BANGLADESH FLOOD ACTION PLAN

Ministry of Water Resources

Flood Plan Coordination Organization (FPCO)

Environmental Study of the Chenchuri Beel Area

April 1995

Prepared by

Environmental Study

FAP 16

ISPAN

IRRIGATION SUPPORT PROJECT FOR ASIA AND THE NEAR EAST

Sponsored by the U.S. Agency for International Development

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PREFACE

This short study is not a required work product of FAP 16. Rather, as with many of the studies conducted, it was done at the request of the Flood Plan Co-Ordination Organization (FPCO) for strengthening of the EIA Guidelines.

The study was designed by the FAP 16 team during early 1995 to look at the environmental aspects of a small segment of the southwestern region of Bangladesh to understand the important environmental issues pertaining to the water sector in that area. The study was to help in reviewing certain parts of the EIA Guidelines of FPCO for the water sector through further field level testing. It was also to help in developing approaches toward the training of EIA practitioners in future.

The Chenchuri Beel area located in the district of Narail (spread over the thanas of Narail, Lohagara and Kalia) was taken up as the study area. Four different mouzas were selected as sample sites for gathering relevant information. Ten days of field-work involving RRA in all four locations, and household surveys in two locations, was completed by the end of February. Data processing and analysis was done in March and the report written during April, 1995.

The focus of the study was on identifying issues and impacts of surface water changes (brought about by human interventions and otherwise) on the people living in the area. The impacts in different sectors like agriculture, fisheries, livestock, navigation, health and sanitation were documented and analyzed. The analysis of the situation existing in the study area generated a number of important points for the improvement of the EIA Guidelines and also to the development of approaches toward future training of EIA practitioners.

ACKNOWLEDGEMENT

The production of this report was the result of a team effort which was overseen by Darrell Deppert, Chief of Party, Irrigation Support Project for Asia and the Near East (ISPAN) and Haroun Er Rashid, Senior Advisor to ISPAN. The senior team members of FAP 16 who conducted the study included Mustafa Alam, Dara Shamsuddin, Khurshida Khandakar and Mokhlesur Rahman. Among the other members, Md. Jakariya and Subrata Kumar Mondal provided valuable input in conducting the household surveys, carrying out the Rapid Rural Appraisals and processing the data. Qazi Salimullah provided support in systems analysis and helped in producing the tabulated results. Golam Monowar Kamal was involved during the earlier part of the study when he participated in the reconnaissance visits.

The study team received full cooperation from the Bangladesh Water Development Board (BWDB) as well as the Flood Plan Co-ordination Organization (FPCO). The study owes a lot to the respondents in the field who were always agreeable to provide information for the study. The government officials and the NGO workers in the field were also very helpful. The contribution of all of them is gratefully acknowledged.

EXECUTIVE SUMMARY

The objective of the Environmental Study of the Chenchuri Beel Area was to determine environmental issues of importance in the area. This was to be done in such a way that the EIA Guidelines of FPCO for the water sector could be enriched through further field testing. An additional purpose of the study was to suggest approaches for future training of EIA practitioners.

The case studies conducted by FAP 16 to develop the water sector EIA Guidelines covered a number of regions of the country. However, time and resource constraints did not allow coverage of all the regions, and the southwest was a region that was not covered. It was nevertheless appreciated that some field level investigation in this region would be of value in improving the Guidelines.

In conformity with the point made above, one of the reasons for selecting Chenchuri Beel area for the study was that it was located in the southwestern region of the country. However, it should be noted that the time available for the study was very short. Because of the limited time, only ten days of actual field work were possible. The scope of the study was accordingly quite restricted in nature, both in terms of the geographical area covered and the issues dealt with. Therefore, the study cannot be a substitute for a full-scale case study, rather it was an attempt to identify environmental issues of concern in the area and assist FAP 16 in further recommending changes to the Guidelines. The results obtained are to be considered in that light.

Four different mouzas in the area with different water regime characteristics were selected for study. Although household surveys in each of the mouzas would have been useful in collecting relevant information, time and resource constraints did not allow this. Household surveys could be conducted in two locations only. However, information was collected from all mouzas through the Rapid Rural Appraisal (RRA) process. The results and observations contained in this report are based on these household surveys and RRAs. The study area was flanked by the rivers Nabaganga and Chitra, and included the Chenchuri Beel around which an FCD Project was implemented by the Bangladesh Water Development Board a decade back. The respondents mentioned that over the years the stretch of the Nabaganga flowing through the study area had dried up substantially and that the Chitra had also become less robust. It was found through discussions and observation in the field that the water regime had been affected both by natural geomorphological changes and human interventions of different sorts. It was also found that flooding had become a rare event.

In the situation of a general reduction in surface water in the area, the study looked at the important environmental components associated with such aspects as navigation, agriculture, fisheries, health and sanitation.

It was found that the importance of navigation on waterways had been substantially reduced. Some changes were observed in the cropping pattern, although HYV paddy cultivation was not extensive due to problems of irrigation. Because of the reduction in surface water, the respondents, particularly the ones near the relatively dry Nabaganga, were facing problems in raising livestock. In the fisheries sector, species diversity as well as catch have been on the decline. As a result, the professional fishermen of the area have been affected. Shortage of surface water has also caused problems for health and sanitation. During the dry season, there is not enough water nearby for bathing. Transporting water for drinking and cooking purposes and washing clothes has become problematic during the dry season.

The findings of the study have produced some recommendations for improvements of the EIA Guidelines and for developing approaches to training of EIA practitioners.

Chapter 1

INTRODUCTION

1.1 Study Objectives

The general objective of the study was to look at the environmental aspects of a small segment of the southwestern region of the country so that the important environmental issues pertaining to the water sector in the given geographical context could be brought out. Apart from this broad objective, two specific objectives of the study have been:

i. to enrich parts of the FPCO Water Sector EIA Guidelines through further field level testing, and

ii. to develop and test components for EIA training at the practitioners level.

1.2 Selection of the Study Area

In developing the EIA Guidelines through case studies, time and resource constraints did not allow the FAP 16 team to cover all the regions of the country. The southwestern region was an area that was left out of the past case studies. The surface water situation in this region being quite different from other regions of the country, it has been felt that by covering parts of this region one would be able to add some new dimensions to the Guidelines.

In selecting the study site within the southwestern region, it was felt that the site should satisfy the following criteria:

i. the site should have an area under FCD/I project(s) so that an analysis of the planned and achieved results of such initiatives in the water sector can be made for enabling a better understanding of project specific issues,

ii. the selected site should provide an opportunity of understanding some aspects of the problem of surface water reduction, a problem which has been acute in certain parts of the southwestern region of the country.

Reconnaissance visits were made to the southwestern region to decide on a suitable study site, and it was found that the area within and around the Chenchuri Beel (see Figure 1), located in the district of Narail, would satisfy the criteria mentioned above.

The Chenchuri Beel FCD Project has been implemented in the area by the Water Development Board about a decade back. The area is flanked by the Nabaganga River on the east and the Chitra River on the west. The stretch of the Nabaganga flowing past the area has been subjected to severe surface water reduction.

1.3 Study Design

The study was designed by the FAP 16 team during early 1995. Given the very limited time available for the study (to be completed by April, 1995 with only intermittent input from the team members), it was felt that rather than making an

overview type of a study of the general site, it would be better to focus on some specific locations. The decision taken in this regard was to study a number of mouzas within the general study site.

Four mouzas (Mallikpur, Gopalpur, Banagram and Chenchuri) were selected for in-depth study. The selection was made in a way that the important issues relating to surface water and environment over a period of time (about two decades) could be covered by studying these mouzas (a general description of the mouzas has been presented in chapter 2).

A check-list questionnaire was prepared for generating information through Rapid Rural Appraisal (RRA). The check-list (see Appendix I) was produced with input from the study team comprising members with diverse backgrounds. Once in the field, each team member discussed with local people the issues which were earlier decided to be his or her area of coverage. In the evening hours there were discussion sessions among the team members to share each others findings.

Apart from the RRAs, household surveys were conducted in two different locations to enrich the level of information. One of these household surveys was designed to elicit information of a general nature regarding the problems caused by surface water reduction (questionnaire included in Appendix II). The second questionnaire was developed to gather information on the specific issue of fisheries from professional fishermen (questionnaire included in Appendix III). It should be noted that the issue of fisheries was a subject matter in the RRA and the general household survey as well.

It was decided that the 'general household survey' would be conducted in Par Mallikpur village of Mallikpur mouza, located by the side of the drying up portion of the Nabaganga. Twenty five percent of the households were selected randomly (through the use of a random number table) for the household survey there. As for the 'fisheries household survey', a community of professional fishermen living adjacent to Chenchuri mouza (in Dariaghata village) was selected. The total field work was of a duration of ten days.

Some information was also available from secondary literature. Of these, the important ones were:

i. FAP 4 Final Reports, 1993.
ii. Chenchuri Beel Sub-Project Report (BWDB), 1986.

The report in the next chapter (i.e. Ch. 2) provides an introduction to the wider area in general, and the study mouzas in particular. Chapter 3 presents the study findings where the physical setting is discussed first. This is followed by a discussion of the resource setting and the employment and quality of life aspects The recommendations for improvement of the water sector EIA Guidelines and approaches to EIA training at the practitioners level are presented in chapter 4. The summary of the findings and some concluding observations are put together in chapter 5.

Chapter 2

DESCRIPTION OF THE AREA AND THE STUDY MOUZAS

2.1 The Area

2.1.1 Location

The study area is situated in the southwest region of Bangladesh (see Figure 1). Administratively, it falls in the district of Narail. The area is flanked by two rivers, the Nabaganga and the Chitra. The Nabaganga lies to the east of the area, while the Chitra lies to the west. The Madhumati River also lies close to the east. The study area is basically comprised of the area covered by the Chenchuri Beel FCD Project (see Figure 2). The major work of the project was completed about a decade ago.

The southwest region can be divided into three broad subregions:

i. the area in the north characterized by comparatively high to medium high land with rolling topography,

ii. the area in the middle with low land and a large number of *beels* (relatively deeper bowl shaped depressions in the flooded low land), and

iii. the coastal area in the south which includes the Sundarbans with its mangrove forests and numerous tidal rivers and creeks.

The Chenchuri Beel study area falls in the second of the above subregions. It lies toward the eastern margin of the moribund delta of the Ganges, the Gorai-Madhumati being the last of the major spill channels of the Ganges before it joins up with the Jamuna.

The satellite image (LANDSAT TM Image; January, 1993) of the study area (see Figure 3) reveal the following points (which were ground-truthed during the field work):

- A major portion of the area is low land, the lowest part being in the southwest.
- The northeastern side is relatively high.
- The Nabaganga has dried up significantly in its eastern stretch up to the point where it meets Madhumati.
- There is substantial desiccation of the *beels*, particularly the Chenchuri Beel, during the dry season.
- The study mouzas of Gopalpur, Banagram and Chenchuri are located around the fringes of Chenchuri Beel (compare with Figure 2).
- Mallikpur mouza is on the two sides of the dried up segment of the Nabaganga (compare with Figure 2).

2.1.2 Climate

The climate of the southwest region is characterized by typical monsoon seasonality (see Ahmed, 1994). Rainfall in the region varies in a northwest to southeasterly direction, increasing from a mean annual of 1200 mm in the northwest

to about 1600 mm to the southeast. However, there are variations in duration and amount of rainfall. Less-than-mean duration of rainfall varies from around 115 days (1 out of 4 years) to about 100 days (1 out of 25 years). The greater-than-mean duration varies from about 130 days (1 out of 4 years) to about 145 days (1 out of 25 years). In terms of amount of rainfall, the less-than-mean rainfall varies from about 130 mm (1 out of 4 years) to about 145 mm (1 out of 25 years) and greater-than-mean rainfall varies from about 1600 mm (1 out 4 years) to about 2000 mm (in 1 out of 25 years).

2.1.3 Settlement

The settlement of the area has developed in two clearly distinguishable rings: an inner ring and an outer ring. The inner ring is developed around the Chenchuri Beel area. The outer ring is aligned along the levee of the bounding rivers, namely the Chitra, and the Nabaganga. The resource base for people living along the outer ring is river and land resources along the *beel* margin. For those living along the inner ring, the resource base is mostly land and water resources of the *beels*. There are *hats* (once/twice a week markets) as well as *bazaars* (daily markets) both along the inner and the outer rings of settlements. The roads, embankments, *khals* (canals) and rivers constitute the communication network used by people to go to these *hats* and *bazaars*.

2.2 The Study Mouzas

Mouza: Mallikpur

Mallikpur mouza is located in Lohagara thana and lies about 4 km south of the thana headquarter (see Figure 4). The dry segment of the Nabaganga passes through this mouza. Twenty five percent of the land in this mouza is high (F_0 land), 50 percent is medium high (F_1 and F_2 land) and 25 percent is low (F_3 and F_4 land). Around 1500 households live in this mouza. There are three villages in the mouza-- Par Mallikpur, Char Mallikpur and Doa Mallikpur. Par Mallikpur lies to the west of the Nabaganga, while the other two villages are to the east of the river. The river Madhumati flows about one km east of Doa Mallikpur.

