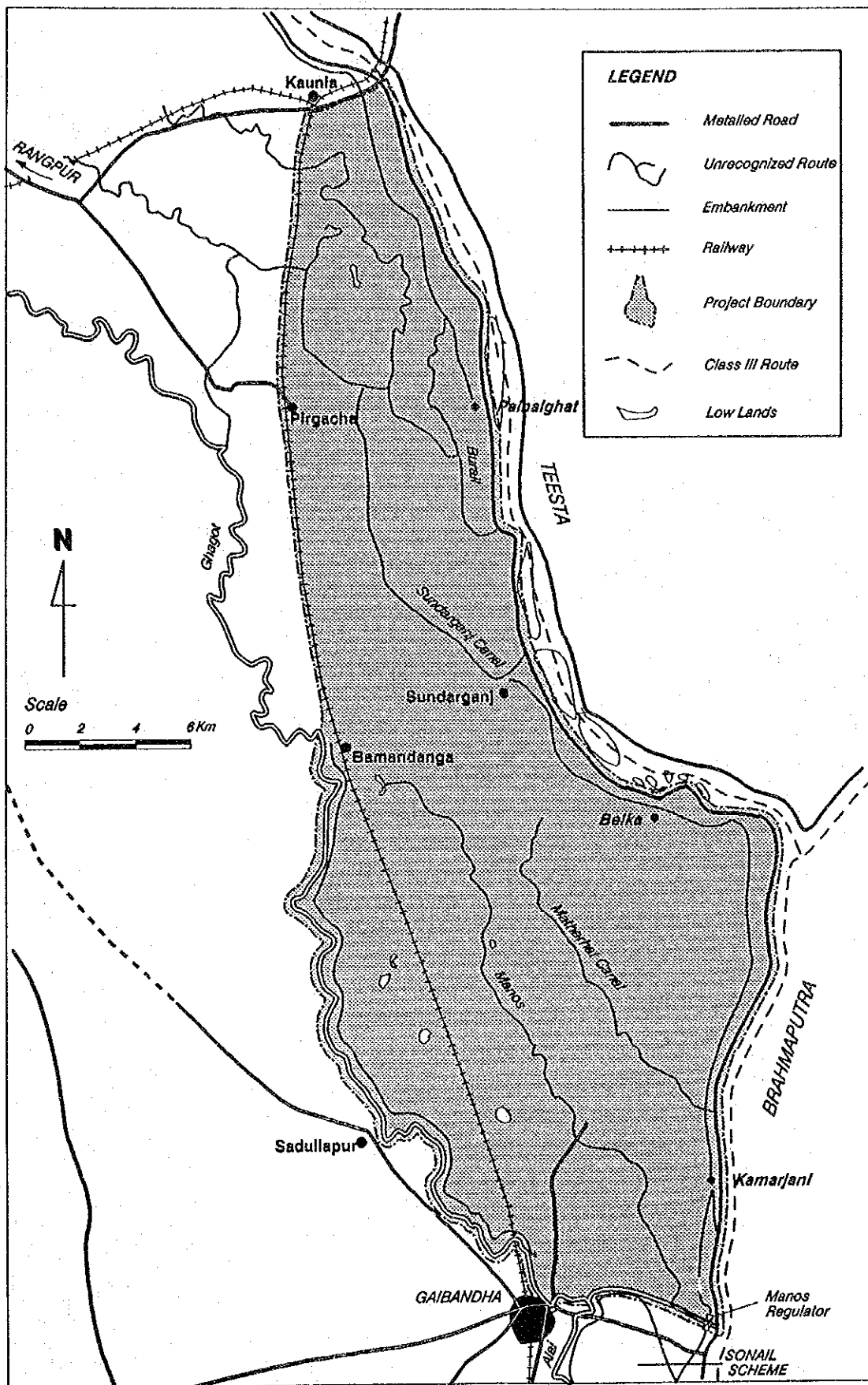


Table - 6.1 Freight Distances and Cost Comparisons in Gaibandha

Route	Unit	Distance	Freight Costs		Freight Costs	
		Km	(Tk./maund)		(Tk./maund/Km)	
			Boat	Truck	Boat	Truck
Rasulpur-Dhaka	Maund paddy	300	12	25	0.04	0.08
Rasulpur-Dhaka	Bell jute	300	15	28	0.05	0.09
Kamarjani-Dhaka	Maund paddy	305	14	30	0.05	0.10
Kamarjani-Dhaka	Bell jute	305	16	32	0.05	0.11
Sundergonj-Dhaka	Maund paddy	325	16	35	0.05	0.11
Sundergonj-Dhaka	Bell jute	325	18	37	0.05	0.11

Source: * Sundarganj Merchant's Association.

Table - 6.2 Cost for Local Transport (Tk/maund/km.)

Commodities	Mode of Transport				
	Rickshaw	Rickshaw Van	Bicycle	Ox-Cart	Boat
Paddy, Rice, Wheat	5.00	5.00	6.00 - 8.00	3.50 - 4.00	2.00 - 2.50
Jute	6.00-7.00	6.00-7.00	x	4.00-5.00	2.00-3.00

CHAPTER 7

COUNTRY BOAT OPERATIONAL REVIEW

7.1 Boat Numbers and Role

There are no current official country boat statistics for Gaibandha District. The statistical year book (1986) records 12,800 in the Greater Rangpur area in 1977, most of which originate from Kurigram, followed by Gaibandha. Data collected from the Department of Fishery record 981 fishing boats in Gaibandha District. The Kamarjani Merchants Association estimated that the number of boats in Gaibandha district, including fishing boats along the main rivers may be 1200-1500. They claim that the country boats for the District might have comprised five thousand before the construction of the BRE.

