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RAP-12

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

13



RAPID RURAL APPRAISAL OF SONAMUKHI-BANMANDER BEEL DRAINAGE PROJECT

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Hunting Technical Services Limited

in association with

Bangladesh Institute of Development Studies
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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

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
- Nagar River Project
- Sonamukhi Banmander Beel Drainage Project**
- Improvement of Sakunia Beel
- Silimpur - Karatia Bridge cum Regulators
- * Katakhal Khal
- Halir Haor
- Kahua Muhuri Embankment
- Konapara Embankment¹
- Polder 17/2
- BRE Kamarjani Reach¹
- BRE Kazipur Reach¹
- * 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
- * Final Report

Note: * Report not yet available

¹ Revised versions of these RRA reports were issued in December 1991.



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SONAMUKHI-BANMANDER BEEL DRAINAGE PROJECT

Project Summary Sheet

Project Name : Sonamukhi-Banmander Beel Drainage Project

Project Type : Drainage

Location

FAP Region : South-West
District : Jessore

Area (ha.) : 9,000 ha. (gross),
7,400 ha. (net cultivable)

Funding Agency : GOB

Implementing Agency : BWDB

Construction started : 1970

Scheduled Completion : ?

Actual Completion : 1978

Original Cost Estimate : ?

Final Cost Estimate : Tk. 11.625 million (current at time of construction)

Major Flood Damage: : ?

Repair/rehabilitation :

A sixteen km. long khal, the Amrakhali, was re-excavated in 1990 in the Project area and has had significant influence on the improvement of drainage.

SONAMUKHI-BANMANDER BEEL DRAINAGE PROJECT

SUMMARY OF FINDINGS

PROJECT BACKGROUND

Sonamukhi and Banmander are two beels in the Upazilas of Sharsa and Jhikergacha in the district of Jessore. A project for draining out excess water during the monsoon period was proposed and implemented during the better part of the seventies (1970-78). The boundary of the Project area as given in the approved PP is the Kobadak river in the east and in the north, the Jessore-Benapole road and railway in the south, and the Kodla (or Kodalia) river in the west. In the north and the west, the boundary is also defined by the international border between Bangladesh and India.

The PP of the Project identified the following flood and drainage problems:

- i. early monsoon flood water from India and local rainfall together caused early flood in the beel areas resulting in submersion of immature aman paddy plants;
- ii. the low lands of the beels were permanently under water and the medium highlands were submerged under 2'-5' (0.6 - 1.5 m) depth of water causing damage to B. Aman paddy; and
- iii. poor drainage conditions delayed post-monsoon drainage causing delay or even absence of sowing of rabi crops in medium-low beel areas.

The main objectives of the Project were, therefore:

- a) removal of drainage congestion;
- b) prevention of damage to crops from monsoon flood; and
- c) reclamation of low-lying areas for cultivation.

PROJECT AS IMPLEMENTED

To achieve the objectives the following engineering features were implemented:

- a) Five drainage sluices of 1 - 3 ventage.
- b) Six bridges. Four bridges are inside the Project area: Keralkhali bridge, Khaskhali bridge, Sialghona bridge and Kulpala bridge, and two are outside the Project area: Ulashi bridge and Jadunathpur bridge.
- c) Embankment: 2 km.

d) Excavation/improvement of drainage channel:

- | | | |
|------|------------------------------------|-----------------|
| i. | Improvement of Betna river | = 25 km. |
| ii. | Loop cutting of Betna river | = 7 km. (2 nos) |
| iii. | Re-excavation of Subarnakhali khal | = 2 km. |
| iv. | Re-excavation of Amrakhali khal | = 16 km. |

Two other regulators constructed outside the Project area have a great impact on the Project drainage system. These are:

- i. Shankarpur regulator - 6 vents (on Betna river)
- ii. Rudrapur regulator - 3 vents (Dudkhali khal)

In the PP practically nothing was mentioned regarding the huge volume of flood water entering the Project area from the R. Kodla, which causes floods in Sarsa Upazila, and as such no flood protection measure was taken to overcome the situation. The Project seemed to be planned only with the specific aim of draining out excess rain water. As a result the drainage facilities are inadequate to cope with the actual situation. No irrigation facility was planned.

PROJECT PERFORMANCE AND IMPACTS

Performance

After implementation, the Project was successful in reducing the magnitude of flood depth, its peak and duration, especially in the eastern part of the Project. In the western part, it failed because it did not consider the effect of flood water carried by the Kodla and the overspilling of its banks.

At present the Project suffers from twin problems of drainage and flood. The problems of drainage are due not only to frequently encountered issues (siltation of rivers and khals; the failure to take into account the volume of water that needs to be drained, leading to design and implementation failures related to the regulators; and inadequate re-excavation of the connecting khals) but also to the fact that the rivers are cross bunded in many places for cultivation of fish, a "problem" peculiar to the area.

The problem of flood is also the result of the above failures and cross-bunds. The Betna and the Hakor are both unable to carry much water during the monsoon because of the latter obstructions.

Agriculture

Improvement in drainage congestion has resulted in some agricultural growth within the Project area. The cultivable area has increased and appreciable changes in cropping pattern and intensity have also occurred. There has been an expansion of the double cropped area. Cultivation of T. Aman and early planting of Boro rice crops have become possible due to the reduction of drainage congestion, especially in the eastern part, the area which is almost entirely irrigated by STW. In addition to this, the area under HYVs has also increased.

In certain parts of the Project area one finds a rapid growth of vegetable cultivation facilitated by the reduction of flood depth and improved drainage.

Two negative impacts on agriculture were noted. These are water shortage for jute retting and increased rat and insect infestation due to the drying-up of beels.

Fisheries

No fishery objectives were set at the planning stage. Fishing grounds were the rivers and baors. Some of the Project's effects in terms of fisheries are:

- a) Creation of loop cuts has allowed fish culture in the old course of the river Betna;
- b) As there is little change in hydrological conditions during the monsoon in the western side, there is little effect on fish breeding and fish production;
- c) The Project has encouraged some people to cultivate fish in the low-lying areas in large enclosures;
- d) The Project has helped in changing the aquatic environment of the baors to encourage better fish growth and fish health, hence fish production;
- e) Dead and seasonally almost dead (e.g. Hakor) rivers are cross-bunded and utilized for fish cultivation.

Livestock and Poultry

Changes that have occurred in the area may not necessarily be ascribed to the Project. Overall there is an increase in the chicken and goat populations and there is a decrease in incidence of worm infestation among livestock.

Increased cropping intensity and the change in cropping pattern have restricted the area for cattle grazing and there is, therefore, now an acute shortage of cattle feed which may be a cause of decline in the cattle population.

Environmental Aspects

The Project has helped in improving drainage conditions, especially in the eastern side of the Project area. The duration and depth of water logging has somewhat declined.

As the area has become more free from long duration floods the rodent, particularly rat, population has increased. A decline in the visits of migratory birds was noted in the area. It is possible that long term use of STWs may have increased iron toxicity in the soil but definitive information is lacking to prove this.

Social and Institutional Aspects

Social and institutional aspects of the Project were studied from three angles which are discussed below:

a) Social and Institutional Impacts

There was no stated objective relating to social and institutional aspects in the Project Proforma. Generally, overall socio-economic life has shown progress but it is difficult to relate this to the Project as such. However, in some areas still ravaged by flood, particularly after the Indian Border Security Force cut on the embankment of the Kodla, the situation during floods must have worsened.

There is an increase in seasonal in-migration in the area and the wage rate shows signs of an improvement compared to what it was a decade back. Here again it is difficult to say why this might have happened. There appear to be substantial informal cross-border trading activities which employ a lot of people who are taken out of the local agricultural labour market. The area has always depended to a certain extent on outside labour. However, it must also be true that the improved agricultural condition would encourage more in-migration.

There seems to be a lack of general public collective consensus in getting involved in the Project. However, the local people in some cases carried out works on construction of small embankments (e.g. at Hatkhola) and excavating channels (Ulashi-Jadunathpur) for drainage improvement and irrigation.

The Project has created social conflict between baor lease holders and cultivators. On the other hand one hears a lot of complaints about absentee khalashis. BWDB as an institution has failed to provide proper planning for O&M.

b) Impacts on Women

The overall pattern of women's activities has remained virtually unchanged under the Project. The impact on agriculture has resulted in increased post-harvest work at home but has also resulted in better wage earning opportunities (e.g. in the rice mills) for women. An additional source of income (RMP) was created due to the development of internal road communications (as decline in water logging and depth has created a need for alternative communication facilities).

c) Impacts on Nutrition and Health

In the Sonamukhi-Banmander beel area the increase in paddy production has not had a significant effect on the food habits of most of the people. The availability of safe drinking water has increased due to the widespread use of STWs and HTWs in the area.

A declining trend was noted in the case of consumption of protein foods - namely fish and pulses - due to lost opportunities for informal fish catching throughout the year and to a decline in pulse cultivation.

Aggregate Economic Impacts

The estimated economic IRR for the Project is 181 per cent. The result is sensitive to the level of net incremental benefit and the rapidity with which full benefits are reaped. Even under a set of very stringent assumptions, however, the IRR is estimated to be 60 per cent.

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ABBREVIATIONS AND GLOSSARY

baor	ox-bow lake
BBS	Bangladesh Bureau of Statistics
BIDS	Bangladesh Institute of Development Studies
BDR	Bangladesh Rifles
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BSCIC	Bangladesh Small and Cottage Industries Corporation
BWDB	Bangladesh Water Development Board
BSS	Bittahin Samabaya Samiti
BSF	Border Security Force
DTW	Deep tube-well (with positive-displacement pump)
dhenki	wooden husking equipment
EIP	Early Implementation Project
XEN	Executive Engineer
FAP	Flood Action Plan
FCD/I	Flood Control Drainage and Irrigation
FPCO	Flood Plan Coordination Organisation
FAO	Food and Agricultural Organisation
FFW	Food For Work
GOB	Government of Bangladesh
ha	Hectare (2.47 acre)
HYV	High yielding variety
lakh	Hundred Thousand (100,000)
IFAD	International Fund for Agricultural Development
JICA	Japan International Cooperation Agency
khal	Natural channel
khalashi	Cleaner (actually guard) of regulator
KSS	Krishak Samabaya Samiti
LGEB	Local Government Engineering Bureau
LIV	Local Improved Variety
LV	Local Variety
LLP	Low Lift Pump
madrasah	School for religious education
MBSS	Mahila Bittahin Samabaya Samity
MSS	Mahila Samabaya Samiti
NGO	Non-government Organisation
O&M	Operation and Maintenance
Parishad	Council
PIE	Project Impact Evaluation
PP	Project Proforma
PWD	Public Works Department
RRA	Rapid Rural Appraisal
R&H	Roads and Highways
RMP	Rural Maintenance Programme (CARE)
STW	Shallow tube-well (with suction pump)
SDE	Sub-Divisional Engineer
SE	Superintending Engineer
TTDC	Thana Training and Development Centre
ODA	United Kingdom Overseas Development Administration
UNDP	United Nations Development Programme
UCCA	Upazila Central Cooperative Association

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 lead 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 Sonamukhi - Banmander Beel Drainage Project.

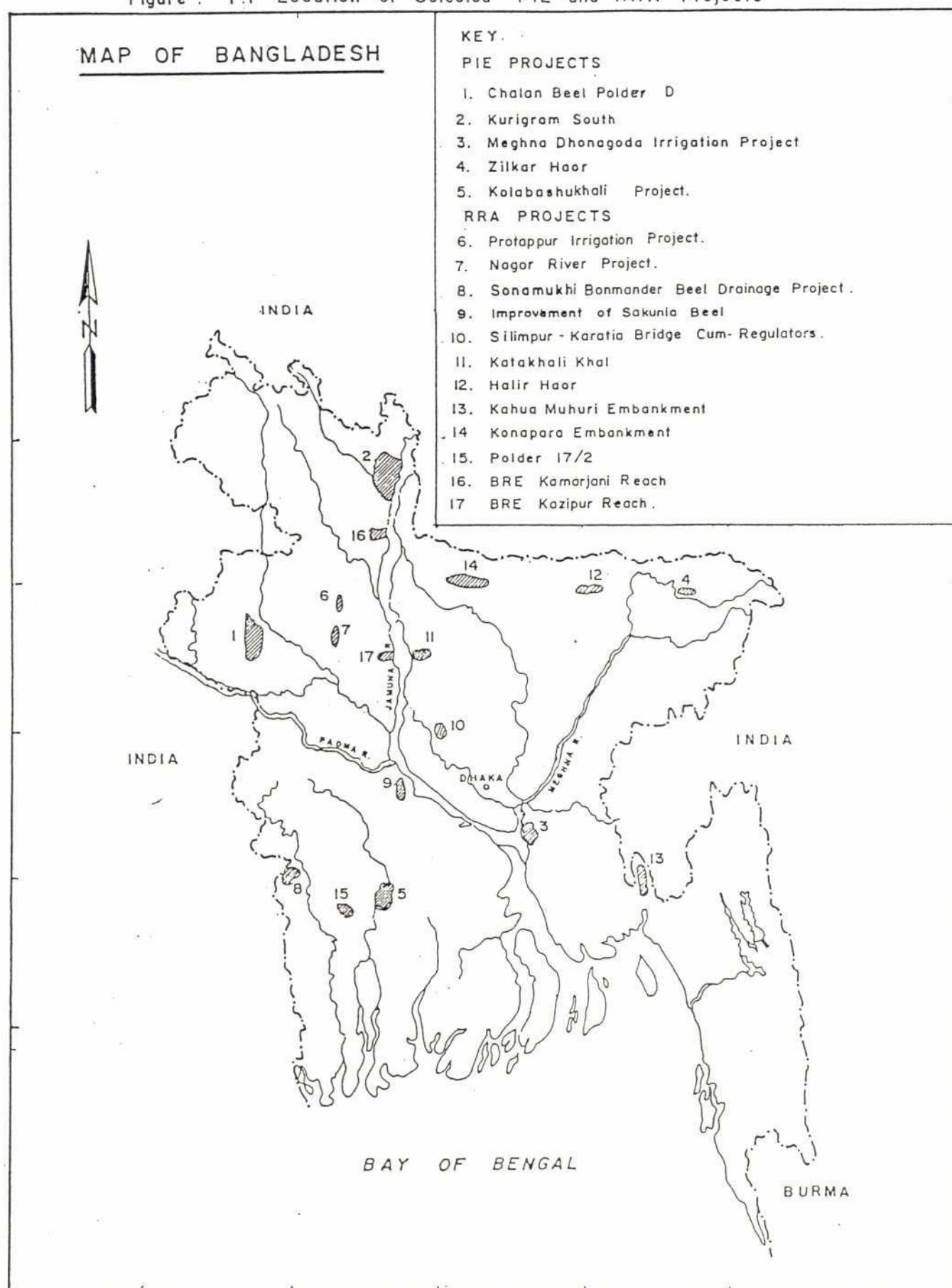
1.2 RAPID RURAL APPRAISAL

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 probability 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.

Figure 1.1 Location of Selected PIE and RRA Projects



1.3 PROJECT LOCATION

The Sonamukhi and the Banmader are two beels in the Upazilas of Sharsa and Jhikergacha in the district of Jessore. A project for draining out excess water during the monsoon period was proposed and implemented during the better part of the seventies (1970-78) in and around these two and other beels in the area. The boundary of the Project area as given in the Project PP is the R. Kobadak in the east and in the north and the R. Kodla (or Kodalia) in the west. In the north and the west, the boundary is also defined by the international border between Bangladesh and India.

A team of professionals drawn from various disciplines conducted an RRA of the Project in late May-early June 1991. A total of twenty one Mouzas were visited and various officials, village people and village leaders were consulted to understand the problems in the area and the impact of the Project.

1.4 PROJECT AREA AND PROJECT CONCEPT

The Project area as described above includes the whole of Sharsha Upazila north of the Jessore-Benapole road/railway line and the part of Jhikergacha Upazila up to the R. Kobadak in the east and again north of the Jessore-Benapole road. The total area of the Project is slightly more than nine thousand ha. The net benefited area under the Project as estimated in the PP is nearly 7400 ha.

Sonamukhi and Banmader are only the major beels in the area. There are many other beels, baors (ox-bow lakes) and other water bodies in the low-lying areas which play a prominent role in determining the hydrology in the region. These include the Radhanagar baor, Rajapur baor, Hopder beel, Bahadurpur beel, Barokona baor, Chotokona baor etc. During the rainy season the beels and their environs are inundated due to local rainfall and inflow of water from the R. Kodalia and R. Betna (including R. Gangni Bhanga, an old course of R. Betna).