There is a *beel* within the mouza called Mallikpurer Doa. A canal named Ghagajogir Khal runs in a north-southerly direction connecting the *beel* with the Madhumati to the south, and Faitker Beel to the north. The main crops grown in the mouza are local aman, pulses, wheat and mustard. Some HYV boro is also cultivated in medium high land. Mallikpur mouza produces large quantities of bamboo which is an important cash crop for the area.

Mouza: Gopalpur

The mouza of Gopalpur is located in Narail thana and is about 8 km to the south of the thana headquarter (see Figure 5). The mouza lies on the northwestern side of Chenchuri Beel. Fifty percent of the land in this mouza is high, 37 percent is medium high, and 13 percent is low. There are two villages in the mouza: Gopalpur and Agrahati. There are around 120 households living in this mouza. The Chitra flows about 3 km to the west of this mouza. About 8 km east of the mouza flows the Nabaganga. Some forty years ago the Kalinadi was an important river flowing through this mouza. This river has now been reduced to a *khal* due to shortage of water. The main crops are deep water aman, pulses, oil seeds, potato and wheat. With some irrigation water made available through shallow tubewells, few households also produce HYV aus and aman.

Mouza: Banagram

Banagram mouza is located in Kalia thana and is 12 km northwest of the thana headquarter (see Figure 6). Twenty percent of the land in this mouza is high, 25 percent is medium high, and 55 percent is low. The mouza is to the west of the Chenchuri Beel. The Chitra is about 2 km to the west of this mouza. There are two villages in the mouza, Banagram and Kaldanga. Around 350 households live in this mouza. A canal by the name of Baghdanga Khal flows through this

mouza. There are four *beels* in this mouza. The main crops are deep water aman, pulses and mustard. Some HYV aus and aman are also cultivated here.

Mouza: Chenchuri

Chenchuri mouza is in kalia thana and is 8 km to the northwest of the thana headquarter (see Figure 7). Ten percent of the land in this mouza is high, 15 percent is medium high, and 75 percent is low. There are two villages here, Chenchuri and Krishnapur. Total number of households is around 700. The Chitra is 4 km to the west and the Nabaganga 8 km to the southeast. There was once a branch of the Chitra that flowed through this mouza, which is now almost dry and is known as the Mora Chitra, or dead Chitra. A drainage canal excavated as part of the Chenchuri Beel Sub-Project, called the Liner Khal, flows by the side of this mouza. The main crops are deep water aman, pulses and mustard.

FIGURE 1

STUDY LOCATION SHOWN ON BANGLADESH MAP

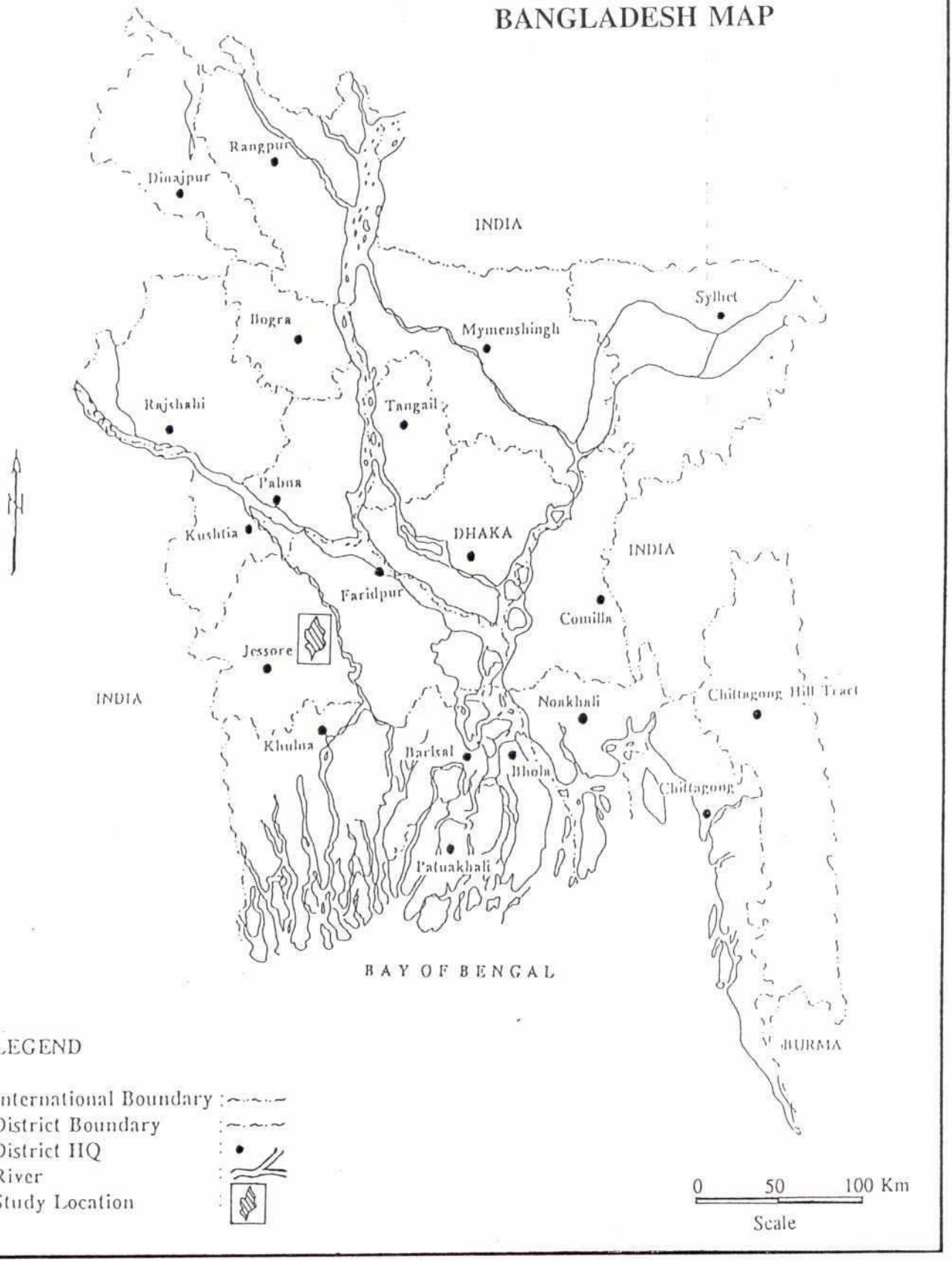


FIGURE 2

CHENCHURI BEEL STUDY AREA BASE MAP

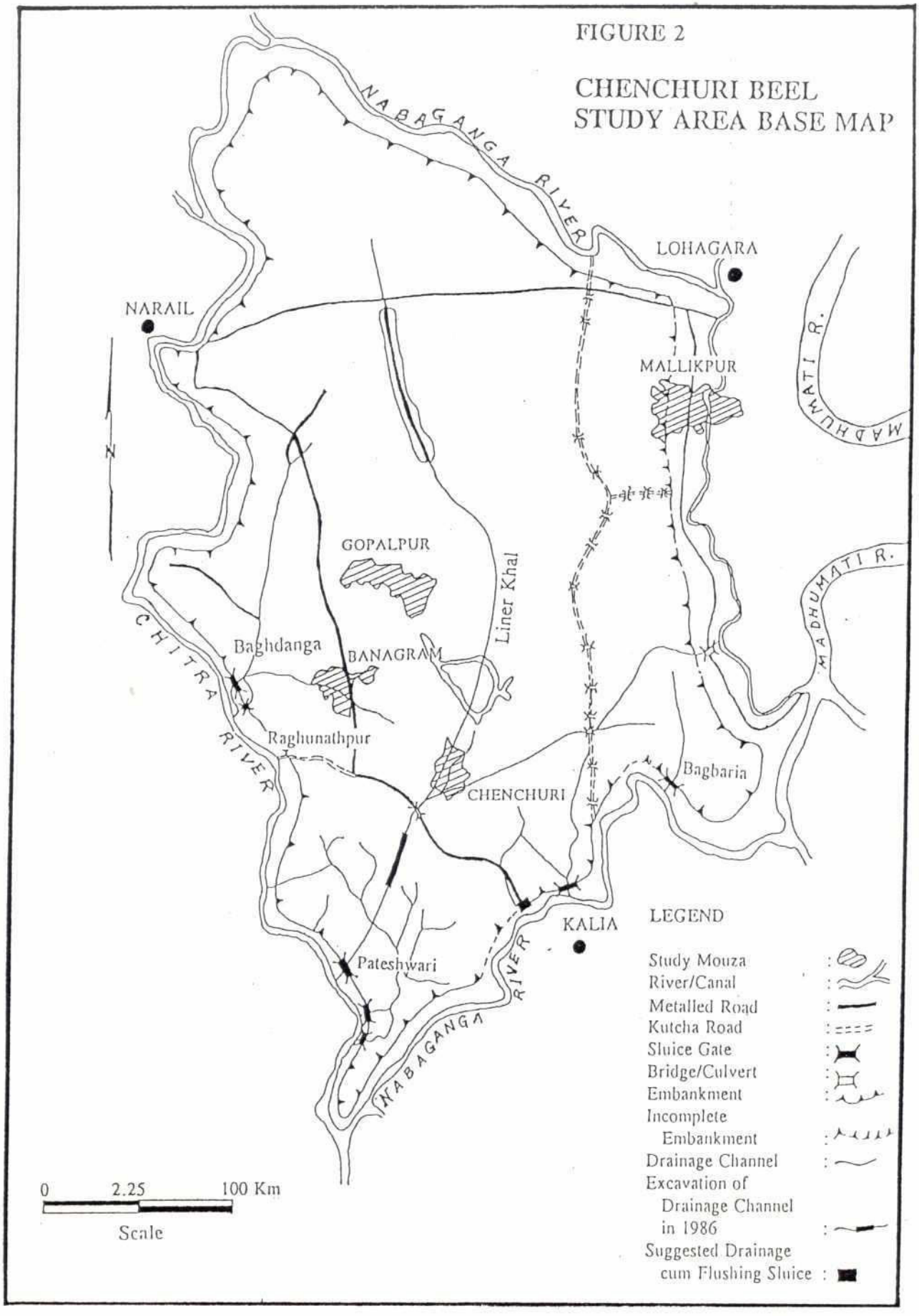


FIGURE 3

**LANDSAT TM IMAGE (January, 1993)
OF STUDY AREA**

Scale 1:165,000 (approx.)