Before the construction of the BRE and the Manos regulator most trade was done by country boat and Kamarjani was an important river port and very good boating incomes were possible. Poor people were attracted to work in the boat sector rather than in other activities. The survey results estimate that the number of jobs and income past and present compare as indicated in Table 7.1.

Table 7.1 Comparison of Current and Historical Trade Boat Numbers, Employment and Income.

Boat Category	Period	Number of Boat	Rate of Employment Per Boat	Total Number of Employment	Monthly Income Per Employee	Total Income
Commercial	Pre-BRE District	5,000	3	15,000	150	2,270,000
	Present GIP	700	3	2,100	900	1,890,000
Fishing boat	1977 District	981	3	2,953	200	588,600
	Present	345	3	1,035	1,000	1,035,000

The study carried out two surveys, one in June and again in August. The first survey found the lean season for movement continuing as the routes in the poldered area were not yet navigable. No boats were using the internal rivers. Three boats were noted at Sadullapur ferry ghat and one tiny ferry boat at Ghagot. People said that in the monsoon some boats can be seen in the Ghagot and Manos carrying passenger and cargo. Along the Brahmaputra and the Teesta right bank, there are three important Centres for the export of goods by boat. These are Rasulpurghat near the Manos regulator, Kamarjani and Sundarganj. At these three places more than one hundred boats were seen waiting and loading. Local traders, Arotiders and the boat men reported that through these three centre about 10 lacs mds of jute and 4 to 5 lacs mds of paddy are exported yearly by 350 country boats of different size and capacity.

The August survey recorded boat numbers are shown in Table 7.2. Again no boats were seen in the river Manos. The field survey indicate changes in volumes of trade increasing as shown in Table 7.3.

After the construction of embankments in the area the use of country boats has reduced considerably. Attempts to take boats over the top of the embankments proved a very hard job and not good for boats. As the main two rivers remain navigable for only three/four months ox carts, rickshaw and rickshaw van have been prominent as rural transport as indicated below.

Table - 7.2 Surveys Records of GIP Boat Numbers in Selected Locations

Place	Type of boat		
	Kosha	Sharonga	Total
Gaibandha	11	0	11
Shadullapur	7	0	7
Rashulpur Ghat	49	7	56
Kamerjani	104	22	126
Sundarganj	35	7	42

Source: Field Surveys, August 1992

Table - 7.3 Historical Trends in Cargo Potential

Market	1992			1980		
	Commodities in mds.			Commodities in mds.		
	Paddy	Rice	Jute	Paddy	Rice	Jute
Kamerjani	400,000	x	700,000	100,000	100,000	150,000
Shadullapur	150,000	200,000	100,000	75,000	100,000	150,000
Sundarganj	100,000	x	150,000	50,000	x	200,000

Table - 7.4 Seasonality of Road and Water Transport

Place	September to June				July to October			
	Local Trade		Int. Dist. Trade		Local Trade		Int. Dist. Trade	
	Road	Water	Road	Water	Road	Water	Road	Water
Kamerjani	100%	00%	20%	80%	80%	20%	00%	100%
Shadullapur	100%	00%	100%	00%	75%	25%	60%	40%
Sundarganj	100%	00%	80%	20%	90%	10%	00%	100%

7.2 Country Boat Types

Historically and before road transport and FCD embankments were developed the types and size of boats prominent in the area were as shown in Table 7.5. Today the Gara and Chowdhury type have completely vanished. Only a few small Shorong types are still involved in fishing. All have been replaced by Kosha types.

Table - 7.5 Country Boat Types in Gaibandha

Boat type	Size of Boat (ft x ft x ft)		Capacity (maunds)		Operational period
	From	To	From	To	
Sharonga	45x6x1.5	52x12x3	50	700	Jan - Dec
Garaboat	45x10x0.5	50x12x3	200	500	Jan - Feb Jun - Dec
Chowdhury	50x12x3	55x18x3.5	500	2500	Jun - Dec
Kosha	45x6.5x1.5	50x9x3	70	400	Jan - Feb Jun - Dec

7.3 Changes in the Country Boat Sector

Typically the changes in the GIP area reflect wider changes which have happened regionally or nationally. These need not be repeated. The following specific items of interest were noted in the field surveys.

a. Change in number

Two opposing answers were surveyed. Some argued that due to the mechanisation only richer people had the capacity to buy and install engines thus competing out non-mechanised boats from the sector. Others argued that the volume of trade is increasing and boat people are getting good incomes and thus people are constructing more boats. What is agreed is that the local operational period and routes have become restricted. Some years ago, almost all the rivers remained navigable through the whole year but now most river routes are only seasonal. Also since mechanisation the trip frequency has become higher increasing competition reducing income. This might suggest that the number of boat could have been decreasing.

b. Changes in the shape and size

Before mechanisation some big boats disappeared because they failed to make a profit. Some big boats retired as the owner could not afford the big engine. As a result the boats were sold or broken and owners constructed or bought smaller ones sometimes as a share arrangement with others. Smaller and shallower-draughted boats have also become necessary as the river routes have become silted up.