The main thrust of the Project has been to ease/remove the drainage congestion through re-excavation of R. Betna and R. Gangni Bhanga and drainage channels taking off from or emptying into them, loop cutting on the R. Betna and the construction of a small length of embankment along the R. Gangni Bhanga. The design of the Project has been quite oblivious to the hydrological situation on the western part of the Project area which is influenced heavily by the behaviour of and structures on the R. Kodla (see Chapter 2 for details).

As indicated earlier, there are many perennial water bodies in the Project area making them natural breeding grounds for various species of fish. Quite naturally the changing hydrology in the area is likely to have certain effects on the capture fisheries. Little attention has been paid or awareness shown regarding such impacts of the Project in the official documents of the Project or during its implementation.

LEGEND:-

- International Boundary
- Remaining Project Boundary
- River / Khal
- Railway Line (with Bridge)
- Pucca Road
- Bridge / Culvert
- Regulator
- Earth Road
- Beel
- Pipe Sluice
- P.S.

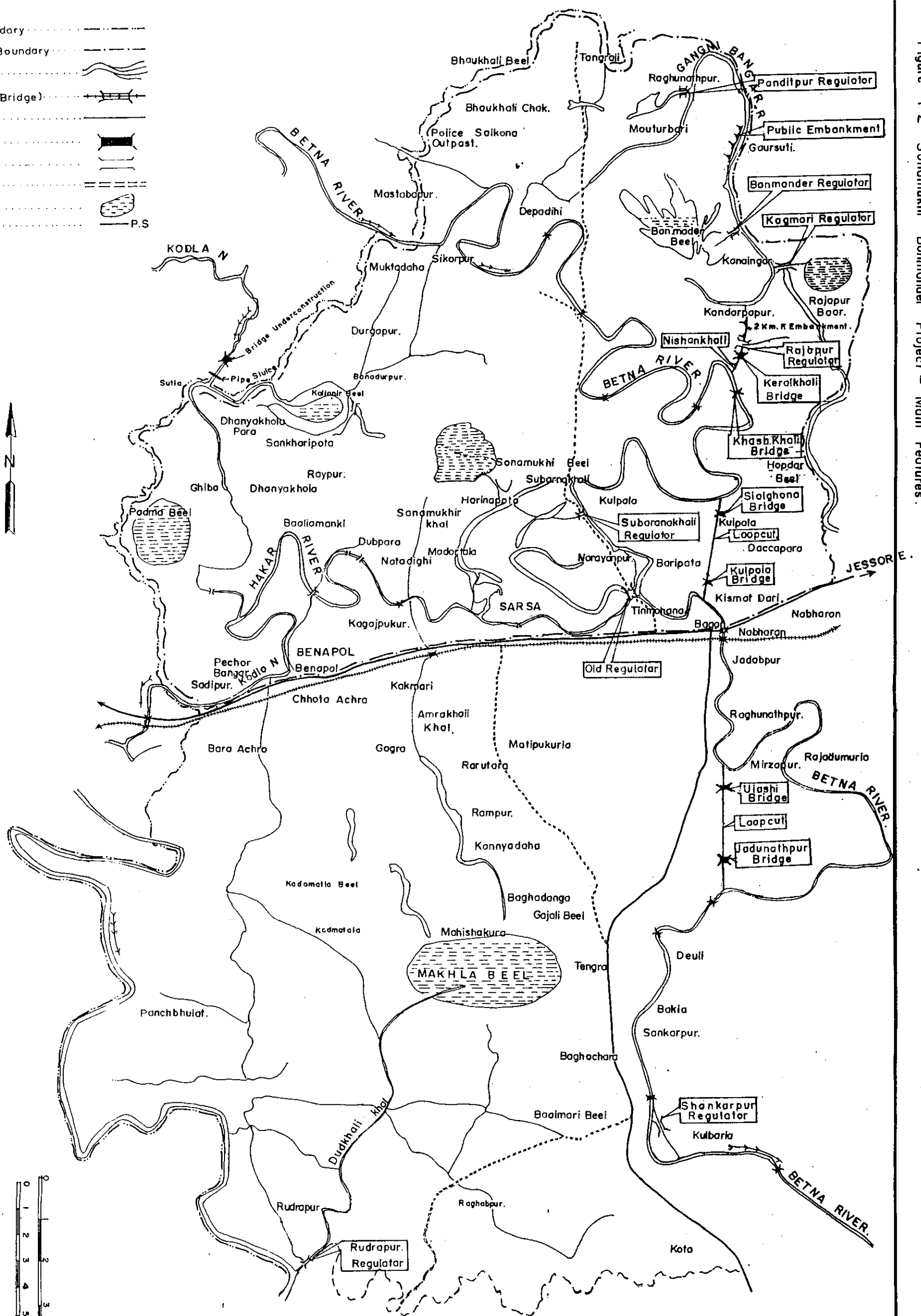
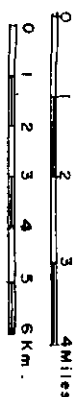


Figure 1-2 Sonamukhi Bonmader Project - Main Features.

SONAMUKHI BONMANDER BEEL
DRAINAGE PROJECT, JESSORE



1.5 ACKNOWLEDGEMENTS

The RRA team is indebted to many people for their help during the field work.

The team gratefully acknowledges the help extended by the Superintending Engineer, Jessore O&M circle, BWDB, the Executive Engineer, Jessore and the Sub-divisional Engineer in charge of the Project area. Without their help it would have been well-nigh impossible to conduct the field investigations. Special thanks are due to the UNO, Sharsa Upazila and other officials in the then Upazila Parishad who readily provided data, information and insights. The personnel of the Bangladesh Rifles deserve our heart felt thanks. It is only with their protection that we could safely examine first hand the water control structures built by India.

The people in the Project area, farmers, fishermen, fisheries lease-holders, labourers, rural craftsmen and women bore cheerfully our interference in their lives, and shared their experiences with us. Without their cooperation, this report would not have been possible.

The Chairman of Bahadurpur Union gave us his time quite freely to accompany us to various areas, explain the problems, technical and social, and introduce us to people so that we could readily obtain local information.

We acknowledge his help most gratefully and hope that his untiring struggle to improve the lives of people in his union is helped through the acceptance and implementation of the recommendations of this report.



2 ENGINEERING ASPECTS

2.1 PROJECT LOCATION

The Project area is located mainly in the Sharsa Upazila with a small part falling in Jhikergacha Upazila of Jessore District, and is bounded by the Indo-Bangladesh border on the north and the north west and by the Jessore-Benapole Railway line on the south. It includes the catchment areas of Radhanagar Baor, Rajapur Baor and Hopdar beel on the east. The net Project area is about 7,400 acres.

2.2 PRE-PROJECT CONDITIONS

2.2.1 The Problem

The Project area had two-fold problems in the past which still exist. These are:

- a) Inundation of the Project area due to local rainfall and inflow of water from India during the monsoon.
- b) Acute drainage congestion due to inadequate drainage facilities.

During the field visits it was revealed that the flood water from India enters the Project area through numerous depressions between Kashipur and Sadipur of which the following are the main locations:

- i. the flood water from Bhaukhali Beel (situated partly in India and partly in Bangladesh) passes to Boalgari Beel in Paukshia and then flows through R. Gangni Bhanga (old Betna) via Mouter Baor and enters the Banmander Beel through depressions near Radhanagar village, inundating the whole beel areas;
- ii. the river Betna enters Bangladesh near Mukundapur (near Mukdadaha) carrying flood water from India during the monsoon season;
- iii. a distributary of R. Kodla in India meets the Bahadurpur Baor (Kalinir Beel), through the Basurtana khal and finally flows to Sonamukhi Beel via Hanukhali khal, inundating the huge beel area; and
- iv. the Kodla river enters Bangladesh near village Ghiba and flows through Bangladesh for a length of about 16 km before it finally enters India near Sadipur village, spilling flood water in Bangladesh.

2.2.2 Pre-Project Drainage System

The Betna, a highly meandering river, along with its tributaries passing from the north to the south almost through the centre of the Project area, has formed the main drainage channel of the area. Some natural depressions/channels connect the low-lying beels and baors to the R. Betna or its tributaries. The Gangni Bhanga river (an old course of the Betna) is connected to the Betna through the Nishankhali khal and helps in draining the area. But

the siltation of all the river beds and their greatly meandering nature created drainage congestion in the Project area.

Thus, the aforesaid conditions caused the following pre-Project effects:

- i. the early monsoon flood water from the Indian territory and the local rainfall together caused early flood in the beel areas resulting in submersion of immature aman paddy plants;
- ii. the low lands of beels were permanently under water and the medium highlands were submerged under 2'-5' depth of water causing damage to B. Aman paddy; and
- iii. poor drainage conditions delayed post-monsoon drainage causing delay or even preventing the sowing of rabi crops in medium low beel areas.

2.3 PROJECT OBJECTIVES

The main objectives of the Project were as follows:

- a) Removal of drainage congestion
- b) Prevention of damage to crops from monsoon flood, and
- c) Reclamation of low-lying areas for cultivation.

To achieve the above objectives the Project was designed to:

- i. eliminate drainage congestion by re-excavating the rivers Betna and Gangni Bhanga and the drainage channels from beels to these rivers;
- ii. construct drainage sluices at the outfall of the khals for controlled drainage and to prevent backflow to the beels;
- iii. construct an embankment from Radhanagar to Nishabkhali on the left bank of the R. Gangni Bhanga to prevent over drainage and flooding of Rajapur beel area;
- iv. cut loops straightening the river Betna
 - from Sialghona to Kismat Dari (3.0km) and
 - from Ulashi to Jadunathpur (4.0km) to increase drainage efficiency;
- v. excavate Amrakhali khal (later stage).

The PP of the Project mentioned practically nothing regarding the huge volume of flood water entering the Project area from India causing flood in the Sharsa Upazila, and no flood protection measure was proposed to overcome the situation. The Project seemed to be

planned only to drain out the excess rainfall water from the Project area and thus the drainage facilities of the Project are inadequate to cope with the actual situation. No irrigation facility was planned.

2.4 PROJECT ACTIVITIES

The Project was completed in 1977. The major engineering features of the Project are as follows:

- a) Structures :
- | | | | |
|-----------------------|------|--------------|---------|
| Drainage sluices at: | i. | Subarnakhali | 3 vents |
| (within Project area) | ii. | Rajapur | 1 vent |
| | iii. | Kagmari | 3 vents |
| | iv. | Bonmondar | 1 vent |
| | v. | Panditpur | 3 vents |
- b) Bridges/Culverts: 6 bridges were constructed in connection with this Project.
- 4 bridges inside the Project area : Keral khali bridge, Khaskhali bridge, Sialghona bridge and Kulpala bridge.
- 2 bridges outside the Project area : Ulashi bridge and Jadunathpur bridge.
- c) Embankment: 2 km
- d) Excavation/improvement of drainage channel:
- | | | |
|------|------------------------------------|----------|
| i. | Improvement of the R. Betna | : 25 km. |
| ii. | Loop cutting of Betna river | : 7 km. |
| iii. | Re-excavation of Subarnakhali khal | : 2 km. |
| iv. | Re-excavation of Amrakhali khal | : 16 km. |

Two other regulators constructed outside the Project area have great impact on the drainage system of this Project. These are

- | | |
|-----|---|
| i. | Shankarpur regulator - 6 vents (on the Betna) |
| ii. | Rudrapur regulator - 3 vents. (Dudkhali khal) |

2.5 PRESENT CONDITIONS OF THE PROJECT

2.5.1 Flood Problems

Since the concept of the scheme was only to drain out the excess rainwater from the Project area without considering the huge inflow of flood water from the Indian territory, the

drainage capability of the rivers, channels and structures in their existing condition is inadequate.

The magnitude of floods has increased and drainage congestion in the Project area has further deteriorated for the following reasons:

a) Water control structures on the Indian side

The Indian Government constructed a 4-vent pipe sluice on the Kodla river in 1976, near the Indian village of Sutia, about 50 m. upstream of the Indo-Bangladesh border and started controlling the river water unilaterally. During the lean period the entire river water is used for irrigation within the Indian territory leaving a completely dry river bed downstream and resulting in the silting up of the Kodla bed in Bangladesh. During the monsoon season the Indian people open the Sutia regulator releasing a huge volume of flood water which therefore cannot be carried by the Kodla, causing flood every year in the Sharsa Upazila. As mentioned earlier, the BWDB appears to be quite oblivious to the effect of the Kodla water in the Project area. The local people have therefore taken the initiative and constructed a road cum embankment on the left bank of the Kodla and a cross dam on the river in Ghiba village inside Bangladesh about 500' from the international border. The embankment and the dam obstructed the flow of the Kodla, eventually causing flood in the Indian territory. During the 1987 flood the affected people in India supported by BSF of India entered Bangladesh and cut the cross-dam, which is still open, causing flood in Bangladesh each year.

b) Road cum embankment within India along the border

The Indian Government is constructing a huge road cum embankment along the border about 150' away from the Project boundary (i.e. the international border) with (apparently) control structures on each river entering Bangladesh from India. This embankment, after completion, may pose a great danger for Bangladesh territory as India will unilaterally be in a position to control the flow of the rivers, depriving Bangladesh of her due share. During the winter the entire river water may be utilized in India, while on the other hand during the monsoon the sudden release of flood water will inundate Bangladesh territory damaging standing crops and property.

At present the flood water from India still enters the Project area at (1) Bhaukhali beel; (2) through the river Betna at Mukundapur; (3) at Bahadurpur through the Basurtana Khal; and (d) through numerous depressions.

2.5.2 Drainage Problems

The Project is experiencing acute problems for the following reasons:

a) The Gangni Bhanga river which acts as the main drainage channel of the Banmander Beel area falling into the Betna through Nishan Khali khal, is almost silted up throughout its length and the numerous cross bunds constructed by the local people on the river bed to create fishing ponds have reduced the flow to a great extent even during the monsoon, causing acute drainage congestion in the Banmander Beel area.

Between the Panditpur and Banmander regulators the Banmander Beel area receives a huge volume of Indian flood water through a number of depressions along the right bank of the Gangni Bhanga river. To overcome this situation the local people are now (1991)

constructing a low embankment on the main depression between the Radhanagar village and Gaursuti at their own cost.

b) The Betna, which is the main drainage channel of the whole Project area, is silted up to a great extent and is no longer a perennial river. The cross-bunds on the river bed for fishing ponds have also created immense additional obstruction to flows. The greatly meandering nature of the river also increases flow time. The two loop cuts of the Betna at Sialghona and Ulashi have shortened the length of the Betna by about 16 km, and have substantially decreased the flow time and thereby improved drainage efficiency and reduced the flood peaks in the area by about 2'-3'. But when the huge inflow from India is accompanied by heavy local rainfall, the Sonamukhi Beel area receives back flow through the tributary of the Betna which passes through Tinmohana and connects to Bara Kona Baor. The backflow through Subarnakhali khal is controlled by a regulator at its mouth. The Sonamukhi Beel area also gets Indian flood water directly through Bahadurpur baor. Thus the drainage inefficiency of the Betna causes drainage congestion in this beel every year.

c) Hakor River:

This was a link river between the Kodla and the Betna river draining the Sonamukhi Beel. The present Hakor river is dead and its bed has been completely changed into fish ponds and farm plots. There is no flow even during the monsoon.

d) Amrakhali Khal:

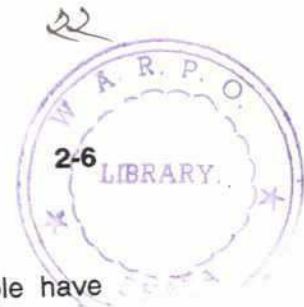
When the drainage congestion in the Sonamukhi Beel became very acute, the Amrakhali Khal was excavated under FFW, connecting the southern part of the Sonamukhi Beel area to the Kanyadaha Baor, which has a link with Makla Beel. The Makla Beel drains into the Ichamati river, through Dudkhali Khal.

e) Rudrapur Regulator:

A 3-vent drainage regulator has been constructed at the end of Dudkhali Khal near Rudrapur village for controlled drainage and to stop the inflow of saline water into the beel area during the high tide. The drainage capacity of this regulator is considered highly inadequate to cope with the present requirement, and creates acute drainage problem in both the Sonamukhi and Makla Beel areas.

f) Shankarpur regulator:

The 6-vent (6'x8') drainage regulator was constructed on the Betna river at Shankarpur village to use the dry river bed of the Betna from Ulashi to Shankarpur as a reservoir for conservation of water during the dry season. The drainage capacity of this regulator seems to be below the actual requirement and thus causes drainage congestion in the whole of Sonamukhi- Banmander Beel Project area. To solve this problem temporarily there was an attempt at a public cut in the cross-dam beside the regulator. The threat of public cut still exists during every monsoon. Moreover, the construction of this regulator has created adverse effects in the down-stream areas as it has stopped the flow of the Betna just after the monsoon. This regulator has therefore helped in the increase of salinity problems downstream and also increased the rate of siltation both in the upstream and the downstream reaches of the river. Discussions with local people at Ulashi and Jadunathpur revealed that the objective of conservation of water for irrigation has not been achieved as desired.



g) Loop cuts at Sialghona-Kulpala & Ulashi-Jadunathpur:

These two loops of the Betna are now abandoned river beds and people have excavated ponds with high embankments, stopping flow through these loops. As a result all the small drainage channels falling into these reaches of Betna are now completely obstructed, causing drainage congestion to the surrounding areas every year.

h) Drainage Net-work:

All the drainage channels connecting the catchment areas to the existing regulators at Banmader, Kugmari, Rajapur and Subarnakhali are completely silted up and the internal drainage network does not function any more.

