Government of the People's Republic of Bangladesh

Flood Plan Coordination Organisation,
Ministry of Irrigation, Water Development and Flood Control

BANGLADESH FLOOD ACTION PLAN

FAP 12
FCD/I AGRICULTURAL STUDY

RAPID RURAL APPRAISAL OF SILIMPUR-KARATIA REGULATOR CUM BRIDGES

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Hunting Technical Services Limited

in association with

Bangladesh Institute of Development Studies
Flood Hazard Research Centre
Hunting-Fishtech
Technoconsult International Limited

under assignment to
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Sanyu Consultants Inc.
under assignment to
Japan International Cooperation Agency

The present report is one of a series being produced by Flood Action Plan components 12, the FCD/I Agricultural Study and 13, the Operation and Maintenance Study.

The full series is expected to comprise the following reports:

FAP 12

Inception Report (joint with FAP 13)
Methodology Report (2 Volumes)
Rapid Rural Appraisals Overview (2 Volumes)

Project Impact Evaluation studies of:

* Chalan Beel Polder D
* Kurigram South
* Meghna Dhonagoda Irrigation Project
* Zilkar Haor
* Kolabashukhali Project

Rapid Rural Appraisal Studies of:

Protappur Irrigation Project
* Nagor River Project
* Sonamukhi Bonmander Beel Drainage Project
Improvement of Sakunia Beel
Silimpur-Karatia Regulator cum Bridges
* Khatakhali Khal
Halir Haor
* Kahua Muhuri Embankment
Konapara Embankment
* Polder 17/2
* BRE Kamarjani Reach
* BRE Kazipur Reach

* Draft Final Report (2 Volumes)
* Final Report (2 Volumes)

FAP 13

Methodology Report
Appraisal of Operation and Maintenance in FCD/I Projects (2 volumes)
Draft Final Report (2 Volumes)
* Final Report

Note: * Report not yet available

SILIMPUR-KARATIA REGULATOR CUM BRIDGES

Project Summary Sheet

Project Name : Silimpur-Karatia Regulator Cum Bridges

Project Type : Flood Control, Drainage, and Irrigation

Location

FAP Region : North-Central
District : Tangail

Area (ha.) : 2833 ha.(gross, all embankment),
1012 ha (approximate area claimed to be served by structures)

Funding Agency : IDA (World Bank, SSDFCP, 955-BD)

Implementing Agency : BWDB

Construction started : 1982

Scheduled Completion : 1983

Actual Completion : 1983/84

Original Cost Estimate : Tk.2.4 million

Final Cost Estimate : Tk.6.36 million

Major Flood Damage : 1988 area flooded, embankment washed away in places.

Repair-rehabilitation: maintenance comprises periodic resectioning of embankment.

Comments:

"Project" largely ineffective, irrigation is all by groundwater, gates have rarely been closed, and floodwater can enter from another river which remains open.

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SUMMARY

Introduction

The project area is situated in the district of Tangail and encompasses the unions of Dhainnya, Porabari and Silimpur, on the left bank of the Dhaleshwari and Elanjani Rivers. The project consists of four one vent gates built in 1983-84 on the embankment at the mouth of khals at Belta, Indra Belta, Fatehpur and Binnafair. These gates are described as flushing inlets in project documents, suggesting their use as irrigation structures. In practice these gates have rarely been used during their lifetime for various reasons, which are indicated in the following paragraphs.

Hydrology

The western and southern sides of the project area are bounded by the Dhaleswari and the Elanjani Rivers, while the northern and eastern sides are bounded by the Lohajang River. The normal pattern is for the Dhaleshwari and Elanjani to drain into the Lohajang, through the khals and overspill. The southern parts of the project area, (eg. Baruha and Charpara) are higher than the northern parts, (eg. Baghil), which were beel areas some twenty years ago.

The khals in the area completely dry up during the Boro season, and are able to retain water for only two to four months in a year. The general project area has become drier than before.

There are very few ponds in the area.

Operation of the Structures

The sluice gates were rarely operated (closed) since their construction in 1984. An attempt was made for the first time during the monsoon of 1991 to close the gates at the initiative of the BWDB, but with little success. Fall boards could not be traced, or when located were difficult to put in place. There are mixed feelings about these structures amongst the local people, but most agree that they have not served any purpose.

Agriculture

The traditional cropping pattern (as exemplified by the practice in the set back distance of the embankment) consists of Aus followed by B.Aman. Jute and sugarcane are also popular here, especially in the more elevated, sandy areas. The winter crops are mustard and wheat. Boro HYV cannot be cultivated in elevated areas because of the high water cost involved in a sandy environment. The cropping pattern within the project area consists of Boro HYV under irrigation in the deeply flooded land, sometimes followed by B.Aman (transplanted). In the medium-low land, it is possible to have T.Aman after Boro HYV and in the medium to high land, jute or aus, rabi crops or sugarcane are found. These lands are typically too sandy to be suitable for HYV Boro. While these changes are a direct consequence of the embankment, none can be attributed to the sluice gates.

Fisheries

The narrow gates have facilitated fishing at the gate mouths. This is a highly seasonal activity, lasting two to three months in a year. The quantity of fish caught is small.

Livestock

Livestock has declined in the project area due to decrease in grazing land, but this is not attributable to the gates.

Non-Farm Activity

The area supports a rich variety of non-farm activity, including weaving, boat and rickshaw transport, carpentry, saw mills and husking mills, trading and horticulture. The Grameen Bank is the main NGO in this area, and supports both men's and women's groups.

Communications

The gates have allowed the embankment to be closed at those points, facilitating road transport, both pedestrian and rickshaw. At the same time the impact on boat navigation has been very adverse, and a source of unhappiness even now, seven years after the construction was completed.

Social Conflict

The potential for social conflict has been aggravated due to the project. A number of contradictions have been sharpened: boatmen versus farmers, char people and those inside the project, fishermen against farmers and high landers against low landers.

People in the char areas outside the project area are disbenefitting because of a riskier agriculture and greater probability of inundation of homestead areas. This has also contributed to tensions.

Observations and Recommendations

1. There is a need to re-examine the raison d'etre for the gates very carefully, taking into account the often conflicting positions and opinions of the local people in and around the area.

2. Now that the gates are there, they are a fait accompli, and efforts should be made to make them easily operable. It is therefore important to provide appropriate fall boards that are easy to put in place or take out as desired. Existing wooden boards, even when traceable, are extremely unwieldy.

3. Successful operation requires effective gate committees that enjoy the support of the vast majority of the inhabitants of the area. This requires a degree of social intervention and organisation which is totally absent. A concerted effort in this direction will require the involvement of not only the Water Board but also the participation of NGOs, union and upazila officials and peoples' representatives.

4. The problem of drainage congestion requires de-silting the khals, which need to be re-excavated.

5. The gates cannot of course be considered in isolation from other developments in the area. Thus the amount of water entering through the gates, even at peak flow levels, is small. The water from the Lohajang enters the area from the eastern side of the project anyway, and is the major source of inundation during the monsoon season. In normal years, the degree of flooding does not appear to cause any problem. Even in 1991 when floods have been more intense than normal, crop damage has been slight in the area. The potential danger has begun to recede with the flood waters.

CONTENTS

ABBREVIATIONS AND LOCAL TERMS

ADC	Additional District Commisioner
BADC	The Bangladesh Agricultural Development Corporation
BBS	The Bangladesh Bureau of Statistics
BIDS	The Bangladesh Institute of Development Studies
BRDB	The Bangladesh Rural Development Board
BWDB	The Bangladesh Water Development Board
CARE	Cooperatives for American Relief Everywhere
C/S	Country Side
DC	District Commissioner
D/S	Downstream Side
EIP	Early Implementation Project
FAO	Food and Agricultural Organisation
FAP	Flood Action Plan
FFW	Food for Works Programme
JICA	Japanese International Cooperation Agency
LPC	Local Project Committee
MBSS	Mahila Bittahin Smabaya Samity
MSS	Mahila Samabaya Samity
NGO	Non-Government Organisation
ODA	British Overseas Development Agency
PIE	Project Impact Evaluation
RDO	Rural Development Officer
RMP	Rural Maintenance Programme (CARE)
RRA	Rapid Rural Appraisal

R/S	River Side
SDE	Sub-Divisional Engineer
SE	Superintendent Engineer
UNDP	United Nations Development Programme
UNO	Upazila Nirbahi Officer
U/S	Upstream Side
WAPDA	Water and Power Development Authority

TERMS

Aman	Paddy crop harvested in November-December
Aus	Paddy crop harvested in July-August
Boro	Paddy crop harvested in May-June
Khalashi	Guard
Mouza	Lowest level administrative boundary
Union	The lowest level administrative tier
Union Parishad	Elected committee at the union level

1 INTRODUCTION

1.1 THE FAP 12 STUDY

The FAP 12 Study is one of the 26 numbered component studies of the Bangladesh National Flood Action Plan, and is jointly supported by the United Kingdom Overseas Development Administration (ODA) and the Japan International Cooperation Agency (JICA). It is led by a group of Bangladeshi and international consulting organisations, involving Hunting Technical Services Limited of the United Kingdom, Sanyu Consultants Inc. of Japan, the Bangladesh Institute of Development Studies (BIDS), the Flood Hazard Research Centre of Middlesex Polytechnic, UK, Hunting Fishtech of UK, and Technoconsult International Limited of Bangladesh.

The objective of FAP 12 is to conduct post-evaluations of a total of 17 projects, representative in type and location, of the FCDI projects so far executed in Bangladesh (see figure 1.1). The results of these evaluations will be passed to other FAP components for guidance in developing strategies for improved flood control and management for the future.

Of the 17 projects for study, 5 will be assessed mainly by Project Impact Evaluation (PIE) methods, using a formal questionnaire approach and probability sampling. The remainder will be assessed by Rapid Rural Appraisal (RRA) methods, and RRA has also been used for preliminary reconnaissance of the 5 PIE projects. The present report describes the findings of the RRA of the Silimpur-Karatia Regulator cum Bridges Project.

1.2 RAPID RURAL APPRAISAL

RRA is a technique of project assessment intended to produce results more quickly than formal interview surveys, while avoiding biases in the data collected. RRA consists of selective direct observation and interviews of informed respondents from representative areas of the project by a small team of well-qualified and experienced specialists who can reach informed judgements quickly in the field. Maximum use is made of documentary sources to minimise the amount of data which have to be collected by interview and to obtain guidance on the location and content of interviews.

In well-conducted RRAs great care is taken to avoid both locational biases (for example observing and interviewing only in easily accessible areas) and socio-economic biases (for example, omitting coverage of women, landless people, and other groups which are difficult to identify, locate or obtain access to).