After mechanisation local boat people noticed some technical difficulties in the existing shorouga, Gara and Chowdhury type boat and advantages for the Kosha type boat and this type has replaced all other types. An additional advantage of the Kosha type was that quality wood became scarce. Plain iron sheet suitable for the Kosha type and shape. Sheeting was cheaper than wood and easier to repair. Over 80 percent of traditional boats are estimated to have become mechanised.

c. Changes in the employment and income

In the early 1980s before mechanisation but after some road transport development the condition of the traditional boat sector was ailing. Incomes were at their lowest and as elsewhere mechanisation was adopted in the mid 1980s. Mechanisation allowed country boats to compete with road transport successful and incomes began to rise. This induced other boatmen to come forward and the number of engine boats began to increase dramatically. Now the focus of competition is not so much between boats and road transport but between boat and boat. As a result individual incomes from boats have decreased again substantially. This has also coincided with a time when fuel prices have increased significantly.

Employment in the local sector appears to have been relatively unaffected by these developments. No labour displacement or major recruiting was reported due to mechanisation. However, although trip frequency has increased, the volume of trade has not increase at the same rate. So boats cannot utilize their full capacity and time.

There is labour displacement in boat building sector amongst the carpenter community. With the transfer to metal sheeting the total amount of work has declined and many carpenter have migrated to India or moved from boat building to the furniture trade. Indicative of this is the village of Kamerjani where there were about 100 carpenter families but now only ten families are left.

d. Changes in the distribution of income

No change in the distribution of income was noted. The traditional system is being still practised although the salary system introduced in a few boat reflects the presence of absentee owners. The share system is as follows:

Capacity of boat	Share of boat	Share of engine	Share of the crew
50-100 md	25%	25%	50% ÷ 2 crews
101-200 mds	28%	28%	44% ÷ 3 crews
201-400 mds	30%	30%	40% ÷ 3 crews

Source: Local boatmen in Chilmari.

e. Technical Changes

Traditionally boats were operated by the manual and hard working operations of pulling, polling, rowing, sailing and drifting. Technical improvement have released the boatmen from their arduous work of previous times. The main changes is the adoption of metal sheeting to replace wooden planks and the use of motor engines.

Mechanisation has increased the speed by at least five times compared to the traditional boats. It has also increased the operational efficiency. This technical improvement allows boatmen to think that they are no longer majhee but operators thus increasing their status.

f. Competition between truck and mechanised boat

In the early 1980s the unpopularity of the slow country boat gave trucks the monopoly. After mechanisation traders have returned to accepting boats because of the improved speed, the lower fuel consumption and transport cost, the greater cargo volumes they can accommodate in each trip and the advantages for carrying bulky goods like jute and firewood which it is not economic to carry by truck.

With the revival of the prominence of the boats in the monsoon, most of the cargo from the project area are transported by country boats. The shock for the truck sector has led the Truck Owners' Association and the Truck Sromik (labour) Union to sometimes demand a ban on mechanised boats.

CHAPTER 8

WATER TRANSPORT PLANNING ISSUES

The following major navigational problems were reported in the GIP area:

8.1 Ease and Seasonality of Navigation

Sand coming from the upper basin, together with the river bank erosion, is depositing in the river channels and raising bed levels in parts. Draught has become shallow and hampered navigation. No-one claimed that the withdrawal of surface and underground water by LLP and STW for irrigation affected the draw down of water levels which affected navigation.

8.2 Obstructed Routes

In the last four decades obstruction caused by the FCD embankments and unplanned roads has been the major change. Small tributaries and distributaries, inter-village connections and connections from the main rivers and river ports to the hinterlands floodplains have all been affected. Commercial and domestic operation and social visits are the main activities impacted. Before the construction of BRE and TRE boat from downstream used to enter the Ghagot, Manos, Matharhat and Burail river with various types of cargo. Today local boats can only ply in very confined areas during the monsoon. These effects have deprived people of the low cost transportation. Routes for country boat operations are severely restricted, as are new water transport income possibilities. There are some bulky goods whose transportation by truck or railway are not economic. As a result the trade is not flourishing. Many traditional social visits have stopped with a negative impact on the cultural life of the rural people.

8.3 Cross Boundary Issues

Some people are of the opinion that most of the rivers here originate from India which because it draws water for irrigation leads to low flows in Bangladesh and an inability to maintain navigational standard. Also, India allow most monsoon water into Bangladesh to avoid floods. This creates strong currents in the rivers causing severe river bank erosion that in turn encourages siltation; again hampering navigation.

8.4 Impact Review

The overall situation in the sector and the problems reviewed would seem to show the same bio-physical, economic, social and cultural effects as found at the regional level but on a smaller scale. These are not repeated (see section 4.6)

8.5 Solution Suggested From Public Consultations

Gaibandha is one of the most important jute growing districts in the region. This study has confirmed that the transportation of jute is not as economic by truck as by boat. Promoting the future of boat access as part of the planning criteria for the GIP could have a significant impact on the economics of jute for both producers and marketeers alike if navigation locks are included in the designs.

The Ghagot is the most important river in the district. A good number of business centers have been established on it as sources of supply of cargo. If regulators were replaced by lockgate about 500 different types of boat could ply and compete with road transport. Dredging would also be required to ensure the durability of navigation and extend the navigation season by three months. Initial estimates suggest the the marketing of between 1,200,000-2,000,000 mnds of cargo can be effected and stimulate navigation demands for between 50 to 100 boats along the river Manos.

The Sorai or Mondiler hat canal is very narrow, but a very important canal in the GIP area. It also has almost silted up and large areas have been converted to cultivable land. The area along the Sarai canal is also on the best jute and paddy growing area. This provides something of a dilemma as to dredge this internal channel for enhancing internal seasonal navigation might also require the loss of the production of jute and paddy along the canal alignment. With excavated it is estimated that some 50 boats could be engaged to move 1,250,000 mnds of cargo. The Sundorgonj canal, which is now blocked by the groyne could provide opportunities for 30-50 boats. Similarly the Nurail canal and some other minor canal could also stimulate another 100 boats and can carry 150,000-250,000 mnds. The potential benefits are summarised in Table 8.1.