2.5.3 Maintenance Problems

There is no O&M manual for this Project. No such manual was ever prepared. Thus the institutional arrangement for the operation and maintenance of the Project structures is quite lax. The O&M problems as observed by the consultants are discussed below:

a) Regulators

There is no maintenance work for any of the regulators and as a result all the gates were found to be leaking. The civil structures, particularly the loose aprons, are damaged. Not a single regulator khalashi was available at site. There was a strong public complaint against the khalashis of Subarnakhali and Banmader regulators, for their absence from site and non-cooperation with the farmers. There is no regulator committee except at the Shankarpur Regulator. One of the gates of the Rudrapur regulator has been non-operational for a long time for want of rather minor maintenance works.

b) Embankment

The embankment from Radhanagar to Nishankhali (about 2 km) along the left bank of the Gangni Bhanga was completed under FFW. It is in bad shape due to absence of maintenance works.

c) Drainage channels/rivers

All the rivers and drainage channels of this Project are silted up or obstructed by cross-bunds for fishing. In 1991 16 kms length of Amrakhali khal and Dudkhali khal have been re-excavated under the FFW programme. For 1991, as informed by BWDB officials, the programme includes the re-excavation of 25 kms of the Betna river.

2.5.4 Irrigation Facilities

In the planning stage the Project was envisaged mainly to provide drainage facilities. Later irrigation with Low Lift Pumps (LLP) was considered, especially during the execution of the Ulashi loop cut and Shankarpur regulator.

Later on, farmers in the Project area have adopted shallow tubewells (STW) irrigation so intensively that there are about 450 STW in only one Union (Rajapur), in addition to a few deep tubewells (DTW) and LLP. One even finds two STWs are sited only a few metres apart.

In 1991 rainfall was much less than usual as a result of which even some of the perennial beels dried up completely. The drying up of the lowest beel beds may indicate the lowering of the ground water table due to extensive use of STW/DTW in the Project area. However as no data could be collected regarding rainfall and ground water table it is difficult to pass any definitive judgement on the matter. Although in some villages within the Project area (Narayanpur) some people complained about the non-availability of ground water for old STWs, no such complaints were heard in other areas.

2.6 IMPACTS

2.6.1 Positive Impacts

- i. The Project has partially fulfilled the primary aim of drainage system improvement by loop cuts in the Betna river.
- ii. The frequency, duration and depths of high floods have been reduced due to the improvement of drainage channels.
- iii. The scheme has provided year round road communication within the Project area.
- iv. The scope for irrigation by STW/DTW/LLP has been increased.

2.6.2 Negative Impacts

- i. The Project has been designed to mitigate the drainage congestion of the area but no protective measures have been considered against the intrusion of Indian flood water inside the Project area.
- ii. The lack of due consideration of the volume of flood water intrusion from India has resulted in an inadequate capacity of most of the existing drainage facilities, and this has created acute drainage congestion in the Project area.
- iii. The lack of regular maintenance works has badly silted up the entire drainage net-work (river & channels). Moreover, the upstream control of the Kodla river in India has silted up the downstream reaches in Bangladesh from Ghiba to Sadipur. The same holds true for the Betna river downstream at Shankarpur regulator due to the absence of regular maintenance.
- iv. The insufficient drainage capacity of the regulators at Shankarpur on the Betna river and at Rudrapur on Dudkhali khal has created a great adverse effect on the drainage system of the Project. In fact, the drainage congestion in the Project area cannot be removed until the total volume of drainage requirement is reassessed and the capacities of these two regulators are increased accordingly.
- v. The cancellation of the old regulator at Tinmohana on the old Betna river has allowed backflow of the water of the river Betna into the Sonamukhi beel.

- vi. The abandoned loops of the Betna river after cuttings at Sialghona and Ulashi are now used as fish ponds and agricultural farms and cause drainage congestion in the locality.
- vii. The Hakor river, which could be a drainage channel for the Sonamukhi beel areas, is completely closed by hundreds of compartments for fish culture and farm plots, and has stopped the drainage facilities in the area.
- viii. The absence of a dwarf embankment between Panditpur and Kanainagar has enhanced the early inundation of the Banmander beel areas causing heavy damage to the standing crops.

2.7 RECOMMENDATIONS

a) Hydrological Reassessment

A hydrological re-assessment of the volume of water to be drained should be made taking into consideration the flood water intrusion from India, to determine the actual capacity required for the drainage facilities (both structures and channels).

b) Drainage Rehabilitation

The drainage channel network of the Project should be re-excavated and extended as may be required and new drainage structures should be constructed. A provisional identification of the drainage facilities to be newly constructed or extended is as follows:

Structures:

- i. The drainage capacity of the existing regulators at Shankarpur on R. Betna and Rudrapur on Dudkhali khal should be increased by extending/constructing additional ventages.
- ii. The cancelled regulator on the old Betna at Tinmohini should be reconstructed to stop back-flow to and control moisture content in the Sonamukhi beel area.

Drainage channels:

Rivers/channels to be re-excavated and extended:

- i. The drainage channels connecting the beels to the regulators
- ii. Gangni Bhangra river from Panditpur to its confluence with the Betna at Keralkhali.
- iii. The R. Betna from Keralkhali to Shankarpur regulator.
- iv. The loop on the Betna from Subarnakhali regulator to Kismet Dari
- v. The R. Kodla from Ghiba to Sadipur with embankment on both banks.

- vi. Amrakhali khal, a substitute drainage facility for the dead Hakor river, should be enlarged and re-excavated up to Kanyadaha baor.

Embankment:

- i. A flood embankment should be constructed along the right bank of the Gangni Bhanga from Panditpur to Kanainagar.
 - ii. Re-sectioning of the existing embankment from Radhanagar to Keralkhali.
- c) Early attention should be given to repair and maintenance of all damaged and leaking sluices.
- d) The RRA team considers that the improvement of the suggested drainage facilities alone will mitigate the flood effect and eliminate the drainage congestion from the Project area.

However, the construction of a flood embankment along the western boundary from Kashipur to Sadipur with relevant control structures to stop or control the inflow of flood water from India to the Project should be studied thoroughly. This embankment, if found unavoidable, should be constructed as an embankment-cum border road and as such a close co-ordination should be maintained with the Roads and Highways Department.

- e) The problem of unilateral control of the R. Kodla by India should be solved through the Joint River Commission and the actual intention of constructing the huge road cum embankment parallel to the border by India should also be studied properly to avoid any future disaster in Bangladesh.
- f) The fluctuation of the ground water table in the Project area and the quality of ground water should be studied to avoid any future problem due to intensive irrigation by STW/DTW.
- g) Both Project committee and regulator committees should be formed for proper O&M of the Project facilities.

2.8 RECOMMENDATIONS FOR FUTURE FCD/I PROJECTS

- i. Thorough hydrological studies are required prior to the design of all FCD/I projects to avoid the problems of inadequately sized structures and siltation of channels.
- ii. A close co-ordination should be maintained with the R&H Department during the design and execution stages of the embankment to achieve the double benefit of flood control and road communication from the same work.
- iii. For border projects, the effects of engineering activities on the other side of the border, particularly in connection with flood control, irrigation and river training works should be studied thoroughly to avoid future adverse effects on projects in Bangladesh.

3 ASPECTS OF AGRICULTURAL IMPACT

3.1 GENERAL BACKGROUND

The Sonamukhi Beel Project is a drainage Project. The Project aims to protect crops from damage which was caused by inundation due to flood water from the local rivers and accumulation of rain water in the low-lying areas, particularly the beels. Available literature shows that the Project area includes areas of the following physiographic groups:

- i. old Ganges Meander Floodplain: formed by old Ganges alluvium, which is located on the right side of the Betna river with a complex relief of broad and narrow ridges and inter-ridge depressions;
- ii. mixed Young and Old Ganges Meander Floodplain : formed by overlaying of the young Ganges alluvium on the old Ganges alluvium. This area is located on the left side of the Betna river with a similar complex relief but having more of the broad ridges;
- iii. mixed Old Ganges Meander Floodplain and Peat Soils : formed through filling up by peaty deposits in the depressions of the Mixed Young and Old Ganges Floodplain area.

The soils of both old and young alluvium are generally medium to moderately fine textured. The loamy soils described as "Calcareous Brown Floodplain Soils" in the SRDI account of general soil types are found on the ridges (highland), while the heavier textured soils described as "Dark Grey Floodplain Soils" are located in the slopes and basins (medium land and low land).

The Project area belongs to a 'Bangladesh dry zone', where the annual rainfall is relatively low (about 1,600 mm in Jessore) and most variable. The Rabi period temperature is moderately suitable to grow temperate zone crops such as wheat, potato and mustard. The variable dates of onset and recession of the monsoon and seasonal flood with varying flood levels can cause both flood and drought damage to crops.

3.2 PRE-PROJECT SITUATION

3.2.1 Crop, Cropping Pattern and Impact of Flood

The estimated net cropped area in relation to area available for cultivation shows that only a little land remained fallow during the pre-Project period (664 ha. or 8 per cent of the area). The cropping intensity, however, was low as land in the project area could not be cultivated more than once a year due to the flood and drainage problems. The overall intensity was just over 100 per cent (Table 3.1).

Broadcast Aman was the predominant crop accounting for nearly two-thirds of the area cultivated. Practically all of it was in the low and medium low land level categories. The other major crop was broadcast Aus accounting for nearly 14 per cent of the area, mainly in the high land category. Boro paddy was almost totally absent. So were HYVs.

According to the Project Proforma, a sharp rise of water level in the Betna river during the early monsoon period in the middle of June caused flooding and submersion of immature Aman paddy plants. Then, during the peak monsoon period, the beel area went under water with a depth varying from four feet to eight feet, causing damage to Aman. Moreover, the lowlying beel area did not drain out quickly in the post-monsoon period. As a result the sowing of rabi crops was delayed, and some areas situated around the beels remained fallow throughout the year.

3.2.2 Input Use, Crop Management and Post Harvest

Under the pre-Project condition the level of use of modern inputs such as improved seeds was very low. As a result the applications of other inputs like chemical fertilizer and irrigation water, the uses of which are generally known to be associated with that of improved seeds, were also very low. As B. Aman needs a rather low level of attention from the farmers, the general level of crop management practices was low. Likewise, the post-harvest operations were of traditional nature such as manual threshing, winnowing, cleaning and sun-drying of crops.

3.2.3 Yield

The limited cultivation of HYVs along with the predominance of B. Aman, a low-yielding paddy, meant that the estimated aggregate average yield of paddy was as low as 1.3 tons per hectare. The yields of the other major crops, jute and pulses, were also low, 1.5 and 0.6 tons per hectare respectively.

3.3 SOURCES OF DATA

During the RRA the following sources were used for collection of data and information:

- interviews with officials of Upazila Agriculture Office and Sub-divisional engineer Office of BWDB;
- interviews with farmers in the sample mouzas which were selected in each category of land level;
- The Project Proforma on Sonamukhi-Banmader and other Beels Drainage Scheme, October 1977, BWDB;
- Reconnaissance Soil Survey Report of Jessore District 1970, Soil Survey of Pakistan;
- Agro-ecological Regions of Bangladesh, UNDP/FAO 1988; and
- 1983-84 Census of Agriculture, Jessore District 1986, BBS.

3.4 THE VALUE AND FEASIBILITY OF THE PROJECT OBJECTIVES

The Sonamukhi Beel Project was planned mainly to contribute to agricultural development through improvement of drainage congestion by means of shortening the main drainage channel and construction of related drainage facilities. The protection of the crops

from the damage due to drainage congestion and local inundation is indispensable to improve the cropping pattern and to stabilise crop yields. As it seems that there is no other specific restriction on land capability and also no other natural production constraints, the Project objective of drainage improvement is considered to be feasible from the view point of agricultural development.

The value of the Project needs to be judged against the specific targets. Very little change in cropping pattern due to the Project was expected, except some small ones in the acreage and yield of Boro HYVs. As it turned out the main change has been in the Boro season accompanied by a large scale dissemination of shallow tubewells for irrigation.

3.5 PROJECT IMPACT

As explained in detail elsewhere the improvement of drainage condition was significantly attained in the area near the Betna river with decrease in flooding depth and duration of water stagnation. However, the improvement of drainage congestion in the interior is rather limited because of insufficient internal drainage facilities compared to the demand on the system, particularly due to a planning failure to take into consideration the interactive hydrology of the area and its relation to the huge volume of flood water entering from the Indian side. The over all impact in terms of agricultural changes has therefore been rather modest. The details of the changes are given below.

3.5.1 Positive Changes and Impacts

- a) The cultivable area has increased in the low lying areas where most of the culturable waste land or grazing land has probably been converted into cultivated land. The cropped area under Boro paddy could be expanded in the beel areas due to earlier recession of stagnant water as a result of the Project.
- b) There has been a remarkable shift towards both Boro HYVs and T. Aman HYVs which now account for 70 per cent and 46 per cent respectively of the area under cultivation (Table 3.1). This has been made possible due to a change of B. Aman land into local T. Aman land a part of which has later been switched to T. Aman HYVs. There was also direct substitution of Boro and T. Aman HYVs for B. Aman varieties. Mixed Aus-Aman and B. Aus have been similarly replaced.
- c) Although the cropping pattern has not changed significantly in some of the medium highland and medium lowland, the crop damage due to occasional flooding has been reduced due to faster drainage facilitated by the Project.
- d) The most dramatic change that has been observed in the Project area is the wide use of shallow tubewells for rabi period irrigation and the cultivation of Boro HYVs. Apart from some addition to the Boro land around the fringes of the beels and low-lying areas, this had little to do with the Project. This may be understood by looking at the comparative proportions of area irrigated by DTWs and STWs. DTWs are costlier and need permanent structures. People, therefore, may not be willing to invest in DTWs unless the risks of inundation and damage to the equipments and the structures are lessened considerably. In the Project area, DTWs irrigate only 12 per cent of the land under irrigation while more than 80 per cent is irrigated with STWs.

- e) The above changes in cropping patterns have led to a rise in the cropping intensity from an estimated 100 per cent to 175 per cent (Table 3.1).
- f) The yields of the T. Aman HYVs have improved substantially compared to the pre-Project situation (Table 3.2). Even the yield rates of B. Aman and the pulses have shown considerable improvement.
- g) The over-all change in production has been quite impressive. In the pre-Project situation, the total estimated production of paddy was about 8530 tons. The production as estimated now stands at nearly 57,000 tons, more than half of which has been due to the cultivation of Boro HYVs which as argued earlier is hardly an impact of the Project. Another 35 per cent of the production is due to the cultivation of T. Aman HYVs, which is to a large extent an impact of the Project. The same may be said of the change in production due to the cultivation of local T. Aman which accounts for about 4 per cent of the total present output of paddy. During the change, the production of B. Aman has fallen but it still remains at 7 per cent of total paddy output. The total gain in paddy output over the eighties is estimated as 48516 tons. If it is accepted that the changes in land under B. Aman, B. Aus, Mixed Aus-Aman, T. Aman varieties (LV and HYV) and T. Aus reflect the impact of the project, then the net change in output during Aman and Aus seasons was 18,541 tons or just about 38 per cent of the total change in output. Adding some 10 per cent of the output change during the Boro season raises the estimated annual output gain due to the Project to just about 21000 tons or 44 per cent of the total. Using the same arguments, the contribution of the project to net incremental value of paddy production is estimated at Tk. 68.5 million or about 44 per cent of the total incremental gain (Tk. 156.9 million) in paddy (Table 3.3).