By its nature RRA is better at obtaining qualitative data rather than quantitative data, though it is generally possible to obtain fairly good quantitative data on key agricultural parameters for the selected locations. What RRA cannot do (in contrast to PIE methods using probality sampling) is provide statistical validation of how far observations can be generalised over the project area, or of differences between areas and time-periods. Its findings must therefore always be interpreted as informed judgements, not as precise statements with known margins of error. Further background to RRA will be found in the FAP 12 Methodology Report.

1.3 GENERAL LOCATION

The Project area is situated in the District of Tangail and encompasses the Unions of Dainnya, Porabari and Silimpur, on the left bank of the Dhaleswari and Elanjani rivers.

The western and southern sides of the Project area are bounded by the Dhalswari and Elanjani rivers, while the northern and eastern sides are bounded by the Louhajang River. The normal pattern is for the Dhaleswari and the Elanjani to drain into the Louhajang, through the khals and overspill. The southern part of the Project area, (eg. Baruha and Charpara) are higher than the northern parts, (eg. Baghil), which were beel areas some twenty years ago. The khals in the area completely dry up during the Boro season, and are able to retain water for only two to four months in a year. Approximately 1000 ha. are supposed to be covered by the project, which is part of the Silimpur-Karatia Flood Embankment Project area.

1.4 SILIMPUR-KARATIA REGULATOR CUM BRIDGES

The Project consists of four one-vent gates at the mouth of the khals located at Belta, Indra Belta, Fatepur and Binnafair, constructed in 1983-84 at a cost of Tk.6.36 million. The flood embankment on which these gates have been situated was originally constructed in the early 1960s with local resources and local initiative. Subsequently, the Water Board took over the Project and has engaged in periodic resectioning and maintenance works.

No statement of Project objectives or rationale could be located, but it has been assumed that the gates were intended to control water intrusion in the area for purposes of irrigation and flood control, and thereby enhance agricultural productivity.

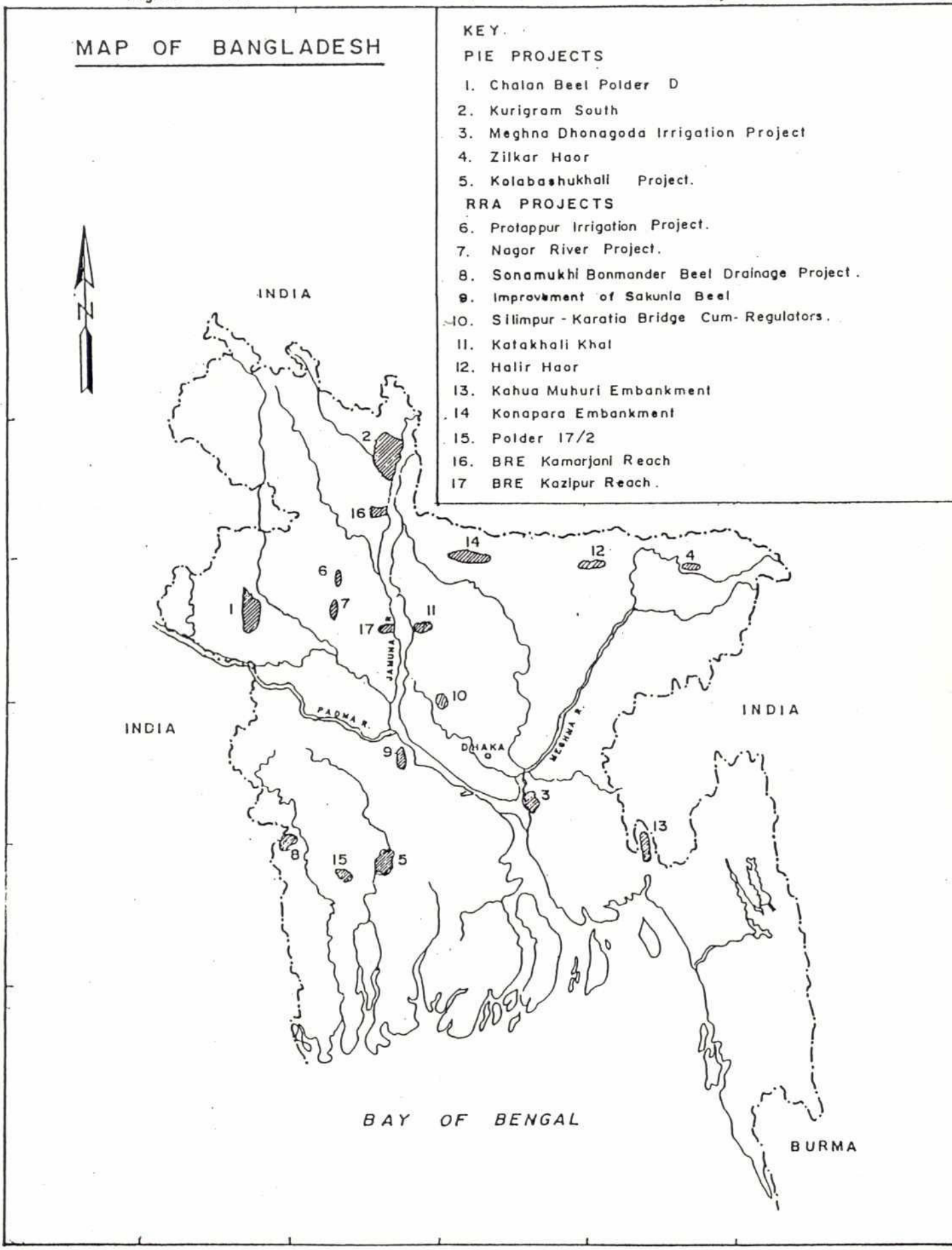
1.5 RRA ORGANISATION

The RRA team comprised specialists in engineering, agriculture and livestock, environment, economics, and institutions. Fieldwork took place in late July for a period of six days. Intensive and detailed interviews were conducted with people within and outside the Project area, BWDB officials and staff and NGO workers. The relatively small area allowed the team to visit all the mouzas.

1.6 ACKNOWLEDGEMENTS

The team would like to register its deep appreciation for the cooperation extended by the BWDB engineers and staff, and the free and frank manner in which views were expressed. The local administration, and in particular, the DC and ADC of Tangail deserve special thanks for their kindness. Last but not least, the people of the Project area deserve to be specially thanked for bearing with us so patiently.

Figure : 1.1 Location of Selected PIE and RRA Projects



Source: Consultants

2 ENGINEERING ASPECTS

2.1 PRESENT SITUATION OF THE PROJECT

2.1.1 Location

The Silimpur-Karatia Flushing Inlet Project (SKFIP) is situated in Sadar Upazila of Tangail District, covering a gross and net area of 1200 ha and 1000 ha respectively. The project area lies on the left bank of the Elanjani and Dhaleswari rivers, and the right bank of the Lauhojang River.

2.1.2 Historical Background of the Project

The flushing inlets are part of the Silimpur-Karatia Flood Embankment Project which was constructed in 1963 by the local people. The original height of the embankment was smaller, and appear not to have been professionally designed. This embankment was constructed on a piece-meal basis, union by union. The construction and maintenance activities were carried out by the local people up to 1975, but subsequently the responsibility for the project was taken over by the Bangladesh Water Development Board. Since then, four flushing inlets were installed for irrigation, but in practice this objective was not served.

During the 1988 floods, the embankment was damaged at several points, and it was repaired under the FFW programme under the authority of the local Union Parishad representative.

2.1.3 Drainage and Flood Control

The general topography of the project area is not evenly sloping from one side to the other. The land has a gradient from west to east, causing the Dhaleshwari river to flow to the Lauhojang River through the project area. The Laohajang River acts as the main drainage channel for the project area. The project area is partially protected from floods due to installation of the flushing inlets. The low and medium low lands are inundated by the overspill of the Lauhojang river.

2.1.4 Irrigation System

The Silimpur-Karatia embankment along with the flushing sluices has provided partial crop-security from flood water. Though the gates of the sluices were rarely closed since installation, the narrower opening compared to the situation before the gates, has reduced water inflows, and has provided a sense of safety to the people. A large number of Deep Tube Wells, Shallow Tube Wells and Low Lift Pumps are in operation in the project area which has intensified agricultural production significantly.

2.2 PROJECT OBJECTIVES

There is very little documentation available on this project. It is variously described as "appurtenant structures in connection with Silimpur-Karatia bundh" and "flushing inlets on flood embankment from Silimpur to Karatia", in the sub-project report available from the BWDB.[1] The same report suggests that "regulators are needed to keep the floods out and to allow

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1 See BWDB memo: WFP no. NE/16.

controlled flooding and drainage of the Project area". The suggestion here is that floods would be controlled and irrigation would be permitted, leading to increases in T.Aman acreage.

2.3 SOURCES OF DATA COLLECTED

The following reports were reviewed:

- Appurtenant structures in connection with Silimpur-Karatia Bund in Upazila Tangail of District Tangail (Sub-Project Report under IDA credit No. 955-BD).

- Project Proforma of Silimpur-Karatia Flood Embankment Project under Upazila and District Tangail (1988, BWDB)

In addition, discussions were held with the local Union Parishad chairmen, members and Upazila officials.

2.4 ASSESSMENT OF PROJECT FEATURES

2.4.1 Project Infrastructure

The construction work on the SKFIP was started in 1983 and was completed in the same year. The engineering features of the project are as follows.

a) Flushing Sluice = 4 Nos.

i.	Sluice at Belta Khal	= 1 vent
ii.	Sluice at Indra Belta Khal	= 1 vent
iii.	Sluice at Fatepur Khal	= 1 vent
iv.	Sluice at Binnafair Khal	= 1 vent

The structures appear to have been constructed to a satisfactory standard and have not sufferred any major deterioration. The sluices have not been operated since their construction in 1983, due to a combination of factors, including absence of committees, unwieldy fallboards and lack of a social consensus.

2.5 OVERALL ENGINEERING/TECHNICAL ASSESSMENT OF PROJECT

2.5.1 Positive Impacts

a) The sluice gates act as bridges, facilitating road transport, both pedestrain and rickshaw/cart/van.

b) The gates used to be closed occasionally to prevent intrusion of flood water at the harvesting stage of crops. Under normal circumstances, the intrusion of water through the one vent gates is not a source of worry. Under more severe flooding, as was the case in 1991, the need for protecting the sugarcane and T. Aman fields could arise.

c) If the gates could be operated easily and timely there is some potential for promoting greater security to agriculture.