FIGURE 4

MALLIKPUR MOUZA

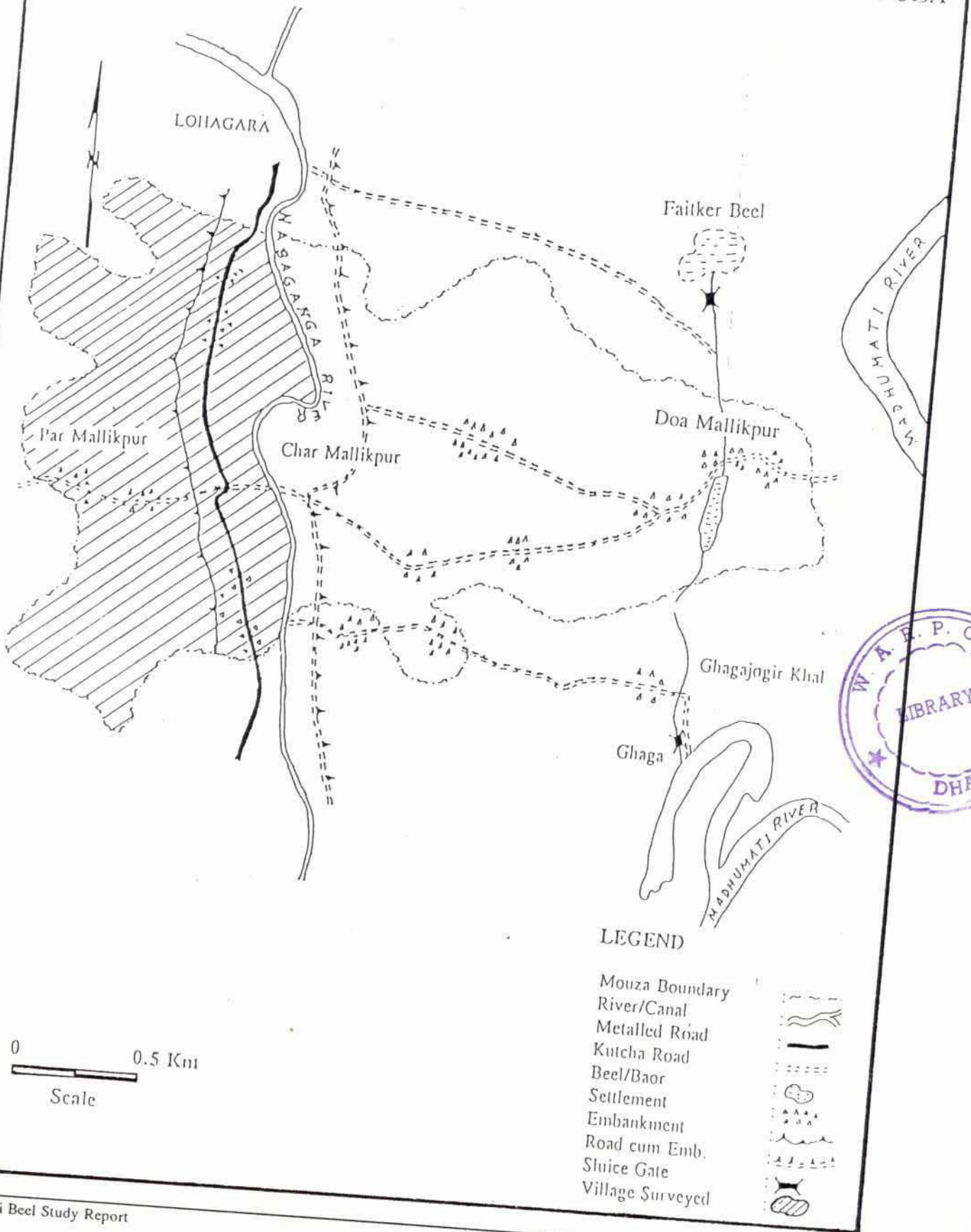


FIGURE 5

GOPALPUR MOUZA

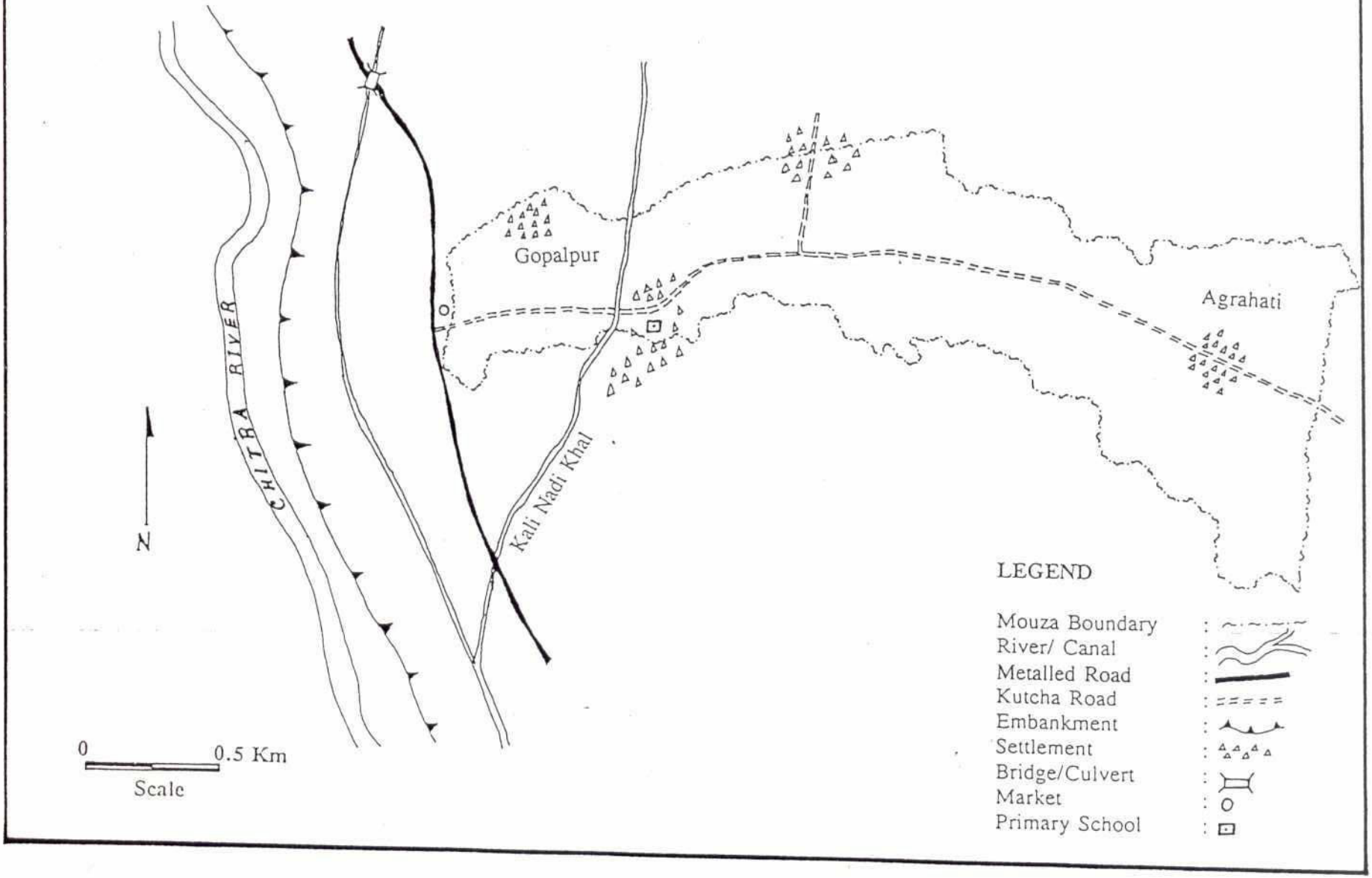


FIGURE 6

BANAGRAM MOUZA

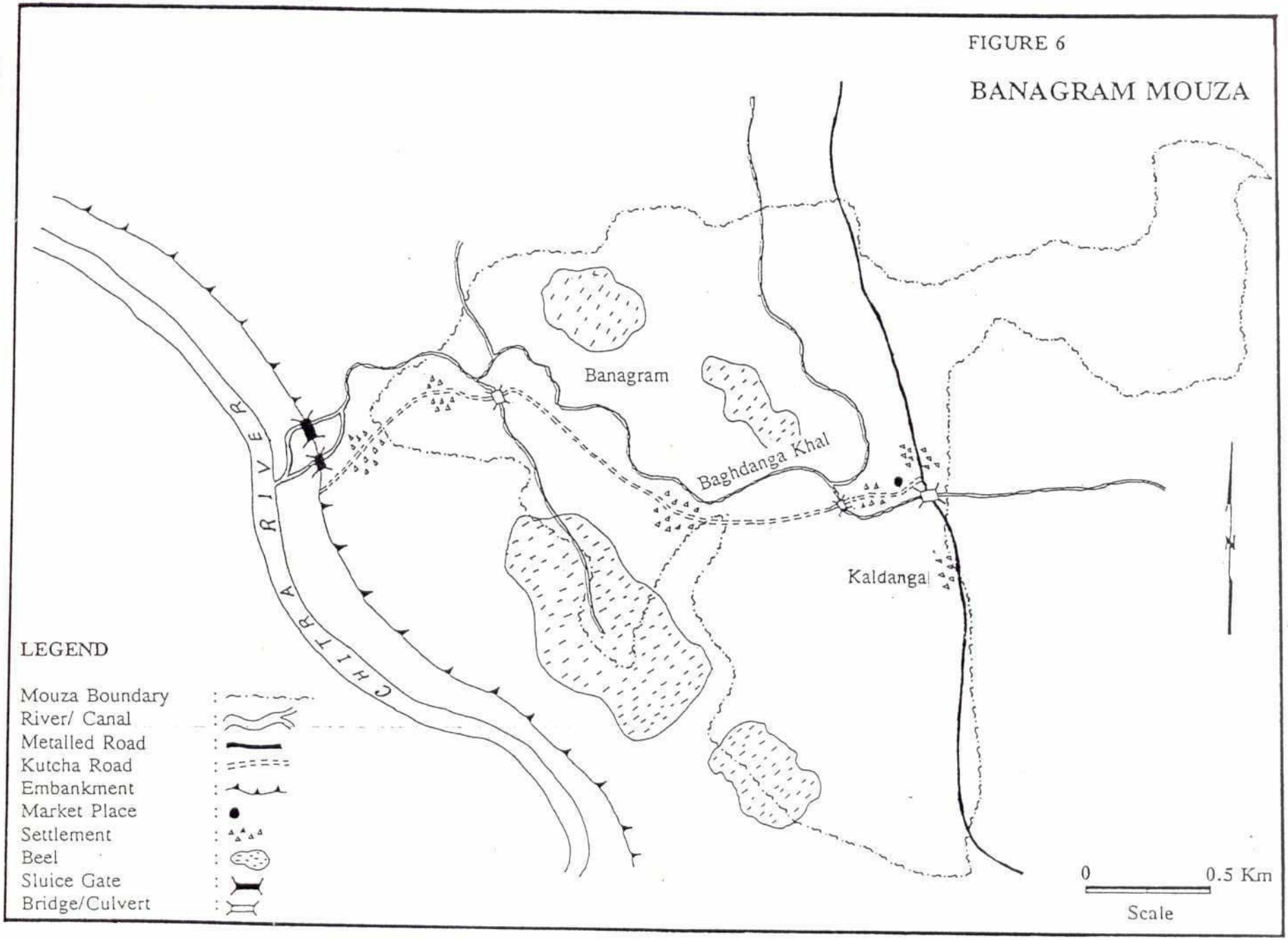
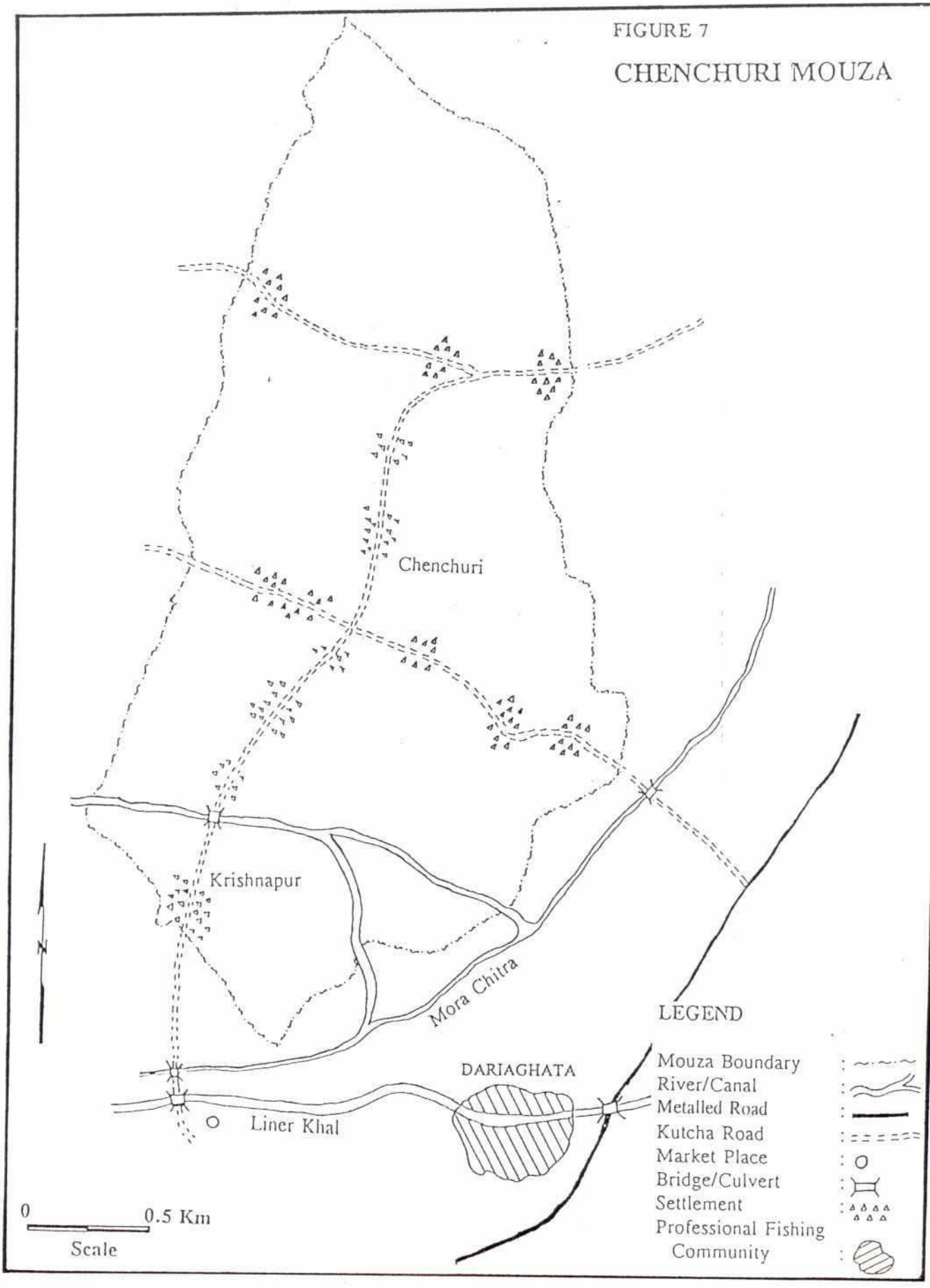


FIGURE 7

CHENCHURI MOUZA



Chapter 3

STUDY FINDINGS

3.1 Physical Setting

3.1.1 Geomorphology

The study area being surrounded by tidal rivers, is heavily influenced by tidal actions. Large volumes of water, along with sediment enter and leave the area through a large number of channels. Land elevation varies from about 1 meter to about 3 meters. The study area, particularly the Chenchuri Beel section is composed of a number of *beels* with ridges in between and along the river bank. The *beels* are the depressions or low areas and the ridges are the levees of the rivers bounding the area.