3.5.2 Negative Changes and Impacts

- a) From the view point of agriculture, the conflict arising between the farmers and fishermen due to the obstructions created by the latter in the rivers, khals and baors has posed constraints to further development of agriculture. Had the drainage obstructions not been there, one could get even more crop output from the land.
- b) In some areas farmers suffer from water shortage during both the Aman and the Aus seasons. This may have been caused by reduced duration and depth of flood water.
- c) The infestation of rats and insects has increased because of drying-up of the beels and better availability of food the year round due to increased cropping intensity.
- d) Shortage of surface water for retting jute arises due to conflict between farmers and fishermen.

3.6. RECOMMENDATIONS

- i. The remaining drainage problem due to lack of internal drainage facilities could be solved by creating some drainage projects with participation of beneficiary groups and local government, aiming to secure more practical planning and design and also effective operation and maintenance activities.

- ii. A comprehensive approach to utilize and retain flood water at the maximum for irrigation, recharging of ground water and fishery at the same time will be required to utilize the available water as a common property resource.
- iii. Inter-agency coordination among the different concerned agencies such as agriculture and fishery along with the BWDB is needed for the above comprehensive approach to be properly implemented with least social friction among various interest groups.
- iv. The problem of iron-toxicity as alleged by some farmers should be investigated. If true, this will call for maximum utilization of surface water for irrigation as opposed to the use of ground water as is happening now.

Table 3.1 Estimated Land Use and Cropping Patterns

Crop/use	Pre-Project (1979-80)	Post-Project (1990-91)
Boro HYV	-	5,450
T. Aman LV	-	1,000
T. Aman HYV	200	3,600
B. Aman	4,860	1800
Mixed Aus-Aman	405	-
B. Aus	1,010	-
T. Aus LV	-	450
Jute	445	450
Pulses	405	900
All Others	85	-
Gross Cropped Area	7,410	13,650
Net Cropped Area	7,385	7,790
Cropping Intensity (%)	100	175

Source: Consultant's estimates based on data from PP, Census of Agriculture (1983-84) and field observations.

Notes: Net cultivated area in post-Project situation takes into account the loss due to land acquisition (120 ha.) and the cultivation of land which remained fallow before the project (525 ha.)

Table 3.2 Estimated Yield and Gross Output in Project Area

Crop	Yield (mt/ha)		Output (mt.)	
	Pre-Project (1979/80)	Post-Project (1990/91)	Pre-Project (1979/80)	Post-Project (1990/91)
Boro HYV	-	5.5	-	29975
T. Aman LV	-	2.5	-	2500
T. Aman HYV	2.8	5.5	560	19800
B. Aman	1.3	2.2	6271	3960
Mixed Aus-Aman	1.2	-	485	-
B. Aus	1.2	-	1213	-
T. Aus LV	-	1.8	-	810
Jute	1.5	1.3	657	585
Pulses	0.6	1.0	22	900

Source: Consultant's estimates

Table 3.3 Net Financial Returns in Crop Production

Crop	Pre-Project (1979/80)	Post-Project (1990/91)	Net incremental Value	Due to the Project
Boro HYV	-	89.8	89.8	9.0
T. Aman LV	-	7.5	7.5	7.5
T. Aman HYV	1.7	69.0	67.3	67.3
B. Aman	28.0	9.6	-18.4	-18.4
Mixed Aus-Aman	-1.4	-	1.4	1.4
B. Aus	-0.8	-	0.8	0.8
T. Aus LV	-	0.9	0.9	0.9
Jute	-1.1	-1.1	0	-
Pulses	0.1	7.7	7.6	-
All	26.5	183.4	156.9	68.5

Source: Consultant's estimates

Note: All valuations (of output and inputs) are at 1991 prices collected during field work.

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4 LIVESTOCK

4.1 PRE-PROJECT SITUATION

The Project area, as has been discussed earlier, is dotted with a number of beels. This vast low-lying area had been, at most, under one crop in the past. A large proportion of the area used to be utilised as fallow land or grazing area for cattle and buffaloes. Bovine animals were always an integral part of the agricultural farming system; besides that, they played a vital role in providing supplementary income to the people, a vast majority (74 percent in Sharsa Upazila) of which used to live on agriculture. There were very few agricultural households which did not possess bovine animals. Even many landless households used to keep a cow for milk which generated cash income.

According to the 1983-84 agricultural census, about 66 per cent of the farm households in Sharsa Upazila (which forms the major part of the Project area) were reported to have bovine animals (Table 4.1). This was the same as the national figure. On the other hand an average farm household owned 2.4 bovines in the Upazila as against 2.0 in the country as a whole.

Among the farm households, most of the large farms (98 per cent) had bovine animals, while among the small farms the proportion was less than one half. The average number of bovine animals per farm has been found to sharply increase as landholding increases. For instance, a large farm owned 6.7 cattle and buffaloes compared to only 1.2 among the small farms.

Among the non-farm households, the incidence of cattle ownership was similar (about 15 per cent) to that for the country as a whole (14 per cent). The average number per holding was the same (0.3).

The availability of bovine animals per acre of cultivated land in the Project area was 1.1 as against 0.9 for Jessore district and 1.0 for the country, as a whole.

As regards goats and sheep in the pre-Project period, the percentage of farm households possessing a goat or a sheep ranged from 64 to 71 depending on areas; the figure for the country, as a whole, was 36 percent. Of the non-farm households, the percentage owning such ruminant animals ranged from 36 to 40 depending on Project localities. The average number of goat/sheep per household in the Project area was estimated to be 2.2 (Table 4.1); the average for the farm household was estimated at 2.5 and that for non-farm ones estimated at 1.2.

As elsewhere in the country, poultry were common in the Project area. More than 84 percent of the farm households, and more than 53 percent of the non-farm ones owned chicken or ducks (Table 4.2); however, ducks were more dominant in the pre-Project period, presumably because of the large number of water-bodies and availability of snails in these areas. Among diseases of poultry, ranikhet and fowl cholera were most widespread.

The Project area lacked any organised effort at the development of the livestock sector. The quality of animals, however, was always good. There were grazing lands where fodder grasses such as uri, dam, milo, pati, shama and baksha grew abundantly. Water hyacinth was also an ample source of green feeds. Among the dry feed stuffs, B. Aus and

B. Aman were the main sources of paddy straw. Pulses and oilseeds, a significant part of which could be used as feedstuffs for the livestock, used to be cultivated in a large area.

The ample availability of feed stuff, particularly green fodder, was not an unmixed blessing, however. As the bovine animals used to graze in the low lying or beel areas they had a higher incidence of diseases such as worm infestation.

The demand for draught power was probably not great in the area during the pre-Project period as most of the land was sown with broadcast Aus or Aman. Minimum tillage is the norm in cultivation of such crops.

In short, there appeared to be no major shortage of draught animal in the past and as a result, there was no hiring of draught animals nor was there any seasonal holding of bovines. As many of the small farmers did not have bullocks, they either did not till their land at all or possibly obtained them in exchange with each other.

4.2 OBJECTIVES

The Project primarily aims at preventing damage to crops through removal of drainage congestion caused by back flow from rivers into the beel areas. The Project also attempts to reclaim low-lying areas for cultivation which had been long left fallow. However, the Project had no planned objective as to possible impacts on livestock nor had it any explicit or implicit aim related to the development of the sub-sector, as a whole.

4.3 SOURCES OF DATA

No document other than the Project Proforma (PP) was available for the Project under study. In fact, no pre-feasibility or post-evaluation study of the Project was done.

The PP does not contain any information on livestock, not to speak of any objective towards the development of the sub-sector. Hence the present RRA is entirely based on data collected from various sources using the techniques of RRA e.g. through key-informant and group interview, secondary information and observation. The key-informant and group interviews included people from all walks of life such as marginal, small and large farmers, the landless, local leaders, Upazila and Union officials, teachers and traders. Assessing the situation during the pre-Project period, however, proved difficult for a Project implemented more than a decade ago. Nevertheless, the team tried to resolve this through cross-checking of information collected from different sources. Besides, information so collected was verified through supplementary information available from published and unpublished official sources at Upazila level.

4.4 FINDINGS

Given that there are so many intervention variables and many development and extension programmes influencing various sectors of the economy in the area, this poses a problem of segregating impacts due to the Project. Important findings and changes which have taken place in the Project area during the post-Project period are mentioned, but these

changes or impacts may not necessarily be ascribed fully or directly to the Project. With this caveat some of the positive developments in the livestock sector are mentioned below.

4.4.1 Positive Findings

a) Chicken Rearing

The percentage of households rearing chickens and the number of chickens per household appear to have increased considerably; the total increases are estimated to be 15 and 25 percent respectively. At present almost every household rears chickens, and on an average a household owns 9 birds.

During the pre-Project period, diseases such as ranikhet and fowl cholera were most widespread while their incidence in the recent past has considerably reduced, according to the Upazila Livestock Office. Moreover, increased availability of foodgrains might have led to increased numbers of chickens in the Project area.

b) Goat Raising

Goat raising has considerably increased. The percentage of households owning goats is estimated to have increased to 63 from 57 in the pre-Project period. The number of goats per household is also estimated to have increased more or less in the same proportion. The average number of goats per all households is estimated at 3.6 at present, as against 3.2 during the pre-Project period.

Like chicken rearing, the raising of goats does not demand much special attention. With the construction of embankments and roads, the grazing areas for goats have increased. This has facilitated goat raising to a large extent. Furthermore, the incidence of diseases (such as pox) of goats has been reduced to a negligible proportion. Besides generating employment to non-farm households, the increased activity of goat raising has also increased the number of goat traders at the village level.

A number of NGOs including BRAC and Mothers' Club are operating in the Project area. Besides extending credit to the landless and destitute women in activities related to poultry and goat development, they are also engaged in training them in vaccination of chickens.

c) Infestation of Diseases

The incidence of worm infestation of livestock has declined significantly (Table 4.3). In the past, helminthic infestations were widespread, largely because of snails in low-lying areas, and claimed lives of many animals every year. The most common diseases were liver flukes and strongyles (round worm). According to the Upazila Livestock Office, worm infestation was the cause of 75 per cent of deaths to livestock. Now that the proportion of area under stagnant water has largely declined and the period of stagnation has shortened, the proportion of the animals with the diseases has come down considerably (to 50 per cent).

4.4.2 Negative Findings

In this Project the increased cropping intensity and the change in cropping pattern have had adverse effects on the livestock population. Some of the negative findings are noted below:

a) Bovine Population

The bovine population has decreased to the extent of 15-20 per cent. Both the percentage of households owning cattle and the number per households have declined. This decline is more so for the smaller farm households and for the non-farm households. The increased cropping intensity requires more draught power, and as such the number of animals should have increased to cope with the peak demand. But the increased cropping intensity also means that less land is now kept fallow or that land is kept so for a shorter period which restricts the area for grazing of cattle. As a consequence the Project area is now experiencing an acute shortage of cattle feed and as a result the total cattle population has decreased.

b) Availability of Draught Animals

On an average, a farm household in the Project area at present owns only 1.2 draught animals as against 2.0 in the country as a whole (1983-84). The present availability of draught animals per acre of cultivated land in the Project area is estimated at 0.9 as against 1.0 for the country as a whole in 1983-84. The smaller farms having been pushed to a worse position, there is a tendency for them to use cows as draught animals instead of bullocks. The incidence of hiring of draught animals is also increasing.

With the developing shortage of draught power, the use of tractors and power tillers has come in vogue. One tractor in the Project area is said to have a maximum capacity of tilling 40-50 acres of land a day while a power tiller has the capacity of 3-5 acres a day.

The incidence of seasonal holding of draught animals is prevailing particularly among smaller farms. These farms are in the practice of keeping their animals for 5 months in a year. They usually dispose of their cattle during Baisak-Jaista once the preparation of land for Aus is completed and when they are in need of cash to meet input costs for their cultivation.

c) Shortage of Green and Dry Fodder

Because of the increase in cropping intensity (from 100 per cent in pre-Project period to 175 per cent at present), the proportion of seasonally fallow land has considerably decreased. The consequence has been the shortage of green feed stuffs in the area in recent times. During the pre-Project period, green grasses such as uri, dam, milo, pati, shama were abundant in the beel/baor area. On the other hand, there seems not to have been any effort, on the part of the livestock department, towards cultivating forage crops such as maize, sorghum and Napier in order to mitigate the shortage of green feedstuffs.

d) Cattle Health

The health condition of cattle is reported to have deteriorated after the Project, presumably because of shortage of availability of adequate and nutritious feed. Paddy straw is one of the main sources of dry feed for cattle. Although the paddy straw of HYV Boro is now abundantly available (the proportion of straw to yield is 1:1), the straw of this variety is less palatable and not easily digestible. Before the Project, B. Aus and B. Aman were the main crops grown, the paddy straws of which were better cattle feed. Now in the wake of the situation when local varieties are largely being replaced by HYV Boro and HYV Aman, the dry feed shortage has become acute, on top of the reduced availability of green fodder. As a result cattle health has worsened. Because of the close proximity to the border with India, Indian cattle of very stout health are commonly seen in the Project area, engaged mainly in pulling carts. One can easily observe the difference in the two species with respect to health condition.

4.5 LESSONS

Livestock, in general, and bovine animals, in particular, constitute an integral part of the farming system. But FCD/I Projects are designed such that only the aspects of crop agriculture are considered while planning for water resource development. Other sub-sectors such as livestock remain generally ignored. It is therefore, necessary in the future that the aims for and effects of such FCD/I Projects on livestock be carefully designed at the very outset and jointly monitored by all concerned.

Table 4.1: Bovine Population by size of farm holding in Sharsa and Jhikergacha Upazilas, 1983-84

Indicators	Sharsa Upazila					Jhikergacha Upazila				
	Small farm	Medium farm	Large farm	All farm HH	All non-farm HH	Small farm	Medium farm	Large farm	All farm HH	All Non-farm HH
% of house holds having bovine	47.9	91.2	98.3	66.3	15.2	50.0	93.0	99.0	67.8	15.7
Number of bovine per HH	1.2	3.4	6.7	2.4	0.3	1.2	3.5	6.9	2.4	0.3
% of house hold having sheep/goat	54.7	74.5	86.3	63.8	36.0	62.8	80.6	91.7	70.9	39.9
No of goat/sheep Per HH *	2.2	2.8	3.5	2.5	1.2	NA	NA	NA	NA	NA

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

Note : Considered total number of households in calculating average per household

* : Estimated on the basis of unpublished information provided by Upazila Livestock Office.

Table 4.2: Poultry Numbers by Size of Farm Holding in Sharsa and Jhikergacha Upazilas, 1983-84

	Sharsa Upazila					Jhikergacha Upazila				
	Small farm	Medium farm	Large Farm	All farm HH	All non-farm HH	Small Farm	Medium Farm	Large Farm	All Farm HH	All Non-Farm HH
% of house holds having poultry	97.8	95.2	82.2	87.8	62.4	76.8	92.7	96.3	83.5	52.9
Number of Poultry per household	5.9	10.6	15.1	8.2	3.1	5.3	10.1	14.7	7.6	2.7

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

Table 4.3 : Incidence of Livestock Diseases before and after the Project

Disease	Percentage of incidence	
	Before	After
Skin disease (eg. Hump Sore)	10	5
Pox	Negligible	2
Foot and mouth	20	5
Anthra	2	1
Black water	2	1
H. Septicemia	2	1
Worm Infestation	50	75
Rabies	1	1
Others	13	8
Total	100	100

Source : Upazilas Livestock Office, Sharsa Upazila

5 FISHERIES

5.1 PRE-PROJECT SITUATION

An earlier section has described the physiography and the hydrology in the Project area. To recapitulate, the area is bounded by several rivers, the Kodla, the Kobadak and the Hakor while the river Betna passes through the centre of the Project area. There are also a large number of beels and baors in the study area (Table 5.1). As a result, nearly 50 - 60 per cent of the area used to be either seasonally flooded for 2-4 months or remained perennially under water. The proportion under seasonal flooding was the largest, about 35 - 40 per cent while those under beels and baors were respectively 6-8 per cent and 4-5 per cent. Further, as a result of the meandering nature of the rivers and their spill channels, numerous isolated low pockets had also formed. During peak flood periods, large areas around the beels were inundated to a depth varying from 4 to 8 ft and the areas could not drain out quickly in the post-monsoon period. During the dry season the Betna dries up in many places and as will be described later numerous cross bunds are put in place for fish cultivation. A similar situation has also been observed in other cases. Be that as it may, the area used to be and still remains a major ground for fishing activities and fish culture. Both carp and non-carp varieties were and are caught and the production was substantial.