2.5.2 Negative Impacts

a) Drainage congestion has been aggravated, especially in the Belta area, as a result of silting up of khals, and in some areas people have built houses on dried up khal beds.

b) The original concept of the gates remains unclear. Although the project documents seem to imply that the purpose was irrigation, this role is difficult to justify.

c) A small amount of crop damage has been reported due to non-functioning of the gates (which were kept open).

2.6 OBSERVATIONS AND RECOMMENDATIONS

1. A detailed study is needed to examine the need for the gates, taking into account the often conflicting positions and opinions of the local people in and around the area.

2. The gates should be made easily operable by providing appropriate fall boards that are easy to put in place or take out as desired. Existing boards, even when traceable are extremely unwieldy.

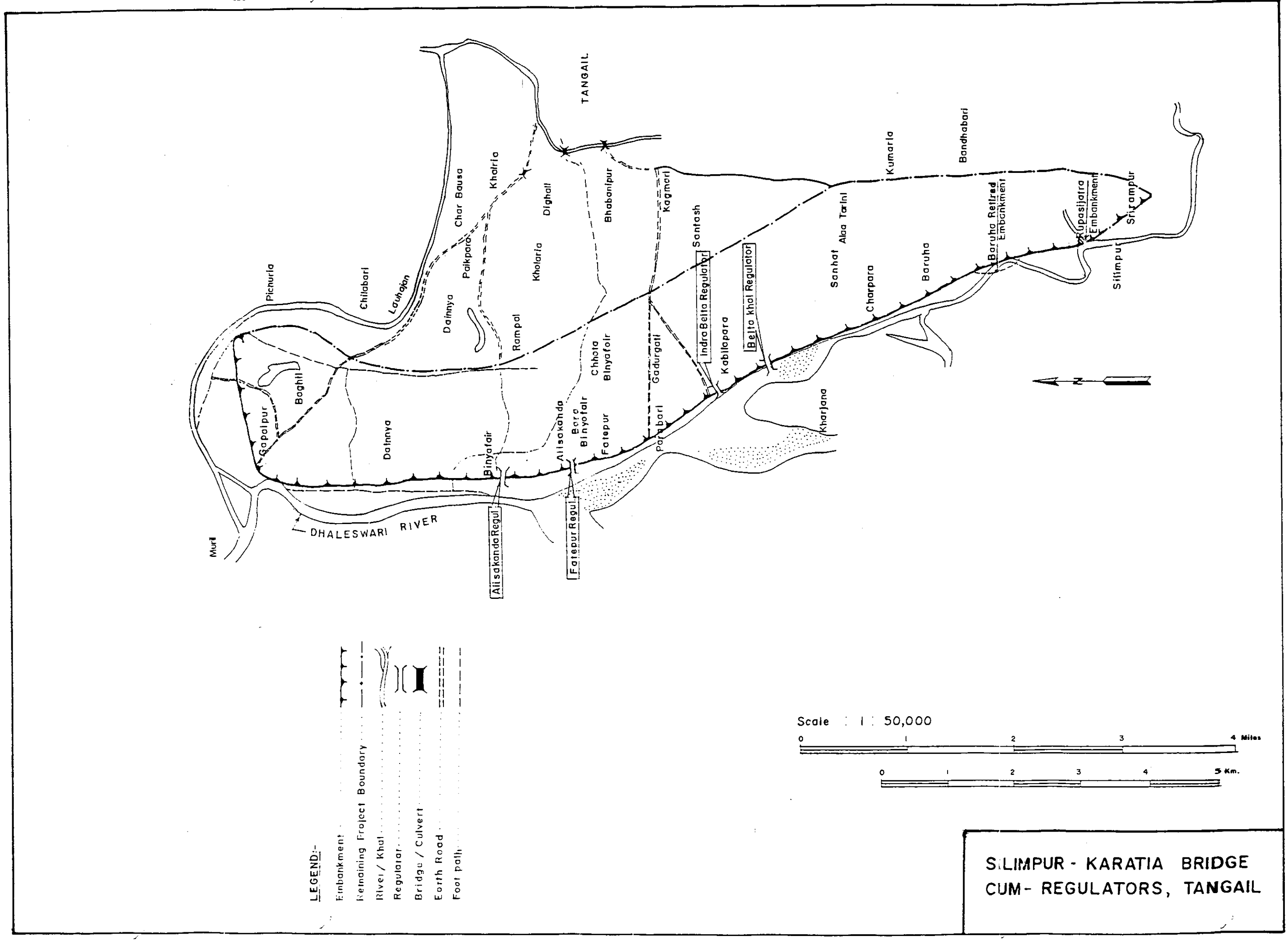
3. The problem of drainage congestion would require re-excavation of the khals. However, such steps will be resisted by all those who are already using these lands for cultivation or homesteads. Indeed the benefits of re-excavation may not be very large, given the susceptibility of inundation from the east (see below).

4. The gates cannot of course be considered in isolation from other developments in the area. Thus the amount of water entering through the gates, even at peak flow levels, is small. The water from the Lauhojang enters the area from the eastern side of the project anyway, and is the major source of inundation during the monsoon season. In normal years, the degree of flooding does not appear to cause any problem. Even in 1991 when floods have been more intense than normal, crop damage has been slight in the area.

5. It would be necessary to regulate the flooding from the Louhajang River in order to promote a more comprehensive approach to flood control and drainage in the area. The construction of a regulator on the Louhajang requires serious consideration.

6. The drainage problem due to lack of internal drainage facilities, needs to be tackled through creation of drainage structures.

Figure: 2.1 Slimpur-Karatia Bridge-cum-Regulators Project showing locations visited and Key Features



3 INSTITUTIONAL ASPECTS

3.1 INTRODUCTION

According to the available records and narration of knowledgeable local people, the project was originally constructed by the Tangail Thana Council in collaboration with Silimpur and Dainnya Union Councils under the Basic Democracy system of the then East Pakistan. At first in the 1964-65 financial year the Thana Council made a grant of Rs. 1,00,000/- for construction of the embankments on the right bank of the Pungli river, Gala khal and the Lauhojang river, along with the left banks of the Dhaleswari and Elanjani rivers. The total length of the embankment on both sides of the rivers and khals was approximately 42.7 kilometers. The main objective was to protect 7000 acres of land from annual floods from the rivers mentioned above.

The local people participated in building the embankments by way of contribution of voluntary labour and paddy donations, over a period of several years. These supplemented allocations received under the Rural Works Programme. Later on the local bodies requested the then Water and Power Development Authority (WAPDA) to take up the project for improvement. The embankment was open at the khals and the rivers over which bamboo bridges were constructed for crossing, but allowing country boats to pass through with cargo and passengers.

3.2 THE PROJECTS

On receipt of the request from the local bodies eg. the union councils, the Water Board made feasibility studies and built 4 (four) Regulators under IDA credit No 955 BD at Binnafair, Fatepur, Indra Belta and Bara Belta khals. These are all one vent 3'x4' brick-built masonry regulators.

3.3 POST-PROJECT INSTITUTIONAL DEVELOPMENTS

It has been an agreed government policy that the responsibility for operation and maintenance (O&M) of small scale drainage irrigation and flood control sub-projects, ultimately be entrusted to local administrative bodies such as Upazilas, Union Parishads etc. They would be expected to mobilize public participation for O&M activities. However, at present the financial and technical resources of Upazilas and other bodies are not sufficient to permit them to properly carry out this responsibility. So it is felt necessary that the BWDB participate in the O&M process for an interim period of time, mobilizing public participation to the greatest possible extent.

3.3.1 Local Project Committee

In order to ensure that local government agencies are directly involved and to encourage active participation by the beneficiaries at all stages of project planning, implementation, operation and maintenance, a local project committee (LPC) would be established at the planning stage for each sub-project. The Government of Bangladesh has now decided that for all small scale flood control drainage and irrigation projects, a local committee would be set up, with the following composition:

(1) Chairman of concerned Upazila	Chairman
(2) Water Board Engineer	Secretary
(3) Union Parishad Chairmen	Member
(4) Beneficiary Representatives 7-10 Nos	Member
(5) UNO	Member
(6) Upazila Engineer	Member
(7) Upazila BADC officer	Member
(8) Upazila RD officer	Member
(9) Upazila Fishery officer	Member

The LPC was to be formed at the pre-project meeting.

The Silimpur-Karatia project was completed in financial year 1983-84 and the local Water Board authority at Tangail assigned one work associate to mobilize local participation and encourage beneficiaries to get involved in operation and maintenance of the sluice gates of the project at Fatepur, Alisakanda, Indra-Belta and Bara-Belta. Five-member committees were formed for each of the gates. The committees apparently did not function well as there was no incentive for them to undertake such responsibilities. Moreover, the fall-boards did not fit well in the brick-built structure. Once the fall-boards were put in, it was difficult to remove them later on.

These committees did not get much support from the local people as they did not command any legitimacy or authority over anybody.

3.4 SUPPORTING INSTITUTIONS

Since the project was completed there were other types of institutional developments in the area such as BRDB cooperatives, Artisan's Cooperatives and the Grameen Bank groups and Centres. These institutions helped in the generation of various types of income raising productive activities for both male and female sections of the population.

BRDB also made experiments in irrigated agriculture through sinking of deep tubewells with buried-pipe-system water distribution. This has increased the acreage of irrigated land from 60 to 100 acres per DTW, with per acre yields of 50 maunds of paddy.

The Artisan's cooperative societies had 56 family heads as members within the project area. They were weaving famous Tangail saries. Both male and female members were found active in their trade. The Artisan's Cooperatives have become inactive because of lack of resources and in their place the Grameen Bank has stepped in.

The Grameen Bank was operating in a big way in diversified activities, having several branches within the project area. The Bank advanced credit facilities for the following trades:

(1) Cow purchase	(2) Cloth shop
(3) General store	(4) Beef fattening
(5) Spices	(6) Weaving
(7) Rickshaw perches	(8) Vegetable gardening and
(9) Trading	(10) Fish Ponds

BRDB Women's Programme have recently organized several groups in the project area and promoted women activities in the following

(1) Poultry raising	106 families
(2) Milk cow raising	202 families
(3) Fruit tree plantation	34 families
(4) Vegetable seed raising	26 families

It was reported that all the group members together received credit to the extent of over seven hundred thousand taka and the repayment record was over 98%.

3.5 RECOMMENDATIONS AND CONCLUSIONS

1. The Silimpur-Karatia embankment was a locally initiated project which later on received supported from the Water Development Board, Tangail.

2. The people appreciated the benefits derived from prevention of flood from the Dhaleswari and Jamuna rivers.

3. Since the construction of the 4 (four) Regulators the Water Board got more involved in the project area for operation and maintenance of the project.