Table - 8.1 Potential Navigation Income and Employment Benefits

River/ canal	No. of Boat	Rate of Employment	Total no. of Employment	Monthly Income in Tk.	Total Income in Tk.	Total Cargo in maund
Ghagot	500	3	1,500	900	1,350,000	1,200,000 - 1,500,000
Manos	100	3	300	900	270,000	200,000
Sarai	50	3	150	900	135,000	150,000
Burail	50	3	150	900	135,000	150,000

Additional benefits may also accrue to the existing 981 fishing boats and their 2900 fishermen and could provide an income at the rate of Tk. 1,000-1,050 as, if this navigation strategy were adopted, the boatmen and fishermen would have access for an additional three months covering the peak seasons for boro, aman, and jute trade.

The type of solutions proposed at GIP followed those from the Lower Atrai.

1. Develop Main Drainage or Sluice Gates as Transshipment Points

The main drainage nodes should be provided with transit facilities to allow loading and unloading of incoming and outgoing cargo.

2. River Dredging

This survey has revealed people in the lower Ghagot and Manos are very negative about the main BRE and sluice gate. Many times they cut the BRE to release the impeded drainage due to the narrowness of the Manos regulator. Some think that the river has become silted up causing over bank spillage and flood three or four times in a monsoon season. This local opinion provide one basis of suporting the removal of the Mans Regulator and carrying out river dredging. The estimated length of river requiring dredging is given in Table 8.2 below. The Burail canal is not considered significant as it is very susceptible to erosion.

Table 8.2 Estimates of Dredging Programme for GIP

River/Canal	Dredging		Length Approximate
	From	To	
Ghagot river	River Brahmaputra	End of the Project	35 Km.
Manos river	River Brahmaputra	Bamandanga	20-25 Km.
Sarail canal	River Brahmaputra	End	12-15 Km.
Sundargonj canal	Sundargonj	Pirpacha	8-10 Km.

3. Redesign of Sluice Gates in Size and in Number

The gates of the Manos regulator are well known to be too narrow. Wider gates designed for passage of boats would assist the stimulation of the water transport sector, promote cheaper transport and allow better control over drainage. The Manos regulator has blocked two rivers in spite of the potential for the river route to support 300 to 500 mds capacity boats and smaller ones. Wherever present or planned sluice gate can be replace by lock gates their size must be adjusted to the size of boats it is likely to have to pass according to the following suggested criteria.

Large boats: Length x breadth x draft = 50'x15'x3.5'

Small boats: " x " x " = 20'x5'x1.5'

4. Disconnect the Ghagot from Manos

Some people suggested to separate the Ghagot from the Manos and make a separate gate and canal up to the Brahmaputra providing two outlets to help improve the situation.

5. Removal of Embankment

Some suggested that the embankments should be withdrawn altogether. They argued that the embankment had made little difference due to the artificial flooding created by the FCD structure. Although the nature of flood is quite different they find no significant reason justifying the embankment. They pointed out the multiple benefits which would arise if boats, fish and alluvium were allowed to enter into the area if the embankment were removed.

PART 3
ARCHAEOLOGY AND CULTURAL
HERITAGE

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GLOSSARY

Mihrab	:	The niche or arched recess in the western wall of a mosque in Asia, towards which worshippers turn for prayer facing the Kabba.
Minaret	:	Slender turret at a mosque from which the muazzin gives the call for prayer.
Sikhara	:	Curvi-linear partition at a spire.
Turrets	:	Small towers.
Zamindar	:	Land holders who leased large tracts of land from the government and then sublet it to cultivators at negotiated rents.
Math	:	A commemorative Hindu movement in Bengal.

REPORT ON ARCHAEOLOGY AND CULTURAL HERITAGE IN THE GIP AREA

1. Introduction

This report provides the results of a reconnaissance study of the cultural heritage sites it was possible to identify which might be affected by engineering works and operations in the Gaibandha Improvement Project (GIP) area. The work was completed between May and July 1992.

2. Methodology

This direct site identification field work was done by study has been carried out by M.S.S.M. Rahman (Consultant Archaeologist) using both primary and secondary and published and unpublished sources primarily from the Archaeology Department and Museums of Bangladesh. Information collected through oral interview and reconnaissance level field survey formed the basis of the local assessment. The bibliography is given in the final Environmental Impact Assessment Volume - Appendix A. The overall assessment of cultural heritage impacts also involves the results of the field surveys undertaken by the ecological and sociological studies. These inter-disciplinary results are discussed separately in Volume 3 - Environment for the GIP and regional studies.