5.2 OBJECTIVES

No fisheries objectives were set during the planning of the Project. More glaring was the total failure to take into account the nature of economic activities in the region, which depended to a considerable degree on fishing in the rivers and baors and beels. In fact the area had been a major fishing ground since the pre-partition days and was known as such all over Bangladesh. One would, in such a situation, have expected some reference, however cursory, to the use of the open water bodies for fishing.

5.3 DATA SOURCES

During the RRA, interviews and informal discussions were held with the Jessore IFAD Fishery Officer, Sharsa Upazila fisheries and administration staff members, with groups of professional fishermen, fish pond owners, private fish farming managers and fish traders. In addition, the area of perennial water bodies, baors and beels, was noted (Table 5.1) for projecting fish stocks and fish resources. Information on fish prices gathered from various sources including the local markets situated in the Project area are also given (Table 5.2).

5.4 PROJECT IMPACTS

The Hakor as it is now is no longer a river. At one time it was a distributary of the Kodla draining into the Betna. Later the Kodla changed its course and became a tributary to the Ichhamati and the Hakor ceased to be a river. The demise of the Hakor became complete when around 1927 the land under the river was settled as agricultural land. In fact it is not land under crop cultivation as such but under pisciculture. From Benapole as one moves east along the old course one sees cross bunds designed to hold water in pond like depressions and for use for fish culture. As the Hakor no longer receives water from any perennial source



these ponds have to depend either on the water spills of the Kodla or on rainfall. Draining the beels therefore seems to have little or no effect on the fish culture activities on the Hakor river for quite a long stretch.

On the Betna and parts of the Hakor, particularly on the eastern side where there appears to be no earlier settlement, one finds mile after mile of cross bunds for pisciculture. These are leased in from the government for a year by groups of fish farmers or traditional fishermen. In theory this is done only during the dry period. Even if this is the case such structures still create problems of drainage, certainly during the dry season and very possibly also during the monsoon. In any case such practices bear testimony to the fact that the Betna cannot drain the water from the beels.

What the above discussion indicates is that while during the monsoon there may not have been much of a change in the hydrological condition in terms of drainage, as pointed out in the section on engineering, during the dry season there appears to be no significant hindrance created by the Project to pisciculture activities. The findings in the Project area regarding the impact on fisheries have to be judged against this backdrop.

5.4.1 Positive Impacts

a) Temporary waterlogging and fish production.

During the monsoon a large part of the area including the beels is flooded. Therefore, fish breeding and fish production continue, but to a lesser extent than before because of the shorter duration of flood due to somewhat better drainage than before, due to loop cuts and excavation/re-excavation of the khals. In fact in some parts (Sialghona, Ulashi), loop cuts have allowed fish culture in the old course which becomes a pond.

b) Bunds in lowlying areas and fish cultivation.

In the pre-Project period, the depth of flooding was very high (4 to 10ft) in the lowlying areas. After the Project, as a result of improved drainage, the depth of flood water has decreased. This situation has encouraged some wealthy people to cultivate fish in the lowlying areas in large enclosures. As an example, in the central part of the Project, near the villages of Sanyastala and Bahilapota, a number of lowlying areas (ranging from 50-110 bighas) are surrounded by small embankments 4 to 5ft high which protect them from overtopping during the monsoon flood and are used for cultivation of various species of carp. Fresh water shrimp are also stocked. This suggests that as a result of the decrease in the depth of flood water during the monsoon new opportunities have been created for fish cultivation.

c) Baor environment and fish production.

For proper drainage newly excavated canals are connected through the baors. Therefore, the baors are in a free-flowing condition during the monsoon flood (4-5 months) rather than static as was the case before the Project. This alteration in aquatic environment has changed the water quality to encourage better fish growth and fish health and hence fish production. Fish out-migration from the baors is prevented by the lease holders in a number of ways. One is to put in at the mouth of the khal while one also finds bunds in such places as the crossings of the Subarnakhali khal through the Chhota Kona Baor. In some cases

such water control structures become a cause of conflict between the lease holders and paddy farmers (see subsection 5.4.2 below).

d) Pond and beel fishing and fish culture

As mentioned earlier the area under study abounds in small and large beels and baors. Further, as discussed above, there are cross bunds on the River Betna and the old course of the Hakor for fish culture. In fact this is an area which has traditionally been famous for fish culture and the tradition continues till to-day. Thus small beels which are flooded during the monsoon but now have the possibility of being drained out, are being bunded to prevent loss of water during the dry season. The poor fishermen are not in a position to do this and it is the wealthy lease holders who are reaping the benefits. Both carp species such as Rui, Katla, Mrigel, Grass carp and Silver carps and others such as Magur, Singi, and Koi are resident and they reproduce in these beels, so augmenting the fish stocks.

Fish farming has probably become more popular as a whole in the District of Jessore. This is clearly noticeable from the large number of small private hatcheries which have been established and are doing a good business.

As mentioned earlier it is not only the large number of beels, baors and ponds which are utilised for fish cultivation but also the dead and seasonally almost dead rivers which are cross-bunded and utilised for fish cultivation. The Hakor, for example has been divided into a large number of ponds (possibly 1000 ponds) from the village Pantapara up to Benapole on the Indian border. Each of these ponds measures 100'x400' and they are extensively used for fish farming by the traditional fishermen who take leases for 2-3 years from the pond owners who date their ownership since the British period. On the Betna, however, the lease is given by the Government and here the period of lease is shorter, just one year, which the fishermen contend does not give them enough incentive for investment in the ponds.

The pisciculture activities in Jessore get a boost from the loans provided by the International Fund for Agricultural Development (IFAD) for fish cultivation in the baors by traditional fishermen. The loans are provided through BRAC, a local NGO. For proper disbursement of loans and for improving the general socio-economic condition of the fishermen, IFAD has also prepared a list of traditional fishermen.

5.4.2 Negative Impacts

One would be hard put to discern any negative impact of the Project on fisheries, apart from the possible losses in flood plain fisheries which have probably been minor. There were impacts which could be traced to agricultural activities in the area such as the heavy use of urea in paddy fields which is leached to the beels or baors because the Project has not been able to drain out water as quickly as planned. The leaching leads to more algae and weeds and to lowering of the oxygen content in the surface water in some places and may have adversely affected the population and growth of fish. How extensive the problem is could not be ascertained.

The Project has created social conflict between the baor lease holders and T. Aman paddy farmers. As newly excavated canals are connected with the baors, the baor lease holders, such as those in the Chhota Kona, Kanyadaha and Bahadurpur baors, try to control the flow of flood water during the monsoon by putting in obstructions on the crossing points and taking other measures to prevent overtopping and hence fish out-migration. As a result,

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water levels in the surrounding T. Aman fields increase in depth causing damage. The practice also causes delays in rabi cultivation due to slower drainage of the flood water which keeps the fields waterlogged in some areas during the sowing season.

Table 5.1a Selected Statistics on the Fisheries in Sharsa Upazila, Baors

Size	No	Total areas (acres)
Less than 20 acres	5	53.88
20 to 60 acres	3	121.03
60 to 120 acres	4	411.12
300 acres	1	299.12
Total	13	885.72

Table 5.1b Selected Statistics on the Fisheries in Sharsa Upazila, Beels and Ponds

Size	No	Total areas (acres)
Public (khas) ponds	6	2.98
Private ponds	2574	2078.02
Cultivated fish ponds	2380	1760.00
Public beels less than 20 acres	1	27.36
Public beels more than 20 acres	17	3000.00
No of fishing villages	30	
No of fishing cooperatives	11	
Membership of fishermen cooperatives	609	

Source : Upazila Fisheries Officer, Sharsa.

Table 5.2 Fish Prices in Village Markets (May 30 to June 4, 1991)

Species	Size	Price Tk/kg.
Rui, (Labeo rohita)	Less than ¼ lb.	30-35
Mrigel	Less than 1 kg	35-45
Katla	More than 2 kg but less than 4 kg. (More than 4 kg. Jessore price)	45-55 80-110
Silver carp	Less than 1 kg.	30-35
Soal & Boal	Less than 2 kg.	40-50 50-55
Bam	Medium size	30-34
Tengra		
Singi	Medium size	80-100
Magur	Medium size	90-110

Source: Consultant's estimates and observations.

6 SOCIAL AND INSTITUTIONAL ISSUES

6.1 PRE-PROJECT SITUATION

6.1.1 Social Conditions

As of 1981 the Project area was sparsely populated with a density of 516 persons per sq. km which was lower than the national average density of population (605).

Farming and fishing were the major occupations of the people as there were a number of beels, haors and baors in the Project area. The Sonamukhi and Banmander beels influenced the economic activities of the area to a great extent as the rhythm of agricultural activities and the extent of fishery were set by the flooding of the beel areas and their depth and the length of the period of inundation and water-logging.

The distribution of land ownership was highly skewed (Table 6.1). The landless households in the whole of Sharsa Upazila constituted about 21 per cent of the total. Although it may not be statistically significant, it is interesting to note that the percentage of such households is much higher in the five fully benefited Unions than in the partially or non-benefited ones. The proportion is about 50 per cent more in the benefited Unions than in the others.

In the pre-Project period (1980-1981), officially recorded total khas lands available for lease in the Sharsa Upazila were about 136 acres, of which only about 40 acres (30 per cent) fell in the five fully benefited unions. Much of the rest was in two partially benefited unions, viz, Dihi (about 56 acres) and Ulashi (32 acres) i.e. about 65 per cent of the total khas lands in Sharsa Upazila.

The wage-rates of daily labourers in 1980 were Tk. 10-12 a day without food in the lean period. During the harvest the corresponding figures were Tk. 13-15. A worker could expect to receive employment for not more than 7-15 days a month on the average during that time. There were rice mills, pottery and blacksmith workshops in the Project area but these were very few in number.

In the pre-Project period, the Sharsa Upazila was a food deficit area. Besides agriculture, smuggling had been and apparently still remains a major income earning activity.

6.1.2 Institutional Conditions

During the pre-Project period, RCS (traditional) and BRDB cooperatives were functioning and operating on a limited scale in and around the Project area. There were no NGO activities nor were there many social organisations such as formal and informal cooperatives, landless groups, youth clubs and fishermen's societies in the Project area.

Social institutions such as schools, madrashas and hospitals and physical infrastructure such as roads and transport systems were poorly developed and the level of literacy was very low.

Share-cropping, as in other places in Bangladesh, used to be and still remains the most common form of land tenancy arrangement. The shares of the land lord and the tenants were the customary 50:50.

The village society (**samaj**) and its factions used to play an important role in matters of litigation, conflict resolution and social festivals.

6.2 OBJECTIVE OF THE PROJECT

There was no explicit objective for improving the social conditions in the villages or establishing rural institutional infrastructure and services. Nevertheless there was an implicit expectation that due to the removal of water-logging and increased facilities for paddy production certain benefits would accrue to the people in the Project area.

6.3 POST-PROJECT FINDINGS

The RRA team during its field visits did get the impression that in the post-Project period the overall socio-economic condition of the majority of the people has significantly improved. Whether the Project has been the main or even a major factor in such a change has been difficult to establish, however. In the border zone in which the Project falls, a substantial proportion of people indicated involvement in informal trading across the border. Obviously in such a situation, the pace of economic activities will be determined by these activities among other factors. It was not always possible to differentiate between the impact of the Project and those of other such activities. Therefore, the findings have to be rather cautiously interpreted.

6.3.1 Positive Findings

There has been an increasing rate of in-migration of wage-labourers into the Project area from other Districts such as Satkhira and Jhikergacha.

The employment and the wage rate of agricultural labours have increased in the post-Project period in almost all seasons of the year as is depicted in Table-6.2 below. The average increase in employment has been of the order of 50 per cent. Wage rates increased too as local labour supply could not cope with the demand as exemplified by the seasonal in-migration from the southern Upazilas. As a result, not only did the nominal wage rate increase, but the estimated real wage rate also increased. Thus while the average daily wage rate for the year as a whole has risen to Tk. 36 from Tk. 13 over the eighties, the rice-equivalent of the rate has increased by about 45 per cent. On the basis of discussion in the section on agriculture, a substantial part of these changes may be attributed to the Project.

In the post-Project period, transport and communication facilities have improved due to the construction of Union Parishad/CARE roads facilitating in their wake the introduction of rickshaws and rickshaw vans creating more and diversified opportunities for non-farm employment.

Table 6.1: Pattern of Distribution of Households According to Land Ownership in the Project and Non-Project Areas in the Sharsa Upazila, 1983.

Name of Unions	No. of HH	No. of Agl HH	Landless HH		No. of HH having cultivable land (acres)			
			No land	No agl land	0.01-0.04	0.05-2.49	2.50-7.49	7.50-and above
Fully Benefitted unions (A)								
1. Sharsa	3663 (100)	2430 (66.34)	9 (0.25)	951 (25.96)	273 (7.45)	1465 (39.99)	806 (22.00)	159 (4.35)
2. Nizampur	1937 (100)	1568 (60.94)	8 (0.41)	316 (16.31)	45(2.32)	849 (43.83)	558 (28.81)	161 (8.32)
3. Lakhsanpur	2021 (100)	1504 (74.42)	9 (0.44)	440 (21.77)	68 (3.38)	844 (41.76)	512 (25.33)	148 (7.32)
4. Bahadurpur	2387 (100)	1851 (74.51)	2 (0.08)	501 (21.99)	33 (1.38)	967 (40.51)	701 (28.37)	183 (7.67)
5. Benapole	3740 (100)	2329 (62.27)	17 (0.45)	1174 (31.39)	220 (5.88)	1470 (39.34)	695 (18.58)	164 (4.38)
Total (A)	13748 (100)	9682 (71.42)	45 (0.33)	3382 (24.60)	639 (6.64)	5595 (40.70)	3272 (23.80)	815 (5.93)
Partially benefitted unions (A)								
6. Dihi	2373 (100)	1943 (81.87)	7 (0.29)	380 (16.02)	43 (1.81)	976 (41.13)	758 (31.95)	209 (8.80)
7. Ulashi	3117 (100)	2400 (76.99)	22 (0.70)	519 (16.65)	176 (5.66)	1440 (46.20)	748 (23.99)	212 (6.80)
Total (B)	5490 (100)	4343 (79.11)	29 (0.53)	899 (16.37)	219 (3.99)	2416 (44.01)	1506 (27.43)	421 (7.67)
Non-benefitted unions (C)								
8. Putkhali	2670 (100)	2112 (79.10)	8 (0.30)	417 (15.62)	133 (4.98)	1229 (46.03)	711 (26.63)	172 (6.44)
9. Goga	2612 (100)	2015 (77.53)	9 (0.34)	413 (15.81)	165 (6.32)	1209 (46.29)	660 (25.27)	156 (5.97)
10. Bagachra	3382 (100)	2457 (72.65)	8 (0.24)	798 (23.60)	119 (3.52)	1656 (48.96)	618 (18.27)	183 (5.41)
11. Kayba	2876 (100)	2260 (87.73)	5 (0.11)	503 (17.49)	108 (3.75)	1401 (48.71)	673 (23.40)	186 (6.47)
Total (C)	11540 (100)	8844 (76.64)	30 (0.26)	2131 (18.47)	525 (4.55)	5495 (47.62)	2662 (23.07)	697 (6.04)
Total: A+B+C	30778 (100)	22879 (74.33)	104 (0.34)	6412 (20.83)	1383 (4.49)	13506 (43.88)	7440 (24.17)	1933 (6.28)

Source: Calculated from the data supplied by Upazila Agriculture Office, Sharsa.

Note: Figures in parentheses are percentages of total number of households in the Unions.

Table 6.2: Wage Rate and Employment of Agricultural Labours

Month	Average Days Employed (Monthly)		Average Wage Rate (Daily) in Tk.		Real Wage (Daily)		% increase in wage in Tk.
	1980	1990	1980	1990	1980	1990	
Baishak	10	15	15	35	2.5	2.9	16
Jaista	10	12	12	30	2.0	2.5	25
Ashar	15	25	12	45	2.0	3.8	90
Srabon	15	20	15	40	2.5	3.3	32
Bhadra	10	15	12	30	2.0	2.5	25
Ashwin	10	10	12	30	2.0	2.5	25
Kartik	10	15	12	45	2.0	3.8	90
Agrahayan	15	20	15	40	2.5	3.3	32
Poush	10	25	15	50	2.5	4.2	68
Magh	10	12	12	30	2.0	2.5	25
Falgun	7	10	10	30	1.7	2.5	47
Chaitra	7	10	10	30	1.7	2.5	47
Total	129	189	13	36	2.2	3.0	45

Source : RRA field visits

Note: Price of rice = Tk. 6/- per seer in 1980
 Tk. 12- " " in 1990

Employment opportunities have brightened in the Project area as evidenced not only from the ubiquitous rickshaw pullers and rickshaw vans and increased rate of wage and employment of agricultural labours (stated above) but also from the increased number of rural industrial establishments one finds in the area (Table-6.3). (For the details on the rural industrial establishments see the section on economic impacts).