There are several *khals* crisscrossing the study area. Among these *khals*, the ones considered to be important by the respondents of the study mouzas are the Pateshwari Khal, Baghdanga Khal, Kalinadi Khal and the Ghagajogir Khal. Some of the other khals in the area are the Jadabpur Khal, Maheshkhala Khal, Bhennatolar Khal, Takimara Khal, Baroipara Khal, Madinar Khal, Mora Chitra Khal, Nutia Khal and the Bagbaria Khal.

It is believed by the people in the study area that the Magura Barrage constructed across the combined flow of the Nabaganga and the Kumar has affected the downstream flow of the Nabaganga. The respondents suggest that the Magura Barrage can explain the silt/sediment deposit at the mouth of the Nabaganga near the Halifax Cut and also the silting up of the Nabaganga in a northerly direction from the Halifax Cut to Lohagara. The Nabaganga now has negligible flows from Lohagara to the Halifax Cut, particularly during the dry season. There have also been changes in the direction of flow of river water. At present the high tide water of the Chitra comes up to Mallikpur via Lohagara. One has to take into account the effect of the Halifax Cut on the flow of the Nabaganga as well. Because of the Halifax Cut, a portion of the Madhumati water has started flowing through the Nabaganga from that point. The existing Madhumati channel from Halifax Cut to the south is getting weaker and is silting up.

3.1.2 Surface Water Reduction

Surface water reduction is of two kinds in the study area: seasonal and perennial. The possible causes of seasonal reduction have been natural as well as anthropogenic, i.e. due to human interventions. Among the natural causes are seasonal variation in monsoon precipitation and drought conditions. The possible anthropogenic factors which have affected surface water in a seasonal way include the following:

a. dry season withdrawal of upstream water for irrigation,

b. draining of *beels* for fishing and irrigation,

c. draining of *beels* for early sowing of rice.

Perennial reduction of water in the area has again been caused by natural and anthropogenic factors. Among the important natural phenomena, the single most important is the upstream flow reduction due to geomorphic causes, such as channel migration of the Ganges resulting in off-take mouth siltation of the Gorai. Among the human

interventions which might have contributed to surface water reduction, the Chenchuri Beel FCD structures, upstream barrage (the Magura Barrage), large scale irrigation withdrawal (the Ganges-Kobadak Project), large scale water diversion (the Farakka), closures (Kaliganga Closure near Kushtia) and interbasin water transfer (the Halifax Cut) are noteworthy.

Major evolutionary changes are taking place in the rivers of the region affecting surface water supplies and sediment transport within the study area. The Gorai, the only remaining spill channel of the Ganges, appears to be drying up in the way that the Mathabhanga, Chandana and the Kumar did in the past. It is possible that over a longer period the Gorai would no longer serve as a Ganges spill channel but become a channel for local drainage only.

The SW10 Planning Unit (as defined by FAP 4), which encompasses the study area almost totally, is not as rich in surface water runoff as some other planning units of the southwest region (see FAP 4 Final Report, Vol. 1, 1993).

3.1.3 Water Control Interventions

To the people of Mallikpur mouza, the embankment of Chenchuri Beel Project on the right bank of Nabaganga, which runs through the village of Par Mallikpur, is a major water control intervention in their area. The embankment has been completed in the locality about ten years ago. People in the area also mention the embankment on the left bank of Nabaganga passing through the village of Char Mallikpur. There are two sluice gates; one where the Ghagajogir Khal starts flowing from the Madhumati, and the other at the point where the *khal* meets Faitker Beel (see Figure 4). They feel that these sluice gates have been beneficial to their agricultural activities through control of water. Most of the respondents indicated that the Magura Barrage constructed upstream is responsible for the drying up of the Nabaganga in their locality. Some of them mentioned other interventions further upstream (for example, the closure at Kaliganga which is a part of the Ganges Kobadak Project). Another local opinion is that the reduction in the flow of water in the Nabaganga is the primary reason for an increased backwater flow through the Nabaganga from the Madhumati. This backwater flow brings sediment which, according to the respondents, has filled portions of the channel.

Another man-made intervention is the Halifax Cut located 5 km south of Mallikpur mouza. This cut was made during the British period to join the adjacent channels of the Nabaganga and the Madhumati. It has resulted in the capture of some of the water flow of the Madhumati by the Nabaganga, resulting in increased flows in the Nabaganga downstream of this cut.

The respondents in Gopalpur mouza mentioned that around ten years ago embankments were constructed on the left bank of the Chitra and the right bank of the Nabaganga. In the opinion of the respondents, the embankment on the Chitra is not all that important since the overtopping of this river rarely affected them. They reported that they knew of only one occasion when around fifty years ago the overtopping of the Chitra caused flooding in their area. However, they pointed out that the embankment could be of value to those living further to the south.

Apart from the embankments, people in Gopalpur mentioned the sluice gate at the mouth of Baghdanga Khal. According to them, this sluice gate has been useful to them, as previously water during peak monsoon used to breach certain portions of the banks of Baghdanga Khal and flood their fields resulting in crop damage.

The respondents of Banagram mouza indicated that the embankment of the Chenchuri Beel Project has prevented floods which used to occur prior to the construction of the embankment. They reported that their area being relatively low, was often subject to flooding by water from the Chitra.

A water control intervention that has created different kinds of problems for the people of Banagram and adjacent areas is the sluice gate on

the Baghdanga Khal. With time, it was found that the sluice had a higher elevation than would be required for effective water control in the area. Additionally, this sluice had only two vents and did not adequately regulate water flow in and out of the area. Following public demand, another sluice gate has recently been constructed nearby to allow better water control through a different arm of the Baghdanga Khal. The recently constructed sluice elevation has been lowered and has four vents. However, it does not have any facility to permit navigation through it.

There has been some conflict of interest in the operation of the sluice gate at Baghdanga. Various portions of the *khal* are leased by different people in different mouzas for fishing. The people who have leased portions of the *khal* nearer to the sluice gate often find it to their advantage to drain out water (allegedly, by creating pressure on the non-local operator of the sluice gate) to pull the fishes on to their ground at such times which are in conflict with the interest of the farmers. The farmers would have liked the water to be retained longer for ease of harvesting the deep water aman by boats. Also, they would like the water to recede slower so that sowing and planting of the HYV aus crop can be facilitated.

There is also a conflict of interest between the agricultural households living upstream (on relatively higher land) and those living downstream (on relatively lower land) from where the sluice gate is located. While the households upstream like to hold on to the water longer for farming operations in their relatively high land, the ones downstream want the water level on their relatively lower land to be reduced for ease of their own farming operations. One other point made by the respondents of the locality is that the sluice gate at Baghdanga has obstructed fish migration into their area and reduced the production of capture fisheries.

The people of Chenchuri mouza are of the opinion that the embankment of the Chenchuri Beel Project has been useful in protecting the area from flooding and salinity. However, they indicate that the flows in the Chitra no longer pose a threat to their area.

An important canal flowing past Chenchuri mouza is the Liner Khal. There is a sluice gate at the point where the Liner Khal flows from the Chitra at Pateshwari. The respondents at the site complained that the sluice gate at Pateshwari was not being operated properly. Although a committee has been formed with people representing various concerned localities to decide on the operation of the sluice gate, the committee does not meet regularly and there is the problem of pressure being applied on the gate-keeper to act differently than what the committee would like. The respondents felt that the sluice gate had been helpful to local agriculture, but that improved operation of the sluice would have been even more beneficial. Local people expressed the opinion that the sluice gate had reduced the volume of fish migration into their area. They contend that the stagnating water has contributed to the recently observed ulcerative diseases in fish of the area.

As in other mouzas, the respondents of Chenchuri mouza also suggested that the Magura Barrage has contributed to the shortage of surface water.

3.1.4 Navigation and Communication

The drying up of rivers and canals and the interruptions made in the flow of surface water through construction of embankments, sluice gates and roads have created problems for navigation in the waterways.

A couple of decades ago, the people of Mallikpur mouza depended quite heavily on the Nabaganga for navigational purposes. During that time the river was wide and active, and large launches and steamers used to ply through this river.

The data presented in Table 1 show that over 40 percent of the households of Par Mallikpur village reported that they found the reduced opportunity for waterway navigation to be a problem.

Table 1 **Households Reporting Problems in Navigation due to Surface Water Reduction**

Occupation Category	Total Number of Households within Category	Number of Households Reporting Problem	Percentage of Households Reporting Problem
Farmer	22	8	36
Day Laborer	16	8	50
Salaried Job Holder	13	7	54
Van Puller	19	5	26
Trader	13	5	38
Others*	9	6	67
Total	92	39	42

* Others include different types of craftsmen and mechanics.

Source: Household Survey of Par Mallikpur Village, 1995.

According to the respondents of Mallikpur, many roads have been constructed over the years to connect their mouza with other areas. However, the cost of transportation by road is much more than what people spent in the past while travel was largely on water. People in the mouza reported that road transportation ends up being almost three times as expensive as transportation by water.

It was quite common for the people of Mallikpur to own boats in the past. However, in the present situation of shortage of surface water, hardly any household keeps boats. The few households who still own boats find it very difficult to maintain the boats due to scarcity of surface water in their neighborhood during the dry season.

The people of Gopalpur mouza reported that the volume of water that flows through the Chitra at present is considerably smaller than what it was in the past. The waterways in the past were used extensively for navigation. The people used to travel to the Chitra through the Kalinadi Khal on which a number of closures have been constructed over the years for road communication. This has seriously disrupted waterways navigation. Travelling by boat to Magura to the north and Khulna to the south was quite common in the past. Currently one does not have direct waterways communication with either of these two areas.

The common belief of the people of Gopalpur mouza is that the Magura Barrage has affected the volume of water flowing down the Chitra. The respondents of this mouza also mentioned that almost all the households used to keep boats prior to the construction of the Chenchuri Beel Sub-Project embankment. They used these boats for general transportation during the rainy season and also for harvesting deep water aman in their *bainjo* (low) land. Although they still cultivate the deep water variety of paddy in the lowland, there is little water in the field during harvest time, so that the need for boats for this purpose is no longer felt.

Some twenty years ago, the people of Gopalpur mouza used to consider the Chenchuri Hat the most important market place for them. The mode of transportation was country boats. They also used to go to the market at Narail by road. Now, going to Chenchuri Hat by boat has become

difficult due to the lack of water in many of the internal waterways.

In Banagram as well, transportation now has become more dependent on vehicular traffic, mainly rickshaw vans. Locally, there was heavy dependence in the past on country boats for going to such important market places as Gajirhat and Gobra Bazar. However, people of this mouza can no longer go to these places by boat due to the construction of the sluice gate at Baghdanga which does not have any navigation locks.

A major sluice gate constructed at Pateshwari (see Figure 2 on page 7) as part of the Chenchuri Beel Sub-Project, has seriously affected the traditional dependence of the people of Chenchuri mouza on water for navigation. This sluice gate has ten vents, but no navigation lock. The respondents stated that there used to be over a thousand boats in the mouza prior to the construction of the sluice gate. After the gate was put up, the number of boats reduced drastically since the respondents could then use the boats only through the smaller internal canals. It was also reported that the Chenchuri Hat, which was once a very important market place, had lost much of its importance. The whole-sale traders are now discouraged by the relatively higher costs of bulk transportation by road as compared to transportation on waterways.

3.1.5 Flooding

As mentioned earlier, the Chitra was not all that prone to flooding in the study area. Overflow of the Nabaganga was however common which did result in floods in parts of the study area. The respondents in Mallikpur particularly mentioned about the severity of the flood that they experienced during 1971. Today flood water can come in only if the embankment breaches. This can cause widespread damage to the aman crop, since the variety that is cultivated now is not sufficiently long stemmed to cope with deeply flooded conditions. According to the respondents, such crop damages due to breaches in embankment have occurred 3 to 4 times during the last 10 years.

The positive and negative impacts of past flooding, as perceived by the respondents of Par Mallikpur village, are presented in Table 2. One can see that a high percentage of the respondents felt that the floods helped in replenishing fish resources and in enhancing soil fertility in their area. Among the negative impacts were the damages caused to the homesteads and the standing crops.

3.1.6 Erosion and Accretion

The Madhumati is the only major river in the area where any significant erosion or accretion occurs. Atoshpara, a village along the Madhumati, has almost totally been eroded by the river. Approximately 50 households from there have resettled themselves in Mallikpur or other mouzas. The Nabaganga downstream of the Halifax Cut is eroding at locations along the right bank and accreting at some locations along the left bank. There used to be erosion at the mouth of the Baghdanga Khal during the rainy season. Ripe aus used to go underwater. The regulator at the mouth of the Baghdanga Khal has helped in reducing the erosion.