3. Regional History

The earliest references to the history of the north-west area of Bangladesh are mythological. In the ancient literature 'Aytareya Bhraman' mention is made of a ruler named 'Pundra' who lived in North Bengal. Although Palaeolithic fossil, stone tools and neolithic remains have been found in the Lalmai hill in the south-east region, no such evidence has been discovered for the north-west region. But the land of Barind area is older than south-east region, so, there is a good possibility of finding palaeolithic and near neolithic remains in the north-west region. The earliest (4th-2nd century B.C.) written records of Bangladesh were found in Pundranagar (Mahastan) near Bogra. Pundranagar was a province of the Maurjan empire, which was located just north of Bogra, on the bank of the Karatoya. It was probably the oldest urban centre in Bangladesh. In a later period it was ruled by the Gupta dynasty. In the late 6th century, after the Guptas, the north-west region became an independent kingdom with the name of Gaur (mainly present Rajshahi district). The Kingdom of Gaur became important during the reign of Sasanka (603-63 A.D) who was an independent monarch. He successfully countered Harsha, the emperor at northern India. After Sasanka, not only Gaur, but the history of Bengal as a whole is not much known. About the middle of the eighth century, an unknown person named Gopala of Pundra Bhardan was made king of Bengal by the people of the country. He laid the foundation of the Pala empire which lasted until 1160 A.D. The Palas, along with Bengal, ruled also a large part of north India for a while. The Palas were the last powerful Buddhist monarchs in the Indian sub-continent. The Pala period was one at extensive conquests as well as a period of considerable developments in art and architecture and widespread trade and missionary activities. The largest single Buddhist temple south of the Himalayas is located at Paharpur in Rajshahi district. This was built by the Pala King Dharmapal in the 8th century A.D. The Pala art had immense influence in Orissa, Kashmir, Nepal, Tibet, Burma, Thailand, Sumatra and Java. After the collapse of the Pala Empire the Sena dynasty came to power and finally the Muslims. During the Sultanate period (1204-1576 A.D) the centre of muslim power in Bengal was centered on the borders of the present Rajshahi district where Firozabad the capital at the northern and the western regions was situated for a long period. This place was visited both by the famous Arab traveller Iba-

Batutar in 1345 and by the Chinese ambassador M. Huan in 1406. In the Sultanate period a large number of buildings were made in the Rajshahi area and their architectural designs were very distinctive. Sultan Shamsuddin Ilias

Shah one of the independent ruler at this period countered the invasion of the emperor of Delhi, Firoz Shah Tugluk, from Ekdala fort which was situated in present Dinajpur district. At the end of the Sultanate period the north-west region along with other parts of Bengal came under the Mughal rule. Finally the British took over the whole region. The history of the north-west region have always been significant from ancient to modern times in the history at Bengal.

4. Preliminary Results

The literature review identified no previous surveys within the GIP area. There are a number of known sites close to the project area but outside of its boundaries. The archaeological sites that have been surveyed in the project area are all new sites. Not even the Department of Archaeology has any record of these sites. These can be termed as new discoveries and are discussed below.

5. Location, Description and Significance of Sites

Four types of sites have been identified - mosques, temples, Zaminadar palaces, crematoria and graveyards. No buried archaeological sites were identified which does not mean that these do not exist given the reconnaissance level of survey. The location of these sites is given in Figure 1, and are listed in Table 1. The sites were also transfer to the 1:50,000 planning maps to allow engineers direct access to knowledge on the proximity of their works to any identified site. Table 1 has also indicated a level of significance of these sites on a three part scale from highly significant, significant to not so significant.