4. Because of flood protection and additional security various types of institutional developments have taken place in the project area.

5. Regulator committees have never functioned properly and the regulators remained ineffective.

6. The Union Parishads should be involved in operation and maintenance of the regulators

7. There must be a series of public meetings and thorough disucssions on pros and cons of every FCD/I project before undertaking such projects in a particular area for ensuring local participation.

4 AGRICULTURAL IMPACT

4.1 INTRODUCTION

The Silimpur-Karatia Flood Embankment Project was initiated in 1962 as a flood protection project. In 1975 the embankment was repaired under the Food for Work Programme and resectioning was necessitated after the 1988 floods. The project includes four sluice gates installed in 1984 to control floods and allow controlled irrigation. These gates represent a seperate investment on a pre-existent project. This RRA aims to assess the impact of these gates, eg. on the agriculture of the area. The Lauhojang River forms the north-eastern boundary of the project, and contributes to seasonal flooding in the area. There are two points on the embankment which were breached in 1988, but has not been repaired.

4.1.2 CROPS AND CROPPING PATTERNS

According to the Upazila Agricultural Office, the cropping intensity in the project is around 180 percent.

The higher lands are dominated by homestead areas, gardens, and village roads. In the medium highland, Aus and jute followed by T. Aman HYV or Rabi crops or even sugarcane, are grown under rainfed conditions. Boro HYV cannot be cultivated because of the high water requirement in a sandy enviroment. On Medium Low land, oil crops or Rabi pulses are grown on residual moisture after rainfed B. Aman has been harvested and before Boro HYV paddy is transplanted under irrigation. Aman followed by Boro HYV is also another important cropping pattern.

4.1.3 INPUT USE AND CROP MANAGEMENT

Modern cultivation practices involving the use of chemical fertilisers, pesticides etc. were already widespread in the pre-project (ie. before gate) situation.

4.1.4 YIELD

Given the widespread diffusion of HYV paddy for both T. Aman and Boro, the average yield of all types of paddy was relatively high, at about 1.8 tons per hectare. The yields of Jute and pulses were 1.2 and 0.6 tons per hectare respectively (Table 4.3).

4.1.5 DATA SOURCES

- Interviews with farmers from sample mouzas, selected from each land level category;
- Agro-ecological Regions of Bangladesh, UNDP/FAO 1988.
- 1983-84 Census of Agriculture, Tangail District, BBS, 1988.
- Small Area Atlas of Bangladesh, BBS, 1986.

4.2 THE VALUE AND FEASIBILITY OF PROJECT OBJECTIVES

The project objective is to allow controlled flooding of the area to promote irigation as

well as flood control. While in principle this appears to be a sensible idea, the fact that the gates are narrow (one vent sluices) and the potential volume of water entering is small, makes the realism of the objective dubious. Further, the river remains dry for 7 to 8 months in a year, so that the potential for winter irrigation is nil. The gates have however served to reduce the volume of water entering from the Dhaleswari, along the western side.

4.3 ACTUAL IMPACT

4.3.1 AS PLANNED

Positive Impacts

a) There has been some acreage expansion of T. Aman (both HYV and LIV) in the medium-highland and medium lowland areas.

b) There has been some substitution of T.Aman local variety by T.Aman HYV, especially in the lowland.

c) Although the cropping pattern has not changed significantly, flood damage has been reduced because of the gates.

Negative Impacts

According to farmers, soil fertility has decreased because of the reduced water flow. Reduced flood levels have also led to an increase in water stress.

4.4 UNINTENDED IMPACTS

4.4.1 Positive Impacts

The project appears to have generated a positive attitude towards realization of full flood control in the area, with the tentative move by the Union and Upazila Parishads to have a regulator installed on the Louhajang.

4.4.2 Negative Impacts

a) The gates have generated substantial social conflict because of their differential impact on social and professional groups, eg. boatmen and farmers, those nearer the embankment and those further away, those outside vs those inside, and those owning low lands and those owning higher land. Conflicts tend to center around the timing of the closing of the gates. Generally the default situation was found to prevail (ie. the gates remained open).

b) Pest related crop damage has increased because of drier conditions and greater availability of food.

c) Jute quality has been adversely affected by reduced water flow, which makes it difficult to treat the raw jute (retting).

4.5 OTHER OBSERVATIONS

a) The cropping intensity in the post-project situation is estimated at 190 percent, an increase of ten percent over the pre-project situation. The increase in the irrigated double cropped in the medium lowland, may be attributed to an improvement in the flooding condition.

b) Paddy production is estimated to have increased from 2,200 tons to 2,500 tons per year. This increase in production is not attributable only to the improvement in flooding or drainage but also to increased paddy production under ground water irrigation (see Table 3).

Table 4.1: Area by Normal Flood Level and Submergence Period

Land Level	Area (ha)	Pre-Project												Post-Project											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Highland (more than 11.0 m)	364 (31.0%)	=====												=====											
Medium Highland (10.4-11.0 m)	326 (27.8%)	===****===												=========											
Medium Lowland (9.8-10.4 m)	282 (24.0%)	===********===												===********===											
Lowland (Less than 9.8 m)	198 (17.2%)	==**********===												===**********===											
Total	1,170 (100.0%)																								

Legend: === Ocassionally submerged
*** Fully submerged

Source: Tentatively estimated by Consultant on the basis of contour map in the scale of 1:15,840 and field observation.

Table 4.2: Estimated Land Use and Cropping Pattern

(unit: ha)

Item	Pre-Project					Post Project				
	Total	H	MH	ML	L	Total	H	MH	ML	L
1. Gross Area	1,170	360	330	280	200	1,170	360	330	280	200
2. Non-cultivated area	970	200	0	0	200	970	200	0	0	0
3. Net cultivated area	970	160	330	280	200	970	160	330	280	200
4. Gross cropped area	1,750					1,840				
(1) Single cropping (Total)	280	30	170		100	250	30	120		100
B. Mixed Aus and Aman	170		170			120		120		
T. Boro HYV	80				80	80				80
T. Boro LV	20				20	20				20
Sugarcane	30	30				30	30			
(2) Double cropping (Total)	540	130	30	280	100	570	130	60	280	100
T. Aus LV + Rabi Upland Crops	10			10		10			10	
Jute + Rabi Upland Crops	150	130	20			150	130	20		
T. Aman LV + T. Boro HYV	40			40		40			40	
T. Aman HYV + T. Boro HYV	140		10	130		190		40	150	
B. Aman + Rabi Upland Crops	200			100	100	180			80	100
(3) Triple cropping (Total)	130		130			150		150		
T. Aman LV + Pulses + T. Boro HYV	130		130			150		150		
5. Cropping Intensity (%)	180					190				

Note: H - Highland, MH - Medium Highland, ML - Medium Lowland, L - Lowland

Source: Estimated by Consultants on the basis of the gross area and the net cultivated area in the concerned document and the data provided by the Tangail upazila Agricultural Extension Office

TABLE 4.3: ESTIMATED CROP PRODUCTION OF MAJOR CROPS

Crop	Pre-Project			Post-Project		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1. Paddy						
(1) B. Aus	170	1.40	238	120	1.40	168
(2) T. Aus LV	10	1.30	13	10	1.40	14
(3) B. Aman	370	0.80	296	300	0.80	240
(4) T. Aman LV	170	1.50	255	190	1.60	304
(5) T. Aman HYV	140	2.30	322	190	2.50	475
(6) T. Boro LV	20	2.00	40	20	2.00	40
(7) T. Boro HYV	390	2.80	1,092	460	2.80	1,288
(Subtotal)	(1,270)	(1.78)	(2,256)	(1,290)	(1.96)	(2,529)
2. Jute	150	1.20	180	150	1.20	180
3. Rabi Upland Crops (represented by pulses)	490	0.60	294	490	0.60	294
4. Sugarcane	30	28.0	840	30	28.0	840
Total	1,940		3,570	1,960		3,840

Note : The total harvested area of crops are not same to the total gross cropped area because the cropping of B. Aus and Aman (Mixed) are harvested twice.

Source : The harvested area is refeerred to Table 2 and the yield are estimated on the basis of the result of field survey

TABLE 4.4: Mauzawise General Information

Union/Mouza	All H.H	Farm H.H.				Cultivated Area (ha)	Irrigated Area (ha)	Agricult. Labour H.H.	No. of Livestock			Total Area (ha)
		Total	Small	Medium	Large				Bovine	Sheep & Goat	Poultry	
1. Danya/Porabari Union	958	738	559	158	21	463	69	392	1,534	1,120	2,839	467
(1) Alisakanda	105	66	53	10	3	33	6	22	140	100	265	31
(2) Bara Binyafair	124	94	78	15	1	50	15	26	153	124	494	83
(3) Chhota Binyafair	189	135	107	24	4	79	27	120	260	152	689	95
(4) Danya Paranballabh	28	18	15	3	0	8	4	15	47	36	80	11
(5) Fatehpur	446	367	260	96	11	264	17	195	804	629	1,106	(1) 212
(6) Porabari Union	66	58	46	10	2	29	0	14	130	79	205	(1) 35
2. Silimpur	1,536	1,121	947	159	19	504	65	542	1,805	1,268	4,759	686
(1) Baniabari	57	24	20	4	4	12	0	21	47	8	97	10
(2) Belta Rakshit	235	168	147	17	4	74	26	89	323	279	1,483	159
(3) Belta Sarai (1)	414	307	247	54	6	164	8	147	528	406	1,306	202
(4) Dighirpar	N. A.											
(5) Gadurgati	182	119	105	14	0	164	6	85	162	62	362	68
(6) Indra Belta	98	70	54	16	0	40	1	12	121	133	165	35
(7) Kabilapara	177	149	140	9	0	37	2	51	167	56	201	61
(8) Kendua	213	138	116	18	4	35	1	34	182	152	607	70
(9) Sanhat	160	146	118	27	1	83	21	103	275	172	538	81
Total	2,424	1,859	1,506	317	40	967	134	934	3,339	2,388	7,598	1,153

Source : Agricultural Census, 1983-84 for data except for total area (the total area is estimated on the basis of the respective Mauza area covered by the project.

Note :(1)Assumed on the basis that 50 percent of the respective Mauza area are covered by the project.