3.2 Resource Setting

3.2.1 Forest and Vegetation

The study area does not have any public forest land. The abundance and distribution of homestead plant species vary from one part of the study area to another. Homestead area per household in the study area ranges from 20 to 90 decimals, which is higher than the national average (4 to 18 decimals, BBS 1993).

The people of Par Mallikpur and Char Mallikpur villages, located on the dying river levee of the Nabaganga, reported that due to low soil moisture, survival of fruit seedlings/saplings (mango, jackfruit etc.) is threatened. The growth of bamboo is quite high on the ridges of the dying Nabaganga. Palm (*tal*) trees are planted in the homesteads as an important cash crop which is relatively drought resistant. Respondents reported lower production

Table 2 Impacts of Past Flooding

Impacts	Households Reporting						
	Farmer	Day Laborer	Service Holder	Van Puller	Traders	Others	Total
Positive Impacts							
Fish Resources Used to Get Replenished	8 (36)	11 (69)	7 (54)	14 (74)	9 (69)	3 (33)	52 (57)
Soil Fertility Used to be Enhanced Due to Siltation	14 (64)	9 (56)	4 (31)	6 (32)	6 (46)	4 (44)	43 (47)
Waste Materials Used to be Flushed Properly	3 (14)	4 (25)	3 (23)	7 (37)	2 (15)	2 (22)	21 (23)
Negative Impacts							
Some Homesteads Used to be Damaged	4 (18)	5 (31)	6 (46)	5 (26)	6 (46)	3 (33)	29 (32)
Some Aman Paddy Used to be Damaged	12 (55)	0	5 (38)	2 (11)	3 (23)	2 (22)	24 (26)
Total	22	16	13	19	13	9	92

Note: Figures within parentheses are percentages of total households within each occupation category reporting specific impacts.

Source: Household Survey of Par Mallikpur Village, 1995.

of palm and date juice as well as coconut in recent years. Most of the respondents have stated a dependence on sales proceeds of bamboo, palm and date trees for earning extra cash.

People of Doa Mallikpur and Chenchuri villages located at *beel* edges are quite dependent on banana crop for their income. The village of Gopalpur, which is also at *beel* edge, produces betel leaf (*pan*, Piper betel), an important cash crop for the area. Betel leaf vines are usually grown in the homestead garden. These vines are very sensitive to drought and low temperature. Therefore, the vines are raised within fenced cover for retention of moisture and protection from cold. The respondents indicated that closures on the Kalinadi Khal (a distributary of Baghdanga Khal) for road construction have contributed to the depletion in ground water in their area.

To ease the problem of surface water reduction, many households excavate ponds in and around their homesteads (mainly for domestic use). During the field visit, most of the ponds were found either completely dry or retaining very little water (maximum water depth was noted to be less than a meter).

Many economically important species of aquatic vegetation, including the waterlily (*shapla*, Nymphaea spp.), lotus (*padda*, Nelumbo nucifera), *paniphal* (Trapa bispinosa), *helencha* (Enhydra flactuans), used to grow abundantly before the change of water regime in the area. An important tree species, good for both fuel-wood and fish

habitat, locally known as *hijal* (Barringtonia acutangula) used to grow in the jute and paddy fields. Now that many of the wetlands have dried up, this species is no longer found in the area.

According to the respondents, over fifty percent of the fuel energy in the area is provided by rice straw, leaves and twigs (the remainder comes from dung). Most households suffer from fuel problems. About 50 percent (mainly landless and small land owners) are dependent mostly on processed rice husk and cow dung. The poor often compensate for the lack of fuel by cooking only one meal a day. The relatively rich households use some amounts of firewood. The areas in and around Pateshwari and Chenchuri Beels were once very suitable for jute cultivation, and people there were dependent on sticks and roots of jute for fuel. As pointed out earlier, due to the construction of a sluice gate near Pateshwari Beel, boat communication has been disrupted. This has discouraged jute cultivation, since the bulk of jute in this area used to be transported by boats. Scarcity of water and the consequent problem in jute retting has led farmers to reduce the cultivation of this crop even further. Besides, the low market price of jute has contributed to the process.

Construction of FCD embankment along the Chitra has helped in increasing crop production, with a commensurate increase in the production of biomass used as fuel.

It may be mentioned here that, according to the FAP 4 Final Report, Vol. 1, (1993), forest development in village homesteads on marginal and F_0 land represents the best possibility of increasing both the area and production of forest in the southwest region. It was also reported that the current productivity is about 15 m^3/ha/year, which could be increased up to 25 m^3/ha/year.

3.2.2 Agriculture and Livestock

A comparison of the cropping patterns practiced in the study mouzas in the past and present are shown on Table 3.

The cropping pattern practiced in an area may be affected by many different factors. The major reasons for changes in cropping pattern in the study area were identified to be the following:

a. implementation of the Chenchuri Beel FCD Project,

b. reduction in the flow of the Nabaganga between Lohagara and the Halifax Cut, and

c. reduction in the flow of the Chitra.

As one can see in Table 3, jute was a common crop in the past, but no longer as important. The shortage of surface water in the area for retting has discouraged jute cultivation. An additional factor that has discouraged jute cultivation is the drop in jute price. Another change that was reported in the cropping pattern was the introduction of HYV paddy in recent years. This has been possible because of the FCD project implemented in the area. However, due to shortage of water in the canals HYV cultivation has not been as extensive as one would have hoped for. In some locations people have started using shallow tubewells for irrigation purposes. Respondents in the area reported that the ground water table had gone down in the recent years so that costs of such irrigation were escalating.

The household survey conducted in Par Mallikpur village showed that 95 percent of the farmers considered the reduction of surface water to be a problem for agriculture. According to them, in the absence of seasonal inundation, agricultural lands have not had the kind of silt deposit that could have maintained the desired level of fertility.

Reduction in surface water in the area has caused problems for livestock rearing. This problem is particularly acute in Mallikpur mouza. In the dry season, bathing of livestock is a problem. Table 4 shows that 76 percent of the respondents, most of whom rear cattle themselves, mentioned livestock bathing as a problem due to surface water reduc-

Table 3 **Cropping Pattern: Past and Present Scenarios**

Mouza and Land Type	Past (20 Years Ago)	Present
Mallikpur		
High	Mixed B.Aus & B.Aman/Jute followed by Rabi	Mixed B.Aus & B.Aman followed by Rabi
Medium	Mixed B.Aus & B.Aman/Jute followed by Rabi	Mixed B.Aus & B.Aman followed by Rabi
Low	Boro/ Mixed B.Aus & B.Aman	B.Aman followed by HYV Boro
Gopalpur		
High	B.Aus/ Jute followed by Rabi	B. Aus followed by Local T. Aman followed by Rabi
Medium	B.Aman	B.Aman/HYV Aus followed by HYV Aman
Low	Mixed B. Aus & B.Aman	Mixed B. Aus & B.Aman
Banagram		
High	Jute/Aus followed by Rabi	HYV Aus followed by Rabi
Medium	B.Aman/Jute followed by Rabi	B.Aman/HYV Aus followed by HYV Aman
Low	Mixed B.Aus & B.Aman	B. Aman
Chenchuri		
High	Jute/Mixed B.Aus & B.Aman followed by Rabi	Mixed B.Aus & B.Aman followed by Rabi
Medium	B. Aman	B. Aman
Low	B.Aman	B. Aman

Source: Rapid Rural Appraisal of Study Area, 1995.

Table 4 **Households Reporting Problems for Livestock due to Surface Water Reduction**

Occupation Category	Percentage of Households	
	Problem in Bathing of Livestock	Problem in obtaining Drinking Water for Livestock
Farmer	95	9
Day Laborer	75	25
Salaried Job Holder	77	0
Van Puller	94	0
Trader	69	0
Others	67	0
Total	76	12

Source: Household Survey of Par Mallikpur Village, 1995.

tion, while 12 percent mentioned problems in obtaining drinking water for the livestock.

Conflict between agricultural practices and fishing practices is common in Bangladesh. An example of this conflict was found in Banagram mouza where the agricultural and fishing households had disagreements over the timing of the opening of the Baghdanga sluice gate (see section 3.1.3). The result was that the sluice gate could not serve its intended purpose.

3.2.3 Fisheries

The Chenchuri Beel area is typical of other flood-plain areas in Bangladesh in terms of having vast areas of depressed land lying between the levees of rivers (in this case the Chitra and the Nabaganga). The respondents reported that the area was very rich in capture fisheries in the past.

Fish Habitats and Development Interventions

The *beels* in the study area are important fish habitat. These are usually named according to the names of nearby villages (Chenchuri Beel, Pateshwari Beel, Banagram Beel, Molladanga Beel, etc). In the seasonally flooded lands and *beels*, there are small ditches excavated by the land owners in order to trap fish which are locally called *apa*. There are thousands of such *apas* in the Chenchuri Beel area. There is a relatively deeper canal shaped area (*nal*) in the deepest part of the *beel*. Thus, in the study area, there are various types of seasonal and perennial wetlands which include *khals, beels,* flooded lands, *nals, apas* and rivers.

The regulators constructed at the off-take of the Ghagajogir Khal and at the outfalls of the Liner Khal and the Baghdanga Khal allow only restricted entry of water into the area which, according to the respondents, has reduced fish production in the area. The respondents also complained that the Magura Barrage has been responsible for much of the reduction of surface water in their area.

Flooding, which is no longer common in the area, used to have several positive impacts on the natural resources. The household survey in Par Mallikpur village revealed that the majority of the respondents (57 percent) believed that flooding replenished the capture fisheries resources every year (Table 2).

In addition to regulators and the barrage, respondents of the study mouzas mentioned that low rainfall in the area contributed to a reduction in wetland area. They also mentioned that due to the siltation at the mouth of numerous *khals* and the siltation of the beds of some of the perennial wetlands, fish habitats in the area have been reduced.

Fishing Community

In Doa Mallikpur, there are a few traditional hindu fishing households called *malo*. They are full-time fishermen who fish year round in the *doa*, or nearby *khals* and rivers. In the early seventies, there were around 30 *malo* households in the village, most of whom have since migrated away to India. In addition to the traditional *malo* fishermen, there are eight muslim households who also fish for living for part of the year (they are called *mia malo*). There are no professional fishermen in Char Mallikpur or Par Mallikpur villages.

Besides the professional fishermen, about thirty percent of the households in Mallikpur catch fish in the *doa* and nearby *khals* for family consumption. Primarily the children from these villages fish with inexpensive gears such as *uncha, chalan* and *jhuri*.

There are no *malo* fishermen in Gopalpur, but some muslim households catch fish seasonally during monsoon and post-monsoon periods for additional income. It was reported by the villagers that about 50 percent of the households of Gopalpur mouza catch fish during *Ashar-Kartik* (June-November) for family consumption.

The mouza of Banagram is surrounded by depressed low lying lands and *beels*. The Baghdanga Khal flows through this mouza. There are diverse fishing grounds in the form of *beels, khals, apas* and flooded lands in close proximity. About 70 percent of the households of this mouza were found to be involved in fishing. There were around 20 traditional hindu fishermen in the mouza. Some muslim households had gradually entered into professional fishing during the sixties. *Magh-Chaitra* (January-March) is the lean period for the fishermen. At that time some of them are involved in fish trading. The *malo* fishermen are very poor with hardly any agricultural land or livestock. They depend almost completely on fishing for their livelihood.

Species Diversity

Fishermen respondents indicated that they used to catch large carps which are no longer found in the perennial water bodies of the area. Most of the formerly perennial water bodies dry up in the dry season and are used for *boro* cultivation.

It has been reported that installation of the regulator at the off-take of Ghagajogir Khal has significantly reduced the migration of riverine species into the wetlands of Mallikpur mouza; giant freshwater prawns are almost non-existent and carps of 0+ year class are found in small quantities as there are no over wintering shelters for them in the *doa*.

All of the *malo* fishermen households surveyed at Dariaghata reported that they do not see, or only rarely see, *sharputi* now-a-days (Table 5). *Raina* was also reported to be very scarce. Among other species which were quite common in the past but have become scarce now are *boal, rui* and *catla*.

Table 5 Fish Species Not Observed or Rarely Observed

Species	Percentage of Households
Sharputi	100
Raina	97
Boal	75
Rui	56
Catla	44
Selenda	40
Aair	37
Chital	33
Bacha	31

Source: Survey of Fishing Community at Dariaghata Village, 1995.

Respondents of Doa Mallikpur reported that at present *rui, catla, mrigel, boal, koi, raina, magur, sharputi, aair, rita, galda chingri* are very rarely found in the area. They stated that no fish seed remains in the *doa* - and this is one of the major causes of fish depletion in the area. People also reported that about 15 years ago, hilsha was found in the Nabaganga during monsoon.