A. MOSQUES

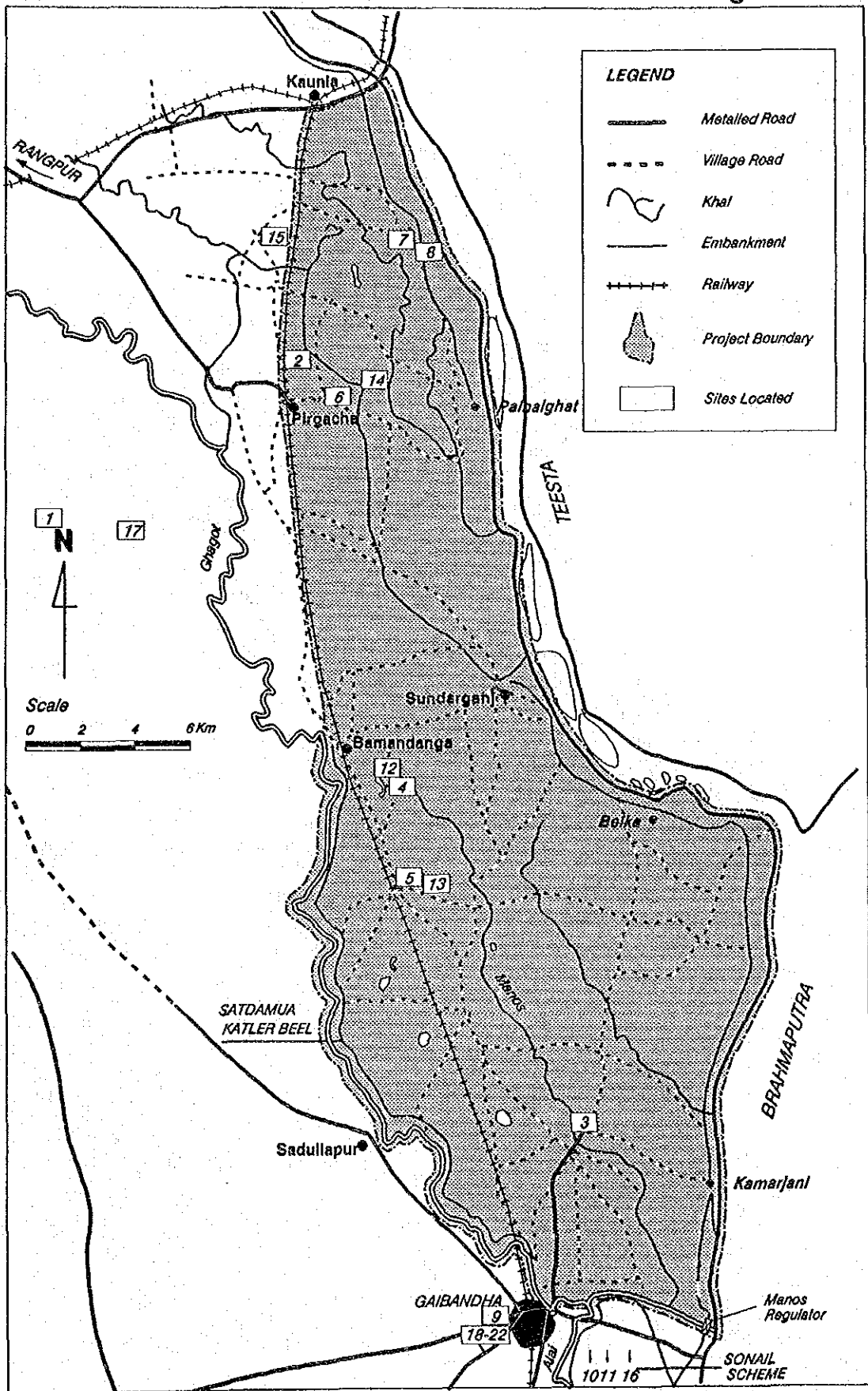
Mithapukur Mosque

The mosque is situated in Rangpur district about 200 yards north-west from Mithapukur Sadar. The length of the mosque is about 20ft. and width is about 8 ft. There are four turrets in the corners, which end with small domes. There are three semi-circle arched gates in the front wall. There are two more gates, one in the south wall and another in the north wall. There are also two turrets on either sides of the central gate. There are three Mehrabs on the west side and three nice domes on the roof. The front wall is decorated with floral motifs. The exact date of the mosque is not known. Seeing the building structure, the scholars are of opinion that it was built in the late Mughal period.

Chandipur Mosque

It is situated at village Chandipur in Pirgacha Union under Pirgacha Upazila by the side of the Rangpur-Pirgacha highway. The mosque is about 20 ft. in length and about 10 ft. in width. There are three semi-circular gates in the front wall. There are two more gates, one is in the north wall and another one is in the south wall. There are four turrets in the corners which end with small domes. One of the domes is broken. There are three big domes on the roof, a big one is in the middle with two smaller ones on either side.

Figure 1
Location of Archaeological Sites



The front wall of the mosque is decorated with floral motifs. A unique thing about the mosque is there is a brick made donation box at the right side of the mosque situated a little bit away from the main structure.

Its significance lies in the fact that the building has been using both by the Hindu and the Muslim communities respectively as temple and mosque. Even to this day every Thursday of the first month of the Bangla year a village fair takes place in the yard of the mosque and people put money and things in the donation box with the belief that all their desires would come true. The characteristics of the mosque indicates that it was probably built in late Mughal period.

Dariapur Mosque and the Grave of a Saint

It is situated at village Dariapur in Ghagot Union under Gaibandha Upazila. The mosque is about 30 ft. in length and 10ft in width. There are three semi circle arched gates in the front wall as well as a single one in the left wall. There are four turrets in the corners, and two more turrets on either side of the central entrance, both ending with small domes. There are three big domes on the roof. The wall of the mosque is about 40"-45" thick. The front wall is decorated with traditional floral designs. Two inches below the cornice, a five inches thick floral design is decorated around the buildings.

A rare characteristic of the mosque is its beautiful Minaret (where from the Muazzin calls for prayer) with staircase and also living quarter underneath the minar.

The Muazzin of the mosque said that there was a stone inscription inside the mosque. Unfortunately the inscription was stolen. The Muazzin also told me that the date of the Mosque was written 1110 Hizri, that is the Islamic year which means if the inscription is correct the mosque is about 300 years old.

B. TEMPLES

Lahiribari Temple

It is situated at village Ramvadra in Sarbananda Union under Sundarganj Upazila. This is a unique example of family owned temples. The floor of the temple is 15'x10' and the height is about 25ft with the Shikhara tapering gradually from the roof level up to the pointed peak. The Shikhara is made of monolith stone slabs. Local people are of opinion that these stones were brought over from Nabadipa.

Interviews with the local people suggest that the temple is probably 200 years old. An interesting characteristic about the decoration of the temple is that no figure motifs have been used to decorate the temple. Instead, the outside walls are decorated with a very small number of floral designs.

Lahiribari Temple

There is another temple in Lahiribari. The temple is octagonal and its height is about 20ft. The temple is decorated with figurative designs. The temple is still in use.

The Votive Temples

The votive temples are situated at village Ramavadra Union Sarbnanda under Sundarganj Upazila. The three temples are decorated with animal figures and floral designs.

Pirgacha Zaminder's Palace Temple

The temple is situated beside the Palace at village Bara Pancha, Pirgacha Union, under Pirgacha Upazila. The length of the temple is about 30ft. and width is 20ft. There are three arched gates in the front wall. Entering through the gates first a verandah leads to three separate rooms each holding an alter. An unique characteristic of the temple is that three of its domes are like domes of a mosque and the remaining seven domes are a slightly pointed like sikhara. It indicates that the design of the temple was considerably influenced by muslim architectural design.

Sadra Temple

The temple is situated at village Sadra Taluk, Tapa Madhupur Union, under Kaunia Upazila. The inside of the temple is square, each side is about 10ft. The height is about 80ft. There is a semi-arched door in the front wall. The wall is 10 inches thick. All the four sides of the temple are decorated with thin brick and the front wall is decorated with beautiful terracotta plaques. An aged villager told me that the temple is about 400 hundred years old. (835 Shakabda).

Untitled Temple

There is a temple at village Rajib, Tepamadhupur Union, under Kaunia Upazila. The temple has two buildings on either side. Unfortunately the buildings are completely damaged and the temple is in a dilapidated condition.