Table 6.3: Level of Employment in Rural Industrial Activities, Sharsa Upazila.

Activity	Employment (No.)		
	1987	1990	% change
Rice mill	84	268	+219
Furniture	12	51	+325
Poultry		23	-18
Agricultural tools including blacksmith	45	179	+198
Saw mill	15	40	+167
Brick field	40	120	+200
Till making	25	49	+96
Bidi making	200	300	+200



Source : BSCIC, Jessore and RRA Team visits.

Note : About 90 per cent of the rice hullers are usually operated by STW engine on a part time basis.

The types of activities exhibiting the highest rates of growth indicate certain interesting socio-economic developments. Agricultural tools have shown one of the most vigorous rates of growth, possibly pointing to the linkage effect of the spread of mechanised irrigation which demands repair facilities at the local level. On the other hand the growth of the furniture industry possibly indicates an increase in affluence. The growth in brick fields may mean either a growing level of affluence the demand by the infrastructure sector. The visits in the villages did clearly show that the improvement in housing has been rather substantial in some places while the agricultural base of the affluence was also made clear when the estimated income of the vegetable farmers were found to be rather large by Bangladesh standards. Although most of the vegetables were really destined for the Calcutta market on the other side of the border, it was also true that the reduction in the depth and duration of flood as a result of the Project had some role to play in making such vegetable cultivation possible.

In the post-Project period, activities of the formal cooperative societies (BRDB/RCS) and NGOs increased considerably. Present performance of these development agencies are discussed below :

a) BRDB Cooperatives

Bangladesh Rural Development Board (BRDB) started working in Sharsa Upazila in 1974, but its activities were very limited in the pre-Project period. In the post-Project period, various types of BRDB cooperative societies are operating and functioning inside the Project area. The present picture of the various societies and their financial performance is depicted in Tables 6.4 and 6.5 below. These tables indicate the better performance of the womens' cooperatives (MSS) both in terms of the their savings and the rate of repayment of loans.

Table 6.4: Performance of BRDB Cooperative Societies at Sharsa Upazila, 1990.

Types of Societies	No. of Societies	Membership (No.)	Total Saving (Tk.)	Total Share (Tk.)
KSS	186	8729	12,36,525	9,99,000
BSS	55	1703	1,85,425	81,750
MSS	43	1647	4,11,220	15,510
Total	284	12079	18,33,170	10,96,260

Source : BRDB, UCCA Office, Sharsa.

Table 6.5: Loan Operation and Realisation under BRDB Cooperatives in Sharsa Upazila.

Types of Societies	Short Term		Long Term		Realisation Rate (%)	
	Loan (Tk.)	Overdue (Tk.)	Loan (Tk.)	Overdue (Tk.)	Short Term	Long Term
KSS	2,57,08,000	34,22,690	2,34,82,057	1,70,75,327 (45,12,300)	86.68	10.00
BSS	12,39,336	48,080 (1,63,831)	-	-	56.00	-
MSS	30,85,700	97,560 (4,99,500)	-	-	96.00	-

Source : BRDB, UCCA Office, Sharsa.

Notes : Figures in parentheses indicate the amount of loan to which maturity time is not over.
: Long term loans are not provided to BSS and MSS.

To understand the impact of the BRDB activities on agriculture it may be noted that it has provided 149 DTWs and 518 STWs in the whole of Sharsa Upazila through the KSS. This represented 51 per cent and 14 per cent of DTWs and STWs respectively in the area.

BRDB has set up a 'Training-cum-Production Centre' at the Sharsa Upazila complex with a view to imparting training for skill development to the women who are without much income or resource. It has already trained up to 500 women in handicrafts, tailoring, sewing and making embroidery quilts.

b) RCS Cooperatives

These are the traditional cooperatives. There are 102 cooperatives of this type in the Sharsa Upazila. Most of the traditional cooperative societies are not functioning or operating properly and are facing various difficulties.

c) BRAC

Bangladesh Rural Advancement Committee (BRAC) started working in Jhikergacha Upazila in 1985 and extended its activities to Sharsa Upazila from 1986. In Sharsa Upazila its activities include irrigation, livestock, rural transport and social forestry. In its irrigation program BRAC procures DTWs through BADC at a cost of Tk. 175,000 each and passes on the equipment to organised groups consisting of a minimum of 104 members. The rate of interest charged for a loan for a DTW is 9 per cent while the water rate charged varies between Tk. 1200 and 1400 per bigha. Total profit is shared between the BRAC and the Group Members on a 20:80 basis. In Sharsa Union there are two DTW groups formed by BRAC, while in Shimulia and Navaron Unions there are 4 and 8 DTW groups respectively.

BRAC supplied 263 rickshaw vans in Jhikergacha and Sharsa Upazilas together. In Sharsa Upazila rickshaw vans were supplied at Sialghona and Dhaka para. In Sharsa, BRAC has a social forestry programme and planted about 5,000 trees for roadside plantation and employed nine women for the purpose. In addition, it involved 7-8 women for homestead plantation in Sharsa. It has provided loans of Tk. 20,531,800 to its 6873 members in Jhikergacha and Sharsa Upazila. Many of the loans have been provided for raising cattle or related to livestock-related activities as may be seen from Table 6.6 below.

Table 6.6: Distribution of Loan By Type of Activities in Jhikergacha and Sharsa Upazila, 1991

Activity	No. of loanee members	Total amount of loan taken (Taka)	Percentage share of total loan
1. Agriculture	651	14,37,226	7
2. Fish Culture	118	2,05,318	1
3. Livestock	3125	1,33,45,670	65
4. Rural Industry	22	2,05,318	1
5. Rural Transport	263	12,31,908	6
6. Small Trading	705	8,21,272	4
7. Food Processing	392	10,26,590	5
8. Irrigation	1249	20,53,180	10
9. Poultry	348	2,05,318	1
Total	6873	20,531,800	100

Source : BRAC Branch Office, Navaron

d) Educational Institutions

During the pre-Project period, the Project area was a relatively backward place with a low level of literacy. During the later part of the eighties, the opportunities for formal education significantly increased. This is partly due to the improvement of the socio-economic condition of the people. There are now about 150 educational institutions of various types. Most, however are primary schools. In recent years there has been a substantial growth in

enrolment but not much of a change in the number of schools indicating a better capacity utilization. The problem of drop-out, however, remains the scourge. The drop out rate is as high as 60 per cent at primary level and 40 per cent at the secondary. Most of the drop-out children are from poorer strata of the society.

e) Other Formal and Non-formal Activities

Besides the above social and educational institutions, a number of other institutions or institutional mechanisms are at work in the Project area. Of particular note is the presence of an office of IFAD, the International Fund for Agricultural Development. IFAD is working to organise the fishermen and landless agricultural labourers for fish culture. There are 11 baors under IFAD-sponsored management in the Project area.

Many informal cooperative societies which have no formal registration with the Registrar of Cooperatives exist in the Project area. Village people have set up these societies on their own initiative. These societies require their members to save regularly to form a savings fund which is used to provide loans to the group members at rates of interest ranging from Tk. 2 to Tk. 5 per month per 100 taka of loan.

Local people, at least in some areas, have proved capable of taking their own initiative for construction of small embankments (e.g. Haokhola cross dam or the one to prevent flood water from the baors near Panditpur). They also, at least once, have been involved in a major community level mobilization for the excavation of a major canal (e.g. Ulashi-Jadunathpur loop cut). In the Bahadurpur Union, the local government (Union Parishad) has shown itself capable of constructing a flood protection embankment on their own without any help from BWDB engineers to safeguard themselves against inundation from the Kodla water.

f) Living Conditions

Overall living conditions of the people within the Project area have improved. This could be ascertained from the improved housing and sanitary conditions and availability of drinking water facilities.

6.3.2 Negative Findings

a) Land Acquisition

The villagers whose lands were acquired recently for the construction of drainage canals at certain places (e.g. Natadighi), were not paid any compensation the first time the earthwork was done. This was shown as being done under the initiative of the union parishads for which generally no compensation is paid as a matter of policy. This created dissatisfaction among the affected land owners.

b) Conflicts of Interest

There are several instances of conflicts of interest between fishermen and farmers. Examples, of course, are the construction of crossdams on the Betna or the closure of the mouths of the Subarnakhali khal at the Chhota Kona baor which create obstructions to drainage of flood water. Similarly the Kanyadaha sluice is kept closed by earth-obstruction for fish culture. People from some villages affected by these actions on the part of the fishermen met the downstream people to find out a solution. They also met the Upazila chairman and

the UNO. But the problem has not been solved. This has created great dissatisfaction to the landowners of Natadighi and Dubpara.

At Subarnakhali and Bahilapota villages the jute growers are not allowed to ret jute in the water bodies by the fishermen groups, which causes conflicts between the jute growers and the fishermen groups.

c) Sluice Operation

Sluice khalashis employed by BWDB are responsible for cleaning and operation of the sluices. BWDB has budget constraints for effective operation of sluices as there is no provision for supplying oil, grease etc. The Project, like many others implemented by BWDB, has not succeeded in involving local people in the routine operation and maintenance of regulators or drainage outlets. There are no local committees for these structures (except for the Subarnakhali sluice). Too often whether these are operated or not depends on the will of local influential persons. Some of these persons were even alleged to have taken away some removable components of the control structures. It was not possible to verify such allegations, however.

6.4 LESSONS LEARNT

a) Project Operation and Maintenance

The first lesson to be drawn on the basis of RRA in the Project area is that proper O&M is essential for the success of a Project. The institutional mechanism in place is inadequate either because of the shortage of funds and/or possibly more importantly due to a system which is not geared to rewards for efficiency or punishment for the lack of it.

Conflict resolution should be one major function of the institutional mechanism for O&M. Unfortunately, so far no attempt has been made to gear the system to this end.

b) Public Consultation

People are perfectly capable of taking up construction activities on their own. So are the local governments. The impetus behind the demonstrated capabilities comes from strongly felt needs. This suggests that the institutional mechanism must include a framework for involvement of and consultation with the people at large at the planning stage. One must be careful, however, in proposing any new format as some of those existing at the moment for involvement of local people during the implementation of the Projects have been found to be non-functioning. On the whole, there appears to be little or no contact between the higher authorities of BWDB and the people.

c) Secondary Socio-Economic Impacts

With the removal, however partial, of the spectre of flood, various opportunities for a diversified economy and occupational structure arise. Such opportunities can be realised only through a supporting mechanism which includes various programmes of credit and training (in production and marketing).

6.5 RECOMMENDATIONS

The section above immediately suggests certain directions in which actions may be initiated. Some of these have already been hinted at. Other recommendations, some of which are specific and some of rather general nature, are made below:

- i. effective annual maintenance of physical facilities on sound engineering basis has to be ensured. At the same time adequate maintenance budgets have to be provided to meet the actual financial cost of operation and maintenance. Too often Projects are approved and/or implemented without any such provision;
- ii. as resources for O&M are scarce, every opportunity must be used for mobilization of such resources. Provided the structures yield tangible benefits to the people and are constructed in response to their felt needs at least a part of the annual maintenance should be funded from local resources. A betterment levy, whether in cash or kind, could be imposed by the local governments on the beneficiaries according to some administratively simple formula;
- iii. there should be a committee to coordinate the maintenance activities and to ensure that local contributions are made and used fairly. The committee should be formed of chairmen of the Upazila and the unions and relevant officials including the representative of the LGEB;
- iv. there should be a field level Regulator Committee for operation of the regulators and sluices. The committee should be composed of representatives of various interest groups, particularly of farmers and fishermen, from all the area served by the regulator/sluice. An appropriate representative of the BWDB would be a member of the committee. For example, in case of the Shankarpur regulator, the Upazila chairman, the UNO and the executive engineer of the BWDB all should be members of the committee as the regulator affects a vast area and many interest groups;
- v. there is no provision for the development of other physical and social infrastructure and rural institutions in project planning. This certainly had been no fault of BWDB as such. The fact, however, remains that the impacts of these various infrastructures are highly interactive and their potentials are realised better in the presence of each other. Planning for the infrastructures, both physical and social, for implementation in the Upazilas therefore should be done keeping their interactive nature in mind;
- vi. the present leasing system of the water bodies for fishing favours richer and more powerful interests at the expense of the poor fishermen despite a facade of those being leased out in favour of fishermen's groups. The problem is very deep-rooted and needs the attention of very high level authorities for its solution. One fact, however, stands out clearly. It is the lack of resources of the poor fishermen which forces them to depend on the rich *de-facto* lease holders. Appropriate credit facilities, therefore, can go a long way in solving the problem.



7 IMPACTS ON WOMEN

7.1 INTRODUCTION

The situation of women in the pre-Project period remains to be precisely known as the only available document, the PP, is completely silent on the issue. There is no reason, however, to believe that it would have been any different from the general situation in which women, particularly rural women, find themselves in this country. This was verified in the field during the RRA as may be seen in section 7.4.

7.2 OBJECTIVES

The Project had no explicit or any implicit objective regarding women's development. On the other hand, however, any Project aimed towards increasing agricultural output is almost invariably likely to have immediate implications for utilization of women's labour both in the wage market and in home production (for a review of the pertinent issues, see Westergaard:1989). Women are involved in crop production, particularly during the post-harvest processing stage. They are employed both as unpaid family labour and also as wage labourers. As total output increases the demand for their labour increases. If there is technological change, particularly a move towards mechanised rice husking, this may actually decrease the demand for unpaid family labour which may be a welcome change as this may free women from the drudgery of backbreaking chores. On the other hand, however, if much of the output growth takes place in the richer households, it may be that a substantial part of it is processed by hired female labour. In such a situation, it is difficult to say which way the net change in employment of hired female labour will move. If mechanisation means simply the use of motors of shallow tubewells for rice husking, hired women are hardly likely to gain as they are not usually found to be employed in such very small establishments. Rather, they are likely to lose a part of the employment obtained previously in rice-husking.

7.3 SOURCES OF DATA

Sources used for collection of data during the RRA comprised interviews with the concerned officials, Union Parishad chairmen, rural men and lastly, but most importantly, rural women. An important source was the handouts provided by concerned officials involved in different rural development programs, both government-run and NGO-supported. In addition, personal observations on the activities and status of women in the Sonamukhi beel area constitute a major method for understanding the problems of women and the opportunities open to them.

A major problem faced by the women's issues specialist during the RRA was the short time available for data collection and interaction with women in the villages. While other male members of the team could form sub-groups and talk to or collect information from many people in the village or in the market-place or in the tea-stall, there is no such place of congregation for women in the village sometimes making it difficult to properly cross-check (triangulate) the information obtained. Also this allowed less effective time than in the case of the male professionals for collection of all types of necessary information such as time-use

changes which is rather an involved exercise. Then again, wherever there had been organizational activities for women, only small groups of women had been involved while others knew little or nothing about it. Such a situation demanded that the women's issues specialist interact not only with women but also with men to collect relevant information.

7.4 PRE-PROJECT SITUATION

During fieldwork within the Project area it was revealed that women were involved mostly, apart from usual household chores, in agricultural activities within the homestead. These included post-harvest agricultural activities such as winnowing, parboiling, drying, husking and storage of paddy and rice. Both unpaid family labour and hired women wage labourers were involved in such activities. The main burden, however, appears to have fallen on the female members of the household which, of course is not an unusual finding. What appeared more surprising is that not many women seemed to be available for hire, possibly reflecting the operation of the "hidden" economy of the border region. Those who had been employed were paid wages in kind, cooked food and paddy.

Traditional methods of husking, particularly by dhenki, were quite common in the pre-Project period. Big farmers usually engaged women wage labourers for this.

Within the households other activities of women included the care and upkeep of the house, cooking and child rearing and homestead gardening.