All 32 fishing households responded that the regulators had adversely affected species diversity. The large catfish (*boal, aair, rita*) and the carps (*rui, catla, mrigel*) were among the most affected species. It was also mentioned that the regulators affected the migration of *raina, gojar, pabda, foli, shol, pangas, borobaim, mola, puti, koi, chela, potka, khalisha* and *raik* between river and floodplain to fulfil their biological needs of spawning, feeding and growth.

There is no carp stocking program in the area. The fisheries production is completely dependent on the natural production system which is dependent on renewal by river flooding.

Fish Production and Fishing: Past and Present

It was reported that the *doa, khal* and floodplain *beels* in Mallikpur area were rich in fisheries resources in the past. About 80 percent of the households of Mallikpur mouza used to fish in the *doa* and other *beels* in the area. The fishing period lasted for three months from *Poush* through *Chaitra* (December-April), usually after the harvesting of the aman crop. According to respondents, the water depth in the *doa* during *Chaitra* (March-April) used to be around 2 feet. Now it dries up during that time and *boro* cultivation takes place in the entire area. In terms of income, the *malo* fishermen of Doa Mallikpur indicated that while in the past they could earn about five hundred taka a day by operating *bheshal jal*, now they are likely to get only around thirty five taka per day.

The household survey of the professional fishermen indicated what they thought to be the reasons for reduction in fish production; 91 percent mentioned disease, 84 percent scarcity of surface water, 66 percent regulators and 56 percent overfishing (Table 6).

A couple of decades back, the *malo* fishermen of Doa Mallikpur used to fish extensively in the Nabaganga. According to the respondents, no

Table 6 Reasons for Reduction in Overall Fish catch

Reasons	Percentage of Households
Fish Disease	91
Scarcity of Water	84
Regulators	66
Overfishing	56
Poor Water Quality	38
Fishing Parent/Young Fish	22
Siltation	16
Current Net	16
Canal Converted into Cropland	3
Shrimp Closures	3

Source: Survey of Fishing Community at Dariaghata Village, 1995.

malo fishermen from this village goes to the Nabaganga for fishing any longer. Surface water reduction has been identified as a serious problem for fisheries in Mallikpur area. Fifty five percent of the respondents mentioned loss in fisheries production due to surface water reduction in their area (Table 7).

There was general consensus among the respondents that the fish catch had declined. The survey

Table 7 **Households Reporting Loss in Fisheries due to Surface Water Reduction**

Occupation Category	Number of Households in Occupation Category	Number of Households Reporting Loss	Percentage of Households Reporting Loss
Farmer	22	11	50
Day Laborer	16	9	56
Salaried Job Holder	13	5	38
Van Puller	19	15	79
Trader	13	7	54
Others	9	4	45
Total	92	51	55

Source: Household Survey at Par Mallikpur Village, 1995.

of the professional fishermen at Dariaghata revealed that in the past the peak season catch was 68 kg/household/day and the lean season catch was 12 kg/household/day. Today, the peak season catch is 13 kg/household/day and the lean season catch is only 3 kg/household/day.

Major changes have occurred in fisheries resources of the floodplains, *khals* and *beels* in the study area. All the 32 *malo* households of Dariaghata noticed that catch from the floodplain had reduced more severely than that from *khals* and *beels*. They indicated that over the last twenty years there has been more than 75 percent reduction in floodplain catch and more than 65 percent reduction in the catch from *khals* and *beels*.

People's Perception about Fisheries

The professional fishermen often have no other means of earning a living than fishing. They are, therefore, quite severely affected by surface water reduction. Many of them had to look for some secondary activity for complementing the low income from fishing. The household survey revealed that some *malo* fishermen of Dariaghata have taken up fish trading, fishing in ponds, fry rearing, petty business, livestock rearing, agriculture, etc. as secondary activities (Table 8).

In order to improve the capture fisheries production in the area, the fishermen have suggested some measures such as frequent opening of gates of regulators, re-excavation of canals, conservation

Table 8 **Adjustments Made by Fishermen to Changed Situation of Fishing**

Steps Taken to Adjust with the Changed Situation	Percentage of Households
Fish Trading	38
Put More Effort in Fishing	22
Do Nothing Extra	22
Fishing in Ponds	13
Fry Rearing	9
Service	9
Agriculture	9
Petty Business	6
Livestock Rearing	6
Wage Laborer	3

Source: Survey of Fishing Community at Dariaghata Village, 1995.

of parent fish, and prevention of fish disease (Table 9). Of the respondents, 72 percent suggested that the gates of regulators be opened during peak fish migration periods, and 56 percent suggested that canals be re-excavated.

Table 9 Suggested Measures for Improving Capture Fisheries

Measures	Percentage of Households
Open Gates of Regulators	72
Re-excavate Canals	56
Conserve Parent Fish	34
Stop Fishing Young Fish	28
Prevent Use of Current Net	18
Prevent Disease	16
Allow More River Water to Enter	16
Stock Carps	13
Stop Fishing for 3 to 4 Months	3

Source: Survey of Fishing Community at Dariaghata Village, 1995.

Many of the respondents suggested that fishing by complete drying up of wetlands in the floodplain is detrimental to the fisheries resource. This type of fishing severely reduces the parent stock for next year's natural recruitment in the floodplain. More than 30 percent of the respondents suggested that certain wetland areas should be kept as fish sanctuaries in order to conserve parent stock in the floodplain.

People of Doa Mallikpur suggested that the *khals* should be re-excavated to make them perennial so that fish can stay in the *khals* throughout the year. This would also stop encroachment of the *khal* by the owners of land adjacent to the *khals*. The farmers were also interested in the re-excavation since it would ensure irrigation water for the boro crop.

Fishing Systems and Access Arrangements

The water bodies (*beels* and *khals*) in Chenchuri and Banagram mouzas are leased out annually to fishermen groups. After obtaining lease, the leaseholder usually subdivides the *khal* into segments by village and offers subleases to interested parties.

The leaseholders often allow poor people to fish in the leased waters. There is a system of community fishing in the area called *polo* fishing which normally takes place after harvesting of aman crop from the low land. Most households participate in *polo* fishing. Within each water body it usually continues for 2 to 3 consecutive days. In Gopalpur mouza, community *polo* fishing takes place every year during *Poush Shankranti* (last day of *Poush*). The *doa* and the *khals* in Mallikpur mouza are treated as open access fishing property. Everyone in Mallikpur can fish there.

Aquaculture Development

Despite the obvious loss in capture fisheries in the area, no aquaculture project or extension service has been established. The ponds in the study area are primarily used for domestic purposes, and only secondarily for fish culture. Out of the four study mouzas, pond aquaculture has been found relatively developed in Chenchuri mouza.

3.2.4 Wildlife

Terrestrial Habitat and Wildlife Species

According to the respondents, a number of wildlife species, namely, vulture (*shokoon* , Gyps bengalensis) King Vulture (*gaduni/ginni shokoon*, Sarcogyps calvus), Flying Fox (*baro badur*, Pteropus giganteus), Black Kite/Pariah Kite(*bhuban cheel*, Milvus migrans), Crested Serpent Eagle (*tila/shap*

kheko baz, Spilornis cheela), Goshawk (*baro machal/borjiala*, Accipiter gentilis), Hispid Hare (*khorgosh*, Caprolagus hispidus), Indian Porcupine (*shajaru*, Histrix indica), Brown Fish Owl (*mechho pecha*, Bubo zeylonensis), Brown Hawk Owl (*lokkhipecha*, Ninox scutulata), Paradise Fly Catcher (*shahi bulbul*, Terpsiphone paradisi) etc. were abundant in the area ten to twenty years ago. Most of these are rarely found today.

The residents of Banagram village reported that certain birds species used to come to their area from the Sundarbans. Common among these were the *narhoi, dunkor, kalkowre, saga* and the *boipakhi*. However, according to the respondents, these are rarely seen in the area at present.

Wetland Habitat and Wildlife Species

It was reported by the respondents that the diversity and abundance of wetland dependent wildlife species in their area was high in the past. The population of Gangetic Dolphin (*sishoo*, Platanista gangitica), crocodiles (*kumir*), shark (*hangor*), and many wetland dependent birds were abundant in the Nabaganga and the Chitra of the study area. Many of the species mentioned above are rarely found in the area today. No major wetland dependent species can be seen now in the dying part of the Nabaganga. Only a very rare Gangetic Dolphin is observed in the Chitra and the upper and lower parts of the Nabaganga.

In the aftermath of crop failures, people have often sold their forest and vegetative resources to ease economic hardships. As a result, some terrestrial habitat has been lost which has affected wildlife population. Similarly, due to loss of aquatic habitat, many aquatic and amphibian wildlife species have become endangered in the area.

3.3 Occupation and Quality of Life

3.3.1 Occupation

The people of the study mouzas rely on agriculture for their main occupation. However, there have been some changes in the occupation pattern over the years. The situation, as found in the different study mouzas, is discussed below.

The people of Mallikpur mouza have traditionally been involved with agriculture, and they remain dependent on agriculture. In recent years, there has been an increase of HYV paddy cultivation.

There were a few households (mainly within the hindu community, based in Doa Mallikpur) whose main occupation was fishing. Most of these households have moved away from the area. One or two families which have stayed manage with the limited fishing they are able to engage in. A new source of employment has been the rickshaw van which has emerged as a major mode of transportation as the dependence on the waterways has been reduced.

The household survey results in Par Mallikpur village on employment and occupation can be seen on Table 10. According to the respondents, 20 years ago, the percentage of households whose main occupation was farming (inclusive of own cultivation and sharecropping) was 63 percent. The corresponding figure during the time of this study (1995) was only 24 percent. This indicates a shift of reliance from agriculture to other sectors. It is interesting to note that as many as 21 percent of the households reported van pulling to be their main occupation at present. Trading has also been taken up more frequently as a main occupation (increased, according to the survey, from 5 percent to 14 percent in 20 years time). Because of higher literacy rates in the area and more jobs being created in the public as well as the private sector, the proportion of people involved in salaried jobs has increased.

The respondents in Par Mallikpur who shifted their main occupation away from farming quoted

Table 10 **Percentages of Households with Different Main Occupations: Past and Present Scenarios**

Occupation Category	20 Years ago	10 Years ago	Present
Farmer	63	37	24
Day Laborer	14	14	17
Salaried Job Holder	4	12	14
Van Puller	1	20	21
Trader	5	7	14
Others	13	10	10
Total	100	100	100

Source: Household Survey of Par Mallikpur Village, 1995.

a variety of reasons for the shift (Table 11). The reason most frequently quoted was the reduced level of production resulting from lower fertility of the soil (80 percent of those who made the shift). The reasons for the reported reduction in soil fertility could not be physically determined. However, the respondents suggested that the reduction in surface water and the consequent reduction in silt deposits and moisture content in the soil were the primary reasons for this decline in fertility. The pressure on the limited agricultural land due to population growth can partly explain why some of the households had to move away from farming (56 percent of the households who made the shift reported this to be a reason). Increase in the cost of agricultural production was also a factor in influencing people in shifting their main occupation away from farming. About a third of the households cited this as one of the reasons for changing their main occupation from farming to something else.

Table 11 **Reasons for Shifting Main Occupation from Farming**

(Period -Last Twenty Years, Number of Households Reporting Shift = 36)

Reasons for Change	Number of Households
Reduction in Agricultural Production due to Loss in Soil Fertility	29 (80)
Due to Break up of Joint Family and the Consequent Reduction in Amount of Land Available to the Household	20 (56)
Increases in the Cost of Agricultural Production	12 (33)
Van Pulling is now is a Better Occupation in terms of Labor to be Employed and Returns to be Made	9 (25)
Small-time Trading is Profitable and Relatively Risk-Free	7 (19)
More Salaried Jobs are Available Now	4 (11)

Note: Figures within parentheses are percentages of households making the shift in occupation.

Source: Household Survey of Par Mallikpur Village, 1995.

Agriculture as a source of income in the village of Par Mallikpur has declined in importance (Table 12). More than 50 percent of the households reported that 20 years ago over half of their income came from agriculture. At present only 21 percent of the households earn such a proportion of income from the same source.

Van pulling at present contributes more than half of the income of 18 percent of the households in Par Mallikpur. The corresponding figure for 20 years ago was only one percent. The survey results also indicated that boat operation and fishing had become less important as sources of income, while trading and salaried jobs had gained in importance.

Information on changes in secondary occupation in Par Mallikpur has been presented in Table 13. It is interesting to note that the total number of households with a secondary occupation has increased during the last twenty years (from 17 to 33). Most of these households have mentioned farming to be their secondary occupation. Thus, it is important to realize that although some people are shifting their main occupation away from farming, many are sticking to it as a secondary occupation.

Table 12 **Importance of Agriculture as a Source of Income**

Period	Percentage of Households	
	More than Half of Income from Agriculture	Up to Half of Income from Agriculture
Two Decades Ago	51	49
One Decade Ago	35	65
At Present	21	79

Source: Household Survey of Par Mallikpur Village, 1995.