Untitled Temple

There is a almost destroyed temple at village Tulshighat, Shapara Union, under Gaibandha Upazila.

Untitled Temple

There is a temple at village Rasulpur, Kanchipara Union, under Fulchari Upazila. Unfortunately this temple is also in a state of disrepair.

Kali Temple

The temple is situated on the bank of Ghagot river at village Bharatkali, Saguna Union, under Shaghata Upazila. The temple is well maintained and is being used by Hindu community. The local people believe that it is about 300-400 years old.

C. ZAMINDER'S PALACES

Bamondanga Zaminder's Palace

It is situated at village Ramvadra, Sarbananda Union under Sundarganj Upazila. While most of the buildings are completely destroyed, few are in the process of destruction. There are still three intact buildings in the palace area. Local people says that the palace is about 450 years old and the Zaminder was a very influential one. He had even Zamindaris in Rangpur, as well as in Calcutta.

Naldanga Zaminder's Palace

It is situated at village Dashalia, Naldanga Union under Sadullahpur Upazila. All the building structures are destroyed except a part of the boundary wall. Three buildings have been reconstructed and people are living there. One of the descendants of the family said that a number of locally popular legends are connected with this Zaminder's palace.

Pirgacha Zaminder's Palace

It is situated at village Barapancha, Pirgacha Union, under Pirgacha Upazila. Many buildings and temples are still in good condition in the palace area though except some are partially damaged, according to local people 200 years of local history is connected with this Zaminder's Palace.

Itakumari Zaminder's Palace

It is situated at village Itakumari, Itakumari Union, under Pirgacha Upazila. The inner building of the palace is already destroyed. In the outside there are two partially damaged buildings. Local people think that about 300 years local history is related with the palace.

Rasulpur Zaminder's Palace

It is located at village Rasulpur, Kanchipara Union, under Fulchari Upazila. Some building are completely destroyed while some are partially damaged. Two buildings are being lived in by people. The palace is about 150 years old.

Begum Rokeya's Palace

The sites is situated at village Khargamuradpur, Union pairaband under Mithapukur Upazila. The site is completely destroyed except two or three columns. Begum Rokeya was the Pioneer in introducing women education in Bangladesh.

D. HINDU CREMATORIA

Five Hindu crematories were found in Gaibandha Upazilla located as follows:

1. Village: Islampur
Union: Ballamjhar
2. Village: Kumurpur
Union: Ballamjhar
3. Village: Vagabanpur
Union: Ramchandropur
4. Village: Radha Krishnapur
Union: Bowali
5. Village: Gopalpur
Union: Ramchandrapur

Besides these five there are a good number of crematories in the total project area. All are situated on river banks which get inundated every year leaving people with serious problems in the cremation of their dead bodies.

E. MUSLIM GRAVEYARDS

There few well-planned muslim graveyards. Those that are located at Gaibandha sadar. At village, traditionally people like to bury their dead bodies near their households. When their homes and adjacent areas are immersed under water the muslim people also face problems with their dead bodies.

6. Reasons for the Destruction of the Sites

In general most of the archaeological sites in Bangladesh are in a state of disrepair. A number of reasons are responsible for the dilapidated condition of the sites. The causes are as follows:

1. Almost every year most of the archaeological sites in the GIP area get inundated by flood. Because of inappropriate drainage system, flood water stays inside the buildings/sites for long time. The stagnant water causes immense injury to the foundation, wall, floor, sometimes even making the whole structure sink into the ground by inches and, in some cases, even by feet.
2. Excessive rain during monsoon varying between 70 to 100 inches in a year and excessive humidity averaging well over 80% encourages the growth of wild vegetation. Once an historic building has fallen into a state of neglect it is quickly overgrown by heavy foliage and this plays havoc with its structure. Especially damaging is the Banyan tree, which holds the building in a grip of fast expanding roots, like an octopus, until the structure is gradually torn apart. Heavy rainfall causes enormous damage when they are in a state of disrepair as are most sites in the GIP area. Water gets inside cracks in the wall and roof structure and over the years the cracks get bigger ultimately making the structure fall apart.

3. The rivers of Bangladesh are notorious for their frequent and violent change of course. Many archaeological sites have been lost due to these changes. The archaeological sites in the GIP area are equally vulnerable to the rivers, particularly the Teesta, Jamuna and the Brahmaputra that flow near to the area.
4. Bangladesh is a densely populated country in the world. To meet the demands of the growing population, more and more of the archaeological sites are being taken for cultivation, as well as their materials being used for building houses.
5. Besides natural causes, the archaeological sites are also being destroyed by man extensively. In most cases bricks, terracotta designs and figures are stolen because of their antique value. Most buildings in the GIP area have been suffering in the hands of these brick and treasure hunters.

7. Importance of Preserving Sites

Bangladesh has a rich cultural heritage. During the two thousand or more years of its chequered history, many illustrious dynasties kings, sultans and Zaminders have ruled this country. The desolated ruins of the magnificent cities and monuments, still visible in many places throughout the country, are reminders of those days and history. Proper help to preserve these archaeological sites is needed. To preserve and research the archaeological sites help preserve history help the reconstruction of past history in a more authentic way. Probably much evidence is still hidden under the ground of these sites.

8. Recommendations

The sites should be free from flood water. To keep flood water away from the sites proper engineering steps should be taken such as:

- (a) Erecting walls around a particular monument or in some cases, around the entire site.
- (b) If possible, building embankment covering the entire project area.

The building should be renovated properly, with the recommendation from the experts.