TABLE 4.5: Area Under Crops By Mauza

Union/Mouza	Net Crops	Gross Cropped	Cropping Intensity	Paddy				Paddy HYV	Wheat	Pulses	Sugar-cane	Oil-Seeds	Jute	Vegetables
				Total	Aus	Aman	Boro							
1. Danya/Porabari	428	664	1,191	385	206	122	57	60	30	93	1	60	98	36
(1) Alisakanda	29	64	221	32	13	13	6	6	2	6	0	5	9	3
(2) Bara Binyafair	43	91	212	51	19	17	15	15	2	8	0	11	10	3
(3) Chhota Binyafair	76	15	197	89	31	31	27	29	4	11	0	13	16	7
(4) Danya Paranballabh	8	13	163	7	4	0	3	0	0	0	0	1	2	1
(5) Fatehpur	249	429	172	185	126	53	6	10	21	62	1	27	55	20
(6) Porabari	23	52	226	21	13	8	0	0	1	6	0	3	6	2
2. Silimpur	463	1,010	1,646	479	275	202	2	72	64	118	12	96	110	49
(1) Baniabari	11	30	273	15	7	8	0	0	2	3	0	2	2	1
(2) Belta Rakshit	68	151	222	76	48	28	0	27	8	12	0	24	14	11
(3) Belta Sarai [1]	157	288	183	177	94	23	0	8	28	31	12	31	33	15
(4) Dighirpar	N. A.													
(5) Gadurgati	36	86	239	49	28	21	0	8	2	10	0	6	8	6
(6) Indra Belta	35	81	231	41	20	20	1	1	2	13	0	7	7	4
(7) Kabilapara	26	50	192	25	17	8	0	2	1	9	0	4	4	2
(8) Kendua	49	133	271	73	35	37	1	0	8	16	0	12	12	5
(9) Sanhat	81	191	235	83	26	57	0	26	13	24	2	12	30	5
Total	891	1,674	3,037	864	481	324	59	138	94	211	13	158	208	85

Note: [1]Assumed on the basis that 50 percent of respective Mauza area would be covered by the project.

Source: 1983-84 Agricultural Census.

5 LIVESTOCK

5.1 PRE-PROJECT SITUATION

Livestock data are available from the Bangladesh Census of Agriculture and Livestock for the year 1983-84. According to the Census, there were about 18 thousand bovine animals, 13 thousand goats and sheep, and about 36 thousand poultry in the project area (Table 5.1). Per household number of bovines, sheep/goats and poultry were reported to be 1.6, 1.1 and 3.2 respectively in 1983-84, compared to 1.7, 1.2 and 4.1 respectively, in the Upazila as a whole. The project area therefore appears to be slightly better endowed with poultry.

In Tangail Sadar Upazila, about 55 per cent of all households possessed bovine animals in the pre-project period; of the farm households, 68 per cent and of the non-farm households, only 15 per cent reported possession of these animals (Table 5.3). The figures for the country, as a whole, were 66 and 14 per cent respectively for the same period. Per acre (cultivated) availability of bovine animals in the project area is estimated to have been 1.4 in the pre-project period, as against 1.4 for Tangail District and, 1.0 for the country, as a whole.

5.2 PROJECT OBJECTIVES

As in most other FCD/I projects, the project under study had no planned objectives, explicit or implicit, as to its probable impact on livestock, or concerning overall sectoral development.

5.3 SOURCE OF DATA

No document other than the Project Proforma (PP) was available; no feasibility study was carried out either. This RRA had to be based mainly on data collected from various primary sources. In particular, interviews were conducted with livestock officials, farmers, traders and other knowledgeable persons.

5.4 FINDINGS

There are many intervention variables that are likely to come into play in generating changes on various sub-sectors of the economy. It is thus very difficult to segregate impacts due to the project. It is virtually impossible to isolate the impact of small structures like one-vent gates, independent of the full flood embankment on which these are situated.

Some of the changes that have taken place during the post-project period are outlined below, with the caveat that these changes may have nothing to do with the project.

5.4.1 Positive Findings

Poultry rearing

Poultry rearing appears to have become more popular in the project area. Both the

percentage of households raising chickens and the per household number of chickens have considerably increased. Based on information collected from the Upazila livestock office, the number of poultry is estimated to have increased to roughly 50 thousand at present, from 36 thousand in 1983-84, a net increase of about 40 per cent. Almost every household at present engages in poultry keeping - an activity which does not demand much attention, and is usually carried out by poor rural women. Per household number of poultry is estimated to be 6 at present as against 3.2 in 1983-84. Free vaccination programmes and availability of credit extended to poor women by local NGOs, have probably had a positive impact, along with greater foodgrain availability.

In the past, diseases such as ranikhet were widespread. This killer disease has been dramatically reduced at present. A number of poultry firms have emerged at private initiative in the recent past. Out of 20 such firms (including 3 duck firms) in the Upazila, five are currently operating in the project area.

5.4.2 Negative findings

As in most other FCD/I projects, the increased cropping intensity and the change in cropping pattern has had adverse effects on the livestock population.

a) **Bovine population**

The percentage of households owning bovine animals and per household number of such animals, appear to have declined but this is not necessarily Project related. The net decrease in the bovine population is estimated at 20 - 25 per cent. One can identify a number of factors for this decline. In the recent past, the proportion of grazing land has considerably declined. The situation has been aggravated following the construction of the flood control embankment, as a result of which vast char areas outside this embankment have become unsuitable for cattle grazing due to severe inundation. This has generated an acute shortage of green fodder in the area. On the other hand, there has not been any noticeable effort, on the part of the livestock office, towards initiating cultivation of forage crops in order to mitigate the shortage of green fodder.

The cropping pattern has slightly changed following the construction of the gates. HYV boro has replaced pulses and oilseed cultivation. This has hindered the availability of pulse straw, pulse bran and oilcake which are important sources of nutritious feed for cattle. While the Upazila itself has been a deficit area in paddy production (annual deficit is roughly 13 thousand M. tons), the project area appears not to be an exception. Although HYV Boro is performing modestly, (which is in no way due to the project) the adoption of HYV Aman is far from satisfactory. The availability of straw remains a problem. Acute problems in storing straw, especially in the wet season, have also been reported. Further, according to the livestock office, the urea treatment technique for straw has yet to be desseminated amongst farmers.

b) **Availability of draught animals**

On average, a farm household in the project area currently owns about 0.9 bovine animals. The situation with respect to the availability of draught animals has been gradually getting worse. Farmers have reported that in order to cope with the draught shortage, they have begun to reduce the number of tillages below what is actually required. Quite a number of farmers reported that they now plough 1-2 times instead of 4-5 times, due to shortage of draught animals, implying that crop production may have suffered.

However, it is difficult to attribute this situation to the project. The maintenance cost of draught animals has increased. The feed cost of a pair of animals is estimated at Tk.8213.

5.5 LESSONS

Considering the fact that livestock are an integral part of the farming system, future FCD/I projects should carefully consider the implications and consequences for livestock, at the project formulation stage.

Policies and measures towards development of feed and fodder for livestock should be devised, in order to mitigate the negative effects of FCD/I projects on feedstuffs.

Table 5.1 Livestock holdings by Unions of the project area: 1983-84

Union	Number of		
	Bovine animals	Sheep and goat	Poultry birds
Baghil	4,867	3,440	7,207
Dainnya	2,691	1,984	5,731
Porabari	2,171	1,511	3,381
Silimpur	8,125	5,663	19,483
Total project area	17,854	12,598	35,802
Total Upazila (Tangail Sadar)	63,886	46,984	156,048

Source: i) The Bangladesh Census of Agriculture and Livestock: 1983-84
ii) Published and unpublished data collected from Upazila office.

Table 5.2 Per household livestock holdings by Unions of the project area: 1983-84

Union	Number of H.H.	Number of farm H.H.	Per household* number of		
			Bovine animals	Sheep and goat	Poultry birds
Baghil	3310	2464	1.5	1.0	2.2
Dainnya	1790	1445	1.5	1.1	3.2
Porabari	1226	1019	1.8	1.2	2.8
Silimpur	4955	3852	1.6	1.1	3.9
Total Project area	11,281	8,780	1.6	1.1	3.2
Total Upazila (Tangail Sadar)	38,151	29,343	1.7	1.2	4.1
Average Upazila in Bangladesh	-	-	1.5	1.0	5.1

Source: i) The Bangladesh Census of Agriculture and Livestock: 1983-84
ii) Published and unpublished data collected from Upazila officer.

* Average estimated on the basis of all HH.

Table 5.3 Bovine population by size of farm holding in Tangail Sadar Upazila: 1983-84

	Bovine population by farm-holding					
	Small farm	Medium farm	Large farm	All farm HH	All Non-farm HH	All HH
% of HH having bovine animal	58.3	97.6	98.0	68.4	14.7	55.0
No. of bovine per reporting HH	2.3	4.0	6.8	3.1 (2.1)	1.7 (0.2)	2.8 (1.7)
% of HH having sheep/goat	48.5	63.0	71.1	52.6	31.2	47.3
No. of sheep/goat per reporting HH	2.4	3.1	3.9	2.7 (1.4)	2.2 (0.7)	2.6 (1.2)

Source: i) The Bangladesh Census of Agriculture and Livestock: 1983-84
ii) Published and unpublished data collected from Upazila office.

Note: The figures in brackets show averages over all HH.

Table 5.4 Poultry population by size of farm holding in Tangail Sadar Upazila: 1983-84

	Poultry bird population by farm-holding					
	Small farm	Medium farm	Large farm	All farm HH	All Non-farm HH	All HH
% of HH having poultry	77.5	91.2	94.4	81.2	50.9	73.6
No. of poultry per reporting HH	5.0	7.3	10.9	5.8	1.8	4.8
No. of poultry per all HH	3.9	6.7	10.3	4.7	0.9	3.5

Source: i) The Bangladesh Census of Agriculture and Livestock: 1983-84
ii) Published and unpublished data collected from Upazila office.

Note: The figures in brackets show averages over all HH.

6 FISHERIES

6.1 PRE-PROJECT SITUATION

The project area is surrounded by the rivers Dhaleswari, Lauhojang and Elanjani. In addition, there are a number of canals and water channels, namely Binnafair khal, Fatehpur khal, Baruha khal, Rupsa khal, Gala khal, Alisakanda khal, Bara Belta khal. There are a number of beels such as the Gurki, Dharabaita, Rampal, Bara beel, Dainnya beel, Panch Kawanna beel, Gatabari and Jailla. All these water bodies including some marshy land would go under water for much of the year. These formed the natural breeding grounds for different species of fish, around which there grew up a significant fishing community. In other words, fishing used to be an important economic activity supporting full time fishermen.

6.2 OBJECTIVES

The possible impact on fisheries was not explicitly considered during the project planning stage. It is expected, however, that the project would in fact have some impact on the fish population in the region.