Table 13 **Changes in Secondary Occupation**

Secondary Occupation	Number of Households		
	20 Years ago	10 Years ago	Now
Farming	6	17	19
Day Laboring	3	3	1
Salaried Job	1	2	0
Van Pulling	1	1	1
Trading	1	2	5
Masonry	0	2	6
Fishing	1	0	0
Boat Plying	1	1	0
Extracting Palm Tree Juice	3	1	1
Total	17	29	33

Source: Household Survey of Par Mallikpur Village, 1995.

Gopalpur mouza is inhabited mostly by people from the hindu community. They remain dependent on agriculture as always. With the advent of better roads, a few have gone into pulling of rickshaw vans. There are no potters or other artisan communities here, and there is very little petty trading. A large portion of the land of this mouza belongs to absentee owners. They usually engage the local people in cultivating their land either as day laborers or as sharecroppers.

The respondents of Gopalpur mouza felt that cultivation of high yielding varieties of paddy increased their income. However, they also mentioned the escalating costs of consumption and production. A change that they perceived was the

greater reliance of the people on markets. The practice of subsistence farming which was common earlier has changed to production for the market. The resulting monetization of the local economy, in the opinion of the local people, has created greater demands for newer goods and services. Now-a-days there is a greater demand for miscellaneous consumer goods and services.

People in Banagram mouza reported that due to greater adoption of HYV rice crop in their area, some are now able to earn higher incomes. It was reported by the respondents that since the area has been protected from possible flooding, the propensity of people to invest in better houses here has gone up.

3.3.2 Health and Sanitation

General health of the people in the study area was found to be very poor. The respondents reported that diseases such as various types of scabies, night blindness, roundworm infestation and scurvy were common in their area. It was reported for the whole area that the incidence of appendicitis was alarming in the recent years.

It was reported by the respondents that some 20 years back, fish, vegetables and fruits were the main sources of protein, vitamins and minerals. In their opinion, due to reduction of surface water and increased consumption, fish supplies had been reduced. As the moisture content of the soil is poor and availability of surface water low, people are not developing homestead gardens, particularly in *rabi* and early *kharif* seasons.

The respondents said that they could hardly afford any animal protein in their diet. It was noted that black bean (*mash kalai*) and grass pea (*khesari*) constituted the main source of protein these days.

The households of the study area are dependent on tube wells for the supply of drinking water. Almost all male members and over 70 percent of the female members are dependent on surface water for bathing. People are almost wholly dependent on surface water for washing clothes, and bathing their livestock. The reduction in surface water and the consequent deterioration of water quality has created problems for bathing, washing and cooking. The Household Survey shows that in Par Mallikpur 97 percent of the households face problems in bathing, 79 percent in cooking and 26 percent in washing clothes.

About 10 percent of the households in the study area use *pucca* (sturdy and relatively permanent) sanitary latrine, 40 percent use *kutcha* (flimsy and relatively temporary) slab latrine, and the remaining 50 percent use *kutcha* holes as latrines.

3.3.3 Gender Issues

Women in the study area, like in other parts of Bangladesh, are very much dependent on water and biomass fuel energy sources for their daily chores. Women in the study area have a tight daily schedule involving cooking, washing clothes, collecting fuel, collecting water, providing feed to the livestock and, rearing children. About 10 percent of the women living along the levees of the Chitra and its creeks earn some cash income from *kashol/kusha/madurkathi* (Desmostachya bipinnata/Cyperus pangorei) by making mats out of this grass or by selling it as fuel.

Nearly 90 percent of the women are dependent on surface water for cooking, bathing and washing clothes. Most of the women in Par Mallikpur and Char Mallikpur villages are dependent on the Nabaganga water for bathing and cooking. It was reported by the respondents that in the dry season many women could take only one bath a week.

Women in Gopalpur, Banagram and Chenchuri are heavily dependent on the *khals* in their area (Pateshwari Khal, Baghdanga Khal, Liner Khal, etc.) for domestic water supply. Therefore, the drying up of these *khals* is posing a serious problem to the inhabitants of the area. About 20 percent of the households attempted to make ponds and ditches in and around their homesteads, but most of the ponds have no water during the dry season.

Chapter 4

RECOMMENDATIONS

4.1 EIA Guidelines Improvement

4.1.1 Sector-Wise Recommendations

Geomorphology

The Guidelines should have indications on how to adapt the EIA procedures to different hydrogeomorphological regions of Bangladesh. The EIA procedures have to be sensitive to two basic types of hydrological situations in which FCD/I projects are found (since the likely impacts of structural interventions in these two situations will be different):

Situation I — Rainy season flood is a problem, but there is no scarcity of water (for irrigation and other purposes) in the dry season. Generally drought is also not a problem in such a situation.

Situation II — Rainy season flood is a problem, but there is scarcity of water in the dry season. Drought is an additional problem. The southwest region is characterized by such hydro-geomorphological situation.

The Ganges delta is geomorphologically divided into two regions, the moribund delta and the active delta. The southwest region is mostly located in the moribund delta where the spill channels of the Ganges are drying up in a sequence that follows a general west-to-east direction. This has changed most of the spill channels from regional rivers to local river, basically draining the local rainfall-runoff.

Navigation and Communication

The Guidelines should deal more explicitly with the subject of navigation by waterways in the context of implementation of FCD/I structures. Although it is often argued that a better road communication network would develop in the flood-prone areas after embankments are constructed, the loss of navigational waterways can create problems for the local markets and growth centers which have traditionally developed on banks of rivers and canals. Also, the Guidelines should deal with the general fact that transportation by road is more expensive than transportation by waterways. One specific item that the Guidelines need to emphasize in this context is the general necessity of keeping provisions for navigational locks in the sluice gates.

Forest & Vegetation

The Guidelines should clearly point out how the characteristics of surface water (in terms of quantity and quality) affect both terrestrial and aquatic vegetation. The relationship between the change in forest and vegetation type (caused by surface water change) and the availability of fuel wood needs to be assessed. Profiles of both terrestrial and aquatic vegetation should be prepared to reflect species diversity and their abundance so that their importance in ecological terms and to the economy can be understood.

As denudation is greatly increasing in many areas, it is essential to monitor and up-date database on natural and plantation vegetation. Data should be collected at regular intervals to record changes in forest type, canopy density, height, volume, number, growth rate, regeneration and propagation.

Agriculture and Livestock

Changes in land type may not be uniform throughout the project area. In fact, some areas may not experience any change in land type at all. This point needs to be stressed in the Guidelines.

Changes in cropping pattern is a function not only of land types, but also of other factors such as availability of newer varieties of crops and miscellaneous market forces. In assessing future with/without projects, these factors should be adequately addressed.

The Guidelines should make explicit the dependence of livestock on the availability of surface water in a given area. Seasonal availability of surface water and its importance for the livestock in terms of bathing and drinking water need to be looked into. Issues related to the changes in land type and cropping patterns and their implication for the livestock in terms of availability of grazing land, fodder diversity and its abundance, draft power, and milk production should be critically assessed.

Fisheries

The EIA Guidelines covered most of the important aspects of data requirements regarding capture and culture fisheries. However, some additions could be made here. Fishing in small ditches excavated in the floodplain and seasonal *beels* by the land owners for trapping fish was found to be heavily practiced in the Chenchuri Beel area. Similar fishing methods are seen in certain other floodplain areas of the country. As such, relevant aspects of such fishing could be included in the Guidelines in terms of fish yield, species diversity and fishing methods.

Under the section on fisheries management, issues concerning common property rights in fishing and access arrangement, particularly for consumption fishing in leased water bodies, need to be incorporated into the Guidelines. This section should also include the indigenous systems, if any, of fisheries resources conservation and management.

The culture fisheries section should include the management aspects of *khas* (government) ponds in the area. The potential of organizing rural poor in fish culture using the *khas* ponds should be assessed. Possible risks/threats (ecological and socio-economic) associated with the rapid expansion of shrimp farming need to be included (example of a process that can create some ecological problem is the extensive exploitation of snail population to be used in the preparation of feeds for shrimp culture).

Occupation

The Guidelines need to address more extensively the changes in employment and occupation which might result from the implementation of FCD/I projects. The fact that these changes may occur within the agricultural sector itself, or beyond, need to be clearly explained. There should also be indications as to how one would be able to separate time series changes in occupation caused by implementation of FCD/I projects from the changes occurring due to other factors like demographic changes, expansion in urbanization, etc.

The role that various government and non-government agencies can play in generating different employment opportunities in the post-project scenario should be elaborated in the Guidelines in its section on Environmental Management Plan, covering particularly the aspects of mitigation and enhancement of opportunities.

Health and Sanitation

The Guidelines should indicate the importance and methods of collecting information on wider issues of health and sanitation (one may note here that this study found reduction in surface water during

the dry season to create problems in bathing in certain areas). Information needs to be sought on both waterborne and airborne diseases.

Gender Issues

The Guidelines should make it clear as to how men and women are directly and indirectly dependent on water resources. There should be clear indicators for assessing gender issues relating to reduction in surface or ground water. An important issue would be the effort and energy spent in procuring water for domestic use.

4.1.2 Recommendations on Procedural Steps of EIA

The procedural steps in the Guidelines is general enough to be applicable to the water sector all over Bangladesh. However, it would be useful to indicate how one can adapt them to regional and project situations. It would be useful to indicate the circumstances under which specific resource components need more emphasis than others.

Project Description and Design

It is necessary to include a description of existing upstream/downstream projects in the river basin/ watershed which may have likely impacts on the proposed project, or which may impact existing projects. In case of FCD/I projects, general availability of surface water and requirement of water for irrigation in existing projects must be taken into consideration. Similarly, in the case of a barrage or dam project, the likely downstream impact of dry season withdrawal of water needs to be considered. For regions with a large number of projects it is advisable to do a regional Initial Environmental Examination (IEE) before an EIA is undertaken.

Environmental Baseline Description

In this step it will be helpful to indicate the geomorphic units in which the proposed project is located. The Guidelines should emphasize the need for indicating the fluvio-geomorphological changes occurring in the region. The seasonality aspects of the issues and the Important Environmental Components (IECs) need to be emphasized.

Scoping

Where the baseline situation is changing, scoping of issues and IECs has to be sensitive to the trend of this change. It should be kept in mind that impacts over a period of 20 to 25 years (i.e., project life) would be relevant to most of the EIAs to be done in the water sector of the country. A checklist of resource components likely to be affected by changing baseline situation will help in covering all the important components.

Major Field Investigation

It is necessary to carefully check and modify the list of data requirements presented in Annex C of the Guidelines. This would be one way of adapting to the local situation. It is assumed that some amount of field investigation has been done prior to this step, preferably while doing the scoping and bounding exercises. An understanding of the project-environment linkage prior to this step would be helpful in identifying the environmental components needing more attention during the field investigation.

Impact Assessment

In assessing impacts, one should be able to isolate future project impacts from changes in baseline situation due to other projects in the watershed or due to other reasons.

Impact Evaluation

In evaluating impacts, particular attention should be given to conflicts among agriculture, fishing and waterways navigation.

Environmental Management Plan

In developing the Environmental Management Plan (EMP), efforts should be incorporated to include 'compensation' for loss of common property re-

sources and rights. This is particularly relevant to lost fisheries resources.

4.2 Approaches to EIA Training for Practitioners

Geomorphology

The EIA practitioner has to be able to adapt to regional and local circumstances. When considering the environment-on-project impact, the practitioners should be sensitive to the likely implications of this on a project that has a life of 20 to 25 years. The practitioner must ask the question: what hydro-geomorphological changes are likely to occur in the region that will affect the objective/ sustainability of the project? This point is important particularly for the steps relating to scoping, bounding, and impact assessment.

Navigation and Communication

In developing modules for EIA training at the practitioners' level, one would have to ensure that time series information on navigation and communication can be obtained for the waterways as well as the roads. The practitioners would also need to look at different purposes (domestic and business) for which the different modes of transportation are utilized. The seasonality issue would be an important consideration here. Therefore, one would need to look at the demand and supply of transportation services during the dry and wet seasons of the year. Methods would have to be developed to take into account transportation services currently available and the way it could change due to FCD/I interventions.

Forest and Vegetation

It is necessary to involve local people of different groups during collection of information on various aspects of forest and vegetation to properly understand recent trends, existing problems and probable solutions. It is important to observe carefully the situation in the total area rather than depend too much on just a few selected households. Methods would have to be developed in ascertaining any relationship between water resources and the nature and extent of forest and vegetation.

Agriculture

Since change in land types has implications for agriculture, the practitioner should be sensitive regarding this particular possibility during the scoping procedure.

In a situation of gradual reduction in surface water, conflicts between farming and fishing communities can become more severe giving rise to acute social problems. This issue is in addition to the fish versus rice issue in terms of nutrition. The practitioner has to be sensitive to this subject and identify areas and population likely to be affected by such conflicts.

Fisheries

The main objective would be to provide overall information on the capture and culture fisheries in the context of the annual hydrologic cycle. The trainees should have clear ideas about the externalities that directly and indirectly influence the fish habitat ecology, production and species diversity.