The sites as well as the monuments should be properly protected. Various steps can be taken to achieve this objective, such as:

- (a) By appointing guards.
- (b) By making local people aware of the importance of our heritage. It needs to be mentioned here that the general public are very ignorant about the history and importance of the monuments.
- (c) By erecting boundary wall around the monument so that nobody can have easy access to the site.

Proper government involvement is needed. Laws should be enacted to protect our heritage. But enactment of laws are not good enough, measures have to be taken to implement them as well so that nobody can use archaeological sites for cultivation or building purposes.

9. Likely Impacts of Proposed Project

Once the final engineering configuration for GIP was selected the alignments of new embankments was compared to the location of sites. At the time of survey the possibilities of river straightening along the Ghargot in Gaibandha town had not been identified. It is known that the likely course of the river straightening will run very close to an important site not surveyed or listed in this study. This will require proper appraisal during the detailed design phase. Table 2. provides an indication of the proximity of the surveyed sites to construction works and indicates the level of impact. This indicates that there are three main sites where problems could occur. These at Bamondanga, Naldanga and Dariapur where two temples, two mosques and 2 palaces could be directly impacted. These sites have already been given a rating of very significant in terms of their cultural and scientific value and thus should be addressed by further survey.

10. Mitigation and Future Work

It is clear that some potentially important cultural and historic sites may be affected by the proposed GIP. As such the detailed design phase will have to include a detailed survey and review of these sites. There was no opportunity to have a senior archaeologist supervise this current study. The detailed design phase must come under the overall control of a senior archaeologist capable of a proper assessment of the remedial, excavation or removal programme that may be required if these sites are to be disturbed or severely impacted by the construction works.

The need for future protection from flood waters is also a decision that will need to be reviewed and the likely sources of funding identified, as well as the institutional responsibilities that will be required to undertake these works.

Table - 1 Location and Significance of the Archaeological Monuments in GIP Region (Codes Refer to Small Area Map Codes)

Sl. No.	Name of the Monuments	Upazila/ code	Union/Code	Village/Code	Significance
1.	Mithapukur Mosque	Mithapukur/58	Mithapukur/58	Mithapukur/58	1
2.	Chandipur Mosque	Pirgacha/73	Pirgacha/76	Chandipur/174	1
3.	Dariapur Mosque	Gaibandha/24	Ghagon/36	Dariapur/241	1
4.	Bamondanga Temple	Sundarganj/91	Sarbananda/75	Ramvadra/904	2
5.	Naldanga Temple	Sadullahpur/82	Naldanga/86	Dashalia/311	2
6.	Pirgacha Temple	Pirgacha/73	Pirgacha/76	Bara Pancha/128	1
7.	Sadra Temple	Kaunia/42	Tepamadupur/81	Sadrataluk/845	1
8.	Temple	Kaunia/42	Tepamadupur/81	Rajib/711	3
9.	Temple	Gaibandha/24	Shapara/94	Tulshighat/973	3
10.	Temple	Fulchhari/21	Kanchipara/59	Rasulpur/870	2
11.	Temple	Shaghata/88	Saguna/95	Bharat Khali/195	1
12.	Bamondanga Z. Palace	Sundarganj/91	Sarbananda/75	Ramvadra/904	2
13.	Naldanga Z. Palace	Sadullahpur/82	Naldanga/86	Dashalia/311	3
14.	Pirgacha Z. Palace	Pirgacha/73	Pirgacha/76	Bara Pancha/128	2
15.	Itakumari Z. Palace	Pirgacha/73	Itakumari/28	Itakumari/366	2
16.	Rasulpur Z. Palace	Fulchhari/21	Kanchipara/59	Rasulpur/870	2
17.	Begum Rokeya's Palace	Mithapukur/58	Pairabad/89	Khardamuradpur/531	2
18.	Hindu crematory	Gaibandha/24	Ballamjhar/14	Islampur/336	3
19.	Hindu crematory	Gaibandha/24	Ballamjhar/14	Kumarpur/570	3
20.	Hindu crematory	Gaibandha/24	Ramchandrapur/87	Vagabanpur/124	3
21.	Hindu crematory	Gaibandha/24	Ramchandrapur/87	Gopalpur/343	3
22.	Hindu crematory	Gaibandha/24	Bowali/21	Radha Krishnapur/812	3

Significance Rating: 1 = Highly Significant
2 = Significant
3 = Not So Significant

Table - 2 Likely Impact of Construction Works and Their Significance

Sl. No	Name of the Monuments	Distance to Nearest Works	Significance
1.	Mithapukur Mosque	NA	3
2.	Chandipur Mosque	< 100m	1
3.	Dariapur Mosque	< 100m	1
4.	Bamondanga Temple	< 50m	1
5.	Naldanga Temple	< 100m	1
6.	Pirgacha Temple	750m	3
7.	Sadra Temple	300m	3
8.	Temple	150m	2
9.	Temple	NA	3
10.	Temple	NA	3
11.	Temple	NA	3
12.	Bamondanga Z Palace	< 25m	1
13.	Naldanga Z. Palace	< 100m	1
14.	Pirgacha Z. Palace	750m	3
15.	Itakumari Z. Palace	150m	2
16.	Rasulpur Z Palace	NA	3
17.	Begum Rokeya's Palace	NA	3
18.	Hindu crematory	NA	3
19.	Hindu crematory	NA	3
20.	Hindu crematory	NA	3
21.	Hindu crematory	NA	3
22.	Hindu crematory	NA	3

Significance Rating:

1 = Highly Significant
 2 = Significant
 3 = Not So Significant

NA = Site outside Project Boundary