6.3 PROJECT IMPACT

6.3.1 Positive Impacts

1. The sluice gates are narrow having only one vent regulators. During the high stage of the water level outside the embankment, there is a great rush of water at the mouth of the regulators. This facilitates fishing in the khals and at the mouth of the gates. The greater the flow of water, the higher is the catch. These points form the main fishing area during the monsoons. This can be observed at the mouth of Fatehpur (Alisakanda khal) and Binnafair (Binnafair khal) regulators. There are 40 fishermen's families in Darjipara and Batoa Jaini villages of Fatehpur union, of which 34 families hold a fishing licence. They are able to survive on fishing, earning a daily income of Tk. 30 to 40 each on average, with a seasonal variation of Taka 20 to 100. Their incomes peak during the monsoons. Some of the fishermen are adopting family planning measures.

   The major fish varieties are Puritius (Puti), local varieties of Hetero pneustes (singi), small fishes, Anabas (Koi), Channa (Sail), Clarias (Magur), Boal, Ruhi, Katla etc.

2. The number of fish-ponds has increased. In Fatehpur mouza there were no ponds in the pre-project period. There are now 3 ponds for fish cultivation. In other ponds in the area, farmers have gone into fish culture, because of the more secure environment. They cultivate Ruhi, Katla and Silver Carps.

6.3.2 Negative Impacts

There has been a substantial reduction of fish production in the area with the reduced water flow in the khals and canals due to the embankment and the gates. Some of the canals

like Fatehpur has been silted up. At some points the canal has been converted into paddy fields and homesteads. At many points roads and barriers have been built, eg. on Alisakanda and Fatehpur khals.

The construction of the gates and the closing of the canal mouths has meant that fishing boats are no longer able to enter the project area. Traditionally this was a fish surplus area, but now it has been reduced to a deficit area.

6.4 OBSERVATIONS AND RECOMMENDATIONS

Although the fish population has been considerably reduced, there is substantial scope for expansion of culture fisheries through proper maintenance and re-excavation of the canals and other water bodies. Fish culture can be combined with paddy cultivation in the numerous beels in the area.

The Fisheries department of the government could take an initiative, with the help of local authorities and NGOs, to realise the fishing potential present. It may be noted, for example, that the Moulana Bhasani Foundation is supporting fish culture projects in 19 ponds and tanks in and around the project area.

7 SOCIAL IMPACT

7.1 PRE-PROJECT SITUATION

There does not appear to have been a traditional ruling class in the area, which formed part of the Zamindari estate of the Maharaja of Santosh. The land owning pattern presented in Table 7.1, is an indication of the socio-economic condition of the area in the late 1970s/ early 1980s. This can be compared with the data in Table 7.2, which depicts the situation for the nation as a whole. The percentage of households with no land is found to be greater (11.1%) in this Upazila compared to the national average (8.7%). In the category of 25 acres and above, it is less (0.11%) compared to 0.20% for the nation as a whole.

The area used to be a labour surplus area, with significant seasonal out-migration of agricultural wage labourers to Sylhet and Dhaka. There was a small market for female agricultural wage labour as well.

Traditional sharecropping and moneylending were widespread here. Informal moneylending rates ranged from 100% to 120% for a monsoon. Dadon or advance sale of crops was common as well. Institutional sources of money lending included Krishi Bank, BRDB, and Grameen Bank.

The Moulana Bhasani Foundation at Santosh is a charitable organization engaged in the fields of education, social welfare and development activities. Organizations like the Grameen Bank and BRDB have been in operation in this area for the last ten years.

The physical infrastructure of the area was poorly developed and boats were the dominant means of communication in the monsoon season. In the dry season mud-roads and bullock carts were the main modes of transport.

7.2 OBJECTIVES

There was no explicit Project objective for improving social and rural service facilities. Nevertheless there was an expectation that due to the Project there would be a change in the social structure and in rural development services, including education, co-operatives and income generating activities.

7.3 IMPACT OF THE PROJECT

7.3.1 Positive Impacts

The closing of the embankment by the gates has allowed it to be used as a thoroughfare, facilitating the movement of bullock carts, rickshaw vans and pedestrians. Improved communications of this type is expected to have a beneficial impact on social and economic exchange and interplay.

7.3.2 Negative Impacts

Whatever positive impacts that may have been generated appear to have been outweighed by the negative ones. The gates have contributed to heightened social tensions in the area, created serious social conflict in the area, with different socio-economic groups taking a different stand on the issue. The broad contradictions are indicated below.

i. Conflicts between those outside the embankment and those inside;

ii. Those owning/cultivating high lands versus those owning/cultivating low lands;

iii. Farmers versus boatmen;

iv. Fishermen versus cultivators.

There are conflicts between groups inside and outside the project. The outsiders complain the project is benefiting the insiders at their cost. Had there been no embankment or regulators the sufferings of the outsiders would have been lessened. Frequent complaints were heard from the outsiders who appear to experience more severe inundation of homestead areas than before. During the monsoon season, these antagonisms tend to surface frequently, particularly in the context of operating (ie. closing and opening) the gates. As a result the regulators are never operated as intended.

There are conflicts between farmers owning high land and those owning low land. The high landers need more water for cultivation and they can cultivate two crops of HYV. The low landers want greater control over water so that the HYV Aus and T.Aman can be safely harvested.

Farmers and boatmen have different perspectives on the gates. The villagers inside the project have serious problems of communication as boats cannot ply their traditional route within the project area. This has severely constrained employment opportunities for boatmen. Some khals have also been converted into agricultural land and homesteads.

There is conflict between fishermen and farmers as fishermen have lost some fishing grounds, and the catch has also been reduced. As mentioned earlier some khals and low lying areas have been converted to agricultural farms.

7.4 OBSERVATIONS AND RECOMMENDATIONS

1. The potential for large benefits does not exist here. Greater public participation, motivation and consensus building will undoubtedly help in generating a more positive atmosphere. This however will not be enough. It will also be necessary to have well designed fall-boards and effective gate committees, so that **when the need arises,** the gates can be operated. It is unlikely that the demand for closing these gates will occur frequently. Only in the event of unusually heavy floods (perhaps a one in five year event) such a demand may arise, as it did to an extent in 1991. The beneficiaries are not at all convinced of the project benefits.

2. The public demand was that the regulators be converted into bridges to allow boat traffic to get inside the project area.

3. The absence of consultation and dialogue amongst beneficiary groups and the lack of initiative on the part of the local government agencies, has prevented a satisfactory resolution of the problem of operating the gates as intended.

4. Inter-agency coordination among the different concerned agencies like agriculture, fishery and social forestry is essential to solve the complex problems related to social conflicts over water control and land and water use.

TABLE 7.1: Land Ownership By Area Size Of Land Owned (Upzilla: Tangail Sadar)

Type of Ownership	All House-holds	House-holds Owning No Land	Number of Households Owning Land								
			0.01- 0.04 acres	0.05- 0.49 acres	0.50-0.99 acres	1.00- 2.49 acres	2.50- 4.99 acres	5.00- 7.49 acres	7.50- 14.99 acres	15.00- 24.99 acres	25.00 acres and above
Total holdings	38151 (100)	4235 (11.10)	1653 (4.33)	10240 (26.84)	5007 (13.12)	9358 (24.52)	4838 (12.68)	1680 (4.40)	944 (2.47)	152 (.39)	44 (.11)
Holdings with no homestead area	546	158	63	139	45	90	34	12	4	0	1
Holdings with homestead but no cultivated area	4573	2157	815	1084	192	213	84	17	10	0	1
Holdings with homestead and operated area upto 0.50 acre	13329	1518	732	7649	1933	1101	265	79	43	5	4
Holdings with homestead and operated area 0.50 to 1.00 acre	5096	235	29	807	1957	1844	163	30	27	3	1
Holdings with homestead and operated area > 1.00 acre	14607	167	14	561	880	6110	4292	1542	860	144	37

Source: District Agriculture Census, Tangail, 1983-84

TABLE 7.2: Land Ownership By Area Of Land Owned (Bangladesh)

Type of Ownership	All House-holds	House-holds Owning No Land	Number of Households Owning Land								
			0.01- 0.04 acres	0.05- 0.49 acres	0.50-0.99 acres	1.00- 2.49 acres	2.50- 4.99 acres	5.00- 7.49 acres	7.50- 14.99 acres	15.00- 24.99 acres	25.00 acres and above
Total holdings	13817646 (100)	1198156 (8.67)	1305266 (9.44)	3895449 (28.19)	1660082 (12.01)	2978992 (21.55)	1597588 (11.56)	649992 (4.70)	415346 (3.00)	89047 (0.64)	27728 (0.20)
Holdings with no homestead area	276977	93539	35078	58794	21723	38484	17081	6979	4034	870	395
Holdings with homestead but no cultivated area	2713969	748965	924388	820816	75573	91235	31994	12217	6654	1464	663
Holdings with homestead and operated area upto 0.50 acre	3898181	229866	279932	2439098	564441	263774	78228	25474	13287	2402	1679
Holdings with homestead and operated area 0.50 to 1.00 acre	1702652	57475	38363	291145	688360	559593	43727	14269	7366	1288	1066
Holdings with homestead and operated area > 1.00 acre	5225867	68311	27505	285596	309985	2025906	1426558	591053	384005	83023	23925

Source: The Bangladesh Census of Agriculture and Livestock, 1983-84

8 IMPACT ON WOMEN

8.1 DATA SOURCES

Interviews with both men and women in the Project area were the main sources of data in the absence of documentary information on the status of women in the villages under the project. Local Upazila officials also provided important information which helped the team to understand the impact of the Project on women.

8.2 PROJECT OBJECTIVE

The Project did not have any explicit objective to improve the status of women in terms of increased employment opportunities and incomes. But the implicit objective, which can be inferred from the main objective of the Project, is that women would be able to find more work during the post-harvest period and thus be benefitted from increased agricultural output as a result of the Project. Increased scope for female employment through embankment maintenance work would also be within the purview of Project objectives.

8.3 PRE-PROJECT SITUATION

Women residing in the villages within the Unions of Dainnya, Porabari and Silimpur of Tangail Sadar Upazila were involved in a number of activities, mostly concentrated within the homestead area. These included threshing paddy and wheat, parboiling and drying paddy, husking paddy and pulses, storing and preserving rice, pulses, stripping jute fibre, washing and drying jute sticks, looking after cows, goats, chicken and ducks, making hand-fans, sewing kantha, quilt making, making baskets with bamboo, preparing fishing nets and all kinds of household chores. Women from poor families used to find work in the rich families for paddy processing during the months of Baishakh, Jaistha, Agrahayan and Poush. These women had to do only household activities and vegetable gardening in the homestead area during the other months of the year.