In the pre-Project period the number of women working outside their homes (other than in post-harvest processing) was very small. There were few opportunities for work available for women. At this time the Bangladesh Rural Development Board (BRDB) started its program for women's development. Through its Mohila Samabaya Samiti (women's cooperative societies), MSS, program women were trained in the making of nakshi kantha (embroidered quilt) and tailoring skills. After the training the MSS in different villages received orders to produce and supply kantha for which the members of the societies received payment on a piece-rate basis. Although no information on the number of such cooperatives was available from the concerned Upazila Officer, the number of women beneficiaries must have been quite small as these cooperatives were located mostly in the areas surrounding the Upazila headquarters.

Educational opportunities for women, in the pre-Project period, were rather few. Early marriages were common in the 1970s. This led parents to emphasize training of girls in household activities rather than educating them in schools.

7.5 PRESENT SITUATION

7.5.1 Positive Findings

With the increase in agricultural production an increase in on-farm activities (such as winnowing, parboiling and drying) has been noted. But the total time spent on such activities may have remained the same due to the decline in the use of dhenki because of the

prevalence of the rice-husking machines or even full-fledged mills as observed in some of the market-places. Thus while the drudgery of dhenki-husking of rice has been lessened it has opened up opportunities for women labourers to be engaged in gainful employment.

The techniques of, and time spent on homestead gardening have remained unchanged. Both cooperative activities and time spent on them, however, have somewhat increased. There appears to be no change in women's earnings from agricultural and gardening sources. In contrast, an increase in the wages of women who work as labourers in post-harvest activities was noted. For those who are involved in income-earning activities, the cooperatives seem to have opened up new opportunities.

In the years after the completion of the Project, a number of government and NGO programmes have started in the Project. These activities are mostly located in the areas surrounding the Upazila headquarters. Bangladesh Rural Development Board (BRDB) has 43 women's cooperatives in Sarsha Upazila with 1,653 members under its jurisdiction. Members are required to save ten Taka per week for a certain period of time, before they can get loans for economic activities (e.g. poultry rearing, paddy processing, etc.). BRDB also engages eight hundred cooperative members in embroidery activities. They earn 300 to 500 Taka per month. The society members also received training in nutrition, vegetable growing and soyabean cultivation. This programme was implemented in 1982.

BRDB has also begun a vocational training programme in the Thana Training and Development Centre (TTDC). This programme started in the Sarsha Upazila in 1988. A master tailor trained sixty women in tailoring techniques. Later, 28 sewing machines were distributed among these trainees. Some members also received training in handloom operation.

BRDB also took up a literacy program in association with another organization. There are 10 reading centres with 250 students in this program.

The Project on Women's Development of the Department of Women's Affairs at the Upazila has 6 training-cum-production centers in Sharsa Upazila. This Project started in 1981. Through this Project women were trained in tailoring and weaving crafts in these centres. After training, the participants were encouraged to set up trades of their own. This programme has stopped since 1988.

The Department of Social Services in the Upazila has 64 mothers' clubs (MC) in eleven Unions of Sharsa. The activity of the clubs aims at family planning through social development. This programme is targeted at landless people with an income less than Taka 1200/year. A minimum of 20 members are needed for the formation of a club. The activities of a club are coordinated by a centre secretary who receives Tk. 50/month as emoluments. Members can get interest-free loans for gainful economic activities. The total number of MC member for the eight Unions in Sharsa is 1,535.

Bangladesh Rural Advancement Committee (BRAC) started their activities in the Project area in 1986. BRAC targeted landless men and women in forming cooperative groups to undertake economic and social activities (irrigation, livestock and poultry rearing, horticulture, food processing, functional education, primary health care, small trading and

cottage industry). Women constitute about 50 per cent of the total group members covered by different BRAC activities. Some of the activities in which women feature prominently include making of nakshikantha (embroidered quilts), social forestry, food processing, ownership and operation of deep tubewells for selling irrigation water, livestock and poultry care and horticulture.

A group of fifteen women under the Rural Maintenance Programme (RMP) coordinated by CARE work on maintaining earthworks in one Union (Laxmanpur). These women receive, as is the case with the RMP elsewhere, Tk. 25 per day as wage received once every two weeks through a local bank.

The cooperative supported by the Bangladesh Krishi Bank in Shikherpur started in 1980. They have twenty four members who saved money in the bank on a weekly basis and later took loans for different economic activities.

BSCIC reported the existence of cottage industries operated by women, such as pottery, tile-making, tailoring and making of nakshikantha, in Sharsa Upazila. BSCIC provides technical support such as providing designs for nakshikantha to the operators of such industries.

Akiz Biri Factory which is the largest biri (one kind of indigenous cigarette) manufacturing company in Bangladesh also employs rural women in their production activities. The factory gives two taka for making a thousand biri shells. Women from only eight households are involved in this work. The reason for the low level of employment is that the rest of the women employees are all drawn from among the households in the Upazila headquarters. If the latter can be regarded as rural, which probably is a more correct way of depicting the Upazila headquarters, then the factory should be termed as a major employer of rural women in industrial activity in the Project area.

One is left with the impression that a lot of activities which help women both economically and socially are going on in the Project area. Very few of these, however, can be directly or indirectly linked to the implementation of the Project.

7.5.2 Negative Findings

In some villages within the Project area some of the cooperatives have closed down due to non-repayment of loans by some of the members.

One also observes fraudulent activities in the guise of non-government organizations. An organization called Polli Foundation working within the Project area seems to be exploiting poor people in the rural areas. Field workers of this organization collected money (10 taka from each person) from two villages with the promise that they would get loans for productive activities at the end of six months. But after collecting money from the villagers the field workers of that organization have not returned to those villages yet. The consultants tried to contact the local officer in charge of this foundation but was unable to locate and contact him.

The Project area is adjacent to the Bangladesh-India border and quite naturally some of the families including the womenfolk in such households have been found to be involved in illegal informal border trade.

On the whole there has been great scope for increased involvement of women in economic activities. A summary view of the changes is shown in Table 7.1.

7.6 LESSONS LEARNT

The Project did not consider women's issues to be important in the process of planning, implementation and operation. It is not known whether women were involved in the earthwork during the implementation phase. It is quite likely that they were. As other sections of this report indicate there have been changes in some of the economic activities directly as a result of the Project, e.g. agriculture and fisheries, in both of which women are involved in several crucial stages of operation; viz., processing and marketing. One therefore can advocate that the issues relating to gender-relations and women be integrated in future projects in all their stages. While doing so several points need to be kept in mind.

Women should be encouraged to participate in off-farm activities. As the observations in the Project area indicate, good extension services can motivate women to be involved in such activities in a group. Thus, if there are reasons to believe that with the increase in crop production, women's employment may actually fall, as may happen in case of large scale use of rice husking machines, both government and non-government organizations should be encouraged to introduce and/or expand other income-generation programmes in the area. There are two aspects of the organizational activities which merit attention.

The first is that there is a felt need for both economic and social activities. Thus not only income-generation should be aimed at but activities in the field of literacy and primary health care and personal hygiene need to be encouraged.

Secondly, attention should be paid to avoidance of duplication of efforts. There seems to be a great need for coordinating different government and NGO activities for women. Officials at the BRDB office at Sharsa complained about other organizations duplicating their projects in the same area. As such in some villages there is more than one programme while in others there is none.

Table 7.1 Activities of Women in Pre and Post Project Situation

Activity	Pre-Project (if present)	Post-Project (If present)	Change
Post-harvest activities:			
- Winnowing	✓	✓	↑
- Parboiling	✓	✓	↑
- Drying	✓	✓	↑
- Husking (by dhenki)	✓	X	↓
Care & upkeep of the house	✓	✓	▲
Kitchen gardening	✓	✓	▲
Care of livestock	✓	✓	▲
Care of poultry	✓	✓	▲
Society membership	✓	✓	↑
Road maintenance	X	✓	↑
Nakshi kantha making	✓	✓	↑
Fuel cake making	✓	✓	▲

Source : Consultant's observations

Note : X = No ✓ = Yes ↑ = Increased ↓ = Decreased ▲ = No change

8 IMPACT ON NUTRITION AND HEALTH

8.1 INTRODUCTION

Information on the status of nutrition in the Project area before the Project could not be drawn from the available secondary sources. The RRA team had to depend on information gathered in the field to understand the pre-Project situation (see section 8.4).

8.2 OBJECTIVES

Objectives in the area of nutritional impacts were not included in Project planning. The Project, as explained below, could have nutritional impact, however.

The Project has been justified in the name of its intended positive impact on crop agriculture, particularly on production of paddy and more particularly that of HYV Boro paddy. This is likely to increase the access to food of people in general and to improve their nutritional status. Further, as HYVs need more labour input than local varieties, labour, particularly hired labour could also benefit nutritionally through higher wages and consequent increase in the bundle of consumption goods which is dominated overwhelmingly by food and foodgrains. Apart from the quantity of food, nutritional quality is determined by other factors also.

HYVs are known to contain somewhat lower levels of protein than the local varieties. In the present case as neither pulse production nor that of fish as a whole appears to have been adversely affected, whether because of the Project or not, the protein loss may be assumed to be insignificant.

The nutritional status of a group of people is determined also by the state of environmental hygiene which, largely, though by no means entirely, determines the prevalence of disease and morbidity. The access to safe drinking water, itself a function of ground water availability and investment in tubewells, is one major indicator of the state of environmental hygiene. In the Bangladesh context this is particularly important because of its impact on the health and disease of children who are nutritionally more at risk than adult men and women.

8.3 SOURCES OF DATA

The data on nutritional indicators in the Project area were collected from concerned Upazila officials, village men and women and through personal observation of the people of age groups most at nutritional risk (0-15 years). It was difficult to gather information on food intake from the villagers as in most cases they do not use any measuring device to measure the amount of food being cooked for consumption. Food intake is also seasonal and very much dependent on the income level of the household.

The discussion in the preceding section along with the problems of measurement makes it clear that understanding the nutritional status of a group of people in an area during RRA is no easy job. It is very difficult to find out the net result of various diverse movements of the important variables. What was attempted, therefore, was to find out if the broad

indicators affecting the nutritional status of the people have or have not changed and infer the possible direction in which they may have moved.

8.4 PRE-PROJECT SITUATION

During discussions in the Project area with villagers it was generally agreed by most of them that there had been no significant change in their food habits over the last few years. In the pre-Project period most families used to consume three meals a day. Consumption of rice was (culturally) adequate because there were fewer people to feed. Use of wheat or *ata* (flour) was not common among the villagers in the pre-Project period. Higher intakes of pulses, fish and other protein sources were claimed.

During this period primary health care facilities were poor due to the lack of good communication with places where medical facilities could be readily available. Therefore, the number and proportion of children receiving inoculation and vaccination was less than at present. Rivers, beels or ponds were the major sources of drinking water. As a result most children suffered from water-borne and other diseases (e.g. cholera, diarrhoea, intestinal disorders etc.).

8.5 POSITIVE FINDINGS

8.5.1 Food Habits and Food Intakes

No significant change was noted among the villagers in their food habits. People still consume three meals a day, which consist mainly of rice. Although they have used wheat in the past, consumption of wheat was not particularly noticeable during the RRA.

An increase in the consumption of vegetables, especially of the leafy varieties, was noted within the Project area. All the villagers who could be interviewed had been found to have consumed vegetables every day of the week. This change in behaviour is possibly influenced by the media. Village women are aware of the nutritionally beneficial effect of leafy vegetables on children because of the different media propaganda and may also be made aware through those activities conducted by most NGO and government programmes.

8.5.2 Safe Drinking Water

One of the major findings related to nutrition and health in the Project area is the better availability of safe drinking water compared to the pre-Project period. Previously only a few households in the villages were privileged to have such access. Currently there are 1,754 HTWs (hand tubewells) in Sarsha Upazila that supply safe drinking water as claimed in a handout produced by the Upazila unit of the BRDB. Also an increase in the use of STWs for irrigation was noted in the rural areas. As has been found in the Project area, the crop fields all surround the homesteads thus facilitating the use of STWs for collection of drinking water whenever these are in operation. The people in general claimed that incidence of gastro-enteric diseases and disorders has significantly decreased during the last few years.

8.5.3 Sanitation and Safety

An increase in the awareness of oral rehydration therapy to combat diarrhoeal diseases was noted among the village women. This was made possible by BRAC which took up this program in the 1980s. Some pucca sanitary facilities were also seen within the Project area.

8.5.4 Family Planning and Health Services

Family planning and health care facilities have improved within the Project area. There are 27 family planning workers serving eleven Unions of Sharsa Upazila as stated by the Upazila social welfare service officials. All women interviewed reported regular visits from the family planning workers. Health workers also provide inoculation and vaccination to the village children on a regular basis. As a result a decline in diseases such as whooping cough was noted.

8.6 NEGATIVE FINDINGS

8.6.1 Health Status

Inadequate nutrition, particularly insufficient intakes of calorie and protein, lead to retardation of growth and malnutrition in the form of stunting and wasting. Although it was not possible to clearly distinguish the two as this would have involved an in-depth measurement technique, the appearance of the children in the Project area in the concerned age group at risk (0-15 years) suggested presence of borderline nutritional deficiency. Children observed showed signs of being underweight with reference to their height and age. This suggests periods of insufficient food intake. During the months of March and April many of the poor people in the Project area suffer from food shortage. As a result the frequency of rice consumption decreases to two times a day and the total amount consumed also decreases.

8.7 LESSONS AND RECOMMENDATIONS

8.7.1 Lessons Learnt

Since nutritional status is closely associated with food production in a largely subsistence economy both the quantity and quality of food production need to be emphasized at the planning stage. The Sonamukhi Beel Project aimed at draining the area of flood water and thus increasing land available for cultivation. As the Project is not totally successful (see Chapter 3) such increase is still uncertain. In areas where paddy production has increased due to the Project a decline in production of legumes such as pulses was noted, although as a whole the pulse area has not declined. People may eat three times a day but the nutritional quality of the food they consume has declined except perhaps for calories. To avoid this type of situation future FCD projects need to consider an objective which will not only increase paddy production but consider other agricultural outputs too.

8.7.2 Recommendations

Measures that could be taken up at the planning stage to avoid the negative impacts obviously include those for encouraging farmers to cultivate vegetables and other nutritious crops.

For encouraging vegetable production, women need to be targeted through suitable extension programmes. As described in Chapter 7, there are quite a few programmes under both government and non-government agencies which try to help women in both income-earning and health-related activities. As these programmes have direct relevance for the improvement of the nutritional status of the households, the programmes, if necessary should be amended suitably.

There is a need to direct the extension efforts not only at women but also equally at men. This is so because greater awareness about hygiene and higher income will not ensure better nutrition. Whereas public and private investment in facilities for drinking water supply may be forthcoming, that on sanitation facilities is still at very early stage. As generally it is men who control the purse strings in a household, they need to be convinced that it is good economics (as future medical expenses are lessened, increasing earning capacity) to invest in them.



9 ENVIRONMENTAL IMPACT

9.1 PRE-PROJECT SITUATION

Chapter 2 has described the physical situation and hydrology in the Project area. That may be considered as the starting point for this section. As has been described there the area is basically a wet land system in a moribund delta characterised by highly meandering rivers which are silting and drying up, leaving in their wake many large and small water bodies, beels, baors and ponds, some natural, some man-made. During the monsoon, the area experienced a large inflow of water from across the border which used to quite easily overflow the banks of the silted-up rivers and inundate a vast area, threatening life, property and income of the people in the area.

Some 10 - 12 per cent of the Project area was permanent wet-land comprising the beels (1250 to 1500 acres or 6 - 8 per cent) and the baors, covering around 900 acres or about 5 per cent of the area. The inundation during the monsoon kept 35 to 45 per cent of the total Project area temporarily waterlogged. The permanent water bodies exhibited the characteristics of a typical wetland ecosystem rich in flora and fauna. Both temporary and perennial water bodies were the main source of fish supply and supported luxuriant growth of aquatic vegetation which after decomposition would add organic matter to and enrich the soil. In addition silt carried and deposited by flood water would also enrich the soil and helped in maintaining natural soil fertility.

On the other hand, however, the heavy siltation in the Betna river, the main drainage channel, coupled with its highly meandering nature has made the river shallow. The river therefore cannot properly and quickly drain the flood water and the accumulated rain water from the low-lying areas. Therefore waterlogging due to the lack of quick and proper drainage in the post-monsoon period was a major environmental problem and created others in its wake.

The wet-land ecosystem gave rise to its well-adapted cropping system with predominance of B. Aman. The low lying areas could not be planted with Boro or other rabi crops for two reasons. During the sowing/transplanting period, much of the land remained waterlogged due to slow drainage of water, while backflow from the Betna through channels connected with the beels inundated the ripening crops during the early monsoon. Then again the same backflow prevented the cultivation of T. Aman during the peak-monsoon period. In fact during the peak-monsoon, the beels interconnected with each other and much of the Project area resembled one vast water body. The waves created by wind during the monsoon also damaged B. Aman.