The following are some specific suggestions:

- An overview of inland fisheries issues in the context of annual hydrologic cycle, water management projects and fisheries projects should be presented.
- Various maps, aerial photographs, and satellite imageries should be used in the identification and assessment of fisheries resources. The sources of these maps should be discussed.
- Various methods of collecting and analyzing fisheries data for catch assessment, fish market survey, and migration study need to be discussed.

Wildlife

The fact that loss of habitat could result from changes in the availability of surface and ground water and its quality (salinity, biological pollutants, chemical pollutants etc.) should be discussed with appropriate examples.

Occupation

The role of the resource base (of which water is a major component) in determining the opportunities of employment and occupation in an area has to be properly appreciated and evaluated. One needs time series data to understand how employment and occupation may change over time due to changes in the volume and quality of surface water. Thus, for EIA practitioners, it would be useful to delve into the historical context. The fact that occupation patterns in the rural areas tend to have distinct seasonal variation is to be appreciated in preparing the profiles. The issue of a secondary occupation should also be made explicit. The time devoted to an occupation and the income earned from it (as against any other opportunity not availed) should be clearly understood.

Gender Issues

Type and extent of dependence of the women of a locality on various resources, and changes in this dependence over time, must be taken into account.

Chapter 5

SUMMARY AND CONCLUSIONS

There have been major changes in the surface water availability within the study area over the last couple of decades. In the past, flooding used to occur somewhat frequently which damaged some of the houses and standing crops. However, it also had the positive impacts of increasing fisheries resources and replenishing soil fertility by depositing silt. Now-a-days floods are rare and the area often suffers from lack of water.

Natural silting up of the beds of rivers and canals, as well as man-made interventions affecting the surface water flow, have contributed to the reduction in the surface water of the study area. FCD/I projects in the area were implemented with the objective of increasing foodgrain availability for the ever-growing population. Although this objective has been attained to an extent, other problems have been created in the process.

Navigation by waterways used to play a very important role in the past. Although road communication is better now, it has not been a perfect substitute for the loss of waterways. Cost of bulk transportation by road is much higher than by waterways. Besides, most of the markets and growth centers have traditionally developed along banks of rivers and canals. Barriers of sluice gates on waterways without the facility of navigational locks have accentuated the problem.

According to the respondents of the present study, productivity of agricultural land in their area has gone down due to the reduction in silt deposit on their land. Given the reduced level of water in the area, the variety of deep water aman which could be produced in the past cannot be produced any more. The variety that is produced now has a relatively shorter stem and has lower yields. Some HYV cultivation was found in the area. However, lack of irrigation facilities have restricted the expansion of HYV cultivation. Some of the respondents reported that the high cost of HYV cultivation was a problem for them. In the recent years, some new cash crops have been introduced into the area (wheat, betel leaf).

Livestock rearing has become difficult in the area due to lack of surface water during the dry season. This dearth in surface water creates problems in bathing the livestock and ensuring drinking water for them.

Fisheries resources, which were once abundant, have been particularly threatened in the area due to the reduction in surface water. Embankments and sluice gates have interrupted natural migration of fish in the area. According to the respondents, capture fisheries resources have been steadily declining over the years, and concerted measures have not been taken to introduce culture fisheries there. Members of the professional fishing community who have been dependent on capture fisheries in the area are particularly distressed by the situation.

The dependence on agriculture for livelihoods has reduced over the years. The reasons for this are many. Apart from reported reduction in soil fertility and increase in production cost in agriculture, the demographic pressure and the consequent land shortage have made a big contribution to the process. Given that more roads have been constructed, van pulling has become a popular

occupation for many people in the area. Somewhat better literacy rates and greater availability of salaried jobs have encouraged some of the people to take up such jobs. Petty trading is also increasing in the area.

The reduction in surface water has created problems for health and sanitation as well. People in the area reported that they found bathing to be a problem due to the reduction in surface water faced during the dry season. In their opinion, this is one reason why skin diseases are so common in their area these days.

The situation obtaining in the study area lent a number of important points to the enrichment of the EIA Guidelines for the water sector and also to the development of approaches toward training of EIA practitioners.

The study recommends that the Guidelines should have indications regarding how to adapt the EIA procedure to different hydro-geomorphological regions. The subject of navigation on waterways needs to be discussed more explicitly. It is also necessary to prepare profiles of terrestrial and aquatic vegetation and discuss how these can be impacted by development projects. The issue of land type changes and the consequent changes in cropping pattern need to be given due consideration. The problems faced by livestock due to surface water reduction needs to be highlighted. With regard to the fisheries sector, issues concerning common property rights and access arrangement in fishing, particularly for consumption fishing in leased water bodies, need to be incorporated into the Guidelines. It is important to include the management aspects of *khas* ponds aquaculture under the section on culture fisheries. It is also necessary to discuss more extensively the changes in employment which might result from implementation of FCD/I projects. The Guidelines need to be more specific on different aspects of health and sanitation. Besides, various gender issues need to be addressed properly.

The suggestions made above require to be integrated into the procedural steps of EIA so that the assessment of environmental impacts in circumstances similar to the one found in the Chenchuri Beel area can be done more effectively.

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APPENDICES

APPENDIX I

RRA CHECKLIST

(Questions which relate to past events/trends should be used to elicit information for the last couple of decades or so)

Historic Geomorphic and Climatic Change

Has any river bed or part of it been dried up in this area? If yes, what are the reasons?

Have there been any shifts in river channels?

Have there been any erosion or accretion of river banks?

Have any new canals been excavated?

What has been the pattern of rain fall?

Flood/Drought Events

What has been the nature of flood in the area/mouza?

What have been the positive and negative impacts of floods?

What has been the role of FCD/I projects in solving flood problems?

What have been the advantages/disadvantages of the FCD/I projects in the area?

Is there any drought problem in this area? If yes, what have been the nature and extent of it?

Infrastructure

What are the water control structures that affect the area?

What were the intended purposes of these? Are the purposes being served?

Is the Operation and Maintenance (O&M) of these structures good ? Who is responsible for O&M?

Do structures other than water control structures (such as roads) affect water regime in the locality?

Navigation and Communication

Has there been any change in navigation and communication in the area?

What have been the advantages/disadvantages of any change that might have taken place?

Occupation and Income

What are the main occupations of the people living in the mouza?

What was the occupational pattern in the past?

If there has been a change in occupational pattern, what are the reasons?

What is the pattern of secondary occupation of the people living in the mouza?

Have income levels of people changed over the years? In what way?

Are there any NGOs working in the area? What is the nature of work done by them?

Agriculture

What percentages of land are under different land types at present? Has the situation changed over time? In what way?

What is the cropping pattern in the area in different land types?

Have there been any changes in cropping pattern over time? Has any of the change been the result of surface water reduction?

Livestock

Have there been any changes in the pattern of livestock rearing in the area?

What are the problems in rearing livestock? Have these problems changed in nature over time?

Has reduction in surface water resulted in the depletion of grazing land, bathing water, fodder, drinking water for the livestock?

What common diseases do the livestock suffer from? Are any of these related to surface water reduction?

Fish and Fisheries

What number and percentage of households in this mouza fish (subsistence and professional)?

How many of the professionals are hindus, and how many are muslims?

Where do people of this mouza fish (subsistence and professional)?

What are the peak and lean fishing seasons?

What are the nature and extent of subsistence and professional fishing in the peak and lean seasons?

What kind of income do the professional fishermen earn during the peak and lean seasons?

What types of gears/crafts are used in fishing? Who owns them?

What are the access rights/fishing arrangements in different water bodies during different times of the year?

Where do professional fishermen sell their fish?

Has there been any change in the surface water regime during the past twenty years or so?

If yes, what are the factors responsible for the change?

What changes have there been in terms of:

- fish habitats (types, area, seasonality, quality,etc.)
- species diversity (important spp., rare spp., etc.)
- catch/production (catch per gear per unit of time)
- fishing income (income by gear type, income per day, etc.)
- fishing rights (leasing/licensing, open access, etc.)
- fishing occupation (occupational change, migration, etc.)

Has there been any change in aquaculture in the mouza? In this context, note any changes occuring in:

- number of ponds
- number of nurseries/hatcheries
- number of people involved in aquaculture
- stocking in beel areas

What are the measures which can help enhance fisheries resources?

Forest and Vegetation

Has there been any change in terrestrial and aquatic vegetation in the area? If yes, what are the reasons for the change?

What has been the composition and diversity of species in the past and what is the status now?

Is their any impact of surface water reduction on the yield and production of vegetables and fruits?

Do changes in cropping pattern or crop failure affect the nature and extent of vegetation?

What are the principal biomass fuel energy sources in the area? Are they sufficiently available throughout the year?

Wildlife

Has there been any change in species diversity and population of wildlife in the area? If yes, what are the reasons for the change?

What are the effects of surface water reduction on the species diversity and population of wildlife?

Health and Sanitation

What are the common diseases in the area? Has there been any change in the pattern of diseases over the years?

What is the nutritional status of people in the area? Have there been changes in this?

What are the sources of water for cooking, bathing, and other household work? Are there differences in access to these sources?

What is the impact of surface water reduction on the sanitation status of the area?

Gender issues

What are the primary occupations of women in the area? Are there some among the women who are involved in occupations generating cash income?

What is the division of work between men and women in the management of water, fuel, feed, and fodder?

How have changes in water regime affected the women of the area in managing their day-to-day activities?

APPENDIX II
HOUSEHOLD SURVEY QUESTIONNAIRE
(GENERAL)

Village: _____
Mouza: _____
Union: _____
Thana: _____

1. **Respondent's Name:** _____

2. **Father's Name:** _____

3. **Land Owned (dec.):** _____

4. **Occupation of the Household** (by income)

   Primary Occupation Secondary Occupation

5. **Surface Water Reduction:**

   If you have observed surface water reduction in your area, what problems has it caused you?

6. **Effects of Surface Water Reduction on Agriculture:**

   6.1 Since when has your operated agricultural land been affected by surface water reduction?

   6.2 Cropping Pattern changes

Main Crops	Operated land devoted prior to surface water reduction (acre/dec.)	Operated land devoted now (acre/dec.)	Yield (per dec.)		Value of Crop per dec. (Tk.)	
			prior	now	prior	now

7. **Flooding/Drought**

7.1 What have been the changes in the impacts of flooding for the household?

20 years ago Now

7.2 What problems have you faced due to drought ?

7.3 What steps does the household usually adopt to minimize flood losses?

8. **Fish and Wetlands**

8.1 Fish species which were abundant 20 years ago, but

not at all observed now:

rarely observed now:

8.2 In your opinion, what are the reasons for loss of species diversity?

8.3 Has there been any change in the following due to construction of embankments or sluicegates?

Fish production : Yes ( ) No ( ). If yes, % increase/decrease:

Species diversity: Yes ( ) No ( ). If yes, affected species:

9. **Employment and Income:**

9.1 Changes in employment pattern over the last 20 years due to changes in surface water/salinity

Main and Secondary Occupation of Household

Occupation Type	20 years ago	10 years ago	Now	Reasons for Change
Main Occupation				
Secondary Occupation				

9.2 Changes in major sources of income of the household over the last 20 years:

Percentage of total income from different sources

Sources of Income	20 years ago (%)	10 years ago (%)	Now (%)	Reasons for change
Agriculture				
Fisheries				
Trade				
Service				
Navigation				
Others (specify)				
	100%	100%	100%	

APPENDIX III
HOUSEHOLD SURVEY QUESTIONNAIRE
(PROFESSIONAL FISHERMEN)

Village: _____
Mouza: _____
Union: _____
Thana: _____

1. Respondent's Name: _____

2. Father's Name: _____ 3. Fisherman Type: _____

4. Family Members: _____ Fishing Members : _____

5. Fish species which were abundant 20 years ago but

   Not at all observed now:

   Rarely observed now:

6. In your opinion, what are the reasons for loss of species diversity?

7. Has there been any reduction in fishing catch over the last 20 years?

   If yes, what extent? % change:

	Increased	Decreased
river		
canal		
beel		
flooded land		
pond		

8. What are the major reasons for reduction in catch ?

9. What changes have there been in the following due to salinity?

Fish Production :
(% increase/decrease)

Species diversity:

10. Has there been any change in the following due to construction of embankments or sluicegates?

Fish production : Yes ( ) No ( ). If yes, % increase/decrease:

Species diversity: Yes ( ) No ( ). If yes, affected species:

11. What were the average peak and lean season catches (kg/household/day) in the past, and what is the situation now?

Past:
(20 years ago)

Peak Season: Lean Season:

Present:

Peak Season: Lean Season:

12. What were the average peak and lean season incomes (Tk/household/day) in the past, and what is the situation now?

Past:
(20 years ago)

Peak Season: Lean Season:

Present:

Peak Season: Lean Season:

13. How have you adjusted to the changes occurring over the last 20 years with regard to fishing?

14. What are the measures which need to be taken for improving capture fisheries production in the area?