8.4 POST-PROJECT SITUATION

8.4.1 Farm Activity

Women's farm activities after the project have not changed that much. In the month of Jaistha women have to remain busy for processing HYV paddy while in the month of Chaitra they remain involved in wheat processing. About 30 per cent of women work in other people's houses to process paddy. They get 3 meals per day plus half a maund of paddy, or in some cases one saree, for the work. During Ashar and Sraban women have to strip jute, wash the jute sticks, dry the sticks and preserve these for cooking fuel. They also cut sugarcane along with the men. In the month of Agrahayan and Poush women again remain busy for processing Aman paddy.

Vegetable gardening in the homestead area has increased tremendously, which is in part attributable to improved water control in the area.

8.4.2 Non Farm Activity

The direct impact of the embankment is the creation of employment opportunities for distressed women. A number of women were found to be engaged in earthwork and repairing of the embankment and roads under the CARE Road Maintenance Programme (RMP). These women get Tk. 720 per month for this work. The activities of NGOs and other organisations have been facilitated to a great extent by the improved roads. There are quite a few Grameen Bank women's groups in the area. The operation of Grameen Bank has helped poor women to be involved in a number of non-traditional activities and to increase family income. The amount of loan provided by the Bank to its beneficiaries ranges from Tk.2000 - 5000 per person depending on their duration of membership of the Bank. The women invest the money in paddy or pulse processing, cattle and poultry rearing, homestead gardening, shop keeping, handicrafts, house construction, etc. There are also Mahila Samabaya Samity (MSS) under BRDB. Ten Unions of Tangail Sadar Upazila are under such activities where 25 Mahila Samabaya Samity (MSS) and 27 Bittahin Mahila Samabaya Samity (MBSS) are in existence.[1]

At present 1430 members belong to MSS and 1069 belong to MBSS. Among the members 370 members got loans amounting to Tk.1000 - 3000 each. They use the loans for vegetable cultivation, cattle and poultry rearing, fish cultivation and weaving. Handloom weaving is a common activity in many houses, in which at least 50% of the work are performed by women. Women remain involved in weaving activities for six months of the year on average.

8.5 CONCLUSION

Compared to many parts of Bangladesh, women's participation in economic activities is substantial in the project area. There is little doubt that superior water control has enhanced opportunities for women, but there is little scope for linking this to the gates per se.

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[1] The MSS and MBSS are Womens' Cooperatives and Assetless Womens' Cooperatives respectively.

9 IMPACT ON NUTRITION AND HEALTH

9.1 PROJECT OBJECTIVE

The Project documents describe the gates as flushing inlets which will facilitate irrigation and agricultural growth, but the project had no direct objective to improve the nutritional and health status. However, an implicit objective that can be assumed from the Project objective is that increased agricultural production as a result of irrigation facilities will ultimately have a positive impact on nutritional status.

9.2 PRESENT NUTRITIONAL STATUS

9.2.1 Food Consumption

Around a quarter of the total population in the project area appear to eat three times a day throughout the year, while the rest eat twice a day on average. At harvest, nearly two-thirds of the people have recourse to three meals a day. During this period, both men and women can work as agricultural wage labourers. Even the poorest of the poor can obtain some paddy by collecting the paddy spikes which are left behind after harvest. Sraban, Bhadra, Aswin, Kartik and Agrahayan (September to November) are the lean months for the poor, when they have to struggle to manage two meals a day. Work available at this time includes earth work and excavation of ponds. Though they get Tk. 25 - 30 per day, the money is not enough to provide three meals for their families.

Wheat consumption has grown in popularity since the rise in wheat production in recent years. Plenty of vegetables are also grown. Sale of vegetables is an important income source. In fact, one third of the income of at least 50% of the households, is derived from homestead gardens. On the other hand fruit consumption seems to have declined over the last ten years, as mature trees tend to be sold off to meet family expenditures. However, tree planting appears to have gained in popularity in more recent years.

Protein consumption has declined in the area, in part due to the decrease in fish resources (see Chapter 6).

9.2.2 Health Condition

Availability of tubewell water for drinking has reduced the health hazards of the villagers to a great extent. In fact, almost all the families have access to tubewell water. This has helped to reduce various water-borne diseases like diarrhoea. The disease profile supplied by Tangail Sadar Upazila Health and Family Planning Office shows that during the first six months of the year 1988 the number of patients (sufferring from diarrhoea and hepatitis) who came for treatment was 6397. This number declined to 5414 during the first six months of 1991. Another common disease suffered by the children is night-blindness due to inadequate protein and vitamin intake. Anaemia is also prevalent specially among the women. Night-blindness and anaemia are basically rooted in nutritional deficiency, and there are indications that their incidence is on the decline, as reported by the Upazila Health Office (Table 9.1).

Table 9.1: Disease Profile Provided by Tangail Sadar Upazila Health and Family Planning office.

Year	Diseases			
	Diarrhoea and Hepatitis	Night Blindness	Deficiency Disease	Anaemia
1988 (January - June)	6397	643	3345	3068
1991 (January - June)	5414	145	1089	2928

9.3 OBSERVATIONS

It is very difficult to attribute nutritional and health status changes to the project. The relationship between the two is indirect and weak.

The proper operation of the gates may help increase benefits in terms of agricultural production, which in turn will have an impact on their food consumption. Such an effect will at best be weak.

10 NON-FARM ACTIVITIES

10.1 INTRODUCTION

The project area supports a rich variety of non-farm activities based mainly on local resources and skills. Cottage crafts include handloom, bamboo and cane crafts, brasswork, rice mills and saw mills. There are over 1000 handloom units operating in the area, employing more than 4000 persons. There are around 125 units engaged in making bamboo and cane products, employing more than 400 people. In three villages of Dainnya union there are about 200 small enterprises specialising in brasswork; the total employment in these units is estimated at more than 900. Processing of hides and skins is an important activity as well.

10.2 THE STATUS AND TRENDS IN NON-FARM ACTIVITY

It will be seen from Table 10.1 that there are around 1500 rural industrial enterprises in the four Unions of the project area, employing over 6000 people, and accounting for 6 percent of households in the project area. In the Upazila as a whole, about 8 percent of all households are engaged in non-farm activities (Table 10.2).

Tangail Sadar in general, and the Project area in particular, is a deficit area in paddy production. The whole Upazila has a paddy deficit of 13000 mts at present. The area of the Project under study comprises more than one third of the total number of unions of the Upazila.

The number of rice mills in the Project area has been decreasing; for instance, the number of rice mills in Porabari bazar was 10 in the early 80s, which has now come down to only 2 at present. However, with the decrease in rice mills, small rice hullers operated with STW engines on seasonal basis, have emerged.

The Project area was traditionally a handloom centre. In recent years, the industry has been suffering from many constraints. High cost of raw materials, and lack of adequate and timely supply of raw materials are among the most severe constraints. As a result of this situation, many looms have now closed down. It is reported that as many as 132 out of a total of 933 looms in Porabari and Dainya Unions closed down during 1990/91.

Other industries such as saw mills, brass works, pottery and oil presses have not done well here. Similarly, activities like blacksmithing, agricultural implement manufacture, rice trading, milk trading, and fertilizer and other input trading have not experienced any remarkable growth.

The Project, consisting of one-vent sluice gates, has seriously affected navigation in the area. There has also been a decline in fish output and fishery employment. Thus unemployment and poverty have continued to rise and out-migration has increased. However, closure of the embankment has facilitated road transport, providing considerable employment to van and rickshaw pullers. Nevertheless, this has resulted in raising the cost of transporting bulk merchandise to and from the project area. It is reported that transportation costs (by boats and van) have increased about five times over the last 7-8 years.

In recent years, efforts have been made by NGOs to generate some employment opportunities for the rural poor in the locality. Mention may be made of Grameen Bank and CARE who are active here. During the field work, it was observed that teams of women were engaged in repair and maintenance work under CARE. It was gathered that on average a woman worker earns about a sum of Tk.700 per month.

Table 10.3, which is self-explanatory, presents estimated annual net returns of different economic activities. A typical large rice mill in the area processes about 8,000 maunds of paddy and 1,000 maunds of wheat a year. The net annual return is estimated at Tk. 48,000. A small rice huller, usually operated with a STW engine on a seasonal basis, processes about 1500 maunds of paddy during the season; the annual return is estimated at Tk 6,500. A typical handloom unit with four looms has a net return of Tk. 31,000 a year; however, there is considerable family labour engaged in this activity, which has not been imputed in calculating cost.

The 6-month milling season for rice husking is also the peak period for boatmen, van and rickshaw pullers. A boatman can earn Tk. 100 to Tk. 125, and a van puller Tk. 100 a day, during this season.

10.3 CONCLUDING REMARKS

The project has had a definite impact on navigation and transport and related activities. Other changes and trends discussed in the above paragraphs have little connection with the project, and could be viewed as independent effects.

Table 10.1: Small and Cottage industries and persons employed by unions in the project area: 1990.

Unions	Handloom		Rice mill		Saw mill		Brick field		Ice cream		Bamboo & Cane		Brass works	
	No.	Employ	No.	Employ	No.	Employ	No.	Employ	No.	Employ	No.	Employ	No.	Employ
Banghil	94	390	5	11	1	3	-	-	-	-	60	320	-	-
Dainya	46	170	11	30	1	4	-	-	-	-	25	40	200	930
Porabari	383	1854	4	9	1	3	1	150	1	6	10	25	-	-
Silimpur	487	1990	22	48	3	10	1	100	1	5	30	38	-	-
All	1010	4,404	42	98	6	20	2	250	2	11	125	423	200	930

Unions	Blacksmith		Welding		Leather Processing		Total	
	No.	Employ	No.	Employ	No.	Employ	No.	Employ
Banghil	18	40	1	3	-	-	179	767
Dainya	4	8	1	4	30	6-	318	1246
Porabari	15	50	-	-	-	-	415	2097
Silimpur	25	52	5	25	-	-	574	2268
All	62	150	7	32	30	6	1,486	6,378

Source: 1. Unpublished Handloom Survey Report, Tangail Sadar Upazila, 1990
2. Consultant's estimate

Table 10.2: Percentage of households engaged in cottage industries by size of land holding : Tangail Sadar Upazila 1983-84.