9.2 ENVIRONMENTAL OBJECTIVES

During the planning of the Project no environmental and ecological impacts were explicitly considered. The stated objectives were, however, to reclaim medium and low lying areas for sowing and transplanting of both Boro and T. Aman paddies and to reduce the damage to Aman crops from flood. As described earlier in Chapter 2 the objectives were purported to be achieved by improving the drainage situation through various engineering means. A change in the physical environment, particularly in the hydrology of the Project area was therefore called for. Thus, though not explicitly stated in the language of the discipline

of environment, the planning for the Project explicitly sought to change the hydrological environment in the Project area.

9.3 RRA DATA SOURCES

During the RRA in the Project area discussions and interviews were held with officials at Sharsha Upazila headquarters and with various categories of farmers, fishermen, village elders, fishing lease-holders, village leaders, other village people and even border security personnel. In addition personal observations were made on the ecology and environment in and around the beels and baors. Soil and water samples collected from selected locations of lowlands and baors were analysed to understand some of the physical processes at work in the Project area.

9.4 PROJECT IMPACTS

9.4.1 Positive Impacts

a) Drainage Canals and Agro-ecosystem

As has been discussed in detail in Chapter 2 loops of the Betna were cut in two places while some of the khals connecting the Betna and the major beels were reexcavated. These works have improved the drainage congestion on the eastern part of the Project area, thus shortening the duration and the depth of flooding. The situation on the western part, however, remains essentially unchanged. The improved drainage in parts has allowed a change in the agro-ecosystem for the better.

Broadcast Aman has been replaced in some parts by HYV T. Aman while there has also been a spatial relocation of the land devoted to B. Aman. The land surrounding the beels now dries up earlier than before because of improved drainage while during the rest of the year (4-6 months) it reproduces essentially the same waterlogged situation. Thus B. Aman fields have moved closer to the deeper parts of the beels while the comparatively higher grounds are now given to T. Aman, Aus and in some cases to sugarcane and vegetables. In some cases the slower rise of the flood water due to its quicker drainage has created an environment better suited to the cultivation of T. Aman during the monsoon. In other cases flood is no longer a major problem. One also now notices papaya cultivation, previously unheard of, though the major impetus has come from the attractive prices that are now offered. The fact, however, still remains that the lower incidence, shorter duration and shallower depths of flood have all combined to help as papaya is a plant which cannot tolerate water logging. Had there been no improvement for the better in the hydrological environment papaya cultivation would not have become popular, however high the price is.

b) Drinking Water and Hygiene

The number of tubewells for drinking water has significantly increased after the Project. In the pre-Project period, there was a serious problem of safe drinking water in this region. The canals, baors and ponds were the only sources of water for drinking, cooking and other purposes. After the Project, some areas, particularly highland and medium highlands, became more or less free from flood water which possibly has provided an opportunity to invest more in tubewells than before. However, there are two other factors which should be borne in mind

before deciding how far the Project may have provided any impetus to such investments by individual households. The first one is the very dense siting of shallow tubewells which allowed villagers to have very good access to pure drinking water while the second one is the increased awareness about personal hygiene due to various programmes (see Chapter 7). In any case the fact remains that there has been a major improvement in the area regarding access to safe drinking water. As a result the incidence of gastro-enteritic troubles and diarrhoeal diseases has decreased.

c) Afforestation along Canals

The ridges along the canals and loop cuttings have provided a good opportunity for afforestation. Dense growth of *babla* plants (*Acacia nilotica*) was noted in some such places indicating their successful establishment. These plants have attained a height of 40 to 50 ft (5 to 6 years growth) with an approximate girth of 9-12 inches.

9.4.2 Negative Impacts

a) Continuing Drainage and Flood Problems in the Western Part

The Project has been unable to take into account the flood water that comes through the Kodla river. As a result, the improvement in the overall drainage in the Project area has been at best modest. The problem is compounded by the fact that the Kodla is an international river and not much can be done about it, particularly in the border area where the Project is located. Furthermore the Kodla, after entering Bangladesh, has completely silted up and looks no more than a thin and long strip of grass. Thus any overspill from the Indian side is bound to create widespread flooding on the Bangladesh side.

The continuing problems of drainage have been made more complicated due to the practice of people putting cross bunds on the rivers for fish farming. Both the Betna and the Hakor are dotted with such fish ponds. After the fish are harvested these cross bunds are, in theory, removed. In practice these are dismantled only partially thus obstructing flow of water during the monsoon, resulting in only a little improvement of the problem of slow drainage.

Very similar problems arise when the khals that are excavated or re-excavated cross the baors. For example, the Sonamukhi Khal which crosses through the Chhota Kona Baor is kept closed by the lease holder of the baor as otherwise his fish would be lost. This practice results in one side of the baor being waterlogged while the other side suffers from lack of water. As such lease holders are locally very powerful men, little can be done to improve the situation.

b) Rat Infestation

Increased rat infestation has been reported in certain places. The problem appears to be more severe in fields along the canal banks. Farmers have claimed that rat damages account for at least 25 percent of the potential production of B. Aman in the lower parts of the beel area. Near the canal banks, which provide better breeding and a sheltered environment, however, the extent of damage is higher and may at some times be as high as 60 - 70 percent.

c) Irrigation, HYV cultivation and soil environment.

Shallow tubewells are used extensively in the Project area for irrigating the Boro paddy crop during the pre-monsoon dry season. The continued use of ground water may give rise to two types of problems. One is the problem of lower level of discharge, while the second may be accumulation of toxic materials brought up with the ground water. Some farmers have complained of the first but the problem does not seem to be widespread and may be only a transitory phenomenon as the problem of recharge may have arisen more due to the failure of rain in 1991 rather than due to the lack of surface water.

Accumulation of sub-soil toxic minerals may be a more real problem. Farmers have mentioned iron in the irrigation water. It is possible that long term use of ground water for irrigation may have a cumulating effect of iron toxicity in the soil.

Every year with flood comes the soil-enriching silt which encourages growth of aquatic plants, the decomposition of which adds a considerable amount of organic matter to the soil. In support of such a process one may observe that the soils in the low-lying areas, and also to a lesser extent in the medium high land, are grey in colour pointing to a high humus content. If so, the reduction in the duration of flood and its depth both are likely to affect adversely the organic content of the soil unless ameliorative measures are taken by the people. The likely fall in the organic content is likely to reduce crops yields.

d) Drainage, Aquatic Vegetation and Wild life

In the Pre-Project period, the dense growth of *uri* grass, a plant of wetland habitat, in the Sonamukhi beel and other low lying areas, was a good source of cattle fodder for a large part of the year. The growth behaviour of this grass is very similar to that of B. Aman in that the stem increases its length with the rise of water level. Since, as a result of improved drainage, there has been a decline of area under wetland in the lower part of the beel, the growth and production of *uri* grass have decreased creating pressure on the supply of easily available fodder, a common property resource. The change has also created favourable environment for the growth of *pati* grass (*Cyperus* sp?), a dry and moist land habitat plant which has increased significantly. Although farmers use the grass as fodder, it is worth-while to mention that *pati* grass is reluctantly accepted by cattle as it sometimes creates stomach disorders.

The fall in water level in some of the baors may have encouraged the growth of certain weeds, more particularly water hyacinth and *zangi*. As is well known the growth of such weeds leads to a fall in the oxygen content in the water making it a less habitable environment for fish and other aquatic animals. Further the reduction in the area of perennial water in the beels and lowlying areas has resulted in some reduction in the numbers of wintering wildfowl.

9.5 LESSONS LEARNT

For planning purposes it should be considered that the natural flow of rivers will take its own course, that any proposed changes to this lotic ecosystem will have effects on environment, and that therefore the ecologists and environmental scientist must be closely involved from the very beginning.

The main lesson to be learned from Sonamukhi-Banmader Drainage Project, which applies equally to all other Projects of a similar type, is that the environmental impact assessment needs to be as carefully planned as the drainage canals, embankments and any other Project components. This implies that, during the implementation phase, strong co-operation and co-ordination among the various disciplines are needed.

9.6 RECOMMENDATIONS

To protect the remaining water bodies of the beels within the Project from any further encroachment, further drainage improvement should be discontinued. Improved and controlled drainage increased the cultivated area in the beels at the expense of perennial waterbodies, and wetlands should be preserved as a sanctuary to maintain ecological balance. Such steps for conservation will not only increase fish production and encourage the natural growth of aquatic flora and fauna but would also provide an opportunity to increase the numbers of wintering wild fowl.

10 ECONOMIC IMPACTS

10.1 INTRODUCTION

In view of the objectives of the Project, an economic assessment will mainly concern the effect on cropping. With this end in view and given the impact on production as discussed in Chapter 3 the value of crop production at accounting prices has been estimated and compared with the financial net returns estimated earlier in sub-section 3.5.1. The impact on livestock and fisheries income and employment have already been discussed in sections 4 and 5. Other changes in employment and wages and in rural industrial and non-farm activities are discussed here. Then again as land prices are a significant indicator of agricultural productivity the evidence of any change as found during the RRA is also presented. Finally, an attempt is made to make an informed guess about the returns to the Project.

10.2 NET ECONOMIC RETURN FROM CROP PRODUCTION

Table 10.1 shows the estimated net returns in crop production in the Project area. These are calculated at economic (accounting) prices as opposed to those in Table 3.3 which are at market prices. The basic conclusion, however, remains the same. There has been a net incremental gain of nearly Tk. 186 million of which nearly Tk. 78 million or 42 per cent may be attributed to the Project.

Table 10.1 Net Returns in Crop Production
(Tk. million)

Crop	Pre-Project Net Return	Post-Project Net Return	Change	Change due to Project
Boro HYV	-	110.0	110.0	11.0
T. Aman LV	-	8.7	8.7	8.7
T. Aman HYV	1.9	73.9	72.0	72.0
B. Aman	27.2	11.3	-15.9	-15.9
M. Aus-Aman	-0.7	-	0.7	0.7
B. Aus	0.3	-	-0.3	-0.3
T. Aus LV	-	1.6	1.6	1.6
Jute	-0.2	-0.1	0.1	-
Pulses	0.1	7.9	7.8	-
All	28.5	213.3	184.7	77.8 (42%)

Source: Consultant's estimates

Note: All valuations are at 1991 economic prices using SCFs from FPCO 1991.

10.3 NON-FARM EMPLOYMENT

Increased growth of crop, particularly paddy, production has had a number of linkage effects in the Project area with consequent changes in non-farm employment and income. Particularly in the recent years, mechanised rice milling has increased (Table 10.2); while as an obvious consequence, the traditional method of rice husking by **dhenki** has declined. According to the local BSCIC office, during the last three years the number of rice hullers (usually operated with STW engines on a part time basis) in Sharsa Upazila has doubled. In addition to that, quite a number of automatic rice mills can be seen in and around the Upazila headquarters, most of which again have recently been established.

Increased growth of paddy production seems to have created other direct and indirect positive impacts on other activities such as rice trading, fertilizer and other input trading, transportation, making of agriculture tools including blacksmithing and light engineering and repair workshop. It is apparent from Table 10.2 that all these activities have experienced a fast growth over the recent years, which eventually has increased over-all non-farm employment opportunities (see Chapter 6).

Table 10.2 Level of Rural Industrial and Non-farm Activities: Sharsa Upazila

Type of Establishment	Number		
	1987	1990	% Change
Rice Mill ¹	42	88	+110
Furniture	3	7	+133
Pottery	7	5	-40
Agricultural tools including blacksmithy	15	55	+266
Saw Mills	5	9	+44
Brick Field	4	10	+150
Roofing Tiles Making	5	8	+60
Bidi making	100	150	+50

Source: Bangladesh Small and Cottage Industries Corporation (BSCIC), Jessore and Consultant's Estimate.

/1 Almost 90 percent are small rice hullers usually operated with STW engines on a part time basis.



10.4 LAND PRICE

Land prices by level are shown in Table 10.3. It appears that the prices have gone up by 3-6 fold over the 1980s. Discounting for inflation at the average rate of 10% p.a. leaves the residual increase which can be termed as quite substantial. The increased value of land, at least partly, reflects the higher productivity. It is interesting to note that the price increase in case of medium and low lands is much higher than that of high lands. The finding is not surprising, because medium and low lands would have higher demand for production purposes particularly during the boro season which has seen the most dramatic change in productivity.

Table 10.3 Per Acre Price of Land

Type	Price Per Acre (Tk.)		Percentage increase (adjusted for inflation)
	1980	1990	
High	18,000	60,000	79
M. High	9,000	45,000	240
M. Low	6,000	36,000	341
V. Low	4,500	18,000	141

Source: Consultant's estimates based on field observations

10.5 PROJECT ECONOMIC RE-APPRAISAL

10.5.1 Project Costs

The investment expenditures for the Project were made over several years. The total cost was Tk. 11,625 million. Just about 80 per cent of the expenses were for construction of sluices (Tk. 5.4 million) and bridges and culverts (Tk. 3.7 million). Only Tk. 0.7-0.8 million was spent for re-excavation of canals and other earth-work.

Evaluation of the Project costs at 1991 prices is extremely difficult as the information on the dimensions of physical work done in the Project area is imprecise. However the construction Cost Index (1969/70 = 100) estimated by BBS shows it to have moved from around 480 during 1976-78 when main part of the construction work was completed to 1536 in 1991. The cost of the Project in 1991 prices may, therefore, be at most 4 times its level in 1977 or Tk.46.5 million.

The above financial costs are converted into economic cost using a weighted conversion factor of 0.778 for capital costs and 0.71 for O&M cost. The O&M cost is again somewhat arbitrarily set at 5 per cent of capital cost or Tk. 2.325 million per year.

10.5.2 Project Benefits

Project benefits are the net incremental value of production that can be attributed to

the project. As discussed in sub-section 10.1 and earlier in the section on agriculture, some Tk. 70-80 million of the net incremental value per year can be estimated to be due to the Project.

10.5.3 Project Returns

Because of the imprecise cost figures and the assumptions made about their valuation at 1991 prices, the Project returns estimated below should be treated only as broad orders of magnitude. Several scenarios are developed to find out about the sensitivity of the results to the changes in assumptions. These are shown in Tables 10.4 and 10.5

The base case indicates an extremely high rate of return to the Project. The EIRR is 181 per cent. Varying the assumptions about level of cost and benefits and how fast full benefits are realised indicate that even under the most stringent conditions the EIRR turns out to be 60 per cent, a high rate. The financial IRR in all cases is lower but remains high even under the most restrictive assumptions.

Table 10.4 Financial Costs and Returns in Sonamukhi-Banmader Project (Base Run)
(Tk. million)

Year	Capital Cost	O&M	Total Cost	Total Benefit	Net Cash Flow
1	4.65	-	4.65	-	-4.65
2	13.95	-	13.95	-	-13.95
3	27.90	-	27.90	34.7	6.80
4	0	2.325	2.325	69.4	67.075
5-20	0	2.325	2.325	69.4	67.075

Source: Consultant's estimates

Table 10.5 Project Re-Appraisal and Sensitivity Analyses

Sl. No.	Scenario		Financial			Economic		
	Cost Stream	Benefit Stream	IRR(%)	B-C ratio	NPV (Tk mn)	IRR(%)	B-C ratio	NPV (Tk mn)
1.	Base	Base	132	9.0:1	329	181	11.8:1	386
2.	125% of base	75% of base	82	4.8:1	224	116	7.1:1	272
3.	125% of base	75% of base + slower benefit accrual	46	3.9:1	169	60	5.7:1	211

Source : Consultant's estimates.

Note: Slower accrual of benefit assumes 10% of full benefits in 3rd year, 25% in fourth year, 50% in fifth year and full benefit from the sixth year.

REFERENCE

- BBS (1986) **Census of Agriculture, 1983-84**, Zila Series, Jessore District.
- BWDB (1977) **The Project Proforma on Sonamukhi-Banmader and Other Beels Drainage Schedule**, (unpublished).
- Soil Survey of Pakistan (1970) **Reconnaissance Soil Survey Report of Jessore District**.
- UNDP/FAO (1988) **Agro-ecological Regions of Bangladesh** (Report 2).
- Westergaard, K. (1989), **Analytical Bibliography on Rural Development in Bangladesh: Studies on women**, BIDS, Dhaka and CDR. Copenhagen, (Unpublished).