		Percentage of households engaged in									
Farm size	No. of HH	Hand loom	Black smith	Poultry	Bamboo & cane	Carpen-try	Brass work	Jute & cotton work	Ghani	Others	All
Small	21,629	4.3	0.2	0.2	0.6	0.5	0.3	0.1	0.3	0.9	7.4
Medium	6,782	2.2	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	2.5
Large	932	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	2.4
Non-farm	8,808	6.0	0.4	1.0	1.6	0.7	0.6	0.2	0.5	2.1	13.1
All	38,151	4.3	0.2	0.4	0.8	0.5	0.3	0.1	0.3	1.0	7.9

Source: The Bangladesh Census of Agriculture and Livestock: 1983-84

Table 10.3 : Estimated annual net returns of different economic activities.

Investment (00 Tk.)	Investment[1] (00 Tk)	Annual net return[2] (00 Tk)
Rice mill[3]	1400	480
Rice mill[4]	400	65
Saw mill	1300	360
Handloom (4 looms)	280	311
Pottery	300	135
Brass work	200	255
Fishing	30	171
Boat transport	60	336
Rickshaw/van	40	250
Blacksmithing	30	72
Bidi making	-	30

[1] Investment on only machinery and equipment

[2] Family labour not imputed in calculating cost; 'returns' have not taken into consideration of non-agricultural use, if any.

[3] Relatively large mills, having oil crushing facilities as well.

[4] Huller usually operated with STW engines on a small scale and on a part-time basis.

Source: Consultant's estimate

11 ENVIRONMENTAL IMPACT

11.1 PRE-PROJECT SITUATION

The Project area was embanked a long time ago, and represents one of several successsive, if somewhat erratic, attempts to reduce or control flooding. These attempts have gradually altered the hydrology and soil characteristics of the area, leading to changes in settlement patterns, flora and fauna and cropping behaviour. The impact of the sluice gates, which were put in place in 1983-84, cannot be isolated from the long term changes brought about by earlier investments in FCD projects.

Prior to the construction of the gates at the mouth of the four khals at Binnafair, Fatehpur, Indra Belta and Belta, water from the Dhaleswari could easily enter the Project area, linking up with the beels further east and with the Louhajang River. This allowed the area to be regularly flushed, and also provided opportunities for fishing and navigation. These were however seasonal khals, tending to dry up completely in the dry winter months. The flood embankment, along with investments in the broader Project area, is reported to have caused the Dhaleswari bed to be silted up, raising its level and increasing the risk of over spilling its banks. This however, seems unlikely in view of the fact that the flow of water was from the Dhaleswari to the Lauhojang. The winter flow of this river has been reduced, leading to a virtual dissappearance of low lift pump irrigaton from this region.

11.2 PROJECT OBJECTIVES

The sluice gates were basically intended to control the flow of water into the Project area, presumably in the interest of crop cultivation, through (a) stopping water intrusion when crops need protection and (b) allowing water to enter when crops suffer moisture stress. These objectives imply that however small, the gates would tend to alter the micro-ecology of the Project area, especially in the immediate vicinity of the khals.

11.3 APROACH AND SOURCES OF INFORMATION

Very little information on environmental aspects was available from secondary sources. This section is therefore entirely based on field interviews and observations.

11.4 PHYSICAL ENVIRONMENTAL IMPACTS

11.4.1 Transport

The closure of the mouths of the khals has allowed the gates to be operated as a continous road, suitable for eg. rickshaws. The increased road communication facility is much appreciated by the people. The negative side of this story is that boat navigation has been adversely affected, and remains a source of resentment in the local boatmen,s community.

11.4.2 Siltation

The construction of the gates has led to a rapid conversion of khas khal land in various spots into paddy fields and homestead lands. Similarly, some of the more elevated areas which were previously cultivable, are now too dry to support a crop in a sandy soil environment.

The gates have remained open for most of their life, allowing water to enter freely. However, because the openings are tiny, the amount of water entering the area is small. Nevertheless, some silt deposition appears to occur even from this reduced flow, making the HYV Boro fields uneven. Farmers have complained that the open gates mean greater care must be taken to ensure that their HYV Boro lands are suitably flat and even to allow proper irrigation.

11.4.3 Land Values

It is interesting to note that the most low-lying lands within the Project area are the most expensive, while the high lands are the least valuable, despite the fact that in the former only one crop can be grown, in the winter under irrigation. This brings out the importance of the HYV Boro crop, and the low cost of irrigation in the low lands.

11.4.4 Sand Deposition and Erosion

Erosion has not been reported in the Project area. Breaches in 1988 led to some areas of sand deposition, particularly in the south (Baruha Mouza). As much as 300 acres is reported to have been affected as a result, leading to a switch from paddy to sugarcane. Over a period of years, sand and silt deposition has gradually made the soil sandy in the upper reaches and sandy-loam in the lower reaches of the Project area.

11.4.5 Drainage Congestion

The silting up of the khals and the drying up of the beel areas in the north and east has worsened the drainage problem in the Project area.

11.4.6 Vegetation

There are very few old trees to be found in the Project area, with most of the mature ones cut down for sale as timber. However, there now appears to be a distinct interest amongst all rural households in planting commercially valuable trees, eg. mahagony, eucalyptus, bamboo and fruit trees. While this trend cannot be attributed to the Project, the improved security from floods certainly has had an impact.

The demand for fuel is met primarily from crop by-products, leaves, etc.. Generally trees are not cut down for fuel.

Gardening in the homestead area has also increased. The grass cover in areas outside the homestead has however been reduced, with greater intensity of cropping. The potential for forestry inherent in the embankment surface has not been tapped.

11.5 CONCLUDING COMMENTS

There have been a number of changes in the physical environment of the project area over the course of the last ten years and more, resulting from quite substantial changes in the hydrology of the area. While these changes cannot exclusively be attributed to the gates, it is clear that the overall Project, comprising the embankment and the gates taken together, has been instrumental in causing these changes.

Effective measures to prevent water pollution in the project area needs to be taken to halt the deterioration of water quality, for instance arising from the use of insecticides and chemical fertilisers.

12 ECONOMIC ASPECTS

12.1 INTRODUCTION

Considerable changes have taken place in the Project area since the construction of flood protection embankements and sluice gates. These changes have stemmed not only from the greater security to crop and animals brought about by reducing the dangers of severe flooding, but also due to the widespread diffusion of minor irrigation technology and the rapid expansion in HYV Boro. The consequent impact on production has also led to second round effects on employment, income, nutrition and non-farm activity.

The evidence in Chapter 4 suggests that the direct impact of the regulators on the agriculture of the area has been very small. In other sections, the negative impact on the environment and navigation was discussed, while the positive impact on road transport was noted. In this section an attempt is made to quantify the agricultural impact in economic terms, based on the data in Chapter 4. The non-agricultural effects are also briefly reviewed to provide an overall assessment of project worth.

12.2 PROJECT COSTS

The final cost estimate of the gates has been put at Tk. 6.36 million in 1983-84 prices. Since the construction of the gates, no O&M costs have been incurred.

The Construction Cost Index (BBS 1990) increased by a factor of 1.39 between 1983-84 and 1987-88. Thus project costs at 1987-88 prices amount to Tk. 8.84 million. To convert this to an economic cost, a conversion factor of 0.82 was used[1], yielding a cost figure of Tk. 7.25 million.

12.3 AGRICULTURAL IMPACT

Table 3 in Chapter 4 provides information on changes in production by crops between the pre and post Project periods. This information, combined with the data on market prices and conversion factors provided in FPCO (1991), has been used to estimate the net economic benefits arising out of the impact on agriculture.

The gross annual change in paddy output is estimated at 273 metric tons, over the pre-project situation, which has a gross financial value of Tk.1.6 million and an economic value of Tk. 1.56 million. If it is assumed that costs are around 50 % of the gross value of output, the net economic return would be Tk. 0.78 million arising from the increase in agricultural output.[2] Table 11.1 indicates the EIRR, NPV and BCR based on a project life of 30 years, and using a discount rate of 12 percent. EIRR is 10.1 per cent, NPV is found to be -0.88 million while the BCR is 0.86.

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1 The Project consists basically of brick masonry work, so that the FPCO (1991) conversion factor of .82 was used.

2 The per acre costs as a proportion of returns for the various crops were found to be as follows: Aus 0.6, B.Aman .61, T.Aman (L) .45, T.Aman (HYV) .35, 0.6.

Table 12.1 Calculation of Economic Rate of Return, NPV and BCR

Year	Net Benefits	Discount Factor	PV at 12%
1	-7.25	.893	-6.47
2	0.78	.797	.622
3	0.78	.712	.555
4	0.78	.637	.497
5	0.78	.568	.443
6	0.78	.508	.396
7	0.78	.452	.353
8	0.78	.403	.314
9	0.78	.361	.282
10	0.78	.322	.251
11	0.78	.287	.224
12	0.78	.256	.200
13	0.78	.229	.179
14	0.78	.204	.159
15	0.78	.183	.143
16	0.78	.163	.127
17	0.78	.146	.114
18	0.78	.130	.101
19	0.78	.116	.090
20	0.78	.104	.081
21	0.78	.093	.072
22	0.78	.083	.065
23	0.78	.074	.058
24	0.78	.066	.051
25	0.78	.059	.046
26	0.78	.053	.041
27	0.78	.047	.037
28	0.78	.042	.033
29	0.78	.037	.029
30	0.78	.033	.026

Economic Impact Indicators

EIRR %: **10.1**
NPV at 12%: **-0.881 (m)**
BCR @ 12%: **0.86**

12.4 OTHER IMPACTS

The impact of the Project on livestock, fisheries, institutions, social harmony, transport and communications etc were reviewed in the previous sections. These impacts are summarized in tabular form below.

Table 12.2 PROJECT IMPACT ON NON-AGRICULTURAL VARIABLES

Impact Variable	Scale
Livestock	0
Fisheries	-1
Social Conflict	-2
Navigation	-2
Road Transport	+2
Environment	-1

Note: The scale used takes a value of between -2 to +2 depending on the intensity of the impact and whether it is positive or negative.

The above table shows that strong negative impacts on navigation and social harmony were reported. The effects on the environment and fish were also adverse, although less vigorous. The regulators had no perceptible influence on the other variables of concern such as livestock, women, non-farm activity and so on.

12.5 CONCLUDING REMARKS

The regulator gates have served very little purpose. The Project concept was poor and very little was done by way of resolving the social conflicts that quickly arose. There is still some potential for rehabilitating the project and allowing some of the intended benefits to be reaped. However, the main intention of using these structures as flushing sluices (for irrigation), is unlikely to be realised, primarily because there is insufficient water available in the dry season. Rehabilitation will require social intervention, formation of effective gate committees and motivation, as well as more appropriate fall boards that can be easily removed or put in place.

The khals and rivers need re-excavation, to improve drainage. However, even if the gates are effectively operated, water can still enter the area from the north and east, ie from the Louhajang side.